



# Waste management in Madras revisited

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**SUMMARY:** *This paper examines how households in Madras (official name – Chennai) view garbage problems, what their preferences are for improved services and the extent to which they would pay for them. It includes a comparison between areas served and not served by Civic Exnora units where neighbourhoods organize their own primary collection; such units now provide services for close to half a million people. The findings are drawn from focus group discussions, household interviews from across a range of income levels and spatial locations (within Madras City, within the nine towns around the city and other settlements within the metropolitan area) and in-depth interviews with those who manage the Civic Exnora units. The findings highlight how people are willing to cooperate and pay substantial sums for waste collection – but not for other waste management costs (such as transport and final disposal). They also show how the financial viability of neighbourhood collection schemes such as the Civic Exnora units depends on having transfer stations close by, to which the collected wastes can be taken.*

## I. INTRODUCTION

THIS PAPER DISCUSSES some issues concerning waste management from the point of view of households in Madras.<sup>(1)</sup> There are three reasons why Madras merits special attention:

- in discussions on non-conventional options for managing garbage in Asian cities, Civic Exnora initiatives in Madras have been highlighted<sup>(2)</sup> and Exnora was identified among the “100 best practices” at the 1996 Habitat II conference in Istanbul;
- in October 1996, after a gap of nearly 25 years, Madras has had local government elections;
- Madras now has a master plan for solid waste management<sup>(3)</sup> as a part of a World Bank funded sanitation project.

Many visitors to cities in Africa, Asia and Latin America describe them as “filthy”. An economic explanation of the causes of the problem of garbage need not be made anew; Hardin discussed some aspects of it, albeit briefly, 30 years ago.<sup>(4)</sup> Since streets and other public spaces are open access resources (or sinks), the cost of dumping wastes for individual households (or firms) is negligible compared to the cost of purifying the wastes prior to dumping – but the cost to society is significant. One solution is to introduce coercion – or a set of collectively determined rules and

norms. If two households have access to a street and if both agree not to dump garbage on that street, the problem is solved. However, this may involve some costs – for example, having to store the garbage and place it in the municipal waste collection vehicle when it comes, or undertaking some recycling. For a self-interested, “rational” person, dumping on the street is still a less expensive option. Using a one-shot prisoner’s dilemma analogy, one may find that, in the absence of communication between the two households concerned, dumping the wastes on the street turns out to be the dominant strategy for both. While cooperation issues have been well-discussed in the case of water,<sup>(5)</sup> the Civic Exnora model of waste collection which has evolved in Madras has a similar basis. Against this background, this paper explores solid waste management issues from the point of view of households. In particular, it seeks to understand whether people would cooperate to keep their streets free from garbage, in spite of some cost.

## II. THE CIVIC EXNORA CONCEPT

EXNORA INTERNATIONAL IS a non-governmental organization based in Madras which promoted the idea of forming neighbourhood associations for managing primary waste collection. Civic Exnora units are formed of households from one or a set of streets, and a small number of office bearers (either elected or, more commonly, filled by volunteers) form the committee that manages the Civic Exnora. One person, responsible for collecting the wastes (called “street beautifier”), is appointed and trained; often a tricycle waste collection cart is purchased with a bank loan or funds from private sponsors. Wastes are collected from each household once daily and are taken to a municipal bin or (increasingly) to a municipal corporation transfer station. Each household contributes a monthly fee to the Civic Exnora. Based on the contributions, a monthly salary is paid to the street beautifier and the remainder is used for repaying the loan for the purchase of the tricycle and undertaking any other programmes. Furedy mentioned that more than 60,000 people were receiving waste services from some 500 roads in about 80 neighbourhoods, organized by 150 Civic Exnora units.<sup>(6)</sup> A more recent estimate states that there are 1,500 Civic Exnoras covering approximately 0.45 million people.<sup>(7)</sup> Furedy’s paper also notes that experiments had begun in backyard composting, and composting in boxes on apartment colonies.

The concept of mobilizing people’s cooperation for tackling waste collection is fairly simple and not necessarily unique to Exnora. For instance, residents’ associations in Calcutta are using the same concept and Chatterjee mentions a similar programme in Hyderabad, India, where the municipal corporation is also contributing to some of the costs.<sup>(8)</sup> What is unique perhaps is the recognition of an unmet need: the lack of an institutional structure to represent the problems of local people and get the attention of the civic authorities in order to redress the problems. That Madras is one of the few cities to be denied an elected local government for 25 years might seem an obvious reason for this lack; and now that Madras has had local elections, there should be no need for Civic Exnoras. Yet, Civic Exnoras have adapted to the new situation and now function as a bridge between elected councillors and the people who elect them. For instance, Civic Exnoras in some zones in Madras City are organizing “face-to-face” with municipal councillors. Also, Civic Exnoras are focus-

1. Madras (or Chennai - its official name) is the fourth largest metropolitan city in India. In 1991, its population was composed of 3.8 million in Madras City (an area of 172 square kilometres) and another 1.6 million in the metropolitan region (about 1,000 square kilometres).

2. See, for instance, Furedy, C. (1992), “Garbage: exploring non-conventional options in Asian cities”, *Environment and Urbanization* Vol.4, No.2, pages 42- 61.

3. Environmental Resources Management (1996), *Municipal Solid Waste Management Study for the Madras Metropolitan Area*, Madras Metropolitan Development Authority, Madras.

4. Hardin, G. (1968), “The tragedy of the commons”, *Science* Vol.162, pages 1243-48.

5. Bardhan, P. (1995), “Rational fools and cooperation in a poor hydraulic economy”, Chapter 9 in Basu, K., P., Pattanayak and K. Suzumura (editors), *Choice, Welfare and Development: A Festschrift in Honour of Amartya Sen*, Clarendon Press, Oxford.

6. See reference 2.

7. Ramkumar, T.K. (1996), “Community initiative for environmental management: the work of Exnora International, an NGO”, paper presented at the International Conference on Environmental Strategies for Asian Cities, Madras, India, February 14-17.

8. Chatterjee, R. (1995), “Response” in Serageldin I., M.A. Cohen and K.C. Sivaramakrishnan (editors), *The Human Face of the Urban Environment*, The World Bank, Washington DC, pages 283-286.

ing a lot of energy on community-level interaction, environmental awareness and tree-planting among other activities. Civic Exnoras are so much a part of the waste management system in Madras that the strategy proposed in the master plan for solid waste management states that "...primary collection will be arranged by community based groups..."

On the other hand, Civic Exnoras are conspicuous by their absence in many suburbs and adjoining urban areas of Madras. If the concept can be so successful in Madras City, and win appreciation as a "best practice", why is it not being used in the suburbs only a few miles away? Is it a lack of awareness or are there institutional constraints? These are questions of interest for both researchers and policy makers.

### III. RESEARCH QUESTIONS AND METHODS

AGAINST THIS BACKGROUND, this research aims to examine some of the following issues :

- How do households in Madras Metropolitan Area view garbage problems compared with other civic services?
- If a Civic Exnora is formed in every street, would the households join?
- To which aspects of waste management do households attach importance, i.e., would they support programmes for street collection (in the form of Civic Exnoras) or would they also support transport and final disposal of garbage?
- How many would like to move towards so-called "zero waste" households, vermi-composting all organic wastes?
- Are there any problems in sustaining the Civic Exnora model?

Research for this study was conducted between June and October, 1996 and March and April, 1998. The research methods included focus group discussions, household interviews based on multi-stage sampling procedures (for the first four questions above), and in-depth interviews with a sample of Civic Exnora clubs (for the final question above). With regard to the first question, i.e., how citizens in Madras compare solid waste management services to other services, respondents were asked to rate the quality of different services – as described in more detail below.

To understand household preferences for joining a primary waste collection system that requires a monthly payment, the contingent valuation method (CVM) was used. In this method, alternative arrangements providing for different levels of waste management services are described, followed by a "willingness to pay" (WTP) question. A closed-ended WTP question is often recommended because there is no incentive to respond in a particular way and it is closer to the purchasing decisions faced by consumers. A multiple-choice WTP question was used, where the respondent was faced with having to decide between two or more options involving different levels of service and different price tags.

The sample for the study was drawn using a multi-stage cluster sampling design. In the first stage, the target sample of 200 households was allocated in proportion to the population of the three spatial units within Madras Metropolitan Area (MMA), namely, Madras City, the nine towns adjoining Madras City which form a major part of its urban agglomeration area, and the other settlements and rural areas within the MMA. A control was used to ensure that at least 30 per cent of the sample households in each spatial unit and second level clusters were drawn from low-income housing areas including slums and hutments (as the esti-

mated population living in such settlements in the MMA is about 30 per cent). In selecting the second and third stage clusters from each spatial unit, population, growth rate (1981-91), average household size, female literacy rates, etc. were used as stratifiers. Also, steps were taken in the survey implementation to ensure representation of different age groups, especially women who formed 43 per cent of the final respondents. Conducting the survey became impossible by the end of September 1996 as door-to-door campaigns by political parties intensified in the run-up to the historic local government elections of October 1996. The survey completion rate of 74 per cent compares favourably with good CVM surveys and the recommended response rates.<sup>(9)</sup>

#### IV. RATING OF VARIOUS SERVICES IN MMA BY HOUSEHOLDS

ONE OF THE issues explored in the Madras household survey was how citizens viewed the performance of various services. In most countries in Asia, Africa and Latin America, many urban services continue to be public sector monopolies. Drawing from Paul's pioneering work on comparing service performance in some Indian cities,<sup>(10)</sup> the views of citizens of Madras were sought on 14 items relating to the urban environment. Respondents were asked to give marks to each item based on the Likert scale where a score of one means "very bad" and a score of five "very good". A score of two means "bad", three "moderate" and four "good". The mean scores for the 14 services covered in the survey are presented in Table 1 below.

<b>Table 1</b>			
<b>Services in Madras Metropolitan Area (MMA) Ranked in Ascending Order (1 "very bad" - 5 "very good")</b>			
	Mean score	Standard deviation	N (valid sample)
River Cooum and waterways	1.25	0.62	122
Mosquito control	1.49	0.82	146
Storm drains	1.93	1.13	147
Tree-planting	1.95	1.16	65
Sewerage	2.19	1.08	109
Roads and traffic	2.34	1.07	148
Solid waste management	2.47	1.31	148
Water supply	2.70	1.14	141
Bus transport	3.17	1.23	143
Electricity	3.18	1.13	142
Telephones	3.31	1.20	85
Beaches	3.33	1.18	123
Fire service	3.48	1.08	82
Suburban trains	3.71	0.97	109

The ratings or scores given to different services are fairly stable across income groups although there are a few exceptions.<sup>(11)</sup> As the standard deviations in the above table indicate, the management of the river Cooum and mosquito control programmes are rated as "very bad" across the board; trains, the fire service and electricity get better scores (three and above). The ranking in Table 1 can be interpreted in other ways too. For

9. Schuman, H. (1996), "The sensitivity of CV outcomes to CV survey methods", Chapter 5 in Bjornstad D.J. and J.R. Kahn (editors), *The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs*, Edward Elgar, Cheltenham.

10. Paul, S. (1993), "Bangalore's public services: a report card", *Economic and Political Weekly*, December 25, pages 2901- 2909.

11. A simple analysis of variance test - ANOVA - using Fisher's F ratio for the 14 services indicated that in only three cases, namely, beaches, electricity and storm water drains, was the null hypothesis rejected at 5 per cent level. The lowest-income group households rated the present level of maintenance of beaches as very good - with an average score of 4.19; the highest-income group households rated it at less than moderate - with an average score of 2.78.

instance, it indicates that, in general, the better performing services are also the ones with a private goods character. These are services for which a user charge is paid (trains, buses) or for which non-payment may result in withdrawal of service (telephones, electricity). On the other hand, those services of a public goods character (where benefits are supposed to accrue to everyone) emerge as poor performers.

It can also be seen from Table 1 that solid waste management has the highest standard deviation; this is partly due to the Exnora effect. The average score for solid waste management by households already covered by Exnora is 3.47 (and would make it the third best service after suburban trains and the fire service). For households not covered by a Civic Exnora, the average score for solid waste management is 2.36 – which would not change its relative position compared to other services.

The figures also indicate that there are seven services where more than 50 per cent of the respondents think performance is either “very bad” or “bad”. These are the management of the river Cooum and other waterways, mosquito control, storm drainage, tree-planting, sewerage, roads and traffic management, and solid waste management (in that order). For instance, more than 80 per cent of households in Madras Metropolitan Area (MMA) think that the condition of the waterways in Madras is “very bad” and another 10 per cent think it is “bad”.

When we analyze this information across spatial units, some interesting differences can be noted. For instance, solid waste management has an overall score of 2.47, however, the service provided by local bodies outside Madras City is skeletal in nature, with very little infrastructure. This is also picked up in the relative scores. In Madras City, this service gets an average score of 2.74 compared to 1.58 in the nine towns in Madras urban agglomeration. Similarly, the fire service, which was given an average score of 3.56 by households in Madras City and 3.50 by households in the nine towns, gets an average score of 1.67 among households in the rural areas of MMA.

The analysis so far can thus be summarized:

- In MMA, on the whole, none of the services is excellent, some are clearly perceived as being better and some worse.
- MMA seems to be relatively better endowed with transport, electricity and communications compared to the “basic” services of water supply, sanitation and waste management. A vision of a Madras with world class automobile plants in one part of the metropolitan area and annual cholera outbreaks killing people elsewhere in the city is not far from reality.
- Among the households covered by a Civic Exnora, the relative ranking of waste management is considerably higher than in those not covered by a Civic Exnora.

## V. WASTE DISPOSAL HABITS OF HOUSEHOLDS

WASTE DISPOSAL HABITS or behaviour are determined by climate, housing conditions, existing levels of service, effectiveness of regulations and cultural and other factors. Also, some characteristics of waste (for example, odour and the impact of flies and rodents) exhibit a distance-decay function. When primary waste collection services are not reliable, the incentive is to explore other options and when regulation is either absent or the majority are non-compliant, the incentive is to dump wastes

in open access spaces such as streets and public spaces. In hot and humid climates, there are disincentives for accumulation or storing of wastes and positive incentives for disposing of wastes as and when they arise. Waste management in any city requires understanding and realigning these incentives in institutional arrangements.

In an Exnora type arrangement, households are required to keep wastes on their premises and hand them over to the street beautifier once a day. The master plan proposals are also built on such a primary collection system. In MMA, 55 per cent of households interviewed do dispose of wastes only once daily and about 23 per cent of households dispose of wastes as soon as they arise. In the lowest-income group, nearly 62 per cent of households said that they disposed of wastes as soon as they arose (see Table 2).

<b>Table 2</b>		<b>Frequency of Household Waste Disposal in Madras Metropolitan Area (MMA)</b>				
Frequency of waste disposal	(Mean) monthly income (Rps)					All households in MMA
	2,000	3,000	4,500	8,000	20,000	
As soon as wastes arise	61.5	28.2	14.3	12.0	6.7	23.0
Once daily	23.1	48.7	61.9	60.0	86.7	55.8
Once every 2 or 3 days	-	10.2	-	12.0	-	6.2
Burnt/composted	15.4	12.8	23.8	16.0	6.7	15.0
Sample composition	11.5	34.5	18.6	22.1	13.3	100.0

When we view the patterns spatially, a different picture emerges. In the nine towns around Madras and in the surrounding rural areas within MMA (where primary collection services are very weak or absent), burning of wastes is the predominant mode of disposal: 46 per cent of households in the nine adjoining towns and 57 per cent in the rural areas resort to this method (see Table 3).

<b>Table 3</b>		<b>Spatial Variations in Waste Disposal Frequency</b>		
Frequency of waste disposal	Spatial unit			All households in MMA
	Madras City	Nine towns	Rural	
As soon as wastes arise	23.2	20.8	28.6	23.0
Once daily	68.3	25.0	14.3	55.8
Once every 2 or 3 days	6.1	8.4	-	6.2
Burnt/composted	2.4	45.8	57.1	15.0
Sample composition	72.6	21.2	6.2	100.0

While looking at the sample composition figures in the last row of Table 3, it may be recalled that we have drawn the sample using the population proportionate sampling method. Using 1991 census figures, of the 1.1 million households in MMA, 70 per cent were in Madras City, 19 per cent were in the nine surrounding towns and the remaining 11 per cent were in the remaining smaller urban areas and rural parts of the metropolitan area.

The next question is, who handles the wastes in the household? While

this question is relevant from several perspectives (gender and intra-household dynamics), it is difficult to capture it all in an interview. In the Madras survey, a much narrower question of who disposes of the household waste was used; such information could be of use in awareness programmes concerning waste disposal (for instance, in the use of containers as proposed in the master plan). For the whole of the MMA, in one of every four households it is the servant maid who disposes of the wastes in the bin. Some people in Madras indicated that maid servants have no incentive to make sure that wastes are thrown only in the bins and are not strewn all over the place. However, there are dramatic differences between income groups. In lower-income groups, in almost all cases, wastes are brought to the bin by a member of the family. In the highest income group, in almost all cases, it is the servant maid who takes wastes to a bin. Attitudes towards waste disposal (as a menial task) or the social status of such a job imply that even within a household, this task is likely to be done by the weaker members, for instance, children or dependent women such as a widow or a daughter-in-law (see Table 4).

Who handles/disposes of the waste	Mean monthly income (Rps)					All households in MMA
	2,000	3,000	4,500	8,000	20,000	
A member of the family	100.0	91.7	50.0	35.7	-	56.1
Servant/maid		4.2	25.0	21.4	83.3	25.8
Street beautifier		4.2	25.0	42.9	16.7	18.2
Sample composition	11.5	34.5	18.6	22.1	13.3	100.0

### a. Extent of Recycling and Recovery of Resources

The questions on recycling and recovery of materials at household level were posed to a sub-sample within the sample households. Hence, the figures may not be very representative and only give a general idea. Householders were asked about three major items, namely, paper, glass and cloth. According to the responses, 90 per cent of households recover paper from their household waste and sell it to waste paper merchants; 86 per cent sell any glass items to waste/scrap buyers rather than dispose of it in the garbage; nearly 61 per cent of households sell any waste clothes to vendors who exchange such clothes for utensils, while 31 per cent of households donate old clothes to charities or the needy. These figures are supported by the composition of waste in Madras. In the preparation of the master plan, the terms of reference did not include a comprehensive analysis of waste composition but samples of waste were collected at the landfill site and the analyses indicated the presence of less than 5 per cent of paper, less than 5 per cent of rags and less than 1 per cent of glass.

## VI. AWARENESS OF CIVIC EXNORAS AND CIVIC AWARENESS

WHILE EXNORA HAS won international acclaim, interestingly, this survey indicates that more than 53 per cent of all households are unaware of the Exnora concept. Within Madras City, where most of the Civic

Exnoras exist, 56 per cent of all households are aware of Exnora and 44 per cent unaware. On the outskirts of MMA, 77 per cent of households in the nine towns and 87 per cent of households elsewhere are unaware of the Exnora concept. If households in Madras City are disaggregated by house type, it appears that 95 per cent of households living in hutments/slums and 100 per cent of those living in detached houses are unaware of the Exnora concept. In all other types of houses, more than 67 per cent of households were aware of Exnora.

In addition to awareness of Exnora, answers concerning four other variables were obtained to gain an understanding of civic awareness:

- 54 per cent of households were not aware of the location or reported an incorrect location for the nearest municipal (or zonal) office for the area (the first place that people call for grievances concerning many civic services);
- 65 per cent of households did not know their zone/ward number (this information is displayed on all street name placards in Madras City corporation area);
- only 14 per cent of the households did not know which organization was responsible for solid waste management (86 per cent of households gave the expected answer);
- 84 per cent of the households were unaware of where and how wastes are ultimately disposed.

The last is a bit puzzling, for either it reflects an "out of sight is out of mind" attitude or perhaps they have not been told what happens to the 2,500 tonnes of garbage that is collected daily in the MMA. One wonders if discussions on internalizing the external costs of waste disposal would have any merit in such circumstances.

Awareness is partly related to educational attainment and partly to media coverage. Print and television have been most influential in promoting environmental issues (see Table 5).

Table 5		Awareness of Civic Exnoras and Media Usage by Households in Madras Metropolitan Area (MMA) (%)		
		Awareness of Civic Exnora		
Medium		Unaware (a)	Aware (b)	Of total (c)
Do you read a newspaper:	No	84.6	15.4	26.5
	Yes	41.7	58.3	73.5
Do you have a TV:	No	90.0	10.0	6.8
	Black and white	66.7	33.3	44.6
	Colour	36.1	63.9	48.6
Do you have cable TV:	No	67.5	32.5	55.2
	Yes	35.4	64.6	44.8

Notes: For each row, column (a) and column (b) add up to 100; for each medium, the figures in column (c) add up to 100.

From the above table it is evident that 90 per cent of those without a television and nearly 85 per cent of those who do not read a newspaper are unaware of Civic Exnora. Television seems to have a greater penetration

in MMA: nearly 94 per cent of all households have one whereas one in every four people (25 per cent) does not read a newspaper.

## VII. WILLINGNESS TO PAY FOR WASTE MANAGEMENT SERVICES: RESULTS FROM A CONTINGENT VALUATION METHOD STUDY

THIS SECTION REPORTS on households' willingness to pay for waste management based on the responses to a valuation survey combining contingent valuation method and choice experiments. The respondents were not asked how much they would be willing to pay but were asked to consider the following options:

- **Option 1:** the proposal that a new Civic Exnora would be started in their neighbourhood costing Rps W per month. (This option was not explicitly offered if the respondent was in a street already covered by a Civic Exnora. However, if they said that they preferred the *status quo*, the response was noted.)
- **Option 2:** the proposed/existing Civic Exnora plus a scheme to improve the transport of wastes from transfer stations to disposal sites to be implemented by the municipal corporation/local body and costing Rps X per month.
- **Option 3:** the proposed/existing Civic Exnora plus the transport scheme plus membership of a scheme aimed at improving the disposal of wastes including setting up of a plant to manufacture refuse-derived fuel (RDF) pellets, costing Rps Y per month.
- **Option 4:** zero waste management strategy – where the respondent would be given technical assistance to create and maintain vermicomposting pits on their own premises; the amortized capital costs and cost of time was given as Rps Z per month.

The figures W, X, Y and Z were randomly assigned to each questionnaire. After the options were explained and any clarifications discussed, the respondent was asked to suggest which of the options they preferred and why. "Do nothing" was not offered (explicitly) as an option, but if the respondent did not choose any of the options offered, it was accepted as "none of the options". Similarly, in cases where households were already covered by Exnora, there was the option of just continuing as was and not joining any new programme for the transport or disposal of wastes. The results of the survey are given in Table 6.

Option description	Percentage of households choosing the option	Mean willingness to pay*			
		Entire MMA	Madras City	Nine towns	Rural MMA
None of the options	20.9	-	-	-	-
Civic Exnora only	34.5	26	25	27	27
Civic Exnora+transport	22.3	51	52	43	-
Exnora+transport+disposal	18.9	70	74	60	60
Zero waste strategy	3.4	84	93	70	-
Total	100.0				

\*willingness to pay in rupees per month

The table shows that more than 75 per cent of households would be interested in joining a scheme for improving waste collection, transport and disposal. Of these households, nearly half would be interested in joining a scheme that provided primary collection services only. Although the other two schemes (transport and disposal of wastes) are hypothetical, compared to the actuality of Civic Exnora, and their benefits of a public goods nature, 41 per cent of all households would join such schemes and would be willing to pay substantial amounts. Notwithstanding the merits of vermi-composting, there were few takers for such a scheme.

**Table 7** Responses to "Willingness to Pay" Question: Impact of being Civic Exnora Members (%)

	Option chosen		Mean willingness to pay**	
	H/h* not covered by Civic Exnora	h/h already Civic Exnora member	h/h not covered by Civic Exnora	h/h already Civic Exnora member
None of the options	23.3	-	-	-
Civic Exnora only	36.8	13.3	26	23
Exnora+transport	18.8	53.3	53	44
Exnora+transport+disposal	17.3	33.3	72	65
Zero waste/vermi-composting	3.8	-	84	-
Total	100.0	100.0		

\*h/h = households  
\*\*willingness to pay in rupees per month

If the sample is disaggregated into those who are already members of a Civic Exnora and those who are not, the mean "willingness to pay" figures present an interesting picture (see Table 7). Those who are already members of a Civic Exnora did not opt for the vermi-composting system at all; and on the whole their "willingness to pay" figures are lower than those for people who are not members of a Civic Exnora. Perhaps, those who are already members of a Civic Exnora know how difficult it is to pursue such community based solutions; or perhaps, once their primary collection is taken care of, they do not face the same crisis situation as those who do not have an effective primary collection system. However, one should not read too much into the results since such comparisons were not the objective of the survey (and hence it was not designed with such sampling requirements).

#### a. Analysis of Non-response

In valuation studies, it is important to understand the reasons for not choosing an option or not responding to the valuation question. About one-fifth of households (20.9 per cent) fell into this category (hereafter referred to as "non-responders"). Of these non-responders, nearly 61 per cent are in Madras City. During the survey, the responses were noted and *post facto* were placed into one of eight groups as shown in Table 8.

Doubts about the cooperation of others and a feeling that it is government's responsibility are the two foremost reasons for not joining an improvement scheme. It is interesting to note that those who were satisfied with the present system gave a high rating to the existing solid waste management system. Those who had doubts about others' cooperation or

**Table 8** Reasons for not Choosing any of the Options for Solid Waste Management

Reason given	Percentage of all non-respondents	Average score given for existing solid waste management
Others will not cooperate	25.8	2.67
It is government's responsibility	16.1	2.20
Present system is OK	12.9	3.00
Cannot afford (more than Rps 10 per month)	12.9	2.00
Already paying taxes	9.7	1.67
Not interested	9.7	2.67
No leadership for such schemes	3.2	3.00
Other reasons	9.7	1.67

who said that they were not interested are perhaps actually satisfied with the *status quo* as they considered existing waste management services to be reasonable (rating of 2.67).

Nearly 65 per cent of non-responders were men. Doubts about the cooperation of others were stronger among women non-responders than among men. Thirty-six per cent of women non-responders thought that others would not cooperate compared to 20 per cent of men. Doubts about others' cooperation was the predominant reason among non-responders from the nine suburban towns; another 30 per cent of the non-responders from those towns thought that it was a government responsibility anyway.

## b. Some Results of Probit Regression Models

In valuation surveys, information is analyzed to explain how "willingness to pay" (the dependent variable) is affected by various independent variables. Had the survey used an open-ended question ("how much would you be willing to pay per month"), the response would be a continuous variable. In such cases, an ordinary least squares regression model can be constructed. However, in the Madras survey, the responses were discrete in nature: the respondent was offered a set of options and then chose one of them. Probit or logit regression models can be used in such cases.<sup>(12)</sup> Here, we are interested in finding out about the strength of an individual's preference for waste management services. Let us call this index *Z*. However, this variable is unobservable to us. We have information on whether the respondent has chosen option 1, 2, 3 or 4. A Probit model helps us to construct a relationship between the unobservable index *Z* and various independent variables using the information we have on the option chosen. The independent variables are the services provided by the option, monthly cost (SWPRICE) and the characteristics of the household such as location, income, etc. All the four options used here can be defined using a set of four binary dummy variables relating to the service provided: primary collection (COLLECT); secondary collection and transport of wastes from transfer stations to disposal sites (TRANS); disposal of wastes (DISP); and whether the wastes are recycled (RECYCLE). For example, if an option provides primary collection, the variable COLLECT is set to 1; otherwise it is set to 0. Similarly, a set of independent variables was used to represent household characteristics: INCOME is the mean monthly income of the income group to which the household belongs;

12. See Maddala, G.S.(1992), *Introduction to Econometrics*, Prentice Hall, Englewood Cliffs. For other references on the subject of qualitative dependent variables or for details of the models discussed here, the author may be contacted.

MMA is location dummy variable (if the respondent lives in Madras City, this variable is set to 0; if the respondent lives in the urban agglomeration area or in a rural settlement within MMA, this variable is set to 1); if the respondent is the owner, the variable OWNER is set to 1, otherwise it is set to 0; similarly, the variable FEMALE is set to 1 if the respondent is a female member of the household.

**Table 9** Some Results from Probit Regression

Parameter	Model 1	Model 2	Model 3	Model 4
SWPRICE	0.00002	-0.00012	-0.0004	-0.0004
COLLECT	-0.6493**	-0.6498**	-0.6517**	-0.6523**
TRANS	-0.131**	-0.1284*	-0.1236*	-0.122*
DISP	0.055	0.059	0.0662	0.067
RECYCLE	-0.93**	-0.92**	-0.902**	-0.90**
MMA		-0.0361	-0.041	-0.040
OWNER			0.0363	0.0367
FEMALE				0.0227
INCOME			0.000002	0.00002
Maximum Log likelihood	-250.03	-249.67	-248.76	-248.64
Restricted				
Log-L	-301.59	-301.59	-301.59	-301.59
Chi-squared	103.12	103.85	105.66	105.90
Significance level	0.0000	0.0000	0.0000	0.0000
** p value less than 0.01 (i.e. 1%)				
* p value less than 0.05 (i.e. 5%)				

Statistical analysis shows that concern for waste management is not limited to middle and upper-income groups; households across all income groups have similar preferences for improving waste management in Madras. From the results in Table 9, it can be seen that price (or monthly charges) is not significant. Also, household characteristics are not significant and do not seem to contribute to any explanation. This is evident from comparing model 1 (in which none of the household characteristics is included) and model 4 (in which four household characteristics are included). A pseudo R-square as a measure of goodness of fit can be defined as the ratio  $(LR - L_{max})/LR$ , where LR is the value of log-likelihood restricted (i.e., all parameters are set to 0 and only constant is used) and  $L_{max}$  is the value of log-likelihood function when it is maximized. For model 1 this is  $(-301.59 + 250.03)/(-301.59)$  or 0.17. Including all the household characteristics, as in model 4, contributes to only a tiny improvement in goodness of fit. Of all the waste management services, households seem to be least concerned with final disposal. This result is plausible given that 84 per cent of respondents were unaware of how and where all the garbage collected in their town is disposed of.

## VIII. SUSTAINING CIVIC EXNORAS: SOME RESULTS FROM A SAMPLE STUDY

FROM THE PREVIOUS discussion, it may appear that forming Civic Exnoras or similar street-level community based groups for solid waste management would take care of waste management problems in Madras.

In the life of this 360-year old metropolis, Exnora is a fairly recent innovation. Can it be sustained on a much larger scale? The functioning of existing Civic Exnoras and lessons learnt will hold the key to this question.

To this purpose, a random sample survey of 15 Civic Exnoras and one community organization, very similar to Exnora but not affiliated or related to it, was undertaken. The Civic Exnoras were selected on the basis of location and the selection undertaken independently of the parent organization, Exnora International, in order to avoid any sampling bias. In each case, contact was established with the office bearers or executive members managing the Civic Exnora concerned and in-depth interviews were held with the concerned individuals; in some cases, a local household was contacted independently and some of the details given by the Civic Exnora office-bearers were cross-checked (no discrepancies were found).

On average, each Civic Exnora had been in existence for 3.36 years, each serving on average about 189 households of which 175 were paying a monthly charge and 14 were non-paying households. However, there was considerable variation in the number of households served by each Civic Exnora. Average household incomes would be an obvious explanatory variable but population density also seemed to matter (see Table 10). Sixty-eight per cent of Civic Exnoras employed one street beautifier, a further 25 per cent had two and the rest had three.

Zone in Madras	Area/locality surveyed	Number of Civic Exnoras	Average number of h/h served by each Civic Exnora	Average density: persons per square kilometre (for the entire zone)
6	Mylapore	1	250	381
	Triplicane	7	127	381
8	T Nagar	3	133	311
9	KK Nagar	2	400	153
10	Thiruvanmiyur	3	227	147

On average, each Civic Exnora is managed by a committee of seven members but there are substantial variations. Nearly 70 per cent have five or fewer members managing them; a few have ten-member committees and a very small percentage have a committee of 20.

All the Civic Exnoras collect garbage. However, many of them undertake other activities as well: 80 per cent take up civic grievances such as water supply problems, drainage overflows, faulty street lights, etc.; 50 per cent organize sports competitions once a year; 40 per cent conduct annual cultural competitions for women (the decoration of streets with artistic patterns – called *kolam*); and 30 per cent have taken up tree-planting in their neighbourhoods.

Only one of the 16 Civic Exnoras surveyed (6 per cent) said they were practising “source segregation”, that is, where households are required to segregate organic wastes from other wastes. Three of the surveyed Civic Exnoras (19 per cent) reported some degree of vermi-composting although the amount of waste being composted is less than 20 per cent.

Based on the discussions, some of the main issues concerning the sustainability of the Civic Exnora approach are identified :

- Civic Exnora is basically a primary waste collection system: it cannot function if there is no secondary waste collection system (or sufficiently large open spaces where wastes can be dumped). This is the main reason for there being few Civic Exnoras beyond the Madras City corporation area where there is little municipal waste collection.<sup>(13)</sup>
- In the past, all that was needed was to employ a person to collect the waste and dump it in a large municipal bin nearby, in many cases beyond the area covered by Civic Exnoras. Not any more. Now, the only acceptable place is a municipal transfer station. At present, nine out of the ten zones in the corporation area have a transfer station. Considering that each Civic Exnora collects garbage from an average 189 households, and each household generates about 0.585 kilogrammes per capita per day, the total quantity of waste to be hauled by the street beautifier is about 550 kilogrammes. Therefore, only areas close to the transfer stations favour the functioning of a Civic Exnora. In areas far away from a transfer station, the monthly charge would have to be higher (to cover higher labour costs). While the contingent valuation method study shows that people are willing to pay, the vehicle breakdown rates and the rates at which street beautifiers leave may also start to increase. An alternative might be the use of a mechanical (automobile) waste vehicle or the separation of waste collection and waste transport functions, and the hiring of appropriate persons for each of these. The unit cost of primary collection is thus likely to rise (significantly).
- A majority of Civic Exnoras in the survey mentioned that their formation was triggered by a crisis. In some cases, this was an unmaintained public urinal that became a nuisance and a public health risk. In others, a severe water crisis in 1993 prompted some cooperative arrangement which then became a Civic Exnora. Cooperation for one public service seems to have encouraged households to cooperate for other public services even when the service provider is different. In some cases, cooperation continues even after the crisis is resolved; in others, households may find few incentives to continue to cooperate once the crisis has been mitigated.
- All the Civic Exnoras have first generation leaders; the people who promoted the idea three or four years ago are still running them. All the leaders recognize that it is time for the leadership to be passed on to others but many feel that there is no-one forthcoming to take on the responsibility. In some cases, Civic Exnoras tend to be identified with the people who took the initiative: when their interest wanes, the organization goes down with them.
- Forty-seven per cent of Civic Exnoras felt that there was either "very little" or "little" cooperation from the households in their neighbourhood. Only 20 per cent felt that people were very cooperative. The remaining 33 per cent were ambivalent and felt that there was some degree of cooperation. (It may be recalled from Table 8 that doubts about the cooperation of others was also one of the main reasons why some people in the household survey did not choose any of the options.) However, this issue needs further examination. The question of whether people cooperate can mean three things to Civic Exnora office-bearers: cooperation in keeping the streets clean; cooperation in paying the monthly charges promptly; cooperation through contributing in cash or in kind to other programmes. All the streets where the 16 surveyed Civic Exnoras function were very clean, so the office bearers might be referring to the other two aspects of cooperation.

13. Nanganallur, in the adjoining urban area, is an exception but many Civic Exnoras there seem to be dumping the wastes in a large open space.

- About 40 per cent of Civic Exnoras are pessimistic about the future while only 14 per cent of them are clearly optimistic: the remaining 47 per cent are ambivalent. Interestingly, the Civic Exnoras which said that there was little or very little cooperation from people are also the ones that were pessimistic about the future.
- All the Civic Exnoras which said that "the committee members work collectively" score highly on optimism and on the degree of cooperation from people; in a Civic Exnora where a few individuals carry the burden, reportedly, there is less cooperation from people and this, in turn, seems to create a certain pessimism. Therefore, encouraging teamwork and discouraging one or two individuals from being identified with Civic Exnora seems to be important; on the other hand, teamwork might be slow and could, in turn, produce fewer results, thus gaining less cooperation from people. Resolving this tension between teamwork and quick results is a very important issue in sustaining Civic Exnoras.
- Continuity in providing the waste collection service is critical for any Civic Exnora. When the street beautifier is absent at short notice (say, due to ill-health or other reasons), a crisis arises and many Civic Exnoras find it hard to arrange a back-up service. Some ask the street beautifier from a nearby Civic Exnora to come and step in for the day. Others suggest that the parent organization (Exnora International) could maintain a pool of street beautifiers who could be sent to the Civic Exnoras that need them on a day-to-day basis.
- Among the various suggestions from people running the sampled Civic Exnoras, for any new Civic Exnora the most important issue seemed to be financial management: the management of the funds collected, maintaining accounts regularly, collecting the contributions regularly and having receipts prepared in advance are mentioned repeatedly. Having an annual meeting of all households in the Civic Exnora, keeping politics out of Civic Exnora's functioning and employing a known person as street beautifier were other issues mentioned. The Civic Exnora leaders may have to be trained in financial transparency and in keeping accounts. (On average, each Civic Exnora comprises 175 households paying Rps 120 a year – a total of Rps 21,000 – a substantial sum.)

At present, much of the innovation seems to be taking place in a few Civic Exnoras or in the parent organization, Exnora International; a majority of the Civic Exnoras are followers. Among the Civic Exnoras that are innovative, three characteristics stand out: regular payments by households; enthusiastic committee members – young persons of around 25 and those older than 55 seem to be outstanding compared to those in their thirties and forties (however, it is difficult to explain why this is so); larger sized committees, i.e., a more representative structure and more democratic functioning. Many among the surveyed Civic Exnoras pointed out that finance is a necessary but not a sufficient condition, however, some of the Civic Exnoras felt that they did not have the necessary human resources to manage finances and accounts.

Another issue of concern to some of the Civic Exnoras was that, in the parent organization's (Exnora International) attempts at being an activist, many of the criteria developed are not necessarily valid at the local Civic Exnora level, yet they cannot but adopt the same criteria. For instance, some Civic Exnoras felt that while the benefits of vermi-composting are much publicised, the negative consequences are not. Healthy earthworms (in the vermi-pits) are attractive to rodents and this, in turn, attracts other visitors (e.g. snakes) from further up the food chain.

## IX. CONCLUSIONS

WASTE IS AN inevitable by-product (for some, a consequence) of economic development; in per capita terms, the greater the GNP, the greater the quantity of waste produced each day. We also know that as low or middle-income countries pursue economic growth, their urban populations grow: the greater the GNP per capita, the greater the percentage of population living in urban areas. At the same time, in most cities, external costs are not internalized – for example, the consumption of resources such as fresh water or the pollution of rivers and waterways. While waste production rates increase with economic growth, so too do the social and environmental costs of disposal of these wastes; but many of these costs are hidden (for instance, treating the cost of government-owned land used for waste landfill operations as zero). Economists would argue that to become sustainable, such cities would have to stop “free-loading” and would have to pay the long-term marginal costs for consuming the resources. Deciding on what the city should pay is one thing; translating this into costs for citizens and businesses (as user charges) is another. Research into issues of how citizens value these improvements and what institutional arrangements they prefer gains relevance in such a context.

This paper has examined issues of waste management from the viewpoint of households in Madras using a contingent valuation survey. The Civic Exnora model of primary waste collection was used in the survey to identify people’s preferences for such a waste management approach. The survey indicates that people are willing to cooperate and pay substantial amounts for waste collection – some of them mainly for primary collection, others for transport and disposal which are “public goods”. This reinforces the master plan proposals for using this model as the central tenet of waste management in Madras Metropolitan Area. At the same time, few people are aware of what happens to the waste and are also reluctant to contribute to such improvements unless there is provision for private benefits (such as those provided by a refuse-derived fuel scheme based on membership).

The survey of 16 Civic Exnoras has identified some issues concerning the sustainability of a Civic Exnora model. Distance from transfer station and having a well-functioning secondary collection system seem to be the main issues. Leadership style, committee-type arrangements rather than personalized arrangements, innovation and financial transparency are the keys to a successful functioning of Civic Exnoras.