

# **Differential public support for waste management policy: The case of Hong Kong**

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## Abstract

Gaining public support for environmental policy can promote pro-environmental behaviors and facilitate policy implementation. A telephone survey was conducted in Hong Kong to solicit 504 respondents' level of support for different waste management policies and to investigate the role of key socio-demographic variables in influencing the level of support for these policies. Data was examined by using multivariate analysis of variance (MANOVA). Findings revealed that variance in policy support for different measures differs significantly across gender, age groups, and education level, while household size and political inclination exhibited less association with support for the policies. Respondents also indicated a varying level of support across policy tools, with policies of developing recycling industry and extending Producer Responsibility Scheme received more support, but municipal solid waste charging scheme and publicity and education measure were less welcomed by respondents. Our analysis infers that current waste management framework should be driven toward a more coherent mode in order to secure greater public support and maximize policy effectiveness. Policy implications could be applied to waste management framework development in cities which share similar background with Hong Kong.

### 1. Introduction

Public support is a key to successful implementation of waste management policy and policy goal achievement (Wan et al., 2015, 2017). It is particularly significant for environmental policies which emphasize active public participation, such as recycling and recovery measures. Most previous research examined public support for waste management strategies by using single measurement (e.g., Afroz and Masud, 2011; Brown and Johnstone,

2014; Dietz et al., 1998; Elliott et al., 1995; Gelissen, 2007; Saphores et al., 2006). Though there have been a considerable number of studies examining relationship between sociodemographic factors and the level of policy support, little research explores the level of support for different waste management tools and the differences in level of policy support across demographic variables in a single study. Previous studies also confined to measurement deficiency (e.g., single measurement) that the results only provide us with limited understanding of the issue. Given the above background, this research aims at investigating the level of policy support and socio-demographic effect on the public support for various waste management options with reference to Hong Kong. Empirical evidence of the level of public support across policies and socio-demographic factors that account for the variations could inform formulation of effective waste management strategies. It assists policy-makers to work out measures that are responsive to the public, thereby promotes public participation and facilitates policy implementation. The densely populated research context with scarce land resources available also gives a unique insight into countries which share similar background.

The study will first brief the study area and research background. Section 3 presents a review of the literature on policy support. Methodological details are given in section 4. Statistical results are reported in section 5. Section 6 is an extensive discussion of the results. Section 6.1 offers explanations for differential policy support across policies in relation to the phenomenon of uncoordinated waste management framework. Section 6.2 begins by comparing socio-demographic effect on the level of policy support with findings from previous studies; and put forward exposition of each finding by drawing reference to these studies. In section 6.3, a new framework toward a coherent waste management and policy relevance based on results are

proposed. We also provide suggestions on recruiting public support targeted at people with different socio-demographic backgrounds in section 6.4. The paper will end with a note on the issue of framework applicability to other cities.

## 2. Study area and research background

Hong Kong was selected as our study area. It is a densely populated city with over 7.3 million population living in a terrestrial area of 1105 square kilometers (Information Services Department, 2015). A large population, rapid economic growth, and consumptive culture have accelerated waste production, making waste management in the city a challenging problem than ever before. According to the Environmental Protection Department (2017b), the quantity of municipal solid waste (MSW) disposal had increased by 11.5% from 9114 tonnes in 2010 to 10,159 tonnes in 2015. Every Hong Kong citizen generated 1.39 kg of MSW per day in 2015. The city has the highest daily per capita MSW rate compared to neighboring cities, about 1.36 times and 1.77 times higher than Taipei city and Tokyo, respectively (Environment Bureau, 2013).

Over the past decades, the Hong Kong government has relied heavily on landfilling as its core waste management strategy. Approximately 65% of MSW is taken to landfills for disposal, with the rest being recycled (Environmental Protection Department, 2017b). Waste minimization and prevention policies by contrast have never emerged as a preferred solution to waste problems. Policy development of waste prevention is fragmented, not wellformed, and ineffective. For example, a territory-wide source separation program introduced in 2005 was only made as a voluntary basis. Under the program, 3-colored separation bins were made available to over 80% of population for encouraging recycling practices; but recycling rate of MSW between 2012 and 2015 remained at a low level of around 35%e39% (Environmental

Protection Department, 2017b). Regarding the producer responsibility scheme (PRS), only plastic shopping bag levy was fully introduced in 2015 since the enactment of Product Ecoresponsibility Ordinance in 2008. Regulations for other types of product including vehicle tyres recycling have not yet been implemented.

Owing to the fact that existing three landfills in Hong Kong are expected to reach full capacity by the end of this decade, in addition to space scarcity and escalating public opposition, landfilling is no longer a panacea for the impending municipal solid waste crisis. The government has recognized the urgency of shifting its waste management to a more sustainable direction and hence promulgated various initiatives in the latest blueprint for resources management (Environment Bureau, 2013). Policies promoting waste prevention and reduction to higher levels of the waste hierarchy have been rolled out to advance the waste management. For instance, along with enhanced financial support for the development of recycling industry, the government introduced a legislative proposal of producer responsibility scheme for waste electrical and electronic equipment (WEEE) and glass beverage containers into the legislature. Under the new direction of waste management, the public are required to make behavioral changes in response to meet the target of reducing 40% per capita MSW generation (Environment Bureau, 2013). Widespread public attention and support would be vital if waste avoidance and sustainable oriented waste management framework are to succeed (Xiao et al., 2017). It is this case calls for an in-depth examination of policy support for different instruments and optimal policy arrangements that could provide timely insight into gaining broader public support for the framework.

### 3. Policy support and waste management policy

Environmental instruments and regulations are set up for the purpose of mitigating deteriorating environmental problems and protecting the environment. Individuals showing policy support for environmental measures can be regarded as an indirect proenvironmental behavior (Kollmuss and Agyeman, 2002). It is a non-activist environmental significant behavior because people affect the environment indirectly through the means of exerting influence on environmental policies (Stern, 2000). The public may support or accept policies by making material sacrifice to achieve the goal of environmental protection, for example, individuals pay higher taxes or endorse increased spending on environmental issues; further, individuals may express support by way of voluntarily complying with policies or changing behaviors in private sphere in accordance with promulgated environmental guidelines and instruments (Stern et al., 1999).

Therefore, gaining policy support is an essential condition for the success of waste management because it enhances political feasibility of policy initiation and facilitates implementation of effective policy (Brown and Johnstone, 2014; Convery et al., 2007; Stern, 2000; Wan et al., 2015). New environmental policies would be easier to initiate if the authority is equipped with adequate public support (Rauwald and Moore, 2002). It is particularly significant for environmental policies with emphasis on waste separation and recycling programs which active public participation is required. Stern et al. (1999) pointed out that policy support is a barometer that can signal both authorities and industries about citizens' concerns about the environmental issues. The present study is an echo of the argument and emphasizes that policy support can serve as an analytical tool which by examining the level of public support for different policy instruments helps identify defects

of existing waste management framework; subsequently, policy-makers can recommend or fine-tune programs that would gain greater public support (Brown and Johnstone, 2014; Ladd, 1990).

Socio-demographic characteristics were frequently used by prior studies as explanatory variables of environmental policy support or willingness to pay for environmental protection. Age is a consistent predictor of policy support which younger generation in general is more prone to support for environmental policy than their older counterparts (Afroz and Masud, 2011; Brown and Johnstone, 2014; Dietz et al., 1998; Gelissen, 2007; Jones and Dunlap, 1992). Regarding gender effect, females were found to be more concerned about environmental problems (Blocker and Eckberg, 1989; Schultz et al., 1995; Triguero et al., 2016) and more willing to pay for environmental protection than men (Bartelings and Sterner, 1999; Stern et al., 1993). Education level is a less robust determinant. Some studies proved that educated people are prone to support increased environmental spending and committed as environmentalists (Barr et al., 2005; Brown and Johnstone, 2014; Dietz et al., 1998; Gelissen, 2007; Jones and Dunlap, 1992; Triguero et al., 2016), however a negative effect was found by Samdahl and Robertson (1989). Similarly, yet many studies proved that higher income results in greater support for environmental policy or involvement in pro-environmental behaviors (e.g., Elliott et al., 1995; Gelissen, 2007; Milovantseva, 2016; Oskamp, 1995), but not Chalcharoenwattana and Pharino (2016), Samdahl and Robertson (1989), Scott (1999) and Zeng et al. (2016). The mixed results may due to heterogeneous contextual background such as social, cultural, economic, political, and regional variation exist in these studies.

Previous studies used environmental spending or willingness to pay or a single policy item as a proxy for measuring the level of support for environmental policy (e.g., Dietz et al.,

1998; Gelissen, 2007). The reliance on proxy or single measurement may lead to inaccurate interpretation of public opinion on waste management framework, especially public's reflection on specific policy. Recently, Triguero et al. (2016) improved the measurement by adding the dimension of measuring policy support; the authors divided waste management solutions in terms of government responsibility, consumer responsibility, and producer responsibility, and evaluated respondents' preference for these options. However, it remains unclear the extent to which people incline toward a particular kind of waste management instrument. As suggested by Ladd (1990), data of public support for every policy tool is essential to recommendation of programs which can gain public support; and thereby it should have a place in future studies. In light of this, a further step was taken to investigate the level of policy support by measuring different kinds of policy instruments in this study. With reference to the socio-demographic factors, findings are expected to give an insight into the optimal combination of different waste management policies that would generate a broader public support and achieve greater effectiveness of waste management framework.

The current literature suffers from defective measurement for policy support and a lack of studies investigating sociodemographic effects in relation to a broad range of policy categories. This paper attempts to fill the gaps by analyzing the level of policy support of each waste management policy and social structures that govern people's support for these policies. The study would enable intelligences to accurately understand sociodemographic effects on policy support and grasp the overall level of support for different policy measures, with specific reference given to a densely populated city with limited land resources available and high volumes of waste generation. Explanations accounting for the variations will be examined and suggestions integrating the findings into the development of coherent waste management governance will be discussed. Results help formulate waste management



policies targeted at specific groups and adjust measures according to the level of policy support, and thereby enabling authorities to gain public support and implement waste management policies with greater success.

Table 1 Respondents' profiles.

#### 4. Methodology

##### 4.1. Questionnaire and variables description

With the aim of obtaining a higher response rate, telephone survey was chosen to collect data in this research. It enables interviewers to establish rapport and trust with respondents. Interpersonal communication offers both interviewers and respondents opportunities to clarify questions and answers, respectively. Subsequently, the survey tends to have a higher response rate that nonresponse error could be reduced (Fowler, 2014; Hine et al., 2016). It is also a cost-effective option compared to other methods such as face-to-face interview and mail survey.

The primary focus of this study examines the level of public support for different waste management policies, and how it varies across the population. A survey questionnaire consisting of two sections was developed for data collection. The first section solicited respondents' level of support for different policy measures. It contained eight policy items which were formed by drawing reference to current waste management policies (PS1, PS3, PS5PS7) and proposed initiatives (PS2, PS4, PS8) suggested by authorities in Hong Kong (Table 2) (Environment Bureau, 2013). Among the policy items, Recycling Fund for Industry (PS6) and

EcoPark (PS7) are specific to Hong Kong context. The former is a HK\$1 billion funding set up for local enterprises to upgrade and expand their waste recycling operations and for non-profit

organization to undertake recycling related projects. EcoPark is constructed by the Hong Kong government to provide rentable longterm land at affordable costs for local recycling industry. Since the main concern of this study is with policies that could promote pro-environmental behaviors, end-of-pipe measures such as landfilling were excluded for assessment. Respondents were required to rate each policy item by using a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). A higher score denotes respondents' more supportive attitude toward the policy measures.

Variables	Frequency*	Frequency#	Variables	Frequency*	Frequency#
	(%)	(%)		(%)	(%)
Gender			Education		
Male	43.70%	46.60%	Primary or below	7.30%	13.50%
Female	56.30%	53.40%	Lower secondary	10.94%	11.90%

Age			Upper secondary	32.19%	41.65%
18e29	21.96%	27.94%	Bachelor's degree	41.42%	27.69%
30e39	12.61%	20.79%	Master's degree or above	8.15%	5.26%
40e49	23.04%	18.24%	Household size		
50e59	26.74%	23.09%	1-person	5.04%	4.19%
60e65	15.65%	9.93%	2-person	16.67%	12.79%
Income			3-person	25.00%	26.98%
Below HK\$5000	27.02%	26.84%	4-person	36.62%	36.28%
HK\$5000e9999	7.85%	11.40%	5 p person	16.67%	19.77%
HK\$10,000e19,999	24.71%	29.45%	Political inclination		
HK\$20,000e29,999	17.55%	18.05%	Pro-democracy camp	22.72%	19.38%
HK\$30,000e39,999	7.39%	6.41%	Pro-localism camp	7.57%	8.61%
HK\$40,000 or above	15.47%	7.84%	Pro-centrist camp	35.86%	36.84%
			Pro-establishment camp	8.46%	8.37%
			No political inclination/Political	25.39%	26.79%

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neutral/Not belong  
to any camp

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Remarks:

(1) \*unweighted data; #weighted data.

(2) Lower secondary and upper secondary education in Hong Kong is equivalent to 7th-9th grade and 10th-12th grade of education in the United States, respectively.

The second section gathered respondents' socio-demographic background. Information about gender, age, education level, income level, household size, and political inclination was collected. Categorizations of each socio-demographic variable are presented in Table 1. Variables (i.e., age, income, education, household size)

were divided into subgroups by referring to the approach adopted by Census and Statistics Department, Hong Kong. Political inclination refers an individuals' political stance of public affairs. As illustrated, there are roughly four political alignments and they represent different positions on the political spectrum in Hong Kong. Generally, pro-democracy and pro-localism camps are more democratic and liberal whereas stance of pro-establishment camp is more conservative and pro-China; and pro-centrists position themselves in between these alignments. All information is necessary for the purpose of investigating the extent to which the level of policy support would vary accross respondents' sociodemographic background.

#### 4.2. Data collection and analysis

The sample was collected from a random household telephone survey conducted from July to August 2016. The fieldwork was conducted at 6:30 p.m. to 10:30 p.m. every day. A set of telephone numbers were randomly selected using known prefixes assigned to telecommunication services providers under the Numbering Plan provided by the Office of the

Communications Authority, Hong Kong. Cantonese-speaking Hong Kong residents (constitutes over 90% of the population (Census and Statistics Department, 2016)) aged 18 to 65 were targeted for an interview in accordance with the last birthday selection rule. The valid response rate was 76.1% and the survey received a total of 504 valid responses. Suggested by Ariola (2006, p.140, see also Ryan, 2013, pp.19e20), Slovin's formula (required samples  $\frac{1}{4}$  total population /  $(1 \pm \text{total population} \times \text{desired margin of error}^2)$ ) should be used to determine the minimum sample size if there is ignorance of the behavior of the population. Given a confidence level was set at 95% with Hong Kong total population size of around 7.3 million, the minimum sample size is 399.98. Thus, a valid sample of 504 is sufficient to warrant conclusions. The profile of respondents is presented in Table 1.

To ensure representativeness of the findings, the sample was statistically weighted before proceed to data analysis. It was weighted in accordance with figures obtained from the Census and Statistics Department regarding the age-gender distribution of year-end Hong Kong population in 2015 and the educational attainment (highest level attended) distribution collected in the 2011 Census. The purpose of this study is to determine the effect and variations of socio-demographic factors on the level of policy support and therefore a multivariate analysis of variance (MANOVA) was performed for data analysis. MANOVA allows the examination of effect of one or more independent variables on multiple continuous dependent variables. The follow-up analyses

## Table 2

Level of policy support by respondents (percent of valid respondents).

(post hoc test) also determine whether there are significant differences between groups of an independent variable on the level of support for each policy.

## 5. Findings

### 5.1. Public support for current waste management framework

There was a modest degree of consensual support for waste management policies (Table 2). Around 55%–65% of respondents indicated their choices as “strongly agree” and “agree” for every policy measure. Mean scores of all policy tools were above 5.0, with an overall average of 5.77. Policy measures have been ranked in order of the mean score.

Among eight policy measures, respondents rated investment in recycling and recovery infrastructure as the top of their list of policy support (mean score 5.92). Both Recycling Fund (PS6) and development of EcoPark (PS7) also occupied a relative high ranking (mean score 5.77). Adequate recycling facilities and well-developed recovery chain encourage recycling practices. The relatively high levels of support for these measures (i.e., PS6-PS8) imply that Hong Kong citizens eagerly call for the government to take up greater responsibility for fostering an enabling recycling environment. Meanwhile, the problem of excessive packaging and inappropriate treatments of end-of-life products are serious in Hong Kong. People have made a demand for extending Producer Responsibility Scheme (PS4; mean score 5.89) with a view to implementing “polluter pays” principle which manufacturers should assume part of the environmental responsibility. Concerning the Construction Waste Disposal Charging Scheme (PS3), the public generally admitted to their responsibility of paying for construction waste generation and thus placed it on the third place of their supporting list (mean score 5.87).

The survey revealed that not all policy measures are equally well-received by the public. Municipal Solid Waste Charging Scheme (PS2) and Plastic Shopping Bag Levy (PS1) were least supported by respondents, with a mean score of 5.55 and 5.67 respectively. The two

charging schemes aim at providing financial incentives to encourage people participating in recycling activities and thereby reduce waste volume (Dunne et al., 2008; Ferrara and Missios, 2005; Yang and Innes, 2007). In Hong Kong insufficient complementary measures such as provision of source separation facilities may contribute to the low score of support for the Municipal Solid Waste Charging Scheme. Regarding the Plastic Shopping Bag Levy, it is a disincentive that incurred financial costs to shoppers (Wan et al., 2015) and thereby may erode public

Measurement of policy support <sup>a</sup>	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree	Mean	Rank <sup>b</sup>
PS1 (Plastic Shopping Bag Levy) <sup>c</sup>	2.3	1.1	4.8	13.1	19.0	20.1	39.6	5.64	6
PS2 (MSW Charging) <sup>d</sup>	1.5	2.3	3.8	11.7	25.4	23.6	31.6	5.55	7
PS3 (Construction Waste Charging) <sup>c</sup>	0.5	0.0	2.2	9.4	23.4	25.8	38.6	5.87	3
PS4 (Producer Responsibility Scheme) <sup>d</sup>	0.3	1.2	1.7	6.8	24.8	26.0	39.2	5.89	2

PS5 (Publicity & Education Campaign) <sup>c</sup>	1.1	0.3	1.8	10.4	27.4	24.4	34.6	5.74	5
PS6 (Recycling Fund for Industry) <sup>c</sup>	1.2	0.7	2.7	8.5	25.7	25.2	36.1	5.77	4
PS7 (EcoPark) <sup>c</sup>	1.3	1.2	3.1	7.4	24.4	25.7	36.9	5.77	4
PS8 (Recycling & Recovery Infrastructure) d	0.3	0.4	2.0	8.8	22.8	24.4	41.4	5.92	1

<sup>a</sup> PS1 e I support the full implementation of Plastic Shopping Bag Levy. PS2 e I support the Municipal Solid Waste Charging Scheme. PS3 e I support the Construction Waste Disposal Charging Scheme. PS4 e I support extending the Producer Responsibility Scheme to other recyclable materials (e.g., packing materials). PS5 e I support earmarking funding to enhance publicity work and education campaigns on waste reduction. PS6 e I support establishing the Recycling Fund to promote the development of local recycling industry. PS7 e I support the development of an EcoPark for the local recycling industry. PS8 e I support government's investment in recycling and recovery infrastructure. b

The mean score was used to rank the policy measures.



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Current waste management policy.

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Table 3

Level of policy support by respondent gender.

Measurement of policy support	Gender (Pillai's trace = 0.046; p = .008)			
	Male	Female		p
F Value (df = 1)				
PS1 (Plastic Shopping Bag Levy)	5.42	5.87	10.331	.001
PS2 (MSW Charging)	5.42	5.68	4.015	.046

PS3 (Construction Waste Charging)	5.75	5.95	3.806	.052
PS4 (Producer Responsibility Scheme)	5.80	5.93	1.374	.242
PS5 (Publicity & Education Campaign)	5.57	5.82	4.920	.027
PS6 (Recycling Fund for Industry)	5.67	5.84	2.121	.146
PS7 (EcoPark)	5.57	5.82	4.182	.041
PS8 (Recycling & Recovery Infrastructure)	5.91	5.87	0.197	.657

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support. Despite the fact that publicity work and education campaigns on waste reduction (PS5) help consolidate environmental consciousness among people and boost recycling rate, the measure was not overwhelmingly welcomed by Hong Kong respondents in comparison with other instruments, only took up a middle ranking of the list.

## 5.2. Discriminating policy supporters by socio-demographic characteristics

Multivariate analysis of variance (MANOVA) was performed to analyze the level of policy support with regard to respondents' major socio-demographic characteristics. Scheffe comparison was selected in the post hoc test. It enables researchers to determine whether there are significant differences among groups of an independent factor on the means of dependent variables (George and Mallery, 2016). Gender effect was associated with support for waste management policy (Pillai's trace  $\frac{1}{4}$  0.046;  $p \frac{1}{4}$  .008). In general, females were more likely to

support for every assessed waste management policy than males (Table 3). Four out of eight policy measures showed notable differences between males and females. Compared with men, women tended to more support for Plastic Shopping Bag Levy ( $p = .001$ ) and earmarking additional resources for enhancing publicity work and education campaigns on waste reduction ( $p = .027$ ). Female respondents also slightly differed from their male counterparts regarding the Municipal Solid Waste Charging Scheme (PS2, 5.68 versus 5.42) and the development of EcoPark for promoting local recycling industry (PS7, 5.82 versus 5.57).

A statistically significant association was found between age and level of policy support (Pillai's trace  $\lambda = 0.154$ ;  $p = .000$ ), with four policy measures showing remarkable differences across different age groups (Table 4). The 30e39 group expressed the highest level of support for the Municipal Solid Waste Charging Scheme (5.93) among age groups. It significantly differed from the age group 18e29 ( $p = .039$ ) and the age group 50e59 ( $p = .038$ ). Regarding charging scheme on Construction Waste Disposal, the

Table 4

Level of policy support by respondent age.

30e39 age group (6.19) showed more support than age group 18e29 ( $p = .018$ ) and age group 60e65 ( $p = .013$ ). The 18e29 generation (5.36) was less in favor of the development of Ecopark for local recycling industry compared with the 30e39 age group (5.93). Concerning investment in recycling and recovery infrastructure, the 18e29 age group differed significantly from the 30e39 ( $p = .001$ ) and 40e49 age group ( $p = .003$ ). Overall, the mature population, compared with the youngster group (aged 18e29), tended to agree with and support the waste management policies.

There was a significant effect of education on the level of policy support (Pillai's trace  $\frac{1}{4}$  0.156;  $p \frac{1}{4}$  .000) (Table 5). Post hoc analysis was performed to detect which education level creates the differences in various policy measures. It was found that respondents with lower education displayed a greater support for spending money on publicity work and education campaigns on waste reduction when compared to their upper secondary counterparts ( $p \frac{1}{4}$  .033) and Bachelor's degree group ( $p \frac{1}{4}$  .007). In addition, respondents with Master's degree or above were prone to the establishment of Recycling Fund and investment in recycling and recovery infrastructure compared to Bachelor's degree respondents ( $p \frac{1}{4}$  .034 and  $p \frac{1}{4}$  .018 respectively).

Although there was a significant income effect (Pillai's trace  $\frac{1}{4}$  0.140;  $p \frac{1}{4}$  .027) (Table 6), there was no significant pairwise differences among the income groups revealed in the post hoc analysis.

Household size only predicted the support for enhancing publicity work and education campaigns on waste reduction ( $p \frac{1}{4}$  .007). Households with 5 or more persons (mean score 5.27) tended to be less support for the policy, whereas the 3-person family showed a greater support for promotional policy (mean score 5.81) (Table 7).

Finally, effect of individual political inclination on level of policy support was considered. The statistical analysis revealed a significant multivariate main effect for political inclination (Pillai's trace  $\frac{1}{4}$  0.127;  $p \frac{1}{4}$  .010) (Table 8). In follow-up tests, the means of two policy measures (PS1 and PS5) differed across political

Measurement of policy support		Age* (Pillai's trace $\frac{1}{4}$ 0.154; $p \frac{1}{4}$ .000)							
		1	2	3	4	5	F Value	p	p in the Scheffe
							(df $\frac{1}{4}$ 4)		comparison

PS1 (Plastic Shopping Bag Levy)	5.50	6.03	5.62	5.56	5.65	1.956	.100	
PS2 (MSW Charging)	5.34	5.93	5.77	5.31	5.58	3.939	.004	p(1,2) ¼ 0.039;
PS3 (Construction Waste Charging)	5.66	6.19	6.00	5.83	5.47	4.813	.001	p(2,4) ¼ 0.038
PS4 (Producer Responsibility Scheme)	5.69	6.00	5.90	5.87	6.00	1.176	.321	p(1,2) ¼ 0.018; p(2,5) ¼ 0.013
PS5 (Publicity & Education Campaign)	5.40	5.66	5.87	5.85	5.98	3.164	.014	
PS6 (Recycling Fund for Industry)	5.54	6.00	5.89	5.74	5.74	2.171	.071	
PS7 (EcoPark)	5.36	5.93	5.86	5.72	5.86	3.198	.013	p(1,2) ¼ 0.045
PS8 (Recycling & Recovery Infrastructure)	5.52	6.19	6.18	5.85	5.86	6.271	.000	p(1,2) ¼ 0.001; p(1,3) ¼ 0.003

Table 5

Measurement of policy support	Education level* (Pillai's trace = 0.156; p = .000)							
	1	2	3	4	5	F Value	p	p in the
						(df = 4)		Scheffe
								comparison

PS1 (Plastic Shopping Bag Levy)	5.68	5.69	5.80	5.38	6.09	2.011	.092
PS2 (MSW Charging)	5.64	6.13	5.85	5.80	6.30	2.413	.048
PS3 (Construction Waste Charging)	5.85	6.10	5.94	5.65	6.17	2.243	.064
PS4 (Producer Responsibility Scheme)	5.83	5.96	5.82	5.47	6.35	3.735	.005
PS5 (Publicity & Education Campaign)	5.80	5.85	5.76	5.54	5.74	0.791	.532
PS6 (Recycling Fund for Industry)	5.95	5.98	5.87	5.72	6.61	3.162	.014
PS7 (EcoPark)							p(1,3) ¼ 0.033;
PS8 (Recycling & Recovery Infrastructure)							p(1,4) ¼ 0.007 p(4,5) ¼ 0.034 p(4,5) ¼ 0.018

\* 1 ¼ Primary or below; 2 ¼ Lower secondary; 3 ¼ Upper secondary; 4 ¼ Bachelor's degree; 5 ¼ Master's degree or above.

Table 6

Level of policy support by respondent income level.

Measurement of policy support	Income level* (Pillai's trace ¼ 0.140; p ¼ .027)
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	1	2	3	4	5	6	F Value (df	p	p in the Scheffe
							¼ 5)		comparison
PS1 (Plastic Shopping Bag Levy)	5.70	5.85	5.65	5.63	5.44	5.97	0.566	.726	
PS2 (MSW Charging)	5.52	5.40	5.56	5.59	6.00	5.85	1.015	.408	
PS3 (Construction Waste Charging)	5.73	6.00	5.95	5.76	5.74	6.21	1.499	.189	
PS4 (Producer Responsibility Scheme)	5.91	5.67	5.90	5.76	6.15	6.24	1.578	.165	
PS5 (Publicity & Education Campaign)	5.73	5.96	5.63	5.54	6.04	5.82	1.298	.264	
PS6 (Recycling Fund for Industry)	5.69	5.77	5.72	5.92	5.89	6.12	1.015	.408	
PS7 (EcoPark)	5.58	5.73	5.70	5.79	5.81	6.18	1.176	.320	
PS8 (Recycling & Recovery Infrastructure)	5.70	6.29	5.80	5.93	5.78	6.39	3.439	.005	

\* 1 < HK\$5000; 2 ¼ HK\$5000e9999; 3 ¼ HK\$10,000e19,999; 4 ¼

HK\$20,000e29,999; 5 ¼ HK\$30,000e39,999; 6 HK\$40,000.

Table 7

Level of policy support by respondent household size.

Measurement of policy

support

Household Size\* (Pillai's trace ¼ 0.124; p ¼ .010)

	1	2	3	4	5	F Value (df ¼ 4)	p	p in the Scheffe comparison
PS1 (Plastic Shopping Bag Levy)	5.61	5.56	5.84	5.61	5.71	0.547	.702	
PS2 (MSW Charging)	5.50	5.58	5.53	5.81	5.32	2.045	.087	
PS3 (Construction Waste Charging)	5.50	5.73	5.94	5.98	5.72	1.633	.165	
PS4 (Producer Responsibility Scheme)	6.17	5.85	5.78	6.02	5.71	1.640	.163	
PS5 (Publicity & Education Campaign)	6.00	5.87	5.81	5.76	5.27	3.564	.007	p(3,5) ¼
PS6 (Recycling Fund for Industry)	5.78	5.60	5.77	5.88	5.67	0.726	.574	0.047
PS7 (EcoPark)	5.72	5.69	5.74	5.76	5.61	0.185	.946	
PS8 (Recycling & Recovery Infrastructure)	5.78	5.82	6.00	5.86	5.86	0.407	.804	

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\* 1 ¼ 1-person; 2 ¼ 2-person; 3 ¼ 3-  
person; 4 ¼ 4-person; 5 5-person.

Table 8

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Level of policy support by respondent

political affiliation.

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Measurement of policy

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support

Political Inclination\* (Pillai's trace  $\frac{1}{4}$  0.127; p  $\frac{1}{4}$  .010)

	1	2	3	4	5	F Value (df $\frac{1}{4}$ 4)	p	p in the Scheffee comparison
PS1 (Plastic Shopping Bag Levy)	5.68	5.00	5.62	5.97	5.90	3.315	.011	p(2,5) $\frac{1}{4}$ 0.022
PS2 (MSW Charging)	5.64	5.42	5.63	5.69	5.45	0.556	.695	
PS3 (Construction Waste Charging)	5.77	5.45	6.03	6.03	5.71	3.065	.017	
PS4 (Producer Responsibility Scheme)	5.99	5.37	5.92	6.00	5.83	2.355	.053	
PS5 (Publicity & Education Campaign)	5.83	5.08	5.66	5.97	5.76	3.263	.012	p(1,2) $\frac{1}{4}$
PS6 (Recycling Fund for Industry)	5.81	5.53	5.71	6.23	5.70	1.834	.121	0.044; p(2,4) $\frac{1}{4}$ 0.044
PS7 (EcoPark)	5.79	5.18	5.68	5.89	5.74	1.760	.136	
PS8 (Recycling & Recovery Infrastructure)	5.91	5.66	5.95	6.00	5.80	0.731	.571	

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\* 1 ¼ Inclined toward the pro-democracy camp; 2 ¼ Inclined toward the pro-localism camp; 3 ¼ Inclined toward the pro-centrist camp; 4 ¼ Inclined toward the proestablishment camp; 5 ¼ No political inclination/Politically neutral/Not belong to any camp.

inclination. Pro-localism camp respondents demonstrated a lower level of support for Plastic Shopping Bag Levy compared to respondents with no political inclination ( $p = .022$ ). A similar result was found for the policy of earmarking resources for publicity work and education campaigns on waste reduction, though the difference between pro-localism camp respondents and proestablishment people was statistically weak ( $p = .044$ ).

## 6. Discussion

### 6.1. Uncoordinated waste management framework

This study revealed that respondents possess differential support for current waste management policies, even though the assessed policies belong to the same policy category (Table 2). For instance, Hong Kong people expressed preference for policies related to the development of recycling industry (i.e., PS6-PS8) rather than promotional measure (PS5), though they are instruments based on government responsibility or belong to policy tools which aim at investing in the future development of intellectual knowledge of the individual and industry development (Wan et al., 2015). Likewise, people welcomed the Construction Waste Disposal Charging Scheme but not for the charging scheme of municipal solid waste. The emerged trend of support for major waste management policies need to be explained in order to formulate policies with greater public support and achieve policy goals effectively.

The incompetent development of recycling chain in Hong Kong explained the high score of support for most policy measures of recycling industry development (PS6-PS8). With enhanced public education programs over the years and the introduction of Territory-wide

Source Separation Program for domestic waste program in 2005, increasing number of Hong Kong people have developed a recycling habit (Ko and Poon, 2009). Nonetheless, structural defects of recycling chain hinder Hong Kong people in their efforts to do recycling. In Hong Kong, there is around one litter bin for every 187 people while the ratio of rubbish bin to recycling bin is 10:1 (Kao, 2014; Woodring, 2015). Most waste separation bins are limited to three types of recovered waste, i.e., waste paper, plastic bottles, and aluminum cans; scope of recyclables recovered has yet been widely extended to other types of recyclables and corresponding recycling facilities are hardly found within communities, resulting in most reusable resources end up at landfills. For example, 98% of generated food waste (around 1.33 million tonnes) was disposed of at landfills, accounting for 38% of total volume of disposed MSW in 2013 (Audit Commission, 2015).

The problem is further complicated by the dysfunction of recycling system in Hong Kong. Shortage of land resources increases operation cost of recycling traders. Besides, over 90% of collected recyclables in Hong Kong could only be exported to other regions or countries for further processing or directly dumped into landfills because there is a lack of well-established local market for the recycled materials. China is currently the major waste trade partner of Hong Kong (Environmental Protection Department, 2017b). Since Hong Kong is a separate entity in trading affairs under the constitutional principle “One country, two systems”, values of exported recyclables fluctuate according to global prices (Kao, 2016). The unstable price risks profit of traders and causes fluctuations in local recycling activities. Under the laissez-faire economic policy, the recycling industry received insufficient financial and technical support from the government. The business environment is becoming increasingly difficult which severely retards the development of local recycling industry. The target of getting more people engaging in recycling practice can only be met by accomplishing with full-fledged

recycling system. Given that the government has set the target of pushing recycling rate to 55% by 2022 (Environment Bureau, 2013), the high level of support for capacitybuilding measures (PS6-PS8) reflects the wish of the people that the government should take up more responsibility to develop local recycling industry.

A considerable number of studies proved that deficiency of knowledge such as separation methods and list of appropriate materials for recycling is a barrier of engaging in recycling practices (Guidotti and Abercrombie, 2008; Mueller, 2013; Xiao et al., 2017). Successful informational strategies would increase awareness of environmental problems among people and persuasively influence individuals' behavior (Steg and Vlek, 2009). In Hong Kong, a lack of promotional work in relation to recycling knowledge may account for the less welcomed current publicity and education work, provided that the city only started to launch a Clean Recycling Campaign for promoting clean recycling in 2015 (Environmental Protection Department, 2017a).

Under the framework of Producer Responsibility Scheme (PRS), manufacturers have responsibility for the environmental impacts of a product throughout its entire life cycle, with particular emphasis on recycling and recovery processes of the product (Lindhqvist, 2000; OECD, 2001). Different groups of stakeholders such as producers, retail sectors, and consumers would bear the cost of managing and recycling end-of-life products (McKerlie et al., 2006; Triguero et al., 2016). Prior studies revealed that 52.5% of Kuala Lumpur respondents and 68.6% of Beijing residents expressed their willingness to pay for improvement of PRS management system or end-of-life product recycling (Afroz et al., 2013; Tian et al., 2016). The results are shared by the current study that around 65% Hong Kong respondents recognized the need of extending PRS (PS4; Table 2). Nonetheless, some research found a contradictory result

that respondents express their reluctance to bear the responsibility of additional cost (e.g., Islam et al., 2016; Wang et al., 2011).

Meanwhile, the Hong Kong government has not yet introduced mandatory PRS for major consumer products (e.g., vehicle tyres, packaging materials). PRS is a legal regulation which change the costs and benefits of performing behavior alternatives; a context with no structural strategies is less likely to drive people towards pro-environmental behavior (olander and ThØgersen, 1995; Steg€ and Vlek, 2009). The incomprehensive regulations and limited recycling channels cause a large volume of excessive packaging materials and obsolete products being disposed of at landfills every day; for instance, over 300 tonnes of beverage glass and 190 tonnes of waste electrical and electronic equipment (WEEE) were disposed of at landfill every day in Hong Kong (Environmental Protection Department, 2017c; Ling et al., 2013). Support for extending PRS to other recyclables implies that respondents consider both consumers and producers should have a role to play in reducing environmental impacts of consumer products.

Studies of pay-as-you-throw (PAYT) systems revealed that considerable number of people oppose against any types of waste charging schemes (e.g., Brown and Johnstone, 2014; Challcharoenwattana and Pharino, 2016; Xiao et al., 2017). Consistent with these studies, Hong Kong people do not consider Municipal Solid Waste Charging Scheme as a preferable option. The least support of the scheme may be partially caused by inadequate provision of source separation facilities throughout the territory. Since the objective of waste charging scheme is creating economic incentive for people to separate and recycle waste, sufficient ancillary facilities should be provided to recyclers in order to absorb the increased flow of source-separated materials. As Puig-Ventosa (2008) and Dunne et al. (2008) suggested, acceptability problem of charging schemes can be prevented by providing people with a great variety of

recycling options which enable them to do different types of separation. Guerrero et al. (2013) proved that stakeholders' willingness to pay for waste processing services is significantly associated with provision of recycling equipment and infrastructure by the government. Recycling facilities and waste charging scheme supplement and complement each other. Given that the MSW charging scheme is scheduled to launch in 2019 (Information Services Department, 2017), the Hong Kong government is advised to increase recycling facilities and infrastructure for making the implementation of the charging scheme more feasible in the future.

## 6.2. The influence of socio-demographic characteristics on policy support

Gender emerges as a strong predictor of policy support (Table 3). Conventional wisdom holds that females are more concerned about environmental issues than their male counterparts (Gifford and Sussman, 2012; Hunter et al., 2004; Jones and Dunlap, 1992; Stern et al., 1993; Zelezny et al., 2000). Female respondents in this study demonstrated a similar pattern. Consistent with studies by Bartelings and Sterner (1999), Chalcharoenwattana and Pharino (2016), Klineberg et al. (1998), and Triguero et al. (2016), the pattern indicates that women compared with men are more willing to support government spending or accept higher costs to accomplish environmental protection. The pro-environmental inclination and hence the increased likelihood of support for waste management policy may attribute to women's perceived vulnerability to risk and perceived role as caregivers (Bord and O'Connor, 1997), and their greater interest in health issues (Davidson and Freudenburg, 1996; Dietz et al., 2002). The findings also support the study by Triguero et al. (2016) that women are more willing to bear greater environmental responsibility and take environmental issues as part of personal responsibility than men.

Prior research and empirical evidence suggested that age is a powerful predictor of environmental concern (exception see Ferrara and Missios, 2005; Triguero et al., 2016), with younger generation tends to involve in pro-environmental behaviors or support environmental policies than older population (Brown and Johnstone, 2014; Carman, 1998; Dietz et al., 1998; Gelissen, 2007; Jones and Dunlap, 1992; Sidique et al., 2010b; Van Liere and Dunlap, 1980). It is suggested that young generation has more opportunities of receiving education and thus increases the understanding of environmental problems; hence, they tend to act in favor of the environment or to be more acceptance of environmental policies. However, this study presented a different view that a lower level of support for certain waste management policies is associated with younger generation, a result further provides empirical evidence to studies conducted by Samdahl and Robertson (1989) and Shen and Saijo (2008). The youngest age group 18e29 compared with their mature counterparts shows less support for both charging schemes (PS2 & PS3; Table 4) and instruments of developing local recycling industry (PS7 & PS8; Table 4). The emerged cohort pattern which is different from results of previous studies may be explained by a general declining confidence in institutions among young people (Smith, 2005). The younger generation in Hong Kong has been a core participant of major chaotic events and social movements in recent years (Lau, 2014); they are skeptical of government's administrative and political capability and opposite against public policies, which may affect their perception of environmental policies.

Hong Kong respondents with low education level are prone to support for enhancing publicity and education campaigns on waste reduction (Table 5), a result which is consistent with findings by Samdahl and Robertson (1989). This is probably because lower educated people have fewer opportunities to receive knowledge about environmental issues and they may assume that it is government's responsibility but not their responsibility to protect the

environment (Triguero et al., 2016). Another noteworthy result is that people with Bachelor's degree compared with their Master's degree or above counterparts are significantly less support for the establishment of Recycling Fund (PS6) and investment in recycling infrastructure (PS8). The statistical results of these two policy items are consistent with findings of most previous studies such as Gelissen (2007), Jones and Dunlap (1992), and Shen and Saijo (2008). The findings also support the argument that higher educated people are more aware of environmental issues and able to identify root cause of the problems (Van Liere and Dunlap, 1980).

Regarding the income effect (Table 6), though statistical result revealed a similar finding with previous research (e.g., Elliott et al., 1995; Gelissen, 2007) that it is positively correlated to level of policy support (Pillai's trace  $\frac{1}{4}$  0.140;  $p \frac{1}{4}$  .027), it has no significant effect across different waste management policies. A possible explanation is that most assessed policy options have no direct cost imposed on respondents, and those strategies may only be shortlived interventions (see Abrahamse et al., 2005). For example, the charging fee was only made at HK\$0.5 per bag under the current Plastic Shopping Bag Levy; meanwhile, the Municipal Solid Waste Charging is a proposed scheme which has yet been finalized and introduced.

Typically, household size is negatively associated with the support for unit-based municipal waste charging scheme. This is because a large family would assume greater financial burden when the charging mode is set as variable rate (e.g., weight-based or head-counted). Triguero et al. (2016) proved the argument that respondents from a larger size of family are less willing to bear consumer-based waste management options. However, the present study highlighted that the change of household size has no significant differences in the level of support for Municipal Solid Waste Charging Scheme (Table 7), the result echoes the study by Afroz et al. (2009) and Brown and Johnstone (2014). It may be because the government has yet finalized charging method of the scheme at the time the interview was



conducted. Moreover, other factors such as the quality of waste management services may confound the relationship between household size and willingness to pay for the scheme or services (see also Afroz et al., 2009; Guerrero et al., 2013).

Political affiliation is a frequently used variable for testing the level of support for environmental issues (Liu et al., 2014). Liberal respondents usually show greater willingness to environmental protection; whereas their counterparts, conservatives, prefer market solutions for environmental problems and thus tend to disagree with too much government intervention (Jones and Dunlap, 1992; Konisky et al., 2008; McCright et al., 2014; Samdahl and Robertson, 1989; Wood and Vedlitz, 2007). Regarding the case of Hong Kong, even though pro-localism camp respondents distinguished themselves from other political-affiliated respondents by showing a lower level of support for Plastic Shopping Bag Levy and publicity work on waste reduction, other political-affiliated respondents indicated a similar degree of agreement across waste management policies (Table 8). The trend lies in the fact that environmental affairs in Hong Kong are nonpartisan issues, resulting in people with different political affiliations share a similar view on environmental protection. Besides, the negative association found among pro-localism camp respondents may be the result of their extended discontent with the government's overall performance.

### 6.3. Toward a coherent and widely-supported waste management

Preceding subsection revealed that the administration intends to reduce landfilling reliance by introducing a series of policy tools in the hope of encouraging more recycling behaviors and minimizing waste. Yet there are insufficient corresponding measures work with current policies in developing the waste management framework at a more complementary level. As Wilson (1996) has pointed out, no policy tool on its own can effectively actualize the goal of sustainable waste management. The piecemeal-style framework would likely result in

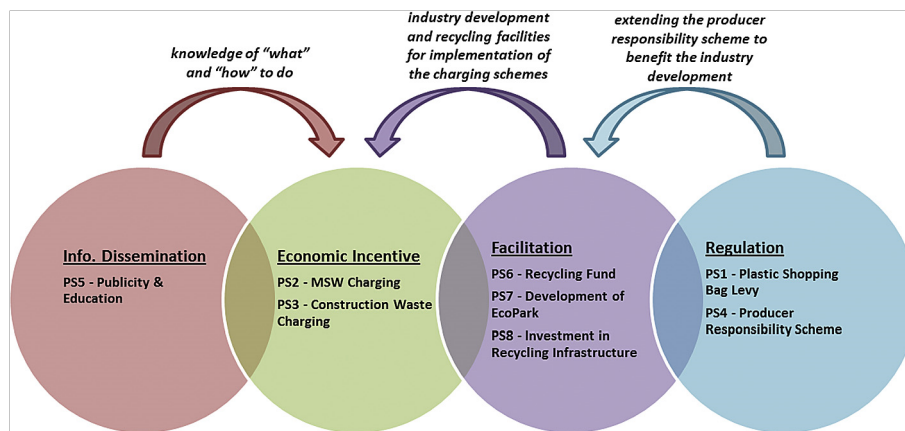


Fig. 1. A coherent waste management framework.

fragmented policies that fail to gain public support and become ineffective for waste problems. To reach an effective and widely-supported sustainable waste management, our study highlights the importance of driving the current framework toward a more coherent and systematic model by changing the magnitude and nature of existing policies while initiating complementary measures whereas necessary. Fig. 1 depicts the logic of optimal combination of policy framework based on the findings. A variety of waste policies can be grouped under the category of information dissemination, economic incentive, facilitation, and regulation according to their nature. A coherent framework suggests that each policy category should not be approached in isolation. Rather, it is interrelated which the implementation of one type of policy is coupled with corresponding measures for mutual

reinforcement. It is only under such a complementary structure and the interplay between different policy categories that policy implementation can achieve an optimal effect and secure a broader public support.

Provision of recycling facilities, infrastructure, and institutional support lays solid building blocks of effective sustainable waste management. Balch (1980) labeled this set of measures as facilitation which seeks to create an environment facilitating recycling development through the means of providing monetary support, subsidies, land resources, facilities, infrastructure, institutions or services to both the public and private sectors. The availability of recycling chain for waste separation, collection, and recovery makes recycling as a practicable behavior (Guerrero et al., 2013). It serves as a means of complementing the implementation of economic incentive measures such as waste charging scheme (Fig. 1). Waste charging drives people participating more in recycling activities. The quantity of separated waste is mostly associated with the introduction of economic incentive measures. Thus, there should be a well-developed recycling chain for processing the increased volume of collected recyclables. Policy-makers are advised to devote considerable efforts in developing measures of facilitation if sustainable development is taken as a waste management strategy.

Comprehensive regulation provides a legal framework for the implementation of sustainable waste management (Manaf et al., 2009). Regulation is laws and statutes that legally restrict one's behaviors and require compliant behaviors under threat of punishment (Balch, 1980; Vedung, 1998). Our study showed that an immature regulation for the Producer Responsibility Scheme (PRS) is not conducive to promotion of recycling behavior. With imperfect regulation, consumers cannot avoid over-packaging materials and have limited channels for recovery of end-of-life products. The recyclables can only end up at landfills,

which the practice is contradictory to sustainable waste management. The high level of support for expanding the PRS revealed in our findings denotes an urgency to comprehend recycling regulations. Enhancing the legislation of PRS to a wider coverage of consumer products and packaging materials helps shift the cost of taxpayers to producers and consumers, with a view to embody “polluter-pays” principle. On the other hand, comprehensive recycling regulations guarantees a stable supply of recyclables for recycling industry, which in turn, benefit the development of the whole recycling chain and facilitate waste separation behavior among the public.

Every waste management policy needs to be supported by promotional campaigns (Wilson, 1996), particularly for the policies that require individuals to change their behaviors, such as waste charging scheme. Policy instruments based on information dissemination mainly refer to publicity and education programs spreading information of a policy, and actions required to be taken to achieve policy goals (Balch, 1980; Vedung, 1998; Wilson, 1996). It has all along been regarded as an effective measure to increase recycling participation as instructions and guidelines help reduce the cost of recycling behaviors (Mueller, 2013; Sidique et al., 2010a). Traditional education campaigns aim at increasing recycling awareness and encouraging participation (Xiao et al., 2017). Nonetheless, the less-supported publicity measures found in our study may imply that content of information dissemination should be designed in accordance with the actual circumstance. For instance, policy-makers may highlight message “how to do” rather than only stick to programs about “what to do” when introducing policies that aim at changing individual behaviors.

Economic incentive policies offer positive or negative financial incentive that guide individuals’ behaviors toward the desired ends of policy (Schneider and Ingram, 1990; Wilson, 1996). Though it provides incentive for people to minimize waste and increase recycling

practices and its positive effect on recycling behaviors has been confirmed (Ferrara and Missios, 2005; Yang and Innes, 2007), the success of its implementation relies heavily on other associated policy tools as illustrated in Fig.1. Take Hong Kong case as an example, the soon introduced MSW waste charging scheme is likely to result in an increase of recycling practices and quantity of recyclables. In view of this, education programs provide people with all necessary recycling information, as well as recycling facilities and recovery infrastructure should be prepared to take up possible challenges derived from economic incentive measures.

In view of driving toward sustainable waste management, a key policy recommendation for Hong Kong is that policies of facilitation should receive priority attention. The inadequate recycling facilities, infrastructure, and institutional support hamper the development of recycling industry and hinder the implementation of sustainable waste management strategies in Hong Kong. The majority of the respondents (65%) agreed with government's investment in recycling infrastructure. On the one hand, the number of recycling bins and scope of recyclables recovered should be increased and extended to facilitate recycling practices among the public while the number of rubbish bin needs to be slashed for the preparation of PRS extension and the introduction of MSW charging scheme; on the other hand, the administration should take a proactive role to develop a comprehensive recycling chain as a response to such a high level of support for infrastructure investment (PS8) and development of recycling industry (PS6, PS7). Setting up a resource recycling center for collecting and processing separated waste in every district would be an option. The community-based center not only facilitates individuals' recycling behavior, but also ensures a steady supply of recyclables from the community. Shortage of land for storing separated waste and low profit return discourage the development of recycling industry in Hong Kong. In addition to Recycling Fund and EcoPark, the government is called for providing the industry with comprehensive financial support and more

rentable land under long-term tenancies, as well as offering up-to-date recycling technology in order to reduce the operational cost of recycling business.

This study found that respondents have a high level of support for extending Producer Responsibility Scheme to other consumer products such as packaging materials and tyres. In view of this, the government is suggested to expedite the enactment of legislation to provide a legal basis for sustainable waste management. The extended scheme also provides a stable source of recyclables supply for local recycling industry.

Our results revealed that the public is less satisfied with current education and publicity work for waste reduction. In view of this, we suggest a shift of education theme from “what to do” to “how to do.” Instead of encouraging recycling participation, proper recycling practices should become the core theme of future publicity work and education campaigns. The change would equip the citizens with proper recycling knowledge and prepare them for the implementation of charging scheme while clean and sorted waste adds value to the recyclables.

#### 6.4. Socio-demographic factors, public support, and intervention strategies

Several socio-demographic factors were found to be significantly associated with variation in policy support for certain policies. Though it may be difficult to manipulate socio-demographic characteristics such as gender, age, and education level, it is still possible for the government to recruit public support by providing tailored information, making use of different informationspreading channels, and introducing an inclusive decision making process.

To encourage behavioral change of different social groups, tailored information is proved to be more effective compared with unified messages for the entire population (Abrahamse and Matthies, 2012). In our study, males, young people aged 18e29 and higher educated respondents possess less support for waste policies. Customized information that matches

recipients' background and relates to behavioral outcomes becomes increasingly important. Behaviors are more likely to change if messages have taken recipients' background and situation into account (Abrahamse et al., 2007). For example, it might be more effective to design information specific for males by stressing the point that showing support for waste policies aims at providing a clean living environment for their family and future generation.

The present study noticed that variation in support for certain policies exist among young generation and respondents with higher education. The novel and vibrant perspective of these population groups deserves more efforts to collect their opinion. Technology may help in this case. New social network such as Facebook and Twitter nowadays overtakes the traditional media like television as a major channel for spreading information. Fast in speed and instant feedback contribute to the popular use of networks among people. Policy-makers may take advantage of new forms of social network to reach a broader public.

Public participation has been increasingly recognized as a crucial element in waste management decision-making processes (Sharholy et al., 2008; Wan et al., 2017). It enhances public understanding of proposed initiatives (Guerrero et al., 2013) and offers opportunities for different population segments for exchanging their opinions with policy-makers, which in turn, help formulate a more representative policy. The integration of a broad range of opinions from the public with diversified backgrounds heightens the level of public support for waste management policies. The practice can also restore the confidence of the public, especially young people, in government's administrative capacity, as it is a concrete expression of government's determination and commitment to solve waste problems.

## 7. Conclusion

This study found that differential policy support exists across different waste management instruments in Hong Kong, with recycling infrastructure and extension of PRS are most welcomed by the majority of respondents while MSW charging scheme is least supported. Conforming with prior studies, gender, age, and education level significantly associate with policy support across waste management options. The investigation suggests that uncoordinated and fragmented waste management framework account for the ineffectiveness of measures and, in turn, the patterns of policy support. In view of this, a coherent and complementary waste management framework was constructed based on the results and discussion. Different from other proposed frameworks which emphasize the hierarchy and priority of waste policy (e.g., Triguero et al., 2016; Xiao et al., 2017), this framework brings attention to the complementary nature of different policy categories and highlights the mechanism of mutual reinforcement between policies. The findings provide policy-makers with evidence for waste management policy formulation and implementation. The research contributes to current literature of waste management in cities which share similar background with Hong Kong. The demographic effects on policy support and proposed coherent waste management framework add valuable reference to existing literature. The present study is also relevant to waste management discussion of many other cities as findings are based on analysis of a broad range of common waste management policies.



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