

Understanding Plastic Bag Consumers' Use Behavior After The Plastic Bag Ban Policy in Major Retail Stores in Bangkok

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Abstract

This study aims to understand the effectiveness of the campaign and the behavior changes of consumers after the campaign. This study estimated number of plastic bag use in Bangkok and develop the knowledge, attitude and practice (KAP) model to investigate plastic bag consumption behaviors among Bangkok consumers. The results showed that the campaign is effective especially in the super market and convenient stores. The number of plastic bags use per visit are approximately 1.9 and 1.7 bags. According to the survey results, fresh market, restaurant, and food delivery are the major sources of plastic bag consumption, on average 3.7, 3.1, and 2.8 bags per visit. On average people in Bangkok use approximately 1.2 bags/person/day. According to the KAP model, knowledge about environmental impact of plastics does not only have a positive effect on attitudes towards plastic bag usage and plastic waste but it also has a direct effect on behaviors in using plastic bags and sorting waste. It is important to continuously communicate about environmental impact of plastics to emphasize proper knowledge and attitudes towards plastic bags among people and to bring out cooperative behaviors in reducing the use of plastic bags and sorting waste for a better environment.

Keywords: Plastic Bag Ban Policy, Plastic Waste Management, Policy Evaluation

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การเข้าใจพฤติกรรมการใช้ถุงพลาสติกของผู้บริโภคหลังนโยบายห้ามใช้ถุงพลาสติก ในร้านค้าปลีกขนาดใหญ่ในกรุงเทพมหานคร

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อทำความเข้าใจประสิทธิภาพมาตรการรณรงค์แจกถุงพลาสติกแบบบางตามร้านค้า การศึกษานี้เป็นการประมาณจำนวนการใช้ถุงพลาสติกในกรุงเทพมหานคร และพัฒนาแบบจำลองความรู้ทัศนคติ และแนวปฏิบัติ (knowledge, attitude, practices, KAP) ผลปรากฏศึกษาพบว่ามาตรการดังกล่าวได้ผลดี โดยเฉพาะในซูเปอร์มาร์เก็ตและร้านสะดวกซื้อ จำนวนการใช้ถุงพลาสติกต่อครั้งของผู้บริโภคอยู่ที่ประมาณ 1.9 และ 1.7 ถุง/คน/ครั้ง จากผลการสำรวจพบว่า ตลาดสด ร้านอาหาร และบริการส่งอาหารเป็นแหล่งบริโภคถุงพลาสติกที่สำคัญ เฉลี่ย 3.7, 3.1 และ 2.8 ถุงต่อครั้ง จากผลการศึกษาตามแบบจำลอง KAP ความรู้เกี่ยวกับผลกระทบต่อสิ่งแวดล้อมของพลาสติกไม่เพียงแต่ส่งผลดีต่อทัศนคติต่อการใช้ถุงพลาสติกและขยะพลาสติกเท่านั้น แต่ยังมีผลโดยตรงต่อพฤติกรรมการใช้ถุงพลาสติกและการคัดแยกขยะอีกด้วย สิ่งสำคัญคือต้องมีการสื่อสารเกี่ยวกับผลกระทบต่อสิ่งแวดล้อมของพลาสติกอย่างต่อเนื่อง เพื่อเน้นย้ำความรู้และทัศนคติที่ถูกต้องต่อการใช้ถุงพลาสติกของประชาชน และเพื่อรณรงค์ขอความร่วมมือในการลดและคัดแยกขยะเพื่อสิ่งแวดล้อมที่ดีขึ้น

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Introduction

The government has campaigned to refrain from voluntarily handing out plastic bags. Seventy-five Thai retailers have joined this campaign since January 1, 2020. Those convenience stores and supermarkets are, for example, 7-Eleven, Big C Supercenter, Makro, Foodland Supermarket, Max value, Family Mart and Index Living Mall.

One of the main challenges of this policy is the lack of enforcement conditions that may prevent the intended goal from being achieved. According to the policy, Natural Resources and Environment Minister expected a decrease of 0.78 million tons of plastic waste. The Pollution Control Department hopes that the pilot program will reduce the use of 13.5 billion plastic bags, or 30 percent of the yearly use of plastic bags (Pollution Control Department, 2021). Therefore, it is important to verify the information and a model was made to assess the consumers' behavior used plastic bags before and after the campaign.

This study applied knowledge, attitude and practice (KAP) model to investigate plastic bag consumption behaviors among Thai consumers. Due to its simplicity and effectively enhance an understanding about behaviors, KAP model has been applied by many researchers to in various areas. The objectives are to 1) develop a model to estimate the use of plastic bags and plastic waste management in Bangkok 2) investigate plastic bag consumption behaviors among consumers based on knowledge, attitude and practice (KAP) model, and 3) provide policy recommendations for reducing plastic bag waste.

This research benefits for policy makers to better understanding the attitudes and behavior of consumer towards the use of plastic bag. The policy makers can reformulate the 13-year plastic management roadmap suitable for the situations. In addition, the results reflect the challenges on the change of people's attitudes and behaviors towards using plastic bags.

Literature Reviews

The amount of plastic consumption and plastic waste in Bangkok

According to data in 2017, the domestic plastic pellet consumption was approximately 8.518 million tons. The total plastic waste was generated 1.93 million tons/ year which are plastic bag 1.11 million tons, plastic bottles 0.4 million tons, cups and plastic boxes 0.23 million tons, plastic cup 0.05 million tons, plastic forks and spoons 0.03 million tons, straw 0.003 million tons, net 0.10 million tons, and shoes 0.009 million tons.



However, on average, only 0.39 million tons of plastic waste is recycled, accounted for 20 percent of all plastic waste. The remaining 1.51 million tons of waste is not recycled, and 0.03 million tons were leaked into the environment (Pollution Control Department, 2019).

The waste situation in Bangkok has an increasing trend, with the amount of waste 10,526 tons per day in 2017 increasing from 9,748 tons per day from 2012 and 8,719 tons per day from 2007 (Office of the Environment Bangkok, 2019). There are many reasons causing increasing number of wastes e.g., increasing number of people from the expansion of the city in the outer and inner areas, especially the areas near the subway routes, the increase of tourists, foreign workers and the population who come to work from the perimeter as shown in Figure 1.

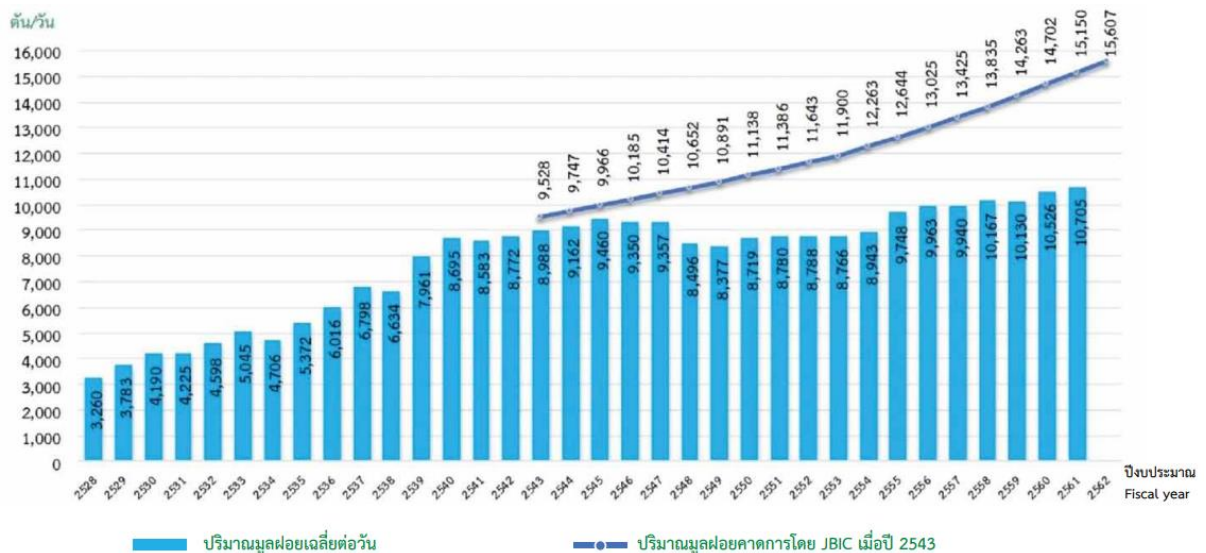


Figure 1: The amount of waste in Bangkok during the fiscal year 2528-2562 B.E. (1985 – 2018 A.D.)

Source: Policy and Planning Division Office of the Environment
(Office of the Environment Bangkok, 2019)

During the Covid-19 pandemic, the overall waste generation in Bangkok was slightly dropped from 10,560 tons per day to 9,370 tons per day (11 percent reduction). However, the proportion of plastic waste was still increased especially from food delivery and test kits, causing plastic waste to increase for more than 60 percent in Bangkok (Simachaya, V., 2020) see Table 1

**Table 1:** Estimated volume of plastic waste generation in Bangkok

Types of plastic	2019 (ton/day)	2020 (ton/day)	Increased volume (tons) in comparison to 2019	Increased percentage in comparison to 2019
Total Plastic Waste	2,120	3,440	1,320	62
Recycled Plastic Waste	495	660	165	33
Contaminated Plastic Waste	1,630	2,780	1,150	71

Source: Vicharn Simachaya (2020)

Plastic Waste Management Action Plan (2018-2027)

Regarding the waste management, Thailand has Plastic waste management action plan 2018-2027. This action plan has been proposed by the Pollution Control Department Ministry of Natural Resources and Environment. The government has a plan to reduce and stop using 1) plastic cap seals, 2) oxo-containing plastic products, and 3) microbead plastic by 2019. In addition, by 2022, four other types of plastics are planned to 100 percent eliminated which are thin plastic bags with the thickness less than 36 microns, foam boxes for food packaging, single use thin plastic cup and plastic straw. The goal is to ban plastic bag with thickness less than 36 microns by 2022 and to recycle 100% of plastic waste by 2027 (Table 2). The government plans to implement 4 mechanisms to achieve the Plastic Waste Management Plan which are 1. building knowledge and understanding with relevant agencies. 2. Promoting public relations through online media 3. using appropriate tools and mechanisms such as behavior change in all sectors and 4. accelerating the issuance of relevant laws/regulations (Pollution control department, 2021).

Table 2: Plastic Waste Management Plan (2018-2027)

Target	2018	2019	2020	2021	2022	2027
1. Target for reuse/recycle plastic waste	22%	25%	30%	40%	50%	100%
2. Target for reduce and ban the use of plastic with other environmentally friendly material						
2.1 plastic microbeads		100%				
2.2 cap seals		100%				
2.3 Oxo plastic		100%				
2.4 Thin plastic bag which its thinness is less than < 36 micron		25%	50%	75%	100%	
2.5 Foam for food container		25%	50%	75%	100%	

**Table 2:** Plastic Waste Management Plan (2018-2027) (Continue)

Target	2018	2019	2020	2021	2022	2027
2.6 Single use plastic cup		25%	50%	75%	100%	
2.7 Plastic straw						

Related research articles

The KAP model process is originated from learning theory (Bandura, 1976) and diffusion of innovation theory (Roger, 1995) cited in

A KAP aims to elicit what is known (knowledge), believed (attitude), and done (practiced) in the context of the topic of interest e.g., in health, environment (Gölemez et al., 2021; Manika, Papagiannidis, Bourlakis, & Clarke, 2021; Oguge, Oremo, & Adhiambo, 2021). This KAP model is simple and easy to apply in various cases and it has been used by many researchers to study the pro-environmental behavior.

Oguge et al. (2021) studied pro-environmental behavior on plastic bag in Kenya. Kenya has made many attempts to regulate the production of single-use plastics through partial bans and the imposition of hefty taxes. This study set out to investigate knowledge and attitudes towards single-use plastics among youths in Nairobi, Kenya. This was a mixed study approach, where both qualitative and quantitative data were derived. The results showed that youths perceive single-use plastics as a serious environmental and health issue. Most respondents expressed willingness to switch to reusable alternatives if provided with financial incentives. In addition, the results showed stronger support for enhanced awareness campaigns and plastic recycling infrastructure. Social media was the most preferred channel to disseminate plastic pollution messaging among the youth. These findings are important in policy development for intensifying awareness and targeting a range of communication and financial support to reduce single-use plastic pollution (Oguge et al., 2021).

Otsyina, Nguhiu-Mwangi, Mogoa, Mbuthia, and Ogara (2018) evaluated knowledge, attitudes, and practices of people in the Nairobi and Kajiado Counties, Kenya, on the usage, disposal, and effect of plastic waste on sheep and goats (shoats). A semi-structured questionnaire was conducted to collect data from 384 respondents in four communities in the two counties. Most of the people irrespective of their age, occupation, and educational status used plastic bags of some type on a daily basis. A high proportion of the respondents (37.0 percent, 142) used plastic bags because of the low cost. Approximately, 79.1 percent or 304 respondents disposed used plastic bags in open dumps. A total of 147 (38.3 percent) households kept shoats. Out of these, 38.1% (56) purchased feed and also allowed their animals to roam. Most of them (45.3%, 174) thought that lack of feed for the animals was the main reason why shoats roam and scavenge at refuse dump sites and road sides. A large proportion of



the respondents (44.5%, 143) mentioned death of animals as the ultimate consequence of ingestion of waste plastic bags. Though, the respondents were aware that indiscriminate disposal of used plastic bags could result in death of the animals from which they derive their livelihoods, they nevertheless continued with the practice. There is a need for a paradigm shift in the way and manner plastic bags are used and disposed. (Otsyina et al., 2018)

Vassanadumrongdee, Hoontrakool, and Marks (2020) studied perception and acceptance level of university students towards plastic bag charging program in their campuses based on the theory of planned behavior. The researchers investigated the factors influencing intention and behavior and changes in students' attitude from 2017–2019. Results showed that students' reusable/cloth bags use behavior and charge acceptance have increased over time. The most influences consumers' intention is perceived behavior control, which itself is determined by waste impact knowledge level and the perceived convenience of carrying reusable bag. In addition, the finding showed that charging schemes are effective in breaking the habit of using plastic which will lead a behavioral change. Therefore, policymakers should implement plastic bag charging regulations in Thailand (Vassanadumrongdee et al., 2020).

Manika et al. (2021) extended the KAP model within an environmental sustainability policy (ESP) context on the UK's single-use bag charge policy, specifically. Based on a cross-sectional survey with 568 British participants, the researchers illustrated the key role of objective knowledge for ESP compliance/behavioral intentions, while subjective knowledge is key for ESP information receptivity. Objective knowledge refers to how much an individual actually knows about a product). Subjective knowledge refers how much an individual thinks he/she knows about a product.

The need for different marketing tactics to promote 'policy products' for sustainable success was illustrated by identifying three distinct segments: the Knowledgeable and Compliant (first to comply, need to maintain information receptivity); the Unknowledgeable But Compliant (need to reduce subjective knowledge); and the Unknowledgeable, Non-compliant, but Receptive (need objective information the most) (Manika et al., 2021).

Conceptual model

This study includes two sets of the KAP model as shown in Figure 2. Attitude towards the uses of plastic bags and plastic waste shows degree of agreement respondents feel about plastic bags and behaviors of using plastic bags in relation with the environmental care. The knowledge about the impact of plastic water on the environment means the collective numbers of general knowledge



that respondents know regarding environmental impact from plastic wastes. Attitude towards government campaign on a ban of plastic bags means how strong respondents agree on current plastic bag ban at supermarkets and convenience stores as well as its future implementation at fresh market and food delivery. Behavior explains how often respondents behave in taking and using plastic bags as well as sorting wastes. Knowledge about the existence of relevant government campaign represents number of government campaigns about plastic waste that respondents know about.

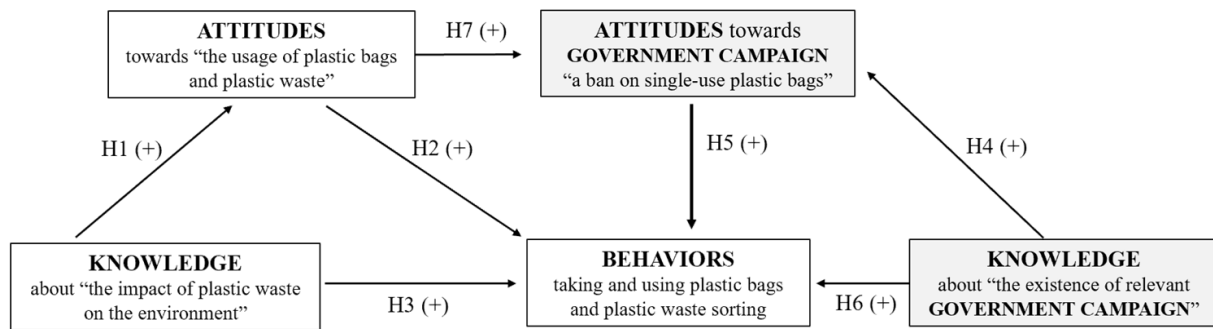


Figure 2: Conceptual Model

On the left part of the conceptual model, hypotheses 1 to 3 refer to KAP model explaining relationships among knowledge about the environmental impact of plastics, attitudes towards plastic bags and plastic waste, and the behaviors of plastic bags consuming and waste sorting, as well as the mediating effect of the attitude towards plastic bags and plastic waste. Similarly, the right part of the model contains hypotheses 4 to 6 referred to KAP model in explaining the influence of government campaigns through the relationships among the knowledge on the existence of government's environmental care campaigns, attitudes towards no single-use plastic bag campaign of the government, and behaviors of plastic bags consuming and waste sorting, together with the mediating effect of attitudes towards no single-use plastic bag campaign of the government. The hypotheses are established as follows.



Research hypothesis

H1: Knowledge about the environmental impact of plastics has a positive influence on environmentally friendly attitudes towards plastic bags

H2: Attitudes towards plastic bag and plastic waste has a positive influence on behaviors of plastic bags consuming and waste sorting.

H3: Knowledge about the environmental impact of plastics directly influences behaviors of plastic bags consuming and waste sorting.

H4: Knowledge about the existence of government's environmental care campaigns has a positive influence on attitudes towards no single-use plastic bag campaign of the government.

H5: Attitudes towards no single-use plastic bag campaign of the government has a positive influence on behaviors of plastic bags consuming and waste sorting.

H6: Knowledge about the existence of government's environmental care campaigns directly influences behaviors of plastic bags consuming and waste sorting.

H7: Attitudes towards plastic bag and plastic waste has a positive influence on attitudes towards no single-use plastic bag campaign of the government.

Methodology

To answer these objectives, quantitative method was applied. Researcher developed survey questions to understand consumers behavior on using plastic bags. The questionnaire was developed into 3 sections which were 1. General information, 2. Implementation of the Plastic Waste Management Action Plan 2018 – 2027, and 3. Suggestions for operation, review and improvement. The survey consists of 35 questions. The questionnaire was written in Thai and questionnaires were reviewed by Institutional Review Board and experts in the field for research ethic and content validity. Convenient sampling method was conducted for this study. The questionnaire was distributed via both online and offline and approximately 803 respondents were replied. For the offline, the research team visited the public areas which are parks, supermarket, and fresh markets. The respondents received compensation 50 THB. For the online, respondents randomly choose to receive 300-500 THB gift voucher. The results from the survey were collected to develop estimation model of number of plastic bag use. The uncertainty and sensitivity analysis were applied using @Risk software. The SPSS was used to develop multiple regression to find the relationship between the dependent and independent variables.



Results

Estimated number of plastic bag use

A majority of total respondents were female (63 percent). For age groups, about a half of overall respondents were 23-39 years old (50 percent). Moreover, fifty percent of all respondents had three to four members in their families. Fifty three percent of respondents hold bachelor's degree. Bangkok residents tended to have higher levels of incomes. The top two monthly income ranges of Bangkok respondents were equally distributed including below 20,000 THB and between 20,001 to 40,000 THB, at 37.2 percent and 37.6 percent, respectively, see Table 3.

Table 3: Respondents demography

Gender		<i>Bangkok (803 samples)</i>	
Male	275 (34%)		
Female	508 (63%)		
Other	20 (2%)		
Age		Field of education	
<23 yrs. old	67 (8%)	None	187
23-39 yrs. old	401 (50%)	Business management	160
40-55 yrs. old	257 (32%)	Finance/account	73
>=56 yrs. old	78(10%)	Marketing	48
Family members		Communication	31
1-2	144 (18%)	Arts	61
3-4	400(50%)	Sciences	14
5-6	203(25%)	Others	229
7-8	38(5%)	Income	
>=9	18(2%)	Below 20,000	299
Education		20,001-40,000	302
Below bachelor	217 (34%)	40,001-60,000	95
Bachelor	427 (66%)	60,001-80,000	36
Master	143	80,001-100,000	26
Doctoral	16	100,001-120,000	16
		Over 120,000	29

From the questionnaire, the estimated number from plastic bag use per week was summarized in Table 4.

**Table 4:** Estimated number of plastic bags used in Bangkok (after the plastic bag ban campaign)

How frequency you go for shopping per week?						
<i>Per week</i>	<i>Fresh market</i>	<i>Supermarket</i>	<i>Convenient store</i>	<i>Grocery store</i>	<i>Restaurant</i>	<i>Food delivery</i>
Never	108	117	56	235	84	244
1-2	273	327	180	275	236	203
3-4	160	216	188	135	225	169
5-6	133	101	173	90	140	109
7-10	129	42	206	68	118	78
AVG shopping/wk.	3.5	2.7	4.5	2.4	3.6	2.7
Total	803	803	803	803	803	803
How many plastics bag received for each visit?						
<i>No of Bags per visit</i>	<i>Fresh market</i>	<i>Supermarket</i>	<i>Convenient store</i>	<i>Grocery store</i>	<i>Restaurant</i>	<i>Food delivery</i>
Never	108	371	364	217	107	217
1-2	216	203	263	335	312	255
3-4	205	118	77	108	184	132
5-6	140	61	46	66	109	98
7-8	74	27	25	44	49	52
9-12	60	23	28	33	42	49
Total	803	803	803	803	803	803
AVG bags/visit	3.7	1.9	1.7	2.4	3.1	2.8
Plastic bags/wk.	13.0	5.0	7.9	5.8	11.4	7.7

From the Table 4, people in Bangkok seems to visit convenient store and restaurant and fresh market on average 4.5, 3.6, and 3.5 times a week, respectively. Fresh market, restaurant, and food delivery are the major sources of plastic bag consumption, on average 3.7, 3.1, and 2.8 bags per visit. From this data, the uncertainty analysis was developed as showed in Figure 3. The average plastic bag used per person per day was estimated in a range of 0.9-1.4 bags/person/day with the average of 1.2 bags/person/day.

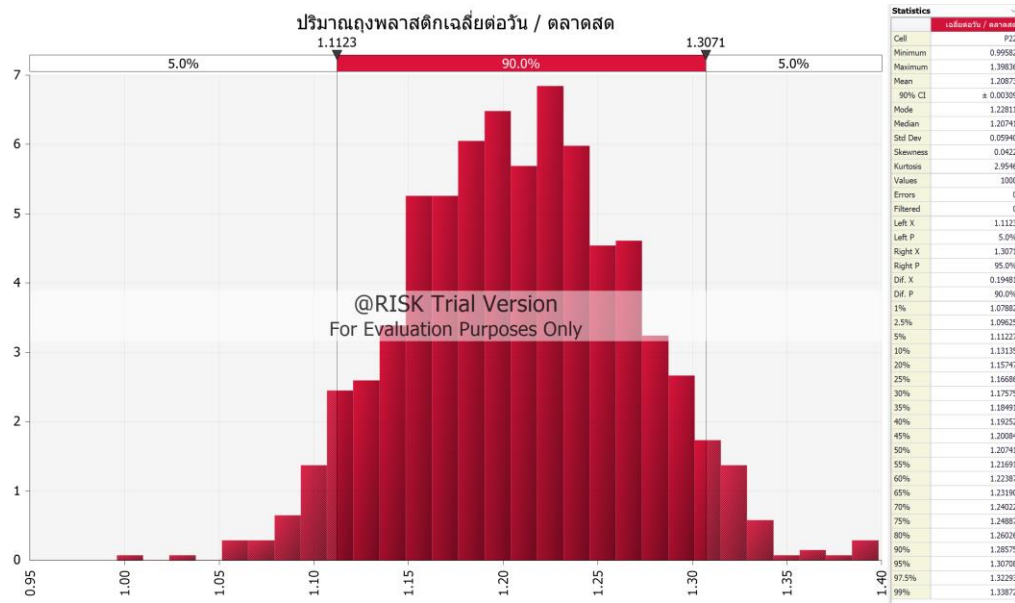


Figure 3: The distribution of plastic bag consumption per person per day

Figure 4: showed the wide range of plastic bag used per person per day from 0 to 10.2 bags/person/day.

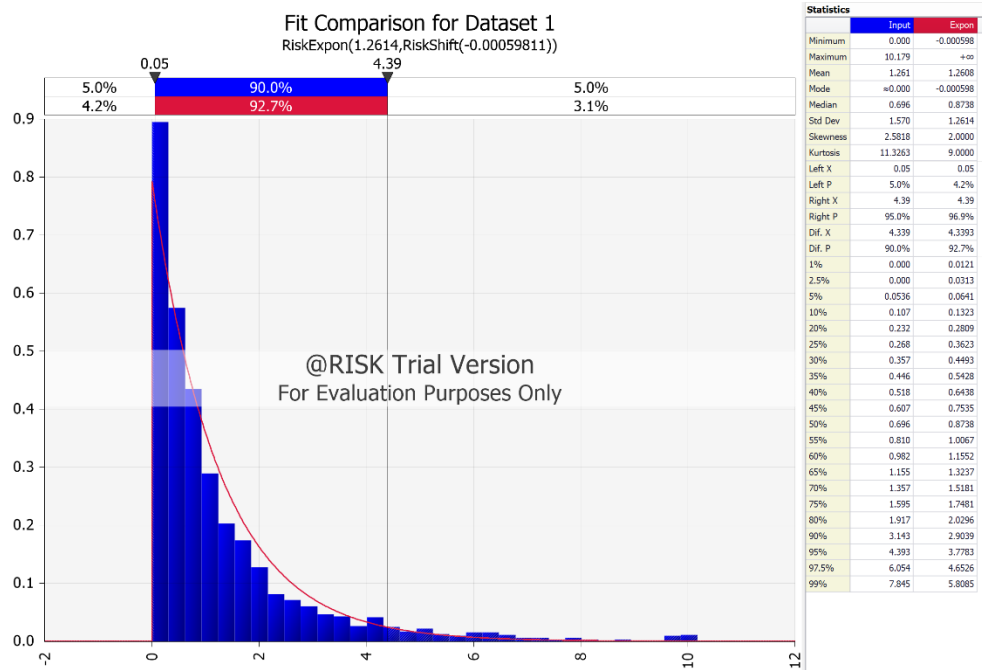


Figure 4: The ranges of min and max of plastic bag use per person per day



KAP towards plastic bag usage behavior

Construct reliability of each scale was separately assessed by using Cronbach's alpha coefficient value. As shown in Table 5, all scales confirmed the reliability with the Cronbach's alpha coefficient value over 0.70. The scale reliabilities of plastic bag consumption behavior as well as attitudes towards plastic bags and plastic waste were improved after removing the items as suggested by Cronbach's alpha coefficient analysis. However, since both of knowledge about the impact of plastic waste on the environment and knowledge about the existence of relevant government policy are single-item scale, these two constructs were not included in this Cronbach's alpha coefficient value assessment, see Table 5.

Table 5: Cronbach's alpha coefficient value

Attitudes <i>towards the usage of plastic bags and plastic waste</i>	Attitudes <i>towards Government Campaign "A ban on single-use plastic bag"</i>	Behaviors <i>Taking and using plastic bags and plastic waste sorting</i>
0.707	0.832	0.820

Table 6: Descriptive statistics and correlations

Variables	KNOWLEDGE <i>about "the impact of plastic waste on the environment"</i>	ATTITUDES <i>towards "the usage of plastic bags and plastic waste"</i>	KNOWLEDGE <i>about "the existence of relevant GOVERNMENT CAMPAIGN"</i>	ATTITUDES <i>towards</i> GOVERNMENT CAMPAIGN <i>"a ban on single-use plastic bags"</i>	BEHAVIORS <i>taking and using plastic bags and plastic waste sorting</i>	Mean	SD
KNOWLEDGE <i>about "the impact of plastic waste on the environment"</i>	1	0.326***	0.501***	0.148***	0.286***	3.190	1.446
ATTITUDES <i>towards "the usage of plastic bags and plastic waste"</i>		1	0.124***	0.470***	0.482***	4.114	0.634
KNOWLEDGE <i>about</i> GOVERNMENT CAMPAIGN <i>"the existence of relevant GOVERNMENT CAMPAIGN"</i>			1	0.086***	0.214***	3.230	2.358
ATTITUDES <i>towards</i> GOVERNMENT CAMPAIGN <i>"a ban on single-use plastic bags"</i>				1	0.355***	3.806	1.094
BEHAVIORS <i>taking and using plastic bags</i>					1	3.493	0.923

Remarks: ***p-value<0.001, **p-value<0.01 and *p-value<0.05

All five variables are significantly correlated with one another across the table. For instances, knowledge about the impact of plastic waste on the environment is significantly correlated with knowledge about the existence of relevant government campaign ($\beta = 0.501$, $p < 0.001$), and with both of attitude towards the usage of plastic bags and attitudes towards no single-use plastic bag campaign of the government ($\beta = 0.326$, $p < 0.001$ and $\beta = 0.148$, $p < 0.001$ respectively). Likewise, plastic bag

consuming and waste sorting behaviors is not only significantly correlated with both of knowledge towards the impact of plastic bags on the environment ($\beta = 0.286$, $p < 0.001$) and knowledge towards the existence of relevant government campaigns ($\beta = 0.214$, $p < 0.001$), but also it statistically correlates with both of attitude towards the usage of plastic bags ($\beta = 0.482$, $p < 0.001$) and attitudes towards government campaign ($\beta = 0.355$, $p < 0.001$).

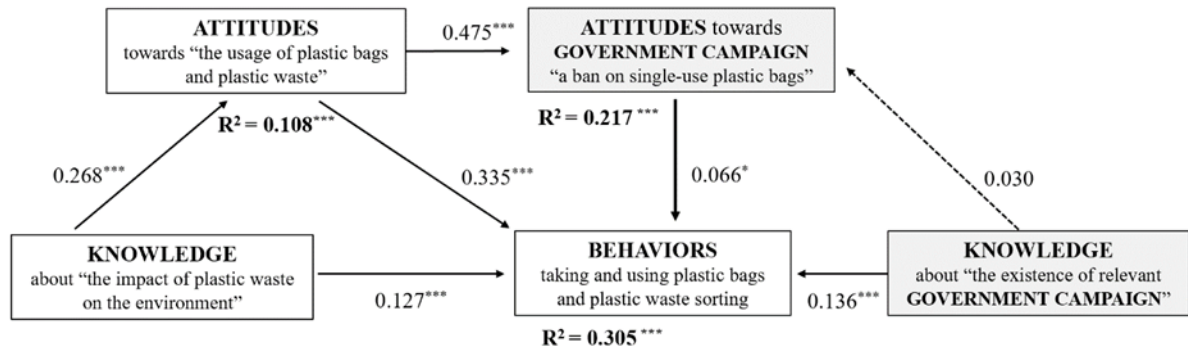


Figure 5: Regression Analysis (Bangkok, 803 respondents)

Remarks: ***p-value<0.001, **p-value<0.01 and *p-value<0.05; and dash line means no statistically significant value.

As shown in the Figure 5, the results demonstrate statistic significant relationships across hypotheses 1, 2, and 3, which are in the first set of KAP model on the left of the conceptual model. Hypothesis 1 proposes a positive relationship between knowledge about the environmental impact of plastics and attitudes towards plastic bags and plastic waste among Thai consumers. The result shows a statistically significant ($\beta = 0.268$, $p < 0.001$) and supports this hypothesis. By this, stronger knowledge about environmental impact of plastics would lead to higher attitudes of environmental care regarding plastic bags and plastic waste. Hypothesis 2, which proposes a positive influence of attitudes towards plastic bag and plastic waste on behaviors of plastic bags consuming and waste sorting, is also statistically supported ($\beta = 0.335$, $p < 0.001$). This means people with higher environmental care attitudes tend to behave in more environmentally friendly ways by avoiding receiving plastic bags and sorting waste at home. Moreover, hypothesis 3 also shows that knowledge and the environmental impact of plastics on behaviors of plastic bags consuming and waste sorting is significantly supported ($\beta = 0.127$, $p < 0.001$). People with good knowledge about environmental impact of plastics would behave well for the sake of better environment. Similarly, hypothesis 5 indicates a positive relationship between the attitudes towards the governmental ban on single-use



plastic bag campaign and behavior in consuming plastic bags consuming and sorting waste which is statistically supported ($\beta = 0.066$, $p < 0.05$). Thus, it is significant to encourage positive attitudes towards governmental campaigns in order to bring out cooperative behaviors among citizens.

Hypothesis 6 showed that the knowledge related to the existence of government's environmental campaigns on behaviors of plastic bags consuming and waste sorting is positively related and significantly supported ($\beta = 0.136$, $p < 0.001$).

Hypothesis 7 shows a positive influence and statistically supported of attitudes towards plastic bags and plastic waste on attitudes towards no single-use plastic bag campaign of the government ($\beta = 0.475$, $p < 0.001$). People with good attitudes towards environmental impact of plastics seem to have good attitudes towards no single-use plastic bag campaign of the government too.

However, hypothesis 4 is not statically supported. This means even though people may highly aware of the existences of government campaigns about environmental care, this knowledge might not affect their attitudes towards governmental campaign.

According to Table 7, the standardized beta coefficients reported three different p-values according to three dependent constructs. Model no.1 represents hypothesis1 that there is a direct effect of knowledge about the environmental impact of plastics on attitudes towards plastic bags and plastic waste which is significantly supported. Model no.2 represents hypotheses 4 and 7. Hypothesis 4 explains the relationship between knowledge about the existence of government's environmental campaigns and attitudes towards the government campaign on plastic bag ban. However, it is not significantly supported. While the direct effect of attitudes on the use of plastic bag towards the attitude on the government campaign (representing hypothesis 7) is supported.

Lastly, model no.3 includes hypotheses 2, 3, 5 and 6 showing significant relationship between all four variables – attitudes towards the usage of plastic bags and plastic waste, knowledge about the environmental impact of plastics, attitudes towards governmental campaign, and knowledge about the existence of relevant governmental campaigns - and behaviors of taking and using plastic bags and plastic waste sorting. These four hypotheses in model no. 3 are all significantly supported.

**Table 7:** Regression results of direct effects by models, in relation to hypotheses

BANGKOK (803 Respondents)	Dependent Variables					
	Model 1		Model 2		Model 3	
	Attitudes		Attitudes		Behaviors	
	Plastic Bag/Waste		Government Campaign (No Single-Use Plastic Bag)		Taking/Using Plastic Bag & Plastic Waste Sorting	
	β	VIF	β	VIF	β	VIF
Intercept						
Independent Variables						
KNOWLEDGE about "the impact of plastic waste on the environment"	0.268***	1.087			0.127***	1.560
ATTITUDES towards "the usage of plastic bags and plastic waste"			0.475***	1.081	0.335***	1.427
KNOWLEDGE about "the existence of relevant GOVERNMENT CAMPAIGN "			0.030	1.055	0.136***	1.411
ATTITUDES towards GOVERNMENT CAMPAIGN "a ban on single-use plastic bags"					0.066*	1.290
Control Variables						
Gender (Male = 1, Female = 2, LGBTQ+ = 3)	0.078*	1.036	-0.015	1.042	0.132***	1.043
Age (<23yrs old=1, 23-39yrs old=2, 40-55yrs old=3, ≥ 56yrs old=4)	0.057	1.048	-0.048	1.056	0.110***	1.059
Family Members (1-2people=1, 3-4people=2, 5-6people=3, 7-8people=4, ≥9people=5)	-0.076*	1.006	0.030	1.012	-0.067*	1.015
Education (<Bachelor=1, Bachelor=2, Master=3, Doctoral=4)	0.115**	1.331	-0.041	1.299	0.076*	1.349
Personal Income (<20k=1; 20,001-40,000=2; 40,001-60,000=3; 60,001-80,000=4; 80,001-100,000=5; 100,001-120,000=6; >120,001=7)	-0.059	1.278	-0.012	1.288	-0.046	1.290
Model Fit Indices						
R ²	0.108***		0.217***		0.305***	
No. of respondents	803		803		803	

Remarks: ***p-value<0.001, **p-value<0.01, *p-value<0.05, and standardized beta coefficients are reported.

Among five control variables, gender, age and education show positive and statistically significant relationship on behaviors in using plastic bags waste sorting. In other words, male seems to show less pro-environmental behavior comparing to other genders. In addition, older and higher educated people tend to be more pro-environmental behavior regarding the use of plastic bags. On the other hand, number of family members has a negative effect on behaviors which means smaller family or lower household members seems to receive more plastic bags. It might be interpreted that they may consume more food deliveries and/or food hawkers which makes them receive a greater number of plastic bags. This is opposite to big families who rather go shopping at supermarket or fresh market for home cooking and thus receive less or even do not use plastic bag.

To indicate multicollinearity, the variance inflation factor (VIF) is applied. As summarized in Table 7, the highest VIF value is 1.560 across all variables in the regression analysis. This is much lower than 10 which is the maximum criterion. Thus, the multicollinearity is definitely not a concern in this research.



Additionally, there are three R-square values (R^2) of the regression reported by three analysis models in the Table 7. In the regression of the model no.1, knowledge about environmental impact of plastics can explain attitudes towards plastic bags and waste at 10.8 percent. This means that the knowledge about environmental impact of plastics alone is not sufficient for the explanation of the attitudes towards plastic bags and waste. For the regression of the model no. 2, to predict attitudes towards a ban of single-use plastic bag campaign of the government, an addition of knowledge about available environmental campaigns of the governments on top of attitudes towards environmental impact of plastics can explain at 21.7 percent. There are other important variables not included in this study. Importantly, in the regression model no.3, a synergy of two sets of knowledge and attitudes – environmental impact of plastics and government campaigns – can explain behaviors of plastic bags consuming and waste sorting at 30.5 percent.

The attitudes towards the usage of plastic bags and waste, and behaviors in receiving and using plastic bags and sorting waste is significant according to KAP theory in both of their direct relationship and mediating role of attitudes. However, the KAP relationship of governmental campaign only shows a direct effect of knowledge about relevant governmental campaigns and attitudes about the ban of plastic bags of governmental campaign on the behaviors in receiving and using plastics bags. However, there is no moderating role of attitudes towards a ban of plastic bags between knowledge of existence of relevant governmental campaigns and the behaviors.

Conclusions

As results of plastic bag ban policy form the major retail stores since 2020, the number of plastic bags use in convenient stores and supermarket dropped significantly. According to our survey results, fresh market, restaurant, and food delivery are the major sources of plastic bag consumption, on average 3.7, 3.1, and 2.8 bags per visit. On average people in Bangkok use approximately 1.2 bags/person/day.

According to the KAP model, knowledge about environmental impact of plastics does not only have a positive effect on attitudes towards plastic bag usage and plastic waste but it also has a direct effect on behaviors in using plastic bags and sorting waste. In addition, the attitudes towards plastic bags and waste moderates the relationship between knowledge and behaviors. Thus, it is important to continuously communicate about environmental impact of plastics to emphasize proper knowledge and attitudes towards plastic bags among Bangkok people and to bring out cooperative behaviors in avoiding plastic bags and sorting waste for better environment.



Moreover, this strong attitudes towards the usage of plastic bags would have a positive impact on attitudes towards a ban of plastic bags of governmental campaign as well. This is crucial since the attitudes towards a ban of plastic bags of governmental campaign has a direct effect on behaviors in receiving and using plastic bags but the attitudes here is not influenced by the knowledge about existence of relevant governmental campaigns. However, the knowledge about governmental campaign itself has a direct effect on behaviors in receiving and using plastic bags. Therefore, communication remains an important factor for relevant government sectors to promote existing governmental campaigns together with the information of environmental impact of plastics in order to achieve cooperative behaviors in reducing plastic bag usage in Bangkok successfully at the end. Similarly, to the recommendation from Oguge et al., (2021) suggested to continuously communicate via social media to disseminate plastic pollution messaging among the youth.

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