Voluntary recycling in Quito: factors associated with participation in a pilot programme

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SUMMARY: This paper describes a pilot recycling programme in Quito and the factors associated with residents' participation in separating their wastes. This municipal programme extended garbage collection to previously unserved neighbourhoods through micro-enterprises formed by residents which provided separate collection services (on different days) for organic (compostable), recyclable and non-recyclable wastes, and delivered these to municipal depots. The revenues from the sale of recyclables went to funds to support neighbourhood improvements. A combination of focus group discussions, in-depth interviews and a household survey identified the steps that would have to be taken to increase and sustain residents' separation of wastes – for instance, a more reliable collection service, more evidence that the funds generated were being used for neighbourhood improvement and a better information system about the programme. The research also highlighted two other issues. The first was the need for better integration between recycling programmes and existing informal waste collection systems. The second was the importance of involving programme beneficiaries in the design of local development interventions, such as the recycling programme analyzed here, for them to be sustainable.

I. INTRODUCTION

THE PROVISION OF basic sanitation services represents a continuing challenge throughout Latin America. Solid waste management is a critical component of providing basic sanitation services and reducing environmental health threats to communities. Approximately 30 per cent of solid waste generated in Latin America and the Caribbean is not collected, and only half of what is collected is properly disposed of, even when local governments contribute significant funds.[1] This situation is expected to deteriorate in the future due to rising populations and, in urban areas, continued rural-to-urban migration, contributing to the rapid growth of cities.

Given these trends, it is necessary to increase the percentage of the population covered by municipal solid waste services, and to improve the efficiency and quality of collection, transfer, treatment and disposal services. The intention is to reduce the waste of scarce financial resources while increasing user satisfaction. Expansion of service coverage in a more equitable fashion is also needed, specifically among peri-urban and marginal populations who are usually the least likely to have access to services. Local

governments often neglect the poor because they are unable to support waste collection through taxes or user fees and they generate the least valuable (recyclable) garbage. It is often poorer neighbourhoods that have to pay the highest collection prices to private providers – in part due to higher costs (for instance, because of difficult access for the providers or because providers are too small to achieve economies of scale) but also on occasion because providers can charge higher prices since there is no competition from other potential providers.[2] Among those residents who already have access to services, user satisfaction is an often overlooked aspect of service delivery but a crucial component in building a sustainable system that is predicated upon voluntary compliance with service guidelines.

Unfortunately, few funds for solid waste management are leveraged at the national level in support of local municipalities, which are usually responsible for operating such services. According to the World Bank, local governments in Africa, Asia and Latin America spend 20 to 50 per cent of total municipal revenue on solid waste services. Despite this outlay of resources, levels of service are generally low, with only 50 to 70 per cent of municipal solid waste actually being collected.

Many municipalities in Latin America are responding by developing their own solid waste management solutions. Growing awareness of the economic benefits of recycling, as well as the health and environmental benefits, has led several municipalities to incorporate recycling into these solutions. Although recyclable materials generally comprise only 15 per cent of the total volume of waste produced, the proportion should continue to rise concomitantly with standards of living.[3] Recycling can reduce costs to the municipality for the collection and disposal of solid waste by reducing the quantity of waste the municipality must transport to its landfill.

However, decision makers have often failed to acknowledge the existence of informal recycling networks such as those people who sort wastes at the landfill (who are known as *minadors* in Ecuador) and those who go house to house, buying recyclable products (who are known as *cacharreros*). Both could be trained and integrated into the formal system. Municipalities have also declined to provide financial incentives and support to buy-back centres that provide a market for recyclables.[4]

A small cadre of progressive municipalities have devised waste management approaches based on the use of non-traditional methods for the solid waste sector. These methods are often used for service delivery in low-income neighbourhoods and for recycling secondary materials. In Latin America, where municipal solid waste services have been unable to keep pace with high levels of urban growth, the informal sector has been called upon to provide services to low-income neighbourhoods.[5]

This paper focuses on a municipal experiment with solid waste management services, specifically, a pilot solid waste collection and recycling programme implemented in the city of Quito, Ecuador. Although the programme was initially well-received, residents' compliance with the programme's guidelines has decreased over time. A local NGO, Corporación OIKOS, looked into why only about one-third of eligible residents actively participate in the recycling programme. This paper is based on a study that explored motivating and limiting factors of recycling behaviour as well as the role that gender plays in recycling at the family level. Although studies of psycho-social predictors of recycling behaviour have been widely conducted in high-income nations, this approach has been less commonly used elsewhere.

Communication Project of the U.S. Agency for International Development and is jointly funded and managed by the Center for Environment and the Center for Human Capacity Development of the Bureau for Global Programs, Field Support, and Research at the United States Agency for International Development and by USAID Missions at collaborating sites.
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II. THE PILOT MUNICIPAL RECYCLING PROGRAMME IN QUITO

IN 1993, THE Municipality of Quito implemented a pilot recycling programme in several lower and lower-middle class neighbourhoods that were previously unserved by municipal waste collection services. At the time the research was conducted, the programme was being implemented in 11 neighbourhoods and was benefiting about 4,500 families. The municipality of Quito was interested in the research because it wanted to relaunch and expand the programme to other parts of the city, increasing coverage to about 40,000 families.

In these neighbourhoods, as well as in most of the city, the largest generators of solid waste are households. The municipality estimated that approximately 70 to 80 per cent of this waste is organic, 15 per cent recyclable and the rest unusable (bathroom products).

Some of the urban areas benefiting from this pilot programme are old, established and cohesive neighbourhoods with a stable resident base, much of it composed of public sector employees. In some neighbourhoods, residents have come together to participate in neighbourhood development efforts. Other neighbourhoods are more recently settled, bringing together migrants from different rural and urban parts of the country.

The pilot recycling programme required that participating families separate their household waste into three categories – organic, recyclable and unusable (bathroom waste products such as toilet paper and sanitary napkins). Each type of waste is picked up at the curb on different days of the week. The municipal government pays neighbourhood teams, called "micro-enterprises," to collect the waste. Micro-enterprises may serve more than one neighbourhood and usually consist of a manager, a driver, a bell holder who signals residents of their impending approach, and two or three collectors. The driver rents his or her vehicle to the municipal agency managing the programme (the Municipal Enterprise for City Cleanliness – EMASEO) and collects both a salary and a truck rental free. The teams collect waste, using carts to manoeuvre down the narrow passages between houses, and deliver it to communal depot sites using small trucks. The municipal authorities are responsible for collecting the waste from these depots and for transporting it to its landfill site. At the time of the survey, the average monthly cost to EMASEO for each micro-enterprise was around US$ 480.

Neighbourhood committees, whose most active members are often women, are instrumental in identifying residents to organize the micro-enterprises. In each neighbourhood, a neighbourhood association works with the micro-enterprises to operate the programme and, in some cases, they have built warehouses for storing the recyclable waste in order to sell it in bulk and thus obtain better prices. The recyclable waste is usually sold by the micro-enterprises and the sales overseen by the neighbourhood association. The money is then used to create a local development fund. EMASEO matches the funds obtained from the sale of these recyclable products and the neighbourhood association decides how to use the money. In one case, the funds were used to improve a green area and create a playground for neighbourhood children. In another instance, the association decided to make street signs.

When the research was implemented, EMASEO was spending about US$ 30/tonne to transport the waste to its landfill site. It was estimated

that the recycling programme would help reduce these costs and would also help create neighbourhood jobs, rent unused vehicles and generate profits for neighbourhood development. The programme also allowed recycling to take place at the source of waste generation, reducing the need for the *minadors* (the people who hand sort waste at the landfill) and their associated health problems. Furthermore, in an attempt to keep costs down, micro-enterprises working in contiguous neighbourhoods were asked to collect waste in more than one neighbourhood. However, it was not EMASEO's intention to have a programme which funded itself from the revenues.

The recycling programme was a great success at the outset. There was a very positive response from neighbourhood associations who had been fighting for waste collection services, and they not only motivated residents into complying but also initiated a series of actions to clean the neighbourhoods. For example, in one area where cliffs over a ravine were used as dump sites, the neighbourhood association built walls and barriers to prevent neighbourhood residents or others from nearby neighbourhoods from dumping their waste in the ravine. Campaigns were initiated to clean up the ravine and, over a year later, the neighbourhood association was very proud to be able to show visitors that it had remained clean.

However, in the second year of programme implementation, interest in waste recycling began to diminish. Waste collectors interviewed prior to the initiation of the research discussed in this paper indicated that only about one-third of the homes in some of the neighbourhoods were complying with programme guidelines. Although some recycling continued to be practised, waste was often not as carefully separated as the programme required. As a result, waste collectors were forced to go through the waste themselves and do the sorting that households were meant to do. For example, organic waste was often mixed with bathroom waste. This practice continued despite the fact that waste collectors reminded families of programme guidelines. When the research was conducted, waste collectors could clearly identify which families on their routes were regular recyclers and which were not. Waste collectors also indicated that, in some instances, the amount of recyclable waste had substantially decreased. They had observed that residents would dispose of waste themselves, reverting to pre-programme practices. There were anecdotes about factions developing in neighbourhood associations and stories about "non-compliants" being supporters of neighbourhood leaders who were no longer part of the neighbourhood associations responsible for supporting programme implementation. Some residents questioned whether the funds collected from the sale of recyclable products were managed properly and there were complaints about the frequency of curb-side collections.

This paper reports on the findings of a study that USAID funded to explore why compliance had fallen. The research sought to explore the incentives and disincentives to recycling among residents, and to examine their knowledge, attitudes, beliefs and behaviours pertaining to household waste, specifically focusing on waste separation behaviour. Residents who separated their waste according to the pilot programme guidelines were compared with those who did not. Study results suggest that respondents' compliance with the recycling programme can best be predicted by:

- their knowledge of the recycling programme guidelines;
- their degree of satisfaction with the collection system;

- their beliefs relating to the social pressure to recycle waste; and
- their attitudes towards giving waste with monetary value to collectors.

An important finding was that the municipality had failed to integrate the formal (municipal) system with the informal (scavenger based) system. The intention of this study is to inform the designers of a communication campaign to encourage greater compliance with the recycling programme. Yet, according to findings, it would be advisable to first modify the programme to make it more complementary to the existing informal waste management system and the current behavioural context.

III. THE STUDY'S HYPOTHESES

THE FOLLOWING HYPOTHESES guided the design of the survey research. These hypotheses are based on information gathered during preliminary focus group discussions and in-depth interviews with male and female members of neighbourhood organizations, micro-enterprise personnel and individual household members.

- The perception that waste separation and recycling should be done for the financial benefit of the family rather than the community is likely to be more prevalent among non-separators, especially males, than among separators.
- Separators are more likely to believe that separation has benefits related to self-growth and image. Separators will be perceived as being more industrious, knowledgeable, collaborative with neighbourhood activities and better parents.
- Familiarity with the pilot programme guidelines regarding when to dispose of and how to separate waste will be more common among separators than non-separators. This knowledge may influence their waste separation practices and may be greater among females than males.
- High levels of satisfaction with the waste collection service will influence separation practices. The reasons behind satisfaction with the service need to be explored.

IV. METHOD

a. Research Design

THE RESEARCH WAS conducted in two phases. In the first phase, qualitative research was conducted through in-depth interviews and focus group discussions with three different types of residents in pilot programme neighbourhoods, namely, members of neighbourhood organizations, micro-enterprise personnel and individual household members. Men and women were compared. Household members, or "programme participants," were then divided into two categories: separators and non-separators.

In the second phase, a survey was conducted. This phase focused on one behaviour, namely, separating household waste into organic, recyclable and non-recyclable bathroom waste. Only one behaviour was chosen, in order to simplify the research, and this particular one was chosen because it is critical to compliance with pilot programme guidelines and easy to inquire about.

The dependent variable examined in the quantitative analysis was waste separation behaviour. The independent variables (predictors of waste separation behaviour) that were investigated can be grouped into three categories:

- knowledge of the pilot programme guidelines;
- attitudes, normative beliefs and outcome beliefs about waste separation; and
- level of satisfaction with the neighbourhood solid waste collection service.

b. Sampling

During the first (qualitative research) phase, four micro-enterprise managers underwent in-depth interviews. Furthermore, over ten separate focus group discussions were conducted with female and male collectors and neighbourhood residents who were classified as either waste separators or non-separators. "Separators" are defined as residents who separate their waste according to pilot programme guidelines. "Non-separators" either do not separate waste at all or do not separate waste according to programme guidelines. The classification of residents into these categories was done after observing their practices and verifying what type of waste was delivered to waste collectors. Invitations to participate in group discussions for these categories were made to certain households in each neighbourhood. Residents participating in the discussions were unaware of how they had been classified. Focus groups and interviews were segregated by gender. In one of the neighbourhoods, adult male residents refused to participate in the discussions and sent their sons as representatives.

During the second (quantitative research) phase, a survey was conducted in six neighbourhoods. The pilot programme operates in four of these neighbourhoods (Quito Sur, San Jose Chilibulo, El Carmen, Solanda 186); the other two neighbourhoods (Solanda 185/189, La Argelia) do not take part in the programme but are being considered for future expansion. Selection of these neighbourhoods was intended to produce a representative sample of men and women from the lower and lower-middle classes, and to include both waste separators and non-separators. This balance was desirable in order to hold constant the potentially confounding influence of socio-economic status.

The sample reflects the demographic proportions of the neighbourhoods visited. For example, if among the neighbourhoods chosen for this study, 20 per cent of families lived in Neighbourhood X, 20 per cent of the sample was selected from that neighbourhood. Household selection was done by randomly selecting blocks and households located in the census segments served by the pilot programme or the two designated unserved neighbourhoods. Within each household, one person was interviewed. This person was the primary decision maker, 18 years of age or older, at home at the time of the visit.

The sample consisted of 410 people: 317 women and 93 men. Of these, 308 were from neighbourhoods served by the pilot programme and 102 from neighbourhoods with an alternative service.

c. Instrument and Procedure

Moderators of the same sex as the study participants conducted qualita-

tive in-depth interviews and focus group discussions. The in-depth interviews explored the reasons for initiating the programme, the type of promotional activities at programme inception, the role of male and female residents in launching the programme, and the way in which the programme operates. The focus group discussions explored the concept of separation and recycling, the facilitating and inhibiting factors in the practice of waste separation, the extent to which recycling was practised even prior to the programme under scrutiny, and the level of satisfaction with the recycling programme.

Interviewers used surveys to collect data among Quito residents in the four pilot programmes and two expansion neighbourhoods. The questionnaire was pre-tested twice and revised prior to its final use. The questionnaire used in the study contained sections on the following:

- how the pilot recycling programme operates;
- the level of satisfaction with waste collection services;
- waste-handling practices in the household;
- attitudes towards the separation of waste;
- attitudes towards giving waste with commercial value to the collectors;
- outcome beliefs about waste separation;[6]
- normative beliefs about waste separation;[7]
- socio-demographics;
- media channels used.

6. Outcome belief: perceived consequence of performing a behaviour.

7. Subjective normative belief: person's perception of the social pressure put on him / her to perform or not perform a specific behaviour.

d. Data Analysis

In the qualitative phase, a content analysis of responses allowed researchers to isolate themes. They then classified themes by gender and whether individuals were separators or non-separators, using both an objective and a subjective definition of separator .

Factors presumed to predict solid waste separation behaviour were grouped into five categories:

- knowledge;
- attitudes about waste separation;
- social pressure to follow the suggested practices;
- outcome beliefs about what may be achieved if these practices are undertaken; and
- level of satisfaction with the service.

In the second phase of this investigation, presumed determinants are called predictors. For the first category, (knowledge), respondents were asked if they knew that a collection and recycling programme existed in their neighbourhood. Those who answered "yes" were then asked a series of further "knowledge" questions. For example, they were asked to correctly identify recycling guidelines, including how to separate waste, how to pack it and which day each type of waste was collected. Correct responses to these questions were added together to create one composite score for programme knowledge.

In the survey, 5-point Likert type scales measured the following:

- attitudes towards waste separation;
- attitudes towards giving waste with commercial value to collectors;
- normative beliefs about separating waste; and
- beliefs about the benefits and drawbacks of waste separation (outcome beliefs).

The first three different sets of questions were added together by topic to form three different composite scales.[8]

8. Reliability analyses were performed for each of the composite scales constructed and each of the variables met the minimum required score of 0.7 or better.

A factor analysis was performed to determine levels of association between sub-groups of outcome beliefs. Responses to questions about the perceived benefits and drawbacks of waste separation (outcome beliefs) were used in the factor analysis, and three groups of associated outcome beliefs were identified.:

- personal/ family benefits associated with waste separation;
- distant benefits of waste separation; and
- drawbacks associated with waste separation.[9]

Waste separation practices were examined using two survey questions associated with performing waste separation. The questions helped determine whether the respondent had had a certain waste product in the household the week prior to the survey and whether it had been separated from organic, unusable or recyclable waste prior to collection. Respondents were considered separators if, during the recall period, they always gave the collector all waste products from their household separated according to programme guidelines. Anyone who had a given waste product to the collector but had not given that product properly separated was considered a non-separator. No partial credit was given for disposing of some waste products in a separated fashion but not others.[10]

In the quantitative research phase, logistic regression explored which presumed determinants predicted waste separation behaviour. Composite scale predictors were used as independent variables in the first stage of analysis and the individual scaled questions that created those composites were used as independent variables in the second stage. The predictors were also analyzed by gender.

9. Personal benefits include aspects associated with self-growth or self-image. Distant benefits are benefits associated with the development of the country. The drawbacks may be due to financial reasons or to the fact that the task of waste separation itself is considered demeaning.

10. Thirty-seven cases were excluded from this definition as they did not provide an answer as to whether or not they separated their waste when giving it to the collector.

V. DIFFERENCES BETWEEN WASTE SEPARATORS AND NON-SEPARATORS

a. Perceptions of Waste and Justifications for Complying with or Ignoring Programme Guidelines

FINDINGS FROM FOCUS groups and interviews indicated that there are four major areas of concern into which perceptions about waste separation can be grouped, namely, financial, development related, self-growth and self-image, and time and effort required to separate waste. As indicated earlier, waste collectors helped researchers to identify who was recycling and who was not. Yet, individuals classified as non-separators by collectors may have defined themselves as separators. Those persons categorized as non-separators who claimed to separate their waste may do so for certain waste products or for other purposes. Cooked organic waste, for example, is most often given to beggars, fed to animals or given to friends and relatives to do the same. Other waste products, such as newspapers, are often reused in the household for different purposes including cleaning windows and glass, making clippings for children's homework and collecting animal waste.

The first area of concern, **financial concerns**, refers to who benefits from the sale of recyclable products: the resident or the micro-enterprise. Non-separators preferred that families kept the profits whilst separators were in favour of the funds being generated with the participation of the micro-enterprises. Men seemed to prefer that their families kept the profits from the sale of recyclables. Advocates of residents personally benefiting from sale proceeds do not seem to trust the way the micro-enterprises manage

the funds. They suggest that families who generate the waste should keep the profits from the sale of recyclables. On the other hand, advocates of micro-enterprises receiving profits argue in favour of creating a neighbourhood development fund with sale proceeds.

One separator woman commented that: "I just found out that money that was made (from recycling) was spent on the street signs..." A non-separator woman added: "We see no advantage for us in all of this. I think that the advantages are more for the managers because we do not know what they do, how they do it or why they do it. They push us to do this, since they are already involved in this programme. But we would also have to see some benefit for ourselves, if at least they gave the bags for free."

Some residents are supporters of recycling because of the **economic implications** for their neighbourhood's development or for industrial and/or national economic development. Those concerned with neighbourhood improvement are generally separators. Others believe that waste separation can help generate raw materials for industry, reducing the need for the importation of such materials and helping their country to develop more independently. These views were more commonly expressed by female non-separators than others.

One separator man commented: "The garbage that you separate will generate sources (of funds) which are of interest for the community itself." A non-separator man said: "In Europe, garbage is used to make fertilizer, they industrialize and make fertilizer. But here in Ecuador we are still very underdeveloped in that regard. There are some intentions, but that type of industry is just beginning."

Self-growth and self-image concerns are related to what may be personally gained or lost by separating waste. On the positive side, some respondents said that separating waste allowed them to be progressive. They learned new habits, set a good example for their children and showed their level of involvement in community development affairs. These views were more often expressed by separators and by women. Other respondents said that waste separation is demeaning and more appropriate for scavengers than for residents. Often, these respondents were non-separators and male.

One separator man commented: "People that separate garbage are educated people. They have education. As I said, that education begins at home. This is the way to set the example for our children, to tell the next generation that things should be done this way." A non-separator woman said: "People separate garbage because that is how they make a living... We throw all of that out and they pick out what they want from the trash cans... They are the ones that can make money out of this..."

The **time and effort needed** to separate waste was identified as a constraint among some residents. Separators tended to believe that the required tasks were not time-consuming and were simple, while non-separators tended to believe the opposite. Some non-separators, particularly men, believed, wrongly, that separation required sorting out the different kinds of waste after they have been deposited in a container.

For instance, a non-separator man argued: "I have no time to separate garbage... for me garbage is garbage and it should just go... I have no time to be selecting out what can be used and what cannot be used. Neither do I have time to wait for the collectors to pick up only the garbage that is convenient for them..."

Gender appears to have a great influence within neighbourhood organ-

izations and households. Women who take an active role in neighbourhood organizations appear to have played an important part in starting the pilot programme. Although men hold the majority of the positions on these committees, especially the more powerful positions, most of the committees' daily activities and the institutional relationships between the committees in the municipalities are carried out by women.

Gender may affect the practice of recycling household waste, since opposition to waste separation appears to come mainly from men. Convincing men to attend the focus group discussions was very difficult. In one case, many of the men invited to the focus group for the second time sent their sons to represent them. Female opposition to the waste separation and recycling programme did exist but to a lesser extent.

No conclusive findings emerged on the role of gender in micro-enterprise management as only four micro-enterprises participated in the programme, three of which were managed by women and one by a man.

b. Socio-demographic Characteristics of Survey Respondents

Survey respondents represented the different socio-economic strata participating in the pilot recycling programme. Approximately half of the sample practices waste separation. The sample included both men and women, yet was skewed toward women. This gender imbalance may stem from the fact that the majority of interviews were conducted during weekdays when women (not men) were present.

c. Psycho-social Predictors of Waste Separation

Results of the survey revealed that approximately half the sample practises waste separation. Solid waste separation behaviour among neighbourhood residents can be predicted by three factors:

- knowledge about recycling programme guidelines and definitions of different types of waste;
- satisfaction with collection services derived from the perception that it is reliable; and
- agreement with giving waste with commercial value to municipal collectors (see Table 1).

Significant differences in knowledge between separators and non-separators were noted for several questions, including: how often do recycling collectors pass ($p<.05$); how must you pack the trash for pick-up ($p=.01$); when is unusable waste collected ($p<.05$); and when are boxes, paper, plastic and bottles collected ($p<.05$). Of particular interest are the low levels of knowledge among both separators and non-separators with respect to who is responsible for collecting waste in their neighbourhood – see Table 2.

When the analysis of predictors of waste separation was disaggregated by gender, it became clear that women respond differently to the variables explored. All three of the variables that were predictors of waste separation for all respondents were predictors for women but not for men. Alternatively, normative social pressure from neighbours emerged as a predictor of waste separation for men – see Table 3 which shows the different scores for predictors of separation behaviour for men and for women.

The study included questions on residents' perceptions of the health, environmental and social effects of disposing of waste in ways other than

Table 1 Predictors of Separation Behaviour for All Respondents

Composite variables included in logistic regression model	Beta weight	Partial correlation R	*P*
Knowledge about recycling programme/ classification of waste	0.02	0.13	0.001
Attitudes about waste with commercial value	0.08	0.09	0.02
Satisfaction with neighbourhood waste collection system	0.34	0.15	0.0003
Composite variables excluded from the logistic regression model	**Score**	**Partial correlation R**	***P***
Attitudes about separating waste	0.005	N/A	0.94
Normative beliefs about separating waste	0.13		0.71
Personal outcome beliefs	0.73		0.39
Distant outcome beliefs	0.15		0.70
Negative outcome beliefs	0.56		0.45
Exposure to messages about recycling waste	0.04		0.85

giving it to collectors. Both male and female respondents considered insects and non-hygienic conditions to be the major adverse outcome of not recycling. Pollution and environmental destruction were reported to be the primary environmental effects. The poor appearance of the neighbourhood was the most commonly voiced social concern. Interestingly, when asked how waste should be handled to prevent destruction of the environment, both male and female separators suggested recycling more often than non-separators.

VI. DISCUSSION

RESULTS FROM THE study suggest that perception of waste differs among households but most residents consider the only real "waste" to be unusable bathroom waste. All other types of waste were viewed as valuable commodities that could either be reused by household members, given to others to reuse or sold to the *cacharreros* who come house to house. In contrast, the municipal government viewed waste not as a resource but as a problem that needed to be addressed in a systematic way to improve local communities. Although the municipality recognized the usefulness of the informal waste collectors, including the *cacharreros*, there was no attempt to incorporate them into the pilot programme. Rather, the municipality was concerned with reducing the number of *minadors* who comb its landfill site as well as decreasing the adverse health effects that can be caused by this practice. Local government tried to create incentives for scavengers to operate from collection points inside the city rather than at the landfill site and provided them with protective equipment (e.g., gloves) for handling waste.

For both men and women, separation practices were clearly linked to

Table 2 **Participants' Knowledge of the Programme (Percentage Answering Correctly)**

Knowledge question	Non-separators n	Non-separators %	Separators n	Separators %	*P*
How must the trash be separated?	14	52	61	46	0.57
How often do recycling collectors pass?	16	60	105	79	0.03
How must you pack the trash for pick-up?	23	85	129	97	0.01
When do they collect kitchen (cooked) waste?	10	37	79	59	0.03
When do they collect unusable waste?	6	22	59	44	0.03
When do they collect boxes, paper, plastic and bottles?	7	26	66	50	0.02
Who is responsible for collecting waste in your neighbourhood?	4	15	18	14	0.86
Which household waste can be classified as organic?	14	52	86	65	0.21
Which household waste can be classified as recyclable?	17	63	82	62	0.9
Which household waste can be classified as disposable?	11	41	60	45	0.68

perceptions of what happens to the funds generated by the sale of recyclable waste. Most respondents preferred to sell household waste products themselves and keep the profit. This preference may stem from the respondents' low socio-economic level. Traditionally, these families have sold certain waste products to the *cacharreros* and the profits have usually been controlled by the women of the household. The pilot programme asked residents to forfeit that revenue for the common good. In order for residents to give up this source of family income and support the pilot programme, they need to be certain that funds will be channelled into beneficial projects for their neighbourhood.

Foregoing personal income is a difficult "product" to promote. The final objective of the recycling programme must therefore be clarified. If the objective is to reduce the amount of waste that ends up in the landfill, then it may not matter if the recycling is carried out by the micro-enterprises or by the *cacharreros*. It is important to consider the extent to which the pilot programme may be competing with an existing informal recycling system and if this competition is beneficial to families, neighbourhoods and the environment. Whether or not both the collection systems can and should continue to operate side-by-side is a question that should be addressed by local municipal officials, micro-enterprise workers and residents, both men and women.

There were several limitations to the quantitative phase of this study. First, classification of respondents as waste separators or non-separators was based upon self-reported behaviour. A more objective measure of behaviour, such as direct observation, while preferable, was beyond the scope of this study. Second, the fact that the sample consisted of more women than men may be problematic since results cannot be generalized for all residents in the neighbourhoods visited. The sample may also be skewed towards residents who generate their income partially or fully after hours, who do not work outside the home or who generate income

Table 3 Predictors of Separation Behaviour

For Female Respondents

Composite variables included in logistic regression model	Beta weight	Partial correlation R	*P*
Attitudes about waste with commercial value	0.1	0.09	0.02
Knowledge about recycling programme/classification of waste	0.26	0.15	0.001
Satisfaction with neighbourhood waste collection system	0.36	0.15	0.0009
Composite variables excluded from the logistic regression model	**Score**	**Partial correlation R**	***P***
Personal outcome beliefs	0.73	N/A	0.94
Distant outcome beliefs	0.15		0.70
Negative outcome beliefs	0.56		0.45
Exposure to messages about recycling waste	0.04		0.85
Attitudes about separating waste	0.01		0.94

For Male Respondents

Composite variables included in logistic regression model	Beta weight	Partial correlation R	*P*
Normative beliefs about separating waste	0.14	0.14	0.04
Composite variables excluded from the logistic regression model	**Score**	**Partial correlation R**	***P***
Satisfaction with neighbourhood waste collection system	2.2		0.14
Attitudes about waste with commercial value	1.03		0.31
Personal outcome beliefs	0.08	N/A	0.78
Distant outcome beliefs	1.4		0.24
Negative outcome beliefs	0.08		0.78
Exposure to messages about recycling waste	0.002		0.96
Attitudes about separating waste	0.34		0.56
Knowledge about recycling programme/classification of waste	0.53		0.47

from the home. However, as only 143 respondents answered the question on the occupation of the adult female in the household, it was not possible to use this as a covariate. The reason for the low response rate is unknown but it would be interesting to explore whether working at home

positively influences waste separation practices. Questions about whether respondents work inside or outside the home are needed in future studies.

VII. CONCLUSIONS

THE PROVISION OF efficient and appropriate solid waste management systems is an investment in environmental protection. Since many municipalities in Latin America, Asia and Africa are constrained in their ability to invest in solid waste services, low-cost technologies (e.g., equipment) and programmes are essential to expanding services to low-income urban residents.[11] The service chosen should reflect not only the limited ability to pay but also the cultural traditions of poor neighbourhoods. In some instances, this may entail involving members of the informal sector, such as the *cacharreros* in Quito who have a long-standing tradition of participating in the collection and recycling of municipal waste. As this study suggests, the success of recycling by micro-enterprises in Quito may rely on such involvement. It is important to communicate to residents that it is acceptable for them to dispose of some of their waste products through such informal waste collectors. The integration of informal waste collection systems has been successful in Mexico and Egypt.[12]

The *cacharreros* in Quito limit the type of waste products they collect and recycle to cardboard and certain types of glass. Families that currently rely primarily on them for collection often dispose of their other waste in ravines or over cliffs. It may be useful to consider future expansion of the informal waste collection system to include other waste products. Such expansion, however, would require a better understanding of the market for new waste products that the house to house collectors would handle. Waste given to micro-enterprises must be separated into the three categories that the pilot programme uses. In future studies, information should be gathered about the roles of the *cacharreros* in waste disposal and the politics surrounding such issues.

Most importantly, any modification of the formal solid waste management system in Quito, including the pilot programme, should be undertaken in a participatory fashion. Study findings suggest first modifying the programme to make it more complementary to the existing informal waste management system and the current behavioural context. One approach is to organize a meeting of male and female stakeholders, including neighbourhood residents, municipal officials and micro-enterprise personnel, to decide the future direction of waste disposal, recycling and the pilot programme.

Several steps might be taken by the municipality to increase compliance with the pilot programme:

- Educating residents about programme guidelines and the contents of waste categories should contribute to the performance of waste separation. Preferably, messages should be disseminated on a continual basis.
- Residents need to be assured that the waste collection service is reliable. Providing testimonies of satisfaction will be helpful in promoting the work of micro-enterprises as well as enhancing their image. However, monitoring the actual performance of the micro-enterprises must be considered by EMASEO.
- Residents must be convinced of the importance of neighbourhood improvement through the sale of valuable waste products collected by the micro-enterprises. To do this, community involvement in setting

11. See reference 2.

12. Bartone, Carl, L. Leite and T. Triche (1991) "Private sector participation in municipal solid waste service: experiences in Latin America", *The Journal of Waste Management and Research* Vol.9, No.6, page 495; also Neamatalla, M.S., R. Assaad, L. Oldham, A. Souveni, and F. Gohary (1985) *Solid Waste Collection and Recycling in Cairo: A System in Transition*, (Draft), Cairo Governate Joint Housing Project Agency, Cairo, Egypt.

neighbourhood development goals for using funds generated by the sale of recyclables is necessary. Since initial income from the sale of recyclables may be small, neighbourhood improvement projects will most likely be small in scope. However, as more funds are generated, the implementation of larger projects may be possible. Neighbourhood participation in deciding how to use profits from the sale of recyclables by the micro-enterprises, therefore, would become an on-going activity.

- Neighbourhood development projects funded by micro-enterprise recycling revenue should be publicized regularly. If the community decides to save funds for a larger project, reminders may include messages about how much money has been collected and how much more is needed to meet the target.
- Recyclers who are contributing to the neighbourhood development fund should be commended for their participation. Such recognition could take the form of stickers on the doors of separators. The cultural acceptability of such an approach will need to be examined and pretested.
- A communication campaign should contain messages about recycling and separating waste specifically targeted at men and at women. Messages for men may be presented in the form of one neighbour supporting another for the contributions made to the development fund. Public recognition is a way of demonstrating to others that a family is adhering to social norms and is acting in accordance with the expectations of their neighbours.
- Appropriate technical solutions for handling organic waste, which is likely to be the bulk of household waste, should be determined. Micro-enterprises may be taking this raw organic waste to the landfill site instead of producing compost. The reasons may be both technical and economic. Micro-enterprise managers and neighbourhood committees do not always fully understand how to compost or they may not have been able to find buyers for the compost. If this is true, a tremendous effort has been made to deal with a small portion of the waste generated by the neighbourhoods (non-organic waste) and the bulk of the waste generated in these neighbourhoods (organic) is continuing to be transported to the landfill.

Future studies may need to examine behaviours other than waste separation (e.g. storing garbage, putting it out, etc.) that together make up the practice of recycling. Researchers should also consider a survey of people who dropped out of recycling programmes. What could also prove useful would be detailed information on the informal collection sector.