

**Phasing Out: Plastic Ban Effects on Local Businesses
Based on Resident and Owner Perceptions in Taiwan**

Remie Sai

ABSTRACT

Plastic pollution is a problem that occurs globally, and its production is rapidly increasing. Governments have proposed solutions to combat this problem. Taiwan's Environmental Protection Administration proposed a plastic ban aimed at the elimination of single-use plastics, specifically straws, bags, tableware, and cups by 2030. Tableware will be regulated at government buildings, supermarkets, and storefront food businesses, etc. The purpose of this thesis is to analyze how tableware regulations towards storefront food businesses will impact them. Surveys were administered to residents and storefront restaurants. Based on both surveys, all 4 business owners and 175 residents (N = 196) agreed with the ban's intent. 84.3% of individuals who labeled themselves as not knowledgeable of the legislation's details also agreed with its implementation. Two business owners support financial assistance programs for additional costs of applying to the regulations but would rather have the government assist in lowering the cost of plastic-alternatives. Owners were mainly concerned with the customer response to switching to reusables or when businesses charge extra for switching to plastic alternatives. 15.5% of individuals would avoid going to businesses with the added charge. In conclusion, businesses can be affected during the plastic ban in terms of increased costs for purchasing single-use plastic alternatives and customer satisfaction. Suggestions include educating customers on why businesses are making these changes, financial assistance from the government, and communication between all stakeholders of the ban, including small business owners who depend on their businesses for their livelihoods.

KEYWORDS

single-use tableware, storefront restaurants, plastic policy, government assistance, sustainability

INTRODUCTION

Plastic is heavily integrated into our surroundings and has environmental and health impacts. From contact lenses to toothbrushes, to the shirt and shoes people wear every day; a majority of common items contain plastic. Despite its convenience and inexpensiveness, plastic has adverse environmental and health effects. Correlations between bisphenol A and endocrine system disruptions increased concerns of plastics' impacts on human health (Rubin 2011). Although waste is disposed of in landfills, some plastic materials can ultimately find its way into the ocean. Plastic-derived chemicals were found in the tissues of marine-based organisms after plastic ingestion (Tanaka et al. 2013). Large fragments of plastic can eventually break down and degrade into microplastics. Once the plastic is broken down into microplastics, organisms in the surrounding ecosystem are harmed. Marine organisms ingest these particles, which bioaccumulate in the system leading to signs of physical health or diseases (Rochman et al. 2013, Sussarellu et al. 2016, Lamb et al. 2018). Plasticizers demonstrated carcinogenic effects on rats, which raised concern on its effects on humans (Turnbull and Rodricks 1985). Microplastics were also found in atmospheric rain and in freshwater intended for human consumption (Dris et al. 2015). Yet despite plastics' effects, there is still continued production of plastic globally and its existence continues to be an issue today (Thompson et al. 2009). If production continues at its current rate, studies estimate there will be more plastic than fish in the ocean if plastic production continues (Jennings et al. 2008). Reduction strategies are important to lessen plastic accumulation in the ecosystem.

Local and national governments began taking action to restrict the world's rapidly expanding plastic production. The United Nations Environment Programme report found 127 countries have placed some form of plastic bag regulation or legislation by August 2018 (Environment 2018). The Irish government placed a tax on plastic bags and noticed a decrease in plastic bags per capita from 328 to 21 bags within a year (Convery et al. 2007). In July 2017, China notified the World Trade Organization that they would be banning the import of plastics from foreign countries; this change forced 43 countries, who have relied on exporting plastics to China, to deal with their waste (Brooks et al. 2018). Countries are prompted to find solutions to limit plastic production either by reducing at the source, relying on shipping plastic waste elsewhere, or finding solutions to deal with plastic at its end life.

Taiwan decided to take action on this issue through their single-use plastic ban. Taiwan's Environmental Protection Administration (EPA) decided to expand its initial ban on single-use plastic bags to other plastic items. The goal was to ban all 4 categories of single-use plastics by 2030. These 4 categories include single-use tableware, beverage cups, bags, and straws. Different types of businesses will be targeted for each item. The businesses targeted for tableware include fast-food chains, department stores, storefront restaurants, and many more. Storefront restaurants are defined in the legislation as food storefronts with a seating area for customers (Environmental Protection Administration 2018). However, storefronts on the streets of Taiwan usually have minimal seating, usually less than 10 seats, due to space limitations. These businesses, or mom-and-pop shops, are usually family-owned. Store owners rely on the costs and profits of their business to directly sustain their livelihoods. The ban on single-use tableware will target small businesses, yet it is uncertain how these smaller storefront businesses will be affected.

In order to address this gap, this research project addressed the question: How will Taiwan's plastic ban affect storefront establishments? Specifically, there were two methods of analysis to answer this central question: (1) what are the Taiwanese residents' perceptions of the ban?; and (2) what are the perceptions of the ban by Taiwanese business owners? Surveys were conducted and analyzed to demonstrate perceptions from residents and business owners. The outcome of this research can potentially impact the way large-scale government regulations, similar to Taiwan's plastic ban, are constructed. It is important to consider entities that are often marginalized and more impacted by legislation on national and local levels. The findings from this study can be used to encourage necessary government assistance of the plastic ban policy across local businesses that shape the Taiwanese culture.

BACKGROUND

Taiwan's plastic ban

Government restrictions can play an important role in resolving issues, like plastic production. Beginning in 2003, Taiwan's Environmental Protection Administration (EPA) issued a restriction on free plastic bags at convenience stores and supermarkets. In 2017, the EPA expanded the types of businesses to 10 other business types including beverage stores and bakeries.

In a 2018 ICC report for Taiwan, food-related single-use plastics represented 11.7% of items found at coastal cleanups (Ocean Conservancy 2018). To respond to the increasing plastic problem, the EPA expanded its regulations on plastics beyond plastic bags.

In May 2018, the EPA issued a ban on single-use plastics by 2030. The ban aimed to target all single-use plastics, specifically plastic bags, tableware, straws, and cups from Taiwanese businesses (Environmental Protection Administration 2018). Each of the four categories of items was planned to be implemented in a series of different stages (Environmental Protection Administration 2018). As of July 2019, all plastic straws were limited for distribution to customers at four business sectors: department stores, fast food chains, government agencies, and shopping centers. Shopping malls and department stores in most regions in Taiwan are restricted from using single-use tableware for dine-in options starting January 1st, 2020. The EPA excuses businesses from using single-use alternatives that are certified biodegradable or materials mainly composed of paper or plant material with removable plastic coating. Additionally, violators are fined from 1,200 NTD up to 6,000 NTD (Environmental Protection Administration 2018).

Responses to the plastic ban

The announcement of the plastic ban in 2018 sparked responses from the public and businesses. Public backlash arose when the plastic ban was first announced. People complained about having to use spoons in order to consume bubble tea, a popular beverage in Taiwan. In response, the EPA advised residents to embrace reducing single-use plastic use, reusing and bringing their own reusables as an alternative (Environmental Protection Administration 2018). Large, stage-one chain businesses like McDonald's and Kentucky Fried Chicken switched to using straw-less lids for their drinks and removed straws from checkout counters at their stores with the exception that paper straws were provided for those with special needs upon request. Others switched to alternatives that are biodegradable, such as paper straws or other biodegradable straws. Despite the media's coverage of residents' perceptions, there is a lack of information about business views on the issue. Business entities in Taiwan are one of the main stakeholders in charge of actively responding to the ban.

Storefront businesses

Taiwan is one of the countries that is attempting to decrease plastic production, specifically through a single-use plastic ban applicable to all businesses. Taiwan's food culture is known for its vast array of local food establishments. Small establishments, including traditional farmers' markets, food stalls, and night markets are known for delicious, inexpensive food, but mostly served with single-use plastics. These establishments are important in the fabric of Taiwanese culture and the main drivers of tourism in Taiwan (CCD et al. 2019). The regulated scope of storefront food establishments is defined as restaurants within a building and includes indoor seating areas for customers to dine-in (Environmental Protection Administration 2018). Food stands and carts within markets are not included in this scope. Small food establishments serve meals that are mostly for to-go orders, with a few exceptions of additional seating areas. Due to space limitations, there is sometimes no space for washing reusables or seating areas for dine-in options; yet storefront businesses are still required to comply with the regulations of this ban.

Cost of alternative tableware for businesses

Related plastic regulations in other countries have demonstrated business concerns for these types of legislations. The EPA allowed businesses to use biodegradable products or reusable items (Environmental Protection Administration 2018). Compared to single-use plastics, these approved items are significantly more expensive. For tableware, businesses are not allowed to provide any single-use cups, bowls, plates, or containers. The shift to non-single-use plastics can pose a large economic burden on small businesses with lower incomes. Recently, the City of Palo Alto passed a similar ban on plastics through the Disposable Foodware Ordinance. Results from in-person interviews in the city showed many owners were concerned with increased costs when switching to sustainable alternatives (Palo Alto City Council 2018). Businesses focusing on reducing production and service costs perceived adopting environmental best practices as a drain on profits (Rutherford et al. 2008). On the other hand, others believed that if there are no environmental regulations in place, then there are no perceived environmental issues (Hunt 2000). Lack of environmental management has been attributed to low awareness of one's overall environmental impact. If business owners were aware of their direct environmental impact, they

were more likely to make changes on their own. Therefore, I used in-person surveys as a data collection method for Taiwanese storefront owners. It was important to take into account business owners' perceptions of their environmental impact and how it influences their response to the ban.

Resident eco-consciousness in Taiwan

The EPA administered surveys to Taiwanese residents and reported that 62.6% of individuals bring their own reusable take out containers on a regular basis. From a surveying population in Taiwan, 73.5% supported not having single-use tableware while dining in, while the support for take-out restrictions was reduced by 12.5% (Environmental Protection Administration 2018). I hypothesize that the more environmentally conscious individuals are, the more they are likely to support the ban; pro-environmental residents will be more willing to pay for the added charges related to the business' response.

Government assistance programs

Taiwan's EPA has not instituted any financial assistance programs or waivers for businesses struggling to comply with the ban. Similar to the Taiwanese ban, businesses in Berkeley will be banned from providing single-use disposables through the City of Berkeley Single Use Foodware and Litter Reduction Ordinance in 2018 (Council of the City of Berkeley 2019). Restaurant owners can apply for waivers if transitions to compostables or reusables are financially difficult. Other waivers include those who cannot comply due to space limitations, inability to have on-site or off-site dishwashing capacity, or if businesses cannot acquire the services for having reusable items. These waivers last for two years but can be renewed if there are continued economic burdens. Financial grants and other technical assistance are also offered for those transitioning to reusable tableware (Council of the City of Berkeley 2019). In 2017, the San Francisco Department of the Environment's ordinance to ban polystyrene foam (or Styrofoam) allowed businesses with annual incomes less than \$500,000 to be waived if there were no affordable alternatives (SF Department of the Environment 2018). On the other hand, Taiwan's EPA has not announced any assistance programs for businesses who may struggle under the single-use plastics ban. Waivers, grants, and technical assistance are all examples of how the Taiwanese

government can ease possible financial burdens for small businesses in Taiwan. Therefore, an additional purpose of this research is to see if similar assistance programs are necessary for small businesses.

METHODS

Data collection and analysis

Local restaurant businesses and everyday residents in Taiwan were the sampling population for this research. The main method of data collection was administered using surveys, which were easier to analyze and the most suitable for this type of research. Two separate survey formats were done for Taiwanese residents and for local business owners. A total of 196 residents and 4 business owners were surveyed in December 2019. In addition, surveys were administered in Mandarin Chinese.

To answer all sub-questions of the central research questions, survey questions were developed to create quantitative and qualitative analysis outcomes. Graphs and tables were created to analyze both stakeholder responses and perceptions of the ban. Overall, final analysis was used to see how the plastic ban can influence these small businesses in Taiwan.

Resident survey

The purpose of surveying individuals is to understand potential behavior when the ban is fully implemented in the future. Taiwanese residents are those who are the most engaged with these businesses when dining at these locations. They are the main factors for customer volume, which could affect the business' profits. Business owners' perceptions of the ban can also be influenced by the customers' views. In addition, residents can choose to go to other food establishments in the case of added charges. Questions were completed online through Qualtrics, an online surveying platform, and self-reported by individuals. In order to understand the demographics of surveyed individuals, questions related to age, gender, and location were asked (Appendix A). Additionally, respondents reported their views on plastic pollution, knowledge of the ban, and their perceptions of the ban.

Business owner survey

I administered surveys to non-chain storefronts with less than 15 dine-in seats or those with no seating areas at all. Surveys were conducted in the city of Taipei, the largest tourist destination in Taiwan. I administered these surveys by approaching each storefront in-person. I decided to use face-to-face interactions to record unique responses distinguishable from other storefronts. All surveys were directed towards business owners since owners are the most knowledgeable about running the business and the economic effects of the ban. Questions were catered towards addressing concerns of complying with the ban in regard to financial ability and logistics (Appendix B). During the survey, I mentioned a few details about the ban such as fines, general timeline, tableware alternatives, and intent of the ban. These details ensured that all respondents had a clear understanding of the legislation as they answered the following questions. I asked them about planned changes in response to the ban. Responses were translated, organized, and quoted for overall analysis.

RESULTS**Resident survey responses**

Data collection was carried out based on two types of surveys in December 2019. All four surveyed business owners and 83% of the residents were located in Taipei, the largest city in Taiwan, and the location of the EPA headquarters. Among all 196 consumer survey respondents, 24% (N=47) were male and 74% (N=145) were female; the largest age group was between 40 to 59 years old (Table 1). The respondents' demographics were compared to the population census of Taiwan at the end of December 2019, which was when the surveys took place (Department of Household Registration, M.O.I 2020). Respondent characteristics, specifically sex and age, were not representative of the Taiwanese population (Table 1).

Table 1. Characteristics of Survey Respondents. The demographic distribution of surveyed respondents in comparison to the Taiwanese population data in December 2019.

Characteristics	Respondents	Taiwan Population, 2019
Sex		
Female	74%	50.4%
Male	24%	49.6%
Choose Not to Answer	2%	
	(N=196)	(N=23,603,121)
Age		
< 17	5%	15.4%
18-24	11%	9.1%
25-39	31%	21.9%
40-59	49%	31.3%
> 60	2%	22.3%
Choose Not to Answer	3%	
	(N=196)	(N=23,603,121)

Questions about plastic pollution were asked in order to understand the respondents' concerns about the issue. The responses showed an overall agreement on plastic pollution as a global problem. In comparison, 2 individuals did not believe individual actions could reduce the global issue of plastic pollution (Table 2). A majority of respondents who strongly agreed or agreed to plastic pollution as a global problem also believed they could reduce the problem through individual actions (Table 2). Those who agreed that plastic pollution was a global problem most likely agreed to the ban as well.

Table 2. Response summary for opinions on the two statements on plastic pollution and its relation to individual action. Based on survey responses, 2 out of 196 respondents did not think plastic pollution can be reduced through individual action.

I can reduce plastic pollution through individual action.					
Plastic pollution is a global issue.		Strongly Agree	Agree	Disagree	Strongly Disagree
	Strongly Agree	112	6	0	0
	Agree	54	22	0	0
	Disagree	1	0	0	0
	Strongly Disagree	1	0	0	0

Overall, respondents expressed having briefly heard of the ban but did not know the details and its intentions. 50.3% of the surveyed population expressed being knowledgeable of the legislation (Figure 1). Although a majority knew about the ban's details, 10.9% reported themselves unknowledgeable, while another 38.9% had only heard of it. Despite the lack of knowledge on the ban, the survey population generally approved of the plastic ban's implementation in Taiwan. 90% of respondents agreed to the ban's implementation while 7% had no opinion of the ban. The correlation between agreement and knowledge of the ban was $r = 0.22$, which indicates a positive correlation between these variables.

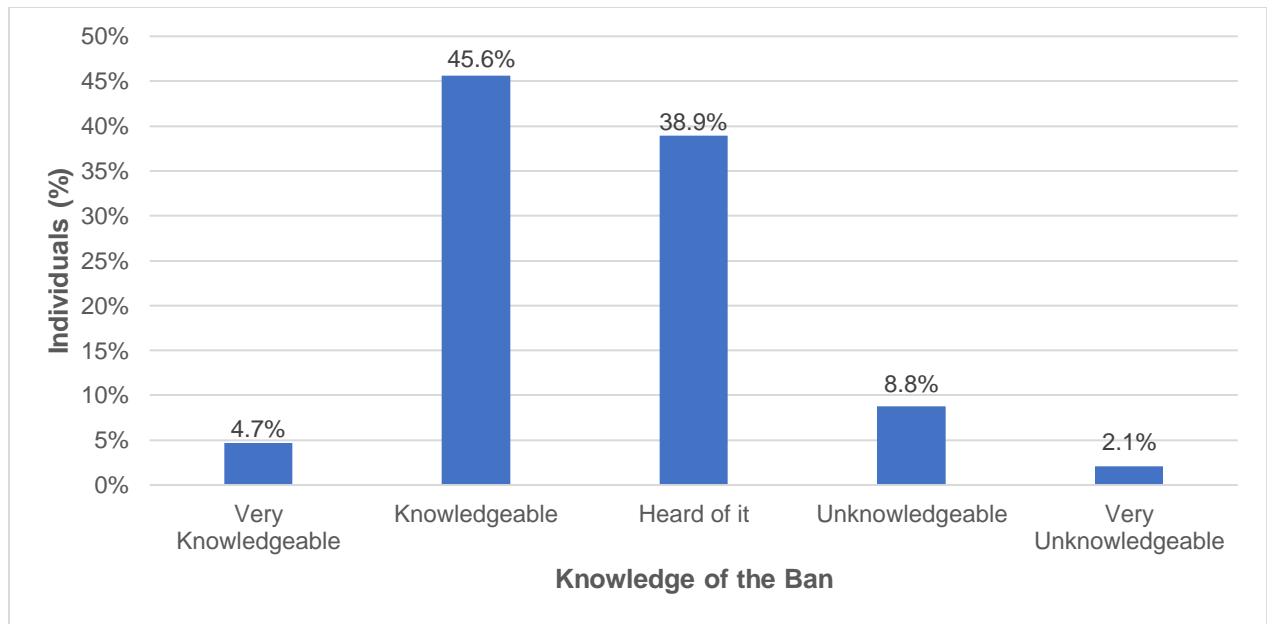


Figure 1. Resident Knowledge of the Ban in Percentages (N=196). A majority of residents had heard of the ban but were also knowledgeable of its details. 10.9% had not heard of the legislation at all.

One respondent expressed their concern for the plastic ban because they believed that forcing people to be environmentally friendly can often become a burden for others. Another respondent disapproved of the ban because they did not believe plastic was a problem. In addition, the ban can be inconvenient. One resident commented, “I think it is good to be eco-conscious...I personally do not like to be forced to be eco-friendly because I think these efforts can be inconvenient and difficult to be carried out.” Another individual expressed their concern that the government’s participation with the ban cannot reduce the amount of plastic produced.

Individuals, despite having agreed and disagreed with the plastic ban, would continue going to the business or would bring their own dining-ware if restaurants charged extra for disposable alternatives. Those who neither disagreed nor agreed with the legislation varied between resorting to dining in at restaurants without an added charge and choosing to bring their own dining-ware (Figure 2).

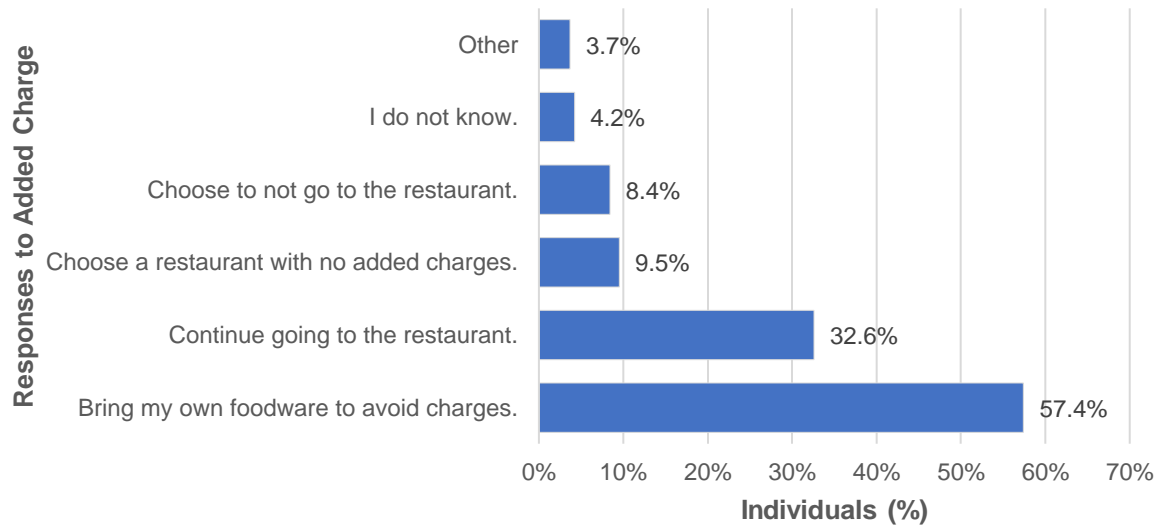


Figure 2. Individuals' perceptions of extra charges at businesses. The results of how residents would respond to businesses that charge customers for increased costs of disposable alternatives.

Despite the extra charges for disposable alternatives, some respondents expressed the fact that they would still visit the business as long as the quality of the food compensated for the price of disposables. One respondent said they would most likely go to the restaurant at a smaller frequency to reduce additional costs. On the other hand, another respondent preferred to completely avoid the restaurant and choose to dine at one that does not serve disposable utensils.

Business survey responses

A total of four business surveys were completed in the city of Taipei in December 2019. I received differing responses to the survey questions. Only two of the four businesses had heard about the plastic ban. However, all businesses agreed to the ban before knowing about its details, which included information about the general timeline, monetary fines, targeted business types, and accepted single-use alternatives. All four storefronts had either complete reusable tableware or only a few exceptions of single-use plastics, like cups. When asked what they would do in order to respond to the ban, most owners expressed switching to reusables for dine-in. Two owners would resort to using approved single-use materials for take-out. The remaining owners had not thought of a plan yet, but would most likely choose to use approved materials since it would be

the only option. All owners expected increased costs for the alternatives, therefore, they planned to charge customers extra to compensate for these costs.

Financial assistance programs could potentially reduce the cost of single-use plastic alternatives and prevent added costs on the business. Two business owners disliked the idea of government assistance because they believed their participation could increase the chances of stricter intervention and regulation. Both entities believed these transitions will be a financial burden to the business in the beginning, but they can ultimately adjust to these changes later on. An interesting finding was that the two owners, who accepted an assistance program, would rather the government fund the manufacturers of the EPA-approved products. These suggestions aimed to lower the cost of these items, which would ease the financial burden on businesses.

DISCUSSION

Surveys were distributed to residents and business owners in Taiwan. Residents were broadly from different parts of Taiwan, while business owners were solely located in Taipei. Overall, results indicated general acceptance of the ban from Taiwanese residents. Residents expressed having heard of the ban but were unknowledgeable about its details. A majority of business owners accepted the ban's intent. Analysis of both surveys could indicate a negative effect on local businesses, despite consumer acceptance for the ban. Some businesses believe government assistance could be helpful while others would rather the money be used to lower the cost of accepted alternative materials sold by manufacturers.

Resident perceptions of the ban

Consumers were not knowledgeable about the ban, but an 89.2% (N= 175) majority agreed with the ban's implementation. 49.7% of surveyed individuals had either only heard of such legislation or had not heard of it at all (Figure 1). This could indicate a lack of education regarding the ban. Education is very important in order to increase awareness of the ban and to increase understanding of its intent. Educational tools include signage, media, or events about the details of the ban. People who believed plastic pollution is an issue generally agreed with the ban. All surveyed residents believed plastic pollution was a problem. However, the 2 respondents who

voted that plastic pollution cannot be reduced through individual action were also supportive of the ban (Table 2). These results suggested that there is a high awareness of an individual's environmental impact, specifically plastic. Additionally, despite not knowing a lot about the ban, residents approved of the ban. This suggests that further education will not be necessary to gain general acceptance. The surveyed demographic was generally conscious of environmental issues. The widespread acceptance of the legislation could potentially be linked to the consciousness of one's environmental impact (Bronfman et al. 2015).

Owner perceptions of the ban

Local businesses expressed concern for the ban although they agreed with its intent to reduce plastic waste. The surveyed businesses were all storefront businesses with less than fifteen seats. All businesses agreed that they would most likely transition to EPA-approved to-go tableware for take-out options after being informed about potential fines for violation. One business owner expressed concern over the increased prices of these approved materials. In response, all business owners plan to charge customers additionally for increased prices of switching to alternative materials.

A business owner with complete dine-in reusables believed using reusables is sanitary because they can control the substances used in cleaning them. One owner said that disposables are believed to have unknown chemicals or compounds that could be harmful to customers. In fact, the surveyed residents generally partook in eco-friendly activities, like bringing their own bags, because of sanitation reasons. 34.1% of residents who bring their own reusable utensils do so for sanitation reasons, compared to 26.36% for environmental reasons. Sanitation could imply that customers believe their own reusables are cleaner than dining locations or that disposable utensils are unsanitary. Chemicals of food packaging and food contact materials, specifically single-use plastic ones, can transfer into food upon contact and can expose food to contacted chemicals (Grohe et al. 2020). The storefront businesses I went to did not have dishwashing machines, therefore, their available reusables were all washed by hand. As one of the residents said, it will be important to use reusables. Businesses will need to ensure reusables are clean and sanitary to eliminate consumer deterrence from the business.

Impacts of business profitability

Based on resident and business owner responses, storefronts could experience a decrease in profitability or could have no effect at all. Businesses understand that EPA-approved materials can be an added expense. If businesses consider using disposables, they are required to use EPA-approved materials. In response, owners plan to charge extra for the added costs. One business owner suggested, “Since this is government regulation, we will need to abide by these rules. However, customers will need to be educated on why businesses are making these changes. Our main concern will be the customers’ reactions, which could affect whether or not they continue to come to our store.” Customers are the businesses’ main priority since they are the ones heavily impacting revenue and profit.

Changes in business operations can affect the customers’ preference to dine at the location, which could have a direct effect on the business and their profits. Changes made to business operations in response to the ban vary from using reusables to incorporating EPA-approved tableware products. However, these two options can lead to added labor costs or decreased profit margins. Restaurants can choose to redirect the burden of increased costs to their customers. Despite supporting the ban’s implementation, customers would be deterred from going to the store. The surveyed residents are more reluctant to dine at the business, under the circumstance that the food’s quality is up to par with the added cost. 11.6% of respondents would choose to go to another restaurant without the added charge or to avoid the restaurant completely (Figure 2). Other businesses without an added charge are highly preferred; these businesses are specifically those with reusable tableware or EPA-approved materials that not financially burdensome. If people decide not to dine-in at the store, businesses can experience a decrease in customer volume. This could potentially decrease overall business profits. However, some residents believed that the added charge would not deter them from dining because they would either pay the charge, or 49.6% of surveyed residents would choose to bring their own dining ware (Figure 2). As all owners mentioned, the ban’s effects on small businesses are heavily influenced by customer satisfaction.

Limitations and Future Directions

Resident and business owner responses were limited in size. As seen in the demographic table, the sample size was small and not representative of the Taiwanese population during the surveying period (Table 1). Therefore, I would recommend expanding both resident and business survey questions to a larger audience in different cities or areas of Taiwan beyond just the city of Taipei. The initial intent of this research was to survey a larger population of owners. However, many storefront owners I encountered were strongly hesitant to partake in the survey. Despite reassurance and guarantee of complete anonymity, many owners were afraid that I would be using information from the interview to harm their business. Therefore, the surveying size for businesses was limited. However, I was still able to learn valuable experiences and insight with the owners I interviewed.

Other factors related to environmental efforts and the perception of Taiwan's plastic ban should be considered. Questions about resident income were not asked. Income and individual affluence are potential factors that can affect their responses to added charges, dining at storefront businesses, and regulations. Trust in the government can influence achieving acceptability among residents (Kim et al. 2013). In addition, residents are far more likely to accept pro-environmental legislation when they have increased trust for other citizens to partake in these eco-conscious behaviors (Harring and Jagers 2013). Both types of surveys for residents and owners were self-reported surveys respectively online and in-person. Self-reported questionnaires have the potential to lower levels of accuracy in responses (Araujo et al. 2017). I recommend future surveys, if applicable, to incorporate using observational or market surveys to account for these biases (Lam and Chen 2006). Market surveys can be applied to the survey by seeing if individuals would choose to pay for added costs or avoid costs by bringing their own reusables. These observations, however, need to be conducted a few months after businesses fully respond to the ban or at a storefront with the added charge already set in place. These factors, including trustiness, income, self-reported bias, must be explored in future surveys to accurately gauge others' opinions and perceptions.

The surveying period was conducted a month before one of the bigger stages of the Taiwan ban. A month later, in January 2020, shopping malls were restricted to using all reusable dining ware for dine-in options (Environmental Protection Administration 2018). Resident and business owners' perceptions could be different once this phase is fully put in place. The Kenyan plastic

bag ban noticed an increase in resident acceptability further into the ban's implementation (Njeru 2006). All phases of the plastic ban will not be fully implemented until 2030, similar studies to this one can be made during its completion.

Suggestions for moving forward

Based on consumer and owner responses, respondents wished the government can place more effort into education and promotion of the ban. A respondent commented, "Limiting plastic is important and it is something that must take place under the criteria that the government has clear guidelines and effective marketing for the common people to follow." As expressed earlier, not a lot of people were knowledgeable about the ban. I would recommend the government to strategize educational efforts to the general public. A large population of Taiwan still rely on the news for information. 89% of the population rely on the internet and 71% on television for sources of news in Taiwan (Newman 2019). One respondent encourages the government to find efficient ways to educate the general public, to release reliable case studies and examples, and create simple strategies for the general public to follow. Using social media, newspapers, television as educational and promotional platforms could increase awareness and knowledge about the legislation. In addition, a business owner expressed wanting more information about the ban. Suggestions for financial difficulties or single-use alternative sources for all business entities could be useful as the ban moves forward.

When asked about financial assistance programs, business owners expressed positive responses because they believed it would help the transition for costly alternatives. However, some business owners encouraged the government to intervene by finding ways to lower the costs of these compostable products. Based on these findings, I suggest the EPA create financial assistance programs that work with manufacturers to reduce purchasing costs of compostable tableware. Financial waivers are also recommended to help business owners during the transition. Waivers will give businesses the opportunity to apply for waivers if transitions to compostables or reusables are financially difficult, as seen in the Berkeley Single Use Foodware and Litter Reduction Ordinance (Council of the City of Berkeley 2019). Other forms of waiving include giving additional time for establishments to transition or creating grants for establishments putting in the effort to respond, but do not have the resources to do so.

Taiwan's plastic ban involves many moving parts and pieces that worked together to create the legislation. Its planning and timeline involved not only environmental organizations and the EPA, but also directly connected with all business entities, like fast-food chains, schools, government buildings, and storefront restaurants (Environmental Protection Administration 2018). Therefore, creating an inclusive legislation involves communication amongst all stakeholders. Actors also involve the manufacturers who create the single-use plastic alternatives approved by the EPA. The purpose of this paper was to gather the views of both residents and business owners who can be negatively and positively impacted by the ban's implementation. Communication and compromise will be needed to meet general satisfaction and agreement and to explore ways to decrease negative effects on all entities.

The survey can be applied to other bans around the world. The main purpose of this paper was to be a voice for the Taiwanese community and highlight thoughts and opinions that are often overlooked. These findings and suggestions are useful information for Taiwan's EPA as they continue to roll-out future phases of the ban. Luckily, Taiwan's plastic ban is still in its beginning stages, which allows room for future adjustments to be made.

ACKNOWLEDGEMENTS

Thank you to Patina Mendez, Samuel Evans, Leslie McGinnis, Jessica Heiges and Roxanne Cruz for their guidance and mentorship throughout this entire thesis process. The CNR Travel Grant for funding my trip to Taiwan so I had the opportunity to explore my culture and engage face-to-face with Taiwanese business owners. Peggie Lee, Linda Lee, and Jiun-Lang Huang who aided in administering surveys to business owners and for providing comfort and hospitality during my time in Taiwan. Yui Sai and Debbie Lee, who aided in translating the surveys correctly and for providing helpful feedback. Claire Lee, Tina Lee, and Stacy Chen for distributing the surveys to residents in Taiwan. My EPSM 175 class for revising rough drafts of my paper, providing honest feedback to improve my writing, and collectively supporting each other throughout this entire year. At last, I sincerely thank all of the residents and business owners who took the time to participate in the survey and to open themselves for discussion.

REFERENCES

- Araujo, T., A. Wonneberger, P. Neijens, and C. de Vreese. 2017. How Much Time Do You Spend Online? Understanding and Improving the Accuracy of Self-Reported Measures of Internet Use. *Communication Methods and Measures* 11:173–190.
- Bronfman, N., P. Cisternas, E. López-Vázquez, C. Maza, and J. Oyanedel. 2015. Understanding Attitudes and Pro-Environmental Behaviors in a Chilean Community. *Sustainability* 7:14133–14152.
- Brooks, A. L., S. Wang, and J. R. Jambeck. 2018. The Chinese import ban and its impact on global plastic waste trade. *Science Advances* 4:0131.
- CCD, P.-L. P. Rau, and International Conference on Human-Computer Interaction, editors. 2019. Cross-Cultural Design: 11th International Conference, CCD 2019, Held as Part of the 21st HCI International Conference, HCII 2019, Orlando, FL, USA, July 26-31, 2019, Proceedings.
- Convery, F., S. McDonnell, and S. Ferreira. 2007. The most popular tax in Europe? Lessons from the Irish plastic bags levy. *Environmental and Resource Economics* 38:1–11.
- Council of the City of Berkeley. 2019, January 22. Single Use Foodware and Litter Reduction Ordinance.
- Department of Household Registration, M.O.I. 2020. Population by Sex and 5 Year Age Group for Counties and Cities, End of Year 2019. Department of Household Registration, Ministry of the Interior, R.O.C., Taiwan.
- Dris, R., J. Gasperi, V. Rocher, M. Saad, N. Renault, and B. Tassin. 2015. Microplastic contamination in an urban area: a case study in Greater Paris. *Environmental Chemistry* 12:592.
- Environment, U. N. 2018, December 6. Legal limits on single-use plastics and microplastics. <http://www.unenvironment.org/resources/report/legal-limits-single-use-plastics-and-microplastics>.
- Harring, N., and S. Jagers. 2013. Should We Trust in Values? Explaining Public Support for Pro-Environmental Taxes. *Sustainability* 5:210–227.
- Jennings, S., F. Mélin, J. L. Blanchard, R. M. Forster, N. K. Dulvy, and R. W. Wilson. 2008. Global-scale predictions of community and ecosystem properties from simple ecological theory. *Proceedings of the Royal Society B: Biological Sciences* 275:1375–1383.
- Kim, J. 2013. Attitudes towards road pricing and environmental taxation among US and UK students. *Transportation Research Part A Policy and Practice* 48:50–62.

- Lam, S.-P., and J.-K. Chen. 2006. What Makes Customers Bring Their Bags or Buy Bags from the Shop? A Survey of Customers at a Taiwan Hypermarket. *Environment and Behavior* 38:318–332.
- Lamb, J. B., B. L. Willis, E. A. Fiorenza, C. S. Couch, R. Howard, D. N. Rader, J. D. True, L. A. Kelly, A. Ahmad, J. Jompa, and C. D. Harvell. 2018. Plastic waste associated with disease on coral reefs. *Science* 359:460–462.
- Newman, N. 2019. Reuters Institute Digital News Report 2019:156.
- Njeru, J. 2006. The urban political ecology of plastic bag waste problem in Nairobi, Kenya. *Geoforum* 37:1046–1058.
- Ocean Conservancy. 2018. 2018 International Coastal Cleanup Report. Ocean Conservancy.
- Palo Alto City Council. 2018. Palo Alto Zero Waste Plan. Palo Alto City Council.
- Rochman, C. M., E. Hoh, T. Kurobe, and S. J. Teh. 2013. Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress. *Scientific Reports* 3:3263.
- Rubin, B. S. 2011. Bisphenol A: An endocrine disruptor with widespread exposure and multiple effects. *The Journal of Steroid Biochemistry and Molecular Biology* 127:27–34.
- San Francisco Department of the Environment. 2018. Single-Use Food Ware Plastics, Toxics, and Litter Reduction. San Francisco Department of the Environment.
- Sussarellu, R., M. Suquet, Y. Thomas, C. Lambert, C. Fabioux, M. E. J. Pernet, N. Le Goïc, V. Quillien, C. Mingant, Y. Epelboin, C. Corporeau, J. Guyomarch, J. Robbens, I. Paul-Pont, P. Soudant, and A. Huvet. 2016. Oyster reproduction is affected by exposure to polystyrene microplastics. *Proceedings of the National Academy of Sciences* 113:2430–2435.
- Tanaka, K., H. Takada, R. Yamashita, K. Mizukawa, M. Fukuwaka, and Y. Watanuki. 2013. Accumulation of plastic-derived chemicals in tissues of seabirds ingesting marine plastics. *Marine Pollution Bulletin* 69:219–222.
- Thompson, R. C., C. J. Moore, F. S. vom Saal, and S. H. Swan. 2009. Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364:2153–2166.
- Turnbull, D., and J. V. Rodricks. 1985. Assessment of Possible Carcinogenic Risk to Humans Resulting from Exposure to Di(2-ethylhexyl)phthalate (DEHP). *Journal of the American College of Toxicology* 4:111–145.

APPENDIX A**Resident surveys on the Taiwan plastic ban**

- 1) Age
 - a. < 17
 - b. 17-24
 - c. 25-39
 - d. 40-59
 - e. > 60
 - f. Choose not to answer
- 2) Gender
 - a. Male
 - b. Female
 - c. Choose not to answer
- 3) What part of Taiwan do you reside in?
 - a. Taipei
 - b. Taichung
 - c. Tainan
 - d. Kaohsiung
 - e. Other: _____
- 4) Plastic pollution is an international problem.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
 - e. Other: _____
- 5) I can reduce plastic pollution from individual action.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
 - e. Other: _____
- 6) Which of the following single-use plastics do you use the most? (Multiple Answer)
 - a. Single-use plastic straws
 - b. Single-use plastic cups
 - c. Single-use plastic bags
 - d. Single-use plastic dining ware
 - e. Other: _____
- 7) When do you use single-use plastics the most? (Multiple Answer)
 - a. Dining; Take-out
 - b. Dining; Dine-in
 - c. Snacks
 - d. Groceries
 - e. Drinks
 - f. Other: _____

- 8) Which of the following apply to you? (Multiple Answer)
- a. I bring my own reusable bag.
 - b. I bring my own Tupperware.
 - c. I bring my own reusable straw.
 - d. I bring my own reusable dining ware.
 - e. I bring my own cup.
 - f. Other: _____
 - g. None of the above.
- 9) If one of the above applies to you, why do you partake in these activities? (Multiple Answer)
- a. Environmental
 - b. Financial savings
 - c. Out of habit
 - d. Sanitation
 - e. Others: _____
- 10) How knowledgeable are you about the Taiwan plastic ban?
- a. Very unknowledgeable
 - b. Knowledgeable
 - c. Not knowledgeable
 - d. Very unknowledgeable
 - e. Others: _____
- 11) What do you think of the Taiwan plastic ban?
- a. Strongly support
 - b. Support
 - c. No opinion
 - d. Do not support
 - e. Strongly do not support
 - f. Other: _____
- 12) If you chose “Do not support” or “Strongly Do not support,” what are your reasons for doing so? (Multiple Answer)
- a. The ban will not change plastic production.
 - b. Plastic is not an issue.
 - c. It is inconvenient.
 - d. Other: _____
- 13) If restaurants implement an extra charge for disposable utensils, will you change any of the following? (Multiple Answer)
- a. Yes; I will choose not to dine at there.
 - b. Yes; I will go to a restaurant with no added charge.
 - c. Yes; I will bring my own reusable tableware.
 - d. No; I will continue dining there.
 - e. I do not know.
 - f. Other: _____
- 14) Any additional comments?

APPENDIX B

Business surveys on the Taiwan plastic ban

- 1) How long has this business been running?
- 2) Which of the following items does your business provide?

	Dine-in	Take out	N/A
<i>Example</i>	✓	✓	
Plastic Straw			
Single-use cups			
Plastic spoon			
Single-use chopsticks			

- 3) Do you charge extra for plastic bags?
 - a. Yes
 - b. No
- 2) What type of material are the to-go boxes?
 - a. Plastic
 - b. Paper
 - c. Other: _____
- 3) Have you heard of any environmental legislation or regulations?
 - a. Yes; _____
 - b. No; _____
 - c. Other: _____
- 4) Have you heard of Taiwan's Plastic Ban?
 - a. Yes
 - b. No
 - c. Other: _____
- 5) If yes, what are your thoughts on the ban?
 - a. It is a bad policy.
 - b. It is a good policy.
 - c. I have no opinion of the ban.
 - d. Other: _____

Taiwan's Environmental Protection Administration (EPA) aims to ban single-use plastics by the year 2030 (Minguo 119). This plastic ban will target tableware items including the ones stated in the beginning. Storefront owners and food chains are one of the businesses entities to which this policy is applied to.

The EPA suggests using biodegradable single-use tableware, paper products or reusable items instead of single-use plastics. Violators will be fined 1,200 NTD to 6,000 NTD after their 2nd citation.

- 8) Do you think this policy will have a positive or negative impact on your business? Why?
 - a. Positive:
 - b. Negative:
 - c. Other: _____
- 9) Will you implement any changes in response to the ban?
 - a. Yes
 - b. No
 - c. Other: _____
- 10) If yes, what changes will you make for dine-in?
 - a. Switch to reusable tableware instead of single-use plastics.
 - b. Switch to biodegradable single-use tableware instead of single-use plastics.
 - c. I do not know.
 - d. Other: _____
- 11) If yes, what changes will you make for take-out?
 - a. Switch to biodegradable single-use tableware instead of single-use plastics.
 - b. Switch to paper-based take-out containers instead of single-use plastics.
 - c. I do not know.
 - d. Other: _____
- 12) What are the effects of making these changes?
 - a. Increased costs due to: _____
 - b. Other: _____
- 13) Would you like government assistance in the case of increased costs?
 - a. Yes
 - b. No
 - c. Other: _____
- 14) If there is no government assistance, will you be able to take on the effects of these changes?
 - a. Yes
 - b. No
 - c. Other: _____

The survey is completed! Thank you for taking the time to do this survey. Your thoughts are very important.