

The role of mobile application in facilitating delivery of food and grocery during COVID-19 pandemic in Saudi Arabia

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Abstract

Mobile Information Technology (IT) plays a fundamental role in several aspects of life. Each part of IT is considered to be a primary part, Mobile Applications are one of the major parts that positively affected the economy of the world. During the pandemic of coronavirus COVID-19 in 2020 most of the countries forced lockdowns to prevent the spread of COVID-19, meanwhile businesses headed for alternative solutions to avoid heavy losses. Mobile Application comes as a primary solution to support business, especially food and grocery to facilitate the chain of ordering and delivering during the pandemic of COVID-19. In this study, a survey has been designed and data was collected to prove how the mobile apps facilitate the order and delivery process in Saudi Arabia, support the business to increase their sales, and come as a way for job opportunities during the pandemic. The analysis of survey results revealed that mobile apps play a significant role during the pandemic. Approximately, 88% of citizens use delivery applications during the pandemic, while 70% of them find job opportunities. For businesses, 72% of them believe the sales percentage has increased. Moreover, 73% of the consumers and business owners are satisfied with using mobile delivery apps.

2010 Mathematics Subject Classification. **54H30**. 68U01, 68M01.

Keywords. mobile applications, COVID-19, delivery applications, food delivery, grocery delivery.

1 Introduction

On 11 March 2020, the World Health Organization (WHO) declared the spreading of Coronavirus which is the fifth pandemic since 1918 [1]. At the beginning of the COVID-19 pandemic, many businesses started to lose their balance as many of them were fully dependent on the physical store, and that is what we call brick-and-mortar business [2]. During the pandemic and when the coronavirus started to spread rapidly, many countries forced the lockdown to control the infection among people, meanwhile, brick-and-mortar businesses started looking for a solution to retrieve their profit with a minimum of loss. There were many grocery stores and restaurants that started using delivery applications to keep up their business and to provide the services people needed. Using Information Technology opens new opportunities for businesses as well as for consumers to facilitate day-by-day needs during the lockdown. Even with the rapid spreading of the pandemic, there is no proof that COVID-19 can be transmitted through food [1]. The crisis of coronavirus affected consumers' behavior, where usually consumers depend on themselves for shopping, during the pandemic most consumers rely on delivery apps to shop for their needs, which encourages consumers to increase their purchases. Some people speculate that after the crisis people will go back to their normal behavior, on the other hand, most of people speculate that this behavior will stick and affect the path of ordering and delivery forever [3].

Advanced Studies: Euro-Tbilisi Mathematical Journal 16, supplement issue 2 (2023), pp. 29–39.

DOI: 10.32513/asetmj/1932200823203

Tbilisi Centre for Mathematical Sciences.

Received by the editors: 15 November 2022.

Accepted for publication: 15 January 2023.

With the rapid development in Information Technology, many industries depend on mobile applications to gain their revenues. Food delivery applications are one of the obvious services that gained popularity by facilitating online ordering of food and grocery and providing two-way benefits for consumers and businesses. According to [4] food delivery applications around the world increased their revenue to 107.4 billion USD in 2019, and this revenue is expected to reach 164.5 billion USD by 2024. The increase in the profit encourages most of the food industry business to rely on the food delivery applications. Applications are constantly being used by sellers to fulfill the demands of mobile users [5]. Mobile applications are proving to be a strong and ubiquitous service delivery platform, which allows sellers to reach a wide range of customers and deliver goods and services [6].

Applications have taken this opportunity, adapting it to restaurants and groceries as an alternative method for increasing total sales and allowing customers to receive goods more comfortably [7]. Simplicity and high capability design with live chat capabilities play a significant role in boosting user activities surrounding the use of food delivery apps [8]. The use of food delivery apps, as well as the income generated by them, has been on the rise in recent years [9]. During the COVID-19 pandemic, mobile applications came as a solution for both citizens and sellers in grocery stores and restaurants to facilitate the order and delivery process of food and grocery. In Saudi Arabia, most of the restaurants and groceries use these applications like Hungerstation, Marsole, Jahez, Domino's pizza, and Nana.

The rest of this paper is organized as follows: Section 2: overview, Section 3: literature review, Section 4: Related Work, Section 5: methodology, Section 6: Survey Design, and Section 7: conclusion.

2 Overview

2.1 Problem background and research significance

The global fluctuations that occurred during the COVID-19 pandemic have forced many industrial and commercial sectors to change their path so that the sources of income and their businesses are not affected, in light of the lockdown that occurred during the pandemic which drives to decrease the visits of grocery stores and restaurants, which forces the merchant of this sector to use the Information Technology to support shopping and delivery during the pandemic in general and the lockdown in particular. The motivation for the grocery stores and restaurants to return the balance of their sales and be unaffected during the pandemic period is the most important motive for our research, to explain how information technology, especially the delivery application has positively facilitated the delivery of food and grocery during the COVID-19 pandemic.

2.2 Research hypotheses

H1: The use of mobile applications during the COVID-19 pandemic facilitates the order of food and groceries in terms of limiting the spread of the COVID-19 virus, job opportunities, and increasing sales.

2.3 Research goal & objectives

The research aimed to conduct a survey study on the role of using Information Technology, more specifically delivery applications, in facilitating the order of food and groceries during the COVID-19 Pandemic.

In this research, a survey has been designed to collect data from the target group (citizens in Saudi Arabia, restaurants, and grocery store owners). The data obtained from the questionnaire

has been analyzed to verify the research hypotheses.

3 Literature review

The COVID-19 pandemic has significant effects on workers, consumers, supply chains, and financial markets [10]. In the background section, we discuss some proposed technical solutions that helped the food and grocery sector during the crisis. One of the most important of these solutions is Food and Grocery Delivery Mobile Applications. This section presents the background of this study, related work and previous studies, and a discussion of the findings.

3.1 Background

The COVID-19 pandemic is considered one of the most affected pandemics in the world as it has become the fifth pandemic since 1918 [1], and it affects several industries. COVID-19 is considered to have “erupted as a serious global pandemic from the end of 2019 and reached the whole of China in February 2020, then progressively expanded worldwide” [4]. During the lockdown, people have difficulties with groceries and food business converts to use the online application to avoid losing their business. In this section we divided the background into several parts, first the effect of the COVID-19 on food and grocery commerce, second part will be about the type of online food delivery applications, after that a brief description about the delivery options that are available are given and the last part will be about payment options.

3.2 Type of online food delivery applications

During the Corona vireos crisis, it was difficult for people to go out to bring foodstuffs, due to the necessity and importance of social distancing. Therefore, there must be another way through which people can obtain their food needs while maintaining social distance. On the other hand, this social distancing may affect food merchants, as they have to obtain ways to enable them to reach customers in their homes. Online food delivery platforms are the ideal virtual marketplace for both consumers and food suppliers [11]. Merchants use electronic food distribution systems to support their work. The Online to Offline (O2O) e-commerce application is one of the most common of these applications, in which customers order a product or service online and receive it in an offline environment [12]. There are two major forms of Online Food Delivery applications: Restaurant-to-Consumer distribution or Platform-to-Consumer Distribution.

- Restaurant-to-Consumer distribution: when the restaurants have its own online application to receive the order. This kind of e-commerce application is referred to as click-and-mortar; the restaurant expands the sources of orders, which helps in increasing income. like in Saudi Arabia: Domino’s pizza, MacDonald.
- Platform-to-Consumer Distribution (Third party delivery company): when the restaurants don’t have its own online application, but it creates a partnership with another platform dedicated to delivering orders from restaurants and groceries. Like in Saudi Arabia: Hungerstation, Marsole, Jahez, and Nana.

Both kinds of applications Restaurant-to-Consumer or Platform-to-Consumer are partial e-commerce applications because the process is started electronically and physically completed. Figure 1 presents the famous certified delivery application from Communications and Information Technology Commission in Saudi Arabia during the lockdown.

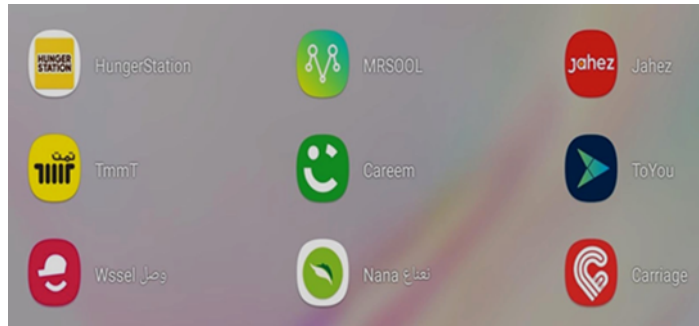


FIGURE 1. Certified Delivery Applications in Saudi Arabia.

3.3 Payment options

Incrementally, payment systems have developed, and we now have increasingly advanced digital payment systems provided by numerous companies around the world. During the COVID-19 pandemic, most people rely on online Applications to order from restaurants and groceries, and due to the precautions and social distancing, cash payment was not allowed, which requires people to use electronic payment when using delivery applications, and this was one of the technology applications during the crisis. The Mobile Payment System (MPS) offers a convenient way for customers to pay for products or services to complete transactions on their mobile devices [13]. An example of the electronic payment methods that were used in Saudi Arabia STC Pay, Apple Pay, Alinma Pay, Mada, and Visa.

4 Related work

The aim of [1] study is to evaluate how COVID-19 affects the economy, especially the food sector from the fields to the consumers, and give a recommendation to reduce the effect of the pandemic. The result shows that, in order for the food supply chain to survive from damaging and losing during the pandemic, they should be more flexible to respond to the challenges they will face and each country must tighten or loosen the measures according to the spread of the virus.

According to the study of [2] they provide a survey to make the comparison of the factors that affect the number of online deliveries done before and during COVID-19 lockdown and expenditures of the household during the lockdown. They reach the result of Increased home delivery during the COVID-19 lockdown. 60% of households who make 1 or 2 order-to-delivery every 30 days before COVID-19 had significantly Increased their order during the COVID-19 lockdown. Households who made 3 to 5 home delivery before COVID-19 lockdown have been increased to almost 55% ordered during the lockdown.

The study [3] discussed the situation of the buying process: consumers attempted to avoid shopping in stores, relying heavily on grocery delivery and pick-up services during the beginning of the pandemic when no clear rules were in place. Results show a 255 increase in the number of households that use grocery pickup as a shopping method and a 158 increase in households that utilize grocery delivery services. The spike in pickup and delivery program participation can be explained by consumers fearing COVID-19 and feeling unsafe.

The study [4] used a hybrid model consisting of three models: Unified Theory of Use and

Acceptance of Technology (UTAUT) model, extended the Expectancy Confirmation (ECM) Model, Task-Technology Fit (TTF) model. The main objective of this study is to verify the continuation of the use of food distribution applications in China during the COVID-19 pandemic. It reviews 532 customers of food delivery applications. The outcome shows that satisfaction is an essential factor, but not the only one. The user continuity of using online food delivery applications is affected by social impact, quality, task technology fit, and confidence.

Three principles of sustainability are addressed in the [10] (Economic, social, environment). Thus, it demonstrates positive and negative effects during the COVID-19 pandemic in the most recent research on food delivery. Online food delivery offers jobs for many citizens, as well as it increases the sales opportunities from an economic standpoint. Online FD enhances the results of public health and traffic services from a social point of view, as well as affects the interaction between consumers and providers. It triggers the critical production of waste with high carbon footprints, from an environmental point of view.

The early periods of the COVID-19 outbreak in China and the impact of quarantine on food retailers are the subject of the research [14]. It endorses the behavioral intention to provide early empirical insights into improvements during the COVID-19 revolution in buying behavior related to food purchases. To collect the data, the researchers established an online survey. The results of the study showed a significant change in the behavior of buyers, as people tended to buy from nearby stores in the city center. In contrast, there was a lack of buyers in agricultural areas far from the city center. The study [10] aims to discuss the international economic impacts of the pandemic through sectors by assessing its prices per the info declared for each globe and Turkey. Additionally, this study tries to place forth attainable economic and political eventualities for the post-pandemic world. This pandemic is having significant adverse effects on workers, consumers, supply chains and financial markets, and in short, is likely to cause a global economic recession.

The research [14] “uses an approach to discover the ways and possibility of transmitting COVID-19 through the foods, food supply chain, surfaces, and surrounding environment before exploring detection tools. As long as more people are involved in the process of the last stages of the supply chain, more measures are needed. With negligible consideration of transmission COVID-19 through the food sector as there is no evidence so far. The study is proof by real life examples, during the lockdown many food supply chains and restaurants worked only for take-away or delivery services with no proof of spreading COVID-19.

5 Methodology

Various methods exist to evaluate research hypotheses and questions, depending on the type of study either qualitative or quantitative the researcher can select the suitable method for the specific problem at hand [15]. In this research, a quantitative method Survey has been used to evaluate the proposed hypotheses. This part will describe the methodological approach used in the study, which include Type of study, Methodology Approach, Type of Selected Method, Requirements, data collection, data analysis and, System Design Procedure.

5.1 Methodology approach

A survey is a quantitative research method comprising a set of questions to effectively gather data from a set of respondents. A survey essentially consists of closed-ended questions with very few open-ended questions. In this research, a survey with close-ended questions has evaluated the effect of the delivery Applications during the COVID-19 pandemic.

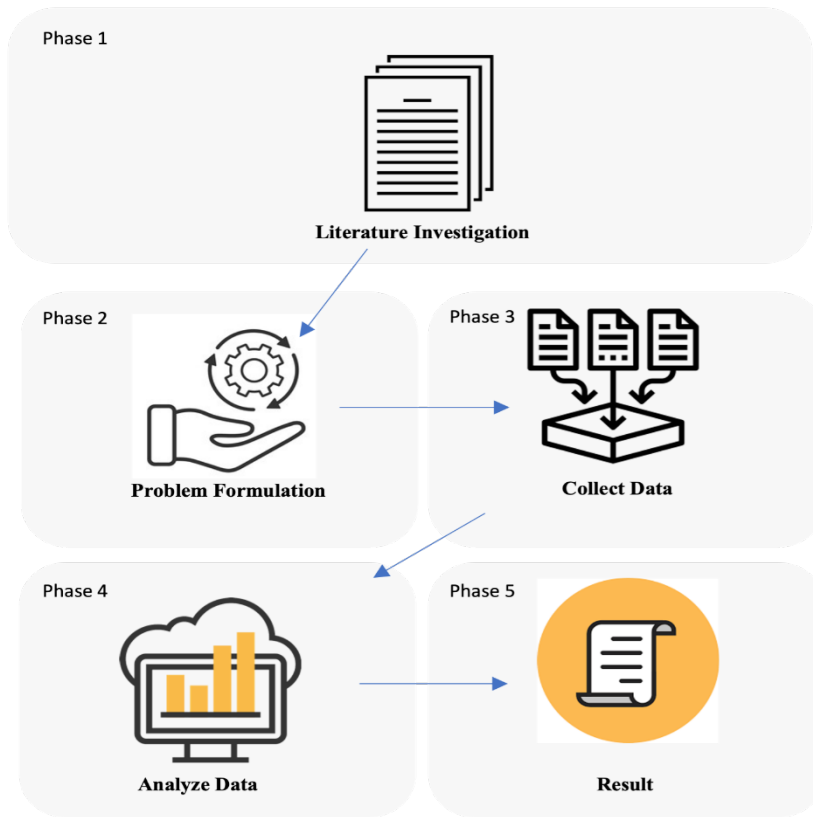


FIGURE 2. Research Frameworks.

5.2 Research framework

The research procedure shown in Figure 2, describe the general procedure followed in the research, which include:

- Literature Review: read and study the previous scholarly works relevant to the topic.
- Problem formulation: determines Goal, Motivation, Scope, Objective of the current research.
- Collect Data: reach to the participants, and encourage them to participate on the survey
- Analyze Data: study and analyze participants' responses.
- Result: describe the outcome of analyzing participants' responses.

5.3 Population and sample

This study involves the owners of grocery and food markets and consumers (citizens) in Saudi Arabia. There were 300 participants between business owners and consumers to analyze. The sample has various criteria selected by the researcher. This involves:



FIGURE 3. The Data collection procedure

- Selecting participants with different ages and genders. This allows the research data to be generalized [16].
- Targeted owners of grocery and food markets, who use the applications during the pandemic.

5.4 Data collection

A survey is one of the most common tools for collecting qualitative data [17]. A survey design provides a quantitative or numeric way to investigate trends of a population through a sample population [18]. The survey has been assessed by a three-point Likert scale recording; agree, to some extent, disagree. The procedure of data collection is shown in Figure 3.

6 Survey design

The most critical stage in this type of study is designing the surveys because once the questionnaire is developed, the researcher has decided the questions and answers and will not be able to go back and get additional information. The researchers must be able to work independently. They should be assured that the questions they ask will help them to obtain the information they need. A survey has been designed via Google Forms (<https://forms.gle/BByhx5RGN95MQdRa8>). It contains three sections distributed across two pages to make the study easier, aiming to improve the accuracy and number of responders. The main page of the survey begins with a brief description about the research and gives information about the topic to ensure that participants are familiar with the subject, and demographic questions: Gender, Age, store owner or consumer? Based on the answer to the demographic questions, the participant will be moved either to the page of the business owners' question or consumers' questions page. See Figure 4.

6.1 Surveys distribution

Online distribution has been chosen as it is considered to be a fast method with less effort and money to get good results. For better distribution, the researchers need to focus on spreading widely

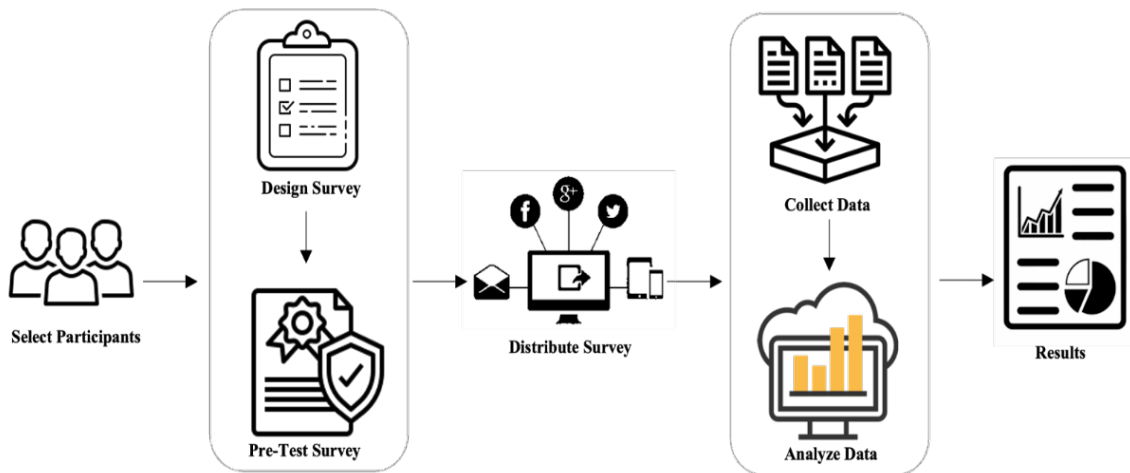


FIGURE 4. Methodology Procedures

to gain different opinions from a different area of the selected sample. An online link was distributed via email, WhatsApp and barcode has been created to be scanned by the owners of grocery and food markets and consumers, posting on social media, going to shops and giving surveys for people and shop owners. The online survey was available from 26 February until 1 April of 2021.

6.2 Data analysis method

Statistical analysis can be conducted on the survey data to make sense of the data that has been collected. There are multiple data analysis methods of quantitative data such as: Cross-tabulation, Trend analysis, MaxDiff analysis, Conjoint analysis, TURF analysis, Gap analysis, SWOT analysis, Text analysis. In this research, the Cross-tabulation method has been used, which is the most commonly used data analysis method. To organize data, it employs a simple tabulation system. This statistical analysis approach aids in the tabulation of data into easily recognizable rows and columns, which aids in the drawing of comparisons between various research parameters. It includes knowledge that is either mutually exclusive or has some relation to one another. It easily takes the information from cross tabulation and creates a visual chart or graph.

6.3 Finding and discussion

The survey comes with results from 290 responses between 34 grocery/shop owners and 256 consumers. The respondents have different ages with the largest percentage for the age between 21 to 60 years old, 34.4% for the age between 21 to 30. This result gives an overview of the responders' awareness. The usage of the delivery apps comes positively helpful for the consumers, as 65% of the respondents increased their use of the delivery apps during the pandemic from before, and just 4.3% of the consumers do NOT use the apps during the pandemic. Therefore, 87.5% of the respondents agree that "delivery apps play a magnificent role in facilitating the order and delivery during the pandemic". In addition, 88.2% of grocery and shop owners agree that delivery apps facilitate the ordering and delivery process. In the opinion of how many safety and precaution procedures the delivery apps follow, 59.5% agree that the delivery product arrived with highly protective packaging, which gives

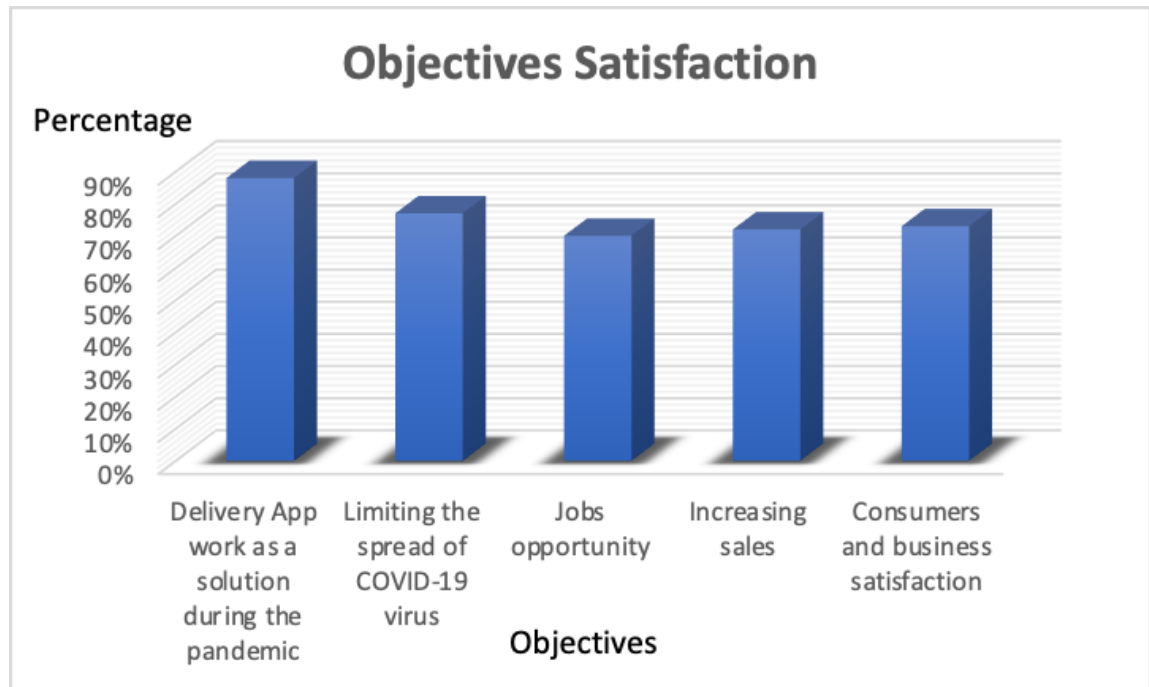


FIGURE 5. Objectives Satisfaction

77.4% see that the delivery apps help reduce the spread of COVID-19. As a result of the survey, between every 290 people, there are 60 people trying or getting a job with the delivery applications which gives 20% opportunity to have a job during the pandemic, as a support for this result, 70.6% of the shop owners resorted to increase the recruitment in delivery apps. From the responses of grocery and shop owners, 50% of them didn't use the delivery application to support their business before the pandemic, and the percentage increased significantly, 88.2% used the apps during the pandemic, and 93% agree that delivery apps increased their sales and become as a huge support for their business. Delivery applications are still positively effective even after the duration of the COVID-19 lockdown, that comes as a result of the responders, 83.7% of the consumers are still using delivery apps today as well as 79.4% of grocery and shop owners are still using the apps to support their business.

The result from analyzing the questionnaire achieved the research objectives as shown in Table 1 and Figure 5.

7 Conclusion

Lockdowns caused by the COVID-19 pandemic have significantly affected shopping behavior. This research has been analyzed home delivery changes caused by COVID-19 by studying the effect of delivery applications during the pandemic on the number of online deliveries made before and during the COVID-19 lockdown. The research surveys people living in Saudi Arabia on e-commerce and

TABLE 1. Research Objectives 2021

Objectives	Met?	Achievement
To develop a survey to investigate the use of delivery applications as a solution during the pandemic.	Yes	The analysis of the survey results shows that the majority (88%) of people use delivery applications as a solution during the pandemic.
To analyze the effect of Mobile Applications in terms limiting the spread of COVID-19 virus, jobs opportunity, increasing sales.	Yes	The analysis of the survey results shows (77%) of people believe that delivery applications limiting the spread of the virus, offer job opportunities (70%), and increase the sales percentage (72%)
Measure the satisfaction of the consumers and business on the performance of information technology during COVID-19 pandemic.	Yes	The analysis of the survey shows that (73%) of the consumers and business owner satisfy on the performance of information technology specifically Mobile Applications during COVID-19

home delivery service and the number of deliveries made before and during the COVID-19 lockdown using online surveys. The approach used in this research was designed to facilitate achieving the research objectives.

As result, this research concluded:

- This research indicates the main reason that drives owners of grocery and food markets to use delivery apps is that people can't go out during the lockdown, which facilitates ordering during the COVID-19 Pandemic.
- This research also points to the relationship of direct and positive correlation between the use of delivery applications during the COVID-19 pandemic and limiting the spread of the COVID-19 virus, job opportunities, and increasing sales.

8 Acknowledgement

The researchers would like to thank the Deanship of Scientific Research, Qassim University for funding the publication of this project.

References

- [1] S. Aday and M. S. Aday, *The early impact of the Covid-19 pandemic on the global and Turkish economy.*, Turkish journal of medical sciences **50(9)** (2020), 520-526.
- [2] A. Almuhammadi, *An overview of mobile payments, fintech, and digital wallet in Saudi Arabia.*, In 2020 7th International Conference on Computing for Sustainable Global Development (INDIACom) (2020), 271-278.
- [3] L. Chenarides, C. Grebitus, J. L. Lusk, and I. Printezis, *Food consumption behavior during the COVID-19 pandemic.*, Agribusiness **37(1)** (2021), 44-81.
- [4] M. Cho, M. A. Bonn, and J. J. Li, *Differences in perceptions about food delivery apps between single-person and multi-person households.*, International Journal of Hospitality Management **77** (2019), 108-116.
- [5] J. Chotigo and Y. Kadono, *Comparative analysis of key factors encouraging food delivery app adoption before and during the COVID-19 pandemic in Thailand.*, Sustainability **13(8)** (2021), 4088.
- [6] Z. Dörnyei and K. Csizér, *How to design and analyze surveys in second language acquisition research.*, Research methods in second language acquisition: A practical guide **1** (2012), 74-94.
- [7] C.R. Kothari, *Research methodology: Methods and techniques*, New Age International Pvt Ltd Publishers, 2013, Third edn (2013), 418.
- [8] C. Li, M. Miroso, and P. Bremer, *Review of online food delivery platforms and their impacts on sustainability.*, Sustainability **12(14)** (2020), 5528.
- [9] D. Marcucci, *Research methods in education.*, New York: Routledge. Journal of Educational, Cultural and Psychological Studies (ECPS Journal) **2(4)** (2011), 201-206.
- [10] G. Mclean, K. Al-Nabhani, and A. Wilson, *Developing a mobile applications customer experience model (MACE)-implications for retailers.*, Journal of Business Research **85** (2018), 325-336.
- [11] C. Moondra, H. K. Mangwani, K. Deshpande, A. S. Bundela, and K. Namdev, *Impact of online food delivery on customers.*, International Research Journal of Engineering and Technology (IRJET) **7(4)** (2020), 2362-2364.
- [12] C. Muangmee, S. Kot, N. Meekaewkunchorn, N. Kassakorn, and B. Khalid, *Factors determining the behavioral intention of using food delivery apps during COVID-19 pandemics.*, Journal of Theoretical and Applied Electronic Commerce Research **16(5)** (2021), 1297-1310.
- [13] K. Perreault, *Research design: qualitative, quantitative, and mixed methods approaches.*, Manual Therapy **16(1)** (2011), 103.
- [14] M. Rizou, I.M. Galanakis, T.M. Aldawoud, and C.M. Galanakis, *Safety of foods, food supply chain and environment within the COVID-19 pandemic.*, Trends in food science & technology **102** (2020), 293-299.
- [15] V. Shankar, M. Kleijnen, S. Ramanathan, R. Rizley, S. Holland, and S. Morrissey, *Mobile shopper marketing: Key issues, current insights, and future research avenues.*, Journal of Interactive Marketing **34(1)** (2016), 37-48.
- [16] A. Unnikrishnan and M.A. Figliozzi, *A study of the impact of COVID-19 on home delivery purchases and expenditures.*, Civil and Environmental Engineering Faculty **16** (2020), 18.
- [17] Y. Zhao and F. Bacao, *What factors determining customer continuingly using food delivery apps during 2019 novel coronavirus pandemic period?*, International journal of hospitality management **91** (2020), 102683.