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**Investigating the Effect of Knowledge of Environmental Implications on Generation Z
Vehicle Choice in Last Mile Delivery Service**

by:

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**An Honors Thesis in partial requirement of the requirements for the degree Bachelors
of Science in Business Administration in Supply Chain Management and Marketing**

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Abstract

Consumer knowledge has a significant impact on consumer behavior and choice, where specific types of knowledge can influence consumer shopping and purchasing decisions. As concerns about the environment and businesses operations' effect on the environment grow, there has been various calls for facilitating increased consumer awareness on environmental issues; with the intent of this knowledge serving to influence consumer decision making in a manner that is viewed as favorable for environmental sustainability. With the substantial growth of ecommerce, one of the decisions that consumers more frequently make is that of delivery service choice as they make online purchase transactions. Various aspects of delivery to consumer homes, also referred to as last mile delivery, offer the opportunity to reduce carbon footprint. These aspects include types of packaging, whether orders are consolidated or not when going to the same location, or the type of vehicle used to make the delivery. With a range of vehicles available from conventional fuel vehicles to advanced full-electric vehicles, company and consumer preference of delivery vehicle type can have effects on the environment. In this paper, the objective is to determine whether making knowledge about the environment available to consumers as they make delivery service decisions can influence the delivery vehicle preference of these consumers. More specifically, with a focus on consumers that belong to Generation Z, an experiment is conducted to determine if getting information on tree degradation and air pollution influences delivery vehicle preferences. Additionally, the research investigates if a delivery fee being charged or not, and the type of item being ordered can also influence delivery service vehicle preference. Results indicate that knowledge of the environment does affect vehicle choice. Further, findings showed that the type of product being delivered had a significant effect on vehicle preference; and that the effect of delivery fee was marginally significant. These findings bear significant implications for retailers, marketers, and supply chain managers as they design supply chains and delivery systems with environmental sustainability being a considered factor.

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Introduction

The biggest contribution to United States greenhouse gas emissions is the transportation sector: contributing 29% of emissions to the U.S.'s emission totals (Sifted, 2022). A proportion of these emissions come from the many trips that delivery vehicles make to deliver products purchased online by consumers; as ecommerce activity exponentially grows (Sifted, 2022).

Delivery trips to a consumer's home, once a delivery order leaves a selling company's facility, occur within what is referred to as last-mile delivery (Boysen, Fedtke, & Schwerdfeger, 2021). As ecommerce activity continues to increase, more customers require or prefer home delivery, resulting in increased demand for last mile delivery service; often with a preference for fast delivery along with other elements of customer service that can include order tracking and returns management (Doi, 2021).

Of note, consumers are looking for more environmentally friendly ways to shop and purchase products (DHL Supply Chain, 2021). Driven by values and purpose, consumer groups have an increasing preference for products that are sourced and produced ethically, and that are consumed and disposed of in an eco-friendly manner (Jacobs, et al., 2019). Adhering to this consumer expectation is very important for companies, as consumer satisfaction is central to maintain and grow revenue, and it leads to repeat purchasing (Jacobs, et al., 2019). One of the additional ways that companies can attend to the increased desire of consumers for eco-friendly products and business processes is through improving the eco-friendliness of home delivery (Boysen, Fedtke, & Schwerdfeger, 2021).

Many research and development programs are focused on investigating and designing the last mile portion of the supply chain to contribute to increased sustainability, not just environmentally, but also economically (Boysen, Fedtke, & Schwerdfeger, 2021). Technology, automation, artificial intelligence, and various other advanced logistics solutions and technologies are being used to drive improved sustainability in last mile delivery operations; and among these technologies are advanced fuel and propulsion systems for vehicles (Boysen, Fedtke, & Schwerdfeger, 2021). The environmental impact of vehicles used to deliver products purchased online can vary widely because of the different levels of carbon emissions emitted into the atmosphere across the various vehicle types used in last mile delivery. So, while the last mile delivery process has been investigated and investment and resources allocated to advanced vehicle propulsion technologies to make vehicles less dependent on fossil fuels has increased, consumer knowledge of the differences in carbon emissions between these vehicles may not be widespread. Given that knowledge or access to information has been shown to influence consumer decisions, can sharing knowledge about environmental impact issues influence consumer delivery vehicle preferences, if consumers are also given information on vehicle carbon emissions levels?

Consumer knowledge has been known to impact consumer behavior and the choices that consumers make while researching, deciding, and purchasing products (Nogueira, Rangel, & al., 2021). The modern consumer has a vast array of information available to them to support decision making; driven by increased access or exposure to the internet, social media, and advertising campaigns, among other factors. (Ignat & Chankov, 2020). As governments, regulators and corporations continue to establish law, policies and requirements regarding environmental sustainability and stewardship, consumers play an integral role in attaining policy objectives. (Ignat & Chankov, 2020). Further, due to a strong commitment to values

observed in individuals belonging to Generation Z (Gen z), those born between 1996 and 2010 (Dimock, 2019), this paper specifically focuses on Generation Z (Gen Z) as a consumer demographic, also considering their increased proportional representation within the consumer population (Francis & Hoefel, 2018).

Shopping is not merely a functional activity but an activity that reflects their personal values and codes of morality. For the purposes of this paper, Generation Z individuals will be defined as people born after the year 1997. It is therefore important for companies to understand the behavior and purchasing decision paths of consumers in Gen Z. Does providing knowledge of the environment just prior to making an online purchase influence vehicle delivery preference? This is investigated in this research. This section is followed by a literature review that discusses previous research findings on knowledge, last mile delivery, and environmental sustainability. It is then followed by the methodology that details the approach utilized to generate findings. The findings section then presents the findings of the analysis, and the discussion section provides a viewpoint given those findings.

Literature Review

General Consumer Knowledge (Information) Impacting Consumer Purchasing Choice

Knowledge has been found to influence consumer decision making (Nogueira, Rangel, & al., 2021). Consumers are inundated with options not only on store shelves but also on their mobile device screens as they shop online. In today's marketplace, modern consumers have access to a vast amount of information that in turn informs their purchasing decisions (Caspersen, 2021). Consumers can compare both price and non-price factors between companies all around the globe. They can price check and compare services across companies all around the globe.

Companies must be aware of the role that information availability and consumer knowledge plays in consumer purchasing decisions and choice. This dynamic can be addressed through leveraging contextual priming to influence consumer choices, including environmental sustainability-based decision making (Yi, 1993).

Contextual priming describes how "prior knowledge" of a product, service, or other object of interest "influences evaluations of an ambiguous product—that can be evaluated in different ways" (Yi, 1993). Marketers use contextual priming to accelerate consumer decision making and remove shopping barriers. In essence, how does the background knowledge of a product influence the perception of the product. Perception of a product or service is of integral importance in consumer decision making since it has a significant effect on the decision to purchase a product or not (Agyekum, 2015). Contextual priming works most effectively on consumers who were moderately informed about a product: they needed to have an average working knowledge on the product and the context surrounding it (Yi, 1993). Also observed is that the two extremes—low and high knowledge individuals—did not respond well to contextual priming (Yi, 1993). In fact, contextual priming was found to be substantially ineffective with these two participant types. Highly knowledgeable individuals are likely to be familiar and have more experience with the product or service. The additional information facilitated by contextual priming will not change their purchasing decisions. Highly knowledgeable individuals have a higher tolerance and are likely to remain with their

decisions even if credible contrary information is presented. With lower knowledge individuals, the study found that these consumers do not see the relevance or are not as sensitive to the salience of the additional contextual information provided. Additional information does not mean much to this subset of customers. Therefore, it can be assumed that for information to have the most significant influence on consumer choice, consumers of a certain product or service will need to possess an average level of knowledge regarding a product or service of interest. Of note, Yi (1993) found similar results with consumer purchasing intentions. The authors found, again, that those with moderate knowledge are more likely to purchase the product or service. This insight regarding the role on contextual priming on consumer purchasing intention can bear significant ramifications regarding the consumer decision making in the context of purchasing products or services where there may be environmental sustainability-based implications.

The modern consumer is learning more about environmental sustainability and how their purchasing decisions contribute to it—whether negatively or positively (Ignat & Chankov, 2020). Companies have begun to acknowledge and address certain areas of their supply chains that negatively harm the environment (Nogueira, Rangel, & al., 2021). In addition, many companies are considering their triple bottom line: the impact on profit, people, and the planet. This triple bottom line consideration includes the environment and how company operations impact the environment. Contemporary consumers will pay a premium price for a brand that they consider authentic and that aligns with their values (Simonetta Pattuglia, 2015). This leads to the question: with an increased working body of knowledge regarding the intersection of environmental sustainability and the transportation operations of a company, would customers be further persuaded to make more environmentally friendly decisions when selecting and choosing delivery options while shopping online?

Environmental Sustainability Implications of Last Mile Delivery

The last mile portion of the supply chain has often been found to be the least cost efficient and environmentally friendly of the entire chain due to increased transportation activity in the form of delivery trips to consumer homes or other preferred delivery destinations (Kammerer, 2020). As a result, last mile delivery to consumers is time and resource intensive for retailers and the logistics service providers that serve them, as well as an activity for which carbon emissions and environmental management have been found to be an issue (Jacobs, et al., 2019). The last mile is a complicated portion because this is where customers meet the supply chain. Customer service culminates at this point and variability increases tremendously. Customization in delivery plays an important role in how companies differentiate themselves from their competitors. Likewise, it is this customization and variability that negatively impacts the environment. The problem is particularly exacerbated in urban cities where there is high demand with inhibiting infrastructure (Bjørngen, Bjerkan, & Hjelkrem, 2021). Increased urban freight flow, or last mile deliveries, results in higher greenhouse gas levels and carbon emissions (Bjørngen, Bjerkan, & Hjelkrem, 2021). There is also an increase in traffic congestion, as more vehicles become more stagnant in urban traffic, often resulting in releasing more emissions into the atmosphere. Another contributing factor to carbon emissions from last mile delivery activity is that of failed deliveries. For various reasons, an ordered package will not make it to a customer in the first instance (Bjørngen, Bjerkan, & Hjelkrem, 2021). Across delivery options,

a 10% delivery failure rate results in a 15% increase in carbon emissions; and for a 50% failure rate, that number jumps to 75% increase (Bjørger, Bjerkan, & Hjelkrem, 2021). The aforementioned dynamics demonstrate that making environmental sustainability-based last mile delivery decision making is of integral importance to companies. Compounding the issue for retailers and logistics service providers is that while last mile delivery activity is under scrutiny for its role in carbon emissions, it also represents an activity through which companies interact with online customers and, when done well, confers competitive advantage for online sellers and retailers—often presenting companies with a challenge regarding finding a balance between reducing delivery activities to control emissions and keeping increasingly demanding customers happy. While service customization in delivery plays an important role in how companies differentiate themselves from their competitors, it is this customization and variability that can negatively impact the environment.

To effectively address this trade-off in last mile delivery service operations, there are various innovations that companies are researching to become more environmentally friendly. Some of these innovations include specialized technology, namely electric vehicles (EVs) and drones (Ignat & Chankov, 2020). Electric vehicles and drones have been discussed more prevalently as being potential solutions due to their alternative powered propulsion systems that will lead to less pollution. However, the barriers to their widespread implementation in delivery networks include insufficient infrastructure and supporting regulatory policies. Drones and EVs will require public sector approval and collaboration to make it a viable alternative. A supplementary solution is the introducing of bicycles into delivery fleets as they represent an emissions free transportation option (Ignat & Chankov, 2020). As one can imagine, this will require an increase in labor standards and takes much more time. Other carbon-reducing approaches in last mile service operations include the use of consolidation centers, crowdsourced deliveries, parcel pickup points, or artificial intelligence systems that optimizes routes; these solutions take advantage of the fact that most ecommerce deliveries, especially in urban settings, are routine purchases (Astrid Bjørger, 2019). Consumer purchase decisions will be integral in environmental sustainability efforts aimed at reducing or better managing carbon emissions. It is, therefore, important to explore the factors that influence shopping decisions made by customers and the types of information and knowledge that influences choice between options.

Knowledge of the Environment Impacting Consumer Purchase Choice

As forementioned, increasingly knowledgeable consumers have a multiplicity of requirements when making purchases online (Pharand, 2021). Customers desire “convenience, speed, and sustainability at the right price” (Pharand, 2021). These requirements can often present operationally conflicting objectives for retailers and logistics service providers (Pharand, 2021). Considering this, it will be easier for companies to create more environmentally sustainable offerings if consumers increase their tangible demands for these offerings. If consumers demonstrate through their purchasing decisions that they will choose an environmentally friendly product or service option, companies can profitably create such offerings. Many consumers want more environmentally sustainable products and processes but lack knowledge on how their purchasing decisions affect the environment. Often, consumers that do make more environmentally sustainable choices are generally “little informed about

how these choices can impact product delivery sustainability” (Nogueira, Rangel, & al., 2021). To that end, it may be the case that there exists an opportunity to better inform consumers about the implications of their purchasing and delivery service decisions on environmental sustainability.

One study discerned that information regarding environmental sustainability influences consumers in general purchasing decisions (Fu & Saito, 2018). They further examined if there is a difference in choice when individuals are presented with options that favor the environment but elongated the delivery time. According to the study, 71% of people were willing to delay their delivery for an option that was more environmentally sustainable. In this instance, this group of consumers changed their behavior after being presented with some knowledge on the impact that their orders would have on the environment and decided on a more environmentally conscious delivery process. In the same study, regarding how long the consumers were willing to delay their order, the average result was 4.7 days or closer to a week. This was directly due to the information consumers had received that conveyed environmental benefits and impacts. This insight can help companies as they work towards making their supply chains more environmentally sustainable. It affirms the notion that consumers are willing to change their behavior if presented with additional knowledge about how ecommerce-based purchase choices affect the environment.

Consumer decision making also changes based on the product being purchased. Product differentiation or classification is the result of a market that has various products that are not homogenous, and that compete against each other (Spence, 1976). Product classification is especially helpful in determining and understanding demand factors from the perspective of the consumer. Product classification utilizes demand trends so that retailers can better manage their supply through proper marketing mixes (Smith, 1956). As Assael (1974) asserts, depending on the good, a consumer spends differing amounts of time on deciding to purchase it. It ranges from consumer goods which are defined as goods that the consumer purchases “frequently, immediately, and with minimal effort” (Hen741). On the other end of the spectrum are specialty goods. Specialty goods require more time, often more money, and are occasional purchases (Hen741). Product classification is especially important to retailers as it informs company and marketing strategy (Girard & Dion, 2010). It has been demonstrated that the types of products that shoppers buy influences a consumer’s purchasing decision (Korgaonkar, Silverblatt, & Girard, 2006). Additionally, Andrew Jessie Fu (2018) identified the types of environmental information that are most relevant to consumers. There are numerous factors, variables, and performance metrics to consider in the context of environmental sustainability. These factors include carbon emissions, air pollution, soil erosion, light pollution, and energy insecurity among others (David Banister, 2011). The authors tested what type of information was the most salient to consumers. Across the information on trees, trash, and electricity, it was the trees that consumers really cared for and were willing to extend on average 0.7 days compared to electricity savings which was the next highest category: illustrating that the environmental effect on trees was more prevalent on participants rather than the effects of electricity. The participants cared more for the environmental impact of trees as opposed to electricity. The study asserts that consumers can be persuaded with environmental knowledge and change their behavior accordingly, especially when that information regards saving trees. This information can be used by

companies to collaborate on environmental efforts with their consumers. According to Andrew Jessie Fu (2018), there was no significant difference between generations and their regard for the environment, except for the 55 to 64-year-old age group. This group of people were less likely to delay their deliveries, and were less sensitive to how their purchase decisions affected the environment.

Given the observations in the literature addressed in the previous section, it would therefore be interesting to focus on a specific generation, Gen Z in this instance, and see how they behave when presented with similar information and options. Given this, the main research question of interest in this study is as follows: does being presented with information on the environment influence Gen Z delivery vehicle choice when requesting home delivery after purchasing product online? Other questions of interest include: do delivery fees and product type also affect the delivery vehicle preference of Gen Z consumers?

Methodology

Approach and Context

In this study, a scenario-based experiment will be used to investigate the research questions. A behavioral experiment uses different scenarios in which participants must make choices to facilitate researchers determining the causal relationship between variables of interest (Barker & Brau, 2020). Scenario-based experiments hone in on the decision-making process and make it easier to isolate or emphasize hypothesized factors (Barker & Brau, 2020). In this study, decision making scenarios will be presented to Gen Z participants. Each scenario will comprise an online product purchasing scenario in which information regarding the product being purchased and the delivery fee to be charged is provided. Further, participants will be presented with different types of information on the environment, or not, prior to being presented with the scenario. Participants will then process all the aforementioned information and then make a delivery vehicle choice from among three available vehicle types – with each vehicle type varying by emissions levels. In the experimental scenarios, a single participant will be presented with either of three types of products being purchased, a delivery fee charge or not, and two types of environmental impact information or not. Participants will then choose between a gasoline, hybrid, or electric vehicle to indicate their delivery vehicle of preference. By providing different scenarios with varying levels of the variables of interest, it can be determined how each of the different variables contribute to delivery vehicle choice. Scenario based experiments use selected situations to further understand participant thought process and choice selection. Scenarios are useful because they are based on real occurrences or realistic situations (Temiz, 2020). In addition, scenarios provide a sense of realism and replicate situations that are feasible (Aligica, 2005). This pseudo-realism is integral to this study as we are seeking to investigate the existence of a proposed causal relationship between the environmental information provided to participants and their preference when selecting delivery vehicle options.

Experimental Design

This study uses a 3 (tree degradation information, air quality information or no information) by 2 (delivery fee or no delivery fee) by 3 (convenience item, shopping item or specialty item)

design. The sample of participants for the study comprised of 682 students that belong to Gen Z, that randomly selected through utilizing a snowball sampling technique at the University of Arkansas between April 7th and April 15th, 2023. Each participant was randomly assigned one of the eighteen online purchasing scenarios (Barker & Brau, 2020).

Factors and Variables

Dependent Variable

The dependent variable in this study is delivery vehicle choice. The presented choices were a gasoline delivery van, a hybrid delivery van, and an all-electric delivery van (EV). As forementioned, this vehicle selection was chosen to offer participants a range of carbon emissions levels across vehicle options. Out of the three vehicle choices, the gasoline vehicle emits the most carbon emissions. On average, it emits 12,594 pounds of carbon emissions in a year (Alternative Fuels Data Center, 2021). These types of vehicles rely on oil for combustion which releases carbon emissions among other pollutants (Tomáš Skrúcaný, 2018). The hybrid vehicle uses a combination gasoline and electric propulsion to operate. Annually, it emits 6,898 pounds of carbon emissions (Alternative FuelsData Center, 2021). The vehicle with the lowest emissions level across each scenario option is the fully battery-operated electric vehicle that annually emits 2,817 pounds of carbon dioxide (Alternative Fuels Data Center, 2021). The gradual differences in emissions rates between the delivery vehicles is of central importance to the study, as the main objective of the research is to determine if exposure to combinations of different levels of the independent factors will influence a preference for vehicles that emit less carbon emissions.

Independent Factors

Information and Knowledge

The main independent factor of interest in this study is that of environmental knowledge or knowledge of environmental impacts. Determining whether exposure to such knowledge prior to making a purchase online influences Gen Z consumers' choice of delivery vehicle is the main objective of this study. Environmental knowledge in this experiment is represented in three categories. The first is that no environmental knowledge or information is provided to study participants. In the second category, information of tree degradation is provided, and subjects are subsequently tested on the knowledge they acquired. Trees are an integral part of the Earth's ecosystem as they regulate air pollution by removing carbon dioxide from the atmosphere and replacing it with oxygen (Tyrväinen, 2005). When living organisms or technologies emit carbon dioxide, trees play a significant role in absorbing it and respirating oxygen back into the atmosphere (Tyrväinen, 2005). In this manner, trees regulate air pollution. However, as gasoline vehicles continue to emit around 12,590 pounds of carbon emissions annually (Alternative Fuels Data Center, 2021) and deforestation continues in tropical locations, carbon dioxide levels continue to increase and there is an increasing loss of biodiversity (Duriaux-Chavarría, 2019).

The severe reduction of trees results in diminished ecosystem vitality, inhibited agricultural production, and loss of human jobs (Duriaux-Chavarría, 2019). In essence, vehicles significantly contribute to carbon dioxide emissions, along with other pollutants, which alter the atmosphere. These alterations potentially inhibit life on earth, including human lives, and

impact trees negatively. In such instances, trees cannot adequately replenish oxygen into the atmosphere, which potentially creates increasingly adverse conditions here on earth (Duriaux-Chavarría, 2019). Figure 1. displays the environmental knowledge on tree degradation and subsequent test given to study participants in the study.

Trees exchange carbon dioxide for oxygen. They take carbon dioxide from the air and release oxygen in exchange. There has been a significant increase in carbon dioxide in the atmosphere as deforestation continues to kill more trees. Home delivery contributes to adding more carbon dioxide into the atmosphere. Irregulated carbon dioxide levels in the air can create an atmosphere and surface level that are harmful to tree growth: including vulnerability to ultraviolet rays and soil poisoning.

Based on the above, which of the following is correct:

- Trees exchange carbon dioxide for oxygen
- Deforestation kills trees and causes more carbon dioxide to be released into the atmosphere
- Home delivery contributes to more carbon dioxide being released into the atmosphere
- Irregulated carbon dioxide can be harmful to tree growth
- All of the above

Figure 1. Environmental Knowledge for Tree Degradation and Test

In the third category, participants receive information on air pollution and are also subsequently tested on the knowledge they acquired. Air pollution is an issue that has grown in relevance as smog, carbon emissions, and greenhouse gases have increased in the Earth's atmosphere (Mayer, 1999). It poses significant environmental threats for posterity and dramatically affects Earth's biosphere. One of the biggest contributing factors to air pollution is the emission from transportation vehicles (Colvile & al., 2000). Among other effects, the increasing polluting of the Earth's atmosphere results in ozone depletion, acid deposition, human health deterioration, and climate change (Colvile & al., 2000). These negative effects are a cause for concern and are hard to reverse unless the production of air pollutants, like carbon emissions and methane, are substantially reduced. Especially in the last mile, transportation vehicles produce more air pollutants to deliver goods to numerous, individual locations. Not only is the individual specificity costly for supply chains, but it also has a significant effect on the environment. Figure 2. displays the environmental knowledge on air pollution and subsequent test given to study participants in the study.

Air pollution is the result of excessive pollutants, often due to the combustion of most gasoline powered technology. Air pollution can result in the production of smog, an increase in light pollution (artificial light at night), and the deterioration of the ozone layer. These have detrimental effects on the atmosphere leading to more vulnerability to ozone deterioration and habitat loss, among other effects.

Given the above, which of the following is true:

- Gasoline powered technology can cause increased air pollution
- Air pollution can result in increased smog, light pollution, and destruction of the ozone layer
- Air pollution has detrimental (negative) effects on the atmosphere
- All of the above

Figure 2. Environmental Knowledge for Air Pollution and Test

Delivery Fee

In this study, we will also factor in delivery fees as part of the scenario experiment to simulate a real purchasing decision, and to determine whether such fees will influence vehicle choice. As participants engaged in the experiment, some of the scenarios included a \$10 delivery fee regardless of which vehicle choice one selects; while for other participants no delivery fee was charged in the scenario, regardless of the vehicle choice. Delivery fees are a common aspect of business and are often implemented to offset logistics cost for online orders (Nguyen, Leeuw, Dullaert, & Foubert, 2019). They are important to retailers as they help recover the costs associated with producing goods and services. Essentially, delivery fees are collected to compensate for transporting costs a business incurs (Hantula & Bryant, 2005). Delivery fees are also important to consumers. In fact, in a study, it was demonstrated that delivery fees are the most important consideration, exceeding the importance of delivery time and tracking ability (Nguyen, Leeuw, Dullaert, & Foubert, 2019).

Delivery fees demonstrate the transactional nature between retailers and consumers and can be used as a marketing tactic to influence consumers to buy a product (Nguyen, Leeuw, Dullaert, & Foubert, 2019). It has been demonstrated that as delivery fees increase, the likelihood of purchasing a product or service decreases (Nguyen, Leeuw, Dullaert, & Foubert, 2019). For example, free online delivery has been cited as the reason consumers chose to buy a product online as opposed to a physical store (Huang & Oppewal, 2006). However, delivery fees are subject to variability and do not affect all consumers the same. Individuals who are 35-49 years old are more sensitive to delivery fees (Dias, Oliveira, & Isler, 2021), as well as those who are of lower economic status (Nguyen, Leeuw, Dullaert, & Foubert, 2019). Additionally, women buying convenience and shopping goods also carefully consider the delivery fees associated with these products and are likely to be more influenced by these fees (Nguyen, Leeuw, Dullaert, & Foubert, 2019). These individuals are more likely to be deterred from buying a product or committing to a purchase due to a delivery fee and are more price conscious as a result. Delivery fees also vary in influence depending on product type. They are more significantly considered in the purchase of electronics (Dias, Oliveira, & Isler, 2021). In this study, the effect of a delivery fee on vehicle choice would be tested for.

Product Type

Product type has been shown to be a determinant of consumer behavioral decision making. In this study, we test if product type influences vehicle choice. The study will look at three different product classification types: convenience goods, shopping goods, and specialty goods (Murphy & Enis, 1986). These classifications are distinguished based on length of consumer decision making time, varying marketing mixes, and frequency of purchase (Assael, 1974). Specific products were chosen to represent the three different product classifications in this study. For the convenience good, a pack of batteries was chosen due to its prevalence as a shopping item.

Moreover, there is minimal risk and effort in purchasing batteries, making it an ideal convenience good (Murphy & Enis, 1986). An iPhone was chosen for a shopping good as many participants have likely shopped for their own cellular device. In addition, consumers, including Gen Z, take their time in considering various phone options before purchase, which defines a shopping good (Assael, 1974). The specialty good product represented in the study was an exclusive smart watch, like those offered only by specialty retailers. The products were

chosen to best emulate purchases that Gen Z college students make often, have made in the past, or a prone to make.

In conducting the experiment, the 682 participants were randomly assigned to any of eighteen experimental scenarios – each scenario representing a unique mix of the factors under consideration: environmental knowledge, delivery fee, and product type. The survey through which the experiment was administered randomly assigned participants to one of these eighteen scenarios in a sequential manner, ensuring that participants were approximately evenly distributed across all scenarios. Figure 3. provides an example of one of the eighteen experimental scenarios utilized in the experiment.



Figure 3. Example of Scenario in Experiment

Findings

To analyze the responses of participants in the experiment, an analysis of covariance, known as ANCOVA, was utilized. The ANCOVA is a variant of ANOVA (analysis of variance) combined with regression analysis (H. J. Keselman, 1998). It is best employed when a study has a covariate: a variable that also has an impact on the response variable (Gianfranco Fancello, 2020). It better analyzes the test of the independent variable and how much the independent variable contributes to the results in the experiment (Chapman, 2001). It differentiates how much can be explained by contribution of the independent variable. In this study, product type was included as a covariate in the model to account for its potential effect on choice of vehicle. In addition, ANCOVA reduces the likelihood of a Type II error in an experiment (Armstrong & Henson, 2002). A Type II error is “the probability of failing to reject the null hypothesis when it is false” and significantly reduces the accuracy of one’s findings (Spanos, 2011). If an experiment was run with a covariate in a traditional ANOVA test, it will probably result in an error due to the covariate variable (Armstrong & Henson, 2002). This accurate consideration of the covariate variable distinguishes ANCOVA from other experimental analysis methods (Jamieson, 2008).

The ANCOVA results indicate that environmental knowledge had a significant effect on vehicle choice ($p = 0.008$; $F = 4.863$; $\eta^2 = 0.005$). Results also indicated that delivery fee

had a marginally significant effect on vehicle choice ($\rho = 0.068$; $F = 3.329$; $\eta^2 = 0.002$). Of note, the covariate of product type was found to be statistically significant ($\rho = 0.048$; $F = 3.923$; $\eta^2 = 0.002$). Of note, when comparing the means of the factors, environmental knowledge of air pollution had the largest effect on vehicle choice (a consumer choosing a more environmentally friendly vehicle option), followed by environmental knowledge on tree degradation and then no environmental knowledge. Interestingly, when comparing means for delivery fee, the existence of a delivery fee resulted in a larger effect on a consumer choosing a more environmentally friendly vehicle option. Table 1. Displays the results of the ANCOVA.

Table 1. ANCOVA Results

	<i>F</i> -value	ρ -value	η^2
<i>Main Effects</i>			
Knowledge	4.863***	0.008	0.005
Delivery Fee	3.329**	0.068	0.002
<i>Interaction Effects</i>			
Knowledge*Delivery Fee	0.990	0.372	0.001
<i>Covariates</i>			
Product Type	3.923***	0.048	0.002

Discussion

In this study, it was discovered that knowledge regarding environmental sustainability had a statistically significant impact on Gen Z participants and their choices of delivery vehicle of preference in home delivery. This has significant implications for retailers and businesses. As forementioned, consumers respond to information (Nogueira, Rangel, & al., 2021). This study shows that information regarding the implications of consumer choices does influence those consumers. Based on this information, retailers can push advertising or design packaging options that inform consumers of the potential impact that the vehicle that is utilized to facilitate their order delivery may have an adverse environmental impact. In Nogueira, Rangel, & al (2021), it stated that consumers were a significant contributing factor to environmental change in the world, specifically regarding business operations. This study further validates that position. Another finding of this study is that consumers react differently to what type of environmental knowledge is provided. This had previously been demonstrated when consumers reacted differently to information between trees, air pollution, and electricity (Fu & Saito, 2018). This finding illustrates that consumers can be influenced not solely by environmental information but by which aspects of environmental sustainability issues are presented to them and how delivery vehicle choice affects that dimension of the environment. Future research could expand and determine which type of information regarding environmental sustainability is more salient to Gen Z versus other generations. As it was predicted that Gen Z would make up 40% of shoppers by 2020, it is important to understand their purchasing behavior and choices, especially if there is the desired outcome for a more environmentally sustainable supply chain (Kahawandala, Peter, & Niwunhella, 2020). In addition, this study also demonstrated that there was a statistical effect that product type had on vehicle choice as well. Further research would be needed to see if there is a product type that

can significantly affect the decisions that Gen Z would choose a more environmentally friendly transportation system. Further research can also be needed to expand the vehicle choices available to the participants. In this study, only three vehicles were tested due to the available information on carbon emission impact (Alternative Fuels Data Center, 2021). In further studies, there is a possibility of finding if other alternatives including consolidation centers, parcel pick-up points, bikes, and drones (Ignat & Chankov, 2020) influence choice. Offering a wider range of transportation and pickup choices may result in different consumer choices. These transportation and pick-up choices along with automation have various impacts on the environment as well as different economic benefits and implications (Doi, 2021). In addition, some transportation and automation choices still require extra time to be fully mature as a transportation mode of choice (Doi, 2021). There is still increased infrastructure and policies required to support modes such as electric vehicles and drones (Doi, 2021). An interesting finding from this experiment is that although delivery fee had a marginally significant effect on delivery choices, consumers chose a more sustainable choice with the inclusion of a \$10 delivery fee.

Additionally, an informal post-experiment inquiry of consumers was conducted and the responses of eight different Gen Z representatives help gain further understanding and perspective around the findings of this study, particularly the correlation between the delivery fee and environmentally sustainable vehicle choice. In many of the responses, there seemed to be an implicit correlation between the environmentally sustainable choice or “good” choice and an increase in expense. One participant stated that there is no “motivation” or incentive to do “the good thing” when one does not have to pay a delivery fee: stating “I must pay this no matter what, so might as well do something ‘good’ with it.” Other participants state that the reason is a matter of convenience which complements the reason provided previously. The participant explained that the no delivery fee was more convenient, and therefore, there was less attention paid to the order and the vehicle choices. Essentially with “more money on the line,” there is more consideration that is taken with the delivery vehicle choice. It is crucial to mention that some participants stated that they would choose the more environmentally sustainable option regardless of the delivery fee. This might be attributed to generational mindset and values. Future research could expound on what this means for this generation and if the addition of a delivery fee could result in more environmentally friendly last-mile delivery vehicle choices.

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