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The attitudes of Guangzhou citizens on waste reduction and environmental issues

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Abstract

Source separation of waste is considered an effective means to enhance waste recycling and it is especially so with Guangzhou. Guangzhou is one of the most populated cities in the world and is facing waste management problems such as increasing cost in waste transport and disposal, local opposition to landfill siting and shortage of waste disposal facilities. In 1997 a questionnaire survey on the attitude and opinion of Guangzhou citizens on source separation of household waste and the acceptance of the New Environmental Paradigm (NEP) was conducted by the authors. About 800 questionnaires were distributed with a response rate of over 98%. It was found that the environmental awareness of Guangzhou citizens was slightly higher than their Hong Kong counterparts in the early 1990 but slightly lower than the Americans' in the late 1970's to early 1980's. Also, some 5% of the surveyed population in Guangzhou showed unfamiliarity with the NEP issues. At the same time, the younger generation, especially those below the age of 17, were found to be more pro-NEP than their older counterparts. Thus, more education and publicity in introducing general environmental concepts to the grown up citizens of Guangzhou are required. In the area of household waste recycling, support for source separation of household waste and waste recovery practice in Guangzhou were found to be greater than those in Hong Kong. Since a new door to door bagged waste collection system is being phased in to replace the older waste collection method in Guangzhou, it is expected that the traditional waste scavenging system will be adversely affected and the waste recovery rate may decrease as a result. For the purpose of resource conservation, it is suggested that a systematic and comprehensive

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household waste source separation programme should be tried out in Guangzhou. Deploying an unskilled labour force and existing scavengers in organized source separation programmes is also a recommended solution.

Keywords: Domestic waste; Waste recycling; New Environmental Paradigm; Guangzhou; Waste avoidance potential; China

1. Introduction

Source separation of waste is considered an effective means to enhance waste recycling. Systematic and formally run source separation of household waste is found in a number of countries where there are usually a shortage of waste disposal facilities. As the capital city of Guangdong province in Southern China, and one of the most populated cities in the world, Guangzhou is also facing waste management problems such as increasing cost in waste transport and disposal, local opposition to landfill siting and shortage of waste disposal [1]. These problems are also shared by other densely populated Chinese cities such as Beijing, Shanghai and Xian.

Source separation of household waste was recommended as one of the priority measures in a waste management planning study [2]. But this suggestion was not taken up immediately by the waste management authority of Guangzhou. One of the concerns is the perceived lack of public support for the source separation programmes (C.Y. Lu, personal communication, 13th August 1997). Public support for source separation of waste is related to a few factors, such as convenience of the scheme to the participants and publicity for the source separation programme, the degree of pro-environmental attitude of the public and the perceived relative urgency of waste and material management issues compared to other environmental issues. Instead of founding on speculations, policy making should be founded on objective and measurable data or information about these factors.

This paper is a report on the findings from a questionnaire survey carried out in Guangzhou during November 1997. The questionnaire consisted of three parts. The first part was a survey on the attitude and opinion of Guangzhou citizens on source separation of domestic waste, waste recovery and the waste collection service. In the second part were twelve statements on the New Environmental Paradigm (NEP) which were designed to measure how receptive the respondents were to an ecologically integrated view of humans and nature. The advantage of using the NEP is that the NEP score offers an internally consistent and valid scale for measuring the acceptance of the environmental paradigm across all groups surveyed [3,4]. The third part was on the demographic characteristics and the form of accommodation of the respondents. The information in this part served as independent variables to be analyzed with the dependent

variables covered in the previous two parts. For obvious reasons, the survey was conducted in Chinese. The English translation of the questionnaire and the survey results are given in Appendix A.

2. NEP

The NEP statements were designed to measure broad concerns for a wide range of environmental issues. They were first used by Dunlap and Van Liere [3]. In this questionnaire, each item was accompanied by five response categories: 'strongly agree', 'agree', 'disagree', 'strongly disagree' and 'no opinion'. The scores reflected the degree of acceptance of the NEP world view. Eight of the items in the scale were worded such that agreement reflected acceptance of the NEP world view. Therefore, respondents were given 4 points for 'strongly agree', 3 for 'agree', 2 for 'disagree', and 1 for 'strongly disagree' to the eight pro-NEP items. On the other hand, disagreement in the other four anti-NEP items (items 3, 4, 6 and 10) reflected acceptance of the NEP world view (see Appendix A). Hence, the score assigned to these four anti-NEP items was reversed. Choosing the 'no opinion' option however reflected unfamiliarity of the issue asked and no NEP score would be given but was interpreted as a category on its own. The final average score was worked out by adding all the scores and divided by the number of answers where a score is assigned. Thus, the mean score had a possible range of 1.0–4.0 where 1.0 represented the strongest anti-NEP position while 4.0 indicated the strongest acceptance of the NEP view. On the other hand, the higher the frequency for the 'no opinion' option chosen, the greater the degree of unfamiliarity of the respondents with the environmental paradigm issues.

3. Methodology and survey plan

Eight hundred questionnaires were distributed to eight secondary schools (one from each of the eight urban districts in Guangzhou) through the help of the Guangzhou Education Bureau and the Guangzhou Environmental Science Society. Two classes from each school were selected randomly by the principals of the schools. The questionnaire and the filling instructions were passed to the students through their form teachers. The students were requested to invite the family members who were most responsible for household waste management to complete the questionnaire. A total of 788 completed questionnaires were returned giving a response rate of 98%.

4. Results

4.1. Findings on the NEP

For the twelve NEP statements, the lowest score was found to be 1.82 and the

Table 1
Mean NEP scores for different target groups in Hong Kong, USA and Guangzhou

Place	Year	Target group	Mean scores (on a 4-point scale)
US	1978	General public	3.03
		Environmentalist	3.65
Hong Kong	1991	General public	2.89
	1994	District Board candidates	3.18
	1995	Teachers	3.06
Guangzhou	1997	General public	2.93

highest score was 4.00. The overall mean score for the population was 2.93. It was also found that about 5% of the respondent chose 'no opinion' in six or more statements or left six or more questions unanswered indicating unfamiliarity with the concepts in question. However, the overall scores of this 5% of the respondents, whether included or not, did not have an effect on the overall mean score of the population.

Similar surveys on the NEP of Hong Kong people were conducted before. In 1991, the mean NEP score for Hong Kong citizens were 2.89 (the score was converted from the original 5-point scale used in the survey to a 4-point scale used in this and other surveys for the sake of easy comparison) [5]. In 1994 and 1995 similar surveys were conducted for District Board candidates (District Boards are composed of elected members who are expected to represent district interest in their advice to the government on local and territory wide matters) and teachers. The mean NEP score was 3.18 and 3.06 for District Board candidates and teachers, respectively [6]. On the other hand, a couple of other surveys found that the mean scores for USA citizens ranged from 2.9–3.2 and US environmentalists were found to have a mean NEP score of 3.65 [3,4]. Table 1 is a summary of the mean NEP scores for different target groups in Hong Kong, the USA and Guangzhou.

From Table 1, it can be concluded that the acceptance of the NEP by

Table 2
The mean scores of Guangzhou, Hong Kong and Washington State citizens for the three categories of NEP statements

	Mean scores (on a 4-point scale)		
	Guangzhou	Hong Kong	Washington State
1. The perception of balance of nature	3.16	3.20	3.21
2. The limits to growth	2.94	2.96	3.00
3. Human's relation with nature	2.66	2.47	2.17

Data for Hong Kong and Washington State derived from [5].

Guangzhou citizens was slightly above that of Hong Kong citizens in the early 1990s but below that of USA citizens in the late 1970s.

The twelve NEP items can be grouped under three categories: the perception of balance of nature (items 2, 5, 8 and 12), of the limits to growth (items 1, 7, 9 and 11) and of man's relation with nature (3, 4, 6 and 10). Table 2 shows the average scores for each category of NEP statements.

Compared with the citizens in the USA and Hong Kong, Guangzhou citizens were found to have a more environmentally friendly view on man's relation with nature, but slightly less environmentally friendly in their perception on the balance of nature and the limits to growth. Yet, the score of Guangzhou citizens on human's relation with nature is still the lowest among the three NEP categories, indicating that more work should be carried out to improve on this area.

As mentioned previously, about 5% of the respondents in this survey showed unfamiliarity with most of the environmental statements or issues. This was especially the case with statements 1, 3, 4 and 11 where 17–29% of the respondents had no opinion or were not able to indicate their positions. Thus, more extensive environmental education work on the fundamental concepts of environmentalism should be carried out in Guangzhou.

4.1.1. The acceptance of NEP by various groups of Guangzhou citizens

Kendall tests have been performed to find out the degree of agreement (W) on the replies to the 12 NEP items made by the respondents. It was found that $W = 0.20$ and is significant at less than the 1% level. Thus, it can be concluded that Guangzhou citizens had quite diverse views on the NEP statements. Since the views were rather diverse, it is useful to find out which are the associated factors. Table 3 presents the mean NEP scores and Z-scores of various categories of respondents. The Z-scores are a comparisons between the mean NEP score of each category of respondents and the overall mean NEP score.

From the Z-scores in Table 3, it is reflected that the youngsters and the lowest income groups are most receptive to the NEP. While government officials, workers in the service industry and the highest income group are least agreeable to the NEP. At the same time, it is noted that the respondents in the old urban districts are less receptive to the NEP than those in the new districts.

To compare the findings of this survey with similar surveys in mainland China is not easy as the authors were not aware of other NEP surveys in China. However, the findings from an earlier environmental awareness survey conducted in 1996 in the Zhejiang province can be used as a substitute. In the Zhejiang survey, the respondents were asked general questions such as 'are they aware of the programmes of World Environment Day' and 'are they frequent viewer of environmental news and publicity'. It was found that the most environmentally aware groups were between 31–40 years of age, received tertiary education, either in technological professions or in government [7].

When the results of the two surveys were compared, the most environmentally aware groups found in the Zhejiang survey all had a negative Z-score in this NEP survey with the exception of the technological professional group. Two reasons are

Table 3
The mean and Z-scores of the NEP scores of various categories of urban dwellers of Guangzhou

Characteristics of respondents		Mean NEP scores	Z-scores
Gender	Male	2.94	0.027
	Female	2.93	0
Ages[a]	<17	3.10	0.460
	18–30	2.97	0.108
	31–55	2.89	−0.108
Education level	Primary or lower	3.00	0.189
	Secondary	2.94	0.027
	tertiary or higher	2.92	−0.027
Occupation	Housewives	2.87	−0.162
	Education or environmental hygiene staff	2.97	0.108
	Provincial or municipal government officials	2.81	−0.324
	Management personnel	2.88	−0.135
	Production, manufacturing, mining and transport sector workers	2.91	−0.054
	Technological and engineering professionals	2.94	0.027
	Service industry workers	2.85	−0.216
	Students and agricultural workers	3.08	0.405
Per capita family income (¥)	<300	3.06	0.351
	300–500	2.91	−0.054
	501–700	2.94	0.027
	701–1000	2.90	−0.081
	1001–2000	2.95	0.054
	≥2000	2.85	−0.216
Living districts	Old urban districts	2.89	−0.115
	New urban districts	3.02	0.047

[a] For the age group >55 the number of cases sampled was too small for analysis.

possible. First, the NEP survey required the respondents to indicate their acceptance of specific core ideas in environmentalism while in the Zhejiang survey the respondents were required to present their agreement on less conceptual issues. Thus, even if the respondents may indicate high awareness in the self-assessment on less conceptual environmental issues, they may still lack comprehensive understanding on more conceptual environmental issues, such as the NEP statements. Second, in the Zhejiang survey, Pan and Huang sampled both the rural and urban population while the present NEP survey was targeted only at the urban dwellers. The variation in the exposure and experience of environmental matters by the urban and rural dwellers may also account for the difference in awareness levels.

4.2. Findings on waste management

4.2.1. Household waste collection

There are two major forms of household waste collection in Guangzhou. The older form of collection requires householders to bring the trash to a designated place in their neighbourhood, usually a structure called the 'refuse hut'. A door-to-door collection method is being phased in to replace the old one. From the survey, it was found that the new household waste collection service has been more rapidly phased-in in the older urban districts than in the new urban districts. On the whole, about 46% of the respondents are still served by the older waste collection service while about 33% of the respondents are served by the new service.

Households served by the older form of waste collection are usually required to pay ¥4 per month (US$1 roughly equals ¥8.5.) and for the newer and more convenient form of waste collection ¥10 per month according to the environmental hygiene officials. The charges include the cost of neighbourhood and building cleaning as well [1]. However, as indicated in this survey, the increase in the charge seemed to have taken place quicker than the change of service (see Section 4.2.3).

4.2.2. Waste collection service

The new door-to-door household waste collection method was found to be supported by 65% of the respondents. But about 13% indicated otherwise and about 22% had no opinion on the change. This indicated that Guangzhou citizens generally favoured a more convenient waste collection method. It is also found that there is an association between those not showing support for the new collection method and the view on the level of waste collection charge (see Table 6) but the charge level could not be used to account for all the 'no support' cases. Thus, further studies are required to find out the main reasons for people's objection to the new collection method.

4.2.3. Collection charges

The mean waste collection charges was ¥10.2 per month per household with over half (51%) of the households paying ¥10 and about 5% enjoying free services. The mean waste collection charges for households served by the older form of collection was ¥9.1 per month per household. This is higher than the officially reported level (¥4). While for the households served by door-to-door waste collection, the mean charge per month was ¥10.8. The most expensive waste collection charges are borne by those served by refuse chutes at ¥13.3 per month.

Most of the respondents (70%) found the level of collection charges reasonable but about 29% felt that the charges are too high. The mean waste collection charge for those who considered it excessive was ¥12.3 which is above the average charge. The perception of the collection charges by the respondents is associated with their income level. A greater proportion from the two lowest

income groups considered the waste collection charge too high (see Table 7). This indicates one of the key factors in affecting the household's acceptance of the rate of charge is its share of family income rather than the absolute level of charge. Thus, the financial burden of an increase in the waste collection charge on the lower income group, even though it may only be a few yuan per month (about US25¢), should not be neglected.

4.2.4. Household waste separation and scavenging

At the time of reporting, there was no formal and organized household waste separation programmes in Guangzhou. However, recyclables in the household waste streams are recovered in two ways: recovery by householders and sold to waste depots/announced scavengers or by the scavengers for profit [8]. The scavenging system is, however, being affected by the change in the household waste collection method which requires all household waste to be properly bagged before collection. The change in the collection method is driven by a desire to provide more convenient services and to prevent scavengers messing up public areas during waste scavenging. However, this change is not accompanied by a plan to recover household recyclables through an organized waste separation and recovery system. It is thus expected that more recyclables will remain in the household waste stream and be found in the landfills. This will attract more scavengers to scavenge waste at the landfills instead. Two adverse impacts are expected. Socially, the safety issue for the hand-picking scavengers in the landfills will become more prominent as more and more workers are competing to retrieve recyclables from the limited workable areas in the landfill proper [1]. In terms of recovery efficiency, when a greater number of scavengers work in the same area, the marginal productivity of the scavengers declines. Furthermore, by retrieving recyclables at the end of the waste stream, even though the recyclables eventually get recovered, they have a greater chance to be contaminated. Thus, the efficiency of resource recovery will decline.

The view of the citizens towards informal scavenging activities and source separation of household waste was also sought in the survey to provide a basis for more comprehensive consideration in policy making.

4.2.5. Public perception of informal waste scavenging

It was found that the majority of the respondents (56%) have no opinion on waste scavenging. About 13 and 31% held a for and against view on this activity, respectively. The main reasons for disapproval were the negative impact on environmental hygiene (15%) and on the city appearance (6%). On the other hand, two reasons were cited to support waste scavenging by the other group of respondents, namely, conservation of resources (8%) and providing a source of income for the scavengers (2%).

Thus, the majority of the citizens were, in fact, neutral about the scavenging issue and a considerable number of the public were aware of the social and environmental advantages of waste scavenging. City hygiene and waste recovery are not two conflicting goals as demonstrated by the curbside and material bank systems in other countries. Thus, there is no reason to sacrifice one for another.

4.2.6. Source separation of household waste

Source separation of household waste was considered as a measure for improving waste management [2]. However, this suggestion was not implemented due to the general perception that there was inadequate awareness by the public to make it successful.

However, in this survey, it was found that source separation of household waste was widely supported. Only 16% of the respondents opined otherwise. Among those who supported source separation of household waste, about 22% preferred a mandatory programme and the rest (63%) preferred a voluntary programme. This compared favourably with two previous surveys conducted by the authors in 1992 and 1993 in Hong Kong. Table 4 summaries these findings on source separation of household waste.

The results show that if a source separation system is in place in Guangzhou, the majority of the respondents are willing to separate waste paper and aluminium cans for recycling (80 and 60%, respectively). Recycling of rigid plastics, glass and white and brown goods are also supported (between 42–47%). Recovering rags, metals and film plastics are less supported. A few respondents also indicated that perishables can also be a target for source separation. Nevertheless, the support is not significant.

The reason for the lack of willingness to separate recyclables was not asked in the questionnaire. However, with the shift to the door-to-door collection of bagged household waste system, it is not unreasonable to suggest that householders may like to save up the film plastics for waste containment rather than recycling.

Even with extensive support for source separation of waste, it must not be taken as a guarantee of success for a household waste separation programme. Factors such as the frequency of recyclable collection, marketing of recyclables, safeguarding against vandalism and the presence of incentives for source separation will affect the participation rate and the financial viability of the source separation programme. All these arrangements must be worked out carefully and fine tuned as the programme proceeds. Nevertheless, the findings from the present survey show sufficient support for trials to be carried out especially for waste paper, aluminium cans, rigid plastic, and glass.

Table 4
A summary of the findings on the support for source separation of household waste in Hong Kong and Guangzhou

	Public	HW	This survey
Place and year of survey	Hong Kong, 1992–1993	Hong Kong, 1993	Guangzhou, 1997
Sample size	404	321	788
Target Population	General public	Housewives	General public
Support separation (%)	77	59	84
Do not support separation (%)	23	41	16

Source for the 'public' and 'HW' survey [9].

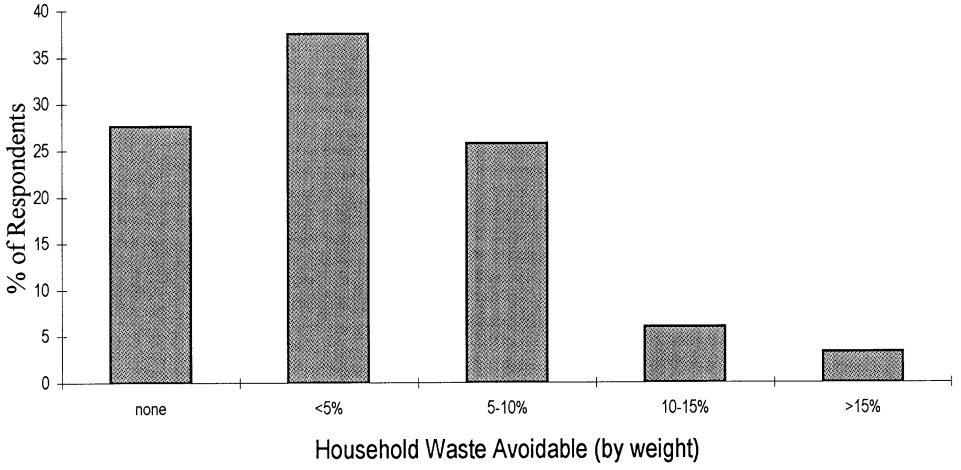

Fig. 1. The frequency distribution of the perceived amount of avoidable household waste.

4.2.7. Avoidable waste

The respondents were requested to make a self-assessment on the amount of avoidable waste generated. To differentiate waste avoidance with waste recycling, a brief list of waste avoidance activities were mentioned in the question for clarification. It was found that about 72% of the respondents perceived some portion of their household waste to be avoidable. The distribution of the percentage of avoidable waste (by weight) is shown in Fig. 1. The findings of this question provides useful information on the avoidable waste potential of Guangzhou citizens.

A significant but weak positive correlation (0.19) between the amount of avoidable waste and the mean NEP scores of the respondents was found. This is consistent with the previous findings that those with lower environmental awareness generally perceived less of their waste to be avoidable [10].

5. Existing waste recovery activities carried out by waste generators in Guangzhou

Selling recyclables to announced scavengers or to recyclable depots in the neighbourhood is still common in Guangzhou. This is made possible by the waste recovery sector in Guangzhou. Briefly, it is a system consisting hand-picking scavengers, announced scavengers, state-owned and privately run waste depots, waste baling workshops and recycling plants. It is loosely managed by the Guangzhou Recyclable Office. Details of this sector can be found in Chung and Poon [8]. Questions 1.9 and 1.10 in the questionnaire (see Appendix A) were designed to find out to what extent the waste generators had carried out the waste recovery work in the past year.

About 85% of the respondents indicated that they normally would save up

and sell the recyclables. Table 5 shows the mean percentages apportioned by the respondents on household waste recovery.

The popularity of material recovery by the householders is consistent with the previous findings on their willingness to source separate household waste. From the findings of these two questions (1.8 and 1.10), it is reasonable to suggest that Guangzhou citizens already possess the knowledge to distinguish household recyclables from non-recyclables. More education and publicity is still required to reinforce and enhance the implementation of a formal source separation programme.

At the same time, from question 1.11 it can be estimated that about 11% of their household waste was recovered in the past year. This compares favourably with the 8% domestic waste recovery rate in Hong Kong [11].

6. Demographic characteristics of the respondents

In general, each demographic, occupation, geographical and income group was fairly well represented in this survey with the exception of age and education level. In terms of the age of the respondents, the 31–55 age range was over-represented and in terms of education level, primary schooling receivers are under-represented.

Some generally expected trends in the demographic characteristics of our respondents are also noted. For instance, it was found that the lower income group tended to have a lower education level and vice verse. Furthermore, housewives, service industry workers and the production, manufacturing, mining and transport sector workers generally have lower education levels than other occupational groups.

7. Statistical associations between variables

A statistically significant association between gender and the support for source separation of household waste was found. In Table 8, it shows that more

Table 5
The proportions of household recyclables sold by waste generators in Guangzhou

Materials	Percent (by weight)	Materials	Percent (by weight)
Paper	56	Other metals	5
Plastics (film and rigid)	3	Rags	1.3
Glass	11	White and brown goods	3.4
Aluminium cans	20	Others	0.3

male respondents have indicated support for a source separation programme especially if it is a voluntary programme.

Two variables were found to have associations with the education level of the respondents (Tables 9 and 10). It was found that the higher education group tended to have a negative view on the scavengers. It was also found that the tertiary education group tended to recover less of their waste.

It was also found that the occupation of the respondents has an association with their attitude towards source separation of household waste. Government officials, people in the service industry and housewives were the least supportive of such a programme. While those in the education and environmental hygiene field were most supportive of source separation programmes. It is of interest to note that government officials though tending to be less supportive of source separation of household waste, were most supportive of a mandatory source separation among all groups. This indicated that while most government officials represented in this survey were not in favour of household waste separation, for those who supported such an idea, a mandatory programme was preferred (Table 11).

The per capita family income of the respondents were found to have association with two dependent variables. Although in general, the majority of the respondents have recovered household recyclables in the past, the higher the family income, the less common it is to do so. In addition, it was found that the lower income groups tended to recover a greater portion of their normal waste than the more wealthy respondents (Tables 12 and 13). These two phenomena indicate that selling household recyclables is largely carried out to supplement family income by the respondents in Guangzhou rather than as an environmentally friendly behaviour.

8. Summary of the findings

8.1. On the NEP

- Government officials, the higher income groups and those who received tertiary education were the least receptive of the NEP, whilst the younger generation and the lower income groups were found to be more receptive of the NEP.

8.2. On household waste collection service and charge

- The more convenient door-to-door waste collection service was welcomed by most people.
- The higher waste collection charge associated with the new collection service was phased in more rapidly than the service itself.
- The average waste collection cum cleaning charge was about ¥10.2 per month per household and was found to be a reasonable rate to most respondents.

- The lower income group tended to find their existing level of waste collection charge too high. This indicates that one of the key factors in affecting the household's acceptance of the rate is its share in family income rather than the absolute level of the charge.

8.3. On waste avoidance and recycling

- People with lower environmental awareness generally perceived less of their waste avoidable.
- Source separation of household waste gained wide support.
- About 85% of the respondents would normally save up and sell the recyclables.
- About 11% of the household waste was diverted by waste generators own recovery activity.
- More male respondents indicated support for a source separation programme especially if it was a voluntary programme.
- Government officials, people in the service industry and the housewives were the least supportive of a source separation programme.
- The majority of the respondents recovered household recyclables in the past but the higher the family income, the less common was it in doing so.
- The lower income group tended to recover a greater portion of normal waste for selling to the waste depots.

9. Policy implications

With its rapid urbanization in recent years, Guangzhou has also experienced waste management problems similar to other major cities in the world, namely, shortage of waste disposal and treatment facilities, increasing amount of recyclables found in the waste stream and increasing per capita waste generation [1]. Yet, the fear that a source separation programme is not likely to be successful is deterring positive action.

As indicated in the survey, there is sufficient ground to organise a trial on a source separation programme of household waste in Guangzhou and this approach has been widely regarded as a right measure in attaining sustainability in waste management. At the same time, the survey result indicated that informal source separation of recyclables is widely practised at present.

Therefore, for policy makers, the concern should not be on whether the public knows how to separate the waste but rather on how to motivate them to separate waste for environmental reasons. As indicated in the survey findings, the lower income group tended to do more recovery. It is likely that the monetary reward is the major motivation of their pro-recovery behaviour. Thus, in an organized source separation programme, an economic element should be built-in to encourage participation. Measures found to be effective in other countries, such as a variable charging rate or 'pay as you throw' rate in waste disposal could be modified to suit the Chinese situation. This would encourage the householders to separate more recyclables from the normal waste stream for recycling.

At the same time, the private waste recovery sector must be strengthened to ensure that recyclables have a positive economic value. It is suggested that the job description of the Guangzhou Recyclable Management Office should be extended to cover the privately run waste depots and the announced scavengers. Codes of practice for level of operators should be established so that accountable and efficient business recyclable transactions are better ensured. This will enhance the competitiveness of locally sourced secondary materials.

Shall the government be involved in marketing the recyclables collected from a community recycling programme? This issue merits a separate discussion. Worldwide, there are several options for this, ranging from citizen's cooperatives (as in the case of Japan) to manufacturers's association (as in the case of Germany) to council run material recovery facilities (as in the case of the USA).

It has to be remembered that there are other important technical and practical factors affecting the implementation of a source separation programme that should be treated with care as well. These factors include the collection frequency, forms of collection, infrastructural support, availability of economic incentive for waste separation, and the management and marketing of collected recyclables.

Regarding the environmental paradigm, it was found that the Guangzhou citizens were slightly more acceptive of the Paradigm than Hong Kong people in the early 1990s. The concerns however should be on the disparity of the NEP scores between different target groups. In particular, government officials, the more wealthy and the tertiary education groups were less acceptive to the environmental ideas than an average citizen. The younger generation, namely those below the age of 17, were found to be one of the most receptive groups to the NEP. Thus, it is believed that the existing school curriculum has been more successful in changing the environmental attitude of the students than the previous ones. While the existing approach in school environmental education should be continued, public environmental education and especially those targeting municipal and provincial government officials should be given a higher priority. This may also have an impact on enlisting the support from government officials for a household waste source separation programme. Not until decision makers have put adequate weight on environmental issues will corrective measures be carried out.

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Appendix A. The English translation of the questionnaire

The questions in this questionnaire are mostly opinion seeking. Through answering these questions, your views on domestic waste and environmental issues are known and improvement on the waste collection and management services can be made.

Part I. On domestic waste.

1.1 Which statement best describes your situation in domestic waste collection?

[353] I need to carry the waste to the waste hut (or a communal collection area) on the ground floor.

[70] I need to carry the waste to the refuse chute for disposal

[263] I need to bag the waste and put it next to my main door for collection.

[76] I need to put the waste bin next to my main door for waste collection.

[2] Others, please specify_____

1.2 How much do you pay for the waste collection service per month (¥10.23 mean)?

1.3 Do you think the charge level is reasonable?

[8] Too low.

[479] Reasonable.

[196] Too high.

1.4 The Environmental Health Bureau has been replacing the old domestic waste collection service with bagged door-to-door collection service. Do you support this change?

[508] Yes, I do.

[99] No, I do not.

[171] No opinion.

1.5 What is your view on the retrieval of recyclables by the scavengers at the district waste collection points?

[102] Should let them continue, because_____

[439] No opinion.

[238] Should stop them, because_____

1.6 Waste avoiding measures include reducing, repairing, reusing materials and declining excessive packaging. How much waste would you consider avoidable in your household?

[212] None.

[288] $< 5\%$.

[198] 5–10%.

[46] 10–15%.

[25] $> 15\%$.

1.7 To separate the recyclables from normal waste by households can increase their recycling potential and save landfill space. Do you support source separation of waste at home?

[170] Yes, I do and should be mandatorily carried out.

[490] Yes, I do but should be on a voluntary basis.

[123] No, I do not.

1.8 Which of the following would you be willing to source separate from normal waste at home? Can choose more than one category.

[612][1] Waste paper, such as old newsprint, outdated magazines.
[226] Film plastics.
[356] Rigid plastics, such beverage bottles, water buckets.
[353] Glass bottles.
[454] Aluminium cans.
[284] Other scrap metals.
[224] Rags.
[318] Old brown and white goods.
[6] Others, please specify_____

1.9 Do you sell recyclables arising from own domestic waste yourself?
[656] Yes.
[119] No (please go to section 2).

1.10 Would you please apportion the following categories of recyclables out of all recyclables recovered in the past year?

	Mean %
☐ Waste paper	45.52
☐ Film and hard plastics	2.58
☐ Glass bottles	9.13
☐ Aluminium cans	16.28
☐ Other scrap metal	4.04
☐ Rags and old clothing	1.05
☐ Old brown and white goods	2.74
☐ Others, please specify_____	0.25

1.11 Out of all the waste (recyclables + waste) generated by your family, how much was recovered in the last year?
[277] $< 5\%$.
[198] 5–10%.
[99] 16%–30%.
[30] 31%–50%.
[22] $> 50\%$.

Part II. The New Environmental Paradigm.

2.1 We are approaching the limit of the number of people the earth can support.
[171] Strongly agree.
[394] Agree.
[67] Disagree.
[15] Strongly disagree.
[122] No opinion.

[1] The figures in this question represent the number of responses indicating a willingness to separate the material concerned.

2.2 The balance of nature is very delicate and easily upset.
[139] Strongly agree.
[457] Agree.
[61] Disagree.
[12] Strongly disagree.
[101] No opinion.

2.3 Humans have the right to modify the natural environment to suit their needs.
[78] Strongly agree.
[349] Agree.
[123] Disagree.
[101] Strongly disagree.
[120] No opinion.

2.4 Mankind was created to rule over the rest of nature.
[68] Strongly agree.
[346] Agree.
[119] Disagree.
[98] Strongly disagree.
[140] No opinion.

2.5 When humans interfere with nature it often produces disastrous consequences.
[201] Strongly agree.
[407] Agree.
[37] Disagree.
[36] Strongly disagree.
[89] No opinion.

2.6 Plants and animals exist primarily to be used by humans.
[21] Strongly agree.
[181] Agree.
[376] Disagree.
[96] Strongly disagree.
[100] No opinion.

2.7 To maintain a healthy economy we have to develop a 'steady-state' economy where industrial growth is controlled.
[95] Strongly agree.
[376] Agree.
[128] Disagree.
[16] Strongly disagree.
[153] No opinion.

2.8 Humans must live in harmony with nature in order to survive.
[311] Strongly agree.
[399] Agree.

Table 6
Crosstabulation of the support for the new waste collection method by the perception on the level of waste collection charges (ignoring those who considered charges too low)

	Is the collection fee reasonable?		
	Reasonable (row%, column%)	Too high	Total
Support	324 (75, 68.4)	108 (25.0, 55.4)	432 (64.6)
Not support	48 (54.5, 10.1)	40 (45.5, 20.5)	88 (13.2)
No opinion	102 (68.5, 21.5)	47 (31.5, 24.1)	149 (22.3)
	474 (70.9)	195 (29.1)	669
χ^2	Value	DF	Significance
Pearson	15.34363	2	0.00047

Minimum expected frequency: 25.650.

[16] Disagree.
[13] Strongly disagree.
[34] No opinion.

2.9 The earth is like a spaceship, with only limited room and resources.
[133] Strongly agree.
[436] Agree.
[84] Disagree.
[8] Strongly disagree.
[106] No opinion.

2.10 Humans need not adapt to the natural environment because they can remake it to suit their needs.
[13] Strongly agree.
[97] Agree.
[422] Disagree.
[158] Strongly disagree.
[81] No opinion.

2.11 There are limits to growth beyond which our industrialized society cannot expand.
[45] Strongly agree.
[322] Agree.
[176] Disagree.
[14] Strongly disagree.
[212] No opinion.

2.12 Mankind is severely abusing the environment.
[169] Strongly agree.
[394] Agree.

Table 7
Crosstabulation of per capita family income by the perception of householders on waste charge levels

Waste charge level	Per capita income of the family (¥)						
	<300 (row%, column%)	300–500	500–700	700–1000	1000–2000	≥2000	Total
Reasonable	20 (4.3, 48.8)	84 (18.3, 61.8)	110 (23.9, 71.9)	126 (27.4, 73.3)	81 (17.6, 80.2)	39 (8.5, 84.8)	460 (70.9)
Too high	21 (11.1, 51.2)	52(27.5, 38.2)	43 (22.8, 28.1)	46 (24.3, 26.7)	20 (10.6, 19.8)	7 (3.7, 15.2)	189 (29.1)
	41 (6.3)	136 (21.0)	153 (23.6)	172 (26.5)	101 (15.6)	46 (7.1)	649
χ^2	Value	DF	Significance				
Pearson	24.27838	5	0.00019				

Minimum expected frequency: 11.940.

Table 8
Crosstabulation of gender by the support for waste separation

	Support for waste separation			
	Mandatory (R%, C%)	Voluntary	Do not support	Total
M	68 (21.9, 41.2)	208 (67.1, 47.3)	34 (11.0, 31.5)	310 (43.5)
F	97 (24.1, 58.8)	232 (57.6, 52.7)	74 (18.4, 68.5)	403 (56.5)
	165 (23.1)	440 (61.7)	108 (15.1)	713
χ^2	Value	DF	Significance	
Pearson	9.24777	2	0.00981	

Minimum expected frequency: 46.957; number of missing observations: 75.

[84] Disagree.
[18] Strongly disagree.
[108] No opinion.

Part III. General information and personal particulars.

3.1 Gender:
[312] Male.
[406] Female.

3.2 Age:
[143] 17 or below.
[30] 18–30.
[561] 31–55.

Table 9
Crosstabulation of education level by the views on the scavengers

Education	Views on the scavengers			
	Should continue (R%, C%)	No opinion	Should stop them	Total
Primary or lower	6 (23.1, 6 2)	14 (53.8, 3.3)	6 (23.1, 2.6)	26 (3.5)
Secondary	66 (13.1, 68.0)	305 (60.4, 72.8)	134 (26.5, 58.3)	505 (67.7)
Tertiary or higher	25 (11 6, 25.8)	100 (46.5, 23.9)	90 (41.9, 39.1)	215 (28.8)
	97 (13.0)	419 (56.2)	230 (30.8)	746
χ^2	Value	DF	Significance	
Pearson	19.55889	4	0.00061	

Minimum expected frequency: 3.381; cells with expected frequency < 5: 1 of 9 (11.1%); number of missing observations: 42.

Table 10
Crosstabulation of education level by the percentage of recyclables recovered by the respondents in the past year

Education	Percentage of recyclables recovered out of total waste (%)					
	None (R%, C%)	<5	5–15	16–30	>31	Total
Secondary	64 (13.2, 61.0)	169 (34.9, 65.5)	143 (29.5, 76.5)	74 (15.3, 78.8)	34 (7.0, 70.8)	484 (69.9)
Tertiary or higher	41 (19.7, 39.0)	89 (42.8, 34.5)	44 (21.2, 23.5)	20 (9.6, 21.3)	14 (6.7, 29.2)	208 (30.1)
	105 (15.2)	258 (37.3)	187 (27.0)	94 (13.6)	48 (6.9)	692
χ^2	Value	DF	Significance			
Pearson	13.71082	4	0.00828			

Minimum expected frequency: 14.428; number of missing observations: 96 (including the primary level respondents).

Table 11
Crosstabulation of occupation by the views on source separation of household waste

Occupation	Support for waste separation			
	Mandatory (R%, C%)	Voluntary	Do not support	Total
Housewives	17 (25.0, 10.5)	38 (55.9, 8.4)	13 (19.1, 11.6)	68 (9.3)
Education/environmental hygiene	25 (26.3, 15.4)	62 (65.3, 13.6)	8 (8.4, 7.1)	95 (13.0)
Government	9 (32.1,5.6)	12 (42.9, 2.6)	7 (25.0, 6.3)	28 (3.8)
Managerial staff	55 (25.7, 34 0)	127 (59.3, 27.9)	32 (15.0, 28.6)	214 (29.4)
Production etc.	17 (18.3, 10.5)	64 (68.8, 14.1)	12 (12.9, 10.7)	93 (12.8)
Technological and engineering	5 (14.3, 3 1)	25 (71.4, 5.5)	5 (14.3, 4.5)	35 (4.8)
Service industry	3 (5.6, 1.9)	39 (72.2, 8.6)	12 (22.2, 10.7)	54 (7.4)
Others (students and farmers)	31 (21.8, 19.1)	88 (62.0, 19.3)	23 (16.2, 20.5)	142 (19.5)
	162 (22.2)	455 (62.4)	112 (15.4)	729
χ^2	Value	DF	Significance	
Pearson	23.72116	14	0.04950	

Minimum expected frequency: 4.302; cells with expected frequency < 5: 1 of 24 (4.2%); number of missing observations: 59.

[13] 56–65.
[7] Above 66.

3.3 Education level:
[26] Primary or lower.

Table 12
Crosstabulation of per capita income of the family by selling of household recyclables

Per capita income/mth (¥)	Sell own recyclables		
	Yes (R%, C%)	No	Total
≤300	42 (91.3, 6.8)	4 (8.7, 3.3)	46 (6.2)
301–500	128 (86.5, 20.8)	20 (13.5, 16.3)	148 (20.1)
501–700	151 (88.8, 24.6)	19 (11.2, 15.4)	170 (23.0)
701–1000	160 (81.2, 26.0)	37 (18.8, 30.1)	197 (26.7)
1001–2000	104 (80.0, 16.9)	26 (20.0, 21.1)	130 (17.6)
>2000	30 (63.8, 4.9)	17 (36.2, 13.8)	47 (6.4)
	615 (83.3)	123 (16.7)	738
χ^2	Value	DF	Significance
Pearson	21.40008	5	0.00068

Minimum expected frequency: 7.667; number of missing observations: 50.

Table 13
Crosstabulation of per capita income of the family by percent of waste sold out of total waste

Per capita income/mth (¥)	Percent of recyclables sold (%)					
	None (R%, C%)	<5	5–15	16–30	>30	Total
≤300	4 (8.9, 3.6)	14(31.1, 5.2)	11 (24.4, 5.8)	11 (24.4, 11.7)	5 (11.1, 10.0)	45 (6.3)
301–500	19 (13.3, 17.0)	59 (41.3, 22.0)	39 (27.3, 20.5)	15 (10.5, 16.0)	11 (7.7, 22.0)	143 (20.0)
501–700	16 (9.7, 14.3)	71 (43.0, 26.5)	34 (26.1, 22.6)	23 (13.9, 24.5)	12 (7.3, 24.0)	165 (23.1)
701 –1000	35 (18.5, 31.3)	68 (36.0, 25.4)	56 (29.6, 29.5)	22 (11.6, 23.4)	8 (4.2, 16.0)	189 (26.5)
1001–2000	24 (19.0, 21.4)	38 (30.2, 14.2)	33 (26.2, 17.4)	19 (15.1, 20.2)	12 (9.5, 24.0)	126 (17.6)
>2000	14 (30.4, 12.5)	18 (39.1, 6.7)	8 (17.4, 4.2)	4 (8.7, 4.3)	2 (4.3, 4.0)	46 (6.4)
	112 (15.7)	268 (37.5)	190 (26.6)	94 (13.2)	50 (7.0)	714
χ^2	Value	DF	Significance			
Pearson	31.91323	20	0.04423			

Minimum expected frequency: 3.151; cells with expected frequency < 5: 2 of 30 (6.7%); number of missing observahons: 74.

[510] Secondary.
[218] Tertiary or higher.

3.4 Occupation:
[69] Housewife.
[96] Education or environmental hygiene staff or workers.
[28] Provincial or municipal government officials.
[214] Management staff of private or state enterprises.
[94] Production, manufacturing, mining and transportation workers.
[35] Technological and engineering professionals.
[55] Service industry workers.
[143] Others, please specify_____

3.5 Per capita income per month (divide total income of the family by the number of family members):
[46] < ¥300.
[152] ¥301–500.
[171] ¥501–700.
[201] ¥701–1000.
[130] ¥1001–2000.
[47] > ¥2000.

3.6 Types of accommodation: choose the answer that best describes your accommodation.
(i) [133] With refuse chute. [476] Without refuse chute.
(ii) [66] Commodity housing. [480] Government housing.
[176] Built by occupants.
(iii) [29] Served by lifts. [497] Not served by lifts. [73] Bungalow.

3.7 Living district:
[49] Li Wan. [70] Dong Shan. [128] Hai Zhu. [77] Yue Shiu.
[77] Huang Bu. [94] Fong Cun. [193] Bai Yun. [122] Tian He.
End of questionnaire. Thank you.

Appendix B. Crosstabulation of variables.

Tables 6–13.

References

[1] Chung SS, Poon CS. A comparison of waste management in Guangzhou and Hong Kong. Resour Conserv Recycl supplement 1998a;22(4):203–216.
[2] Guangzhou Environmental Health Institute. Planning to Abate Pollution from Solid Waste in Guangzhou: 1995–2010. Guangzhou, August 1996.
[3] Dunlap RE, Van Liere KD. The new environmental paradigm. J Environ Educ 1978;9:10–9.
[4] Albrecht D, Bultena G, Hoiberg E, Nowak P. The New Environmental Paradigm Scale. J Environ Educ 1982;10:39–44.

[5] Hong Kong Environment Centre. New Environmental Paradigm Survey 1991. Ng TLG, editor. Hong Kong, 1991.
[6] Wong KK. The environment: heading towards sustainability? In: Nyaw MK, Li SM, editors. The Other Hong Kong Report 1996. Hong Kong: Chinese University Press 1996:367–387.
[7] Pan LP, Huang YH. A report on the environmental awareness survey of the general public in the Zheiiang Province. Environ Pollut Prev 1997;19:24–27, 31.
[8] Chung SS, Poon CS. Waste recovery systems in Guangzhou and Hong Kong. Resources, Conserv Recycl supplement 1998b;23(1–2):29–40.
[9] Chung SS. Policy and Economic Considerations on Waste Minimization and Recycling in Hong Kong. PhD Thesis. Hong Kong: Hong Kong Polytechnic University, 1996.
[10] Chung SS, Poon CS. Hong Kong citizen's attitude towards waste recycling and waste minimization measures. Resour Conserv Recycl 1994;10:377–400.
[11] Planning, Environment and Lands Branch. Draft Waste Reduction Plan for Hong Kong: Consultation Paper. Hong Kong, May 1997.