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RESEARCH PAPER

Evaluation of the customer requirements for last mile delivery in Brazil

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ABSTRACT

Goal: This paper aims to understand the value of possibility of scheduling, cost of scheduling, app technology and reschedules features that embody the last mile logistics system.

Methodology: The method utilized a stated preference technique in a sample of 83 potential consumers in Florianopolis/Brazil.

Results: The results show that consumers are interested and willing to pay for services and amenities such as scheduling at the time of purchase and associated technology. This finding corroborates the pricing process for online product delivery and confirms the trend toward customer-customized systems.

Limitations of the investigation: This research is limited in the scope of methodology.

Practical implications: The presented result can be used by companies to be able to use the right attributes in the last mile process.

Originality: The Last Mile is the logistics stage that delivers most value to the end customer. Therefore, there is present in the literature the difficulty of interpreting what the customer most expects in terms of service at this logistical stage. Then, understanding which features are important to the customer is a good way to implement improvements in the last mile logistics.

Keywords: Last mile; Logistics; Stated Preference; Logistic; Urban logistic.

INTRODUCTION

In a logistics process, we have the Last Mile stage, which deals with the final part of product delivery (Jiang et al., 2021; Uzir et al., 2021). This stage occurs when the order leaves the distribution center bound for the final address: the client. It is during this process that the customer often notices the quality of the logistic service (Perboli et al., 2021; Rai et al., 2018; Shrestha et al., 2021; Junior et al., 2019; Santos, 2019; Antônio; Santos, 2019).

Besides representing about 1/3 of the cost of a company's deliveries, the last mile is increasingly becoming a competitive differential in the process of product distribution, due to more and more technology and alternatives present in the market (Castillo et al., 2018; Souza et al., 2020; Souza et al., 2019). This is due to the fact that online shopping has increased, as have express delivery alternatives, often delivered on the same day to the customer and causing the customer to make decisions based on purchases in those alternatives that best suit him (Souza et al., 2020; Mikl et al., 2020; Neto et al., 2020).

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This makes the last mile an important step in a company's process, since the main transportation costs are incurred here as well as the delivery of the "shopping experience" to the customer (Uzir et al., 2021).

There are strong actions for improvement in this logistical stage, in order to meet higher demands and customer expectations (Kautish et al., 2021; Tsai and Tiwasing, 2021). And for this to raise the needs of customers, as well as generate this differential, to meet certain requirements in search of the best service is a strategic path to follow (Tueanrat et al., 2021). In the research developed by Ling et al. (2021) it is possible to see that market research can lead an organization to conduct a satisfaction-oriented business strategy that increases its earnings.

In the study of Rai et al. (2021), 45% of customers would like to choose their delivery location, as well as the time, in a very specific way other than the popular ones presented by the company. In the publication of the same authors, 79% who used the express service, but in case of need for rescheduling, did not get a positive perception of the process, which makes not repeat the purchase in this establishment. This study, which was applied in Europe, came close to the context that this article will bring in its development. Therefore, this type of research to understand what the customer expects in terms of features during the last mile process has not been explored in Brazil (Milioti et al., 2020; Zhou et al., 2020).

In Aktas et al. (2020) the customer each day is more attentive to the possibilities and features during their buying process and due to this, understanding what leads these individuals to make these decisions is something relevant to be understood. In this way, popular and well applied surveys can provide a basis for strategic decision-making within an operation as pointed out by Rai et al. (2018). The main features present in the literature and evidence as being positive in the consumer's view are scheduling, cost of scheduling, app technology and reschedules (Faugère; Montreuil, 2020; Lim; Winkenbach, 2019).

The current literature presents directions for investigation of better attributes, as well as the dynamic behavior of the consumer facing the last mile process (Souza et al., 2020; Mikl et al., 2020; Neto et al., 2020). In the same way, the need to use different methods to point out which ones end up being a gap. Since there are different approaches present to mitigate customer perception. Due to these directions in conjunction with the use of other research approaches, this paper was motivated (Perboli et al., 2021; Rai et al., 2018; Shrestha et al., 2021).

Thus, there is a last mile challenge with the difficulty of customer availability to receive goods purchased with express delivery processes. In this paper, by applying the stated preference methodology with a certain population of individuals, we seek to understand the customer's perspective of the express delivery process and what limits them in relation to receiving it, such as: scheduling, rescheduling, technology, and cost.

Therefore, aiming to contribute to the current knowledge present in the literature, with the advancement of the customer's better understanding of the attributes included in a last mile process. Making this research relevant to the literature, as well as for management purposes, where one can, at the end of the article, understand which are the best attributes that were investigated in this research.

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METHODOLOGY

To achieve the objectives presented, this paper applies a questionnaire using the Stated Preference technique (Brown, 2003), through which it is possible to compile information from the respondents in such a way as to obtain reliable evidence of the behavior of a consumer when faced with the problem described above. The use of DCE (Discrete Choice Experiments) is a widely used method to explore consumer preferences, and is applied to understand the preference for energy equipment (e.g., Fettermann et al. (2020, 2021)), in the context of transportation (e.g., Youssef et al. (2021)) and food (e.g., Calegari et al. (2018)). The use of this type of modeling allows the researcher to derive the marginal utility of each attribute considered in the customer's choice, allowing a better understanding of the decision-making process performed by the customer (Hensher et al., 2015). This type of model also allows the researcher to measure an economic estimate for each specific attribute, called willingness to pay (WTP). In summary, the step-by-step of this research is presented in Figure 1, and the steps are described throughout this methodology section.

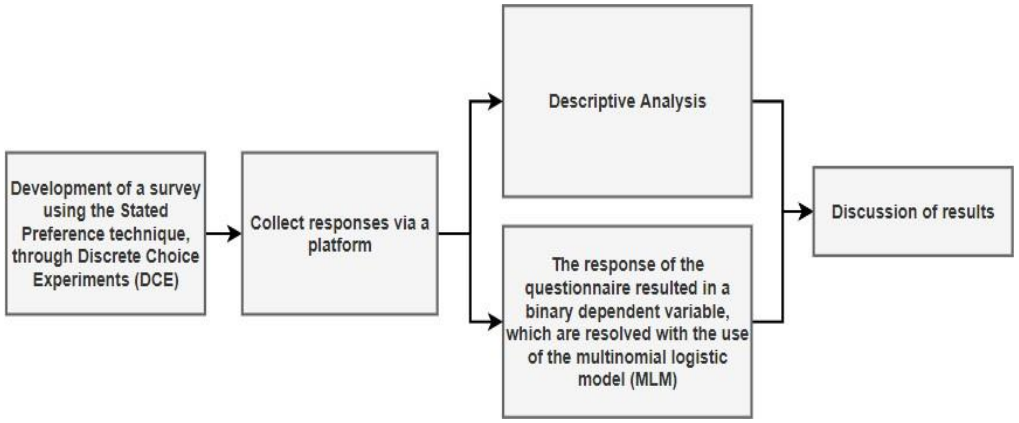

Figure 1. The step-by-step of this research.
Source: Authors.

Research Instrument

The research instrument consists in the presentation of a stated preference experiment, in which respondents are asked to choose among different scenarios which display the configuration of the last mile delivery system. In this instrument, scenario alternatives are presented according to the presence/absence of each of the features considered important for the customer's choice of last mile delivery system, namely: (i) possibility of scheduling the delivery, (ii) possibility of rescheduling the delivery, (iii) an applicative (app) to manage and monitor the delivery, and (iv) cost of delivery. For the cost of delivery, a survey of costs in the region was carried out, as well as other similar studies in the literature (e.g., Calegari et al., 2018; Fettermann et al., 2020). The results about the cost applied in the region found a lower value of R$15.00, and a higher value of R$50.00. The DCE experiment considered these values for the cost as lower and higher values for the variable.

To build the scenarios in the questionnaire was used an orthogonal design, as recommended by the literature (Hensher et al., 2015). A complete factorial design with four variables in two levels (24), as proposed in this research, results in 16 different scenarios. In order to reduce the number of scenarios presented to the respondent a fractional factorial design (2k-1) (Montgomery; Wiley, 2013). This type of experiment is used in order to reduce the number of scenarios in comparison to the complete factorial design (e.g., Fettermann et al., 2021), resulting in a total of eight different scenarios. In order to facilitate the response process, it is indicated to reduce the number of alternatives presented to the respondent at a time, thus this experiment considered four choice tasks, presenting two scenarios at a time to the respondent.

The last mile logistic features presented to the respondent were represented by an icon to assist the answer of the questionnaire. An example of a choice task included in the questionnaire is presented in Figure 2.

Figure 1 presents an analytical framework organizing key topics related to the science of training and Industry 4.0, thus guiding the research questions of this study and the systematic literature review that will be presented in the next sections.

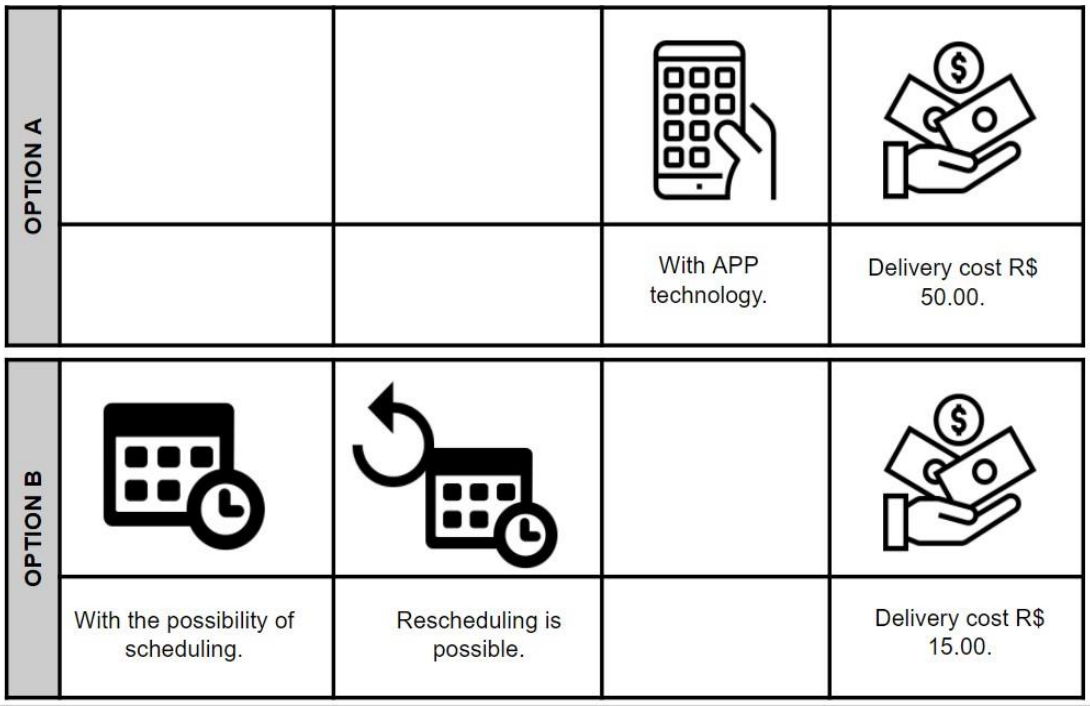

Figure 2. A survey choice task.

In addition, sociodemographic and residence-related questions were also included in the questionnaire (Table 1). The variables collected were classified into three different categories: (i) sociodemographic, (ii) residence, and (iii) last mile delivery system. The questionnaire was designed using the QuestionPro® distributed via social networks and email lists. The respondents also answered whether or not they have an reception gateway for receiving their products throughout the day.

Table 1. Variables considered in the questionnaire.

Identification	Category	Variables	Description
A	Sociodemographic	Age	Years
B	Sex	Gender	0-Female / 1-Male
C	Residence	Location	City region
D	Reception gateway	Presence of a reception desk for receiving orders	0-Absent / 1-Disponible
C	Reception gateway	Possibility of scheduling	0-Absent / 1-Disponible
D	Delivery	Rescheduling possibility	0-Absent / 1-Disponible
E	Delivery	Application	0-Absent / 1-Disponible
f	Delivery	Cost	R$15-low / hig-R$50.00

Data Collection and Analysis

The response of questionnaire results in a binary dependent variable, recommending the use of logistic models (Tabachnick; Fidell, 2019). Each respondent is presented with four choice tasks, each with two alternatives, and a total of eight responses are obtained. Thus, from the total of 83 respondents, a database of 664 answers was achieved. To consider that the same respondent performs the choice task for alternatives more than once, and that this decision is conditioned on the alternatives presented, the literature recommends to use the multinomial logistic model (MLM) (Hensher et al., 2015), which in this situation is a specific case of the MacFadden choice model. The willingness to pay (WTP) consists of the marginal value of each attribute, and its calculation is given by Equation 1 (1), where βN and βM are the estimated coefficients of the non-monetary and monetary variables, respectively (Hensher et al., 2015).

$$MWTP = \frac{\frac{\partial V}{\partial v_N}}{\frac{\partial V}{\partial v_N}} = -\frac{\beta_N}{\beta_M} \quad (1)$$

An alternative to calculate a confidence interval for the WTP values is using the The Krinsky Robb method (Krinsky; Robb, 1990). The Krinsky Robb method presents an alternative for simulating the asymptotic properties of the parameters estimated by the maximum likelihood method, obtaining simulated patterns of the multivariate normal distribution, considering both the standard errors and the covariances of the estimated parameters (Bliemer; Rose, 2013).

From the MLM model, first the coefficients of the four features considered for the last mile delivery system, (A) scheduling, (B) rescheduling, (C) application and (D) cost, will be estimated. Subsequently, the moderation effect of the four features along with the interactions between the variables (E) reception gateway and (F) delivery frequency with the variables (A) scheduling, (B) rescheduling and (C) application will be tested. Finally, the willingness-to-pay for each of the estimated significant non-monetary variables will be calculated.

Construction: instruments for data collection and data analysis

For data collection, we used the Survey methodology approached by Pinsonneault & Kraemer (1993) in a quantitative manner, which enables standardized information about the theme exposed here in this research. The features that influence the respondents' decision when making a decision are presented in Table 2.

Order	Features	Description	Options
1	Possibility of scheduling	Possibility of scheduling in customer delivery windows	Presence and absence
2	Cost of scheduling	Amount charged for the scheduling of a certain delivery window at the client	R$ 15.00 or R$ 50.00

3	App technology	Technological functionalities, such as a tracking application	Presence and absence
4	Reschedules	Possibility to reschedule unsuccessful deliveries	Presence and absence

RESULTS AND DISCUSSION

Sample description

The questionnaire was open for answers for 2 weeks, in this period (03.20.2021 to 04.02.2021), a total of 83 respondents from Federal University of Santa Catarina (Brazil), which has a population of about 50.000 people among students and employees were obtained. Figures 3 shows, respectively, the distribution of respondents by sex and age. The most of the respondents in this survey are between 23 and 30 years old. Another significant number of respondents was 45 years old. The age range of the respondents ranged from the minimum age of 21 years old to the maximum age of 53 years old, as shown in Figure 3.

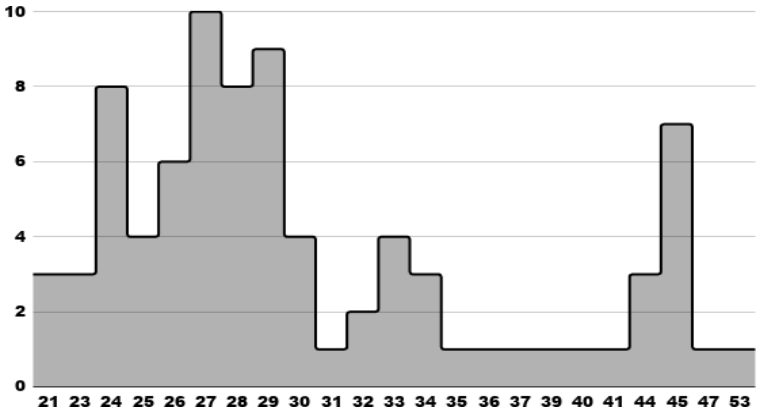

Figure 3. Distribution of respondents by age.
Source: Authors.

In the Figure 4 shows how many men and women answered the questionnaire. The majority of participants were identified as belonging to the female gender, representing 62% of the sample. The other 38% were classified as male.

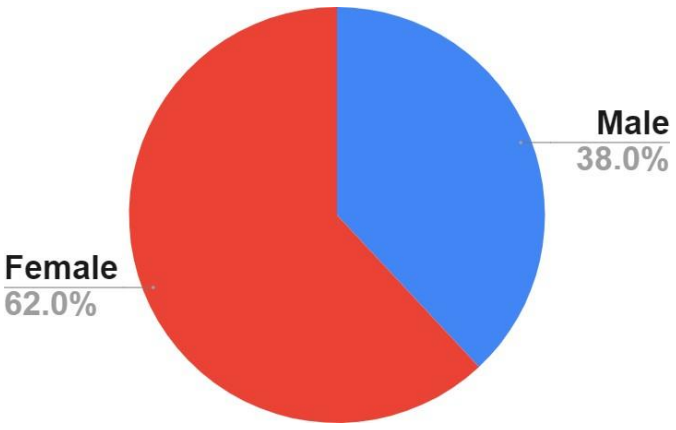

Figure 4. Distribution of respondents by sex.

All survey respondents, answered whether or not they have someone to receive their goods throughout the day. Of all the responses, the majority of respondents (59.78%) declared that they did not have any type of reception gateway for receiving products, while the minority (40.22%) reported having an reception gateway, which characterizes a greater ease in receiving goods. Through the questionnaire it was also possible to identify the frequency of purchase of items for home delivery, Figure 5 demonstrates the behavior of respondents.

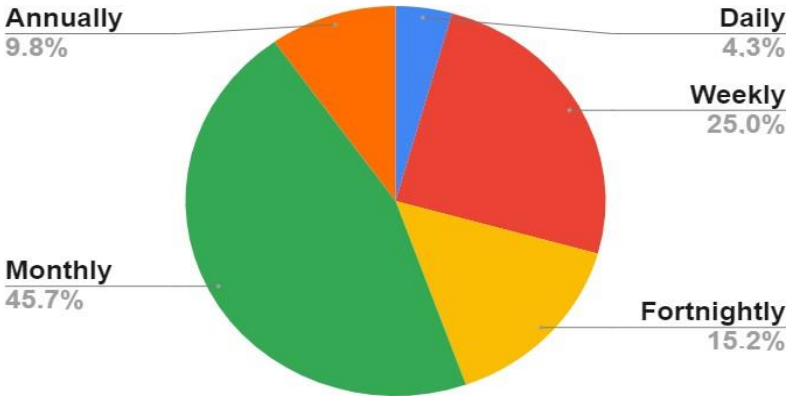

Figure 5. Frequency of online purchase for delivery.

It was identified that most consumers make purchases for home deliveries monthly (45.7%) or weekly (25%). The three main categories of consumption for delivery have been identified, as shown in Figure 6 below. The respondents' three largest categories of consumption were classified in the following order: food, clothing and technology, representing, respectively, 30.8%, 18.3% and 14.3% of the total responses.

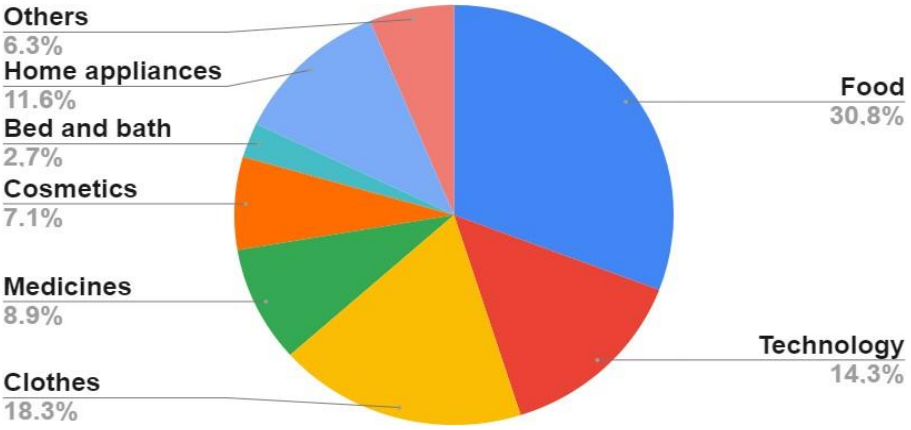

Figure 6. Categories.

Estimated model

First, the effect of the last mile delivery system features was estimated. The results of the estimated MLM model are presented in Table 3. The estimated model has a coefficient of determination value adjusted to the model (Adjusted Rho-Squared) of 0.578, considered satisfactory for this type of model (Hensher et al., 2015).

Variable	Coefficient	Error	Z	P-value
(A) Schedule	0.7290	0.2427	3.00	0.003 ***
(B) Rescheduling	0.3700	0.2053	1.80	0.072 *
(C) Application	0.7290	0.2502	2.91	0.004 ***
(C) Cost	-0.0746	0.0096	-7.77	0.000 ***

* Significant at 10%, ** significant at 5%, *** significant at 1%

The results indicate that all four features showed significant coefficients (P-value > 0.10) for estimating the last mile delivery system. As expected, the positive value of the coefficients of the features scheduling, rescheduling and application indicates that these features contribute positively to the respondents' utility. Similarly, the negative value of the cost attribute indicates that it contributes negatively to the respondents' utility.

The estimated model with the delivery features moderated with the variables (E) reception gateway and (F) delivery frequency is presented in Table 4. The estimated model has an adjusted Rho-Squared value of 0.558 (different from the Table 3 that was with 0.578). This result indicates that despite including more independent variables in the model it did not show better predictive ability than the previously estimated one.

Table 4. Coefficient estimated by the MLM model.

Variable	Coefficient	Error	Z	P-value
(A) Schedule	0.8349	0.8189	1.02	0.308
(B) Rescheduling	0.3702	0.9074	0.40	0.683
(C) Application	0.6435	0.8397	0.76	0.443
(D) Cost	-0.0772	0.0081	-9.48	0.000***
(EA) Reception gateway*Scheduling	0.6578	0.5643	1.16	0.244
(EB) Reception gateway*Rescheduling	0.0452	0.588	0.07	0.939
(EC) Reception gateway*Application	-0.6765	0.533	-1.29	0.205
(FA) Delivery Frequency*Scheduling	-0.1423	0.235	-0.60	0.545
(FB) Delivery Frequency*Rescheduling	0.0192	0.262	0.07	0.942
(FC) Delibery Frequency* Application	0.1395	0.242	0.57	0.535

* Significant at 10%, ** significant at 5%, *** significant at 1%

The results indicate that the inclusion of the moderator variables does not contribute to improving the quality of the model. This result is evidenced by the AIC and BIC results, which present higher values than the previous model (Table 3). When analyzing the estimated variables, it is found that only (D) cost presents a significant effect (P-value < 0.00). This way, it can be understood that both the moderation of the variable (E) reception gateway and the variable (F) delivery frequency also do not present a significant contribution to the configuration of the delivery system considered in the study.

The values of willingness to pay (WTP) for the delivery features considered are presented in Table 5. The WTP values were estimated by the Krinsky and Robb method (Krinsky; Robb, 1990) for the significant variables estimated previously.

Table 5. The values of willingness to pay.

Variable	WTP	2,5%	97,5%
(C) Schedule	R$ 10.9674	R$ 5.3547	R$ 16.4628
(D) Rescheduling	R$ 5.1940	-R$ 0.7659	R$ 11.0194
(E) Application	R$ 10.9674	R$ 5.8937	R$ 16.0629

The values indicate that including the possibility of scheduling increases the possibility of the customer paying for the delivery by R$10.96. The same value is estimated for the inclusion of an application for tracking the delivery. Despite the same value, it is found that the confidence interval of the WTP of the scheduling variable is a little smaller. When including the possibility of rescheduling the delivery the customer is willing to pay the value of R$5.19.

DISCUSSION

The purpose of the present research was to understand the customer's perspective towards the last mile delivery system and their preferences regarding the services offered, such as scheduling, rescheduling, technology, and the associated costs. The proposed model indicated the utility of the respondents in relation to the features described.

Through the methodological analysis it was found that the data obtained through the questionnaire generated a reliable database, with an adjusted coefficient of determination value of 0.578, as well as p-values with statistical significance, allowing a relationship analysis between the features.

The results showed the positive utility of the features of scheduling, rescheduling and available technology, confirming consumer preference for delivery systems with greater flexibility and traceability. The features of greatest relevance to respondents were the possibility of scheduling and use of technology for traceability. On the other hand, the rescheduling attribute did not present the same level of importance at the moment of choice.

Based on the results, it was possible to demonstrate that the possibility of scheduling delivery is a service that, despite the cost, generates in the consumer a high sense of usefulness, awakening the willingness to pay a higher purchase price. The same result was obtained for delivery systems that make tracking technology available in applications. The use of innovative services and tools contributes positively to the customer's "online journey" and customer loyalty, as pointed out by (Vakulenko et al., 2019).

It is possible to describe that delivery scheduling and its traceability contribute to maximizing the number of successful deliveries (Özarık et al., 2021) nitrating benefits for customer and deliverer, minimizing the total cost of the delivery system and increasing customer satisfaction.

Regarding the behavioral characteristics of frequency of purchase and residential, presence or absence of concierge, the results showed no relevant relationship in the decision-making process about the delivery system.

CONCLUSION

Considering the current scenario of high demand for online shopping channels and goods delivery systems, this research brings relevant results that present consumer preferences in the decision-making process at the time of purchase.

The results show that consumers are interested and willing to pay for services and amenities such as scheduling at the time of purchase and associated technology. This finding corroborates the pricing process for online product delivery and confirms the trend toward customer-customized systems. In addition, we were able to add to the literature research that seeks to understand which attributes are most important at the moment of customer choice, as well as to use the methodology proposed here. With this, we can also impact the managerial level with this research, because it becomes the basis for identifying what to offer as a company to its customers.

Future works may contribute in this line of research by adding other features to the delivery/receiving system, taking into consideration multi-channel sales and the possibility of picking up products at specific points, identifying for example, how many kilometers the customer would be willing to travel to pick up a product.

As a research implication, it is necessary that in new surveys, there should be a larger number of respondents to obtain as many answers as possible for further analysis. Since this research was limited to the number of respondents presented in the methodology of this article.

Furthermore, another possibility for future research is to conduct other survey methodologies that may yield positive results and add new research to the literature.

A limitation of practical implications of this research is the region in which it was applied and the number of people from which answers were collected; this may impact the results. It would be positive in new research to conduct it in different regions in order to map the largest possible amount of consumer cultures.

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