Taiwanese perception of the behavioral cost on plastic reduction behaviors and their willingness to act in the dining out context

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Abstract

This study investigates how the perception of behavioral costs influences Taiwanese citizens' willingness to engage in plastic reduction behaviors (PRB). Through a mixed-methods of both qualitative and quantitative approach combining semi-structured interviews (n=8) and a questionnaire survey (n=323). The study identifies key dimensions of perceived costs: time, financial, convenience, and hidden factors, including psychological and social burden. While the semi-structured provides a micro-level and details of plastic-using habits, the survey provides an overview perception that could support the results.

The thesis runs through the policies implemented in past decades to give a glimpse of the current progress of reducing plastic waste from the perspective of governments. Moreover, it also discusses the unique dining-out culture in depth to provide contextual understanding of Taiwan and highlight the urgency of the issue.

Findings show that the three dimensions have an impact on the willingness to a different degree. Moreover, it also concluded that while PRB is generally considered affordable, habit formation and intertwined factors, which are deeply rooted in socio-cultural background, still create significant psychological barriers.

The study concludes that addressing the knowing-doing gap requires policy interventions. In particular, working on reducing subjective perceived costs through restructuring the external environment and forming a new habit pattern.

Keywords: Plastic Reduction Behavior, Behavioral Cost, Knowing-doing gap, Taiwan, Pro-environmental Behavior, Dining out Culture, Eating-out culture

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Abbreviations

Abbreviation	Description
ECM	Environmental Communication and Management
EPA	Environmental Protection Administration
LPCB	Lightweight plastic carrier bags
PEB	Pro-environmental Behavior
PRB	Plastic Reduction Behavior
SLU	Swedish University of Agricultural Sciences

1. Introduction

Taiwan began its plastic reduction policy in 2002, restricting various plastic products including disposable utensils and plastic bags. In 2018, the government expanded regulations, prohibiting businesses such as bakeries and beverage shops from providing plastic bags for free. The goal is to completely ban four categories of single-use plastic products by 2030, including plastic straws, single-use beverage cups, plastic bags and single-use utensils. However, according to statistics provided by the Ministry of Economic Affairs, R.O.C., Department of Statistics (2025), the domestic sales of plastic bags increased from 146,690 metric tons in 2002 to 234,034 metric tons in 2024.

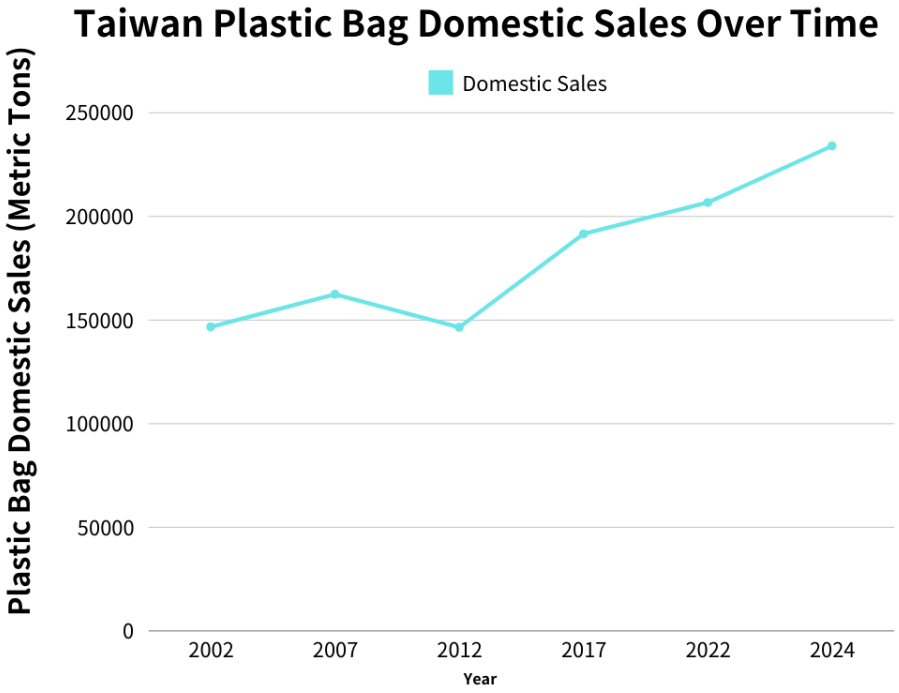

Figure 1. Taiwan Plastic Bag Domestic Sales Over Time. (Ministry of Economic Affairs, R.O.C, Department of Statistic, 2025. https://service.moea.gov.tw/EE520/investigate/InvestigateDA.aspx [2025-02-27])

Since 2002, nearly 30 years of efforts to reduce plastic have had minimal effects. Moreover, according to Environmental Protection Administration (EPA, 2024), the usage of single-use beverage cups skyrocketed from 1.5 billion cups per year in 2011 to 4 billion cups in 2021.

In addition, from 2010 to 2020, plastic waste became the third-largest source of waste in Taiwan, with a particularly high percentage of 20.20% in 2020 (EPA, 2021) a record high.

The Environmental Protection Administration also responded to inquiries about plastic reduction policies for this thesis, noting that due to the impact of the COVID-19 pandemic, the amount of waste had significantly increased. This indicates that changes in the lifestyle of the Taiwanese people were also one of the factors contributing to the increase in plastic usage.

Interestingly, at the same time, survey results from Wang et al. (2021) indicated that the environmental awareness of the Taiwanese people has been increasing year by year, which leads to the core of the study: why, despite such high environmental awareness, has plastic usage in Taiwan increased rather than decreased?

The question highlights a gap between knowledge and action on part of the Taiwanese people. In other words, although Taiwanese citizens are aware of environmental issues and understand the importance of adopting eco-friendly behaviors, certain factors may hinder them from taking action.

To explore the underlying causes of the knowing-doing gap, this thesis begins by examining individual plastic-use behaviors among Taiwanese people with semi-structured interviews. In particular, it considers how these behaviors are shaped by daily habits, with a focus on Taiwan's prevalent eating-out culture, a factor also identified by the EPA as a key contributor to increased waste.

The study uses the concept of *perception of behavioral cost* to explore why many Taiwanese people, despite being environmentally aware, do not consistently act on this awareness. I focus on the specific costs they associate with plastic reduction and examine how these perceptions shape their behaviors.

I broadly defined *perception of behavioral cost* as how a person views the costs they consider when deciding to engage in pro-environmental behavior (PEB), which will influence their actions. This concept was derived from various studies (Ajzen, 1991; Steg and Vlek, 2009), which indicated that in the pro-environmental behaviour context, people make reasonable choices during the decision-making process (Steg and Vlek, 2009).

These cost-benefit assessments are tied to one's sense of agency, the belief that they can actually execute the behavior. This leads to the key role of perceived behavioral control (Ajzen, 1991), which refers to an individual's assessment of how easy or difficult it is to perform a specific behavior. When the perceived difficulty or cost, whether in terms of time, effort, or convenience, outweighs the

perceived benefits, people are less likely to engage in pro-environmental actions, even if they recognize their importance.

By integrating this with the concept of perceived behavioral cost, this study aims to understand the barriers that prevent environmentally aware individuals from taking plastic reduction actions.

1.1 Research Aim & Research Question

This thesis aims to investigate how perceived behavioral costs and hidden factors influence the willingness of Taiwanese individuals to engage in plastic reduction behaviors (PRB), and to further examine how these factors contribute to the persistence of the knowing-doing gap.

By exploring the disconnection between environmental awareness and actual behavior, this research seeks to reveal the culturally and behaviorally specific factors in shaping PRB, particularly in the context of Taiwan's dining out culture. While previous studies have focused on general environmental awareness (Huang et al., 2020), this study emphasizes the role of individual cost perceptions in shaping behavioral outcomes, specifically focusing on time, financial cost and convenience.

Accordingly, the central research question is: How do perceptions of behavioral cost affect Taiwanese individuals' willingness to engage in plastic reduction behaviors in the context of dining out?

To answer the central research questions, the study examines the following sub-questions:

1. In what situations/contexts do individuals view the costs of taking action as especially significant?
2. Do Taiwanese people see the three dimensions (time, financial and convenience) as their behavioral cost?
3. What is the relationship between perceived behavioral costs and the willingness of Taiwanese people to reduce plastic use in dining out contexts?
4. What leads some individuals to view the costs associated with reducing plastic usage as high? Is this viewpoint influenced by their own experiences or by social norms?

Last but not least, due to limitations in length and time, this paper does not cover the potential interplay between Taiwan's production systems, government, and users.

1.2 Thesis Outline

The thesis is structured in five chapters. The first chapter provides an overview of the thesis, which is built on four sub-questions connected to the research aim.

The second chapter presents a literature review to discuss the background of plastic reduction policy and the thriving dining-out culture in Taiwan and its impact on plastic waste. Moreover, the chapter also reviews how behavioral cost takes an important role when implementing PEB.

The third chapter outlines the method and working process, drawing on semi-structured interviews and surveys, which employ a combination of qualitative and quantitative methods.

The fourth chapter presents the research results from interviews and a survey. The interviews describe the daily life of Taiwanese people's plastic-using habits in detail. The survey presents three dimensions of perception of behavioral cost: time cost, financial cost, and convenience, which 323 participants filled out, and provides an overview of how people relate the factors as burdens of plastic reduction behavior.

The fifth chapter discusses the integration of both qualitative and quantitative results to investigate the underlying patterns and themes aligned with the concept of perception of behavioral cost. In addition, this chapter further explains how perceived behavioral costs contribute to the formation of habitual patterns, which in turn lead to a knowing-doing gap between environmental awareness and actual action.

2. Literature Review

As an Environmental Communication and Management (ECM) student, I found that depicting the plastic reduction history and the cultural context in Taiwan could be an interesting topic. Since EC gives us a broader approach to examine how daily circumstances shape our perception of the environment, as well as how society shapes behavior (Pezzullo and Cox, 2018), I seek the opportunity to investigate a deeper dynamic relationship between attitude—behavior—and policy implementation in the literature review.

2.1 Plastic Reduction Policy Background

Compared to the EU inhabitants consuming 95 lightweight plastic carrier bags per capita in 2018 (Eurostat, 2024), the EPA estimated that Taiwan used 780 plastic bags per capita per year from 2002 to 2018, as cited by Huang (2018). This showed Taiwan used eight times more LPCBs than the EU in 2018, and the extreme heavy usage of plastic is a common phenomenon in Taiwan.

The EPA officially launched "Restrictions on the Use of Plastic Shopping Bags and Disposable Plastic Utensils (including Styrofoam)" in 2002 as a starting point for plastic reduction policy, according to the Waste Disposal Act. The first phase of the implementation includes government agencies, schools, state-owned enterprises, and military institutions to reduce plastic usage.

In 2003, the regulation was extended to require consumers to pay for plastic shopping bags, which could no longer be provided for free by seven regulated categories: public sectors, department stores, discount warehouses, chain supermarkets, convenience stores, fast food chains, and street diners. Approximately 20,000 businesses were affected (EPA, 2017).

In 2006, the EPA further divided the original policy "Restrictions on the Use of Plastic Shopping Bags and Disposable Plastic Utensils (including Styrofoam)" into two separate implementation areas: plastic shopping bags and disposable plastic utensils. This separation allowed each category to be regulated and enforced independently. The restriction on plastic shopping bags remains in exchange for payment (Ministry of Environment, 2017). Regarding disposable plastic utensils, the public sectors and schools were prohibited from providing disposable utensils and plastic containers. (Ministry of Environment, 2006)

In 2007, a new environmental regulation targeting single-use plastic trays and packaging materials was launched (Ministry of Environment, 2007). This shift caused a rapid growth in Taiwan's bio-plastics sector, particularly in polylactide (PLA) production. PLA, a biodegradable plastic, quickly became the dominant alternative for packaging items such as eggs, salads, cakes, and bubble tea. (Walther et al., 2021) .

In addition, as the purchase of take-out bubble tea has become a daily routine for Taiwanese citizens, the government has established a new policy. In order to achieve the goal of source reduction, the EPA introduced the "Single-use Takeaway Beverage Cup Source Reduction and Recycling Incentive Program" (Ministry of Environment, 2011). Under this program, customers who return single-use cups with a recycling reward label of a particular chain brand were eligible to receive a reward of NT$1 for every two cups returned.

However, the program was repealed in 2022 and replaced by a new regulation of the "Single-use Beverage Cup Restriction Policy". The program encouraged consumers to bring their own reusable cups to reduce the use of disposable containers. Moreover, the EPA has completely banned bubble tea shops from providing disposable plastic cups by the end of 2024 (EPA, 2024).

In 2018, in addition to the originally specified seven categories that cannot be provided for free plastic bags, there are now extended categories. The regulation included bakeries, bubble tea shops, retail of books and stationery, laundry business, medical equipment business, pharmacies, and retail of home appliances and telecommunications service providers (Ministry of Environment, 2017).

As the international community has gradually paid attention to the issue of marine plastic pollution in recent years, the EPA has increasingly emphasized the same issue. Plastic straws have been among the most common types of waste found on Taiwan's beaches, which led the EPA to launch a "Single-use Plastic Straw Restriction Policy" in 2019 (Ministry of Environment, 2019). This aims to prohibit public sectors, schools, department stores, shopping centres, and chain fast food businesses from providing single-use plastic straws to customers for dining in.

Overall, the timeline has reflected the progressive evolution in Taiwan's plastic-related policies. It covered items such as plastic bags, plastic disposable utensils, disposable cups and plastic straws. The sphere of influence had gradually expanded from public sectors such as government agencies and state-owned enterprises to private companies. The policies have affected the daily

consumption behavior of individuals as well, formulating more specific and diverse restrictions in the past decades. However, even though the plastic restriction policy was implemented progressively, it can still be seen that the use of plastic bags and disposable items is increasing year by year.

According to Liao (2022), the total number of disposable cups used in 2020 reached approximately 3.99 billion, of which plastic cups accounted for 2.26 billion and PLA-coated paper cups for 1.61 billion. Furthermore, from May to June in 2021, during the pandemic, the recycling volume of waste plastic boxes and waste plastic trays reached 5,343 metric tons, an increase of 31.5% compared to 4,063 metric tons during the same period in 2020 (EPA, 2021). The data showed that although the government continues to promote the policy, the actual usage remains high. Due to the impact of the pandemic, the takeout industry aggravated the situation (EPA, 2025). Combined with the public's preference for disposable items due to hygiene concerns, the policies have significantly undermined the effectiveness during the pandemic. This also highlights the practical difficulties of implementing a plastic reduction policy.

Table 1. Plastic Reduction Policy Overview.

Year	Policy
2002	Public sectors began to limit the use of plastic bags and disposable plastic items (including styrofoam).
2003	The restriction on use of plastic bags included seven regulated business categories.
2006	Government agencies and school cafeterias were prohibited from providing disposable plastic tableware for dine-in services.
2007	Implementation of the regulation to reduce the use of single-use plastic trays and package boxes.
2011	Implementation of the "Single-use Takeaway Beverage Cup Source Reduction and Recycling Incentive Program."
2018	14 regulated business categories were prohibited from providing plastic shopping bags for free.
2019	Restaurants, department stores, shopping malls, and hypermarkets were prohibited from providing any type of single-use tableware for dine-in customers. Implementation of the "Single-use Plastic Straw Restriction Policy."
2022	Implementation of the "Single-use Beverage Cup Restriction Policy."

2.2 Dining out culture

Kaplan Mintz et al. (2019) claimed that culture and structural contexts both influence people's pro-environmental behaviors. Thus, to understand behavioral costs and hidden factors that affect the willingness to implement PRB, the culture is bounded by geography, which plays an important role in examining this.

The word culture refers to a broad concept of shared beliefs, values, behaviours, language, and practices that are rooted in a population or a community, both in material and non-material aspects (Willis et al., 2024). The prominence of night markets, street diners, convenience stores and bubble tea shops illustrates how Taiwan's geographical cultural context shapes norm-governed consumption habits and waste management practices (Kaplan Mintz et al., 2019). At the same time, it represents a sense of normalcy around convenience-driven lifestyles in Taiwan.

According to the National Health Research Institutes in Taiwan (Ministry of Health and Welfare, 2015), the frequency of dining out among the Taiwanese population is high. People aged 15-18 have an 80-90% opportunity to eat out in the morning, followed by the statistic of 85-90% dining out for lunch and 65-70% for dinner. Individuals above 18 have lower rates of dining out: breakfast for 55-65%, lunch for 47-62% and dinner for 27-33%. According to Li (2021), it is significant that eating out accounts for a notable portion of household waste, which has also led to many environmental issues.

This preference for dining out has led to environmental consequences, particularly in the form of food-related plastic waste. The top five types of beach litter along the coastline in 2018 were PET bottles, plastic straws, disposable tableware, beverage cups, and plastic bags, according to the Taiwan ICC beach cleanup data (as cited in EPA, 2018). Moreover, in 2023, the top three types of domestic beach litter in order were PET bottles, plastic bottle caps and cigarette butts. If categorized by materials, approximately 91.1% of beach litter was plastic and roughly 75.2% was food-related (The Society of Wilderness, 2023).

The dining out culture has a great impact on the 2.1 plastic reduction policy background. Li (2024) mentioned that when formulating the policy to limit the use of plastic bags for shopping, the government took into account the Taiwanese people's preferences. Believing that there is still a necessity to use plastic bags for takeout, especially with soups, greasy foods, and hot dishes. Therefore, the government did not impose strict restrictions on street diners regarding the prohibition of plastic bags. This led me to observe that the policy was constrained by the locals' dietary habits and actual needs during the design phase, highlighting the role of cultural factors in its feasibility.

Culturally appropriate implementations are more likely to result in successful policy outcomes (Willis et al., 2024). The policy that aligns with a society's cultural norms and values may help ensure social acceptability in the policy adoption (Willis et al., 2024). This is the reason why we need to explore Taiwan's dining culture, not only to understand the context behind policy formation but also to use this as a foundation to reshape our relationship with plastic.

2.3 Behavioral Cost and Habit formation

Attitude towards the environment was previously considered an important component in the effort to guide the public towards pro-environmental behavior (Ajzen, 1991; Huang et al., 2020). Yet, Stern (2000) proposed the possibility that cultivating positive environmental attitudes may still fail to result in meaningful environmental impact. Other studies also showed that a positive environmental intent does not necessarily lead to environmentally significant behavior (Kaiser et al.,1999; Fishbein et al., 2003; Diekmann & Preisendörfer, 2003).

Building on this concern, Ajzen (1991) introduced the concept of perceived behavioral control in the Theory of Planned Behavior. He emphasized that the resources and opportunities available to an individual, such as time, money, and access, can significantly influence the likelihood of performing a behavior. He noted that behavior often depends not only on motivation but also on non-motivational factors, such as the accessibility, in other words, whether it is easy for a person to do PEB.

Although Ajzen's model indirectly incorporated ideas related to behavioral cost, it was not until Stern (2000) that this concept was more fully developed and systematically integrated into environmental behavior theory. Stern (2000) built the Value-Belief-Norm (VBN) theory to better explain the relationship between environmental concern and behavior. In doing so, he explicitly integrated behavioral cost as one of the key components. Huang et al., (2020) highlighted that behavioral cost, in addition to attitudinal factors from Ajzen's Theory of Planned Behavior, plays a major role in determining behavior realization according to Stern's research.

Expanding on this, Stern (2000) stated that for personal behaviors not strongly reinforced by external contexts (e.g., through legal requirement or tangible reward), the more difficult, time-consuming, or expensive the behavior, the less likely it is to be driven by attitudes alone.

The follow-up research, such as Diekmann and Preisendorfer published in 2003, compared the behavioral effect in both low-cost and high-cost situations. They claimed that behavioral cost do not merely shape behavior but also moderate attitudes toward behavior, a point that can be seen as conceptually related to the knowing-doing gap. The study pointed out that the cost stands as a key factor in intervening the correlations between attitudes and behavior. For instance, when it comes to “easy-to-perform actions” with a low-cost situation such as switching off lights in a daily routine, attitudinal factors play a major role. On the other hand, when facing a high-cost situation (e.g., installing a new heating system), the impact of environmental intentions is not significantly correlated.

Rau et al., (2024) proved that the cost of behavior will affect the likelihood of the specific behavior being adopted. Taking the change to a green electricity tariff as an example, their research showed that its adoption rate is low compared to switching off lights. Most of the participants refused the adoption due to financial constraints, or they were not allowed in a certain living condition. Furthermore, reducing the use of streaming services to save housing energy was directly refused by 74.13% of the participants based on personal comfort and mental health considerations. Their results demonstrated that PEB is influenced by various behavioral costs, including time, financial expenses, convenience, psychological factors and social norms.

Other than the aforementioned factors, the participants in the research (Raul et al. 2024) stated that the motivations behind certain behaviors were influenced by their upbringing. It noted that behaviors that are acquired during childhood are often regarded as “normal” and, thus, are perceived as low-cost.

To conclude, the behavioral cost has been discussed over decades and has proven itself as a crucial element when examining the value-action gap or so-called attitude-behavior gap (Raul et al. 2024). It also revealed that habits, defined as persistence of behaviors without thinking (Kurz et al., 2015), play a critical role in reducing the behavioral cost. When an action is internalized as a habit, individuals no longer need to repeatedly assess costs.

3. Methodology

In order to delve deeper into the study's research questions, methods such as semi-structured interviews as a qualitative method and a survey questionnaire as a quantitative method were used to conduct the research. The primary goal of the study is to identify how perceived behavioral costs influence the willingness of Taiwanese individuals to engage in plastic reduction behaviors in dining out contexts. Mainly focusing on understanding the relationship between behavioral costs and the actual behavior, while also exploring the underlying hidden factors, such as psychological aspects or social norms.

The first phase consisted of conducting interviews that included researching and contacting interviewees. The second phase focused on the qualitative data analysis, which was conducted through coding that finds, refines, elaborates, and integrates concepts and themes (Rubin & Rubin, 2005). Defining the pattern and underlying factors of plastic usage gives an overview of the daily habits of using plastic.

The third phase continued with the design of the survey questionnaire, which was built upon the semi-structured interview. The data carried out three dimensions of perception of behavioral cost, which included: time cost, financial cost, and convenience.

The fourth phase analyzed quantitative data by using the Google Form response dashboard and SPSS, which examined whether the perceived behavioral costs affect individuals' likelihood of engaging in plastic reduction behavior. This phase included descriptive statistics, reliability testing, and regression analysis, which will be explained in detail in the following sections.

3.1 Semi-structured Interview

In the context of the semi-structured interview, I tend to find out the factors that hinder people in Taiwan from doing plastic reduction behavior, and identify what the costs are for them to apply PRB. The interview was conducted in Mandarin. I transcribed the interviews with the "Dictate" feature in Microsoft Word and double-checked the transcription word by word.

The questions primarily concentrated on two critical domains: Firstly, exploring when individuals are more willing to adopt plastic reduction behaviors and what

deters them. Secondly, examining the reasons behind their perceptions of certain actions as being associated with high costs.

Additionally, asking what kind of background (e.g., family, education level, or social norms) leads to such perceptions. The in-depth interview focused more on psychological factors and contextual elements surrounding these actions, with some additional questions due to the response from interviewees (Robson & McCartan, 2016), to seek the hidden factors. The general questions can be found in the table below:

Table 2. Interview Guides for 8 interviewees.

1. What is the frequency of your use of plastic products? (follow-up questions afterwards based on the usage) 2. (For frequent users) Why do you prefer them over reusable ones? What is the main reason you avoid using plastic products? What would encourage you to adopt more plastic reduction behaviors? 3. (For infrequent users) Why do you prefer them over plastic products? 4. In what situations/contexts do you view the costs of taking action as especially significant? (e.g., shopping, dining, traveling) 5. What leads you to view the costs associated with reducing plastic usage as high? Is this viewpoint influenced by your own experiences or by social norms?

For the thesis, I also emailed the Taiwan Ministry of Environment to discuss how they have implemented plastic reduction policies over the past 30 years. This included exploring the reasons behind the continuous increase in plastic waste in Taiwan.

Table 3. Interview Questions for the Taiwan Ministry of Environment

1. How have the public and businesses responded to plastic reduction policies in the past decades? 2. What challenges has the Ministry encountered when implementing plastic reduction policies? What are the major obstacles or resistance? 3. Despite the Taiwanese's strong environmental awareness, why do citizens struggle to translate this awareness into practical action? 4. Compared to Japan and South Korea, which also have strong dining out cultures, why has Taiwan not successfully reduced plastic consumption to the same extent? 5. What strategies or policy adjustments does the Ministry plan to implement in the future to further reduce plastic waste?

3.1.1 The Interviewees

The interviewees were chosen based on their (1) subjective perception of environmental friendliness; (2) different age groups (20~30, 30~40, 40~50, above 50); and (3) varying annual income, which is reported in New Taiwan Dollars (NT$) in the following table. US$ equivalents are calculated using the exchange rate of US$1 = NT$32.

Table 4. Basic Information about Interviewees

Name	Education Level	Age	Pronoun	Annual Income (NT$ / US$)
A	Bachelor	25	She	X
B	Bachelor	54	She	330,000 / 10,313
C	Master	40	He	700,000 / 21,875
D	Bachelor	27	He	500,000–600,000 / 15,625–18,750
E	Bachelor	25	She	400,000–500,000 / 12,500–15,625
F	Bachelor	29	He	360,000 / 11,250
G	Bachelor	25	They	360,000 / 11,250
H	Bachelor	41	He	400,000 / 12,500

3.1.2 Thematic Analysis

Following transcription for thematic analysis, only the statements deemed necessary were selected for translation in the results section. Thus, I tried to find the patterns that elaborate the same themes that answer my research question (Rubin & Rubin 2005) and identified the factors that would contribute a great influence on individuals' PRB.

Throughout this phase, it became evident that several factors were mentioned repeatedly, which naturally became my initial codes. Therefore, I added the theme under the code "factors", which is further divided into two main sections. My aim was to analyze the eight conducted interviews about their daily habits of plastic usage in order to depict a full picture of the context in which people go through the decision-making process of implementing PRB. This also helped highlight the underlying factors that are not easily recognized at the conscious level.

Furthermore, I also analyzed how income affects people's plastic reduction behavior.

3.2 Survey

The self-reported survey was designed to identify whether the three dimensions of behavioral cost have an influence associated with plastic reduction, particularly in dining out contexts.

Before the questionnaire design begins, I summarized semi-structured interview three behavioral costs that the interviewees frequently mentioned, which also referred to the topic I chose to present in my survey: **Time cost** refers to the time taken to find alternatives that do not require the use of plastic products; **Financial cost** refers to the cost of purchasing reusable products or spending extra money on certain product; and **Convenience** refers to whether giving up the use of disposable plastic products causes inconvenience.

3.2.1 Data Analysis

The survey contained 28 questions (see Appendix 1) which included demographic questions (e.g., gender, age, annual income, education level); three dimensions of perceived behavioral cost answered with Likert Scale 1-5 (1 =Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree); one open-ended question to seek other factors that haven't been mentioned in the questionnaire; the impact of each cost factor with Likert Scale 1-5 (1= No influence, 2 = Slight influence, 3 = Moderate influence, 4 = Significant influence, 5 = Strong influence); and the frequencies of PRB in daily life with Likert Scale 1-5 (1 = Almost never, 2 = Rarely, 3 = Occasionally, 4 = Frequently, 5 = Almost always).

The questions were analysed using the Google Form response dashboard and SPSS. For SPSS, validity analysis, descriptive statistics, reliability analysis and regression analysis were conducted to analyze the relations of the variables.

Validity analysis refers to the correctness and authenticity of the survey, which is the very first step for evaluating the degree of effectiveness. It is closely related to the objectives of the research: the results obtained from a study must align with its goals in order to be considered (Wu & Tu, 2019; Robson & McCartan, 2016).

Descriptive statistics were used to understand the distribution of the data, such as the age and gender distribution of participants and the average scores of each question, to assess the influence of these factors. Reliability analysis was

conducted to ensure consistency within the questions, meaning to determine that the questions within each set are highly correlated (Wu & Tu, 2019).

Finally, regression analysis was used to examine "whether time cost, financial cost, and convenience cost can predict the willingness to reduce plastic," demonstrating the influence of these three dimensions on Taiwanese individuals.

For a better overview of the present research, all variables of the studies are shown in Table 5 below.

Table 5. All Variables.

Category	Construct/ Variable	Code & Question
Independent Variables	Time Cost	**Time_cost1:** When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store. **Time_cost2**: Plastic reduction behaviors require additional time for preparation. **Time_cost3:** Plastic reduction behaviors require extra time for maintenance. **Time_cost4:** Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.
	Financial Cost	**Financial_3:** Plastic reduction behaviors require extra time for maintenance. **Financial_4:** Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.
	Convenience	**Convenience_1:** When shopping or dining out, I use disposable plastic products because I find eco-friendly options harder to access. **Convenience_2:** Carrying reusable items (such as reusable bags or utensils) feels inconvenient to me. **Convenience_3:** Practicing plastic reduction behaviors requires extra preparation when shopping or dining out, which reduces convenience. **Convenience_4:** Many places (such as restaurants, supermarkets, and night markets) do not offer suitable plastic-free alternatives,

		making it difficult for me to engage in plastic reduction behaviors. **Convenience_5:** Overall, I find engaging in plastic reduction behaviors inconvenient.
	The Assessment of Each Behavioral Cost	1. Time cost 2. Financial cost 3. Convenience
Dependent Variables	PRB Willingness	1. Even if it takes extra time, I would still choose to engage in plastic reduction behaviors. 2. I feel that my income can support my plastic reduction behaviors. 3. I am willing to allocate a certain portion of my income to support my plastic reduction behaviors. 4. Even if plastic reduction behaviors require extra costs, I would still choose to engage in them. 5. Even if it is inconvenient, I would still choose to use eco-friendly products.
Control Variable	Demographic Information	1. Gender 2. Age 3. Which of the following best describes your personal annual income last year? 6. Education level

3.3 Language Proofreading

To minimize potential spelling and grammar errors, Grammarly was used as a supplementary proofreading tool during the writing process. The software assisted in identifying basic language issues, while the final revisions were manually checked by my kind and nice friends to ensure clarity, accuracy, and consistency with the academic tone.

3.4 Methodological Reflections

This section describes my personal findings during the entire research process. First of all, I would like to share the fact that every single interview was conducted through Google Meet, Line, or FaceTime. Hacker et al. (2020)

explained that web-conferencing systems, such as Zoom, facilitate meetings that might not be able to take place otherwise. In my case, since I was located in Sweden, it was an inevitable choice.

Although I did benefit from the web-conferencing systems, I believe that I also see the limitation of it: it is hard to lead the conversation on a sensitive topic. During the interviews, I could sense that some interviewees felt uncomfortable sharing opinions, despite my emphasizing that the responses would not be judged in all respects. In my opinion, face-to-face interviews would alleviate stress since the interviewees could grasp my friendly facial expressions and gestures properly. Fortunately, I successfully conducted the interviews, since I had been encouraging them throughout the web meetings.

For the quantitative method, as someone with no prior experience in statistical software, using SPSS to conduct analysis was a significant challenge. It was my first time independently processing and analyzing data, from setting up variables to running and interpreting the results of reliability tests and regression analysis.

To bridge this gap, I relied heavily on Mandarin academic resources and tutorials to learn the technical steps. While this allowed me to successfully complete the analysis, I recognize that this reliance may have limited my exposure to broader methodological discussions available in English literature. Moreover, due to my limited technical skills and time constraints, I was only able to apply the most basic analytical methods available in SPSS. In retrospect, I see this as a limitation: not only did it potentially narrow my analytical perspective, but it also revealed a missed opportunity to engage more deeply with global academic practices in the field of environmental behavioral research.

4. Results

The following section describes the results of interviews and surveys. While the interview captured the daily habit of plastic usage in detail, the survey was designed to complement these insights by quantifying the extent to which perceived behavioral costs influence individuals' willingness to reduce plastic use.

4.1 Analysis from Interview

To give an overview of how perception of behavioral cost affects Taiwanese individuals' behavior, I categorize the results into three topics: (1) the factors that influence PRB; (2) social environmental factors; and (3) the impact of income on PRB. In the following subsections, these topics will be presented in detail.

4.1.1 The Factors that Influence PRB

Throughout the research phase, I asked the interviewees about their habits of using plastic when shopping or dining out, including but not limited to any form of plastic products. Based on their self-explanatory processes, I further inquired about the circumstances under which they would use plastic and what considerations led them to choose non-pro-environmental behavior.

It can be observed that everyone focuses on different aspects. Analyzing the eight conducted interviews shows that if we categorized them by keywords, they can basically be divided into the following five aspects: (1) financial cost, (2) convenience, (3) hygiene concerns, (4) time cost and (5) unpredictability. In addition to these five aspects, some respondents also demonstrated a comprehensive consideration that includes these factors.

The financial cost was mentioned by several interviewees. They preferred the way of not paying extra to choose a more sustainable way, such as buying their own reusable products, since the store will provide the utensils or bags anyway. Interviewee C, D, and H mentioned in order:

> The first consideration is the cost of money, followed by convenience, and then hygiene concerns.

> […] The second thing I consider is money. I am not very willing to spend money on something extra.

> I believe the primary factor is still the money […]

These statements showed that while participants may be environmentally aware, the additional cost associated with purchasing reusable items or avoiding plastic becomes a significant obstacle. The perception that eco-friendly choices are financially burdensome discourages action.

The frequency with which convenience is mentioned is comparable to financial cost factors. Carrying containers and intentionally reducing plastic use are both seen as "troublesome", which D mentioned in the interview:

> The first thing that comes up is definitely 'convenience', carrying something with me has always been quite inconvenient for me.

Convenience plays a critical role in decision-making, especially when participants are tired or under time pressure. Even those who regularly bring containers may give up on such behavior when it feels too effortful, highlighting the fragility of pro-environmental routines. Interviewee F explained further in his response:

> I personally feel the convenience matters. I bring my own container to the office to buy lunch when eating out.[…] But when it comes to dinner, I don't think I will do it the same. When I get off work, I feel extremely exhausted, which leads me to want to quickly buy something to eat at home, so I would go directly to buy, for example, a lunch box, and they would give me a plastic bag.

Two of the interviewees talked about the hygiene concerns when eating out. This represented the night market and vendors' culture in Taiwan, which possibly did not have well-maintained surroundings, just seats beside the road and dining. The situation in detail was described by interviewee A:

> However, apart from convenience, it could also be because some restaurants have hygiene issues, which might lead me to opt for disposable utensils as well. At night markets or food stands, I will tend to use disposable utensils even if they provide environmentally friendly ones.

Interviewee G, who self-claims to be an active practitioner of plastic reduction behavior, mentioned that time cost is a burden for them to take action. Although they bring sustainable options when dining out, such as carrying containers, bags and reusable utensils, it is still inevitable for them to consume groceries without plastic. They noted that large supermarket chains offer well-packaged products,

while traditional markets typically sell unpackaged items. However, they choose not to shop at traditional markets because traditional markets usually open early in the morning, which conflicts with her work schedule.:

> I could have woken up early to go to the traditional market and bring my own bags and containers to pack tofu and eggs to avoid any possibility of using plastic. But I chose not to do that because of the working schedule right after.

The statement shows that even when time could be theoretically manageable, it is often considered an obstacle when considering a comprehensive situation. This highlights how behavioral costs are subjective. It's not only about the real time needed, but also about how the individual values that time.

Interviewee E gave an interesting insight into "unpredictability" in the eating out context. The unpredictability encumbers the PRB, though she has the money, time and tools, which she further explained in the interview:

> I don't think it's predictable after all whether this container is enough to hold the meal you want. Or, you might not be able to plan everything perfectly and prepare for it. Unless it's a situation you can control, for example, if you frequently go to a certain vendor and you know that they always give you that specific portion, then you would know which container that fits. And ideally, the staff at that store would be willing to accommodate you[…]

Interviewee F's response revealed a layered and adaptive approach to PRB. By analyzing his actions around coffee consumption, F demonstrated an intertwining consideration of factors:

> I basically drink coffee every day, and when I buy coffee, I also bring my own cup. [...] In the afternoon, I might not have as much time, but if I need a second cup, I will make instant drip coffee, and the filter paper is actually much cheaper than the beans. I usually choose to drink one cup of my own brew in the morning and a drip coffee in the afternoon. It's an economical choice.

Compared to other interviewees who might forgo action entirely due to inconvenience or cost, F's response shows a more flexible and reflective approach, highlighting the role of adaptive strategies in sustaining long-term plastic reduction habits but also considering all the factors: balancing time and financial constraints with environmental intentions.

This also showed how individuals can make conscious, context-based compromises to maintain sustainable habits. His choices exemplified how perceived behavioral costs do not necessarily lead to inaction, but instead may result in modified strategies that still align with pro-environmental values.

4.1.2 Social Environmental Factors

“I will use whatever they provide. ” (interviewee C, 2025). It’s a crucial concept that popped out in the interview. He pointed out the key factor that was also mentioned by subsequent interviewers: the impact of the social environment on users’ habits. The quote not only reflected the individual’s passive acceptance of the existing system and services but also indicated the hidden factor rooted in the social culture behind the behavior. Most of the interviewees mentioned that the surroundings, the options that the store provides and unconscious behavior have a significant impact on the willingness to implement PRB.

The response also highlighted the convenience of the dining out culture in Taiwan. For a long time, the fast and convenient consumption model has gradually shaped the public’s expectations for efficiency in daily life. It normalized the use of disposable plastic products as part of life, which interviewee D mentioned:

> […] In short, in the environment of Taiwan, these things have been provided since childhood, so it has become a habit that is too convenient to the point where you wouldn’t want to do it any other way. On the contrary, preparing reusable items yourself feels too troublesome and also costs money. When it comes to selling these items in Taiwan, I don’t know if it’s an issue with the business model or if there’s something else going on, but from a consumer’s perspective, it just feels like buying these things is too expensive and not worth it.

The responses from the interviewees also echoed this context. Actively implying PRB is often seen as requiring extra effort or additional burden. Thus, even if the individual might agree with the concept of PRB, when it comes to the practical field, they often hesitate to take action due to being perceived as troublesome or inconvenient, which is shaped by their socio-cultural background. This showed that the social environment shaped the public’s habits. Moreover, it increased individuals’ perception of the action costs associated with reducing plastic use, thereby suppressing their willingness to practice PRB.

Interviewee F reflected on the current situation:

> The reason that makes me feel reducing the use of disposable products is costly is probably because it is an unconscious behavior that is too convenient to overlook. If we really delve into it, for example, if I go to a convenience store today and buy bread and a rice ball, am I not using disposable plastic products? I am definitely using them. They can't even be reused like other plastic bags. I don't think people are aware of this at the moment of purchase.

Interviewee F further explained that even though he suddenly realized "Oh right, buying a rice ball is still a one-time waste" during the interview, he would still buy it. He feels like he can't resist the situation, since there is no alternative option.

Interviewee E claimed that even though she consciously tends to choose a more environmentally friendly lifestyle, regardless of dining out or cooking herself, she often faces constraints and challenges from the external environment when it comes to actual implementation. She described her observation of daily life in detail:

> No matter whether you eat out or do it yourself, let's take eating out as an example first. They are definitely going to give me a container, which might be made of paper, but on top of that, there will be a plastic lid. Although I don't need the plastic bag, there may still be waste from containers. On the other hand, if I do the cooking myself, the ingredients will be packaged in plastic. Even though I choose to go to the traditional market, they are likely to do the same. For instance, when buying meat, they also use plastic bags, which is quite difficult to avoid. […] Drinking bubble tea can also have this issue, but it's much easier to avoid producing waste since you can prepare it beforehand. Many snacks also come in individual packaging.

Most of the stores provide disposable paper containers with a partial plastic, such as PE lamination or a plastic lid for to-go, which lacks a sustainable option, making PRB hard to implement. She also mentioned that the inevitable overpackaging in supermarkets has become a burden in reducing plastic waste.

The experiences represented that individuals have environmental awareness and the intention to take action. However, it also showed that if the surroundings and the system are unable to provide feasible options, individuals might encounter obstacles in the process of taking actions. In other words, the unfriendliness of the social environment not only increases the behavioral costs for individuals practicing plastic reduction but also weakens the possibility of sustaining such behaviors in an intangible way.

Interviewee E has a deep understanding of how the surrounding environment shapes behavior, as she once lived for a month on Lanyu, an offshore island in Taiwan with limited resources and difficulties in waste management. She mentioned that the impact of the environment on her behavior was significant, and she also noted the differences in the amount of waste generated by different lifestyles:

> I once lived in Lanyu for a month. During that time, I stayed in a small room and did not intentionally reduce my waste, but it turned out that the garbage I produced within one month filled up only one plastic bag. […] You can say it's quite different. You can't really eat out there, you have to cook for yourself.

4.1.3 The impact of income on PRB

Interestingly, despite partial interviewees mentioning the burden that the financial cost brings, they all unanimously believed their income could support PRB at a certain level. The financial cost could be perceived as an obstacle, but not an absolute reason to stop taking action.

To analyse this further, different interviewees expressed different definitions of how they can afford a particular action. Some claimed that buying sustainable daily products and using reusable utensils or containers are barely affordable, while others said that they could financially support beach clean-up activities or related environmental organizations. Interviewee G talked about how they implement PRB with limited financial resources:

> I do think I take action within an acceptable scope. While I am unable to contribute financially to the environmental organization, I am eager to engage in proactive action to the best of my capabilities.

Interviewee H also stated:

> I donate to Greenpeace regularly, or sometimes sponsor the travel allowance for clean-up activities. But if you ask for more expenses, I would consider it.

The statements presented that despite the individuals perceiving the financial factors as a burden, they still take various actions when facing financial cost, which can be seen as a range that could be flexibly adjusted.

Apart from those who gave a positive response, interviewees D and C provided different perspectives that questioned the essence of PRB. D clearly stated that even though he had the ability to afford various forms of pro-environmental behavior, he would not want to:

> I can afford that, but I don't want to. It's a waste of money. Besides, I don't have the habit of carrying those environmentally friendly products, such as reusable utensils. Thus, I will simply use the plastic products that the store provides.

C also doubted the company that claimed to be environmentally friendly, while their true intention might be to cut down the cost or even engage in greenwashing. The tag of "sustainability" is merely a way for manufacturers to make a profit. It actually barely has a positive impact on the environment.

> It's merely a way for them to cut down. You used to not pay NT$5 or NT$10 for those products back in the day, but right now the store passes on the increase in costs to the customer. Could you tell if it's "environmentally friendly"?

The sceptical attitude revealed another layer of action cost, in which the interviewees pointed out the necessity and legitimacy of PRB. In spite of taking action being affordable for individuals, when it comes to the use of money, individuals may have doubts about the true value of so-called "environmentally friendly". They may still choose to refuse participation. Therefore, trust and a sense of identity with action also become important social psychological factors influencing the willingness to reduce plastic use.

4.2 Analysis from the Survey

The survey collected a 323 participants through social media platforms including Instagram, Facebook and Linkedin. 70.6% of participants were female (228), 28.8 % were male (93), and 0.6% were non-binary (2). In addition for age, the average age of the respondents was around 37 (Mean= 36.8). Since there was a wide age range (Std. Deviation= 13.944), it exhibited a right-skewed distribution.

This showed that most participants are younger than the mean age, which indicated that a small number of older individuals have increased the average. There is one missing value on age, but it had little impact relative to the 322 valid responses. The details presented in Table 6 below:

Table 6. Age Group (1 missing value).

Age Group	Frequency	Percent

Under 18	1	0.3
18 – 29	158	48.8
30 – 39	39	11.9
40 – 49	35	10.6
50 – 59	67	20.7
60 – 64	21	6.4
Over 65	1	0.3
Total	322	99

Moreover, annual income is categorized into five tax brackets due to Taiwan's progressive cumulative tax rates of 5%, 12%, 20%, 30%, and 40%. According to the survey, 64.0% of individuals fall within the NT$0 - 590,000 bracket (5%), 29.4% in the NT$590,001 - 1,330,000 bracket (12%), 6.2% in the NT$1,330,001 - 2,660,000 bracket (20%), 0.3% in the NT$2,660,001 - 4,980,000 bracket (30%), and 0% in the NT$4,980,001 and above bracket (40%).

The percentage of educational level from highest to lowest in order were bachelor's degree 52%, master's degree 24.5%, high school 14.2%, associate degree 7.1%, Ph.D 1.5% and junior high school or below 0.6%.

For validity analysis, the Exploratory Factor Analysis (EFA) is a way to evaluate validity, which is used to explore or verify observed variables (Denis, 2021). To summarize, EFA verifies that a seemingly chaotic set of items is actually measuring the same concept, ensuring that the latent constructs behind the originally designed dimensions exist (Denis, 2021).

The Kaiser-Meyer-Olkin (KMO) test in factor analysis assesses the adequacy of sampling by examining inter-variable correlations, indicating whether the data are suitable for grouping into latent factors (Denis, 2021). KMO values above 0.7 are preferred, while a value below 0.5 is unacceptable (Denis, 2021). The Rotated Component Matrix reveals how variables load onto constructed factors, where factor loadings >0.4 (or ideally >0.5) are considered significant (Hair et al., 2017; Hair et al., 2019).

The KMO value (.832) confirmed the data's suitability for factor analysis. In addition, the Rotated Component Matrix also revealed that the items I originally defined under separate constructs overlapped conceptually. As shown in Table 8, the convenience construct also contained Time_cost 1 (time for using utensils) and Time_cost 4 (overall time cost), which indicated that participants may have perceived these time-related items as part of convenience rather than as distinct time cost factors.

Notably, all extracted factors demonstrated acceptable factor loadings exceeding the commonly recommended threshold of 0.40 to 0.50, supporting the convergent validity of the survey across these three distinct dimensions.

Table 7. KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.831
Bartlett's Test of Sphericity	Approx. Chi-Square	1246.152
	df	55
	Sig.	<.001

Table 8. Rotated Component Matrix[a]

Code & Question	Time Construct	Financial Construct	Convenience Construct
Time_cost1: When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store.	.540		.421
Time_cost2: Plastic reduction behaviors require additional time for preparation.	.859		
Time_cost3: Plastic reduction behaviors require extra time for maintenance.	.818		
Time_cost4: Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.	.588		.495
Financial_3: Plastic reduction behaviors require extra time for maintenance.		.862	
Financial_4: Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.		.855	
Convenience_1: When shopping or dining out, I use disposable plastic products because I find eco-friendly options harder to access.			.655
Convenience_2: Carrying reusable items (such as reusable bags or utensils) feels inconvenient to me.			.855
Convenience_3: Practising plastic reduction behaviors requires extra preparation when shopping or dining out, which reduces convenience.			.738

Convenience_4: Many places (such as restaurants, supermarkets, and night markets) do not offer suitable plastic-free alternatives, making it difficult for me to engage in plastic reduction behaviors.			.328
Convenience_5: Overall, I find engaging in plastic reduction behaviors inconvenient.			.792

Due to time constraints, the analyses of each construct (see: 4.2.1-4.2.3) were mainly focused on descriptive statistics and reliability analysis. Reliability analysis indicated that a Cronbach's α between 0.65 and 0.70 is considered the minimum acceptable threshold, 0.70 to 0.80 indicates good reliability, and values above 0.80 suggest very good reliability (Wu & Tu, 2019). In short, Cronbach's α is used to ensure that the scores of all constructs are reliable and internally consistent (Wu & Tu, 2019).

Regression analysis was conducted with the independent variables (time cost, financial cost, and convenience; see Table 5: All Variables) to examine the dependent variables (Willingness of PRB), assessing whether these predictors influenced the practical behavior.

4.2.1 Time Cost

As shown in Table 9, the four items measuring time cost had a Cronbach's α of 0.762, indicating acceptable internal consistency.

Table 9. Questions of Time Cost Construct.

Code	Question
Time_cost 1	When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store.
Time_cost 2	Plastic reduction behaviors require additional time for preparation.
Time_cost 3	Plastic reduction behaviors require extra time for maintenance.
Time_cost 4	Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.

Table 10. Statistics of Time Cost Construct.

Code	Mean	Std. Deviation
Time cost_1	3.14	1.200
Time cost_2	3.61	1.020
Time cost_3	3.93	.960
Time cost_4	2.97	1.047

According to the mean scores, the perceived intensity of time-related costs is ranked as follows: Time Cost_3 (maintenance time) had the highest mean of 3.93, approaching the “Agree” level; followed by Time Cost_2 (preparation time) at 3.61, indicating a perception between “Neutral” and “Agree”; Time Cost_1 (time for using utensils) scored 3.14, slightly above “Neutral”; and Time Cost 4 (overall time cost) had the lowest mean of 2.97, slightly below “Neutral”.

The maintenance could be seen as the most significant obstacle within the time cost dimension. According to the result page of the Google Form dashboard, up to 76.2% of the participants agreed on the maintenance costs, such as cleaning or washing the reusable product. The preparation stage, for instance, buying or carrying eco-friendly products, was determined as time-consuming, with 63.8% of people agreeing.

Interestingly, although the respondents acknowledged that each stage took time, they scored the Time Cost_4, the overall time cost, the lowest. Considering that the score for Time Cost_1 is only slightly above the “Neutral”, it indicates that the time cost of using eco-friendly products is relatively uncontroversial. This may reflect that respondents’ perception of time cost does not constitute a sense of “a significant amount of extra time.”

In addition, the item with the greatest divergence is Time cost_1 (SD=1.20), which indicates a significant difference in opinions regarding “whether using eco-friendly products takes more time.” Among all the questions, the highest consensus is found in Time cost_3, with a standard deviation of 0.96, where the majority agree that maintenance requires additional time.

4.2.2 Financial Cost

Financial Cost Construct initially contained five questions (see Appendix 1). Validity analysis suggested that Financial_1 and Financial_2, which related to different constructs, were not suitable for inclusion in the financial cost construct. Further reliability analysis revealed low internal consistency ($\alpha = 0.511$) for five questions. After removing Financial_1, Financial_2 and Financial_5, the reliability increased to 0.751, indicating that the remaining two items effectively capture the core concept of financial cost. Details of the items are shown in Table 11:

Table 11. Questions of Financial Cost Construct.

Code	Question
Financial_3	I believe that choosing more pro-environmental options (such as purchasing eco-friendly alternatives like reusable utensils, reusable bags, or shopping at zero-waste stores) is more expensive than using single-use plastic products.
Financial_4	I believe plastic reduction behaviors require additional expenses.

Table 12. Statistics of Time Cost Construct.

Code	Mean	Std. Deviation
Financial_3	3.06	1.205
Financial_4	3.00	1.133

The result discovered that, unlike time cost, the mean and the percentage of financial cost are relatively average. However, looking at the SD of the two questions (Financial_3=1.205; Financial_4=1.133), it can be found that the participants have different perceptions of financial cost. From the summary of the Google Form, no particular option exceeds 30%. This phenomenon may reflect that different income groups have different sensitivities to environmental additional costs.

4.2.3 Convenience

The questions that constituted the convenience dimension are shown in Table 13. Although the validity analysis showed that Convenience_4 is lower than the acceptable value (0.4), it was still retained because it was mentioned in the further analysis.

Moreover, the validity analysis suggested that besides Convenience_1 to 5, Time Cost_1 and Time Cost_4 should also be included in the convenience construct. The reliability analysis of the seven items yielded Cronbach's α=0.831, which meets the recommended standard. This suggested that respondents might not clearly differentiate between time and convenience when evaluating plastic reduction behaviors.

Table 13. Section 4: Questions of Convenience Construct.

Code	Questions
Convenience_1	When shopping or dining out, I use disposable plastic products because I find eco-friendly options harder to access.
Convenience_2	Carrying reusable items (such as reusable bags or utensils) feels inconvenient to me.

Convenience_3	Practicing plastic reduction behaviors requires extra preparation when shopping or dining out, which reduces convenience.
Convenience_4	Many places (such as restaurants, supermarkets, and night markets) do not offer suitable plastic-free alternatives, making it difficult for me to engage in plastic reduction behaviors.
Convenience_5	Overall, I find engaging in plastic reduction behaviors inconvenient.
Time cost_1	When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store.
Time cost_4	Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.

Table 14. Statistics of Convenience Construct.

Code	Mean	Std. Deviation
Convenience_1	3.14	1.128
Convenience_2	3.02	1.205
Convenience_3	3.37	1.136
Convenience_4	3.42	1.088
Convenience_5	3.01	1.053
Time cost_1	3.14	1.200
Time cost_4	2.97	1.047

Convenience_4 had the highest mean (=3.42), which showed that many places fail to provide suitable plastic reduction options is a significant barrier recognized by individuals in the dining out context, with 55.7% of participants choosing 4 (agree) and 5 (strongly agree). Moreover, Convenience_3 stood for the concept of "needing to prepare", similar to how Time Cost_2 seemed to be considered as inconvenient, which led 53.9% of respondents to agree on the question. For Convenience_1, 44.9% of respondents believe that the difficulty in low accessibility of eco-friendly options is a barrier. For Convenience_2 and Convenience_5, responses are mostly distributed between 2 (disagree) and 4 (agree), which may indicate that convenience is influenced by various factors, making it difficult to define clearly.

In addition, Time cost_1 and 4 may be categorized under convenience factors due to their semantic overlap with the concept of convenience. "When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store", and "Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time" are subjective concluding sentences. I could assume that the concept of time-

consuming may be equal to inconvenience. Besides, in the practical field, time cost may become the core of inconvenience, especially in daily behavior choices.

For example, remembering to bring a reusable bag requires preparation, and finding alternatives takes time to compare. These all make people feel "inconvenient" to some extent, rather than viewing time-consuming tasks as a separate issue. The conceptual boundaries between constructs were therefore less distinct than initially expected, highlighting the need for clearer question wording in future research.

4.2.4 Regression Analysis

Regression analysis was used to examine the influence of these three dimensions on Taiwanese individuals. Based on the reliability and validity confirmed in Sections 4.2.1 to 4.2.3, all constructs met the recommended standards. Therefore, the three independent variables were combined to examine whether they could explain the dependent variable: willingness to engage in plastic reduction behaviors.

Wu & Tu (2019) stated that the R value ranges from 0 to 1, with values closer to 1 indicating stronger correlations. The R squared (or coefficient of determination) indicates how much variance in the dependent variable can be explained by the independent variables. A p-value of less than 0.05 suggests that the model or the item is statistically significant (Wu & Tu, 2019).

The multiple linear regression analysis showed that the overall model was significant ($p < 0.001$), with an R squared of 0.109, meaning the three predictors explained 10.9% of the variance in willingness to engage in PRB. Although the R squared is relatively low, some key patterns emerged: time cost showed no significant impact ($\beta = 0.109$, $p = 0.149$); financial cost had a significant positive effect ($\beta = 0.173$, $p = 0.003$); and convenience showed a significant negative relationship ($\beta = -0.422$, $p < 0.001$).

Table 15. Statistics of All Constructs.

Independent Variables	Beta	P value	Significance
Time Cost Construct	0.109	0.149	No significant impact.
Financial Cost Construct	0.173	0.003	Positive effect.
Convenience	-0.422	< 0.001	Negative relationship.

Construct

Dependent Variable: Willingness to implement PRB

The positive effect of financial cost indicates that “the more one spends, the higher the willingness to reduce plastic”, which may reflect that respondents believe reducing plastic requires a higher expense (such as eco-friendly products being more expensive), yet they are still willing to support it.

The negative impact of convenience indicated that the more inconvenient the behavior is perceived to be, the lower the willingness. It is important to clarify that all items in the convenience construct were intentionally designed to measure perceived inconvenience. Therefore, higher scores reflect lower perceived convenience. Based on this design, the negative regression coefficient ($\beta = -0.422$, $p < .001$) indicates that individuals who perceive plastic reduction behaviors as inconvenient (higher score) are less willing to engage in them. This finding is aligned with expectations and reinforces the idea that perceived convenience plays an important role in behavioral willingness.

5. Discussion

To make the discussion more accessible, this section is organized based on the core research aim and sub-questions. By answering these questions, I interpreted the findings not only in relation to existing literature but also in light of local cultural and social contexts.

5.1 answers most research questions by examining how the perception of behavioral costs influences plastic reduction in the dining out context. It also depicts the whole picture of the relationship between daily life habits and plastic usage, whether individuals act consciously or unconsciously. Moreover, it also discussed the factors that popped up from both qualitative and quantitative results and concluded how the factors intertwined.

5.2 is built upon 5.1, which summarizes both the literature review and results, showing that the gap between policy and practice exists because of the knowing-doing gap of individuals. This session helps connect the results to a broader implication for environmental policy and practice.

Lastly, the chapter highlights what ECM focuses on. Environmental communication is never a one-way transmission but a constitutive mode that constructs people's relationships with the environment, which involves various elements (Pezzullo and Cox, 2018).

This study adds to and reinterprets the concept of the knowing-doing gap. It shows that people's awareness and knowledge do not always lead to behavior change. Instead, their actions are shaped by practical concerns such as personal routine, culture, habits, convenience, hygiene, etc. Although these behaviors may seem inconsistent from an outside perspective, they make sense when viewed in the context of daily life. Environmental communication helps us understand how people give meaning to their actions and build up the decision-making process.

Based on this understanding, the habit-based intervention proposed in this study can be developed to support behavioral change. By providing a new approach for cultivating PRB to the policy maker and future research, environmental communication showed the flexible relationship between people, policy and environment.

5.1 Perception of behavioral cost

The literature review explored the impact of behavioral cost on pro-environmental behavior. In this study, the perception of behavioral cost was assessed through quantitative data using a Likert scale to measure the influence of each dimension. Additionally, various social norms mentioned in qualitative interviews further supported the findings. Taken together, these results clearly indicate that the perception of behavioral cost significantly affects individuals' willingness to engage in PRB, particularly in the context of dining out.

The survey analysis showed that it is somewhat difficult for the three dimensions to be completely independent in practice. For instance, the concept of convenience is a mixture of two aspects of the construct, which provides evidence that the factors overlap.

The time-related cost has the least impact on the three dimensions. Or, you can also say that it is the behavioral cost that people are mostly willing to conquer. Despite the statistics presented, individuals did sense the time cost, it didn't feel like a lot of extra time was spent in the practice. This aligned with the regression analysis that time cost isn't a significant factor. However, Interviewee G proposed another way to view time cost: Time Management. From their narrative, I can observe the overlap of time and convenience factors. Conflicts and inconvenience in time management lead them to perceive it as a cognitive cost.

As I discovered in the results section, the financial factor is a thought-provoking construct. The contradiction lies in the fact that although individuals generally feel that their income can support PRB, the willingness to implement these behaviors shows a declining trend, as evidenced by both qualitative interviews and quantitative surveys. Interviewee D directly said, "I can afford that, but I don't want to", meaning that the subjective perception of affordable income does not necessarily lead to the practice of PRB.

Interviewee C further mentioned other financial-related aspects in the interview, questioning whether the current policy is a way to cost down or greenwash. This kind of questioning is mixed with psychological factors and has become an obvious barrier for those who already have a certain cognition.

Additionally, the statistics presented "the more one spends, the more their willingness increases". On one hand, it reflected that respondents believe that reducing plastic requires a higher cost, but are still willing to support it. On the other hand, it may show that the individuals who agree have higher incomes and are willing to spend more. Unfortunately, due to time constraints, a comparative

analysis of income could not be conducted, but this can provide a good direction for future research on willingness to reduce plastic.

The factors of convenience themselves are mixed with many hindrances. Not only can the overlap between time cost and convenience be seen in the quantitative results, but it can also be seen that people consider multiple reasons in the process of decision-making unconsciously. Interviewee F revealed that his PRB is built on psychological factors and time pressure and stated “inconvenience” in his interview, meaning that he somehow related the concept of effortlessness with convenience. The result showed that the more people have to give, the less they want to put it into practice.

Moreover, the interviewees also mentioned other factors associated with convenience. Interviewee E mentioned the unpredictability of dining out, which can cause inconvenience. This inconvenience can refer to the users themselves or to the inconvenience caused to the restaurant. For example, the difficulty in predicting whether reusable containers can hold a specific portion of food leads to unforeseen inconveniences.

The underlying psychological factors and enviornmental factors constitute the social structure, such as social norms, which could be seen in the interview, that have a great impact on the perception of the cost. When people take convenience for granted, and when the public views the use of these disposable products as part of the “environment”. Taiwan is a country where eating out is embedded in daily life due to long working hours, dense urban living, and the wide availability of inexpensive ready-to-eat food. This convenience-oriented infrastructure allows individuals to engage in consumption practices without needing to consider the broader consequences of resource depletion.

Taiwan is a society with a heavy reliance on convenience stores and take-out culture. The public frequently comes into contact with single-use plastic products in their daily routine, which, over time, has created a habit of “use and throw away”. Several interviewees clearly pointed out during the interviews that they “never had environmental habits” (Interviewee D, 2025) or “were not used to bringing my own reusable products” (Interviewee C, 2025). These general life experiences may produce an extra psychological burden on acting environmentally friendly. This also reflects that the perception of the costs of personal behavior does not solely stem from the complexity of the actions themselves, but may be profoundly influenced by the everyday habits learned from the socio-cultural background.

Disposable products have become something people keep at their fingertips, which makes people support PRB in principle, but it is difficult in practice. Combining the results of 69% respondents and all of my interviewees confirmed that PRB is affordable with their level of income, these single-use products are simply too easy to access. In this context, some individuals, especially those with more economic means, may feel even less urgency to engage in environmental actions, as they perceive their access to resources to be secure, both now and in the future (Berthold et al., 2023).

Cited from interviewee F, he admitted that he didn't even realize that buying a packaged rice ball from a convenience store involves using plastic. The interview shows how normal and how unconscious it could be when people grow up in such an environment: people couldn't even recognize the behavior as a form of plastic consumption. This reflected how deeply plastic use has been embedded in daily habits. In this context, using plastic is not seen as an active choice, but rather a default option, which is rarely questioned.

The significant impact of environmental factors is thoroughly conveyed through Interviewee E's experience. Her experience showed that the entire environment had created a situation where "eating out is not possible" in Lanyu. Plus, when people perceive resources as limited, the amount of waste and the frequency of using disposable products decrease significantly. This situation not only indicated the importance of creating an accessible environment but also pointed out that cultivating a perception of source scarcity would be a new approach for reducing plastic.

I find that various factors, which contribute to the aforementioned costs, such as time, convenience, financial resources, and hidden factors including psychological aspects, environmental context, and social norms, are intertwined to shape an individual's habits. For example, participant D revealed that the environment he grew up in made certain behaviors feel completely natural. He saw it as a given that restaurants or street vendors should provide a convenient dining experience. This sense of convenience was built on a culture of low-cost dining, where decisions required little thought, and actions required no additional time or effort.

5.2 From Policy to Practice / Knowing-Doing Gap

Throughout the research, I tried to shed light on how policies promote the implementation of PRB (From policy to practice), but more importantly, to understand the gap between policy and individual behavior, which refers to the "knowing-doing gap". The policies are intended to keep the behavioral cost down

with bans, awareness campaigns and incentives. Nevertheless, the knowing-doing gap is not solely caused by objective costs, but is also closely related to people's subjective perceptions of these costs (e.g., feeling that it is troublesome, or forgetting). Thus, in the transition from policy to practice, overlooking this psychological and habitual gap can hinder the effectiveness of behavior change.

In the context of Taiwan's dining culture, the convenience and affordability of eating out have led to habitual use of single-use plastics. This habitual behavior persists despite awareness of environmental issues, illustrating the "knowing-doing gap" where knowledge does not necessarily transform into action. Understanding the interplay between perceived behavioral costs and habit formation is essential for designing effective interventions that promote sustainable behaviors.

Quoted from the EPA (2025), "Although the publics have environmental awareness in general, their actions are often influenced by considerations of convenience and cost, making it difficult for them to change their consumption habits in daily life". On the other hand, they also stated: "The growth rate of general waste remains high largely due to the shift in consumer habits caused by the COVID-19 pandemic, such as food delivery and online shopping". In other words, the government is aware of the current knowing-doing gap.

According to Wang et al., (2021), most of the public had a positive attitude toward plastic bag and plastic straw reduction policy, despite making their life inconvenient. This somehow aligned with the result of the survey, which showed that more than half of the people have a high willingness to choose environmentally friendly options. However, in the same research, it also presented that only 35% of participants agree on increasing the cost of plastic bags, which also aligned with my survey analysis that there is a significant disconnect between the perception and practice of spending money.

Combining the policy review with the respondents' evaluations of the effectiveness of policy implementation, it is believed that the original intention of the plastic restriction policy is unclear (interviewee C). Interviewee G claimed that the government should incorporate penalties in order to truly influence behavior. This situation echoes the phenomenon of the disconnection between government policies and implementation in Blake's research (1999).

He pointed out that policymakers need to recognize that shaping a new habitual pattern requires a long-term agenda. Besides, when tackling the challenges, it

should be considered more than one certain factor (Blake, 1999), which should include all factors aforementioned.

While the current policies in Taiwan focus on restricting certain behaviors or encouraging alternatives through incentives and bans, they may overlook the micro-level barriers individuals face in their daily routines. The present findings in the thesis suggested that perception of behavioral costs serves as a critical but complex mediator in this gap. When sustainable habits have not been formed early in life, even low-cost actions can be perceived as effortful or disruptive due to psychological factors.

Economic development has boosted the consumption habit with convenience (Wang, 2021). Consuming single-use products has become a characteristic of modern society. Therefore, policies that aim to bridge the gap from intention to action must go beyond structural regulations and instead address the psychological and habitual dimensions of behavior.

Last but not least, the formation of habits plays a crucial role in sustaining pro-environmental behaviors. Habits, defined as automatic responses to the contextual environment through repetition (Kurz et al., 2015), can either facilitate or hinder sustainable practices. Kurz et al. (2015) emphasized that habitual behaviors often override rational decision-making processes, making it challenging to alter established routines. Many PEBs are matters of personal habit or household routine, which I suggest that the policy maker needs to have a broader vision of implementing policy. Refocusing policy on its core purpose, it is not about thinking of ways to stop a certain phenomenon, such as reducing the use of beverage cups or straws, but rather about considering how to make PRB transform into a new habitual pattern that is low-cost, repeatable, and, most importantly, an automatic option without thinking.

6. Conclusion

The aim of this study was to understand how Taiwanese individuals perceive the costs of plastic reduction behavior (PRB), and how these perceptions influence their willingness to act. I have explored this question due to the increasing volume of waste yearly.

First of all, I introduced the background of the plastic reduction policy in Taiwan for the past two decades. The section not only described a rich context of dining out culture, but also pointed out the negative impact on the environment of this thriving situation. Thus, I propose the three dimensions of behavioral cost that affect the willingness of PRB. Through literature review, it is evident that research on behavioral costs has become increasingly comprehensive. However, the dimensions of perceived behavioral cost remain relatively underexplored, despite their critical influence on the individual decision-making process. Different from behavioral cost, which focuses on the objective perspective of cost, the perception of behavioral cost emphasizes the subjective view on the willingness to implement PRB in the research.

The comprehensive qualitative and quantitative results proposed that the three factors all have varying degrees of influence on the willingness to PRB. The time cost has the least impact overall. However, the analysis showed that time could be seen as an inconvenient factor for participants. Moreover, financial cost is one of the factors that most clearly highlights the knowing-doing gap. It points out that despite the participant having the ability to afford PRB, their financial means may lead them to perceive that resources are within their grasp, and thus, they believe that PEB can be postponed. Finally and above all, the convenience construct has a significant impact, and different factors are intertwined and inseparable.

The individual's perceived behavioral cost significantly affects whether they start the action. Therefore, we need to build a society that cultivates PRB to become a habit. In other words, high action costs can hinder the establishment of new habits, especially in situations lacking social support.

All mentioned above relate to the perception of behavioral cost. Then, you may ask, how are we going to improve? In discussion, I propose a new approach to bridging the gap between values and actions. That is, the policymaker needs to promote a new habitual pattern, making it easy for the public to adapt.

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Explanation:

Surname, First name, initial. (Year of Publication). Title. Diss. University. Publisher. Permanent link.

Article author (Year). Title. Title of the journal. Volume (Number), Page Number/Article Number. Permanent link.

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Popular science summary

Why do the waste increased yearly in Taiwan? Why do so many people say they care about the environment, but still use plastic every day? What are the factors that burden people to act environmentally friendly? What could their perception of the burden lead them to? This research delves into the subjective factors that prevent Taiwanese people from reducing plastic use, which I defined it as the "perceived behavioral cost", especially focused on three types of cost: time, financial, and convenience.

The result showed that the time cost has the least impact on their behavior on using plastic. This mean though the participants sensed environmentally friendly action such as cleaning the reusable cups cost extra time, they are still willing to do it. Or, you can say that hey are more willing to overcome it. However, interestingly, most people claimed choosing sustainable product isn't too expensive, they still don't do it regularly. Not to forget that one reason they hesitate to take these actions is that they find them inconvenient or easyily overlooked.

Moreover, the study also delved deep to explore the invisible factors that effect people's engagement on plastic reduction behavior. Such as the external environment makes plastic products so easily accessible that people often don't even realize they're consuming plastic.

The discussion spans from individual behavior to policy implementation. It not only unpacks how subjectivity perceived behavioral cost influences the action, but also offers a new perspective for policymaking: instead of simply banning or promoting a single policy, we should focus on creating an environment that reduces perceived costs. Especially, starting with shaping habits. The study suggested that instead of only banning things like straws, we should focus on helping people build new, easier habits that fit naturally into daily life.

This study reviewed the history of policies and explored behavioral costs and their current impact on individual behavior. This is important because, in Taiwan, despite the implementation of plastic reduction policies for over 20 years, the usage of plastics has actually increased rather than decreased. Indeed, the pandemic was a significant turning point that caused the policy to fail, but now, two years after the end of the pandemic, there are no signs of a slowdown.

In summary, this reflects a significant gap between Taiwan's plastic reduction policies and actual individual behavior, indicating that there is still a need for

deeper adjustments for the policies in terms of design and implememtation, particularly considering the behavioral costs.

With mixed-method approach, I interviewed 8 people and designed survey with 323 respondents for data analysis. The interviews provided detailed insights into daily plastic usage habits, while the survey was designed to complement these findings by quantitative supports.

Appendix 1

Survey Questions

Section 1 - Demographic Information

1. Gender
2. Age
3. Which of the following best describes your personal annual income last year?
4. Education level

Section 2 - Perceived Costs [Time Cost]

[Likert Scale 1-5 (1 =Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)]

1. When purchasing drinks or taking out, using a reusable cup or utensils takes more time than using the disposable plastic options provided by the store.
2. Plastic reduction behaviors requires additional time for preparation.
3. Plastic reduction behaviors requires extra time for maintenance.
4. Overall, I feel that engaging in plastic reduction behaviors takes a significant amount of extra time.
5. Even if it takes extra time, I would still choose to engage in plastic reduction behaviors.

Section 3 - Perceived Costs [Finacial Cost]

[Likert Scale 1-5 (1 =Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)]

1. I feel that my income can support my plastic reduction behaviors.
2. I am willing to allocate a certain portion of my income to support my plastic reduction behaviors.
3. I believe that choosing more pro-environmental options (such as purchasing eco-friendly alternatives like reusable utensils, reusable bags, or shopping at zero-waste stores) is more expensive than using single-use plastic products.
4. I believe plastic reduction behaviors requires additional expenses.
5. Even if plastic reduction behaviors require extra costs, I would still choose to engage in them.

Section 4 - Perceived Costs [Convenience]

[Likert Scale 1-5 (1 =Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)]

1. When shopping or dining out, I use disposable plastic products because I find eco-friendly options harder to access.
2. Carrying reusable items (such as reusable bags or utensils) feels inconvenient to me.
3. Practicing plastic reduction behaviors requires extra preparation when shopping or dining out, which reduces convenience.
4. Many places (such as restaurants, supermarkets, and night markets) do not offer suitable plastic-free alternatives, making it difficult for me to engage in plastic reduction behaviors.
5. Overall, I find engaging in plastic reduction behaviors inconvenient.
6. Even if it is inconvenient, I would still choose to use eco-friendly products.

Section 5 - Please rate how the following factors influence your plastic reduction behaviors:
[Likert Scale 1-5 (1 =Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)]

1. Time cost
2. Financial cost
3. Convenience

Section 6 - Other Influencing Factors (open-ended question)
Are there any other factors that affect your plastic reduction behaviors?

Section 7 - Daily Behavior
[Likert Scale 1-5 (1 =Almost never, 2 = Rarely, 3 = Occasionly, 4 = Often, 5 = Almost always)]

1. When eating out or getting takeout, I bring my own reusable utensils.
2. When shopping, I bring a reusable shopping bag.
3. I avoid purchasing products with single-use plastic packaging.
4. I choose to use reusable packaging (such as reusable cups or reusable bags).
5. When making purchases, I proactively refuse plastic straws, disposable utensils, plastic bags, and other single-use plastic products.