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Innovative Delivery Methods in the Last-Mile: Unveiling Consumer Preference

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Abstract: Background: Consumer preferences are one of the most dominant factors shaping the implementation of last-mile delivery innovations. This study investigates how innovative delivery methods affect consumers' last-mile delivery preferences and focuses on understanding consumer expectations for integrating these methods. Methods: A discrete choice experiment was implemented. Data from 480 participants in Istanbul were analyzed by multinomial logistic regression using the Apollo package in R Studio. Results: For the selection of delivery to the address, the delivery price, delivery term, and the delivery time window are significant attributes. However, the delivery method and information and tracking attributes do not emerge as decisive attributes in this choice. For the selection of delivery points, the delivery price, delivery term, distance, pick-up accessibility, information and tracking, and the delivery method have been identified as key influencing attributes. Conclusions: The study suggests actionable recommendations aimed at improving negative perceptions of delivery points, advocating for harmonized regulatory frameworks, strategically integrating technology, and developing delivery schedules to enhance overall service quality. This study fills a gap in the literature by examining different last-mile delivery attributes and locations. It also provides valuable insights in understanding consumer expectations and innovative delivery methods.

Keywords: last-mile delivery; consumer preferences; drone; autonomous robot; smart parcel lockers

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1. Introduction

The last-mile delivery process is crucial in establishing direct physical interaction between consumers and e-commerce companies. This pivotal process facilitates this interaction and significantly influences overall e-commerce satisfaction. According to [1], approximately 75% of consumers are willing to spend more with e-commerce companies if satisfied with the last-mile delivery service. Similarly, a report [2] from the United Kingdom revealed that 50% of consumers express reluctance to make future purchases from e-commerce companies following dissatisfaction with the last-mile delivery experience. Consequently, last-mile delivery services have become a focal point for e-commerce companies striving to increase market share and enhance the consumer experience.

However, the increasing demands placed on traditional last-mile delivery method, coupled with the limitations of existing infrastructure, present formidable challenges. These challenges include, e.g., congestion, environmental impact, and operational costs [3–6]. In light of these challenges, there is a growing need to explore alternative strategies to enhance the efficiency and sustainability of last-mile delivery processes. Recognizing these challenges, the authors of [7] argue that a new approach to last-mile delivery is essential, giving rise to innovative methods designed to mitigate the negative impacts of traditional practices. In the traditional delivery method, shipments are delivered to recipients by delivery workers using vehicles that follow predetermined routes from delivery centers. Innovative last-mile delivery methods encompass a variety of strategies, technologies, or combinations, all aimed at enhancing the efficiency and effectiveness of last-mile delivery.

In some innovative delivery methods, such as smart parcel lockers and service points, the primary focus is the last-mile delivery location. Conversely, the focus is on the vehicles in bicycle, drone, and autonomous robot deliveries. As documented in [8], extensive research underscores the benefits of these innovative delivery methods, demonstrating their effectiveness in reducing emissions, alleviating congestion, lowering costs, and providing a more consumer-friendly form of delivery.

Despite all these advantages that innovative delivery methods offer or promise to offer, one of the main factors to consider is consumers. In today's world of ever-increasing consumer demands, last-mile delivery research on consumer preferences and behavior is more critical than ever [9]. The authors of [10] argue that without solid evidence, it may be difficult for last-mile delivery firms to take advantage of drone delivery and adapt their business models to a more competitive environment. This assertion applies to various other innovative delivery methods. Although there is research on the benefits of these delivery methods, their limited use in practice and how consumers will react to the innovative delivery methods implemented are not clearly known. Therefore, it is necessary to consider consumers' expectations in the creation phase of innovative delivery methods. Researchers emphasize the need for studies to assess consumer behavior for different innovative delivery methods [11–16].

There is a growing body of literature examining consumer behavior toward innovative delivery methods from a psychological perspective [11,12,15–17]. However, one stream of studies examining consumer behavior is the discrete choice experiment studies that quantitatively examine their sensitivities and trade-offs regarding innovative delivery methods with econometric models outside of psychological studies. When the discrete choice experiment literature is evaluated, the studies include the following: studies that examine a single delivery method/location [18–28], different delivery methods [3,10,29,30], and consumer preferences for different delivery locations [13,14,31,32].

In last-mile delivery, firms typically decide on the delivery method, while consumers determine the delivery address. Therefore, investigating consumer expectations regarding the place of delivery is crucial [7]. In the studies on delivery locations, the authors of [32] focused only on post offices, while the authors of [14] presented the two highly correlated delivery methods of service points and smart parcel lockers as separate alternatives. The authors of [31,33,34] did not focus on innovative delivery methods used in delivery to the address, although delivery points, service points, and smart parcel lockers were not presented as separate methods. Despite the introduction of innovative delivery methods in various markets, their impact on the choice of last-mile delivery and their potential to replace traditional delivery method have been studied to a limited extent and are not yet fully understood. For innovative delivery methods to work effectively, they need to reach a certain level of consumer preference. As in the case of Sainsbury's, Somerfield, Asda, eBay, Google, and Webvan, last-mile delivery methods without a sustainable economic structure will struggle to balance pricing, consumer expectations, and service levels, jeopardizing sustainability [35]. These cases highlight the importance of the delivery context in which innovative delivery methods are offered. Incorporating innovative delivery methods into last-mile delivery without a comprehensive understanding of consumer expectations poses a significant challenge for companies aiming to implement these innovative methods successfully. Therefore, in order to make innovative delivery methods as practical as possible, understanding consumers' preferences for last-mile delivery is essential. From a consumer perspective, the acceptance and effectiveness of these methods are not yet well understood, while there is a growing literature indicating their operational advantages. From an empirical perspective, there is a significant gap in understanding consumers' reactions to innovative last-mile delivery methods and their impact on their preferences. Moreover, the attributes used in the studies may vary from region to region as a result of local conditions [13,15]. Consequently, it warrants investigation within the framework of a developing country where e-commerce is experiencing rapid growth.

This study aims to investigate how innovative delivery methods influence consumer preferences in last-mile delivery, and to offer insights into seamlessly integrating these methods into sustainable delivery structures. Through discrete choice experiments, this research quantitatively assesses consumers' sensitivities to innovative delivery methods and the trade-offs they have to make. Properly establishing the attributes and levels of the last-mile delivery when presenting innovative delivery methods to consumers can significantly increase the likelihood of their adoption. Having extensive insights into consumer preferences helps e-commerce and last-mile delivery companies to implement these methods more effectively. For this aim, two research questions were formulated: Firstly, how do innovative last-mile delivery methods impact consumer preferences for last-mile delivery? Secondly, which attributes and levels of last-mile delivery need to be combined to shift consumer preferences from delivery to the addresses to delivery points?

2. Materials and Methods

2.1. Discrete Choice Experiment

Numerous attributes influence decision-makers' selection of products or services. The total utility an individual derives from a good or service is determined by these attributes, which are shaped by varying levels of attributes [34]. The discrete choice experiment is a method employed to unveil the general preferences of decision-makers. This inference is achieved by transforming data regarding the choices made by a group of decision-makers among multiple alternatives with differing attributes into an indirect utility function [35]. This method facilitates the elicitation of preferences for alternatives that are currently unavailable while acknowledging the potential for cognitive dissonance between the decision-maker's expressed preferences and their actual behavior [36]. This study uses a discrete choice experiment to elucidate consumers' preferences for the last-mile delivery.

Companies typically decide on the delivery method for last-mile delivery, while consumers determine the delivery address. Consequently, it is imperative to explore consumer expectations concerning the delivery location [7]. Given the variations in delivery locations, we employed the term "labeled alternative". This approach aims to enhance the precision and reliability of research results by presenting participants with distinct and tailored alternatives. Two options were identified: delivery to the address, currently the most prevalent method, and delivery points, which have rapidly evolved in recent years as a significant alternative to delivery to specific addresses. Delivery points encompass diverse delivery methods, with service points and smart parcel lockers being the most widely utilized [14]. The authors of [14] found a high correlation between these two delivery methods. Therefore, the delivery points are presented as a single alternative in the broader scope.

Drawing from interviews with drone operators and insights from Unmanned Vehicle Systems International, the authors of [10] concluded that the technical feasibility of delivering packages weighing up to 5 kg by drone has been extensively tested worldwide. Additionally, the authors of [3] established that drones can serve as an effective last-mile delivery solution for small and lightweight packages. Conversely, smart parcel lockers have inherent package size and weight constraints due to locker dimensions. Furthermore, as highlighted in [27,36], a substantial portion of e-commerce products are characterized by small volume and weight. In light of these limitations, a product was chosen for each product group, tailored for packages ranging from 1 to 3 volumetric weight, a range common in e-commerce transactions and suitable for universal use regardless of gender. The taxonomy proposed in [37], which categorizes products as convenience, shopping, and specialty products, was employed for product classification. The researchers carried out the product selection for each category based on the products that women and men use in common. The chosen products included deodorant, as a representative of convenience products, shoes for shopping products, and cell phones for specialty products.

The study concentrates on discerning the attributes and levels deemed significant by consumers in their selection of a delivery alternative. This phase of the research involves

the identification of attributes and levels likely to hold importance for consumers. An initial literature review was conducted to pinpoint these attributes, encompassing previous studies that employed preference methods for last-mile delivery. Articles, books, book chapters, theses, and dissertations employing the stated preference methods were considered within this context.

Incorporating all identified attributes and levels into the survey was not feasible. Consequently, the chosen attributes formed the core components of the questionnaire intended for participant presentation. Determining which attributes and levels to include, aligned with the study's aim, was author-defined, and subsequently refined by incorporating feedback from five mid-level managers employed by last-mile delivery companies. The attributes and their corresponding levels are delineated in Table 1.

Table 1. Alternatives, attributes, and levels.

Alternatives/ Attributes	**Delivery to the Address**	**Delivery Points**
Delivery price	• 20 ₺ • 30 ₺ • 40 ₺ • 50 ₺	• 20 ₺ • 30 ₺ • 40 ₺ • 50 ₺
Delivery method	• Delivery workers • Drone • Autonomous robot	• Service points • Smart parcel lockers
Delivery term	• Within 2 h • Within 24 h • Between 25 and 48 h • Between 3 and 7 days, but the delivery date of choice	• Within 2 h • Within 24 h • Between 25 and 48 h • Between 3 and 7 days, but the delivery date of choice
Delivery time window	• Day delivery during weekdays (09:00–18:00) • Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00) • Option to choose from day delivery during weekdays (09:00–18:00), evening delivery during weekdays (18:00–22:00), or day delivery during weekends (09:00–18:00) • Option to choose from day delivery during weekdays (09:00–18:00), evening delivery during weekdays (18:00–22:00), day delivery during weekends (09:00–18:00), or evening delivery during weekends (18:00–22:00)	
Pick-up accessibility		• Available for collection during weekdays (09:00–22:00) • Available for collection during weekdays (09:00–22:00) and Saturdays (09:00–22:00) • Available for collection seven days a week (09:00–22:00) • Available for collection 24/7

Table 1. *Cont.*

Alternatives/ Attributes	Delivery to the Address	Delivery Points
Information and traceability	• Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer • Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer and live location tracking	• Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points • Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points and live location tracking
Distance		• 500 m from your home/workplace • 1000 m from your home/workplace • 1500 m from your home/workplace • 2000 m from your home/workplace

2.2. Survey and Sample

The discrete choice experiment involved the creation of a questionnaire administered to participants. The experimental design, generated through the Ngene program, employs a D-efficient design. A pilot study was conducted to enhance precision, following the approach in [10], utilizing 12 sets of alternatives (scenarios) comprising 5 blocks for each of the 3 product groups. A total of 75 participants contributed to collecting 375 data points in the pilot study. Analysis using a multinomial logistic regression model yielded β values. Subsequently, these β values were employed to renew the D-efficient design to derive the final design. For practical considerations, the ultimate design comprised 2 blocks, each containing 12 sets of alternatives (scenarios) created separately for the 3 product groups (e.g., Figure 1).

Subsequently, the scenarios were integrated with sociodemographic, e-commerce, and last-mile delivery questions, shaping the questionnaire's basis. Google Forms, an online survey platform, facilitated the dissemination of these questionnaires. The study's target population comprises individuals aged 18 and above residing in Istanbul and engaging in online product purchases within the last year. Istanbul was chosen as the focal point due to its substantial population, a significant portion of Türkiye's inhabitants being actively involved in e-commerce, and its early adoption of innovative delivery solutions. The study enrolled 480 participants in Istanbul (Türkiye), employing convenience sampling as the preferred technique. Following the sample calculation method proposed in [37], a minimum of 100 respondents, with a minimum of 30 respondents per subgroup, was stipulated to conduct the subsequent analysis for each category. Furthermore, convenience sampling's selective nature compromises the findings' generalizability and questions the sample's representativeness [38]. The selection of convenience sampling was driven by its expediency, accessibility, ease of implementation, and cost-effectiveness. This research marks the initial stride in evaluating innovative delivery methods from a consumer perspective, validating the appropriateness of convenience sampling for this exploratory phase.

Two distinct survey scenarios were formulated, creating six survey versions across three diverse products, and subsequently distributed through various social media platforms. The average time to complete the survey was approximately five minutes, and participants did not require specialized technical skills. Before commencement, participants received a briefing note on innovative delivery methods. The survey was accessible and could be completed on either computers or smartphones. Thus, 480 individuals successfully participated, with an equal distribution among the 6 survey versions. The surveys distributed via social media apps and WhatsApp version 2.23.2.71.

You purchased a cell phone over the internet for 8250 ₺. The company offers two different delivery alternatives, each with its own unique attributes, for delivering your product. Please make your selection based on these two alternatives, regardless of any previous delivery preferences you may have.

	Delivery to the address	**Delivery points**
Delivery method	Delivery workers	Smart parcel lockers
Delivery term	Within 3 and 7 days, but the delivery date of choice	Delivery between 25 and 48 h
Pick -up accessibility		Available for collection seven days a week (09:00–22:00)
Delivery time window	Day delivery during weekdays (09:00–18:00)	
Delivery price	40 ₺	50 ₺
Information and Traceability	Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points
Distance		500 m from your home/workplace
Which alternative would be more favorable for you?	☐	☐

Grey rectangles indicate that the attribute is unavailable for the relevant alternative.

Figure 1. Example of choice scenario.

2.3. Model Estimation

Various models are available for estimating participant preferences (parameter values) in a discrete choice experiment, including binary probit and logistic regression, multinomial logistic regression, nested logistic regression, and mixed logistic regression. The authors of [39] argued that no single model is inherently superior, but they suggest considering alternative models if the assumption of independence among alternatives is violated. The authors of [40,41] asserted that multinomial logistic regression (Multinomial Logit) is prevalent in nearly half of the studies. Over the years, the multinomial logit (MNL) model has been increasingly adopted. Multinomial logit is a direct extension of binary logistic regression, a point highlighted in prior works [42,43]. According to the authors of [44,45], this analytical approach finds applicability in modeling dependent variables featuring not just two but multiple categories. Empirical investigations, such as those conducted in [22,26,30,46], have showcased the utilization of multinomial logit in analyzing dependent variables, presenting two alternatives within distinct research paradigms. Although requiring less computational power and providing a simple economic evaluation, multinomial logit models have an unrealistic error term distribution assumption, leading to several limitations [46]. However, it appears to demonstrate robustness to deviations of the random component distribution from the model [47].

Respondents' preferences and other variables were quantified to analyze the survey data. Subsequently, a multinomial logit discrete choice model was estimated using the Apollo package in RStudio [48].

Equations (1) and (2) depict the utility functions for the two alternatives:

$$V_{DA} = ASC_{DA} + DAP * \beta_{DAP} + DAM2 * \beta_{DAM2} + DAM3 * \beta_{DAM3} + DAT1 * \beta_{DAT1} + DAT2 * \beta_{DAT2} + DAT3 * \beta_{DAT3} + DAW2 * \beta_{DAW2} + DAW3 * \beta_{DAW3} + DAW4 * \beta_{DAW4} + DAI2 * \beta_{DAI2} \quad (1)$$

$$V_{DP} = ASC_{DP} + DPP * \beta_{DPP} + DPP2 * \beta_{DPP2} + DPT1 * \beta_{DPT1} + DPT2 * \beta_{DPT2} + DPT3 * \beta_{DPT3} + DPA2 * \beta_{DPA2} + DPA3 * \beta_{DPA3} + DPAA4 * \beta_{DPA4} + DPI2 * \beta_{DPI2} + DPD2 * \beta_{DPD2} + DPD3 * \beta_{DPD3} + DPD4 * \beta_{DPD4} \quad (2)$$

3. Results

3.1. Descriptive Results

Table 2 illustrates the distribution of the sample based on sociodemographic variables.

Table 2. Sociodemographic variables of the sample.

Sample = 480	Frequency	Percentage (%)
Gender		
Male	222	46%
Female	258	54%
Age		
1945–1964	18	4%
1965–1982	133	28%
1983–2000	193	40%
>2001	136	28%
Education		
Primary school	31	6%
High school	219	46%
Associate's degree	25	5%
Bachelor's degree	153	32%
Graduate degree	52	11%
Employment		
Public	90	19%
Private	167	35%
Student	112	23%
Housewife	54	11%
Retired	11	2%
Self-employed	31	7%
Unemployed	15	3%
Monthly Household Income		
5500 ৳ <	4	1%
5501–13,000 ৳	168	35%
13,001 ৳–26,000 ৳	198	41%
>26,001 ৳	110	23%

While the survey attracted slightly more female respondents (54%) than males (46%), this disparity remains close to a balanced 50–50 distribution. Analyzing participant age groups revealed that 40% were born between 1983 and 2000, 28% between 1965 and 1982, 28% in 2001 and later, and 4% between 1945 and 1964. Regarding educational attainment, 46% of participants completed high school, 32% hold a bachelor's degree, 11% possess a graduate degree, 6% have completed primary education, and 5% obtained an associate's degree. Notably, the survey question concerning educational status was framed as "the school most recently graduated from", encompassing university students within the high school graduate category. Consequently, the highest rate was attributed to high school education. Regarding employment, 35% work in the private sector, 23% are engaged in ongoing education, 19% work in the public sector, 11% are housewives, 7% are self-employed, 3% are unemployed, and 2% are retired. Regarding monthly household income, 41% of participants fall within the 13,001–26,000 ৳ range, 35% in the 5501–13,000 ৳ range, and 23% with incomes of 26,001 ৳ and above. Unfortunately, there is no available e-commerce usage data for the overall population, limiting direct comparisons with the sample. When

comparing the sample to the broader population of Istanbul, a similar distribution was observed regarding the gender ratio, but notable disparities arose concerning education levels and age groups. This discrepancy is likely attributed to a higher representation of educated and young to middle-aged individuals among e-commerce users.

Table 3 presents the findings of the sample on e-commerce and last-mile delivery. Online shopping frequency among participants varied, with 29% shopping 12–24 times, 26% shopping 53 times or more, 24% shopping 25–52 times, 17% shopping 4–11 times, and 4% shopping 1–3 times annually. Notably, half of the participants (50%) shop online 25 or more times a year. The vast majority (99%) have used the delivery workers option, 27% have used service points, and 11% have experienced smart parcel lockers. Drones and autonomous robots, yet to be widely implemented, received no preference. Participants generally viewed delivery points as a viable option (65%), with 23% undecided and only 12% holding an unfavorable opinion. Regarding the preferred location for delivery points, store/grocery/market led at 48%, followed by public transportation stops (27%), chain markets (17%), gas stations (4%), and shopping malls (4%). Of the respondents, 62% believed that last-mile delivery methods will enhance the delivery process, 26% remained undecided, and 12% expressed a negative opinion.

Table 3. Findings on e-commerce and last-mile delivery among the sample.

Sample = 480	**Frequency**	**Percentage (%)**
How many online purchases, excluding food and grocery orders, do you make annually?		
1–3	21	4%
4–11	82	17%
12–24	138	29%
25–52	112	24%
>53	127	26%
Which delivery methods do you use for your current e-commerce purchases? (You can check more than one option)		
Delivery workers	476	99%
Drone	0	-
Autonomous robot	0	-
Service points	128	27%
Smart parcel lockers	55	11%
Do you consider delivery points, such as smart parcel lockers or service points, a feasible option for your online shopping?		
Yes	309	65%
No	59	12%
Undecided	112	23%
Could you specify your preferences regarding delivery points, including smart parcel lockers or service points?		
Supermarket chains	82	17%
Gas stations	21	4%
Public transportation stops	126	27%
Store/Groceries/Market	230	48%
Shopping mall	21	4%
Innovative delivery methods, such as smart parcel lockers, service points, drones, and autonomous robots, will enhance my delivery experience.		
Yes	297	62%
No	58	12%
Undecided	125	26%

3.2. Choice Model Estimation

Choice model estimation findings quantitatively revealed consumers' preferences toward last-mile delivery, thus effectively filling the current research gap in understanding consumer responses to innovative delivery methods in last-mile delivery. Table 4 shows that the model demonstrated an acceptable fit with the data, as indicated by an adjusted McFadden R^2 value of 0.1607. In the literature, an adjusted R^2 value of 0.10 and above indicates an acceptable-fitting model [24,49,50].

The alternative-specific constant (ASC) represents each alternative's characteristics in the not explicitly modeled choice set. Estimated alongside other parameters, it signifies the difference in fundamental utility when choosing a specific alternative relative to others in the set, holding all other attributes constant. Considered a fundamental variable influencing preference for unobservable characteristics, the ASC for delivery to the address was fixed at "0" with no *p*-value, indicating its reference status. In contrast, the delivery points' ASC was −1.4841, a statistically significant value suggesting that individuals, considering unobserved characteristics, tend to avoid this alternative.

Table 4. Choice model estimation findings.

Model	**MNL**			
Parameters	**Value**	**T. Ratio**	**Std. Err.**	***p*-Value**
Alternative-specific constants (ASC)				
ASC_DA				
ASC_DP	−1.4841	−4.4910	0.3304	0.00
Delivery to the address (DA)				
Delivery price (DAP)	−0.0855	−16.4709	0.0051	0.00
Delivery method (DAM)				
Delivery workers (DAM1)				
Drone (DAM2)	−0.1127	−1.2665	0.0890	0.10
Autonomous robot (DAM3)	−0.0299	−0.3517	0.0852	0.36
Delivery term (DAT)				
Within 2 h (DAT1)	1.9219	9.0271	0.2129	0.00
Within 24 h (DAT2)	1.0245	5.3651	0.1909	0.00
Between 25 and 48 h (DAT3)	0.6487	4.4816	0.1447	0.00
Between 3 and 7 days, but the delivery date of choice (DAT4)				
Delivery time window (DAW)				
Day delivery during weekdays (09:00–18:00) (DAW1)				
Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00) (DAW2)	1.0280	8.5069	0.1208	0.00
Option to choose from day delivery during week-days (09:00–18:00), evening delivery during weekdays (18:00–22:00), or day delivery during weekends (09:00–18:00) (DAW3)	1.5856	13.8686	0.1143	0.00
Option to choose from day delivery during week-days (09:00–18:00), evening delivery during weekdays (18:00–22:00), day delivery during weekends (09:00–18:00), or evening delivery during weekends (18:00–22:00) (DAW4)	1.5952	14.1489	0.1127	0.00
Information and traceability (DAI)				
Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer (DAI1)				
Notifications by SMS or e-mail when thepackage is received for shipping and the package is shipped to the consumer and live location tracking (DAI2)	−0.0025	−0.0350	0.0733	0.48

Table 4. *Cont.*

Model	**MNL**			
Parameters	**Value**	**T. Ratio**	**Std. Err.**	***p*-Value**
Delivery points (DP)				
Delivery price (DPP)	−0.0609	−8.1564	0.0074	0.00
Delivery method (DPM)				
Service points (DPM1)				
Smart parcel lockers (DMP2)	0.3372	3.6462	0.0924	0.00
Delivery term (DPT)				
Within 2 h (DPT1)	1.4305	6.6063	0.2165	0.00
Within 24 h (DPT2)	1.3612	9.2462	0.1472	0.00
Between 25 and 48 h (DPT3)	1.1543	8.3185	0.1387	0.00
Between 3 and 7 days, but the delivery date of choice (DPT4)				
Pick-up accessibility (DPA)				
Available for collection during weekdays (09:00–22:00) (DPA1)				
Available for collection during weekdays (09:00–22:00) and Saturdays (09:00–22:00) (DPA2)	0.2702	2.7468	0.0983	0.00
Available for collection seven days a week (09:00–22:00) (DPA3)	0.4698	4.7448	0.0990	0.00
Available for collection 24/7 (DPA4)	0.1860	1.8707	0.0994	0.03
Information and traceability (DPI)				
Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points (DPI1)				
Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points and live location tracking. (DPI2)	−0.3009	−4.4061	0.0682	0.00
Distance				
500 m from your home/workplace (DPD1)	0.8113	6.3929	0.1269	0.00
1000 m from your home/workplace (DPD2)	0.7390	6.6810	0.1106	0.00
1500 m from your home/workplace (DPD3)	0.6452	6.1082	0.1056	0.00
2000 m from your home/workplace (DPD4)				
Initial Log-Likelihood: −3992.53 Final Log-Likelihood: −3351.1 Adjusted McFadden's R^2: 0.1607				

The delivery price attribute showed a statistically significant value of −0.0855, aligning with expectations that an increase in the price of a product or service corresponds to a decrease in perceived benefit. Consumers are willing to pay less for delivery in the context of e-commerce shopping. Survey respondents accorded substantial importance to delivery price when selecting the delivery to the address alternative. Similarly, the statistically significant value of the delivery price attribute at −0.0609 underscores its significance in choosing the delivery points alternative.

The delivery method attribute was characterized by three levels for delivery to the address: delivery workers, drone, and autonomous delivery robot, with the delivery workers set as the reference level, being the most widely used method. The values for drone (−0.1127) and autonomous delivery robot (−0.0299) were not statistically significant, indicating that the delivery method on selection of delivery to the address was not influenced. Survey respondents showed no distinct preference among the three delivery methods when opting for delivery to the address. Conversely, the service points were considered the reference level for the delivery points alternative, comprising service points and smart parcel lockers. The statistically significant value of smart parcel lockers (0.3372) suggests that participants consider the delivery method attribute in choosing the delivery points alternative, with a preference for smart parcel lockers.

The delivery term attribute, expressed as "within 2 h", "within 24 h", "between 25 and 48 h", and "between 3 and 7 days on the desired day", designated "3–7 days on the desired day" as the reference level to assess consumer preferences regarding the right to choose the delivery day. The levels "within 2 h" (1.9219), "within 24 h" (1.0245), and "between 25 and 48 h" (0.6487) were all statistically significant. As anticipated, delivery term emerged as a crucial attribute in selecting the delivery to address alternative, indicating a consumer preference for shorter delivery periods in e-commerce purchases. This suggests that, despite the option to choose the day, participants prioritized quicker delivery, demonstrating sensitivity to term constraints over waiting for a preferred day. Similarly, the delivery term attribute for the service points alternative, expressed as "within 2 h", "within 24 h", "between 25 and 48 h", and "on the desired day between 3 and 7 days", designated "3–7 days on the desired day" as the reference level. The values for "within 2 h" (1.4305), "within 24 h" (1.3612), and "between 25 and 48 h" (1.1543) were all statistically significant. This indicates that respondents are influenced by the delivery term attribute when choosing the service points alternative, showing a preference for shorter delivery times despite the right to choose a specific day.

The information and traceability attribute, encompassing "Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer", and "Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer and live location tracking", designated the first level as the reference level. The choice of this reference level aims to explore differences between real-time tracking and basic information provided to individuals. The value of the level "Notifications by SMS or e-mail when the package is received for shipping and the package is shipped to the consumer and live location tracking" was -0.0025, indicating statistical insignificance. This suggests that the information and tracking feature is not a significant factor in participants' choice of delivery to the address alternative. While live location tracking reduces utility for participants, the effect needs to be more substantial to be generalized to the entire population, hinting that participants may perceive this attribute as unnecessary. The notification and traceability attribute also includes "Notification by SMS or e-mail when the package is received for shipment and placed at the delivery points" and "Notification by SMS or e-mail when the package is received for shipment and placed at the delivery points and live location tracking", with the first level as the reference. The value of the level "Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points and live location tracking" was -0.3009 and statistically significant. This signifies that the information and traceability attribute influences participants' choice of delivery points alternative. The negative utility of live location tracking implies that, contrary to expectations, participants perceive real-time tracking as a less desirable feature. This could stem from respondents considering the reference value sufficient and viewing the live tracking feature as unnecessary or cost-creating.

The attribute "Delivery time window" comprised four levels: "Weekdays between 09:00 and 18:00", "Weekdays between 09:00 and 18:00 or weekdays between 18:00 and 22:00", "Weekdays between 09:00 and 18:00 or weekdays between 18:00 and 22:00 or weekend between 09:00 and 18:00", and "Weekdays between 09:00 and 18:00 or weekdays between 18:00 and 22:00 or weekend between 09:00 and 18:00 or weekend between 18:00 and 22:00". The reference level was set as "Between 09:00 and 18:00 on weekdays" to understand consumers' preferences for delivery options with broader time intervals. The values for the levels were 1.0280, 1.5856, and 1.5952, respectively. All levels showed statistical significance. This indicates that the delivery company's working hours significantly influence the selection of a delivery to address alternative. Respondents expressed a preference for receiving deliveries within extended time intervals. The benefit derived by participants notably increased with the inclusion of 09:00–18:00 h on weekends, while the inclusion of 18:00–22:00 h on weekends provided limited additional benefit.

The pick-up accessibility, including "Between 09:00 and 22:00 on weekdays", "Between 09:00 and 22:00 on weekdays and 09:00 and 22:00 on Saturdays", "Between 09:00 and 22:00 seven days a week", and "available for collection 24/7", designated "Weekdays between 09:00 and 22:00" as the reference value to uncover consumer preferences for a broad time range. The respective values for the levels were 0.2702, 0.4698, and 0.1860. All three levels were statistically significant, indicating that the hours of delivery availability significantly influence participants' choice of delivery points alternative. Contrary to expectations, available for collection 24/7 level yielded less benefit. Instead, participants derived the most benefit from the "09:00–22:00 seven days a week" level. This suggests that participants perceived this time interval as the most ideal. From their perspective, there is no greater benefit if delivery points are open outside these periods.

The distance attribute of the delivery points comprised the levels "500 m from your home/workplace", "1000 m from your home/workplace", "1500 m from your home/workplace", and "2000 m from your home/workplace". The corresponding level values were 0.8113, 0.7390, and 0.6452, respectively. All three levels were statistically significant. The distance of the delivery points plays a crucial role in participants' choice of the delivery points alternative. This result indicates that as the distance increases, the benefit derived by participants from this attribute decreases. However, there was no significant difference in use between a 500 m distance and a 1500 m distance.

3.3. Relative Importance of Delivery to the Address

Table 5 indicates that for the delivery to the address alternative, the delivery term, delivery price, and delivery time window emerged as the most crucial attributes in respondents' responses to the choice tasks, making a statistically significant contribution to the model. These three attributes collectively represent 98% of the relative importance. The delivery method held a 2% share among the remaining two attributes, while information and traceability did not carry any weight. Notably, delivery term (41%) and delivery price (31%) stood out as the most influential attributes, followed by delivery time window (26%). However, delivery method, information, and traceability attributes were not statistically significant.

Table 5. Relative importance of delivery to the address.

Attributes	Lowest Utility Contribution	Highest Utility Contribution	Utility Contribution Range	Relative Importance
Delivery price	−4.275	−1.71	2.565	41%
Delivery term	0	1.9219	1.9219	31%
Delivery time window	0	1.5952	1.5952	26%
Delivery method	−0.1127	0	0.1127	2%
Information and traceability	−0.0025	0	0.0025	-

Table 6 presents that in the context of the delivery points alternative, delivery price and delivery term emerged as the most impactful attributes influencing respondents' decisions in the choice tasks. These two attributes collectively contribute to 66% of the relative importance. The remaining four attributes (distance, pick-up accessibility, delivery method, and information and traceability) constitute 34% of the overall importance. Specifically, delivery price (37%) and delivery term (29%) take precedence as the most crucial attributes, followed by distance (16%). Pick-up accessibility (9%) ranks fourth, while information and traceability (6%) and delivery method (3%) are considered the least important attributes. Importantly, all attributes were deemed statistically significant.

Table 6. Relative importance of delivery points.

Attributes	Lowest Utility Contribution	Highest Utility Contribution	Utility Contribution Range	Relative Importance
Delivery price	−3.045	−1.218	1.827	37%
Delivery term	0	1.4305	1.4305	29%
Distance	0	0.8113	0.8113	16%
Pick-up accessibility	0	0.4698	0.4698	9%
Information and traceability	0	−0.3009	0.3009	6%
Delivery method	0	0.1561	0.1561	3%

3.4. Martket Share Simulation

The simulation results revealed how consumer preferences shift under various scenarios, enabling firms to understand consumer reactions and adaptation processes better, thereby helping the creation of new last-mile delivery designs. Table 7 shows that diverse scenarios were formulated to discern participant preferences regarding various delivery methods. The initial scenario (reference), designed to mirror contemporary market conditions, notably saw over three-quarters of participants opting for delivery to their addresses, with the remaining preferring delivery to delivery points. The subsequent exploration centered on a price-centric scenario, aiming to elucidate the influence of pricing on the transition toward delivery points selection. Upon reducing the price discrepancy by 30 ₺, favoring the delivery points, an observable shift occurred, with 42% of respondents altering their preference. Another facet of investigation delved into the technology-oriented scenario, scrutinizing the impact of both the delivery method and the incorporation of live tracking attributes. The findings revealed a lack of discernible influence exerted by these attributes on decision-makers' preferences. Moreover, the focus shifted to a distance-centric scenario, whereby a reduction in the proximity of the delivery points to 1500 m correlated with a 13% uptick in participant inclinations toward the delivery points. Conversely, scenarios featuring distances below this threshold exhibited only marginal enhancements favoring the delivery points. Lastly, analysis of the delivery term scenario underscored that expedited delivery times toward the delivery points elicited a surge in participant preferences for this specific delivery locale.

Table 7. Market share simulation.

Scenario	Delivery Price	Delivery Method	Delivery Term	Delivery Time Window	Pick-Up Accessibility	Information and Traceability	Distance	Delivery to Address	Delivery Point
Reference scenario	30 ₺	Delivery workers	Between 25 and 48 h	Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00)		Notifications by SMS or e-mail when (1) the package is received for shipping and (2) the package is shipped to the consumer		78%	22%
Reference scenario	30 ₺	Service points	Between 25 and 48 h		Available for collection during weekdays (09:00–22:00)	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points	2000 m from your home/workplace		
Price-focused scenario	50 ₺	Delivery workers	Between 25 and 48 h	Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00)		Notifications by SMS or e-mail when (1) the package is received for shipping and (2) the package is shipped to the consumer		36%	64%
Price-focused scenario	20 ₺	Service points	Between 25 and 48 h		Available for collection during weekdays (09:00–22:00)	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points	2000 m from your home/workplace		
Innovation-focused scenario	30 ₺	Delivery workers	Between 25 and 48 h	Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00)		Notifications by SMS or e-mail when (1) the package is received for shipping and (2) the package is shipped to the consumer		78%	22%
Innovation-focused scenario	30 ₺	Smart parcel lockers	Between 25 and 48 h		Available for collection during weekdays (09:00–22:00)	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points and live location tracking.	2000 m from your home/workplace		

Table 7. *Cont.*

Scenario	Delivery Price	Delivery Method	Delivery Term	Delivery Time Window	Pick-Up Accessibility	Information and Traceability	Distance	Delivery to Address	Delivery Point
Distance-focused scenario	30 ৳	Delivery workers	Between 25 and 48 h	Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00)		Notifications by SMS or e-mail when (1) the package is received for shipping and (2) the package is shipped to the consumer		65%	35%
Distance-focused scenario	30 ৳	Service points	Between 25 and 48 h		Available for collection during weekdays (09:00–22:00)	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points	1500 m from your home/workplace		
Time-focused scenario	30 ৳	Delivery workers	Between 3 and 7 days, but the delivery date of choice	Option to choose between day delivery during weekdays (09:00–18:00) or evening delivery during weekdays (18:00–22:00)		Notifications by SMS or e-mail when (1) the package is received for shipping and (2) the package is shipped to the consumer		50%	50%
Time-focused scenario	30 ৳	Service points	Within 2 h		Available for collection on weekdays (09:00–22:00)	Notifications by SMS or e-mail when the package is received for shipment and placed at the delivery points	2000 m from your home/workplace		

4. Discussion

Last-mile delivery is an important urban logistics activity that directly and indirectly affects the lives of many urban residents, whether they are e-commerce consumers or not. Problems experienced in last-mile delivery create internal and external costs and negatively affect economic, environmental, and social issues, the three pillars of sustainability. In order to reduce these negativities, innovative solutions are proposed at different stages of the last-mile delivery. Achieving the expected contribution from these innovations depends on the consumers, who have a key role in the last-mile delivery. This study investigated how innovative delivery methods influence consumer preferences in last-mile delivery.

When evaluating the delivery locations, it became clear that participants generally prefer deliveries to their own addresses. This trend suggests that consumers are increasingly opting for home delivery services, which are both familiar to them and frequently utilized. This preference aligns with existing literature [22–24,28,47] and reflects consumers' inclination toward the convenience of shopping from home. E-commerce provides consumers with great convenience, such as shopping without leaving home. Home delivery service shows the consumers' tendency to maintain the habit of not having to travel to pick up the order. Additionally, with growing competition in the Turkish last-mile delivery market and consumer-friendly legal developments, delivery services have evolved to prioritize consumer satisfaction. Attributes such as advance notifications, follow-up calls, and repeated delivery attempts further enhance consumer contentment, potentially driving increased demand for delivery to the address.

The first evaluated attribute was the delivery price. Our study confirmed that delivery price is a crucial factor influencing consumer choices for both delivery to the address and delivery to the delivery points. Analogous to delivery to the address, an increase in the price of delivery points corresponds to a decrease in consumer-perceived benefit. Notably, delivery price emerged as one of the most pivotal attributes for delivery to the address and delivery to the delivery points. These findings align with existing literature [3,10,22,25,26,28,29,31,51,52] and highlight the persistent importance of delivery cost in consumers' decision-making processes. This emphasis on delivery price can be attributed to consumers' price sensitivity [10]. Research in [53] indicated that approximately three-quarters of consumers opt for the cheapest delivery option. This consumer behavior, akin to seeking affordable products through e-commerce, underscores the significance of last-mile delivery in pursuing cost-effective solutions. Additionally, the prevalence of free delivery options by many e-commerce companies may deter last-mile delivery charges for them, fostering a heightened sensitivity among consumers. The authors of [54] suggest that despite competitive product prices, consumers exhibit a reluctance to pay for delivery, reinforcing the feasibility of incorporating last-mile delivery charges into the total price as a strategic policy.

The second evaluated attribute was the delivery method. Our findings revealed an interesting perspective on the influence of the delivery method on consumer preferences. Contrary to prior literature [3,10,29], we found that the delivery method did not significantly affect the choice of delivery to the address. This could be due to consumers placing higher priority on delivery terms and prices. Notably, our study added a new dimension to the existing literature by suggesting that consumers show no strong preference between traditional delivery method and more technologically advanced ones, such as autonomous robots and drones, for home deliveries. This indicates a potential shift in consumer attitudes toward delivery technology, differing from the significant adaptation challenges reported in existing literature regarding the acceptance of autonomous robots and drones. In contrast to delivery to the address, participants leaned toward a delivery method without human interaction, potentially influenced by the perception that smart parcel lockers operate similarly to user-friendly bank ATMs. Notably, the delivery method emerged as a crucial attribute for the delivery points alternative, aligning with previous studies [10,23]. Participants preferred smart parcel lockers over service points options,

a trend supported by similar findings in [14]. This preference could be attributed to the perceived ease of use and accessibility of smart lockers, similar to bank ATMs.

The third evaluated attribute was the delivery term. Our research underscored the significant role of the delivery term in consumer decision-making for both delivery to the address and delivery points. This finding is in line with previous research [3,10,25,29,51], which identified delivery speed as a critical competitive factor in e-commerce. Notably, the study in [1] highlighted the impact of delivery time on consumer loyalty, revealing that faster delivery services can persuade over half of consumers to switch brands or retailers. This emphasizes the strategic importance for companies to focus on expediting their delivery processes to align with consumer expectations.

The fourth evaluated attribute was information and traceability. Our findings revealed an interesting distinction in how consumers value information and traceability in last-mile delivery. While this attribute appeared not critical when consumers chose delivery to the address, it became significant in the context of choosing delivery points. This observation aligns with some studies [28] that report no substantial impact of tracking on delivery choices for delivery to the address, yet contrasts with others [19,25,48] that highlight the importance of information and traceability. One possible explanation for the diminished emphasis on tracking for delivery to the address could be that consumers find the standard level of information provided to be adequate. They may view additional tracking features as either superfluous or as adding unnecessary costs.

The fifth evaluated attribute was the delivery time windows. Our study highlighted the significance of delivery time windows in shaping consumer preferences for delivery to the address. The authors of [14] support the idea that increasing the hours of operation enhances utility, consistent with the findings of this study. However, the utility increase was noticeably limited after weekdays between 09:00 and 18:00 or weekdays between 18:00 and 22:00. This suggests that certain levels of working hours offered by firms are sufficient to satisfy consumers.

The sixth evaluated attribute was the pick-up accessibility. Our findings indicated that the accessibility of pick-up points, particularly the hours available for collection, plays a significant role in consumer preference for delivery points options. This is in line with the authors of [14], who found that extending pick-up hours generally enhances customer utility. The most contributing level of utility was "Between 09:00 and 22:00 h, seven days a week". Interestingly, the available for collection 24/7 option provided less benefit, especially with an extended delivery timeframe. Participants may consider "Seven days a week between 09:00 and 22:00" the most suitable time interval, choosing based on when they can receive deliveries rather than broader time intervals.

The last evaluated attribute was distance. Our research confirmed that the proximity of delivery points is a key determinant in consumer choice, echoing the findings of prior studies [14,21,23,30,31]. This emphasizes the need for e-commerce and last-mile delivery companies to focus on the strategic placement of delivery points to ensure convenience and accessibility. The significance of location convenience is such that if consumers find smart parcel locker locations too distant or difficult to access, they are likely to seek alternative delivery services, as suggested in [51]. Consequently, the effective positioning of delivery points, ensuring they are within a reasonable distance for consumers, is crucial. This can significantly enhance the attractiveness and usage of these delivery options, contributing to their broader adoption in the market.

4.1. Theoretical Contributions

In an era where last-mile delivery solutions are evolving, this study emerges as a beacon of theoretical exploration, probing the uncharted territories of consumer preferences and decision-making within innovative delivery methods. While scholarly literature has experienced a surge in studies centered on these solutions since 2017, a substantial portion has predominantly evolved within the technology acceptance framework, leaving a gap in exploring these solutions through econometric models. This research makes a significant

contribution by addressing this gap, employing and contextualizing econometric models within this domain, thereby enriching the literature on innovative delivery methods. An additional substantial contribution stems from the discrete choice experiment method, which traditionally concentrates on presenting delivery vehicle options or combining vehicles with delivery locations as alternatives. The literature on delivery locations remains underdeveloped [14,31,32,34], making this study a pioneering attempt to scrutinize innovative delivery methods explicitly tailored to the delivery location alternative.

Furthermore, while the prevalent delivery to address currently involves delivery workers, the imminent integration of drones and autonomous robots as innovative delivery solutions signals a transformative shift. This study is one of the few inquiries that delve into discerning consumer preferences between human-driven and machine-based delivery alternatives [3,10,29,30].

Recognizing the regional and cultural variations in consumer preferences, this study marks an initial attempt to utilize the discrete choice experiment method to explore last-mile delivery solutions in the context of Türkiye. The unique focus on Istanbul's population offers distinctive insights, especially within the context of mega-cities, contributing significantly to the understanding of consumer behavior in densely populated urban areas.

In summary, this study significantly contributes to the academic domain by shedding light on the primary factors influencing consumer choice in last-mile delivery alternatives. Identifying and ranking key attributes for both delivery to the address and delivery points alternatives enriches the existing theoretical framework within the field of last-mile delivery. Additionally, this study offers insights into the nuanced differences in attribute importance between these two delivery modes, providing a deeper understanding of consumer preferences.

4.2. Practical Contributions

This study delineates a structured guide tailored for last-mile delivery enterprises, policymakers, and industry participants, facilitating navigation through the complex realm of consumer perception and operational efficacy. Embedded within this framework is a clarion call, a convergence of pragmatic measures stemming from meticulous analysis and strategic anticipation.

Firstly, last-mile delivery companies should implement comprehensive promotional campaigns to counter the initial negative perception of delivery points among consumers. Leveraging diverse methods, mainly through social media platforms, is pivotal to effectively reaching a wider audience. Additionally, introducing incentive-based practices, such as scoring systems and bonuses, could further encourage the adoption of delivery points.

Secondly, policymakers are crucial in mitigating the negative externalities caused by consumers' preference for delivery to the address. Implementing regulations aligned with the characteristics identified in this study could significantly address these challenges; thus, positively impacting urban logistics.

Thirdly, strategic technology adoption is critical. The consumer acceptance of autonomous delivery robots and drones is likely to be more favorable if these technologies are integrated into an appropriate delivery structure, facilitating a smoother adoption process. Moreover, considering that the live tracking attribute is less valued by consumers, based on this study, firms should cautiously assess their usage data in pilot phases to ensure alignment with consumer expectations before scaling up investments.

Fourthly, the "09:00–22:00 seven days a week" timeframe was observed to be optimal. Adjusting this timeframe while aligning delivery points' locations with supermarket chains, groceries, and stores could facilitate their use as delivery points.

Finally, companies could further promote the use of delivery points by strategically establishing them within a 1500 m range, considering consumer population densities.

4.3. Research Limitations and Future Directions

Despite its contributions, this study has certain limitations that warrant consideration. Primarily focused on the B2C domain of e-commerce, the research may need more insight into broader delivery landscapes, where various innovative methods are trialed. The exclusion of the return process, an integral part of e-commerce transactions, limits understanding of the holistic dynamics of last-mile delivery. Additionally, the reliance on consumer assumptions for innovative delivery methods, such as drones and autonomous delivery, may impact the generalizability and depth of analysis. Especially since the findings of this study differ from the literature for autonomous delivery robots and drones, there is a need for replication in different contexts to generalize the findings of the study. Moreover, the sampling technique limitations, subjectivity in attribute creation, and potential bias from prevailing delivery price systems could influence the findings. Addressing these limitations, future research endeavors could explore diverse geographical and cultural contexts beyond Istanbul, incorporating robust sampling methods to enhance generalizability and delving into diverse subgroup perspectives. Conducting comparisons across diverse groups could yield more homogenous results when analyzing the data on a subgroup basis. Incorporating varying delivery price structures, considering the status quo alternative, and employing alternative analysis methods, such as mixed logistic regression or latent class analysis, could provide a more comprehensive understanding of consumer behavior in last-mile delivery preferences.

5. Conclusions

This research sought to explore the impact of innovative delivery methods on consumer preferences in last-mile delivery and aimed to provide insights into the seamless integration of these methods within sustainable delivery frameworks. In this context, the study rigorously examined the attributes influencing consumer preferences for two distinct delivery alternatives: delivery to address and delivery points. In the delivery to address alternative, key determinants primarily revolved around the delivery price, delivery term, and delivery time window. Conversely, attributes such as information and traceability, and delivery method did not showcase any impact on this choice. Even the integration of advanced delivery technologies, such as drones, autonomous robots, and live location tracking, failed to significantly alter consumer preferences, emphasizing the enduring dominance of fundamental delivery attributes in shaping preferences within this alternative. In contrast, the selection of the delivery points alternative was notably influenced by a more comprehensive set of attributes, including delivery price, delivery term, delivery method, pick-up hours, information and traceability, and distance. Since delivery points are a new alternative, the determinants guiding choices extend beyond essential attributes. However, foundational attributes, such as delivery price and delivery term, retain significant importance, indicating their enduring impact despite the evolving nature of this alternative. The study suggests an avenue for steering consumers toward utilizing delivery points by strategically implementing various attributes and levels in the last-mile delivery process. This underscores the potential for tailored design within last-mile delivery alternatives to actively influence user behavior and encourage the utilization of these delivery points.

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