

Customer Satisfaction Analysis on Online Food Delivery Services during the COVID-19 Pandemic Using Bayesian Network

Rendi Kurniawan and Tutik Farihah

Department of Industrial Engineering
Universitas Islam Negeri Sunan Kalijaga
Yogyakarta, Indonesia 55281

rendikurniawan190@gmail.com, tutik_farikhah@uin-suka.ac.id

Abstract

During the COVID-19 pandemic, the public is urged to reduce the intensity of contact between people outside the home. Therefore, the government implemented Large-Scale Social Restrictions (PSBB) which caused many people to carry out activities only from home. This causes internet usage in Indonesia to continue to increase rapidly, one of which is because people choose to use food delivery services through applications. Online food delivery (OFD) is the process of ordering food through an application that can be done from anywhere and will be sent to our address according to the estimated time displayed by the application. This research aims to determine the best hybrid model of customer satisfaction in using OFD and determine the most influence factor in customer satisfaction using OFD during the COVID-19 pandemic. Bayesian Network is an approach that uses a Directed Acyclic Graph (DAG) to represent the dependency relationship between random variables represented by nodes. The factors in this research are efficiency, system availability, privacy, fulfillment, perceived value, loyalty intention, price saving orientation and time saving orientation. Our findings reveal that the fulfillment is the most influencing factor on customer satisfaction in using OFD during the COVID-19 pandemic.

Keywords

Bayesian Network, Online Food Delivery, COVID-19 Pandemic

1. Introduction

During the COVID-19 pandemic, almost all community activities were carried out from home such as ordering meals, shopping, learning, take an exam and work. As stated by CNBC (2020), during the COVID-19 pandemic, internet users increased by 15-20% due to the implementation of Work From Home (WFH). Internet users in Indonesia reach 175.4 million with the number of connected smart phones reaching 338.2 million units, or it can be said that the average Indonesian has more than one smartphone (www. Cyberthreat.id 2020). However, during the COVID-19 pandemic, customers have more considerations regarding the risk of spreading COVID-19 through direct contact with other people. This social distancing parallel with government considerations in PSBB. Business-to-Consumer (B2C) food shopping has emerged new wave and capture big share and sale in food industry. Online Food Delivery Services is one of the emerging modes to supplement the role of B2C in e-commerce food shopping. The OFD digitalises traditional offline food delivery services with information technologies for mobile payment and meal ordering (Wang *et al.* 2020). Consumers can use OFD platforms to order and to make payment for meals from local restaurants or other food service sectors, with those meals delivered to them (Wang *et al.* 2020). According to Alvara's 2019 survey in Indonesia e-commerce section, OFD's service was ranked the second most widely (87.8%) with 71.7% consumer using Gofood and 39.9% Grabfood (Alvara 2019). It generated revenue of approximately \$1.915 million USD in 2020 and is forecasted to increase by 54.8% in 2024(www.statista.com) Although the OFD service industry seems to be hugely promising, the nature of this market is poorly understood. However, delivering superior service to increase customer satisfaction and maintain consumers loyalty, is important in any service industry to get more competitive advantage (Yeo 2017). It infers that firms must get customer satisfied first before customer loyalty is created and the competitive advantage is achieved. Therefore, OFD service providers must concern on how the customer perceived in online service and such understanding requires measuring the OFD service quality (Ghosh 2020). Thus, assessing perceived service quality of the customer is very important for the service company for sustainability.

1.1 Objectives

This research was conducted with a bayesian network approach to find out the best customer satisfaction hybrid model in using food delivery services during the COVID-19 pandemic and to find out factor the most influence on customer satisfaction. The factors are expected to be a reference for service providers of online food delivery to improve service quality during and after the COVID-19 pandemic.

2. Literature Review

Bayesian Networks (BNs) have received increasing attention during the last two decades (Peña *et al.* 2005, Kyrimi *et al.* 2020) for their particular ability to be applied to challenging issues and aid those making decisions to reason about cause and outcome under conditions of uncertainty (Kahn *et al.* 2020, Constantinou & Fenton 2018).

Research using the Bayesian Network has been carried out in several fields such as safety analysis (Fan, *et al.* 2020, Qiu *et al.* 2019, Li *et al.* 2019), supply chain risks (Badurdeen *et al.* 2014, Garvey *et al.* 2015, Wahyuni *et al.* 2020, medical (Putra *et al.* 2018, McLachlan *et al.* 2019).

In Customer Behaviour with focus decision on at Smart TV, Bae and Chang (2012) use BN to identify factors that determine the smart TV buying decisions of users and analyze the relationships among the factors., This research proposed that BN methodology could use to identify the important attributes for the adoption of smart TV in consumers' intention. They concluded that relative advantage has the greatest influence on the purchase intention of smart TV, followed by compatibility, entertainment, web-browsing and n-screen. Farihah (2019) use BN to identify factors in university selection for undergraduate level. Research concluded that academic skills, information and influence of parents have direct relationship in university selection.

The online food ordering system is the process of ordering food through websites, applications, it can be done from wherever we are, can order what food we like and within the time displayed by the application they will send the food to where we are (Parmar 2020) which integrating online ordering services and offline delivery from restaurant-owned food delivery services such as KFC, Pizzahut, Domino's, McDonald's, etc. or third-party applications as intermediaries such as Gofood, Grabfood (Zhao and Bacao 2020).

Reasons motivating consumers to buy from an online medium are important for food retailers. In terms of technology adoption, there have numerous research from consumers view (Shah 2020, Yeo *et al.* 2017, Haghigi *et al.* 2012, Sunaryo *et al.* 2019, Ghosh 2020, Alreck and Settle 2002, Zhao and Bacao 2020). Yeo *et al.* (2017) conducted research to identify positive relationship between convenience motivation, post-usage usefulness, hedonic motivation, price saving orientation, time saving orientation, prior online purchase experience, consumer attitude and behavioral intention towards OFD services. They collected 224 valid questionnaires to empirically test the research model using the partial least square (PLS) path modeling approach. Based on their research, convenience motivation, hedonic motivation, price saving orientation, time saving orientation have relationship with consumer attitude and behavioral intentions.

Another research in consumer satisfaction in On Line Food Delivery was carried out in the city of Tehran by (Haghigi *et al.* 2012) in 10 randomly selected branches of a popular Fast-food chain, to determine Customer Loyalty towards fast food. 268 valid questionnaire were taken to empirically test using Confirmatory Factor Analysis technique vis Structural Equation Modelling. The result from this research obtained indicated that Restaurant environment, Food and Service Quality and Price have a significant effect on Customer Satisfaction.

Gosh (2020) conducted research in Indian cities using 260 questionnaire to test the empirical model in determining Customer Satisfaction towards Online Food delivery services pertaining to fast food through Exploratory Statistical techniques. Food and Service Quality (e.g Taste, Freshness, Variety, Ease of Use, Availability, Safety, Payment Options, Transaction Time and Security) are the most important factor beside customer service, price and time.

In Indonesia's Local Fast Food Industry, Food Quality and Service Quality are generally considered as most significant factors in determining Customer Satisfaction using Confirmatory Analysis (Sunaryo 2019). During COVID-19 pandemic, Prasetyo *et al.* (2020) conducted research in Indonesia with total of 253 respondents voluntarily participated and answered 65 questions. This research using Structural Equation modeling (SEM) which indicated that hedonic motivation (HM) was found to have the highest effect on customer satisfaction, followed by price (P), information quality (IQ), and promotion((PRO).

3. Methods

There are four stages in conducting this research : the stage of compiling a questionnaire, building a model, validating the model and analyzing the model. In preparing the questionnaire, the first step taken was to determine the factors and parameters that affect customer satisfaction in using online food delivery based on the literature study that has been carried out in order to obtain eight factors used to represent customer assessments of service quality. The first

factor is efficiency (easy to order or find information, well organized, easy to use, order faster than the traditional way), system availability (does not *crash*, does not *freeze*, can be used immediately after downloading), privacy (protects shopping behavior, protects payment instruments, does not misuse customer information), fulfillment (delivers as promised, delivers according to the time shown, the seller prepares food according to the order), perceived value (economical prices and services, services according to consumer needs, feeling safe in using food delivery services during COVID-19), loyalty (saying positive things, recommending others, considering being the first choice, price saving orientation money, look for the promo, the cost is comparable to that obtained), time saving orientation (very useful during a pandemic, can accomplish more work faster, save time). Furthermore, the distribution of the questionnaire online through a google form.

The relationship between nodes in the network based on the variables from the questionnaire which result from model development stage, will be the basic state to calculate node probability, parent node probability and conditional probability.

The fourth stage is model validation of Bayesian model with the smallest error value and sensitivity analysis to determine the factors most influenced customer satisfaction in using OFD during the COVID-19 pandemic.

4. Data Collection

Primary data was collected using online questionnaire (google form) across diverse age and occupations. A total 100 respondents on OFD consumer in Yogyakarta were observed using purposive random sampling between Nopember 2020- April 2021. The limitation of the respondents is frequency order in a week using OFD.

5. Results and Discussion

5.1 Numerical Results

A total of 100 respondents demographic profile have been captured in the Table 1. as shown in Table 1, slightly more than half of the respondents of this study were female at 53 percent. All of the respondents description have same pattern with age as more than half of respondent on one description. Majority age of the respondents between 17-22 years (72%) with frequency order once until fourth time in a week (53%). Majority occupation of the respondents is student (79%).

Table 1. Demographic profile

Descriptions		Number of Respondents	Percentage
Age	17-22 years	72	72%
	23-28 years	25	25%
	28-35 years	3	3%
Occupations	Professional worker	7	7%
	Student	79	79%
	Businessman	5	5%
	Other	9	9%
Gender	Male	47	47%
	Female	53	53%
Frequency Order/week	1-4 times	53	53%
	5-8 times	27	27%
	More than 8 times	20	20%

Validity and reliability testing was conducted using pilot study data of 30 questionnaire. The validity test is carried out to test each variable contained in the research questionnaire whether it is valid or not. The reliability test was carried out to determine whether the respondents' answers to the questionnaire were reliable so that further data processing could be carried out. If the Cronbach's alpha value is greater than 0.6, the variable is declared reliable or trustworthy. The following is a summary of the validity and reliability tests at Table 2.

Table 2. Results of Validity and Reliability test

No.	Variable	Pearson	Cronbach's Alpha	Description
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1	EFF1	0.833	0.731	Valid and Reliable
2	EFF2	0.742	0.731	Valid and Reliable
3	EFF3	0.647	0.731	Valid and Reliable
4	EFF4	0.778	0.731	Valid and Reliable
5	SA1	0.841	0.737	Valid and Reliable
6	SA2	0.856	0.737	Valid and Reliable
7	SA3	0.731	0.737	Valid and Reliable
8	P1	0.923	0.844	Valid and Reliable
9	P2	0.892	0.844	Valid and Reliable
10	P3	0,800	0,844	Valid and Reliable
11	FLL1	0.829	0.763	Valid and Reliable
12	FLL2	0.777	0.763	Valid and Reliable
13	FLL3	0.877	0.763	Valid and Reliable
14	PV1	0,929	0.757	Valid and Reliable
15	PV2	0.761	0.757	Valid and Reliable
16	PV3	0.760	0.757	Valid and Reliable
17	LI1	0.878	0.836	Valid and Reliable
18	LI2	0.928	0.836	Valid and Reliable
19	LI3	0,816	0,836	Valid and Reliable
20	PSO1	0.810	0.630	Valid and Reliable
21	PSO2	0.866	0.630	Valid and Reliable
22	PSO3	0.615	0.630	Valid and Reliable
23	TSO1	0.886	0.849	Valid and Reliable
24	TSO2	0.898	0.849	Valid and Reliable
25	TSO3	0.858	0.849	Valid and Reliable

5.2 Graphical Results

Model development built based on previous research in customer satisfaction in OFD and Service quality (Parasuraman et al. 2005, Yeo et al. 2017, Zhao and Bacao 2020) and based on the initial presumption of decision making in general (logically). The system availability and time saving orientation factors have positive relationship with efficiency factors which means easier system use, the efficiency will be achieved. This relationship has the same pattern with time saving orientation and efficiency, a little time to response, packaged, delivered then the bigger efficiency in consumer view.

Perceived value factors are considered to have a relationship with efficiency factors, fulfillment factors and price saving orientation factors. Based on previous research, these factors have a relationship with customer satisfaction. Efficiency factors are meant to relate to the interface of the web application, and fulfillment factors related to the behind-the-scenes website infrastructure (site promises about the order delivery and item availability fulfilled). Loyalty intention has a relationship with perceived value and privacy factors. If the service is perceived as well as privacy, the OFD service provider is able to provide optimal service and can also maintain the privacy of consumers, the level of loyalty from consumers will tend to increase. Description model of the initial model (Alternative 1) can be seen in Figure 1.

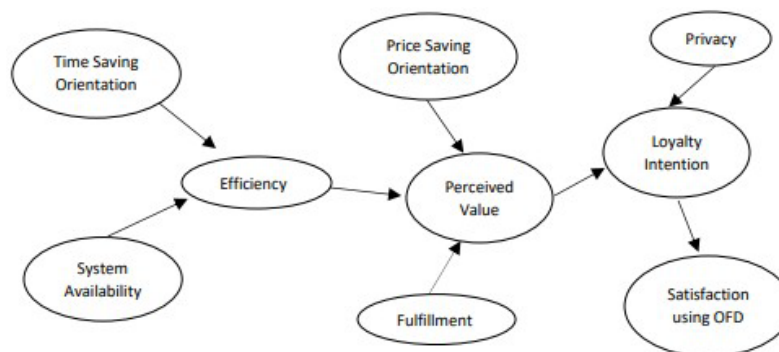


Figure 1. Bayesian Network Model 1

Hybrid model customer satisfaction model using Netica 6.07 software can be seen in Figure 2.

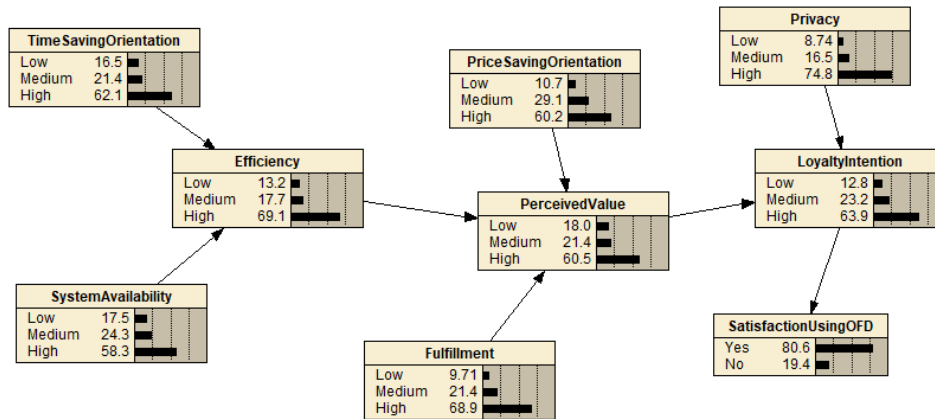


Figure 2. Model 1 Bayesian Network

As shown at Figure 2. efficiency set as parent node time saving orientation and system availability. Loyalty intention as parent node perceived value and privacy while perceived value set as parent node price saving orientation and fulfillment. Only loyalty intention node has direct arc with satisfaction node. This alternative Bayesian model is able to describe consumer satisfaction of 80.6%.

Alternative model is obtained by changing the arrows (arcs) that connects between nodes with fulfillment (food quality, item availability and delivery time) and customer satisfaction. The concept model for alternative 2 can be seen at Figure 3.

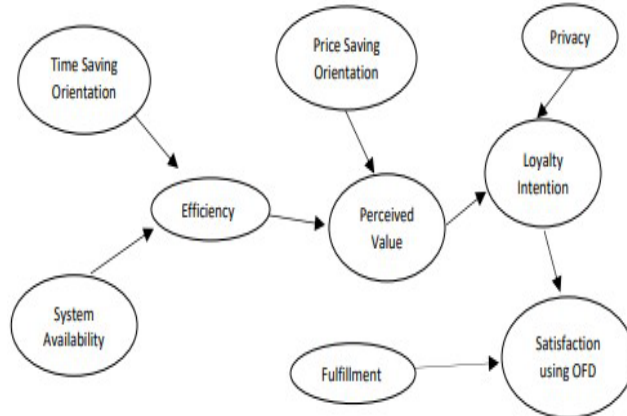


Figure 3. Concept model Alternative 2

Bayesian Network model for alternative 2 obtain using Netica 6.07 software can be seen at Figure 4

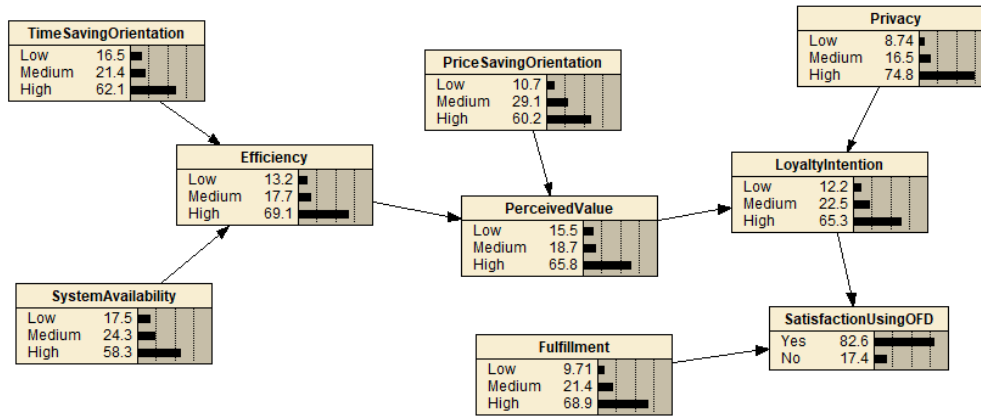


Figure 4. Alternative Model 2 Bayesian Network

As shown at Figure 4. efficiency set as parent node time saving orientation and system availability, loyalty intention as parent node perceived value and privacy while fulfillment have direct arc with satisfaction node. Based on alternative model 2, the percentage obtained at satisfaction node using OFD is 82.6% or more higher than first alternative.

5.3 Proposed Improvements

Another alternative model obtained by changing price saving orientation and time saving orientation arc. The efficiency node, which was previously the parent node of time saving and system availability, becomes a node formed by price saving orientation and system availability. The same thing is done on the perceived value node where there is a change in the constituent nodes of efficiency and price saving are replaced with efficiency and time saving orientation. Concept model for alternative 3 can be seen at Figure 5.

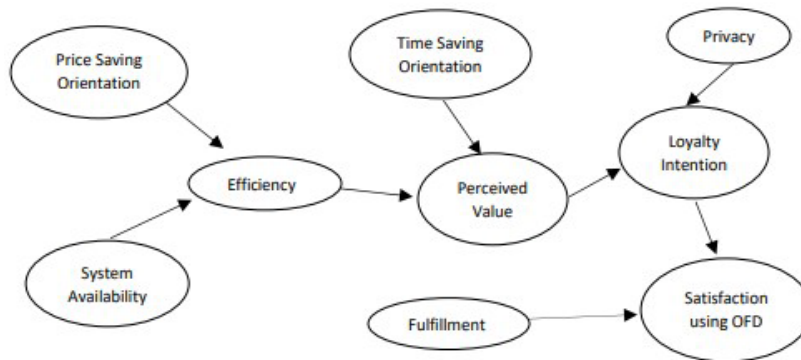


Figure 5. Concept Model Alternative 3.

Bayesian Network model for alternative 3 using Netica software can be seen at Figure 6.

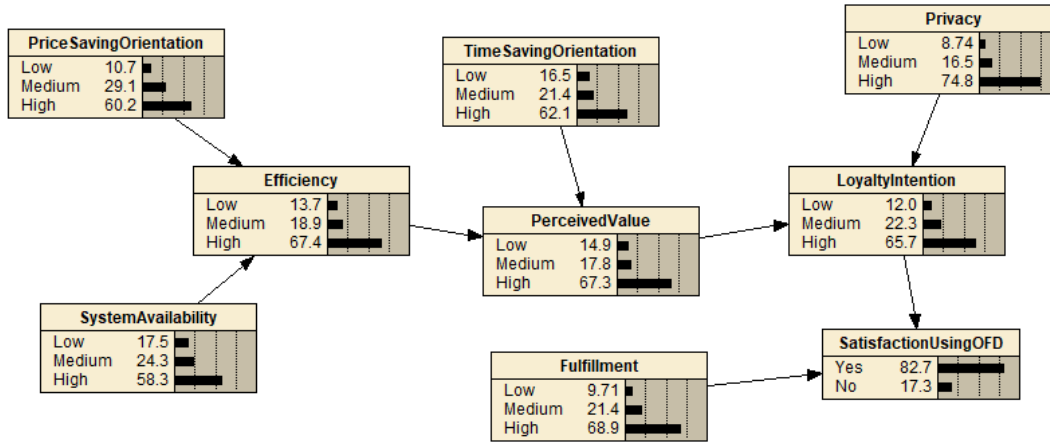


Figure 6. Bayesian Network

Based on Figure 6. efficiency set as parent node price saving orientation and system availability, loyalty intention as parent node perceived value and privacy. There are two node have direct arc with satisfaction node: loyalty intention and fulfillment. The percentage obtained at satisfaction node using OFD is 82.7% from this model as the highest percentage from other previous model.

5.4 Validation

From several alternative bayesian network models, all validation is used to compare the results of the satisfaction node model with the results of the questionnaire. The results of the validation of the three alternatives can be seen in Table 3.

Table 3. Model Validation

Model	Satisfaction Node	Error
Alternative 1	80.6%	2.4%
Alternative 2	82.6%	0.04%
Alternative 3	82.7%	0.03%

It can be seen from Table 3 that the model alternative 3 has highest value satisfaction node with 82.7% and dissatisfied node 17.3%. This almost close with actual conditions, which 83% respondents satisfied in online food delivery service and 17% dissatisfied with it. The error rate alternative 3 have smallest value between two alternative (alternative 1 and 2) then can be stated this alternative as best hybrid Bayessian Network model at this research. The next stage is sensitivity analysis to determine the influence of factors in forming satisfaction on using OFD. Sensivity analysis can be seen in table 4.

Table 4. Sensitivity Analysis Results

No.	Node	Value Mutual information	Percentage
1	Satisfaction Using OFD	0.66384	100%
2	Fulfillment	0.1133	16.8%
3	Loyalty Intention	0.06658	10%
4	Privacy	0.00520	0.783%
5	Perceived Value	0.00478	0.72%
6	Time Saving Orientation	0.00042	0.0628%
7	Efficiency	0.00029	0.0437 %
8	Price Saving Orientation	0.00002	0.00288 %
9	System Availability	0.00001	0.00151%

Table 4 shows the greatest mutual information value from all factors saat node satisfaction mencapai 100%. The fulfillment factor have greatest with 16.8% or equal to 0.11133. This value shows that fulfillment (delivers as promised, delivers according to the time shown, the seller prepares food according to the order) is the main reason consumers feel satisfied using food delivery services during the pandemic. It followed by loyalty intention (saying positive things, recommending others, considering being the first choice, price saving orientation money, look for the promo, the cost is comparable to that obtained). Both node are also shown to have a direct relationship or shape customer satisfaction using OFD. While other node such as privacy, perceived value time saving orientation, efficiency, price saving orientation and system availability indirectly shape consumer satisfaction.

The results of this study state that node fulfillment which contains factors of food provided as promised, delivery according to the time indicated, the seller preparing quality food / food is directly correlated with OFD customer satisfaction the same as previous research conducted by Gosh (2020) who stated that e-service quality (food delivered as promised, personal information, easy-to-use interface, available whenever needed) and food quality (fresh food, packages and variety) were the determinants of customer satisfaction in 260 respondents in India. The suitability of loyalty (consisting of price saving orientation and look for promo) in shaping OFD service satisfaction, similar with research conducted by Prasetyo et al. (2020) which states that promotion is one of the determinants of customer satisfaction.

In this study also obtained results that loyalty is formed by perceived value (economical prices and services, services according to consumer needs, a sense of security in using food delivery services during COVID-19) and privacy (protecting shopping behavior, protecting payment instruments, do not misuse customer information in accordance with research conducted by Luarn and Lin (2015) in Taiwan. Their research on 180 respondents using Partial Least Square Structural Equation Model (PLS-SEM), obtained that trust, satisfaction customer, perceived value, and commitment are separate constructs that are combined to define loyalty.

6. Conclusion

The best Bayesian Network model in customer satisfaction using OFD was alternative 3 with two variable/node (loyalty intention and fulfillment) have direct relationship with satisfaction node. While other node such as privacy, perceived value time saving orientation, efficiency, price saving orientation and system availability indirectly shape consumer satisfaction. This model has error 0.0003 in predicting consumer satisfaction compared with actual data. The fulfillment factor which consist of food delivers as promised, delivers according to the time shown, the seller prepares food is the factor with the highest mutual information value with a value of 0.11133. This proves that the fulfillment factor is the factor that most influences consumer satisfaction in using food delivery services during the COVID-19 pandemic.

As the limitation of this study, firstly, our sample of 100 online food delivery service is somewhat small. Future studies on service quality, especially online service quality, can perform studies by collecting larger sample size and adopting different improved measures of service quality in order to adapt to the existing trend. Secondly, in relation to the mediating role, future study should include other factor to investigated customer satisfaction

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Biographies

Rendi Kurniawan is undergraduate student in Department of Industrial Engineering, Science and Tehnology Faculty at Universitas Islam Negeri Sunan Kalijaga. His research interest include human factor, statistic and probability, manufacturing and lean.

Tutik Farihah is lecturer in Department of Industrial Engineering, Scence and Technology Faculty at Universitas Islam Negeri Sunan Kalijaga. She earned B.Sc in Industial Engineering from Institut Teknologi Sepuluh Nopember, Masters in Industrial Engineering from Universitas Gajah Mada, Indonesia. She has published journal and conference papers. Mrs Tutik has completed research project with MORA, Migrant Care, Zirconia Company. She has taught courses in facility planning and management, health safety and environment management, entrepreneurshio, visual merchandising for engineers and small enterprises. Her research interests include statistic and probability, human factor, facilities planning, multi criteria decision making, human reliability, marketing, lean manufacturing.