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Waste Pickers and Collectors in Delhi: Poverty and Environment in an Urban Informal Sector

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ABSTRACT *Waste pickers and collectors constitute the bottom layer of waste recycling in the metropolis of Delhi. Pickers collect waste just by picking them up from public places such as garbage dumps and streets, whereas collectors purchase waste from waste producers such as households and shops for sale to higher-level waste traders. Most pickers have incomes below the poverty line set by the Planning Commission of India, whereas the majority of collectors earn marginally higher than the poverty-line income. The poverty of pickers is not transitory, but chronic as they have no connection to enter the community of collectors and higher-level waste traders within which the community mechanism works effectively to reduce risk and transaction costs. Despite their low economic and social status, pickers and collectors are making important contributions to society. It is found that pickers and collectors are adding more value than their own income to waste producers' income and to the saving of the city government's expenditure for disposing waste. Increased public support not only for social services, but also production services and infrastructure can be justified not only for the purposes of reducing poverty but also for furthering their positive contribution to society.*

I. Introduction

Significant research has accumulated on the economic organisation of the urban informal sector in developing economies. Most of the previous studies focused on income levels and living standards, aiming to identify the extent and the nature of urban poverty in relation with rural–urban migration.[1] Little exploration has yet been conducted on the contributions of the urban poor to economic growth and environmental conservation. This study attempts not only to investigate the characteristics of urban poverty, but also to measure the contributions of the urban poor to society. For this purpose, we undertook field research on the activities of residents in the slums of Delhi, India, who make a living through the collection of

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waste materials for use by recycling plants.[2] One group is called 'pickers'. Pickers just pick up waste thrown away in public places such as streets and parks. Another group is called 'collectors' who go around households, shops and restaurants to buy waste. They constitute a bottom layer of the urban informal sector. Pickers are the poorest of the poor being barely able to eke out subsistence, whereas collectors are at the fringe of poverty. Yet, they are making valuable contributions to society by converting unusable waste into productive resources as well as cleaning the city. We attempt to measure both their private earnings and external benefits to society.

Our field survey was of a pilot scale. This is due to the great time and effort required for finding respondents who would agree to answer our questionnaires under the sheer absence of sampling frames for residents in urban slums, unlike the case of rural villages where the community is typically stable and its border is clearly delineated. Owing to the small sample size without due application of random sampling procedures, how representative our data are is open to question. As such, our findings should be taken as hypotheses to be confirmed by larger-scale studies in the future.

Following this introduction, Section II specifies the scope of this research including the study site, the group of people and their activities to be covered by this study, as well as the method of data collection. Section III. identifies the social characteristics of waste pickers and collectors, and outlines the modes of their business operation. Section IV estimates their earnings from waste picking and collection and, also, estimates their family incomes including earnings from other activities in order to assess the incidence of poverty among them. Section V identifies the social segmentation of the labour market as the cause of chronic poverty among pickers, and explores the underlying community mechanism. Section VI estimates the social value added from the waste marketing and finds what portions of the value added are captured by marketing agents themselves including pickers and collectors and what portions are externalised to waste producers such as households and to the public sector such as the city government. Finally, Section VII discusses the policy implications of the findings.

II. Scope and Approach

Pickers and Collectors in the Marketing of Waste

First the major target groups of this study need to be clearly defined. One group is called 'waste pickers' (locally called *Kacharawala*) and another group 'waste collectors' (called *Kabadis*). Their roles and functions can better be understood with the aid of Figure 1, which maps out the flows of waste from their origins to end users in the City of Delhi and its surroundings. Note that the bold arrows in this figure represent the major channels of waste flow, on which this study focused.

Pickers and collectors comprise the bottom layer in the system of marketing waste, as they collect waste directly from its origin. Both are small self-employed agents, typical of the urban informal sector, and live mainly in slums. Both earn their livelihood by selling collected waste to higher level traders. Yet, they are different in

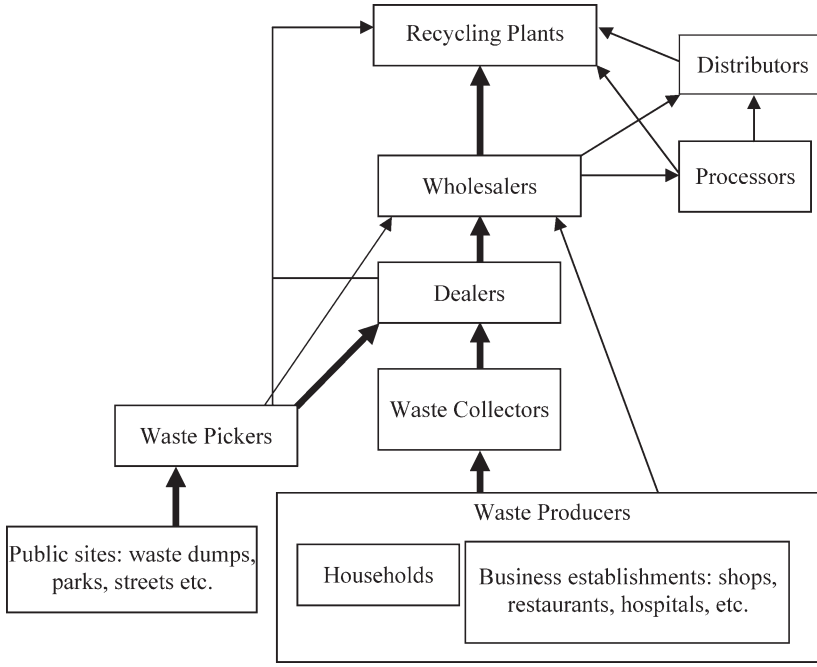

Figure 1. Marketing channels of recyclable waste

one critical point. Pickers need no capital for picking up waste, such as scraps of papers, used bottles and cans, from public places. In contrast, collectors buy them from the producers of waste in cash, for which they must have some operating capital. Correspondingly, the scale of operation of collectors as measured by the amount of waste collected is usually much larger than that of pickers.

There are many more chains of marketing before the waste collected by pickers and collectors reaches recycling plants. In most cases their collections are sold to 'dealers', who assemble the waste into large bulk and sell it by item to 'wholesalers'. While a dealer deals with nearly all the items of waste, a wholesaler usually specialises in one item, for example, one wholesaler deals only with paper and another only with metal. This waste assembled by item is delivered to recycling plants as materials for their production. Besides these major routes, other channels are also operating. Dealers deliver some items, such as polythene, directly to recycling plants. Also, some waste materials assembled by wholesalers are processed by 'processors' with such operations as removing labels and caps from used bottles, before being delivered to recycling plants. Where recycling plants are located far away from Delhi, it is common for the waste assembled by wholesalers to be channeled through 'distributors' who specialise in distant trade. Also it should be noted that some households and business establishments prefer to bring their waste to dealers directly rather than waiting for collectors to come. Although this study focuses on pickers and collectors, we try to analyse their activities in their relationships with other segments of waste marketing in the metropolis.

Study Site

Our field investigation was centred on the district of North-East Delhi. Delhi is a mega city with a population of nearly 14 million in 2001, covering an area of about 1,500 square km. The North-East District falls within the flood plane of the Yamuna River, which had been a rural area until three decades ago. Thereafter, the city has expanded and covered this area. Many of the former villages under flood-prone conditions turned into urban slums, where poor immigrants moved in from the neighboring state of Uttar Pradesh and also from far-off states. Consequently, the North-East District is Delhi's most densely populated district with a population of about 1.8 million in an area of 60 square km. Its population density was more than three times the average of the City of Delhi (Government of India, *Census of India* 2001: 172–3). Under this environment the business of recycling waste thrives. A casual visitor to this district can easily spot piles of re-cyclable waste, which are the establishments of the waste dealers and wholesalers.

Survey Procedures

We tried to approach the activities and incomes of pickers and collectors as well as other traders engaged in waste marketing by means of a questionnaire survey. We conducted three rounds of the survey: the first round from 8 January to 25 February 2002 aimed to cover pickers and collectors, and the second round from 22 November 2002 to 20 January 2003 aimed to cover both waste producers (households and informal business establishments) and upper-level traders from dealers to recycling plants, while collecting supplementary information from pickers and collectors. The winter months were chosen for the surveys, because winter is considered to be in-between in terms of seasonality in waste picking and collection activities between its peak in summer and the slack in the rainy months.[3] Finally, the third round survey was conducted from 2 to 19 September 2003 for closing 'the holes' of the previous two surveys, especially on institutional aspects.

The numbers of respondents by category that our surveys were able to cover are shown in Table 1. As is clear from the table, the size of our sample is very small, especially for traders. Such a small sample is inevitable because of the great difficulty of catching traders who are willing to answer queries. First, there is simply no list of residents in urban slums usable as a sampling frame. This situation contrasts sharply with rural villages where such a list can usually be obtained easily from village offices. Second, unlike the case of rural surveys, in which suspicion of respondents to outside investigators can somehow be reduced with due introduction by village officials and agricultural extension workers, no such mediation can be found in urban slums. More serious in our case is that traders are understandably very cautious in keeping their business confidential. Usually, the refusal to answer questions is stronger among larger business operators (Nakanishi, 1991; Hayami and Kawagoe, 1993).

III. Socio-economic Characteristics and Operational Modes of Pickers and Collectors

One of the most important characteristics of those engaged in waste picking and collection at the bottom of the system of re-cycling waste in North-East Delhi is that

Table 1. Number of respondents under different categories covered by the three surveys

	Survey period		
	1st round Jan.–Feb. 2002	2nd round Nov. 2002–Jan. 2003	3rd round September 2003
	Number of observations		
Waste producers:			
Households	–	60	3
Shops and establishments	–	40	2
Waste traders:			
Waste pickers	35	–	9
Waste collectors	35	–	10
Dealers	–	10	4
Wholesalers	–	14	5
Recycling plants	–	4	–
Total	70	128	33

they are mostly migrants from the rural areas in other states. In our sample, no picker was born in Delhi and only one collector who was born in Delhi was a son of a migrant. Eighty-nine per cent of pickers and 94 per cent of the collectors came from rural areas (Table 2). These data seem to show that waste collection is a relatively easy profession for new migrants from rural areas to enter. Certainly, it is much easier to start picking than to start collection business in terms of needs of capital and skill, as to be discussed later. The majority of the former (69 per cent) migrated from faraway states, such as Bihar and West Bengal, in contrast with a high share of migrants (74 per cent) from the neighbouring state of Uttar Pradesh for the latter.

Other socio-economic characteristics of our respondents are summarised in Table 3. The low skill requirements for waste pickers and collectors are reflected in their low levels of education. More than 90 per cent of pickers were illiterate. Even, collectors' illiteracy rate was above 80 per cent. None received education beyond the 8th grade. In terms of religion, both pickers and collectors were more or less equally distributed between Hindu and Muslim. As a major deficiency in our survey, we did not dare to ask about the caste status of Hindus because of its highly sensitive nature. However, it was our impression obtained form casual talks with them as well as with several people surrounding them that they belonged to low castes, but they are not necessarily limited to specific occupational castes such as sweepers and cobblers. Another deficiency in our survey may be the lack of effort to disaggregate data on migration beyond the state level. This deficiency, however, does not seem as serious as to change the basic conclusion in Section V on the importance of ethnic communities in creating social segmentation between pickers and collectors.

The majority of both pickers and collectors were adult males (18 years old and above) with an average family size of larger than five. In this characteristic, pickers in Delhi were different from those of Manila, the Philippines, and Kathmandu, Nepal, where waste picking was done mainly by women and children (Nakanishi, 1991; Bal Kumar, et al., 2001). It was no surprise to find the relatively large family size among collectors, because many of them were the sons of migrants and were living with

Table 2. Origins of pickers and collectors

The place of origin	Picker				Collector			
	Total no.	(%)	From rural area	From urban area	Total no.	(%)	From rural area	From urban area
Delhi	0	(0)	0	0	1	(3)	0	1
Uttar Pradesh	11	(32)	8	3	26	(74)	25	1
Bihar	13	(37)	12	1	5	(14)	5	0
West Bengal	11	(32)	11	0	2	(16)	2	0
Others	0	(0)	0	0	1	(3)	1	0
Total	35	(100)	31 (89)	4 (11)	35	(100)	33 (94)	2 (6)

Note: Figures in parentheses are percent of the total.
Source: The 1st round survey.

Table 3. Socio-economic characteristics of pickers and collectors

	Picker		Collector	
	No	(%)	No	(%)
Religion:				
Hindu	16	(46)	14	(40)
Muslim	19	(54)	21	(60)
Others	0	0	0	0
Age:				
Adults ($\geqslant$18 years)	33	(94)	35	(100)
Children ($<$18 years)	2	(6)	0	0
Sex:				
Male	31	(89)	33	94
Female	4	(11)	02	06
Family size:				
No. of all family members	5.6	–	5.9	–
Type of housing:				
Temporary shelter	33	(94)	2	(6)
Permanent house	2	(6)	33[a]	(94)
Education:				
Illiterate	32	(91)	27	(77)
Up to 5th grade	3	(9)	7	(20)
6th to 8th grade	0	0	1	(3)
Above 8th grade	0	0	0	0
Average no. of school years	0.4	–	1.2	–
Work experience:				
No. of years engaged in present work	11	–	9	–

Note: Figures in parentheses are the percentage of the total number of respondents (35) for both pickers and collectors.
a) Eight collectors out of these reported living in rented premises with the average rent of Rs 325 per month.
Source: The 1st Round Survey.

parents. On the other hand, most pickers were new migrants accompanied by wives and children. This observation seems to be consistent with Banerjee's (1984) finding that men of low castes owning no farmland tend to migrate with families, whereas those of cultivator castes leave their wives to take care of their land properties.

While pickers and collectors were similar in the characteristics so far observed, their living standards seem quite different in terms of their housing conditions. Most of the pickers (94 per cent) were squatters living in temporary shelters made of such materials as mud, brick, tin and bamboo (locally called *Jhuggi-Jhopadis* or *Kaccha*). In contrast, most collectors (94 per cent) lived in permanent houses made of brick and cement (called *Pucca*), which were built on the lands they owned (75 per cent) or rented (25 per cent) with the average rent of Rs 325 per month. This difference clearly indicates the distinctly higher income and wealth position of collectors relative to pickers, even though land values and rents are low in the newly urbanised areas of North-East Delhi.

A major difference between pickers and collectors was found in the means of transporting the waste that they collected (Table 4). The majority of pickers (57 per

Table 4. Distribution of pickers and collectors by means of conveyance of materials

	Picker		Collector	
	No	(%)	No	(%)
Person's back only	20	(57)	3	(9)
Bicycle only	1	(3)	4	(11)
Rickshaw cart only	1	(3)	28	(80)
Person's back and rickshaw cart	13	(37)	0	(0)
Other	0	(0)	0	(0)

Note: Figures in parentheses are percentage of the total number of respondents (35) for both pickers and collectors.
Source: The 1st Round Survey.

cent) relied solely on the strength of their own back and the additional 37 per cent of them rented rickshaw carts (man-pedalled three-wheel carts) only on occasions when they were able to assemble an exceptionally large bulk of waste which would be too heavy to carry on their own back. In contrast, 80 per cent of collectors regularly used rickshaw carts. This difference reflects the difference in their modes of operation. Typically, a collector goes around households and informal business establishments, and collects a relatively large bulk of waste, which is difficult to carry on his back alone. On the other hand, for a picker who picks up waste bits and pieces, a bag on his back is usually sufficient. As will be explained in detail below, most collectors did not own rickshaw carts but were allowed to use the carts owned by dealers without paying rental fees under a patron–client relationship.

In Table 3 it was found that the main operators of waste picking and collection were mostly adult men. However, it was common for them to receive support from family members. As many as 34 pickers out of 35 respondents received family support, mainly in picking and sorting operations. In contrast, less than half of the collectors received family support. It might be that the relatively high income and high social status of collectors induced them to refrain from letting family members, especially women, be engaged in 'dirty work' in terms of the traditional belief of Hinduism.

IV. Income Levels and Poverty Incidence

We now proceed to estimate the income levels of pickers and collectors and to find the incidence of poverty among them. It must be cautioned that the estimates of incomes reported in this section pertain to those during the survey period. Therefore, the estimates of average earnings per picker and per collector per day as well as average incomes per family member per day are not the averages for a year, though we are hoping that these estimates are not too far away from the annual averages, since our survey period covering winter months lies in-between the peak and the slack seasons in waste picking and collection activities (Section II and note 2). Considering this data limitation, our results may only be usable for very broad comparisons.

Earnings from Waste Collection

First, earnings from waste collection are estimated in Table 5. In the 2001 survey we asked pickers about the quantities of waste they collected per day on average of the previous week and, also, the values of their sales to dealers. In the case of pickers, their sales to dealers equal their earnings (Column 2). In the case of collectors, their payments to waste producers must be subtracted from their sales to arrive at their earnings. Therefore, in addition to the same questions asked to pickers, we asked about the quantities and the prices of the waste they purchased from households and business establishments. The differences between the money received and the money paid were the earnings of collectors (Column 7). These earnings are considered to be their labour incomes, since rickshaw carts used by collectors were lent from dealers free of charge.

Pickers' average earning per working day thus estimated was Rs 59.1 (US$ 1.2 at the prevailing exchange rate of Rs 48 per $1), which was about 40 per cent lower than the minimum wage of Rs 93 per day for casual labourers that was determined by the municipal authority (Municipal Corporation of Delhi). In contrast, collectors' average earning of Rs 117.7 ($ 2.5) was about 25 per cent higher than the minimum wage.

An apparent anomaly in Table 5 is that quantities purchased by collectors (Column 3) were smaller than those sold by them (Column 5) in the order of 10 to 15 per cent, despite the possibility of incurring losses in the process of storage and transportation. We gather that it was a fairly common practice among collectors to cheat waste producers, especially housewives in weighing waste at purchase.[4]

Household Income Levels

Further, we estimated the average income per family member in the households of pickers and collectors in Table 6.

The total incomes of pickers' and collectors' households consist of earnings from their collection activities, plus earnings from other sources. On the latter we asked in the survey on their normal earnings from the other sources per month (Row 4). The other incomes include earnings from casual work by collectors themselves, such as truck loading and unloading, and other family members' earnings, such as embroidering and vending fruits by wives. For obtaining the estimates of total household incomes per month, daily earnings from waste collection activities, which are estimated in Table 5, are multiplied by the numbers of working days (24 days for pickers and 26 days for collectors). Incomes per month from the collection activities and the other sources are added together to determine total monthly household incomes (Row 5). The total monthly incomes are divided by the number of household members to obtain average monthly incomes per capita (Row 7), which are further divided by 30 days to arrive at average income per capita per day (Row 8). Average incomes per day per household member turned out to be as small as Rs 14 for pickers and Rs 25 for collectors, respectively.

How high would the incidence of poverty among pickers and collectors be? The standard procedure is to classify those earning less than a certain poverty line of income into the group of poor people. For the estimation of the poverty incidence

Table 5. Average earnings per day of pickers and collectors

	Picker		Collector				
	Quantity sold (kg) (1)	Money received = earning (Rs) (2)	Quantity purchased (kg) (3)	Money paid (Rs) (4)	Quantity sold (kg) (5)	Money received (Rs) (6)	Earning (Rs) (7) = (6) − (4)
Polythene	7.1	21.1	0	0	0	0	0
Plastic	1.2	5.1	9.7	56.7	10.9	76.0	19.4
Paper	6.4	11.0	13.5	53.0	16.8	68.0	15.0
Rubber	0.9	0.7	4.5	2.1	5.7	6.9	4.8
Metal	4.7	18.5	31.6	169.0	36.1	227.1	58.0
Broken glass	1.7	0.9	11.5	5.7	13.4	13.0	7.4
Bottles	1.9	1.8	12.9	8.8	13.1	15.9	7.1
Total	29.9	59.1	83.7	295.3	96.0	406.9	111.7

Source: The 1st Round Survey.

Table 6. Average per-capita family incomes of the pickers' and collectors' and poverty incidence among them

	Picker	Collector
Estimation of family income per capita per day		
(1) Daily earnings from waste collection (Rs/day)	59	112
(2) Number of active days per month	24	26
(3) Monthly earnings from waste collection (Rs) (1) × (2)	1412	2912
(4) Monthly earnings from other sources	940	1591
(5) Total monthly household income (Rs) (3) + (4)	2352	4503
(6) Average number of family members	5.6	5.9
(7) Average income per capita per month (Rs) (5) ÷ (6)	420	763
(8) Average income per capita per day (Rs) (7) ÷ 30	14	25
Percentage below poverty line		
Poverty line:		
Planning Commission = Rs 17/day	88	22
Purchasing power parity US $1 = Rs 10/day	17	4
Purchasing power parity US $2 = Rs 20/day	100	39

Source:
(1): Table 5 (Columns 2 and 7).
(2), (4), (6): The 1st Round Survey.
(6): Table 3.

from our sample observations, three alternative poverty lines are used. One is the poverty line that was set at Rs 17 (Rs 16.84 to be exact) by the Planning Commission (Government of India, 2001: 166) for the Delhi Union Territory in 1999 – 2000, on the basis of the National Sample Survey (NSS) data. Two alternatives are one dollar and two dollars per day measured in terms of the purchasing power parity (PPP), which are commonly used by the World Bank and other international organisations. Since the purchasing power of the Indian rupee is estimated to be just about five times higher than the exchange rate (World Bank, 2002: 232), one US dollar in PPP is considered to be equivalent to one fifth of the official exchange rate, namely Rs 10, and two US dollars equivalent to Rs 20. Those who earned incomes below these poverty lines are classified as being poor according to their respective standards.

The incidence of poverty among pickers and collectors as measured by percentages of our sample observations below these three alternative poverty lines are shown in the lower section of Table 6. Using one US dollar in PPP as a poverty line, only 17 per cent in pickers and 4 per cent in collectors were classified as being poor. However, if the poverty line is raised to two dollars per day, all the pickers were found to be poor, whereas about 40 per cent of collectors belonged to this category. If we use the poverty line set by the Planning Commission, which is supposed to best represent the standard of poverty specific to India, the estimates of poverty incidence fall between the estimates using PPP-US $1(Rs 10) and $2(Rs 20) as the two alternative international standards. Namely, according to the Planning Commission poverty line (Rs 17), 88 per cent of pickers in our sample were poor, whereas only 22 per cent of the collectors were classified as being poor.[5] This difference between

pickers and collectors corresponds to the difference in their housing conditions observed in Table 3.

From those data it seems reasonable to assume that pickers in Delhi are located at the bottom of the urban informal sector in both the level of income and the standard of living, similar to other major cities in developing economies, such as Jakarta and Manila (Papanek, 1975; Nakanishi, 1991). Yet, pickers were unanimous in saying that their income levels in Delhi were several times higher than those in home villages in the eastern states. Their assessments could well be overestimating economic gains from rural-to-urban migration by neglecting differences in the cost of living (Joshi and Joshi, 1976). Yet, some pickers remarked that their earnings in Delhi were twice as high as their earnings as labourers in Calcutta. Their remarks could involve some exaggeration, but it seems to be an undeniable fact that migration brought them major income gains. This may not be a surprise considering not only the fact that most pickers came from much poorer regions than Delhi, but also the tendency observed by Connel et al. (1976) for the rates of out-migration to be higher in villages characterised by higher inequalities in asset and income distributions within poor regions.

V. The Community Mechanism of Chronic Poverty

The problem of pickers is that their poverty is not transitory, being limited to the initial phase of migration as envisaged by Mazumdar (1979), but rather it is chronic as the opportunities are denied for them to move up to the rank of collectors. Of course, pickers can escape from chronic poverty if they can move to some other more lucrative occupations. However, the collector business is most probably the easiest profession for pickers to be able to ascend in terms of skill and required knowledge. If the opportunity is denied for pickers to join collectors, their chance of escaping from chronic poverty is likely to be very narrow. For this consideration, the analysis in this section is focused on the mechanism by which pickers are unable to ascend to collectors and further up to higher echelons in the hierarchy of the waste-recycling business.

Social Segmentation

Because of the apparent similarity of work done by pickers and collectors, we tend to expect that a new migrant who started as a picker will be able to ascend eventually to the rank of collector, as he accumulates experience and savings to cover the needed amount of working capital. In reality, however, such an occupational ladder is closed to pickers. In fact, labour markets for pickers and collectors are clearly segmented by ethnicity. As observed in Table 2, most collectors came from adjacent Uttar Pradesh (UP), whereas pickers came mainly from remote eastern regions. In general, socially low-status activities such as waste collection and distribution are easy for new migrants to enter relative to higher-status professions already occupied by earlier settlers. Since migration to Delhi from adjacent UP began much earlier than from the eastern states, lucrative activities in waste recycling from collectors to wholesalers have been occupied by the members of the UP community established in North-East Delhi.

Under such a condition it is not difficult even for a new migrant from UP to become a collector. Typically, when a young man comes from a village to Delhi, it is easy to find an established collector through the connection of relatives and friends, who is willing to accept him as an assistant and gives him apprenticeship on how to deal with housewives and shopkeepers in buying waste. Meanwhile, the collector introduces his apprentice to the dealer to whom he regularly delivers his collection. Often, the dealer also of the UP origin permits the new migrant to sleep in a corner of his junk store. After acquiring the necessary know-how through several months' apprenticeship, he becomes a collector under the regular-supplier contact with the dealer. According to this contract, the dealer lends a rickshaw cart free of charge and gives a cash advance of about Rs 500 to the collector. The dealer also advances emergency-relief credits in the event of the collector's sickness or accident. For these benefits the collector is obliged to sell all his collections to the dealer at about 5 per cent lower prices than those prevailing in the market. In the beginning he continues to stay in the junk store and goes back home to UP several times a year when farming is busy. As he accumulates experience and develops regular-customer relationships with many households and shops, his income becomes sufficiently high to marry and live in a rented house. In this way the constraints of capital and know-how to enter to the rank of collectors are removed by community relationships among UP migrants. Also, the patron–client relationships with dealers effectively insure collectors against subsistence crisis, similar to the relationships envisaged by James Scott (1976) among peasants in South-east Asia.

Such a relationship should work as a brake on collectors' moral hazards in breaching implicit contracts against his patron dealer, for example, by selling collected wastes using a cart rented from his patron to different dealers, or absconding after selling out the cart. In addition to the psychological cost of betraying an intimate patron, the collector must fear forever losing the benefits from multi-linked contracts, including not only waste trade, but also credit (cart rental and cash advance) and insurance (emergency assistance), relative to the expected gain from a one-shot moral hazard. Moreover, if his moral hazard is detected, not only will he lose his present patron, but also his bad reputation will soon be circulated around the community of UP migrants so that he will lose the opportunity to enter a similar contact relationship with other patrons. This community mechanism of sanction through social opprobrium and ostracism seems to be sufficiently strong to prevent collectors from exercising moral hazards and opportunism. This is one of many examples which show that the community mechanism serves as a substitute for contract enforcement through legal procedures, under the condition that the expected gains from dispute settlement on small transactions typical in low-income economies are not sufficiently large to pay for judicial costs involved in formal court procedures.[6] As this mechanism can be relied on, dealers do not hesitate to assist young UP migrants in starting waste collection by renting a cart and giving some cash advance.

This kind of community mechanism for facilitating new entrance operating among UP migrants is totally aloof to migrants from eastern states. For some time after migration, it is not possible technically for a migrant from the Bengali-speaking region to become a collector because he cannot communicate with the sellers of

waste in Hindi. However, even after he develops a decent command of Hindi, it is difficult to find collectors who would accept him as an apprentice. A Bengali migrant who had lived in Delhi for 24 years, who can now communicate in Hindi perfectly well, said that he was not able to become a collector simply because no opportunity was given to him to learn the necessary know-how and receive the patronage form a dealer. In this way, pickers are trapped by chronic poverty with no ladder open for them to ascend to a higher echelon in the waste-recycling business, not to mention the difficulty of entering better professions elsewhere. The stability of this poverty equilibrium is reflected in our sample observations that, on average, pickers were engaged in the present occupation longer than collectors (the bottom row in Table 3).

This social segmentation is not entirely based on ethnicity. We encountered a few pickers of the UP origin operating side by side with Bengali pickers. They were especially poor, orphans for example, and have no connection with established collectors. Thus, socially disadvantaged people including Bengali migrants and the ultra poor from UP comprise the bottom section of the informal sector in North-East Delhi. They cannot move out from chronic poverty because they are denied access to the 'social assets' consisting of a network connections that are critically important for upward mobility in developing economies (Jagannathan, 1987; Nakanishi, 1991; Banerjee, 1983, 1991, 1995).[7]

Occupational Ladder

In contrast with pickers trapped in chronic poverty, the occupational ladder is open for collectors to ascend to dealers and, further, to wholesalers. Collectors said that necessary know-how to become a dealer, such as the ability to assess the values of wastes and enforce implicit contracts with collectors, can be acquired through experience in the role of collector. The major constraint appears to be access to capital. We gathered that, for starting the dealer business, capital of about Rs 25,000 is needed. This includes the purchase of five rickshaw carts, each costing Rs 3,000, and operating capital of about Rs 8,000 for advancing credits to collectors and buying waste from them, in addition to about Rs 2,000 for renting a junk store per month. Such a sum is hard to mobilise for ordinary collectors whose daily earnings were only about Rs 100 on average. Yet, progression from collectors to dealers was not rare, though not common. Own savings plus borrowings from other family members, relatives and friends were the common sources. Some mobilised funds by selling farmlands in home villages. It was interesting to find that rotating saving and credit associations (ROSCA, locally called 'Committee') play an important role. With 20 members, each contributing Rs 1,000 per month, a fund nearly sufficient to start one dealer can be accumulated every month. In fact, we encountered several dealers who began their business through this source.[8]

As with the progression from collectors to dealers, the ladder is open for dealers to become wholesalers. In this case, the capital constraint is more strongly binding, because the wholesaler operation needs a wide junkyard space for sorting, packing and storing a large bulk of wastes in each specialised category. They said that it requires several times more capital to operate as a wholesaler than to operate as a dealer, though it is difficult to come up with concrete figures. The sources of finance

for starting this business are the same as those listed for becoming a dealer. Here again, ROSCA seemed to play a significant role.

The open occupational ladder from collectors to wholesalers appears to be critically dependent on the community network among UP migrants. All the upper-rank waste traders whom we were able to interview came from UP either alone or with parents. With this network of the UP community, if a collector attempts to become a dealer, for example, it should be relatively easy to develop a connection with a wholesaler for the sale of waste purchased from collectors. Indeed, the social assets in the form of community network were the basis for UP migrants to escape from the trap of chronic poverty and enter the dynamic economic sector.

The occupational ladder is sometimes open for pickers. In fact, we found pickers selling their collections exclusively to Bengali dealers who moved up from pickers. Because the dealer buying waste from pickers needs neither to render cash advances nor to lend the rickshaw carts, the capital requirement for starting the business should be one fifth or less of the dealer dealing with collectors. Yet, given their minimum subsistence income levels, a picker who can accumulate enough savings to become a dealer must be a sheer exception. Also, as reflected in the data of Tables 2 and 4, there are exceptional cases in which Bengali migrants acted as collectors who bought waste from Bengali households for sale to Bengali dealers on a small scale using their back or bicycle.

Compared with the relationship between collectors and UP dealers, pickers' and collectors' relationships with Bengali dealers are much looser because no such bonds as cash advance and cart rental were tying them together. Yet, it is common for them to deliver their collections exclusively to a specific dealer, because of the expectation of receiving credits and other forms of assistance in the event of emergency. Such a patron–client relationship is particularly valuable to poor pickers constantly facing health hazards as they are operating in awful sanitary conditions such as garbage dumps in addition to taking a poor diet.

Though the transition from picker to dealer is sometimes possible, Bengali dealers considered it difficult to ascend further to the rank of wholesalers not only because the amount of capital required is beyond their reach, but also because no appropriate connection is available for them to enter the network of wholesalers and recycling plants. Thus, poor pickers and small-scale Bengali dealers form their own community within which poverty is reproduced as a stable equilibrium.

Market Competition

As illustrated with the contract between collectors and dealers, transactions among informal-sector agents are highly personalised, multi-dimensional and long term. As with the collector–dealer relationship, dealers try to develop regular-supplier relationships with a single wholesaler (by each waste material item of specialisation) and wholesalers with a single recycling plant. In return, the wholesaler gives to entrusted dealers and the recycling plant to entrusted wholesalers credits and other forms of assistance. Such a patron–client relationship is strongest and most rigid between collectors and dealers, but it is also significant in other nexuses. Such community-type bonds are effective in reducing transaction costs on commodities like waste materials characterised by highly variable qualities making grading and

standardisation very difficult, for which market failures based on information asymmetry tend to occur (Hayami and Otsuka, 1993).

According to our investigation, the regular supplier contract between collectors and dealers does not seem to render monopoly/monopsony power to the dealer side. So long as a collector uses a dealer's cart and receives credit from him, the collector is obliged to submit all his collections to that dealer. However, it is free for the collector to leave this dealer's shop and enter into a contract with another dealer. They said such shifts, albeit very seldom, occur when a dealer continues to pay unreasonably low prices for collected waste. It also happens that collectors attached to the same dealer bargain by group with the dealer for giving them fair prices. On the other side, other dealers sometimes try to attract collectors to join their shops by offering better terms. The 'voice and exit' options in the sense of Albert Hirschman (1958) are thus available to collectors, which seem to be sufficiently strong to prevent dealers from exercising monopoly/monopsony exploitation.

Indeed, an empirical support for this hypothesis can be found in Table 5. The bottom of column 6 in this table shows that the average value of collectors' sales to dealers amounted to about Rs 400 per day. Of this sum, 5 per cent (which is a normal discount rate on dealers' purchase price of waste from collectors under the regular supplier contract including the privilege of using a rickshaw cart free of charge) was about equivalent to the prevailing market rental rate of Rs 20 per day for a cart. This calculation seems to show that the multi-linked contract was not a device to exploit collectors, but rather to give a favour to them, considering other benefits such as cash advances and emergency relief. It is likely that, by giving better terms than those prevailing in the market, dealers aim to suppress collectors' moral hazards, because the more favourable the present contracts are for collectors, the less inclined they will be to exercise moral hazards as they fear losing the favourable contracts, according to the logic of the efficiency wage theory (Shapiro and Stiglitz, 1984). This can also be viewed as one example of exchange between favour and loyality in the patron–client relationship emphasised by Scott (1976).

We were not able fully to explore the relationships between dealers and wholesalers and between wholesalers and recycling plants. However, we did not hear complaints on exploitation based on the community-type relationships. Rather, we often heard their complaints on the difficulty of entering such relationships with upper agents. Dealers, for example, highly valued market information and technical advice from their patron wholesalers in addition to credits.

In this way the community relationship among UP migrants was effective to correct market failures stemming from information asymmetry, but it also entailed the cost of excluding non-community members and thereby forcing them to suffer chronic poverty. This case illustrates the mechanism by which the correction of market failures by the community is associated with 'community failures' similar to the mechanism by which the correction of market failures by the state often gives rise to government failures.[9]

Territory

Another possible factor in the creation of market imperfection is segmentation by territory. For example, Bal Kumar, et al. (2001) reported that operations of waste

pickers in Kathmandu were segmented into several territories by groups of picking boys and each picker is allowed to collect in only one territory established for his group. A similar territorial segmentation was also observed in Calcutta by Jagannathan (1987: 64–5). However, in our study site both pickers and collectors unanimously answered that they were generally free to operate anywhere they want. An exception emerged in connection with the government. The caretakers of public dumps, who were the employees of the municipal authority, often demanded money to pickers for their access to these dumps. Some caretakers in charge of major dumps sold the exclusive use of each dump to a group of pickers for a fixed fee by month. This kind of petty corruption by local government employees may well be common in developing economies. In fact, a case was reported for Cali, Colombia, in which drivers of the city's trucks carrying garbage to a public dump received bribes for giving to certain pickers the right of exclusive initial selection from their truck loads (Birkbeck, 1978).

Besides this rent-seeking by caretakers, both pickers and collectors complained that policemen were a major hindrance to their operations. They said it was common for policemen to stop their operation unless they pay bribes. This practice was especially harsh on Bangladesh pickers who usually did not hold immigration permits.

Thus, pickers caught in a poverty trap created from social segmentation were further exploited by government agents. This case represents one of the many examples to show that the manipulation of the state's power by government employees for their own benefits is one major source of government failure.

VI. Estimation of Social Value Added from Waste Marketing

Despite their low social status, waste collection and distribution activities are making important contributions to economic well-being in society. First, they generate private incomes to migrants from rural areas, which are considerably higher than earnings in their home villages. Second, their activities increase private incomes of waste producers such as households and informal business establishments. Third, they reduce public costs of disposing wastes for the conservation of the city's environment. In this section we try to assess these contributions by estimating social value added from waste marketing activities.

Private Earnings from Waste Marketing

The first step of our estimation is to trace the entire marketing system in terms of prices paid and received on waste in each segment of the waste marketing. By doing so, we assess how the prices paid by end users are distributed among various traders and producers of waste.

Table 7 compiles data from our surveys on prices received (PR) and prices paid (PP) of wastes at different marketing links from waste producers to recycling plants. The data presented in this table apply to the flows of waste channeled through collectors, because it is only through this channel that waste producers are linked with traders. An exception is the case of polythene, because our sample collectors did not deal with polythene. The case we were able to observe pertains to pickers who

Table 7. Average prices of different types of waste at different market links (Rs/kg)

	Waste producer	Collector		Dealer		Wholesaler		Recycling plant
	PR	PP	PR	PP	PR	PP	PR	PP
Plastic	5.43	5.82	7.01	6.87	8.62	7.53	8.50	13.00
Paper	4.05	3.92	4.05	4.23	5.07	5.16	5.18	6.00
Rubber	–	0.45	1.20	1.25	–	1.75	–	2.75
Broken glass	0.54	0.49	0.98	0.99	1.42	1.55	2.35	3.00
Bottles	1.23	0.89	1.86	1.86	1.92	2.12	2.95	3.28
Metal	5.99	5.34	6.28	5.64	7.38	6.81	7.11	11.00
ARI (%)	1.0		0.6		0.2		26.8	

Note:
PR = price received.
PP = price paid.
ARI = average rate of inconsistency = (PP-PR)/(PP + PR/2) × 100.
Source:
Waste producer: average prices calculated from Table 5 (Columns 3 and 4).
Collector: average prices calculated from Table 5 (Columns 5 and 6).
Other: the 2nd Round Survey.

collected polythene and sold to dealers who, in turn, delivered it directly to recycling plants. Therefore, the figure entered in the column of collectors' margin for polythene is the receipt of pickers from dealers.

The prices reported in Table 7 are average prices, namely, the divisions of sale or purchase values by corresponding quantities. The data for waste producers and collectors are taken from Table 8, which are based on the First Round Survey (January–February 2002), and those of other traders and recycling plants are obtained from the Second Round Survey (November 2002–January 2003). The data from the first survey pertain to the averages in the week prior to the survey date as explained previously, whereas the second survey gathered prices prevailing on the survey date.

If a survey is applied to a pair of traders (for example, collector and dealer) doing the same transaction at the same time point, the PR of the seller (collector) should be equal to the PP of the buyer (dealer). In practice, however, our respondents are not necessarily trading partners engaging in the same transactions and, also, the dates of the surveys were different. In particular, the survey dates on collectors and other traders were more than one year apart. Naturally, large differences are expected between corresponding PRs and PPs. Yet, the average rates of inconsistency (ARI), which are calculated as the rates of differences between PRs and PPs averaged over waste items are surprisingly small, except between wholesalers' PRs and recycling plants' PPs (the bottom row in Table 7). For the estimation of marketing margins at various segments of waste marketing, we use the average of PRs or PPs since we have no basis to judge which of the two is more accurate and reliable.

Table 8 shows how final users' expenditures for the purchase of waste materials were distributed among waste producers and traders. In the case of plastic, for example, out of Rs 10.8 paid from recycling plants for the purchase of one kilogram of waste, 52 per cent went to the hands of waste producers. The rest went to collectors (12 per cent), dealers (11 per cent) and wholesalers (25 per cent). This distribution differs widely across waste items but, on average, waste producers' share was about one third and traders' share was two thirds.

One important point to be emphasised with respect to the data in Table 8 is that waste producers' receipts from collectors were generally larger than the margins that collectors themselves received. In the absence of collectors' activities, the income of households and business establishments from the sales of wastes should have been much smaller. Thus, collectors contributed to increases in the incomes of waste producers in addition to the generation of their own private incomes.

Contributions to the City's Environment

In addition to collectors' contributions to the incomes of waste producers, both pickers and collectors are making a major external contribution to society in the form of improving the city's environment. If their operations were absent, the waste collected by them would have been thrown away into parks and streets beyond the capacity of public garbage dumps. If the city authority wanted to avoid environmental deterioration, the increased garbage must have been disposed at its cost. Therefore, pickers' and collectors' contribution to the city's environment can be

Table 8. Distribution of payments from recycling plants among various segments of the marketing channel (Rs/kg)

	Plastic	Paper	Rubber	Broken glass	Bottle	Metal	Polythene[a]
Waste producers' receipt	5.63 (52)	3.99 (71)	0.45 (16)	0.52 (19)	1.06 (34)	5.67 (63)	0
Marketing margins							
Collector	1.31 (12)	0.15 (3)	0.78 (28)	0.47 (18)	0.80 (26)	0.29 (3)	2.96 (59)
Dealer	1.14 (11)	0.98 (18)	0.52 (19)	0.49 (18)	0.76 (24)	1.14 (13)	2.04 (41)
Wholesaler	2.67 (25)	0.47 (8)	1.00 (36)	1.19 (45)	0.50 (16)	1.96 (22)	0
Total	5.12 (48)	1.6 (29)	2.3 (84)	2.15 (81)	2.06 (66)	3.39 (37)	5.00 (100)
Recycling plants' payments	10.80 (100)	5.59 (100)	2.75 (100)	2.68 (100)	3.12 (100)	9.06 (100)	5.00 (100)

Note: Figures in parentheses are shares in the price paid by the recycling plants.
a) This column reports the case in which polythene was collected by pickers and sold directly to dealers who sold directly to recycling plant. Therefore, the entry in the row of collector's margin (Rs 2.96) is pickers' receipt from dealers.
Source: Based on average of PPs and PRs in Table 7 except for polythene. The polythene price received by pickers is from the 1st Round Survey and the price paid to wholesalers is from the 2nd Round Survey.

measured by the public cost that the city government would have had to shoulder for disposing waste by the amount collected for recycling by pickers and collectors.

How much public spending is saved on the average of waste collected and sold by picker or collector per day? The data on the average quantities collected are already reported in Table 5. The problem is to estimate the public cost needed to dispose of one unit of waste. According to the information obtained in 2003 from the Office of Sanitation and Conservancy Engineering in the Municipal Corporation of Delhi (MCD),[10] waste collected by them was disposed at three landfills located 20 to 30 kilometers away from the city using its own and chartered trucks. The cost of chartering a truck with a loading capacity of five tons was Rs 1,300 per day. Assuming that a truck carrying five tons of garbage travelled to a landfill twice a day, the transport cost per ton would have amounted to Rs 130. In addition, MCD paid Rs 97 per ton for levelling and dressing the unloaded garbage. Thus, the direct costs of MCD's garbage disposal operation add up to Rs 227 per ton. The overhead administrative cost is difficult to estimate. However, our informants in MCD considered it likely that about 30 per cent more than Rs 227 needs to be paid if the whole disposal operation would be contracted out to a private agent. Therefore, we adopted Rs 295 ($= 227 \times 1.3$) as the estimate of the public cost per ton of garbage disposal.

The public cost savings resulting from the operations of pickers and collectors can be estimated by multiplying the unit public cost estimated above with the quantities of waste they collected and sold, which amounted to Rs 8.9 per picker per day and Rs 28.3 per collector per day. These external benefits are quite significant relative to their private incomes, amounting to about 15 per cent of pickers' average earning and 25 per cent of collectors'. Although such public cost savings could have not been realised by pickers and collectors alone, because higher-level traders, such as dealers and wholesalers, are also involved in the recycling of wastes. Yet, it is certain that, unless pickers and collectors effectively collected wastes at the bottom of the recycling system, significant increases in the public cost would have become inevitable for maintaining the city's environment.

Aggregation

Our approach is to estimate total value added from waste marketing activities per year in the City of Delhi by aggregating marketing margins at various levels using total quantities of wastes as weights, together with waste producers' receipts and public cost savings. Most of the data needed for this aggregation have been assembled in the previous analysis, except the total numbers of pickers and collectors operating in Delhi.

Of course, official statistics are not available on how many people are engaged in such informal activities as waste picking and collection. Therefore, we had to rely on indirect estimation. The number of pickers was estimated from the data on the number of public garbage dumps, which was supplied from MCD. Also, through consultation with MCD officials and other knowledgeable persons, we assumed that one built-in structure (called *Dhalab*) can supply sufficient waste for six pickers, one bin for two pickers, and one open dumping site designated by MCD for one picker

to make their living. Applying these rates to the numbers of garbage dumps, we estimate the total number of pickers operating in Delhi to be 8,034.

The number of collectors was estimated from the number of households and business establishments, from which waste is collected. Assuming the average family size of five persons, the total number of households in Delhi was estimated to be 2,756,000 from the official data of total population. On the other hand, the number of informal sector enterprises was determined from an official source to be 910,000 (Government of India NSS, 2001: 23). Through consultation with knowledgeable persons including collectors and dealers, we assumed that the average numbers of households and enterprises covered by one collector were 312 and 104, respectively. Applying these rates to the total numbers of households and enterprises, we estimate the total number of collectors to be 17,587.

The aggregate social value added from waste marketing estimated for the City of Delhi consists of three components. The first component is the private income of waste traders. This is the portion of total value added generated by waste traders that they were able to internalise.

The second component is the income of waste producers. This portion of value added represents a windfall gain to waste producers resulting from increased demands for their waste owing to traders' activities. Because this income gain of waste producers is realised through market transactions, it is a kind of 'pecuniary externality' created by waste traders, according to the definition of Tibor Scitovsky (1954). Even though waste producers themselves carry out some positive activities such as storing their waste, such activities typically do not require inputs having significant opportunity costs. For example, the labour of a housewife used for storing old newspapers should be difficult to translate to alternative employment to earn a significant income when collectors stop coming to her house. To the extent that she enjoys appreciation in the value of her waste due to the activity of collectors, while she herself bears no significant cost, she is a 'free rider' to enjoy pecuniary externality, similar to a landowner who enjoys appreciation of his land value or rent corresponding to the extension of a railway to his area without making investments in land development himself. The relatively inelastic supply of waste materials, which is common to commodities not using opportunity-cost resources, makes it possible for waste producers to capture a large share of economic surplus emanating from market transactions as positive pecuniary externality.[11]

The third component is the income to the city government in the form of public cost saving. This is the portion of 'technological externality' in the classical sense.

Of the first component, the aggregate incomes of pickers and collectors were obtained by multiplying their average incomes per capita per day (Table 5) with their numbers and further with the estimated numbers of their workdays per year. The incomes of dealers and wholesalers were calculated first by multiplying marketing margins (Table 8) with quantities picked and collected (Table 5), which were further aggregated using the same procedures as applied to pickers' and collectors' incomes.[12] These are not really the incomes of dealers and wholesalers themselves, but are gross values added by labour and capital used in their enterprises, which are not necessarily owned by the enterprise operators. Waste producers' incomes were calculated by aggregating their average receipts from collectors (Table 5) in the same

way as used for the calculation of pickers' and collectors' incomes. Aggregation of public cost savings also followed the same procedure.

Findings

Table 9 reports that the total social value added from waste marketing activities in the City of Delhi in our survey period was estimated to be Rs 3,587 million per year (US $74 million at the prevailing exchange rate). Of this sum, about half was internalised by traders as their private incomes, and the rest was externalised to the income of waste producers and the budget saving of the city administration. It is important to recognise that those informal agents dealing with waste and being looked down upon by citizens as dirty low castes are making significant contributions to citizens' welfare. Clearly, waste producers are the major beneficiaries of waste collection and distribution activities with more than 40 per cent of total value added

Table 9. Social value added per year from marketing of recyclable wastes in Delhi

			% of	
		Rs million	(10)	(1)
(1)	Waste trader	1,789	49.8	100.0
(2)	Picker	137	3.8	7.6
(3)	Collector	615	17.1	34.4
(4)	Dealer	494	13.8	27.6
(5)	Wholesaler	543	15.2	30.4
(6)	Waste producer	1,622	45.2	
(7)	Household	814	22.7	
(8)	Business establishment	808	22.5	
(9)	City administration (Public cost saving)	176	4.9	
(10)	Total	3,587	100.0	

Source:.
(1): (2) + (3) + (4) + (5).
(2): Rs 59.1/day (Table 5, Column 2) × 288 days/year (= 24 days × 12) × 8,034 pickers (Text).
(3): Rs 111.7/day (Table 5, Column 7) × 312 days/year (= 26 days × 12) × 17,587 collectors (Text).
(4) and (5): Estimated by multiplying total quantities picked and collected by item per year (Table 5) with marketing margins (Table 8), where total quantities per year are calculated by multiplying per-day quantities (Table 5, Columns 1 and 5) with the total numbers of work days of pickers and collectors as assumed in (2) and (3).
(6): Estimated by multiplying collectors' average payment per day (Rs 295.3) in Table 5 (Column 4) with the total number of collectors' work days as assumed in (3).
(7) and (8): Total payment from collectors = Total receipt of waste producers, as estimated in (6), is allocated between households and business establishments assuming that the share of the former is 0.502 and the share the latter is 0.498. These shares are based on the estimates of demands for collectors who buy wastes from households (8,834) versus those buying from business establishments (8,753) (Text).
(9): Estimated by multiplying the garbage disposal cost of MCD (Rs. 293 per ton) with the total number of work days of pickers' and collectors as assumed in (2) and (3).
(10): (1) + (6) + (9).

accruing to them as their net income addition, without bearing significant costs except storing their wastes.

It may appear that their contribution to the city's environment, as measured by the public cost saving of less than Rs 200 million or US $4 million is not so large. However, their contribution to environmental conservation could well be much larger than this figure shows. Note that, in theory, the sum of incomes of waste traders and producers (Rs 3,411 million or $71 million) is equal to the total payment from recycling plants for the wastes they purchased, though they may differ due to sampling and observational errors. If this waste were not supplied to the recycling process, the manufacturing sector should have been compelled to use natural resources having a value no smaller than that of the waste, which should have significant negative externalities. For example, the shortage of waste paper supply should force paper mills to increase the use of pulp made of timber tips, which may promote felling forests associated with the increased incidence of flood and soil erosion. Similarly, increased mining activities to compensate for the decreased supply of metal scraps may increase pollution of air and water by toxic materials. The positive externalities resulting from the conservation of natural resources due to the recycling of waste should spill over widely beyond the confines of Delhi City. The total of such external benefits is difficult to measure, but is likely to be quite significant.

VII. Some Policy Implications

Our investigation into the life and work of waste pickers and collectors in North-East Delhi revealed that these informal agents who engaged in the activities traditionally regarded as dirty by the majority of the Indian population under the influence of Hinduism were mostly migrants from rural areas to urban slums or slum-like environments. Despite the similarity of their work, however, pickers and collectors belonged to different economic and social groups. Most pickers were below the poverty line set by the Planning Commission, whereas the majority of collectors were marginally above the poverty threshold. Collectors mainly came from UP adjacent to Delhi, and pickers came mostly from remote Bengali speaking states. Because of their connection to the UP community network, most UP migrants had advantages in becoming collectors with the possibility available of climbing up a social ladder to higher-rank waste traders. On the other hand, Bengali migrants and exceptionally poor UP migrants having no such connections have no better option than remaining poor as pickers. This contrast reveals the fact that social segmentation by community is the basis of chronic poverty among the poorest of the poor.

Pickers' incomes are meagre and living conditions are dreadful even by the standards of India. Collectors' conditions are only marginally better to the eyes of observers from high-income economies. Yet, they are making highly valuable contributions to society. In addition to earning private incomes for their own subsistence, they are producing significant benefits to the sellers of waste, such as households and shops, and to the city government for saving the cost of disposing of garbage as well as to wider society beyond the City of Delhi for saving natural

resources. Despite their critically important role, their share of income produced from the system of waste recycling is rather small.

What kinds of policy can be envisaged for improving their income and living and, also, for further promoting their contributions to society? No doubt the provision of such social services as education and health, as emphasised in United Nations' *Millennium Development Goals*, are important. In particular, the improvement of sanitary conditions in slums, such as drinkable water supply and sewage disposal systems, will have large immediate impacts on their work and income by reducing the days lost due to sickness. Education will be especially effective to further enhance the upward mobility of collectors.

However, these social services alone are unlikely to rescue pickers from chronic poverty in the short to the medium run. Since decent work opportunities presently available have already been occupied by the members of the UP community, it does not seem possible to make such opportunities available to Bengali migrants. The only possible way seems to be the creation of new work opportunities. Public support should be provided in this area. For example, good potential seems to exist for some pickers (and collectors also) to add value to their collected waste materials through simple processing, such as fabrication of used cans and bottles into utensils and ornaments usable by the low- to middle-income population. Creation and expansion of such new processing activities at the bottom of the informal sector will surely increase work opportunities accessible by new migrants. For such potential to be realised, public support on industrial research, extension and training as well as infrastructure such as electricity is necessary. In fact, one Bengali dealer who attempted to start a mini-scale processing of plastic was forced to abandon the project because of unreliable electricity supply.

In order to elevate these crude manufacturing activities to become the source of sustained increases in the incomes of the poor, it is critically important to keep improving the skill of workers, not only in crafting but also in making new designs and models for attracting wide demand from domestic as well as overseas markets. For this purpose, industrial extension and training must continue to be strengthened for upgrading the capacity of operators in cottage industries and mini-factories, so that advanced skill and knowledge will spill over their family members and employees. For supporting innovative activities of these mini-entrepreneurs, it is necessary to make applied industrial research laboratories and market information services accessible to them. Knowledge and skill learned from this process will not only increase the income earning capacity of workers in a certain section of industry, such as processing of waste materials, but will also facilitate their mobility to other production and employment opportunities.

Another type of public support that will have more immediate impact would be to prevent government employees, including the police, from exploiting the poor who have no means openly to protest. In fact, stopping policemen's extortion and public dump caretakers' money demands for picking in their 'territories' is considered by many pickers we interviewed as having a much higher priority than the supply of public health and education services. Institutional innovations for channelling the protests of the poor to the public, such as locating ombudsmen in urban slums, must seriously be contemplated.

Although the case of significant private monopoly was not observed, in order to increase transparency in transactions, the city authority may consider the possibility of establishing such institutions as the wholesale market of wastes, similar to the wholesale markets for vegetables and meats. Also effective in increasing market competition and efficiency could be the provision of public information services, such as regular price quotations on typical waste items through mass media. On the other hand, direct interventions by government into markets, such as controls on prices, wages and interest rates as well as business licensing, should be avoided. Such government regulation is not only impossible to enforce effectively in the informal sector, but also likely to become the major source of corruption and rent seeking, with the effect of depressing the incentives of private traders, worsening the lot not only of high-level traders, but also of those at the lowest level, including pickers and collectors (Bromley, 1979; De Soto, 1989).

These are only a few casual ideas based on a small-scale pilot study. In order significantly to improve the efficiency of the waste re-cycling system in the metropolis in low-income economies and to reduce poverty among people working at its its lowest levels, actual policy designs must be based on the replication of much larger and more intensive studies.

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Notes

1. Some significant studies include: Papanek (1975), Joshi and Joshi (1976), Mazumdar (1979), Schaefer (1981), Sethuraman (1981), Nakanishi (1991), Banerjee (1983, 1984, 1991, 1995).
2. There is no official demarcation of slums. In this paper the word 'slum' is used rather impressionistically to indicate a residential quarter where people's living standards, including the conditions of housing and infrastructure such as water supply systems, are obviously very poor and where many residents are illegal squatters having no property rights on the real assets that they are using.
3. In addition to the advantage of obtaining data close to annual averages, the winter months are convenient to catch respondents to our questionnaire survey. In summer, pickers and collectors as well as upper-level traders are often too busy to answer our questions and, in winter, few of them show up in their waste recycling operations making it difficult for us to catch them. Nevertheless, we admit that limiting our data collection to a certain season of a year, owing to the constraint of our research resources, is a major limitation of the present study. Also, note that we were able to catch pickers and collectors for interview mainly in their working places, such as dealers' junk stores, and were seldom able to visit their houses for interviewing family members. We had to take this approach because of the non-availability of their home addresses for use as a sample frame and also due to respondents' unwillingness to accommodate us in their houses. Consequently, our data on family members' activities and earnings are likely to be less accurate than those of pickers and collectors themselves.
4. According to the results of the 2003 survey, waste producers who complained about collectors' cheating comprised 48 per cent of households and 20 per cent of business establishments. The reason why not so many complained may partly be because some of them developed regular customer relationships with collectors for preventing their moral hazards (22 per cent of households and

33 per cent of business establishments) and partly because the incomes from the sales of wastes were usually too small for them to care about.

5. Note that the Planning Commission poverty line is based on the NSS data of household expenditures, whilst our data for estimating poverty incidence in Table 6 are measured in terms of household incomes. The possibility cannot be denied that our procedure may overestimate the poverty incidence of the poorer group (pickers) relative to the other (collectors) to the extent that poorer people tend to consume more than their current incomes, although it is questionable if the poor can continue net borrowing. However, this possible bias, if it exists, is likely to be minor relative to the magnitudes of other measurement errors and unlikely to change our conclusions.
6. For the power of long-term, multi-liked contracts to reduce moral hazards, see Bardhan (1980), Fudenberg and Maskin (1986) and Bell (1988). For the community mechanism of contract enforcement, see Hayami and Kikuchi 1982, Ch. 2) and Hayami (2001, Ch. 9).
7. Although we were not able to make formal investigation, our casual observations during the three-round surveys did not hint at the possibility that the caste status is a significant factor underlying the social segmentation between pickers and collectors. The same applies to regional variations within each state. However, to the extent that people in lower castes and migrants from poorer districts are likely to be poorer and hence endowed with poorer 'social assets', the probability of migrants even from UP not being able to become collectors could be higher for those of lower castes and of origins from poorer districts. It was our impression that poverty is a more dominant factor than caste in determining social segmentation in the urban informal sector such as our study site. Certainly, discrimination based on caste is much less visible and binding in a great metropolis like Delhi than in rural villages and towns. On the other hand, discrimination based on ethnicity appears to be strong, presumably because differences in such traits as language are clearly visible even for people living in the metropolis.
8. Of course, collectors who can afford to continue contributing Rs 1,000 every month are limited to those who are exceptionally gifted in trade skills, hard working and frugal. Usually, only those who have developed a reputation for being capable and reliable can receive recommendations by friends or business acquaintances for admission to ROSCA.
9. Both failures stem from the basic limitations of the two organisations. While the state by nature cannot escape from the agency problem in which politicians and bureaucrats tend to maximise their own profit at the expense of citizens, the exclusion of outsiders is the very basic condition for the community to organise cooperation among its members (Hayami, 2001: 314–19). There are manifold cases illustrating that government regulation intended to correct market failures resulted in greater social welfare loss. Similar results may be produced by government regulations on community-based activities. In our case, if the government would prohibit the informal cart rental arrangement as a part of the regular-supplier contract on the charge of its discriminatory and monopolistic nature and replace it by a formal cart-rental system under the management of a government agency, it is likely to produce major social welfare loss, similar to the repeated failures of government-run 'small farmer credit programs' associated with the prohibition of 'usury' by private moneylenders (Von Pischke et al., 1983; Adams et al., 1984).
10. MCD is a public corporation mandated to provide civic amenities in Delhi under the city council of elected representatives.
11. The first and the second components of our estimate of social value added may be regarded as proxies of economic surpluses accruing to buyers and sellers in the market in terms of standard welfare economics. The direct estimation of such surpluses, though theoretically possible (Harberger, 1971), is beyond the scope of this study.
12. Underlying this procedure is the simplifying assumption that all the waste sold by waste producers was channelled through collectors, dealers and wholesalers in succession up to recycling plants. This assumption may result in a slight overestimation of collectors' income relative to dealers', because about one-tenth of households and one quarter of business establishments sold their wastes directly to dealers. However, our estimate of total value added would be little affected, because the reduced margins of collectors due to waste producers' direct sales to dealers should become the increased incomes of producers and dealers.

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