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Public perceptions about the management of plastic consumption in Kang Meas District, Kampong Cham Province

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សង្ខិត្តន័យ

ការស្រាវជ្រាវនេះមានគោលបំណងវិភាគយ៉ាងស៊ីជម្រៅទៅលើចំណេះដឹង ឥរិយាបទ និងការអនុវត្តរបស់ប្រជាជនក្នុងសហគមន៍ទន្លេអំពីការប្រើប្រាស់និងការគ្រប់គ្រងប្លាស្ទិកនៅស្រុកកងមាស ខេត្តកំពង់ចាមនៃប្រទេសកម្ពុជា។ ការស្រាវជ្រាវនេះក៏មានគោលបំណងពន្យល់ផងដែរអំពីស្ថានភាពបច្ចុប្បន្ននៃអនុវត្តជាក់ស្តែងរបស់ប្រជាជនក្នុងតំបន់នោះ ដើម្បីទាញយកចំណេះដឹងនិងឥរិយាបថរបស់ពួកគាត់ស្តីពីការប្រើប្រាស់ថង់ប្លាស្ទិក និងសិក្សាអំពីផលប៉ះពាល់ជាអវិជ្ជមានមកលើបរិស្ថាន ព្រមទាំងគាំទ្រឱ្យមានការកែលម្អការគ្រប់គ្រងកាកសំណល់ប្លាស្ទិកនៅតាមទីជនបទនៃប្រទេសកម្ពុជាឱ្យបានប្រសើរឡើង។ ក្នុងការស្រាវជ្រាវនេះ គំរូសរុបចំនួន ២៣៥ គ្រួសារនៅឃុំកងតាណឹងនិងឃុំរកាអារត្រូវបានសម្ភាស។ ការសិក្សានេះបានរកឃើញទំនាក់ទំនងរវាងការប្រើប្រាស់ប្លាស្ទិក និងសូចនាករួមួយចំនួនដូចជាប្រាក់ចំណូលជាដើម។ ឧទាហរណ៍ ប្រាក់ចំណូលគ្រួសារកាន់តែខ្ពស់ មានការប្រើប្រាស់ប្លាស្ទិកកាន់តែច្រើន។ ដើម្បីកាត់បន្ថយការប្រើប្រាស់ប្លាស្ទិកឱ្យមានប្រសិទ្ធភាព គប្បីមានការសិក្សាកំណត់តម្លៃថង់ប្លាស្ទិកឱ្យបានត្រឹមត្រូវ ដើម្បីប្រជាជនអាចសម្របខ្លួនទៅនឹងការបង់ថ្លៃថង់ប្លាស្ទិកដែលអាជីវករបានខ្ចប់ទំនិញជូន។ ការចោលសំរាមប្លាស្ទិកតាមផ្លូវ ឬតាមទីសាធារណៈ ឬតាមដងស្ទឹង ដងទន្លេ ឬតាមដងព្រៃកបានបង្ហាញអំពីឥរិយាបទមិនល្អរបស់ជនខ្វះចំណេះដឹង"។ គ្រួសារទាំងនោះត្រូវ

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ការការជួយជ្រោមជ្រែងកាន់តែខ្លាំងដើម្បីរួមគ្នាអនុវត្តគោលនយោបាយជាតិចំពោះការគ្រប់គ្រងការប្រមូល និងការយកកាកសំណល់ទៅចោល។ តាមរយៈការស្រាវជ្រាវនេះ ការគ្រប់គ្រងកាកសំណល់ប្លាស្ទិកអាចត្រូវបានកែលម្អដោយ៖ (១) លើកកម្ពស់យល់ដឹងអំពីការប្រើប្រាស់ប្លាស្ទិកដើម្បីឱ្យប្រជាជនទាំងនោះមានឥរិយាបទ និងទម្លាប់ល្អក្នុងការអនុវត្ត (២) អាជ្ញាធរមូលដ្ឋានគួរផ្តល់កន្លែងចោលសំរាម និងធ្វើយុទ្ធនាការតាមសហគមន៍ ដើម្បីកំចាត់កាកសំណល់ប្លាស្ទិកក្នុងភូមិឬឃុំ (៣) គាំទ្រគោលនយោបាយស្តីពីការគិតថ្លៃថង់ប្លាស្ទិក ដើម្បីកាត់បន្ថយការប្រើប្រាស់ថង់ប្លាស្ទិកទូទាំងប្រទេស (៤) ផ្តល់ថវិកាជូនអាជ្ញាធរមូលដ្ឋានសម្រាប់ប្រមូលនិងបែងចែកសំរាមប្លាស្ទិកឱ្យបានត្រឹមត្រូវសម្រាប់ការកែច្នៃឡើងវិញ និង (៥) បញ្ចូលចំណេះដឹងស្តីពីការគ្រប់គ្រងកាកសំណល់ប្លាស្ទិកក្នុងកម្មវិធីសិក្សាតាមសាលារៀនដើម្បីលើកកម្ពស់ការយល់ដឹងតាំងពីក្មេង។

Abstract

This paper analyzes the knowledge, attitudes, and practices associated with the management of plastic consumption in *Kang Meas* District, *Kampong Cham* Province. It describes the negative environmental impacts of plastic consumption and advocates for improved plastic waste management in rural areas of Cambodia. A cohort of 235 households in *Kang Ta Noeng* and *Roka Ar* communes was selected to participate in this research. A significant correlation between plastic consumption and indicators such as household income was found. For instance, the higher the household income, the more plastic that each household consumed. To reduce plastic consumption, an adaptation study is required to set an appropriate price for plastic bags that may be enforced by small businesses. Littering on the road or in other public places such as rivers or canals was found to be driven by *people's behaviour and lack of knowledge*. Households demand better support to meet national policies for waste management, collection and disposal. It is recommended that the management of plastic waste is improved by 1) awareness-raising about issues linked to plastic consumption to improve the attitudes, behaviours and practices of local people 2) the designation and provision of waste disposal sites by local authorities, including community campaigns to manage plastic waste on a commune or village basis, 3) supporting a policy to discourage the use of plastic bags nationwide by charging a fee for their use,

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4) providing sufficient budgets for local authorities properly collect and separate plastic for recycling, and 5) include knowledge about the management of plastic consumption in the school curriculum to raise awareness and plastic consumption from an early age.

Keywords: plastic, consumption, behaviours, knowledge, attitudes, waste management.

Background

Human life is impacted by environmental changes (Younan & Jenkins, 2020). Plastic waste has become a significant concern for humans, yet, it is vital to support daily activities. Dumping (Joyner & Frew, 2009) plastic trash into oceans has caused marine pollution at a scale that may never have been imagined before plastic packaging became widely used. Used plastic bags, bottles, and other packaging pollute shorelines as a result of disposing of waste in rivers and the ocean (Scott, 2007). This issue is one of the most serious environmental problems in Cambodia. In Phnom Penh alone, around 10 million plastic bags are consumed daily. They are used due to their convenience and low cost by food vendors, grocery stores, and clothing retailers for wrapping and packaging.

Plastic waste has a significant impact on more than 1,200 species of sea mammals and fish as it accumulates in their digestive tracts over time (Carey, 2010). Plastic, in the form of user end products, accounts for 60-80% of all marine litter (plastic bags, bottles, and packaging) (Chou, 2019), with the remainder linked to industrial raw materials (resin, granules, and pellets). In 2015, it was estimated that globally 55%, of plastic waste was discarded, 25% was incinerated, and 20% was recycled. The United Nations Development

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Program suggests that *"500 billion plastic bags are disposed of and 13 million tons of plastic is washed into the oceans each year. Every minute one million plastic bottles are bought, and every year 100,000 marine creatures are killed by plastic waste. Plastic takes hundreds of years to degrade in the environment. Up to 90% of bottled water and 83% of tap water were found to contain plastic particles, with plastics comprising 10% of all human waste."* (Taylor, 2018).

Plastic consumption is a behavioural issue. Environmentally-friendly behaviours are a function of social norms, attitudes, and perceived behavioural control. These behaviours, such as public littering can be further influenced by a lack of public infrastructure, coupled with the infrequent collection of waste from low-income households and rural areas where services are not readily provided (Fang, 2017). Thus, transforming the existing knowledge, attitudes and practices of people is central to addressing this problem.

Currently, plastic waste in rural riverine communities is disposed of in pits or large open spaces, from where it accesses rivers and streams, which are also used as illegal sites for dumping plastic and other solid waste. Common alternatives, such as the open burning of plastic waste cause air pollution and the release of carbon, which is the driver of climate change. Changing public behaviour to improve public hygiene and sanitation is not straightforward. Although there are regulations promulgated by the Royal Government of Cambodia to manage the effective management of plastic waste, law

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enforcement is weak in rural areas, and it is difficult to prevent haphazard disposal practices (Kumar et al., 2018).

In April 2018, the Ministry of Environment (MoE) introduced a new system, where people would be charged 10 cents per plastic bag at major supermarkets in Phnom Penh, such as Aeon, Bayon, and Lucky (UNDP, 2018). However, local markets, small grocery stores, and restaurants still provide plastic bags without charge and their consumption has not been significantly reduced. Plastic that is disposed of in the natural environment causes ongoing damage. Single-use plastics are easily carried long distances to oceans (Slavikova, 2018). They block stormwater drains, leading to flooding problems during the rainy season. Even the proper disposal of plastic wastes in landfills can take 400 years to completely degrade.

A study conducted across the 24 provinces, including 26 towns under provincial supervision has identified that Cambodia's waste collection services tend to be provided by private companies that operate in central urban areas only. In some towns, trash is collected from markets and residences (UNCRD, 2017). While reliable data on solid waste generation in urban areas is not available, it is evident that waste collection and disposal at provincial dumpsites is variable. Plastic waste generation has been recognized as one of the most significant environmental issues by a growing world alliance of more than 1,000 organizations and businesses (Testa, 2020). Thought leaders in 60 countries are working toward a world free of plastic pollution and its toxic impact on humans, animals, waterways, the ocean, and the environment.

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There is a need for trash to be disposed of properly and for people to reduce the number of plastic products their use.

In rural areas of Cambodia plastic waste tends to be burnt, buried, or illegally dumped (Denney, 2016) resulting in negative impacts. Promoting Individual awareness to think about *one's behaviour* is key to responding to this problem. It is important to understand the key determinants of the knowledge and attitudes of the community to lead these thought processes (Seng et al., 2018). A particular focus should be the creating awareness among local communities about the need for reduced plastic consumption and recycling among children who may share this knowledge of plastic with their families. This is a most critical issue in the riverine communities of Cambodia. As such, this research has three main objectives: 1) to examine the current situation of the plastic consumption in the riverine communities in Cambodia, 2) to assess the knowledge, attitudes, and practices of local people related to regarding plastic consumption and its negative environmental impacts, and 3) to advocate for necessary changes to how plastic waste is managed in these communities.

Cognitive-behavioural therapy for reducing plastic consumption

This research adopts a framework that employs the concept of cognitive-behavioural therapy (see Figure 1) to analyze the behaviour, awareness and capacity of local people regarding plastic management (Beck, 2011). This analysis of the behaviours, knowledge and practices related to how local people consume, collect, and reduce the use of, and dispose of plastic is important. It is key to building the capacity of the local people via awareness-

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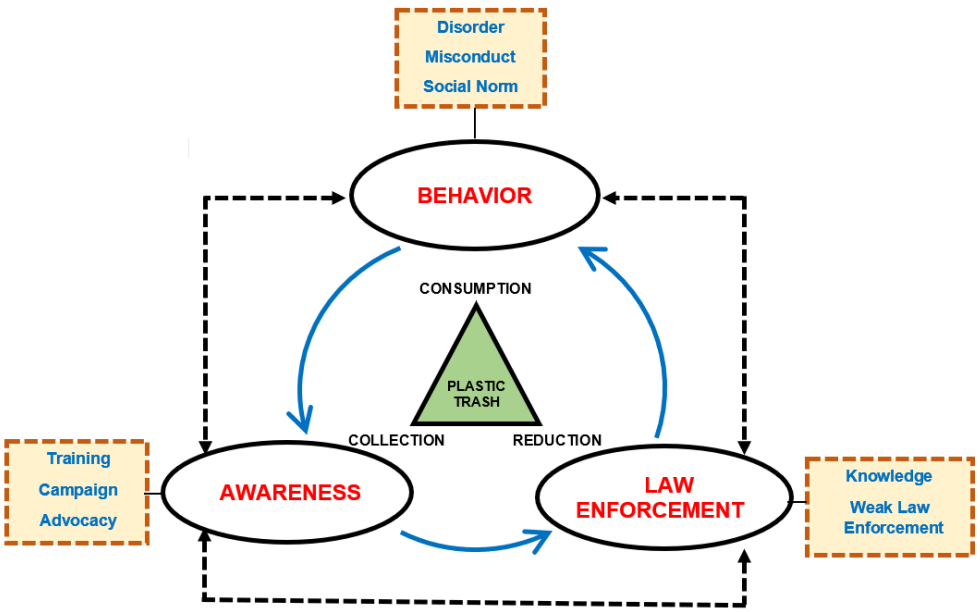
raising, campaigns, and public advocacy about the problem. Additionally, community-led interventions in the collection and disposal of plastic bags and law enforcement may also help improve plastic management behaviours.

Figure 1. Cognitive-behavioural therapy conceptual framework adapted from Beck (2011)



Research Methodology

The study adopted both exploratory and descriptive approaches to responding to the research questions. Data was collected using a survey and participatory field interviews about plastic consumption, waste disposal, public awareness, and the behaviours of local people related to the consumption and disposal of plastic waste. The face-to-face interviews interview questions were prepared in advance. In addition, a case study on one village was developed, highlighting the efforts made to improve levels of

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participation in more effective waste management practices with a focus on plastic waste.

Kampong Cham is one of the most populous provinces in Cambodia, located 40 km to the northeast of the capital city, *Phnom Penh*. It is situated at the mouth of the *Tonle Sap* near the Mekong River, which flows along the eastern border shared with *Tboung Khmum* province. Two communes in *Kang Meas* District of Kampong Cham were selected for the study, *Kang Ta Noeung* and *Roka Ar*. These communes are located along the bank of the Mekong River and are seasonally inundated each year during the rainy season. During these events, solid waste that has been littered on the roadside and low lying locations in each commune is washed into the river by the floodwaters.

The two communes were purposively selected to provide a comparison of waste management behaviours. *Roka Ar* commune is a moderately populated agricultural area, while *Kang Ta Noeng* commune is more densely populated with a local market and commercial activities, which consume a greater volume of plastic bags and produce more plastic waste. The two communes are similarly affected by seasonal flooding. The location of the two communes within Kampong Thom is outlined in Figure 2.

The sample size of the interview cohort was selected using a formula proposed by Yamane (1967) employed for identifying a statistically significant cohort. An acceptable sampling error of +/- 9 % was deemed appropriate. In 2017, there were 2,512 households in *Kang Ta Noeng* Commune and 2,199 Households in *Roka Ar* Commune (MoP, 2017). Thus 235 households were

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selected to participate in the interviews in the two study communes based on the formula below:

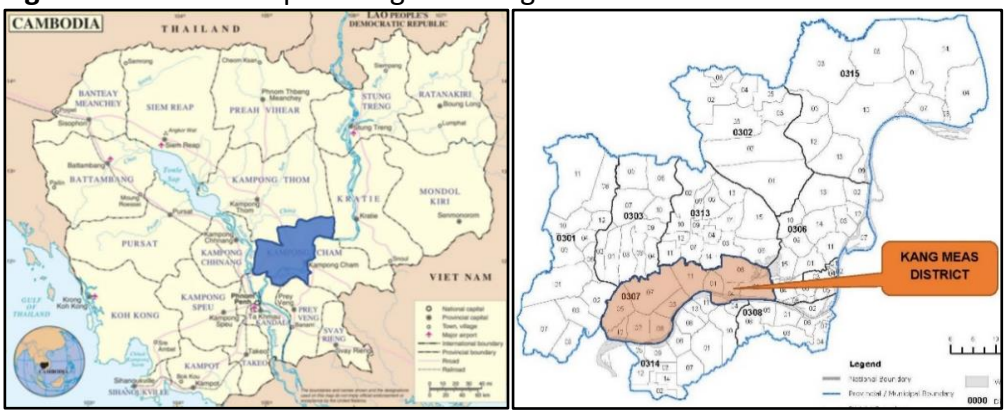
$$n = \frac{N}{1+N*(e)^2}$$

n = Sample Size

N=Total number of households

e =Level of precision (9%)

Figure 2. Location map of Kang Ta Noeng commune and Roka Ar commune



Both qualitative and quantitative data were analysed. The quantitative data was accessed through household interviews and a questionnaire. Qualitative data from the key informant interviews and focus group discussions were also analysed.

Results and Findings

Household plastic consumption in riverine communities

Respondents from each commune frequently go to the market to purchase goods for daily consumption. The frequency of these visits was not consistent but dependent on the needs of each household, income levels, and interests. Approximately 57.0% of respondents visited the market daily,

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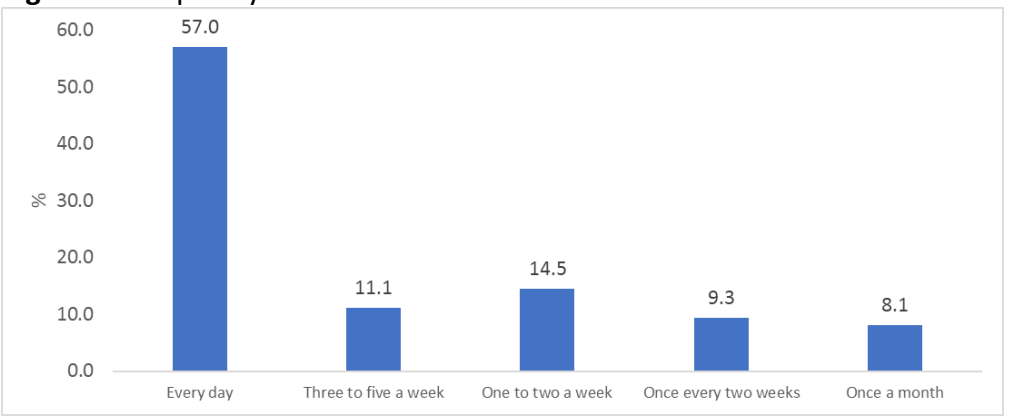
11.1% visited the market 3-5 times a week, 14.5% visited the market 1-2 times a week, 4.7% visited the once every two weeks, 8.1% visited the market monthly, while 4.7% visited the market less frequently than this. These results are shown in Figure 2.

Figure 2. Frequency of visits to the market



Interviewees were also asked about their purpose for using plastic bags. Respondents indicated that they are used to carry various items from the markets including water bottles or other drinks (20.4%), ready-to-eat food from vendors (15.3%), meat and fish (45.1%), fruit and vegetables (13.2%), bread or other bakery items (1.7%), clothes and/or shoes (0.4%), and other goods (3.8%). These results are shown in Figure 3.

In response to the question *"Where do you use plastic most frequently?"*, 48,9% of respondents indicated the grocery store, 21.7% indicated fish and meat shops, 15,70% indicated the supermarket, 13.2% indicated vegetable and fruit shops, while 0.4% indicated that they use plastic most frequently for garbage disposal. As the study area is not a large urban area, there is an absence of supermarkets, thus grocery stores have a larger share of retail

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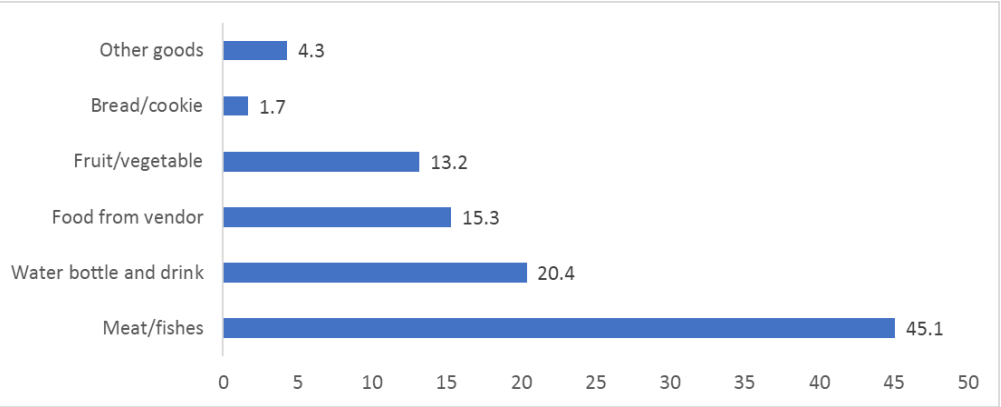
business. In rural communities, people tend to purchase meat and fish from local markets. Many people grow vegetables and fruits in their house, thus purchases of vegetables and fruit are less frequent than in urban areas. Water and drinks are other items commonly purchased from vendors in rural riverine communities. The results for the question are shown in Figure 4.

Figure 3. The purpose of using plastic bags



Data about the weekly consumption of plastic bags per household were also collected. There was not a large difference between the two communes in the study. Overall, 23.4% of respondents consumed ten, or less than ten bags per week; 47,2% consumed 11 to 30 plastic bags per week, 17.0 % consumed 31 to 50 bags per week, and 12.3% consumed more than 50 plastic bags per week. The average weekly consumption of plastic for all households was 27.6 bags with a standard deviation of 21.1 bags. Table 1 displays the disaggregated results for the weekly consumption of plastic bags in *Kang Ta Noeng* and *Roka Ar* communes.

Several variables were tested to determine whether there was a significant correlation between levels of correlation between plastic bag

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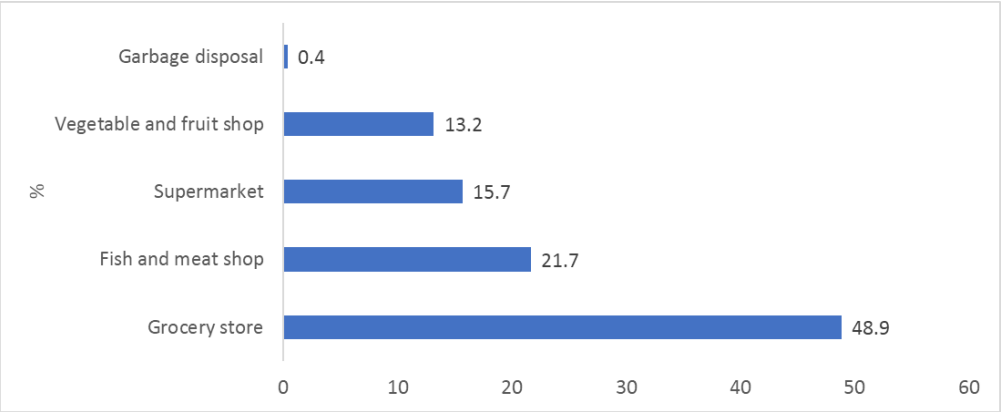
consumption and factors such as age, level of education, number of household members, and net income.

Figure 4. Sources of plastic consumption



Household income was found to be the most significant indicator of plastic bag usage (P-*value*=0.010). Households with higher incomes were found to tend to use plastic bags more frequently, while factors such as age, level of education and number of household members were much less significant. These results indicate that respondents lacked knowledge of the impacts of plastic bag usage and consume as many as their income allows. The correlation between weekly plastic bag consumption and various indicators is shown in Table 2.

Figure 5 goes into more detail about the correlation between household income and the number of plastic bags consumed per week. The relationship is strongest for levels of weekly plastic bag consumption of up to 20 plastic bags. The majority of people using less than 20 plastic bags were found to have a meagre household income of less than 1,000 USD per month, whereas

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levels of income were more evenly distributed for higher rates of consumption.

Table 1. Number of plastic bags consumed per week

Attributes (%)	**Kang Ta Noeng**	**Roka Ar**	**Overall**
0-10 Bags	21.2	25.6	23.4
11-30 Bags	50.8	43.6	47.2
31-50 bags	16.1	17.9	17.0
51 Bags and above	11.9	12.8	12.3

Table 2. Correlation between weekly plastic consumption and various indicators

Attributes	Pearson Correlation	P-value
Age	-0.032	0.620
Education	-0.005	0.945
Household Members	-0.031	0.639
Household Income	0.167	**0.010****

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Knowledge regarding plastic consumption

Data about the knowledge of participants regarding plastic consumption was collected. A weighted average index was used to rate the degree of knowledge the household had obtained about plastic consumption on a five-point scale: (1) highly agree; (2) agree, (3) moderately agree; (4) disagree; (5) strongly disagree. Further, a t-test was also conducted using these five indicators. The results indicate that there was a moderate level of knowledge about the bio-degradability of plastic bags in *Kang Ta Noeng* (0.45) and a low level of knowledge in *Roka Ar* (0.37). There was a moderate level of the fact that single-use plastic bags take between 20 and 450 years to decompose

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(WWF, 2021) (0.46 for both communes). These results are summarised in Table 3.

Figure 5. Correlation between household income and weekly plastic bag consumption

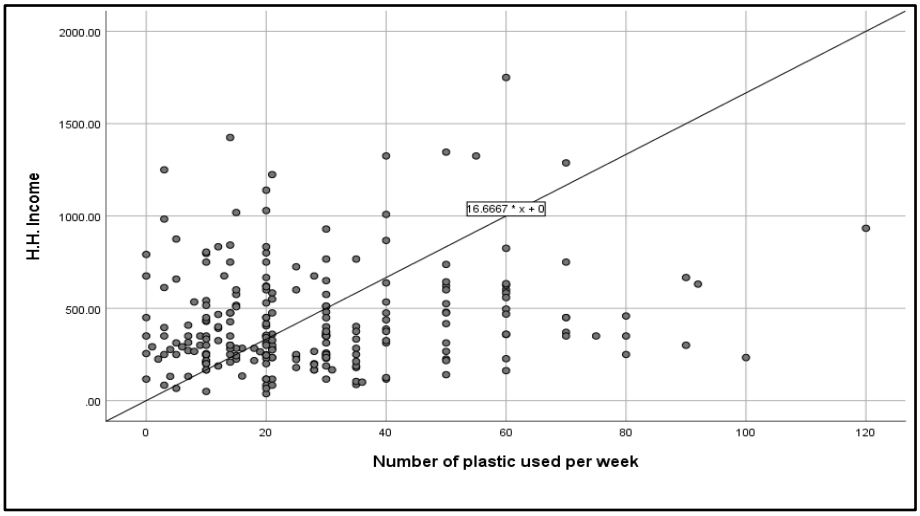

Table 3 Level of knowledge about plastic bag consumption among respondents

Indicators	**Kang Ta Noeng** (n=118)		**Roka Ar** (n=117)		**Overall** (n=235)		**P-*value***
	WAI	OA	WAI	OA	WAI	OA	
Degradable	0.45	M	0.37	D	0.41	M	***0.000******
Decomposed in 20-450 years	0.46	M	0.46	M	0.46	M	***0.000******
Global issue	0.36	D	0.38	D	0.37	D	***0.000******
Burning plastic bags pollutes the air	0.43	M	0.46	M	0.44	M	***0.000******
Fish poisoning	0.63	A	0.64	A	0.63	A	***0.000******
Burning in public area	0.68	A	0.78	A	0.73	A	***0.000******
Policy to charge 20 cents per plastic bag	0.74	A	0.70	A	0.72	A	***0.000******

Notes: WAI = Weight Average Index measured on a five-point scale [Strongly disagree (SD) = 0.00-0.20, Disagree (D) = 0.21-0.40, Moderate (M) = 0.41-0.60, Agree (A) =

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0.61-0.80, Strongly Agree (SA) = 0.81-1.00]; OA= Overall Assessment; *Significance at the 0.05 level; **Significance at the 0.01 level.

Households in *Kang Ta Noeng* and *Roka Ar* were found to have poor levels of knowledge about the adverse environmental impacts of plastic bad consumption and plastic waste. For instance, it was known that plastic waste may cause fish poisoning, which may eventually impact humans. They also believed that because of this knowledge, it is necessary to improve the current situation and leave a clean environment for the next generation. Thus, a policy of charging 20 cents for each plastic bag taken from a shop was generally agreed with. However, out of 235 respondents, only 89 had sufficient knowledge of plastic management to be driven to make further changes to their behaviour. Up to 146 research participants have insufficient levels of knowledge to influence them to change.

Table 4. Comparison of sufficient knowledge and previous awareness raising

Attributes	**Have you ever received any form of awareness-raising regarding plastic management?**			***X²***	**P-*value***
		Yes	No	Overall		
Do you have sufficient knowledge of plastic waste management?	Yes	25	64	89	21.480	***0.000******
	No	9	137	146		
	Overall	34	201	235		

***P-*value*=0.000 is perfectly significant between awareness-raising and knowledge of plastic even though the respondents were not known enough.

To further analyse this result, three tables were created and analyzed to compare the cohort with sufficient knowledge and the cohort without sufficient knowledge. Each cohort was asked to answer questions about whether they 1) had engaged in previous awareness-raising training activities

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2) would accept if a seller did not provide them with a plastic bag 3) would be willing to pay for a plastic bag when making a purchase. The responses to these questions from the different groups are analyzed below.

In response to the first question, *have you ever engaged in previous awareness-raising training activities*? Of the 89 respondents who had sufficient knowledge of plastic waste management, only 25 indicated that had previously engaged in awareness-raising training activities. Meanwhile, among the cohort of 146 who had insufficient knowledge of plastic waste management, only 9 of them had engaged in these activities. The chi-square value of 21.48 and the asymptotic significance value of 0.000 are summarised in Table 4 above. These results indicate that accessing awareness-raising training is significant in improving knowledge. Thus, to reduce plastic consumption and to improve attitudes to the disposal of plastic waste, it is recommended that these activities are provided to households at regular intervals until there is a sustainable improvement.

In response to the second question *Would you be accepting if a seller did not provide a plastic bag?* Of the 89 respondents who had sufficient knowledge of plastic waste management, 38 would not be accepting if a seller did not provide a plastic bag to them. For the cohort of 146 respondents, who did not have sufficient knowledge of plastic waste management, 94 would not be accepting of this practice. Table 5 demonstrates that the chi-square value calculated was 10.563, with an asymptotic significance of 0.000. This suggests that having sufficient knowledge of plastic waste management is essential for reducing the demand for plastic consumption.

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Table 5. Comparison between sufficient knowledge and acceptance of not giving the plastic bag

Attributes	**When you buy something, If the seller does not give you a plastic bag, do you accept this?**				X^2	**P-value**
		Yes	No	Overall		
Do you have sufficient knowledge of plastic consumption?	Yes	51	38	89	10.563	***0.000******
	No	52	94	146		
	Overall	103	132	235		

***P-*value*=0.000 is perfectly significant.

In response to the question *Would you be willing to pay for a plastic bag when buying something?* Of the 89 respondents who had sufficient knowledge of plastic waste management, 43 would be willing to pay for plastic bags when buying something. This was higher than 26 respondents from the cohort of 146 respondents who did not have sufficient knowledge of plastic waste management.

Table 6. Comparison of sufficient knowledge on plastic consumption and willingness to pay for plastic bag

Attributes (%)	**Are you willing to pay for plastic bags when you buy something?**				X^2	**P-value**
		Yes	No	Overall		
Do you have sufficient knowledge to manage plastic bags?	Yes	43	46	89	24.810	***0.000******
	No	26	120	146		
	Overall	69	166	235		

***P-*value*=0.000 is perfectly significant.

Table 6 demonstrates a calculated chi-square value for this test of 24.810 and an asymptotic significance of 0.000. This comparison demonstrated that knowledge of plastic waste management did not have a significant impact on whether a respondent would be willing to pay for a plastic bag. This indicates that willingness to make these payments is dependent on the attitude, rather

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than the knowledge of respondents. Many of the respondents with knowledge of plastic waste management still refused to pay the fee.

A further analysis was conducted to assess the correlation between the price paid for plastic bags and the maximum price desired. Some respondents had experience paying between 100 riels (2.5 cents) and 500 riels (12.5cents) for one plastic bag. These respondents indicated that they were willing to pay the maximum price for one plastic bag. These prices are shown in Table 7.

Table 7: Maximum price willing to pay for a plastic

Attribute (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
Nothing	31.4	29.1	30.2
100-500 (12.5 Cents-)	67.8	66.7	67.2
600-1000 (25 Cents)	0.0	2.6	1.3
1100-above	0.8	1.7	1.3

The pricing of plastic bags should be selected carefully. If the price is too low, it will be easily afforded and will be unlikely to reduce the consumption of plastic bags. This will lead to the fee eventually becoming ineffective. To effectively reduce plastic consumption, there is a need for a study on a realistic adaptive pricing strategy for plastic bags to enable feasible law enforcement for all sellers in small businesses in the future.

Attitude towards plastic waste management

In response to the question, *Why do you use plastic bags?* 40.4% of respondents indicated that they did because everybody does; 33.6% of respondents suggested it was because they were light and durable; 17.4% suggested that there were no other materials to replace plastic bags, 5.1%

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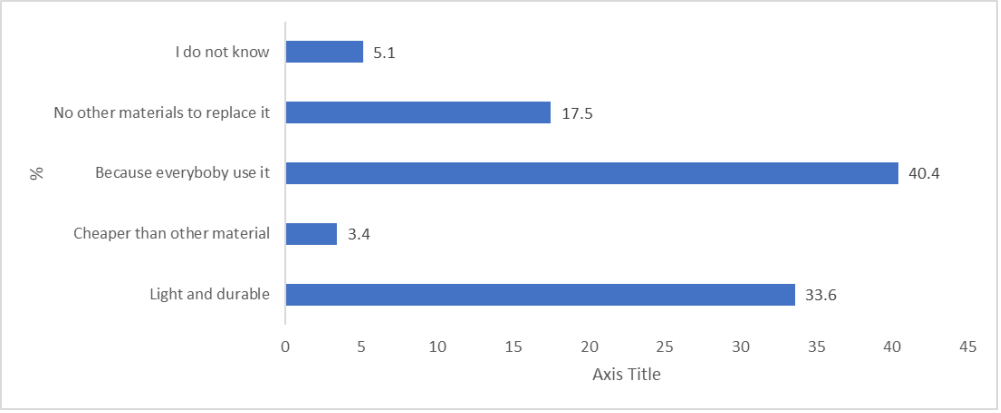
said that they did not know; while 3.4% responded that plastic bags were cheaper than alternative materials. These results are summarised in Figure 6.

Figure 6. Reason for using plastic



The above results suggest that plastic bags are popular and have the advantage of being lightweight and strong. There are no readily available materials for replacing plastic bags at a comparable price, which makes it difficult to replace them. This makes it harder to change plastic consumption behaviours. The attitudes and behaviours of those who littered with plastic after use were then analyzed. Of this cohort, 47.2% did not believe that this behaviour mattered; 34.9% thought that someone in the community would eventually collect plastic waste; 13.6% expected somebody else would collect it, and 1.3% believed that the waste would biodegrade naturally. A further 3% did not understand the question.

Others suggested that plastic waste was rarely seen after seasonal flood events. This is a serious environmental issue as plastic bags dispose of near the Mekong River are often washed down the river towards the ocean during

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the wet season. Table 8 presents a summary of the attitudes held towards littering with plastic in the study area.

Table 8. Attitudes towards littering with plastic waste

Attributes (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
Disappear natural	0.0	2.6	1.3
Somebody will collect	17.0	10.3	13.6
Community will collect	37.3	32.5	34.9
No mater	45.8	48.7	47.2
I don't know	0.0	6.0	3.0

Table 9. Feeling of regret when littering with plastic bags

Attributes (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
I feel very sorry as I did a terrible thing	56.8	59.0	57.9
I feel a little sorry, but I have no other solution	31.4	31.6	31.5
It is my habit to throw outside	10.2	6.8	8.5
I feel I did the right thing	1.7	0.0	0.9
Cleaning is a government responsibility	0.0	2.6	1.3

Even though many people litter with plastic waste in public places, many indicate that they do not feel they have done the right thing. After throwing out used plastic in a public place, 57.9% suggested that they had done a terrible thing; 31.5% suggested that they felt a little sorry as there was no other solution; 8.5 % suggested that this was a usual or regular habit; 1.3% suggested that this was a job for the government or community to control;

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while 0.9% mentioned that they felt no sorrow. Table 9 summarises these results.

Most people (89.4%) who littered public places with plastic waste felt sorry in their minds but continued with this behaviour as no collection service was available. Thus, if these behaviours are to change, it is necessary to provide proper waste collection and disposal systems, with community involvement, initiated by representatives at the commune and village level.

Practices following plastic consumption

Practices after plastic consumption depend on the respondent and their environment. Overall, 47.2% of respondents indicated that they throw plastic waste into a river or stream; 34.9% bring used plastic waste home to home to reuse or dispose of using a waste collection service; only 13.6% use a public garbage bin; while 1.3% throw away public waste immediately after it has been used. Along the Mekong River, many respondents find it easy to throw plastic bags into the river or stream as it is washed away during the rainy season. This practice is readily observed in the study area, with large quantities of plastic bags thrown into canals and under bridges. These results are summarised in Table 10.

As there is no garbage collection system in either commune, participants were asked how they manage plastic waste. Overall, 48.5% of respondents indicated that they burn their plastic bags and other waste in their house or open public space; 6.0% dump garbage on low-lying land or roadsides near their house; 13.2% of them throw the garbage into the nearby waterways or rivers; 3.4% bring their garbage to the public collection point, while a further

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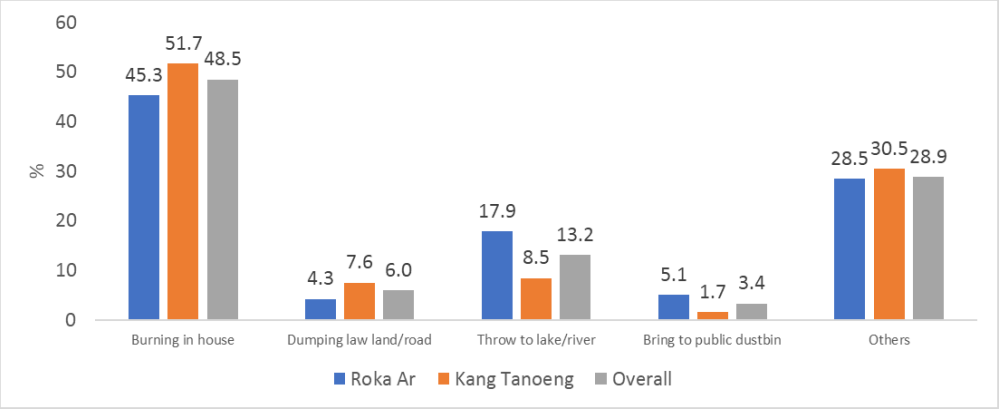
28.9% did not provide a specific answer to this question. These results are summarised in Figure 7.

Table 10. Disposal practices after using single-use plastics

Indicator (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
Throw immediately on the road or open space	0.9	1.7	1.3
Throw in the public dustbin	12.7	14.5	13.6
Bring back to my house and reuse or throw away	38.1	31.6	34.9
Throw into the river/lake	46.6	47.9	47.2
Others, specify	1.7	4.3	3.0

Figure 7. Disposal practices after plastic consumption



Management of plastic consumption

Many respondents expressed concern about future environmental problems if the current situation of disposing of plastic waste is continued without any government intervention. Overall, 62.1 % of respondents thought the community would become increasingly unclean; 16.2% worried about health problems associated with burning plastic; 12.8% were concerned

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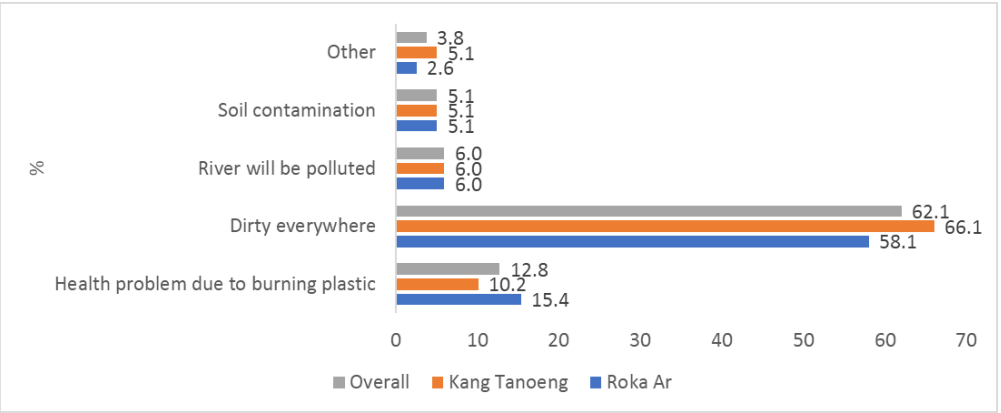
about the river becoming more polluted; 5.1% were primarily concerned about soil contamination; while 3.8% had a different response. These results are summarised in Figure 8.

Figure 8. Future problems without improved plastic waste management



In response to the question *What is the most urgent need for improving waste management,* 55.3% of respondents suggested regular collection of waste was required; 25.5% suggested that community waste disposal sites were necessary; 9.4% referred to the need for proper education and training provided by the government; 7.2% suggested that the community needs to be active in initiating community movement to clean the environment; 0.9% suggested that new policies were required from the RgoC; while 1.7% provided a different response. These results are summarised in Table 11.

In response to the question *If a recycling program was set up, would you be willing to separate your plastic waste into separate bags for collection purposes?* 86.8% of respondents agreed to participate in the separation collection program; 10.2 % suggested that they were unsure, as they did not know precisely what the program would involve; while 3.4% suggested they

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would not agree to participate in the program. Most people would welcome RGoC policy and campaigns for the improvement of the current waste management system within the local government. Table 12 summarises these results.

Table 11. Most urgent need for improving waste management in the commune.

Attributes (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
Regular collection of waste	54.2	56.4	55.3
Public dumping site	29.7	21.4	25.5
Education and training	6.8	12.0	9.4
Community campaign	6.8	7.7	7.2
Government Policy	0.0	1.7	0.9
Other	2.5	0.9	1.7

Table 12. Intended participation in a recycling program

Attributes (%)	**Kang Ta Noeng** (n=118)	**Roka Ar** (n=117)	**Overall** (n=235)
Yes, I will do	86.4	87.2	86.8
No, I don't want to do	3.4	4.3	3.8
Not sure	10.2	8.6	9.4

Respondents indicated that they would be willing to participate in a program that separated plastic waste for recycling. If adequately recycled, plastic bags can be repurposed to produce composite lumber as a base material for decks, benches, and playgrounds. Plastic bags can also be reprocessed into small pellets, which can be made into new plastic bags, containers, crates, and pipes. Recycling may help to conserve natural resources, keep roads, streets, streams, and rivers clean, and protect wildlife

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by properly separating and collecting plastic bags instead of burning or burying them in a landfill.

Interviews with the two commune chiefs revealed that plastic bags were commonly used by shops and food stalls. They mentioned they often communicated with villagers advising them not to throw plastic bags in public places but it was difficult to prevent this behaviour as the commune was too large to manage. They also suggested that they had not considered using information about the knowledge, attitudes, and behaviours of villagers to plan their activities in the past.

Beyond the household interviews, two focus group discussions were also conducted to further clarify the situation regarding plastic bag consumption and waste management. Three men and three women from each commune were selected for the group discussion. In *Kang Ta Noeng*, households had advised every shop in the commune that they expected them to provide plastic bags free of charge when they made purchases. This advice was consistent with habits and existing practices for both sellers and customers. Nobody is required to bring shopping bags to the market. After using plastic bags, the participants advised that they did not have a pre-determined place in which to dispose of the plastic bags. Thus, households tend to throw them in open public spaces or on the Mekong River.

The commune officer mentioned that he often advised people not to dispose of plastic bags in public places, yet the households suggested that they had little choice to do this, beyond burning them or throwing them into the river. In *Roka Ar*, householders mentioned that people commune throw

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plastic bags into public spaces or burn garbage without thought. Most used a strategy of collecting plastic waste and throwing it into the river. There is a branch of the Mekong River in the centre of the commune, which is deep. Households tend to use this branch as a disposal place. A local NGO was also consulted about institutional activities used to reduce plastic bag consumption. During this discussion, it was suggested that the current situation may be improved by classifying types of recyclable waste into three groups, then transferring the national budget to allocate local authorities to manage waste in the commune. Training may be provided on plastic waste management, funded by charging an additional cost for using plastic bags in the marketplace.

Discussion

The results presented in the previous section are of practical importance in understanding the attitudes and behaviour of respondents from two riverine communities in Cambodia towards plastic consumption and plastic waste management. This has been used to answer the following research questions.

What is the current situation regarding plastic consumption and plastic waste management in rural riverine communities in Cambodia?

People living in the two communes go to the market frequently to access goods for their daily consumption. As the study area is not an urban area, there are no supermarkets. Thus small grocery stores supply the majority of the retail products in the two communes. The overall average weekly consumption of plastic bags per household in the two communes is 27.6 bags, with a standard deviation of 21.1. There was no remarkable difference in

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plastic consumption between each commune. Household income was found to be the most significant indicator of plastic bag consumption, whereas other factors such as age, education, and the number of household members had less influence on the consumption rate. Villagers tend to consume more plastic if they have the financial resources to do so. These indicate a lack of knowledge among villagers and a need for training activities that raise awareness of plastic waste management, community-led efforts, and enhanced law enforcement to reduce plastic bag consumption.

To what extent are local people be aware of the significance of plastic management in riverine communities?

Plastic bags and other waste are regularly burned by households, with no law enforcement implemented to discourage such actions. Only 89 out of 235 respondents, were found to have sufficient knowledge about the need for plastic waste management. When there is low awareness of the impacts of poor plastic waste management, it is difficult to improve the situation. The research found that awareness-raising activities targeted at local people would provide sufficient knowledge on plastic waste management to reduce the consumption of plastic bags and improve the attitudes towards the disposal of plastic waste. These activities would be required to be provided at regular intervals to be sustainable. It was found that when households disposed of plastic waste in public spaces, 89.4% of respondents felt sorry in their minds, but continued to do so as there was no alternative garbage collection service. Overall, 46.6% of households in the rural riverine communities studied admitted to throwing single-use plastic waste into rivers or lakes, while 48.50% of respondents burned plastic waste at home.

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What role does the RGoC play a role in promoting plastic waste management?

Overall 62.1% of households surveyed indicated that they were concerned that their communities might become more unclean in the future if there is no improvement in the collection and disposal of plastic and other solid waste. However, several constraints prevented this from occurring. These factors were closely examined to inform the research about possible interventions that may be utilised in this context. As the study was conducted in riverine communities, villagers tended to throw plastic waste into the rivers or streams as this waste would be washed away during the rainy season.

Householders indicated that an appropriate alternative would be for local authorities to provide public dumping sites near the village to improve plastic waste management. This was described as an urgent need that would enable waste to be collected more regularly in a convenient location. Moreover, 86.4% of householders indicated that they would be willing to participate in a trial program designed to separate plastic waste for recycling. Recycling is a strategy that may help to conserve natural resources, keeping roads, streams, and rivers clean. Thus, it is recommended that the RGoC trial this type of program.

It was found that plastic bags are popular because they are lightweight, strong and easy to carry. Currently, it is perceived that there are no alternative materials capable of replacing these resources. Thus, an effective way to mitigate their negative impacts is to reduce their consumption. Currently, only people who shop in supermarkets in larger urban areas pay for plastic bags. The RGoC should expand this policy nationally to include smaller retailers to trigger a more effective reduction in plastic bag consumption. The

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strategy used to implement this policy needs to be carefully considered as the effect of paying more for plastic bags is known the diminish over time (Haoran, 2010). Policies on charging fees for plastic bag consumption need to be coupled with long term efforts to enforce laws regarding plastic waste disposal to be effective.

Policy implications for promoting plastic waste management in Cambodia

The following recommendations are presented to the RGoC ad other supporting institutions to effectively reduce plastic consumption and improve plastic waste management practices in rural riverine communities in Cambodia.

- The *Ministry of Environment* should conduct research into the effectiveness of the current practices of charging for plastic bags in supermarket chains to guide the further expansion of this initiative to other small business activities to enhance the reduction of plastic bag consumption nationwide. Additionally, the Ministry should plan and provide awareness-raising training on plastic consumption and plastic waste management for rural riverine communities.
- The *Ministry of Interior* should develop a policy on plastic waste management and waste collection services that enables local authorities to effectively implement waste management systems at the commune level and seek to arrange access to necessary budgets to establish and operate these services.
- The *Ministry of Education, Youth and Sports* should include reducing plastic consumption, separation of plastic waste, and behaviours and

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practices related to effective plastic waste management in the school curriculum for elementary and secondary schools to raise awareness from an early age.

- *Provincial Governments* should provide a practical training program for community-based plastic waste management.
- *Local (Commune) Authorities* should prepare a guide on reducing plastic consumption and plastic waste management via public dumping sites located close to villages. Awareness-raising activities among local villagers should be conducted to reduce plastic consumption and change plastic waste management practices.
- *NGOs* should provide awareness-raising activities focused on the reduction of plastic consumption and plastic waste management. At the same time, NGOs should help to facilitate and support communities to conduct campaigns to clean plastic waste from areas along rivers.

The effectiveness of the current policies that charge fees for the use of plastic bags in supermarket chains should be reviewed and assessed for their efficacy in reducing plastic consumption. The price of various sizes of plastic bags should be considered carefully to avoid excessive consumption of plastic bags when customers purchase goods. If the fee is too low, it will not be effective in reducing consumption. Thus, it is necessary to conduct more detailed research to provide a logical framework by which the RGoC may implement effective policies to further reduce plastic consumption in the future.

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Conclusion

The research analyzed the knowledge, attitudes, and behaviours of people in the riverine communes in Cambodia related to plastic consumption and plastic waste management. Plastic waste in rural communities tends to be found illegally dumped in pits, rivers, and large open public spaces areas. A field survey found that burning plastic waste is a common practice in riverine communities, even though people knew it pollutes the air causing climate and human health impacts. But the evolution of behaviour is not easy, although there are regulations and laws in force by the RGoC.

A sample of 235 households from two communes in *Kang Meas* District in *Kampong Cham* was selected to participate in interviews to collect primary data. It was found that respondents used plastic to carry various items from the markets in each commune. The average weekly consumption of plastic bags was found to be 27.6, with a standard deviation of 21.1. Most respondents (40.4%) indicated that they used plastic bags because everybody else does. Moreover, 33.6 % said they were used because they were light and durable. After disposing of plastic waste in a public place, 57.9% of respondents felt that they had done something terrible, while 31.5% felt a little sorrow as there were no viable alternatives. When disposing of plastic waste, 47.3% of respondents admitted throwing it into rivers or lakes, while 34.9% brought the waste home to later dispose of or reuse it. There was no existing waste management system in either commune.

Regarding the management of plastic waste, 48.5% of respondents indicated that they either burn it at their house or in open public spaces, while

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13.2% of respondents throw plastic waste into the nearby canals or rivers. A greater number of households throw plastic waste into rivers in *Roka Ar* Commune than in *Kang Ta Noeng* Commune. Overall 6.0% of respondents reported that they dump plastic waste on low lying land near their houses. Only 3.4% of respondents bring plastic waste to public collection points.

Most respondents expressed concern about future environmental problems if the current waste management situation continues without any government intervention. Many (55.3%) suggested the more regular collection of waste; 25.5% suggested that public dumping sites need to be provided close to the village; while 9.4% suggested a need for public education and training. The research activities found that people will continue to use plastic, and then burn it or dispose of waste in the river or low lying areas if no alternative waste management system is provided.

People tended to pay less than 500 riels (12.5 cents) for one plastic bag and considered this to be the maximum price they would be willing to pay. This price needs to be set carefully. If it is too low, it will be ineffective in reducing plastic bag consumption. Respondents indicated that they would be willing to participate in a program to separate plastic waste for recycling. Recycling may help to conserve natural resources and protect wildlife by properly reducing consumption, separating and collecting plastic waste instead of burning or burying it in the dumping site in the village.

The consumption of plastic bags will not be reduced if current knowledge, attitudes and practices of people in rural riverine communities are not responded to. Thus, the RGoC should expand the policy of charging a fee for

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the use of plastic bags to include small retailers in rural communities nationwide. To support the RGoC's decision making, a further study assessing the effectiveness of the current policy of charging a price on plastic bags should be conducted in future research.

References

Beck, Judith S. (2011) Therapy, Basics and Beyond, Second Edition, The Guilford Press, A Division of Guildford Publications, Inc., New York.

Carey, M. J. (2010). Intergenerational transfer of plastic debris by Short-tailed Shearwaters. *EMU-Austal Ornithololog*y, 229-234.

Chou, T. P. (2019). Impacts of Pollution on Marine Life in Southeast Asia. *Biodiversity and Conservation 2019 (4)*, 1063-1082.

Denney, L. (2016). *Reforming Solid Waste Management in Phnom Penh.* The Asia Foundation and the Overseas Development Institute.

Fang, Wei-Ta. (2017). *Normative Beliefs, Attitudes, and Social Norms: People Reduce Waste as an Index of Social Relationships When Spending Leisure Time.* Sustainability. Retrieved from https://www.mdpi.com /2071-1050/ 9/10/1696.

Haoran He et al (2010) "*The Effects of an Environmental Policy on Consumers –Lessons from the Chinese Plastic Bag Regulation*". Environment and Development Economics.

Kumar, S. R. (2018) *State of Waste in Phnom Penh, Cambodia.* Phnom Penh: UNEP.Retrieved from https://www.unenvironment.org/ietc/resources/ r eport/ state-waste-management-phnom-penh-cambodia.

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MoP, (2017) *CDB Nat 2017 (Commune database),* Ministry of Planning, Cambodia.

Scott, G. (2007) Plastic packaging and coastal pollution. *International Journal of Environmental Studies*, 35-36.

Seng, Bandith, Takhesi Fujiwara, & Vin Spoan. (2018). 'Households' knowledge, attitudes, and practices toward solid waste management in suburbs of Phnom Penh, Cambodia. *Waste Management & Research*, 993-1000.

Slavikova, S. P. (2018) *The negative impact of shopping for plastic bags on the environment.* Phnom Penh: Greentumble. Retrieved from https://greentumble.com/impact-of-plastic-bags-on-the-environment/.

Taylor, A. (2018) *World Environment Day 2018: Beat Plastic Pollution.*The Atlantic. Retrieved from https://www.theatlantic.com/photo/ 2018/06/the-theme-for-world-environment-day-2018-is-beat-plastic-pollution/562082/.

Testa, H. (2017) *Meet Incredible Teen Who Created Plastic Pollution Awareness Day to Inspire the World.* One Green Planet. Retrieved from https://www.hannah4change.org/ jakemartcorp.wordpress.com.

UNCRD. (2017) *November Report 2017.* Phnom Penh: UNCRD. Retrieved from https://www.uncrd.or.jp/content/documents/5686[Nov%202017]%20Cambodia.pdf.

UNDP. (2018) *Our plastic problem is out of control. Here is how we can fight it.* Phnom Penh: UNDP. Retrieved from https://www.kh.undp.org/conte

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nt/cambodia/en/home/presscenter/articles/2018/our-plastic-problem-is-out-of-control--here-s-how-we-can-fight- i.html.

UNDP. Cambodia (2019). *Plastic pollution in Cambodia.* Phnom Penh: UNDP Cambodia.Retrieved from https://www.khkundp.org/con_tent/cambodia/en/home/projects/our-action-for plastic-pollution-cambodia/how-you-can-help-tackle-plastic.html.

WWF Aaustralia (2021) The Life cycles of Plastics, Retrieved from https://www.wwf.org.au/news/blogs/the-lifecycle-of-plastics.

Younan, Sarah & Jade, Jenkins (2020) Reality Check: Adding Plastic to Natural History. *Journal of Museum Education*, 42-51.