

# Analyzing Consumer Behaviors and Attitudes Towards Plastic Bag Consumption in Hanoi Wet Markets

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**ABSTRACT:** This research investigates consumers' stated attitudes and behaviors towards plastic bag consumption in Hanoi wet markets. The project leveraged a stated preference survey (SPS) and background demographic survey of the consumers at two wet markets to run a linear regression and determine the "value" that the general Vietnamese population places on plastic bags compared to alternatives. Altogether, the demographic survey gathered 163 responses and SPS 235 responses. The SPS provided survey respondents with four different options to store the vegetables they bought in the wet market: plastic bag, paper bag, eco-friendly tote bag, or a reusable bag. Four different attributes (price, volume item can hold, weight item can hold, and the number of times item can be used) and their respective levels were presented. The analysis ( $p < 0.05$ ) showed that price and functionality are the two most important actors in deciding whether a consumer would use a plastic bag or an alternative at the wet market. For each additional unit kilogram that an item, could hold, the probability of a person purchasing that item decreased by 3.21%. On the other hand, a unit increase in price (measured in VND) decreased the probability that a person would purchase the item by 0.0001178%. Ultimately, despite the current excessive use of plastic bags, the general Vietnamese demographic (91%) demonstrated a shift or a desire for a shift towards the adoption of plastic alternatives.

**KEYWORDS:** Earth and Environmental Sciences; Environmental Effects on Ecosystems; Data Science; Behavioral Economics; Plastic Alternatives; Linear Regression; Effective Preferences.

## ■ Introduction

Plastics are crucial to modern society due to their versatility, affordability, and durability. As a result, the production of plastics has increased exponentially within the past 70 years: while only 2 million tonnes of plastic were produced in 1950, 350 million tonnes of plastic were produced in 2020.<sup>1</sup> Further research shows that plastics contribute to climate change<sup>2</sup> and can be detrimental to human health for multiple reasons.<sup>3</sup>

Plastic pollution itself threatens human health because humans can consume microplastics when eating seafood. Though over 90% of the microplastics humans ingest are digested properly, they have the potential to enhance respiratory responses and disrupt the gut microbiome due to the toxicity and chemical transfer of pollutants from plastic particles.<sup>4</sup>

Hanoi, the capital of Vietnam, is home to 8 million people with a GDP growth rate of 7.62% as of 2019.<sup>5,6</sup> Unfortunately, but in line with its urbanization rates, booming economy, and limited government enforcement, Vietnam ranks as the 7th largest contributor to plastics pollution globally while ranking 15th by population. Likewise, Vietnam's consumption of plastics continues to grow as it develops, generating over 1.8 tonnes of plastics per year.<sup>7</sup>

There have been multiple government efforts in order to reduce the excessive plastic consumption. For example, on April 11th, 2013, the government proposed a plan to improve environmental pollution control regarding the use of non-biodegradable plastic bags. The policy set a limit on the total number of plastic bags used and a newly devised waste management system that would take place by 2020.<sup>8</sup> Moreover, on May 7th, 2018, the government adjusted its

initial national strategy to improve solid waste management: by 2050, Vietnam will rely 100% on eco-friendly plastic bags in shopping malls and supermarkets as an alternative to non-biodegradable counterparts. Furthermore, the government has stated it will also restrict the production and imports of plastic bags starting in 2026.<sup>8</sup>

Vietnam has an increasing middle class and adopts a consumerist lifestyle as a means of enhancing one's identity and social status.<sup>9</sup> Therefore, when an updated version of a product is introduced, people will quickly adapt and switch to using the updated product. This study operates under the belief that consumerism can be leveraged to alter plastic consumption in Vietnam: an introduction of new plastic alternatives for free or at low-cost could drastically reduce the number of plastic bags used, as it is easy to make customers adopt the alternative option.<sup>10</sup>

Pre-existing data on Vietnam's plastics consumption, particularly within wet markets, is elusive, but there is still some information about wet markets in general that is important. In Vietnam, wet markets are a traditional open-air, food market that sells animals, meat, fresh produce, and various other products. Furthermore, despite online and drop shipping becoming more common especially during the COVID-19 outbreak, wet market sales continue to increase rapidly, growing by 4% in 2020 alone, reaching a total revenue of VND 1,027 trillion [\$44.90 billion].<sup>11,12</sup>

According to initial research, the three main reasons why people still use wet markets are due to the freshness of the products, interpersonal relationships, and the context of the situation.<sup>12</sup> Wet markets are a pillar of Hanoi consumerism because the middle class perceives that they sell cheaper



the team to draw more accurate conclusions. The survey accepted responses between August 1<sup>st</sup>, 2021, and September 1<sup>st</sup>, 2021.

The current study utilized discrete, binary numbers to represent the respondents' actions (0 representing that they declined a particular option and 1 representing that they chose a particular option). This value was set as the left-hand value (LHS Value). Using the LHS Value allowed our team to record the consumers' behaviors thoroughly: each respondent had four rows of data and only one reflected the choice they had made. The information was compiled into an Excel database. Table 1 shows how the Excel data is formatted.

**Table 1:** Excel database format.

ID	LHS Value	Price	Volume	Weight	Times
1	1	30000	12.5	20	150.0
1	0	2000	3.0	5	5.0
1	0	0	1.5	3	2.5
1	0	100000	2.0	5	150.0

With the created database, an OLS regression test was run to examine the different correlations between the consumers' decisions and other factors or variables such as price and weight the items could hold. The dependent variable was set as the LHS Value.

Ultimately, the team hypothesizes that approximately 85% of the consumers surveyed at the wet market would use plastic bags as their main method of storing products. Additionally, it was predicted that the two main factors affecting consumer decision on plastic bag alternatives would be price and availability. With this study, the team hopes to recommend a policy that effectively promotes sustainable habits and decisions for the local consumers.

## ■ Results and Discussion

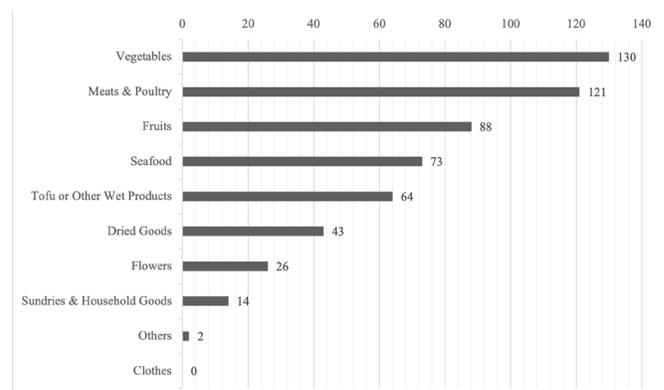
### *Respondents' Demographics:*

Table 2 visualizes 136 respondents of the initial survey's demographics, which includes their age group, assigned (biological) sex, their frequency in visiting the wet market (times per week), and whether they live in the same district as that of the wet market. Respondents included 97 women and 39 men. Ages ranged drastically from children (0-14 years old) to the elderly (65+ years old) where the most common age group was 25 to 40 years of age, accounting for 31.62% of the respondents. 88.18% of the respondents lived in the same district as that of the wet market they visited.

Figure 4 shows what people tend to purchase in the wet markets. It can be observed that the female respondents outnumber the male respondents by 2.5:1. Moreover, there was a total of 130 purchases for vegetables, 121 purchases for meats and poultry, 88 purchases for fruits, 73 purchases for seafood, 64 purchases for tofu or other wet products, 43 purchases for dried goods, 26 purchases for flowers, 14 purchases for sundries and household goods and 2 other purchases.

**Table 2:** Summary of demographic information.

Category Group	Categories	Count
Sex	Female	97
	Male	39
Age Group	0-14	1
	15-24	12
	25-40	43
	41-55	39
	56-65	20
Residence in the Same District	Yes	121
	No	15
Market Visit Frequency (Times per Week)	1	19
	2	22
	3	17
	4	13
	5	11
	6	2
	7	46
	7+	4



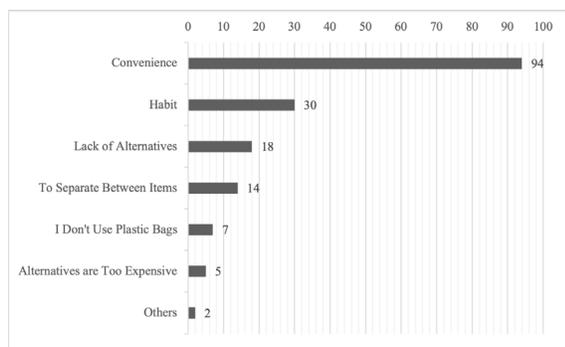
**Figure 4:** Items purchased at the wet market.

### *Plastic Consumption by Wet Market Customers:*

We asked people why they use plastic bags, what they do with the plastic bags after use, and whether they were willing to adopt a plastic-alternative.

Firstly, as represented by Figure 5, 55.49% of the total respondents stated that they use plastic bags out of convenience, while 17.65% of respondents stated that they use plastic bags out of their habitual practices. Only a mere 4.12% of the respondents do not use plastic bags at all. This low number

demonstrates how only a low percentage of the consumers in Hanoi wet markets are currently using recyclable bags.

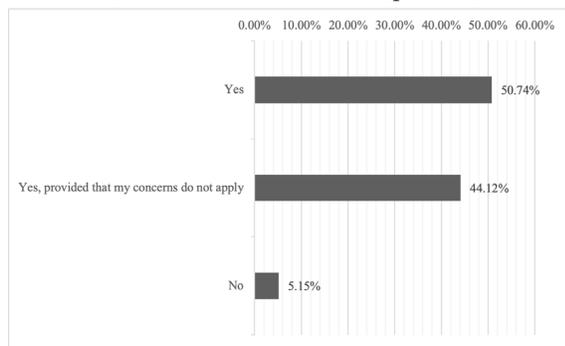


**Figure 5:** Predominant Reasons why consumers use plastic bags.

43.48% of survey respondents predominantly use their leftover plastic bags to store other trash while 35.87% claim to simply dispose of the plastic bags directly into the waste stream. The third most common use for leftover plastic bags is as storage for other items (15.85%). Only a mere 1.64% stated that they do not use plastic bags and 0.54% of respondents reported reselling plastic bags to plastic recyclers.

#### **Consumers' Willingness to Adopt Non-Plastic Alternatives:**

Responses to the question of whether respondents were willing to adopt non-plastic alternatives or not are illustrated by Figure 6. The three available answer choices for this question were "yes," "yes, provided my concerns do not apply" and "no." The possible concerns were those mentioned in the question that asks consumers on why they use plastic bags: there is a lack of alternatives, the alternatives are too expensive, etc.



**Figure 6:** Consumers' willingness to adopt a non-plastic alternative.

As shown in Figure 6, approximately 50.74% of the respondents have said they are willing to use a non-plastic alternative. In addition, 44.12% of the respondents stated that they will likely use a non-plastic alternative given that their concerns do not apply. Lastly, only a mere 5.15% of the customers stated that they are not willing to use a non-plastic alternative.

Despite the current excessive use of plastic bags in Hanoi wet markets, the local consumers have demonstrated a high interest in the adoption of non-plastic alternatives. Hence, the consumers are at an ideal situation where they will likely adopt a non-plastic alternative when they become easily accessible, cheap, or satisfy their concerns

#### **Analysis of Stated Preference Survey:**

Results indicated that 63% of the respondents chose the tote bag, 22% chose the paper bag, 9% chose the plastic bag and 6% chose the recyclable container. An ANOVA regression was conducted to validate the accuracy of the study. The test showed that the database had a final F significance value of  $1.32 \times 10^{-81}$ .

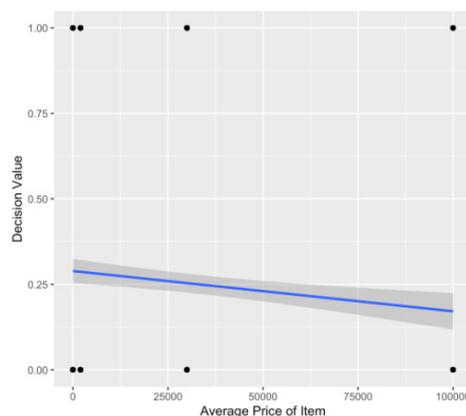
First, the team ran OLS Regression on the LHS value against other variables, such as price, volume, weight, and times (Table 3).

**Table 3:** OLS regression values depending on the four variables.

Categories	Values	Coefficient Estimate	P-Value
Price	Intercept	0.2889	9.4856E-51
	Slope	-1.178E-6	0.0007221
Volume	Intercept	0.01423	0.4188
	Slope	0.04964	2.882E-65
Weight	Intercept	-0.01548	0.4177
	Slope	0.03218	9.324E-63
Times	Intercept	0.02001	1.565E-13
	Slope	0.001302	9.406E-12

Then, RStudio was used to create linear models and plot correlations between the consumers' choices and other variables. First, the LHS value was graphed against the price of the item.

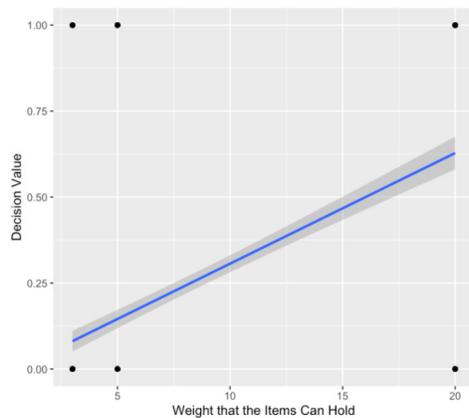
According to the linear model ( $p = 0.000722$ ), the probability of someone choosing a free item is 28.89%. However, for each unit increase in price (measured in VND), the probability of someone choosing that item decreases by 0.0001178%. Therefore, the probability of someone buying an item that costs 100,000.00 VND is reduced to 17.11%. This is illustrated by Figure 7.



**Figure 7:** Probability of someone accepting an item depending on its average price.

Furthermore, the team also investigated whether or not there exists a correlation between the consumers' choices and the weight/carrying capacity of an alternative use.

The following linear regression showed functionality as another key factor potentially influencing consumers' decisions: for each additional unit kilogram that the item was able to hold, the probability of a purchase of that item grew by 3.21% ( $p = 9.3235E-63$ ). The findings are illustrated by Figure 8.



**Figure 8:** Probability of someone accepting an item depending on the weight it can hold.

## ■ Conclusion

The demographic and stated preference survey revealed that the general Hanoi population predominantly uses plastic bags. However, results indicated that Vietnamese citizens are also open to transitioning to eco-friendly alternatives through a 91% affirmative response toward plastic alternatives.

According to the on-site background survey, a main concern in adopting a plastic-alternative seems to be in how consumers are habitual in their plastic bag usage. However, the preference survey showed that 90.63% of the consumers exhibited a tendency to prefer non-plastic alternatives such as tote bags due to their robust and reusable nature. Hence, consumers have a willingness to buy into certain attributes such as the weight the bag can hold and the number of times it can be used. This insight is useful for considering policy and marketing levers to increase alternative product use.

Eco-friendly alternatives like paper bags, tote bags, or reusable containers are responded to encouragingly as compared with a plastic bag when shopping at a wet market. However, this stated affinity in the preference survey does not reflect an actual willingness and follow through to change a behavior pattern. In reality, single plastic bag use is still the overwhelming (98.36%) norm.

All in all, considering that 91% of the respondents chose a non-plastic alternative in the stated preference survey, one potential solution the government could implement is a subsidy for the eco-friendly bag producers. This would increase the quantity of recyclable bags supplied to Vietnam's domestic consumers and decrease the unit price of recyclable bags, which effectively targets the issue of price and availability.

To determine the true preference of respondents or to indicate an intent in their actual behavior, the next step is to complete an A/B testing method at wet markets and combine these with Google trends or a third observational study. This includes prototyping designs including setting up a stall that sells non-plastic alternatives for a period of time. This would allow consumers to potentially gain insights about such eco-friendly products; gain first-hand experience shopping with and using these alternatives at no risk, and offer corrective or confirmative bi-dimensional data to the results of our two surveys.

The research discussed in this article aimed to better understand attitudinal preference in wet markets and other mini grocers in Hanoi's urban core for changing consumer behavior. We hope to utilize this research for further investigation as well as to help spread awareness in Vietnam to some of the problems, solutions and general attitudes surrounding adoption of pro-sustainability behaviors that function and have merit. Finally, eliminating single-use plastic bags is a topic worth considering in its own. The consequences of not changing behaviors in the world's largest markets means vast populations will continue to suffer from a more toxic local environment and global ecosystem--much of it carried out by our own hands. This would be tragically ironic since simple, cheap solutions already exist.

## ■ Acknowledgements

I would like to thank my advisor Andrea Dunchus of Duke University for constant guidance and support and my fellow investigators at the Hanoi Urban Lab: Hoai Anh Le, Hai Nguyen, Truong Hoang Ha, Thuy Linh, and Lam Dinh for their tireless effort without whom I would have been able to accomplish little of this.

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Jinmoo Yoo is a senior at Hanoi International School. He aspires to leverage data science to devise private market solutions and smart government policies on pressing environmental, social, and business issues. Jinmoo hopes to major in data science or operations research with a minor in environmental sciences/engineering.