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Ranking of barriers to online shopping in grocery stores due to the prevalence of COVID-19

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Abstract

With the spread of the coronavirus in the world, many businesses faced major problems and unprecedented recession. Governments have also put special laws and social distancing on the agenda to face the disease. The epidemic has had several effects on consumer buying behavior. People rush to the shops to get the items they need, especially online stores, which are very popular among all stores. This increase in demand for supplies due to the corona epidemic has created numerous problems for online stores.The purpose of this article is to rank the barriers to online shopping at the time of the outbreak of the Corona virus, and five main barriers to doing so have been identified. In this paper, the Fuzzy Hierarchy Process (FAHP), triangular numbers and expert opinions are used to compare pairs. It has been seen that the shortage of goods has the highest weight compared to others. Finally, suggestions are made to remove these barriers.

Keywords: COVID-19, Fuzzy AHP, barriers, online shopping

1. Introduction

At present time, the world is facing the coronavirus disease known as Covid-19. The coronavirus disease 2019 (COVID-19) is an acute respiratory disease caused by another novel coronavirus (SARS-Cov-2, previously known as 2019-nCov)[1]. The first case of the coronavirus was reported in December 2019 in the Wuhan city of China, which is known as the major transportation hub of China[2]. World Health Organization (WHO) has declared the COVID-19 outbreak as a global pandemic on March 11, 2020. The virus has spread worldwide leading to a global pandemic. As of April 7, 2020, over 1.3 million people have been infected with the virus, with over 75,000 deaths recorded[1]. The virus has grounded economic activities globally. Livelihoods have been disrupted, economies affected and health facilities stretched globally. Covid-19 has been humanity's biggest disruptor of life and businesses. The coronavirus pandemic has taken the whole world by storm[3]. Many countries have shut down their sea docks and airports after the spread of the virus. The virus has affected the lives of many people. The current outbreak has had severe economic consequences across the globe, and it does not look like any country will be unaffected. This not only has consequences for the economy; all of society is affected, which has led to dramatic changes in how businesses act and consumers behave[4]. Those who were not working in essential industries were instructed to stay at home, and to avoid attending mass-gathering locations—such as sports venues, theatres, gyms, shopping centers, and restaurants[5].

The COVID-19 pandemic outbreak has forced many businesses to close, leading to an unprecedented disruption of commerce in most industry sectors. Retailers and brands face many short-term challenges, such as those related to health and safety, the supply chain, the workforce, cash flow, consumer demand,

sales, and marketing. Many markets, especially in the fields of tourism and hospitality, no longer exist[4]. While some businesses are struggling, some businesses are thriving. This is true for a number of Internet-based businesses, such as those related to online entertainment, food delivery, online shopping, online education, and solutions for remote work. In many cases, the Internet is at present also the main way to get essential supplies and receive essential services[4].

The epidemic of COVID-19 and quarantine and social distance on the one hand and the dramatic advancement of technology such as smartphones, the Internet and e-commerce in recent years have changed the shopping behavior of consumers and their influx into online services. For example, consumers cannot go to the store, so the store comes home[6]. The potential long-term trend that may emerge from the COVID-19 pandemic is the way consumers purchase food and how they buy fruits and vegetables. The move to online grocery shopping has been particularly notable given the share of online purchases made by retirees and households that have not traditionally purchased groceries from home[7].

2. Barriers of online shopping due to COVID-19

The pandemic situation changes behavior of consumer drastically in every field of the world. Naturally, the purchase behavior of consumers would change further and influenced by the lockdown in the nation due to lack of availability of products and services in various stores and shops. With respect to this pandemic situation, the consumers have no other option but to depend mainly on online platform to shop and fulfil the necessary requirement for the survival[7]. In the meantime, customers face barriers to meet their needs online, the most important of which are the following:

2.1 Shortage of goods

During this epidemic, the supply and demand of food was unbalanced due to the shortage of supply and potentially by panic buying behaviors, which have since been replicated in much of the rest of the world. A sharply visible demand-side shock evident in Iran, and in many countries, has been panic buying or hoarding behaviors by consumers. One of the more dramatic images in the early stages of the COVID-19 pandemic has been supermarket shelves emptied of key food and non-food items, including pasta, rice, canned goods, flour, frozen foods, bottled water, hand sanitizers, hand soap, and toilet paper. Government officials and food industry representatives have been quick to emphasize that there is plenty of food in the system. As governments around the world ramped up social distancing policies, many consumers engaged in stockpiling behaviors in anticipation of movement restrictions and fear of disruptions to food distribution systems[8]. Debnath calls this the action of consumers who buy large quantities of products or goods due to sudden concerns about future shortages or rising prices, buying Panic[7]. Buying panic causes many online businesses to face a shortage of products that are unable to meet customer demand there. These jobs create barriers to customers' online purchases by limiting the number of items they buy for consumers.

2.2 Price increase

Product prices are closely related to consumer buying behavior. In today's epidemic, consumers store food and other products indefinitely, which will definitely lead to higher product prices.[7] Excessive purchase of goods by customers, and consequently shortages of goods may increase the price of

products in the market. This price increase is one of the barriers for customers to buy. On the other hand, disruption in the supply chain and turbulence in it also increases the cost of goods.

2.3 Failure to deliver on time

COVID-19 keeps customers at home but the demand for online shopping and home delivery is constantly increasing. Most consumers try to buy products online but are dissatisfied with the online shopping option due to delays in delivery. Ali points out in his study that nearly three-quarters (70%) of consumers, prioritized buying food online and more than half chose home delivery. Among all consumers, the younger generation and urban dwellers prefer home delivery, while the older generation prefers in-person shopping to online shopping[3].

Potential disruptions in food supply chains, such as labor shortages, disruption of transportation networks, can delay the delivery of customer orders. On the other hand, the volume of online shopping orders is increasing day by day, all of which leads to delays in the delivery of goods by stores[8].

Many grocery stores that offer online food sales and delivery services during the corona virus do not have delivery units, and deliveries are usually through an intermediary contractor such as postal or shipping companies. And these contractors are usually less concerned about the timely delivery of goods than online buyers.

2.4 Weak ICT infrastructure

Prior to the corona virus, many food businesses in Iran did not have online sales and their sales ended in face-to-face sales, but despite the corona virus, most of these businesses turned to online sales. These businesses are somehow the first in the field of online sales and have a nascent information and communication technology infrastructure. These infrastructures usually have weaknesses such as low internet bandwidth, network and telecommunication problems, user distrust of newly established sales sites, etc.

On the other hand, another consequence of quarantine is the sharp increase in the use of the Internet and social media. Previous research has shown that people who feel lonely are more likely to use social media and, in some cases, even prefer social media to physical interaction[4]. This severe use of the Internet by individuals has caused many interruptions in the Internet network, slowing down the Internet and many interruptions in the online payment network in Iran.

2.5 Difficulties to return purchases

The online stores mostly offer a free return policy to their customers. These stores give consumers an opportunity to return the product without any delivery cost. Reasons for a product return could result from many reasons, for example damaged goods, failed or wrong orders delivered, to customers' change of heart after maybe finding the product elsewhere at a cheaper price among others. It has been seen earlier that customers demand for a seamless shopping experience in the online stores without any extra hassle or costs. However, as per human psychology, when a consumer buys a product, it demands to get the desired one, sometimes the stores are unable to deliver the exact product shown in the shopping platform[9]. Such problems in the delivery of online products are another barrier to purchase in this area. Food is usually difficult to return, and if there is a return, the return time is much shorter than other goods. Now, despite the spread of the Corona virus and the busy delivery of goods, the priority of these parts is to send goods rather than return to return goods.

3. Fuzzy analytic hierarchy process

The analytic hierarchy process (AHP) is an approach that is suitable for dealing with complex systems related to making a choice from among several alternatives and which provides a comparison of the considered options, firstly proposed by Saaty (1980)[10]. The fundamental principle of the analysis is the possibility of connecting information, based on knowledge, to make decisions or previsions; the knowledge can be taken from experience or derived from the application of other tools. The AHP is based on the subdivision of the problem in a hierarchical form. In fact, the AHP helps organize the rational analysis of the problem by dividing it into its single parts; the analysis then supplies an aid to the decision makers who, making several pair-wise comparisons, can appreciate the influence of the considered elements in the hierarchical structure.

Although the AHP is to capture the expert's knowledge, the traditional AHP still cannot really reflect the human thinking style. The traditional AHP method is problematic in that it uses an exact value to express the decision maker's opinion in a comparison of alternatives[11]. In addition, AHP method is often criticized due to its use of unbalanced scale of judgments and its inability to adequately handle the inherent uncertainty and imprecision in the pair-wise comparison process (Deng, 1999). To overcome all these shortcomings, FAHP was developed for solving the hierarchical problems. Decision makers usually find that it is more confident to give interval judgments than fixed value judgments. This is because usually he/she is unable to explicit his/her preference to explicit about the fuzzy nature of the comparison process[10]. This paper proposes the use of FAHP for determining the weights of the main criteria.

3.1. Methodology of FAHP

In this study the extent FAHP is utilized, which was originally introduced by Chang (1996). Let X = {x1,x2,x3, ...,xn} an object set, and G = {g1,g2,g3, ...,gn} be a goal set. According to the method of Chang's extent analysis, each object is taken and extent analysis for each goal performed respectively. Therefore, m extent analysis values for each object can be obtained, with the following signs:

$M_{(g_i)^1}$,$M_{(g_i)^2}$, …, $M_{(g_i)^m}$, i=1, 2…, n

Where $M_{(g_i)^j}$ (j= 1, 2,…, n) all are TFNs. The steps of this method are as follows.

Step 1: The first step in the hierarchical analysis process is to create a graph of the problem.

Step 2: Create pairwise comparison matrices for each of the levels, factors and sub-factors.

Step 3: If we have n experts and $a_{(i_J)^t}=⌊L_{(i_J)^t},m_{(i_J)^t},u_{(i_J)^t}⌋$ is the triangular number assigned by expert t, their ideas are combined in a matrix by an arithmetic mean.

After combining the opinions of experts in a matrix, for each row of the matrix, a value pair called si, which is itself a triangular number, is calculated as follows.

(1)

The value $∑_{(〖j=〗_1)^m} M_{gi^j}$, which is the sum of the fuzzy numbers in each row and is obtained through the fuzzy sum operation as follows:

(2)

Then the inverse of the vector above is computed, such as

(3)

Step 4: As M1 = (l1, m1, u1) and M2 = (l2, m2 , u2) are two triangular fuzzy numbers, the degree of possibility of as M2 = (l2, m2 , u2) ≥ M1 = (l1, m1, u1) is defined:

$V(M2 \geq M1) = \sup_{y \geq x} ⌊\min(\mu_{(m_1)}(x), \mu_{(m_2)}(x))⌋$,

(4)

And can be expressed as follows:

V (M2 ≥ M1) =hgt (M1 ∩ M2) = μ_(M_2) (d) (5)

(6)

Fig.1 illustrates Eq. (9) where d is the ordinate of the highest intersection point D between lM1 and lM2 to compare M1 and M2, we need both the values of V (M2 ≥ M1) and V (M1 ≥ M2).

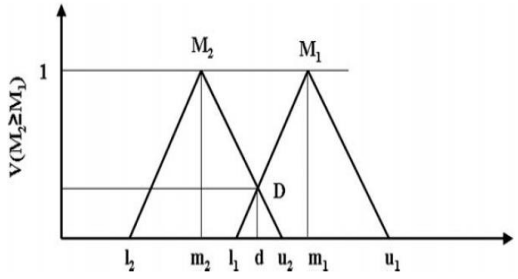

Fig 1 the degree of possibility of $M_1 > M_2$ [12]

Step 5: The degree possibility for a convex fuzzy number to be greater than k convex fuzzy M_i (i = 1, 2, ...,k) numbers can be defined by

V (M ≥ M_1, M_2, … M_k) = V [(M ≥ M_1) and (M ≥ M_2) and…and (M ≥ M_k)] = min V (M ≥ M_i), i = 1,2,…,k (5)

Assume that = min V (S_i ≥ S_k) for k = 1,2, . . .,n; k ≠ i. Then the weight vector is given by

$$w' = \left(d'(A_1), d'(A_2), \ldots d'(A_n)\right)^T$$ (6)

Step 6: Via normalization, the normalized weight vectors are w = (d(A_1), d(A_2),…, d(A_n))^T where W is a non-fuzzy number.

4. Application

The purpose of this paper was to ranking barriers online shopping due to covid 19 for a Tehran's chain stores. Firstly, a comprehensive questionnaire including main criteria of barriers online shopping due to covid 19 is designed to understand and quantify the affecting barriers in the process. Then, fifteen decision makers from different areas evaluate the importance of these barriers with the help of mentioned questionnaire. Their demographic information indicates that most respondents have a master's degree or doctorate. All respondents consist of business departments, site support departments and professors / associates of colleges / universities. All academics involved in the survey teach either engineering or management, and by their profession, they have hands-on experience in dealing with online shopping activities. It has been observed that all respondents have 5 years or more work experience. Therefore, in general, it can be concluded that all respondents to the survey have sufficient expertise in business management**.**After identification of evaluation barrier, with the help of expert committee, fuzzy linguistic values are used to determine weights of criteria. A fuzzy scale as proposed by Hongming (2020) has been considered for pairwise comparisons of one criterion over another and the same is shown in Table 1 [13].

Table 1 Fuzzy scale

Linguistic Term	Triangular Fuzzy Number (l, m, u)
Low important (L)	(1,1,2)
Rather low important (RL)	(1.5,2,2.5)
Fairly moderate important (FM)	(2,3,4)
Moderate important (M)	(3.5,5,6.5)
Highly moderate important (HM)	(6,7,7)
High important (H)	(7.5,8,8.5)
Very high important (VH)	(8,9,9)

In the first step, the graph related to the problem is drawn according to Figure 2.

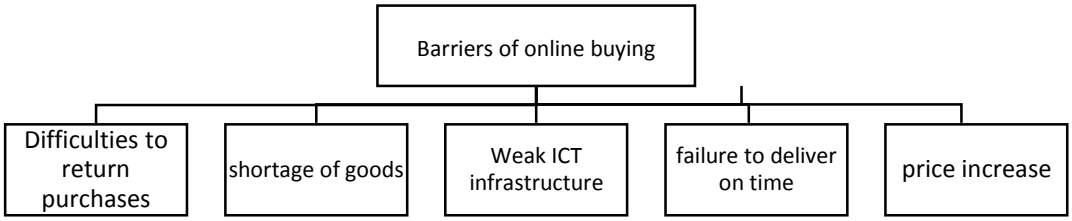

Figure (2) graph of the problem

Firstly, each decision maker, individually carry out pairwise comparison by using linguistic terms (Table 1). One of these pairwise comparisons is shown here as example (table 2):

Table 2 example of pairwise comparisons

Criteria	Shortage of goods	price increase	Weak ICT infrastructure	failure to deliver on time	Difficulties to return purchases
Shortage of goods	(1,1,1)	(2,3,4)	(3.5,5,6.5)	(2,3, 5)	(3.5,5,6.5)
price increase	(0.25,0.333,0.5)	(1,1,1)	(3.5,5,6.5)	(1.5,2,2.5)	(6, 7,7)
Weak ICT infrastructure	(0.154,0.2,0.258)	(0.153,0.2,0.286)	(1,1,1)	(2,3,4)	(6, 7,7)

failure to deliver on time	(0.25,0.333,0.5)	(0.4,0.5,0.667)	(0.25,0.333,0.5)	(1,1,1)	(3.5,5,6.5)
Difficulties to return purchases	(0.153,0.2,0.286)	(0.143,0.143,0.166)	(0.143,0.143,0.166)	(0.153,0.2,0.286)	(1,1,1)

Then, a comprehensive pair-wise comparison matrix is built as in Table 3 by integrating fifteen decision makers' grades through.

Table 3. Pairwise comparison matrix

Criteria	Shortage of goods	price increase	Weak ICT infrastructure	failure to deliver on time	Difficulties to return purchases
Shortage of goods	(1,1,1)	(1.5,2.647,4)	(1.5,4.054,6.5)	(2,3.948,6.5)	(1.5,4.709,7)
price increase	(0.250,0.378,0.667)	(1,1,1)	(2,5.299,1.5)	(1.5,3.515,6.5)	(2,3.987,7)
Weak ICT infrastructure	(0.154,0.247,0.667)	(0.118,0.189,0.5)	(1,1,1)	(2,4.490,8.5)	(1.5,3.695,8.5)
failure to deliver on time	(0.154,0.253,0.5)	(0.154,0.284,0.667)	(0.118,0.223,0.5)	(1,1,1)	(1.5,1.847,7)
Difficulties to return purchases	(0.143,0.212,0.667)	(0.143,0.251,0.5)	(0.118,0.271,0.667)	(0.143,0.541,0.667)	(1,1,1)

According to step 3 s_i is obtained for each criterion according to Eq (1).

S_1 (Shortage of goods) = (7.5, 16.35, 25) $\otimes$ $(\frac{1}{81}, \frac{1}{46.4}, \frac{1}{23.5})$ = (0.093, 0.355, 1.064)

S_2 (price increase) = (6.75, 14.17, 23.6) $\otimes$ $(\frac{1}{81}, \frac{1}{46.4}, \frac{1}{23.5})$ = (0.083, 0.308, 1.007)

S_3 (Weak ICT infrastructure) = (4.77, 9.62, 19.1) $\otimes(\frac{1}{81}, \frac{1}{46.4}, \frac{1}{23.5})$ = (0.059, 0.209, 0.816)

S_4 (failure to deliver on time) = (2.92, 3.65, 9.6) $\otimes(\frac{1}{81}, \frac{1}{46.4}, \frac{1}{23.5})$ = (0.036, 0.078, 0.411)

S_5 (Difficulties to return purchases) = (1.54, 2.27, 3.5) $\otimes(\frac{1}{81}, \frac{1}{46.4}, \frac{1}{23.5})$ = (0.019, 0.049, 0.149)

These fuzzy values are compared by using Eq. (6) and these values are obtained:

Table 4 Values of V($S_j \geq Si$)

$V(s_j>s_i)$	Value	$V(s_j>s_i)$	Value	$V(s_j>s_i)$	Value	$V(s_j>s_i)$	Value	$V(s_j>s_i)$	Value
$V(s_1>s_2)$	1	$V(s_2>s_1)$	0.95	$V(s_3>s_1)$	0.83	$V(s_4>s_1)$	0.59	$V(s_5>s_1)$	0.15
$V(s_1>s_3)$	1	$V(s_2>s_3)$	1	$V(s_3>s_2)$	0.88	$V(s_4>s_2)$	0.58	$V(s_5>s_2)$	0.2
$V(s_1>s_4)$	1	$V(s_2>s_4)$	1	$V(s_3>s_4)$	1	$V(s_4>s_3)$	0.73	$V(s_5>s_3)$	0.36
$V(s_1>s_5)$	1	$V(s_2>s_5)$	1	$V(s_3>s_5)$	1	$V(s_4>s_5)$	1	$V(s_5>s_4)$	0.59

Calculate the minimum degree of possibility**:**

D´ (Shortage of goods) =min V ($S_1 \geq S_2$, S_3, S_4, S_5) = min (1.000, 1.000, 1.000, 1.000) =1.000

D´ (failure to deliver on time) =min V ($S_1 \geq S_2$, S_3, S_4, S_5) = min (0.59, 0.58, 0.73, 1.000) =0.58

D´ (Difficulties to return purchases) =min V ($S_1 \geq S_2$, S_3, S_4, S_5) = min (0.15, 0.2, 0.36, 0.59) =0.15

D´ (price increase) =min V ($S_1 \geq S_2$, S_3, S_4, S_5) = min (0.95, 1.000, 1.000, 1.000) =0.95

D´ (Weak ICT infrastructure) =min V ($S_1 \geq S_2$, S_3, S_4, S_5) = min (0.83, 0.88, 1.000, 1.000) =0.83

Therefore, the weight vector becomes

W´ = (1.000, 0.95, 0.83, 0.58, 0.15)

Normalizing the weight vector, we get

W = (0.285, 0.271, 0.236, 0.165, 0.043)

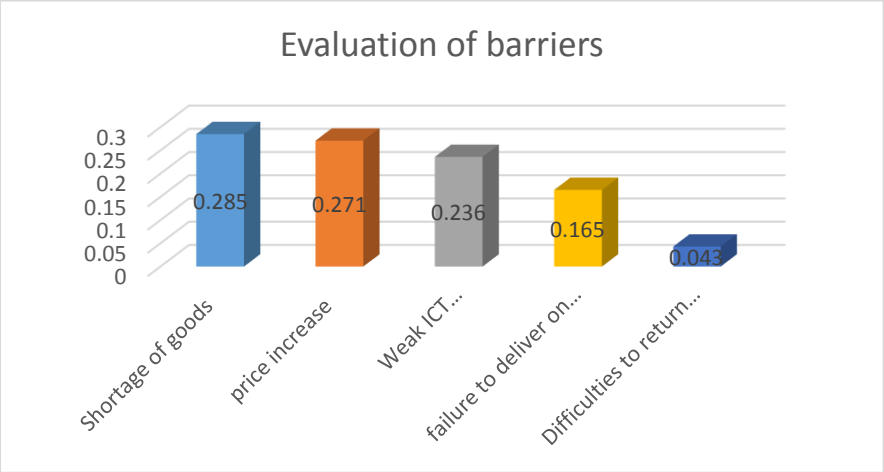

Figure (3) Evaluation of barriers

5. Result and Discussion

As mentioned above, five barriers to online shopping were identified and ranked according to experts. The results as shown in Figure 3 are as follows**:**

1-Shortage of goods

2- Price increase

3- Weak ICT infrastructure
4- Failure to deliver on time
5- Difficulties to return purchases

According to Figure 3, the most important barrier in online shopping is the lack of goods and the weakest barrier is the problems in returning the goods purchased by customers. This does not mean that return problems are insignificant, but rather that they are less important than the other barriers examined. Lack of goods when offered in online stores is the most important barrier for consumers to buy. As mentioned earlier, due to the corona epidemic and the imposition of quarantine restrictions, a large number of consumers have flocked to online stores, which is the main reason for the shortage of goods in these stores. This increase in demand for online shopping has also led to higher prices for products. This price increase is the next barrier in consumers' purchasing, which has also reduced the purchasing power of consumers.The third barrier, given the weights gained, is the weakness in the ICT infrastructure**.** Joining many people to stay home to prevent the spread of disease and break the chain of transmission in the community has led many of them to resort to the Internet to spend time at home and in addition to social networks of facilities and programs Various uses such as downloading movies, music and games, which increased Internet consumption. This excessive use of the Internet has disrupted the network, disconnected and connected to the Internet, and caused problems with online payment sites. On the other hand, the problems caused by the technical defects of the sales site, such as not being up to date, improper design of the site, etc., have added to this barrier for online shopping.Many stores did not sell online before Corona. The outbreak of the coronavirus and the endangerment of businesses have prompted these businesses to move their products to online sales. As a result, many of these businesses do not have an integrated and orderly distribution system and if they have a distribution system, they do not have the ability and potential to meet the needs of customers**.** Lack of an integrated and regular distribution system prevents the timely delivery of products to customers, which causes serious damage to the store brand and customer trustThe last factor in the barriers obtained, which weigh less than the others obtain, is the problems in returning the purchase. Problems that seem to be relatively less important than other factors. Food is usually difficult to return, and if there is a return, the return time is much shorter than other goods. In the context of the corona epidemic and the busy delivery section, the priority of these sections is to send the goods rather than return to return the goods.

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