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Informal Recycling and Collection of Solid Wastes in Developing Countries: Issues and Opportunities

Martin Medina

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Abstract
The recovery of items from waste represents an important survival strategy for poor populations throughout the developing world. In many areas that lack municipal collection of wastes informal collectors operate a privately and in an unorganized manner. This paper proposes a typology of public policies toward scavengers; argues that scavenging activities should be supported; analyzes recent experience on the formation of scavengers' cooperatives as a means to promote grassroots development in their communities; examines the use of appropriate technology, and suggests ways in which scavengers and informal waste collectors could be incorporated into formal waste management programs.

Keywords: Scavenging, Informal Refuse Collectors, Waste Management, Recycling, Cooperatives, Developing Countries, Sustainable Development, Grassroots Development, Public Policy, Appropriate Technology

Introduction

Throughout cities in Asia, Africa, and Latin America, varying numbers of poor individuals survive by salvaging materials from the waste stream. These people recover materials to sell for reuse or recycling, as well as diverse items for their own consumption. Those individuals are generally known as 'scavengers' or 'rag pickers' in English, but they also receive different names, depending on the local language, on the place where they work, and on the material(s) they collect. For example, Colombians use the generic term 'basuriegos', but depending on the material they collect, scavengers are known as 'cartoneros'(cardboard collectors), 'chatarreros' (ferrous metals collectors), 'traperos'(rag collectors), 'frasqueros'(glass bottle collectors) and so on. In Mexico, dumpsite scavengers are known as 'pepenadores', while the term 'cartoneros' applies to the cardboard collectors and 'buscabotes' to the aluminum can collectors working on the

streets. Most studies report that human scavengers constitute poor segments of the population of developing countries.[1] Scavenging is a widespread occurrence: one can find on the streets or in garbage dumps of Third World cities people collecting all kinds of materials for reuse or recycling. It has been estimated that up to 2 % of the population in Third World countries survives by recovering materials from waste (Bartone, 1988).

Scavengers face multiple hazards and problems. Due to their daily contact with garbage, scavengers are usually associated with dirt, disease, squalor and perceived as a nuisance, a symbol of backwardness or even as criminals. They survive in a hostile physical and social environment. Even though scavengers are not always the poorest of the poor, their occupation is generally ascribed the lowest status. In this paper I look at scavenging patterns in developing countries, public policy towards scavengers, discuss recent experiences in the formation and operation of cooperatives and present ways in which scavenger and informal collectors can be successfully incorporated into the formal waste management system in a socially and environmentally desirable manner.

Scavenging Patterns in Developing Countries

The picture of scavenging that emerges from reviewing the literature is that of an occupation that provides a livelihood to the poor. Scavenging is an important survival strategy in which impoverished individuals cope with scarcity.

[1] See, for example, Abad, 1991; Keyes, 1974; Castillo, 1990; Birkbeck 1978 and 1979

Scavengers typically specialize in recovering only one or a few types of materials from waste. Sometimes the right to scavenge in certain neighborhoods is actually bought and sold. In some cases, such as in several Mexican, Colombian and Ecuadorian cities, collection crews bid to their supervisors for being assigned to collecting wastes in upper-income areas, where recyclables are more plentiful. And in Mexico City, Bogota, Bangkok and Manila, city collection crews often include a 'volunteer' who is not a municipal employee and whose sole responsibility is the recovery of recyclables from the refuse inside the trucks; the revenue obtained from the sale of the salvaged items is then distributed among the crew (Castillo, 1990; González, Cadena and Suremain, 1993).

Scavenging takes place at all stages along the waste management system:

a) Source separation at the household or place generating waste material; here materials are reused, sold or given away. For example, old newspapers are used for packing, discarded photocopy paper is recovered, folded and sold to store owners, who use them as bags when they sell small items, such as postcards. Clothing is handed down from father to son of from older to younger brother. Commercial and industrial separation of wastes at the source also occurs in developing countries: on Mexico's northern border the assembly plants known as 'maquiladoras' separate the cardboard in which they receive shipments of parts and components and

donate it to charities. Such donations are tax-deductible for the plants (Medina, 1992; Kresse and Ringeltaube, 1982; Santos, 1979).

b) During collection, collection crews sort out recyclables for sale on their way to transfer or disposal facilities, such as in the cases mentioned above (Castillo, 1990; González, Cadena and Suremain, 1993)

c) Informal collectors retrieve recyclables prior to the disposal of the refuse they pick up. For example, in Cairo, Egypt, some 30,000 zabbaleen make up a network of garbage collectors. A pair of zabbaleen working with a donkey-drawn cart can collect garbage from 350 households in a day. After sorting the garbage, the collectors feed the edible portion to pigs to fatten them for sale; sell pig droppings and human excrement to farmers for fertilizer; and sell scrap metal, glass, paper and plastics to middlemen, who then sell the materials to craftsmen or to industry. The monthly income of a zabbaleen family at the end of 1984 ranged between 1 and 5 times that of a civil servant's salary (Meyer,1987; Furedy,1984b). Bangkok refuse collectors spend 40% of their working time recovering recyclables, thereby doubling their wages (Cointreau, 1984)

d) Itinerant buyers purchase source-separated recyclables from residents. In Manila, for example, itinerant buyers known popularly as 'bote dyario' roam the streets buying recyclables from residents (Lohani and Baldisimo, 1990).

e) At the communal storage sites, as well as commercial and residential

containers placed curbside (Ouano, 1991)

f) On the streets or public spaces, picking up litter, such as in Pune, India, where the approximately 10,000 ‘rag pickers’ in the city recover recyclables from garbage thrown into the streets (Chapin, 1995)

g) In vacant lots where garbage is dumped and in illegal dumps, common in many Third World cities (Vogler, 1984; Mendoza, 1983)

h) In canals and rivers that cross urban areas and carry materials previously dumped upstream, such as in the Pasig River and its tributaries in Manila (Abad, 1991)

i) At composting plants, like the one in Monterrey, Mexico, that allows scavenging activities in the premises (Vogler, 1984)

j) At municipal open dumps, where many people actually live and work sorting out recyclables. As many as 20,000 scavengers live and work in Calcutta's municipal dumps (Furedy, 1984c)

k) At landfills, prior to burial of wastes, scavengers recover materials, such as in Mexico City's landfills (Cointreau and de Kadt, 1991)

The poverty prevalent in most developing countries force the poor to make the most of the resources available to them. Given their very low incomes, scavenging provides them with reusable and salable materials. In doing so, the poor have developed creative ways in order to satisfy their needs, including the recovery of items not necessarily part of the waste stream:

- In several Mexican localities, thieves steal telephone and electrical copper wires, cutting it off from existing lines in order to be melted down and recycled (Jaramillo, 1995; Medina, 1995; Rejon, 1995; Santacruz, 1995). Stealing of copper wire has also been reported in New York City's subways (Faison, 1993) and in transmission lines for Russian trains (Anon., 1994c)
- In Mali, one of the world's poorest countries, many farmers search and dig for artifacts produced by the ancient Mali Empire in order to sell them to art collectors in the U. S. and Europe (Brent, 1994; French, 1995)
- In Agra, India, women recover the dung produced by 30,000 head of cattle, to use it as a source of energy in cooking (Guibbert, 1990)
- In Calcutta, scavengers walk along the railroad tracks in order to recover the pieces of coal that fall from the trains (Lapierre, 1985)
- In India, human bones and skeletons from dead individuals who were not cremated are recovered from the Hoogly river to be sold to medical schools abroad or crushed and turned into glue (Lapierre, 1985)
- In Cairo, children search ox dung for undigested kernels of corn to eat (Linden, 1993)
- In Vietnam, scavengers dig on agricultural fields and jungle, searching for scrap metal left over from the war (Donohue, 1994)
- In Colombia, informal miners search for emeralds among emerald mines' tailings (Anon., 1994a)

- In Bogotá, Colombia, a scavenger was observed collecting pieces of glass produced by a terrorist bomb to sell them for recycling (Anon., 1992a)
- Residents of the area near Cali, Colombia, site of the December 20, 1995, crash of American Airlines flight 965, looted the scene, obtaining seats, seat belts, pieces of metal from the plane and passengers' possessions (Wald, 1996)
- In Lima, Peru, scavengers recover the clothes of deceased individuals in order to be sold or reused (Santos, 1979)
- In Beirut, Lebanon, the demolition of buildings damaged or destroyed during the civil war produced steel rods that people recover for recycling (Anon., 1995e)
- In Jakarta, Indonesia, scavengers dig for steel rods in buildings located at the former site of the Jakarta fair (The Jakarta Post, 1992)
- In West Java, scavengers collect cigarette butts on the streets, to be used in the production of batik (Sicular, 1992)
- Mexican residents cut off and dismantle sections of the steel fence that has been erected between Tijuana and San Diego by U.S. authorities, in an effort to stop illegal immigration and drug smuggling. They later sell the metal in Mexico for recycling (Fainaru, 1995)

Based on a review of studies, both academic and policy-oriented, as well as on anecdotal evidence, it is possible to enumerate the following generalizations about scavengers:

1) Scavenger individuals are poor, relative to the rest of society. Many studies have found scavengers' earnings to fall below the minimum wage. There are exceptions, however: in Cairo, the 'zabbaleen' make as much as three times the median income in the city, by combining garbage pick up, recycling operations and raising pigs (Bartone, 1988).
2) Due to their daily contact with waste materials, their low incomes, and their often raggedly appearance, society ascribes a low status to scavengers. Their scavenging activities frequently face a hostile, and sometimes violent, environment[2]
3) Immigrants, often from the rural areas, comprise an important percentage of scavenger populations. In Cairo, for instance, most zabbaleen are descendants from individuals who migrated from northern Egypt in the 1880s. That was also the case in the United States, where Jewish immigrants at the turn of the century made a living and prospered by collecting metal scrap for recycling using horse carts (Meyer, 1987; Katzman, 1988)
4) Scavenging epitomizes the informal sector: it constitutes a labor-intensive, low-technology, low-paid, unrecorded and unregulated activity
5) Scavenging can render economic and environmental benefits, such as work for unemployed individuals, supplies raw materials for industry, reduces the demand for collection, transport and disposal equipment and facilities.

[2] See section below, on Public Actions Towards Scavengers

Further, materials recycling has a lower environmental impact compared to the use of virgin resources[3]

6) Scavenging not only generates benefits to society; it may also have social costs, such as:

- There are high health risks associated with this type of labor. According to Castillo (1990), Mexico City scavengers have a life expectancy of 35 years, while the general population's is 67 years. The prevalence of infectious diseases is high. And a study of the zabbaleen in Port Said, Egypt, showed that the infant mortality rate was 1/3 (i.e., one death of an infant under one year of age out of every 3 live births). This is several times higher than the rate for the region as a whole (Semb,1982). The prevalence of enteric and parasitic diseases among the zabbaleen is, according to Semb, "much higher" than the one for the region. However, he did not provide any figures. And in Cairo, one in four babies born in the scavenger communities dies before reaching their first year (Meyer, 1987). In Manila, more than 35 diseases have been identified on scavenger communities and slums, including diarrhea, typhoid fever, cholera, dysentery, tuberculosis, anthrax, poliomyelitis, skin disorders, pneumonia and malaria (Adan, Cruz and Palaypay, 1982). The health effects of practicing this activity on scavengers deserve careful study. Serious investigations on this topic are scarce.

[3] See, for example, Avila, 1989; Diaz, 1985; Bartone, 1988; Furedy, 1989; Thomé-Kozmiensky, 1982;

- Scavengers searching for recyclables in curbside containers may spread the wastes in the streets (Cointreau, 1983)
- Scavengers are often seen either as a nuisance or as a source of humiliation by people and authorities. In many countries exist the impression that they should be forced out of this occupation by modernizing the service (Guibbert, 1990)
- Scavengers can be grossly exploited by middlemen. For example, scavengers in Indian, Colombian and Mexican cities may receive as low as 5.55% of the price industry pays for recyclables. On the other hand, scavengers on the U.S.-Mexico border are paid 50% of what industry pays for materials (Holmes, 1984; Medina, 1997).
- Scavengers may interfere with the normal operation of transfer and disposal facilities (Furedy, 1990)

7) Scavenging represents an adaptive response to chronic poverty prevalent in developing countries. However, scavenging also appears during particularly stressful situations that beget extraordinary circumstances and scarcity, such as war and severe economic crises. For example, during the American Revolution, the U. S. Civil War and World War II, salvage drives produced scrap metal to be melted and made into weapons. During the Great Depression, many unemployed individuals earned cash by collecting metal and other types of scrap (Barringer, 1954). Recent evidence confirms this:

Chandler, 1984; Lohani, 1984; Furedy, 1984a; Furedy, 1984b.

- In the aftermath of the collapse of the Soviet Union in 1989, and the ensuing economic problems and unemployment, street and dumpsite scavenging appeared in Hungary, Russia, Ukraine, Yugoslavia, and Rumania (Brubacker, 1995; Boneti, 1992; Anon., 1995a; Anon., 1995b; Laredo Morning Times, 1994; Dascalu, 1992)
- In the early 1990s, some Jewish immigrants from the former Soviet Union survived in Israel by recovering food from waste (Anon., 1993)
- During the siege of Sarajevo by the Bosnian Serbs, some of its inhabitants survived by scavenging for food in refuse containers, dumpsters, and dumps. They also collected all kinds of wooden items to be used as firewood (Anon., 1995c; The New York Times, 1993; The Jakarta Post, 1992a; USA Today, 1993)
- Due to the economic problems caused by the international embargo against the Bosnian Serbs, Belgrade residents resorted to scavenging in the local garbage dumps in an effort to recover food to eat and materials to sell (ABC News, 1993)
- During the United Nations-sanctioned trade embargo on Haiti, in an attempt to bring the elected president Jean-Bertrand Aristide back to power, scavenging at a large scale emerged. Haitian scavengers particularly looked for items discarded by U. S. peace keepers, such as prepackaged military meals and metal parts. In Port-au-Prince, scavengers unearthed caskets in the cemetery in order to steal any jewelry the

deceased may have buried with, and the caskets' iron and bronze handles (Selsky, 1994; The New York Times, 1995a; The News & Observer, 1995; Anon., 1994b)

- During the siege of Grozny by the Russians in their efforts to defeat the Chechen independence movement, scavenging emerged as a survival strategy (The New York Times, 1995b)

8) Depending on the degree of industrialization of a country, scavenging supplies raw materials largely to either artisans or to industry. In regions where industrialization is relatively more advanced, such as in Latin America and Southeast Asia, the materials recovered by scavengers are consumed by industry. Studies have documented industrial use and demand for inexpensive materials recovered by scavengers.[4] On the other hand, in regions where use of industrial consumer products is not widespread, such as in Africa, the Caribbean and the non-oil producing countries of the Middle East, scavengers supply artisans with materials (Vogler, 1984). In these countries, artisans manufacture a wide variety of consumer goods from materials collected by scavengers, such as sandals and water bags from old tires, oil lamps that use burnt out light bulbs as fuel reservoirs, children's toys, musical instruments and household utensils made from metal scrap. In Senegal, machinery for making metal utensils and furniture are themselves produced from cannibalized spare parts and recycled materials (Gerry, 1979). In Nairobi,

Kenya, artisans make and repair low-cost products such as braziers, water storage and containers for cattle feed from recycled materials (King, 1979). It has been estimated that in Pakistan alone, over 100 different products made from recycled materials can be found for sale in the markets (Grothues, 1990).

9) In dumpsites located near agricultural areas, scavengers recover organic materials to be used as fertilizer as well as for food for goats and pigs. This practice is common in Africa (Main, 1993). Slum dwellers in Latin America also raise pigs for sale or for their own consumption, feeding them food leftovers. And in the Philippine city of Baguio, scavengers collect ashes at the local dump to be used as fertilizer by farmers. Those ashes result from fires that break out at the dump regularly (Castillo, 1990; Medina, 1997).

Public Actions Towards Scavengers

Authorities in developing countries display a wide variety of policies that deal with scavengers. Those policies can be classified into the following:

1) Repression

The dominant view of scavenging, which still prevails in many developing countries, sees scavenging as inhuman, a symbol of backwardness, and a source of embarrassment and shame for the city or country. Based on this, scavenging has been declared illegal and punished in many Third World cities, such as in several Colombian, Indian, and Philippine localities (González and Suremain,

[4] See, for example, Santos, 1979; Furedy, 1990; Vogler, 1984; Castillo, 1990; Holmes, 1984

1991; Furedy, 1984c; Keyes, 1974). Restrictions and a hostile attitude towards scavengers typify repressive policies. In one of those instances, Cairo authorities banned the donkey carts where the zabbaleen transport wastes on the streets between sunrise and sunset (Meyer, 1987). Sometimes scavengers face extreme animosity and violence. For example, in some Colombian cities organized groups established a campaign of 'social cleansing' ('limpieza social') since the 1980s. In this, those groups either kill or kidnap and transport to the countryside indigent individuals that they consider 'disposable' ('desechables'), such as beggars, prostitutes, and scavengers. For instance, in 1992, forty corpses of scavengers were discovered at the Universidad Libre de Barranquilla, located in the Colombian town of the same name. The scavengers had been killed, their organs recovered and sold for transplants . The rest of their bodies was sold to the university to be dissected by medical students (Anon., 1992). Approximately 2,000 *disposable* individuals had been killed by the end of 1994 as a result of the 'social cleansing' campaign in Colombia (Anon., 1994a).

2) Neglect

In other cases, authorities simply ignore scavengers and their operations, leaving them alone, without persecuting or helping them. African cities such as Dakar, Senegal, Bamako, Mali, and Cotonou, Benin, illustrate the policy of neglect towards scavengers (Waas and Diop, 1990; Diallo and Coulibaly, 1990; Tonon, 1990). Indifference towards scavengers and their activities characterizes a policy of neglect.

3) Collusion

Government officials sometimes develop with scavengers relationships of exploitation and of mutual profit and mutual assistance; that is, relationships of political clientelism. Mexico City illustrates a situation of collusion between authorities and scavengers' leaders. Over the last five decades, a complex structure developed, involving legal and illegal relationships between dump scavengers, the local bosses known as 'caciques', street sweepers, refuse collectors, middlemen, industry, and local authorities. Some of the illegal relationships include the payment of bribes to government officials by the *caciques* for ignoring the *caciques*' abuses of power; the tips that refuse collectors demand from small industries and some households to pick up their waste, and the 'sale' of refuse collection routes in wealthy neighborhoods.[5] The *caciques* have close ties with government officials and the PRI (Mexico's ruling party), and the most powerful scavenger boss became deputy representative in the Mexican Congress in the mid-1980s. Scavengers have disguised themselves as peasants and workers in officials parades and during PRI and government rallies. Scavengers have also beaten up anti-government demonstrators (Castillo,

[5] Since upper-income individuals tend to consume more industrialized products, their garbage contains more recyclable materials than that of low-income communities; thus, serving wealthy areas produce a higher income to the collectors working on these routes

1990). Thus, the Mexican government gets bribes and political support from scavengers, and scavengers obtain legitimacy and stability in their operations.

4) Stimulation

The multiple and repeated failure of American and European waste management technology in developing countries,[6] as well as environmental awareness has effected a change of policies towards scavengers. Recognizing the economic, social, and environmental benefits of scavenging and recycling, governments have started to change their previous attitude of opposition, indifference or tolerance, to one of active support. For example:

- In Indonesia, president Suharto declared scavengers beneficial to the country's economy and environment. Now the government supports the formation of cooperatives of dumpsite and street scavengers. Private banks have granted loans to scavengers' coops. And the government established a duty on imported waste materials in an effort to increase scavengers' income (Salim, E., 1992).
- In Shanghai, the recycling system is run by the government's Shanghai Resource Recovery and Utilization Company, which has more than 24,000 employees, but there are also 10,000 'free collectors' sanctioned by the city government (Furedy, 1990)

[6] See "Scavenging and Appropriate Solid Waste Management" in this paper

- In Egypt, with the financing of the World Bank, the 'zabbaleen' community (informal waste collectors and recyclers), was provided with water, sewers, and roadways, and was supplied with improved collection and waste processing equipment (Cointreau and de Kadt, 1991)
- In Porto Alegre, Brazil, authorities have integrated scavengers in the curbside recycling program, serving 79% of the city's 1.1 million residents, and reducing the program's overall costs (Wells, 1995)
- In Korea, scavengers at open dumps have been provided with new housing, clean water and bathing facilities (Cointreau and de Kadt, 1991)

Scavengers' Cooperatives

It can be argued that scavenging provides benefits to society and that it should be supported and not persecuted. Recycling of solid wastes reduces air and water pollution, saves energy and reduces waste from industrial processes compared with the use of virgin materials; it provides both income and reusable products for the poor, and in many cases reduces imports of raw materials. Scavenging also reduces the amount of wastes that need to be collected, transported and disposed of, which translates into savings to the local governments and extends the life of dumps/landfills. Thus, scavenging provides social, economic and environmental benefits.

Industries that consume recyclables in developing countries encourage and support the formation of middlemen or waste dealers between the companies

and the scavengers in order to assure an adequate volume and quality of the materials. As a result, opportunities arise for the exploitation and/or political control of the scavengers, since they must sell their pickings to a middleman, who in turn sells to industry. Industry demands a minimum quantity from their suppliers and will not buy from individual scavengers.

Can scavengers be organized successfully in cooperatives to promote sustainable grassroots development? I argue that it is possible for scavengers to organize themselves in cooperatives in order to circumvent the middlemen and to break the "vicious circle of poverty" in which many scavengers find themselves. The results can be dramatic. For example, the members of the "Sociedad Cooperativa de Seleccionadores de Materiales" (Socosema), created in 1975 in Ciudad Juárez, on the Mexico-Texas border, saw their incomes increase ten-fold after replacing the "concesionario" (middleman). The members of the coop now enjoy better living conditions, medical care, legal protection, a school for their children, they are self-reliant, are recognized by the authorities, and have developed stable business relationships with industry (Castillo, 1984c).

But even if scavengers are highly motivated, several obstacles stand in the way of the formation of a cooperative. The following factors can hinder the formation and profitable operation of scavengers' coops: the authorities' lack of support; industry's reluctance to deal with the coop; the scavengers' low educational level; their lack of financial resources; not having access to credit, and their lack of business experience.

The Philippine and Indonesian governments have tried to support scavenging and small businesses that use recyclables. The Philippine project ‘Pera sa Basura’ (‘Cash for Trash’), started in Manila in 1978, failed because it attempted to substitute the informal system with government control of the scavengers. The Indonesian efforts support the formation of scavengers' cooperatives and provide them with credit. In order to raise the prices of recyclables, the Indonesian government enacted laws restricting the import of waste materials. Wastes from industrialized countries kept the prices of recyclables low, according to the Indonesian government. A persisting problem, however, has been the smuggling of waste materials from industrialized countries into Indonesia (Medina, 1997).

More successful so far have been the efforts of NGOs in supporting scavengers' cooperatives in Mexico, the Philippines, India and Colombia. The "Fundación Social", a Colombian NGO represents a unique case in the world. Since 1986 they have supported the formation of scavengers' coops throughout Colombia, and provided the coops with loans, grants, and assistance on legal, technical and business matters. Interestingly, NGOs with a strong presence of Catholic priests have played an important role in the formation of scavengers’ coops in Mexico and Colombia. The ‘Fundación Social’ was founded and is currently headed by a Catholic priest. The Brazilian catholic church has also played an important role in the formation of NGOs in that country.

At present the *Fundación Social's* "Programa Nacional de Reciclaje" assists over 78 coops in various Colombian regions . Local, regional, and a national association of scavengers' coops exist, which has given them more bargaining power with industry and authorities. Coop members report a higher standard of living, as well as improvements in self-esteem and self-reliance compared to when they worked individually. Many coops plan to become part of the waste management system in the future, by signing contracts with municipalities for the rendering of various services for a fee. Several Colombian towns, such as Guarne, Chiquinquirá and San Gil, have already signed contracts with scavengers' coops for the rendering of waste management services. The Colombian coops strive for the transformation of the scavengers into small businessmen (Anon., 1990).

Role of NGOs in the Formation and Operation of Scavengers' Coops

NGOs can play a critical role assisting in the formation and operation of a scavengers' cooperative. The energy and creativity of NGOs can be of tremendous value in advising scavengers to organize themselves in cooperatives; in helping the coops to obtain loans, grants or furnishing the credit themselves; and in providing technical, business and legal assistance to the coops. Newly-constituted coops are particularly vulnerable, when they may have to deal with the opposition from the middlemen being replaced. Industry may be reluctant to have their usual supply channels disrupted. And the authorities may

covertly hinder the formation efforts of a new coop if a patron-client relationship exists between them and the scavengers (Castillo, 1984c).

A window of opportunity appears during changes of administration, particularly at the local level. A new Mayor, especially a member of a different political party than his / her predecessor, may be more inclined to support a recently-formed scavengers' coop in order to demonstrate his / her commitment with the poor and in favor of change. Such an action could improve the Mayor's image, while scoring political points. A mass media campaign conducted by the involved NGO, presenting the scavengers' plight, their harsh working and living conditions, as well as the benefits the community receives from their labor, can boost public support for the scavengers and their efforts to organize. In addition to the use of mass media, a grassroots information campaign can also be conducted among community leaders, schools, and neighborhood associations. This approach has been followed in several Colombian cities with good results (González and Suremain, 1991).

Obtaining the support of an international environmental group and the publication of a story in an influential medium, such as The New York Times, may be a strong motivation for governments to act in favor of scavengers, in order to avoid further embarrassment. Stories in the international press about official ineptitude and corruption can be powerful incentives for the respective authorities to do something about it, even if it is for public relations purposes only. For example, when I conducted research in Manila, a grassroots group was

campaigning in favor of the relocation of the 'Payatas' dump. When I approached them, they gave me all the information I requested and asked me to try to publish a story or article in the U.S. about the dump. Reportedly, the Philippine government sometimes pays more attention to what is said about the country in the foreign press than in the domestic press. Political insiders in the Salinas administration in Mexico have described the particular importance that the former president gave to foreign press coverage of the country (Castaneda, 1995).

NGOs should avoid making the coops dependent on them, and should not solve every single problem the coops face. Instead, NGOs can help develop the problem solving skills of the members of the coop through training workshops. NGOs can also play the role of consultants for the coops. The *Fundación Social* offers assistance to the scavengers' coops affiliated to its national program. NGOs should help the coops develop a democratic self-rule as soon as the coops are constituted. The opportunity exists for one or more canny and ambitious individuals to seize power, acting essentially as *caciques* and plundering the coop. That is exactly what happened to the "Sociedad Cooperativa de Recolectores de Materiales de Nuevo Laredo", in Mexico, which failed and disintegrated in 1994 (Medina, 1997).

Scavengers, Informal Collectors and the Formal Waste Management System

The recent and ambitious privatization efforts throughout Latin America and elsewhere present challenges and opportunities for scavengers. In Colombia, Mexico and elsewhere, private companies that have been awarded contracts to handle and dispose of municipal solid wastes do not allow scavenging activities in the dumps/landfills they operate. Scavengers may have to adapt to these changing times in order to survive.

Scavengers' coops can render certain services to cities, such as street sweeping, collection of mixed wastes and/or recyclables, and provide cleaning services to public or private establishments. In fact, two of the most successful scavengers' coops in Latin America have diversified their operations and now provide cleaning services in addition to scavenging. Socosema, in Ciudad Juárez, Mexico, previously mentioned in this paper, cleans up the locales of several assembly plants commonly known as "maquiladoras" and obtains, free of charge, all the recyclables generated by the plants. When the amount of recyclables at the plants is small, Socosema is paid for its cleaning services. And the "Cooperativa Recuperar" in Medellín, Colombia, has been cleaning up the local bus terminal since 1984. The co-op now also provides cleaning services to private companies, public spaces, markets, local fairs and conventions.

The scavengers and informal collectors who, for a fee, pick up the garbage of low-income residents not served by the sanitation crews, have a definite advantage operating in slums and squatter settlements. In many Latin American cities, informal collectors using pushcarts, tricycles, donkey carts, horse carts, or

pick up trucks serve the poor and retrieve the recyclables contained in garbage. For example, in Santa Cruz, Bolivia, informal waste collectors serve about 37% of the population. And in the Mexico City suburbs of Ciudad Nezahualcoyotl, Chalco and Iztapaluca, hundreds of informal collectors using pick up trucks, push carts and horse carts provide service in areas not served by municipal authorities (Herrera, 1995). In some Indian communities, residents pay a fee to local sweepers for cleaning the street in front of their houses (Phatak, 1993). These facts demonstrate that slum dwellers are willing to pay for waste collection service.

Given the conditions of hilly, unpaved or narrow streets common in those settlements, sanitation trucks may have no access to them. Alternatively, if they do enter those areas, the vehicles break down easily considering the harsh conditions of the streets and roads. It is not uncommon for Mexican cities to have, at any time, half of their collection vehicles idle in the garages awaiting some kind of repair. Additionally, faulty or nonexistent maintenance as well as lack of spare parts contribute to that high percentage of idleness (Maynez, 1988). Thus, the vehicles used by the informal collectors are more appropriate to the conditions of the slums, and can provide the service at a lower cost than a private company using state-of-the-art, imported, and expensive compactor trucks. However, informal collectors often simply dump illegally the collected garbage in vacant lots, river banks or ravines, posing risks to human health and the environment. Given that dumps or landfills tend to be at a considerable distance

from residential areas, and that animal-drawn and man-pushed vehicles have the disadvantage of a limited range, it is convenient for those informal collectors to dump the collected refuse as soon as they can (Pickford, 1984). Incorporating the informal collectors into a formal program could bring some control over their operations, and stop the illegal dumping. For example, if incentives were created for the informal collectors to bring the refuse they collect to transfer stations, local authorities then would be responsible for its transport to the final disposal sites. In such way, pick up charges would be standardized, the informal collectors would be accountable for their actions and would be encouraged to use the transfer stations; service would be improved, particularly in slum areas, at an affordable cost to the city (no expensive and imported collection trucks would be needed) and jobs would be created for unskilled individuals.

Waste management programs attempting to incorporate scavengers should consider the population's willingness and ability to pay for waste collection, the composition of the waste generated –which often depends on people's income– as well as the industrial demand for recyclables in the area (Medina, 1997). Scavengers respond to market forces and not to environmental considerations. If there is industrial demand for a particular material and the price is right, they will collect it. In big cities with diversified economies, scavengers pick more types of items than the ones working in smaller settlements. For example, scavengers in Mexico City retrieve over 20 different materials and articles, including old mattresses, organic matter, milk cartons, rubber, leather, animal

bones and so forth (Castillo, 1990). On the other hand, scavengers in Nuevo Laredo, on the Texas-Mexico border, recover only the materials purchased by the local middlemen: cardboard, aluminum and ferrous metals. Additionally, as most scavengers do elsewhere, Nuevo Laredo scavengers also recover whatever items they find for their personal consumption, such as discarded food and clothes (Medina, 1997).

If the price paid for a material is high enough, scavengers may resort to stealing it from wherever it's available. For instance, thefts of copper wire in Mexico have become increasingly common (Jaramillo, 1995; Medina, 1995; Rejón, 1995). The thieves take the wire from existing telephone and electricity transmission lines, cutting it off and selling it to smelters for recycling. Such thefts of copper wire have also been reported in New York City's subways and in Russian train lines (Faison, 1993; Anon., 1994c). And throughout the United States, thefts of materials -particularly paper and aluminum cans- from recycling programs have increased dramatically over the last two years (Verhoevek, 1995; Mason, 1995). Those 'paper poachers' steal the paper placed curbside by residents, before the city crews collect it (Anon., 1995d).

Conflict may arise between the scavengers and NGOs if the latter intends to maximize recycling (some environmental groups advocate a 100 % recycling rate), and the program may end up with large quantities of materials that cannot be sold because there is no demand for them. That has been a common mistake

in many recycling programs in both developing and industrialized countries (Chandler, 1984).

Ignoring the differences in waste composition generated by the different income groups may also lead to conflict among scavengers. High-income neighborhoods' garbage contains more recyclables than that of low-income areas. If fixed collection routes are designed, those serving the wealthier zones will make more money than the rest, unless a redistributive mechanism is developed. A more equitable system may be the rotation of collection routes, such as the one used in Cuenca, Ecuador, and elsewhere, so that everyone has access to both rich and poor areas' recyclables.

Scavenging and appropriate waste management technology

Waste management technology developed in industrialized countries has limited application in developing countries. The garbage produced in developing countries is more organic, dense and humid than the one generated in industrialized countries. The physical and socioeconomic conditions prevalent in Third World cities are also quite different (Cointreau, 1983; Furedy, 1990; Diaz and Goluecke, 1985). Consequently, they require different solutions.

The inappropriateness of using compactor trucks in slums has already been discussed. Other examples of transfer of advanced technology to developing countries that may fail are: incineration, in-vessel composting, and mechanical equipment to sort wastes in material recovery facilities. Expensive incinerators

have been built in cities such as Manila, Mexico City, Lagos, Nigeria, Istanbul that have not operated as expected. For example, three incinerators built in Lagos in 1979 with a Western European grant –at a cost of U. S. $30 million– were never used, two of them were dismantled in 1989, and the third was converted into a civic center (Main, 1993). In most cases, developing countries' garbage does not sustain combustion, making necessary the addition of fuel, increasing the costs of an already expensive technology.

In-vessel composting also requires costly equipment and electrical power. Large-scale composting projects in Africa and Asia were often too complicated, expensive and inappropriate to the local conditions. As a result, some facilities closed, others were scaled down, and many operate below their planned capacities (Lardinois and van de Klundert, 1994). A more appropriate alternative may be the windrow composting method, which uses solar energy to decompose organic waste and unskilled labor, thus creating jobs. An additional advantage of this method is that it requires a lower investment than in-vessel composting. Furthermore, scavenging activities can facilitate the composting of the organic portion of wastes by removing the inorganic materials (Main, 1993; Lardinois and van de Klundert, 1994).

Open dumps constitute a health hazard. Sanitary landfills represent a dramatic improvement over open dumping. The biggest problem is the high cost of building and operating them. Many developing countries cannot afford sanitary landfills. A lower-cost alternative may be the so-called "Manual sanitary landfill",

which, instead of using bulldozers and heavy construction equipment, uses light compacting equipment operated manually by workers. Again, the denser, more organic garbage generated in developing countries does not need as much compaction as in industrialized countries. Scavengers' coops could operate these landfills. However, this method may be more appropriate to smaller settlements. It has been used successfully in the town of Marinilla, Colombia (Jaramillo, 1988).

Scavengers, Informal Collectors and Recycling Programs

Source-separation of recyclables, whenever possible, should be preferred to the recovery of materials from mixed wastes. Source-separation produces cleaner, higher-quality materials, commanding higher prices. But it requires an active public participation. If participants in the recycling programs are offered some kind of incentive, they will be more likely to separate their recyclables. Scavengers' coops can take part in formal recycling programs, such as in the Indian city of Pune. Approximately 6,000 'rag pickers' have organized in a coop, and in 1994, together with 6,000 unorganized scavengers, recycled 25 % of the waste generated by the city's one million residents (Chapin, 1995).

The following incentives have been successful in encouraging public participation:

- In several Japanese cities, residents are given toilet paper in exchange for their recyclables

- In several South Korean localities, children receive candy for their recyclables
- In Curitiba, Brazil, residents receive vegetables and concert tickets for their recyclables
- Some American cities award diverse prizes through random selection among those separating their recyclables
- Money is a powerful stimulus, and is often used in many cities, where scavengers or itinerant buyers pay residents for their recyclables.

Conclusions

Scavenging represents an important survival strategy for the world's poor, in which individuals recover materials from waste to satisfy their needs. Despite the fact that scavenging occurs in quite different environments throughout the developing world, it shows distinct patterns. Scavengers are usually migrants from rural areas. They respond to market demand and not to environmental considerations. Middlemen often take a large percentage of the profit from the sale of materials, which helps explain scavengers' low incomes. Scavenging takes place in a wide variety of settings, from open dumps to garbage floating in canals and rivers. In addition to chronic poverty, scarcity brought about by war and severe economic crises also encourage people to resort to scavenging in order to satisfy their needs.

Authorities in most developing countries do not fully realize the social, economic and environmental benefits of the recycling activities carried out by scavengers.

The formation of scavengers' coops can promote sustainable grassroots development among that segment of the population. NGOs can play an important role in organizing scavengers and in helping them, particularly in the formative and initial stages of their operations. Scavengers' cooperatives can be a means of achieving a better standard of living for its members, dignify their occupation, and strengthen their bargaining power with industry and authorities.

Scavengers and informal collectors can be successfully integrated into formal programs for the collection and recycling of solid wastes, in the form of cooperatives or microenterprises. By doing so, refuse collection could be extended at a low cost to authorities, creating jobs and benefiting low-income communities. The ever present problem regarding the collection and disposal of solid wastes in developing countries can be solved using appropriate technology in an economically-viable, socially-desirable and environmentally-sound manner. Incorporating scavengers and informal collectors into formal programs would be an important step in the right direction.

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About the author:
Martin Medina has a B.A. in Community Development from Monterrey Technological Institute (ITESM, Monterrey, Mexico), an M.S. in Ecology from the University of North Carolina at Chapel Hill and is a Ph.D. candidate in Environmental Studies at Yale University. He was a Ph.D. Fellow at the United Nations University / Institute of Advanced Studies and a Visiting Scholar at Tokyo University from June 1996 to February 1997. He has professional experience in public and private organizations and has worked and conducted research on waste management issues in the United States, Mexico, the Philippines, Central and South America. His dissertation attempts to fill some of the gaps in our knowledge of scavenging in developing countries, industrialized nations and Eastern Europe. He is currently working on an innovative waste collection system for slum areas in developing countries.

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The United Nations University
Institute of Advanced Studies

53-67 Jingumae 5-chome,
Shibuya-ku, Tokyo 150,
Japan

Tel: 03-5467-2323
Fax: 03-5467-2324
Email: unuias@ias.unu.edu

URL: http://www.ias.unu.edu
FTP: ftp://www.ias.unu.edu