Community-Based Solid Waste Management Systems in Hanoi, Vietnam

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Abstract

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In many Asian cities, private or public systems are only able to collect between 30 to 50 percent of solid waste and many dispose waste in ways that are detrimental to the environment. Solid waste management is a complex task which depends as much upon organization and cooperation between households, communities, private enterprises and government as it does upon recycling and disposal. The conventional view is that either private or public management is the most efficient system, irrespective of the nature of the resource, or the socioeconomic condition of the people. However, because local governments lack the appropriate financial, technical and human resources, they are neither able nor willing to manage these systems. Three community-based solid waste management systems were studied in Hanoi, Vietnam. Community waste issues were explored in the context of their urban environment. The results suggest that the success of sustainable urban social infrastructure programs lies in the involvement of local communities as major stakeholders and decision-makers. Specifically, that the community, given the opportunity, is capable of adequate waste management.

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Table of Contents

List of Illustrations

List of Tables

List of Figures

1 Introduction

The migration of people into urban centres in search of jobs has accelerated urbanization in developing countries (Henderson, 2002). The pace of migration outstrips the growth of employment with incomes above poverty levels, the provision of low-cost housing, and the ability of urban municipalities to provide social and environmental infrastructure and services (El-Shakhs, 1992). While natural urban population increase has overtaken migration in contributing to urban growth, as much as 40 percent or more of the urban population increase continues to be due to migrants arriving from rural areas and small towns (Glaeser *et al*. 1992). Between 1950 and 1995, the proportion of the global population living in urban areas increased from 29 percent to 43 percent; by 2005, more than half of the world's population will be living in urban areas (Henderson, 2002).

In many cities of developing countries, private or public systems of waste management are inadequate, only able to collect between 30 to 50 percent of solid wastes and most cities dispose solid waste in ways often detrimental to the environment such as open burning, burying or dumping in rivers (Hoornweg and Thomas, 1999). Solid waste management (SWM) is a major responsibility of local governments, typically consuming between 20 and 50 percent of municipal budgets in developing countries (van Beukering *et al.* 1999). It is a complex task which depends as much upon organization and cooperation between households, communities, private enterprises and government authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal (UNEP, 1996).

At the same time, solid waste recycling provides jobs and income to many of the urban poor. It is estimated that between 20 to 30 percent of the solid waste in large Asian cities is recycled in the informal sector (UNEP, 1996). Because private or public systems do not often take the involvement of the urban poor into account, they can cause damage to the economies and livelihoods of the poor and, at the same time, instead of protecting the environment, end up damaging it.

There have been various attempts to solve the increasing social or infrastructural inadequacies due to urbanization (Henderson, 2002; Hoornweg *et al*. 2000; Rushbrook and Pugh, 1999). One drawback has been the over reliance on state or local municipal governments in planning, executing and managing waste management systems. The result of this reliance has been partial success, mostly short lived, or absolute failure (Drakakis-Smith and Dixon, 1997; Smith and Scarpaci, 2000). This study looks at the community as the central decision makers for the planning, implementation and managerial operation of a waste management system. The urban focus of the study has been influenced by poor sanitary conditions resulting from rapid urbanization in all major areas of Vietnam, the lack of research on community development of waste management systems in Vietnam as well as the research interests of the author and the WASTE-ECON project.

1.1 Statement of the Problem

Since 1986, Vietnam has experienced a period of rapid economic growth that has been closely associated with the implementation of a renovation process - *doi moi* in order to promote socioeconomic development and re-engagement with the international and regional Pacific Asian economies (Drakakis-Smith and Dixon, 1997). This renovation process has opened the economy to international capital, introduced elements of the market economy and substantially reduced the central control exercised by the state (Boothroyd and Nam, 2000; Drakakis-Smith and Dixon, 1997). In recent years, this growth has brought with it challenges and problems that Vietnam is struggling to address. Among these are environmental problems often resulting from industrialization. Vietnam has experienced high rates of economic growth through its industrialization process, particularly in its manufacturing, services, and urban sectors (Irvin, 1997). Between 1986 and 2000, average industrial and service growth rates accounted for 10% while the GDP increased by 6-8 percent annually during the same period (ADB, 2000). This growth and accelerated urbanization in Hanoi and Ho Chi Minh City has created immense pressure on the urban environment (ADB, 2000).

As a result of this growth, especially within the sub-urban areas of Hanoi, social services, including regular collection of household solid waste, are inadequate (personal communications: Nguyen Dahn Son, 2002). Within a metropolitan area such as Hanoi, the capacity of the Urban Environment Company (URENCO) to provide waste management services within different areas of the greater Hanoi area is quite different (personal communications: Nguyen Dahn Son, 2002). Currently, the Hanoi Urban Environment Company (URENCo.) is unable to collect much of the daily solid waste generated even within central areas of the city. Hanoi URENCo. attempts to provide primary collection (from households) and secondary collection (transfer to trucks) as well as final disposal (dumping in the Nam Son Landfill). In suburban areas, within the territorial jurisdiction, there is some degree of primary collection, but hardly any secondary collection and disposal. In smaller urban settlements within the sub-urban areas of Hanoi, there is limited primary collection. Adger (1998) reports that some 44 percent of rural households in Vietnam dispose their waste casually onto the ground or into a water body. Thus, while households in different parts of Hanoi have similar needs for environmental services, those living in sub-urban areas have different environmental needs compared with those living in central urban areas of Hanoi.

Pham and Nguyen (2002) estimate that URENCO can collect only about 65% of the total amount of solid waste in urban Hanoi while those areas on the periphery of the city often have limited or no collection services (no figures available). They state that the remaining waste in the urban centre and in sub-urban areas has historically been thrown into ponds, rivers, sewers and public lands, polluting water, land and air. Thus, the inability of government to provide adequate waste collection services for all of Hanoi has lea to a polluted environment which can inevitably lead to negative health effects.

1.2 Study Relevance

This study is not only relevant but also timely in the wake of increased urbanization in large centres of Vietnam. White and Whitney (1992) suggest urbanization is a major contributor to unsustainable development, among other things, through its production of waste. In light of the

rapid urbanization in Hanoi, officials have drafted Master plans proposing large-scale investments in coordinated programs or urban infrastructure development (personal communications: Nguyen Dahn Son). However, the ability of the government to finance, implement or manage the necessary development of this urban-based infrastructure is highly questionable.

While there are some, albeit limited studies documenting community-based solid waste management systems in Southeast Asia, there appears to be an even greater limitation of information on those in Vietnam (Anschutz, 1996). This study will therefore add new and relevant knowledge to the available collection of literature on the subject matter. Furthermore, it fits well with the current global trends of community-based approaches to environmental problems. These have become widespread in the 1990's since the emerging consensus has been that the implementation of sustainable development should be based on local level solutions and community participation (Mwangi, 2000). Such community-based systems are critical for environmental management programs in developing countries because these countries are rich in communal resources although they are often poor in financial resources.

1.3 Literature Review

Solid waste management has now become a global issue (Bulle, 1999). Many different actors have experimented with various technological options to find viable alternatives for appropriate collection and disposal of waste. These experiments have significantly established the fact that solid waste management is not just a technical issue (dalla Torre, 1992). It has socio-political and cultural dimensions that need solutions through imaginative policies, administrative reorientation, institutional and organizational arrangements and an informed population.

The conventional view has been that only private or public management of these systems is the most efficient irrespective of the nature of the resource to be managed or the socio-economic conditions of people associated with the resource (Kant and Berry, 2001). However, local governments often suffer from a lack of financial, technical and human resources and are not able or willing to manage these systems. Despite these deficiencies, there are some

examples of successful community-based systems from around the world. See: Ostrom (1990), Bhide and Sundaresan (1984), and Ascher (1995).

The need to understand community participation and community-based environmental management initiatives have been addressed by researchers and concerned institutions for the several years now. In 1992, the UNDP-funded and World Bank managed Metropolitan Environmental Improvement Programme (MEIP) initiated studies on this issue in four Asian cities (Lapid, 1992). The purpose was to understand the impact of urban environmental degradation on the welfare of the poor, to find out how they were coping with this degradation and to recommend community-based actions to enhance welfare. This was followed by a similar study under the UNDP Asia Pacific 2000 Programme (AP 2000). Presently, authors, researchers and development practitioners are now trying to shift the traditional mindset that poverty "causes" environmental deterioration and that urban poor generate wastes that degrade their habitat (Lee, 1994).

The more common view now appears to be that the urban poor are the victims and not the cause of environmental deterioration. Given access to important resources like land and even a minimal support from external groups and institutions, low-income communities can improve and maintain a decent and liveable environment.

Lee (1994) suggests that the provision of support by external NGO's has shown great potential as catalysts in assisting low-income communities in terms of empowerment and environmental issues (Lee, 1994). For the longer term, she states that the increasing activism of indigenous NGO's in mobilizing community collective efforts represents a significant source of outside support. Douglas *et al.* (1994) argue that facilitation and implementation of such community-based efforts as empowering strategies for the poor and improving their access to important environmental resources, particularly land, infrastructure and services, is necessary for environmental management.

Klundert and Lardinois (1995) argue that a top down approach to community development is not effective or sustainable. They state that intervention agencies, even with the best intentions, cannot impose 'foreign' concepts and programs, and expect positive and

sustainable results. However, they do note that forming partnerships between communities and the private or public sector, both formal and informal, can be a successful approach in strengthening urban environmental management.

Mockler (1998) studied community-based solid waste management systems in Indonesia. She discovered that initiatives in existence since the early 1980's have been shaped and instituted primarily by various institutions including projects by Indonesian and international institutions, government departments, municipal governments, and private companies. Her findings indicated that the scale of project initiatives varied from household level waste separation for composting and recycling, to small to medium scale neighbourhoods. She points out that these projects and research studies have addressed not only the technical aspects of community-based composing, management, economic feasibility, self-funding mechanisms but also how to link household level actions with the primary and secondary solid waste collection system successfully. Discouragingly, she notes that in Jakarta, of the fifteen projects focusing on household waste separation for composting and recycling, only four have survived. Most households felt no financial incentive to participate because there was an insufficient volume of organic waste to produce sufficient quantities of compost to sell.

More specifically, Anschutz (1996) suggests that community-based waste projects often fail because of low participation from households. If solid waste management is not a 'felt need', this will have consequences for their participation in the service and their willingness to pay. Mockler's (1998) study suggests that a 'felt need' is a necessary prerequisite for successful implementation of a community-based solid waste management system.

Dhungel, (1992) conducted research in Balaju, a community near Kathmandu, Nepal. She found that the community practised unsafe methods of waste disposal by throwing waste on vacant land or nearby courtyards. Lacking these sites, waste was thrown into public streets. Residents would dispose of their garbage indiscriminately around the neighbourhood in the belief that the municipal sweepers would somehow collect and dispose of it. The system was not efficient because of the community's low willingness to participate in the project. A local women's organization offered a solution to this problem. Through lectures they convinced people of the

need for proper solid waste handling. However, a more successful and measurable change of behaviour was achieved by the women's organization through the provision of buckets and a competition among households for the cleanest environment.

Thus, providing services that users want to pay for is a strong prerequisite for the financial sustainability of waste management. Where the users perceive that new services are better than existing services, they will be more enthused to make a higher contribution.

Salequzzaman *et al*. (2000) conducted a study in Khulna city, Bangladesh and found that formal and informal education and training by external institutions had influenced community members' willingness to pay. They found that lectures including details of the surrounding environment, the relationship between humans and the environment and advice on how solid waste could be managed were beneficial when presented in combination with motivational activities. However, they do note that the major limitation to educational programs within communities is the manner of transferring the information.

Selvam (1996) investigated participation in a communally organized collection and recycling program and found that 70% of the people were against separation of waste at home because it was inconvenient. Camacho (1992) devised a solution to this in the Philippines where proceeds from the sale of recycled material were given back to households as an incentive to participate in the separation.

Another common issue within community waste systems centres on the management of the system. Yayasan (1993), working in Padang, Indonesia, describes management of community-based solid waste services as often being a voluntary activity, carried out mostly by the more affluent residents who are motivated by community benefits such as a cleaner environment, better health of neighbourhood residents, status of job, etc. This is not necessarily a problem however, as Yayasan (1993) also states that exclusive dependence on one person to manage the operation is considered undesirable, because accountability to the community and the continuity of the services may not be secured anymore. In other words, the person responsible for the system is responsible for everything and need not report to or be accountable to any other person. She does note that a positive spin off is that the one person is able to use

personal influence to have other affluent people in the community make extra financial contributions when faced with maintenance problems.

Anschutz (1996) studied waste collectors and explains that their salary is often low because they derive their income from waste collection fees and often from the sale of recyclables. Neither yield much revenue in low-income neighbourhoods and collectors must often compete with waste pickers for recoverable recyclables. But, there are a number of ways of improving the conditions of waste collectors. Nkotto (1995) points to a situation in Cameroon where waste collectors are employed only part time – allowing them time to complete other tasks. This has been met with success as collectors report they prefer to work at other jobs but use waste collection to supplement their income.

Waste collectors are often perceived as untrusting as they are often quite poor. Desai (1994) notes that the nature of the work is often considered unpleasant, filthy and in some cases unhealthy. A negative perception of waste collectors lessens when the collectors are from the community; in this way, they gain a sense of responsibility for the cleanliness of the community. Further, perceptions change and trust by others increases as collectors gain credibility over time.

It is impossible to present all relevant literature on community solid waste management, but some of the more common issues have been addressed and solutions, where possible, have been described.

1.4 Research Question

Are the project's outcomes related to the community's socioeconomic conditions and waste management organization?

1.5 Study Objectives

In general, to:

1. conduct a comparative study of three different community-based waste management organizations that are diverse in nature

2. develop a theoretical framework that classifies waste as a public good and design principles as an aid in analyzing institutional arrangements present in the communities

Specifically, to:

3. determine the socioeconomic background and community perceptions of the environment and solid waste
4. analyze each community's waste management organization and functions
5. determine the impact of each community's organization
6. analyze each within a framework of design principles

Through these objectives ascertain the merits and viability of community organizations in the provision of socially viable and sustainable systems of waste management in developing countries. In doing so, the study attempts to exemplify the current inadequacies of existing operational systems that are heavily reliant on centrally planned, implemented and managed systems in the provisions of waste collection services. This study is important in Vietnam as it adds to the growing body of literature of successful community-based management systems as an alternative to public or private management systems.

1.6 Study Area

With a population of approximately 5 million people, Hanoi, the capital city of Vietnam is located in the northern part of the country, 140 km from the Gulf of Tonkin (CFSI, 2002). The city is located on the west bank of the Red River. Urban and sub-urban Hanoi covers an area of 2146 sq km; it is composed of 7 inner city districts including *Hoan Kiem*, *Ba Dinh*, *Hai Ba Trung*, *Dong Da*, *Tay Ho*, *Thanh Xuan* and *Cau Giay*, and 5 suburban districts, which include *Tu Liem*, *Thanh Tri*, *Dong Anh*, *Soc Son*, and *Gia Lam* (Figure1). The suburban district of Tu Liem is located west of the city and Thanh Tri is located south of the city; Dong Anh and Soc Son districts are in the north; and Gia Lam districts are in the east (Palladino, 2001).

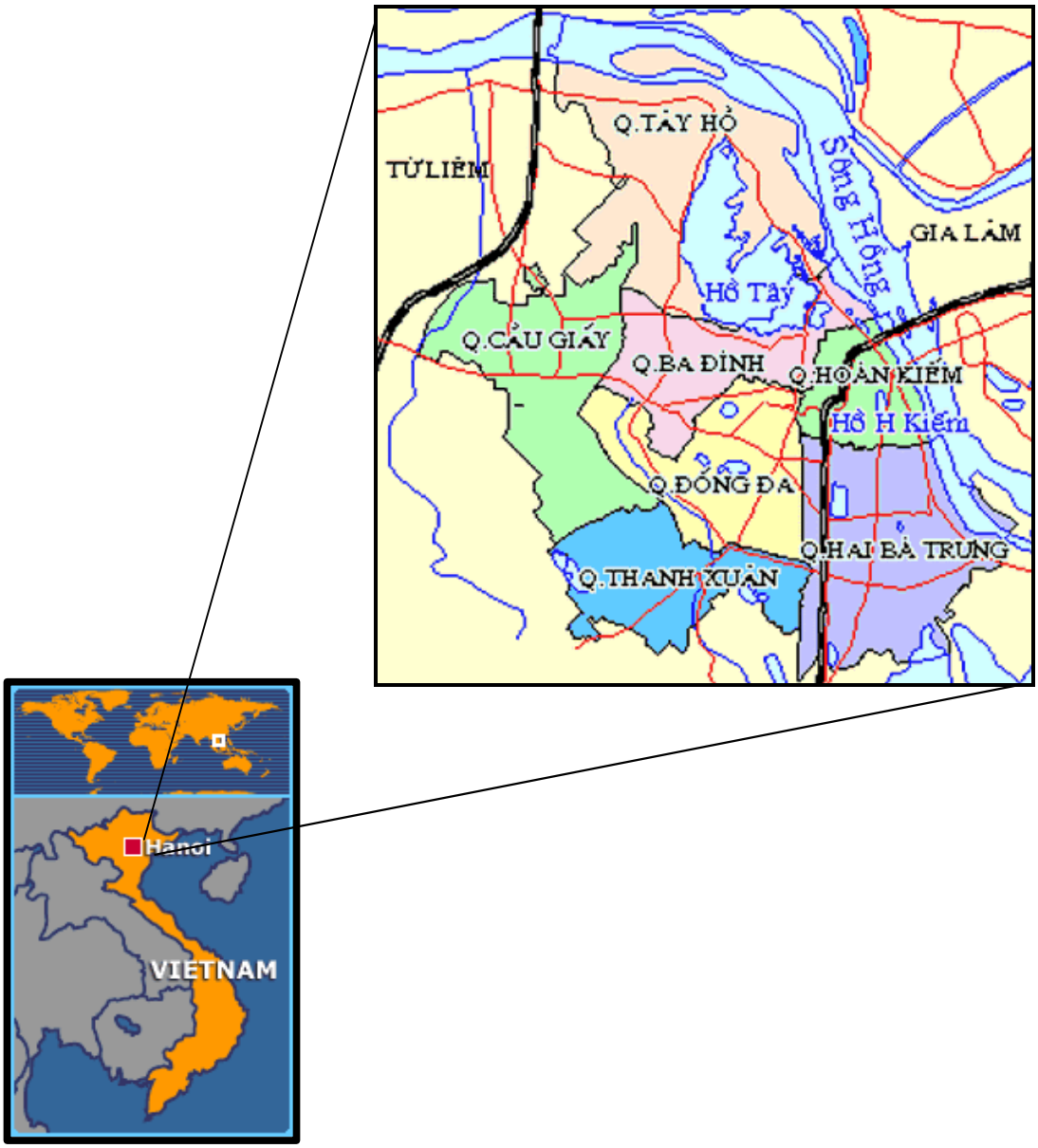

Figure 1. Map of Vietnam and enlarged view of Hanoi showing Tu Liem District, Thanh Xuan District and Dong Da District.

2 Methodology

A framework for classifying waste as a public good was developed using relevant theoretical literature. In addition, design principles to later analyze self-organized and self-governing common pool resources (CPR's) were developed. These principles included elements of the work of Ostrom (1990), Esman and Uphoff (1984) and others (Ostrom, 1992) that critically explore the institutional arrangements necessary for successful community-based management.

In general, three main sources of information and data were utilized. Primary data was collected from the field through questionnaires, structured and semi-structured interviews. The study used secondary sources of information and data, especially as it addressed conceptual and contextual issues as well as a review of literature. Secondary sources were also used for the development of a theoretical framework and design principles. Furthermore, secondary literature was used for comparative purposes, specifically that which pertained to existing systems of waste management in other developing countries. Finally, personal observations and experiences acquired from just being in the community were an invaluable asset utilized in rationalizing some of the study assumptions and conclusions.

To meet the remaining study objectives, it was necessary to identify communities within the greater Hanoi area that were not reliant on or included in the Hanoi Urban Environmental Company's (URENCo.) collection activities. Initially, this was accomplished through a mail out and follow-up comprehensive survey. This survey included (I) the name of the precinct and district; (II) the type of communal organization responsible for the community-based solid waste management system (CBSWMS) (III) membership of the organization; (IV) categories of the solid waste being dealt; (V) main features of waste management systems such as waste collection, separation, transfer, and disposal systems; (VI) resource (financial, labour, and other resources) sharing system; and (VII) the period of operation.

Prior to mailing the comprehensive survey, it was translated from English to Vietnamese then back translated and finally translated by a second individual to ensure a correct and accurate translation.

Upon receipt of the comprehensive survey, it was determined that there were three communities within the greater Hanoi area that had some degree of self-organization where management planning, implementation and operation were not centrally controlled by the URENCo.: (1) The Model of Solid Waste Collection and Management at Nhan Chinh precinct, Thanh Xuan District, (2) Solid Waste Management by the Women's Association at Minh Khai precinct, Tu Liem district (3) Thanh Cong Successful Sanitation Environmental Cooperative, Thanh Cong precinct, Dong Da district. A detailed comparative study was conducted using

aspects of the theoretical framework and design principles. In addition to those items listed in the comprehensive survey, a comparative study was conducted. This included (I) perceptions of community members about solid waste; (II) motivations behind the initiatives; (III) organizational structure of the community-based solid waste management system; (IV) set of rules for the operation of the system; (V) economic contributions of the system to the local community; (VI) other contributions such as health, physical assets, community empowerment; (VII) effectiveness of the system in waste collection and waste management.

Methods for field data collection closely followed those described by the FAO's Guidelines for Implementing an Institutional Analysis (Thomson, 1992). These included (1) gathering information on the history of the community; specifically, the system of waste management in place prior to the current system; (II) gathering information on the social structure of the precinct as it related to the waste management system; (III) gathering information on different socio-economic categories in the precinct.

Due to time limitations, questionnaires were administered to a random selection of 50 respondents from each of the three communities. In addition, structured and semi-structured interviews were randomly administered to approximately 20 households within each community; there was some intentional overlap between respondents who participated in both questionnaires and interviews.

An attempt was made to interview those individuals who were directly responsible for the household collection and removal of household waste. This often, but not always, included those who were responsible for waste collection payment.

Field Sampling techniques including interviews, transect walks and mapping exercises as described by Mukherjee (1993) were utilized when interviewing those individuals in the organization who were responsible for the daily collection of waste and fees.

The data from the field survey and comparative study of three communities has been used to answer the basic hypothesis of the study, namely that community participation has several benefits: that increased community participation may ensure a greater involvement in

local level decisions and that different individuals may contribute in varying degrees to the waste management system.

2.1 Limitations

The limitations of this study include language barriers and a scarcity of time and resources. When the interviewee did not speak English, the interview was conducted through a skillful interpreter. Some difficulties in communication were encountered through the interview process. For example, using an interpreter put more demands on the time and energy of everyone involved; sometimes interviews took twice as long as they might have had there not been a language barrier. As a result of these demands, the interviewer was not able to ask all the information that he wanted to. Also, at certain moments, it was not entirely clear whether some information had been misunderstood or condensed by the interpreter.

Due to limited time availability for field research, an exhaustive study could not be undertaken. This is especially evident in the sample size used for field questionnaires and interviews which, given each community's population size, is limited. However, as already indicated, the sample size was limited by a scarcity of time and resources. Moreover, the field data was perhaps not as complete as it could be as the interviewer was only present for approximately 3 weeks, and in some instances there was a great deal of reluctance on the part of community members to divulge information to an outsider with or without remittance particularly when questions related to the validity or effectiveness of the local government.

3 Theoretical Framework and Design Principles

3.1 Waste as a Common Pool Good

In order to implement successful policies and bottom up reorientation successfully, it is necessary to understand the resource or good - in this case, solid waste. McKean (1998) argues that a public good is one whose consumption does not reduce the quantity available to others to consume, is nonrivalrous or nonsubtractive, cannot be depleted and should be paid for by public

funds and delivered by public agents. In contrast, private goods are subtractive where the quantity available to others can be deleted. These goods then should be paid for by private individuals (often through user fees) and delivered by the private sector.

Many activities included under the broad umbrella of solid waste management vary in the extent to which they are pure public goods. Figure 2 provides a framework for categorizing various activities of solid waste management as public or private goods.

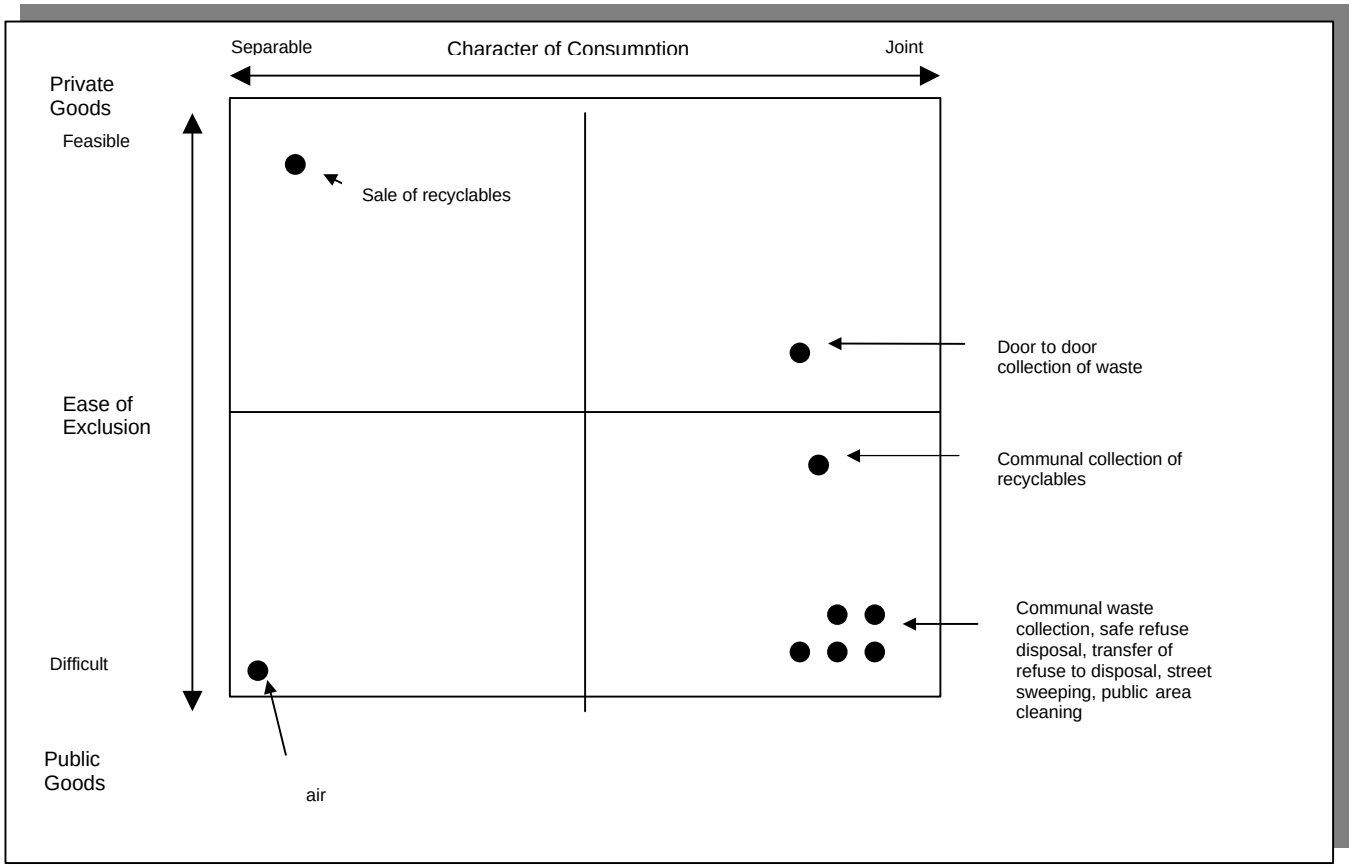

Figure 2. Public versus private goods in solid waste management (McKean (2000); Furedy, 1989).

As an urban environmental problem, waste displays characteristics of an open access resource. It may be managed by national, regional, or local governments; by communal groups; by private individuals or corporations; or not managed at all (Furedy, 1989).

Hardin (1968) concludes that collective action (achieved through coercion) is essential for reaching a socially desirable solution. In this way, the problem of waste or dirty streets can be

viewed as a co-operation problem. Sen (1973) describes a situation involving glass bottles and four alternative cases faced by an individual. If only two households have access to a street, co-operation between both to maintain it litter free would keep the street clean. However, that would require each of them to face some costs (Sen (1973) defines costs as additional effort or loss of leisure time). Dumping garbage on the street is a cheaper alternative and each individual acting autonomously might prefer to throw litter onto the street rather than go to the trouble of taking garbage to a collective bin or taking their waste out at an appropriate time – for example, when the collector rings a bell (Basu, 1997). What seems to be rational behaviour by each of them leads to a socially undesirable outcome - a street full of waste. In general, benefits from keeping the street clean are likely to be of public good character while the costs are private. Sen (1973) provides an example using the prisoners' dilemma game to suggest that an arrangement to keep the street clean costs 15(XX) per month for one household (Figure 3). The costs faced by each household can be shown as follows:

		Household 2	
		Co-operate	*Not Co-operate*
Household 1	*Co-operate*	-15, -15	-15, 0
	Not Co-operate	0, -15	0,0

Figure 3. Use of prisoners' dilemma game depicting an arrangement to keep a community's street clean (Anand, 2000).

From a cost point of view, Sen (1973) shows that household 1 will be best off when it does not co-operate but the other household does pay for the scheme (Anand, 2000). Similarly, household 2 is best off when it does not pay for the scheme but household 1 does pay for it. Sen (1982) does acknowledge that this is a non-repeated prisoners' dilemma; however, not co-operating turns out to be the dominant strategy.

Therefore, those communities with limited access to refuse collection by public institutions or where private institutions do not exist must attempt to co-operate and participate in a communal system of waste collection and disposal in order to minimize cost (waste, dirt on streets, environmental pollution, health hazards etc) (Anand, 2000). Collection by a communal

system can include the collection from a public area or from a private establishment or household. It requires the participation of residents who bring their refuse either to a central collection point or to a collector who rings a bell. Such participation represents a significant, voluntary contribution by the community residents (Anand, 2000). In the case of a communal collection point, it is difficult to make an accurate account of those residents who bring their waste to the point. In addition, when community residents do not take their waste out when the collector rings the bell, their waste must in some way pollute the public area whether they dispose of it in public streets, bury it or burn it. Irrespective of the disposal method, these activities can negatively affect other community members. In this way, communal systems of solid waste collection can be considered a public good (Furedy, 1989).

That said, whether waste collection from individual households can be treated like a private good depends to some degree on the education or socioeconomic status of the residents. Further, it depends on whether charges are difficult to implement; this is often the case unless a strong community organization exists to enable some form of cost recovery through a user fee. In communities where household residents are aware of the need for public cleanliness and there is the problem of limited resource efficiency of the government, household collection services can be treated as private goods for which those households who participate are willing to pay for services (Furedy, 1989). In communities where the residents have a limited awareness of the need for public cleanliness, there is a resistance to user fees and a common tendency to use polluting activities such as distributing waste in public places, in agricultural fields, and in burning.

3.2 Design Principles of Community-Based Waste Management Systems

Ostrom (1992) suggests that users and suppliers of irrigation systems must craft a variety of institutional arrangements to cope with the physical, economic, social, and cultural features of each system. The same can be said for waste management where system managers must outline, design and implement institutional arrangements for the provision of the community's waste collection and disposal. Esman and Uphoff (1984) note that there exists a rich literature of various structural or institutional arrangements within these organizations.

Ostrom (1990) defines design principles as "…an element or condition that helps to account for the success of institutions in sustaining the physical works and gaining the compliance of generations of users to the rules-in-use". Although she characterizes design principles as those that exist for long-enduring, self-organized systems, the situation is somewhat unique in Vietnam. Until the introduction of *doi moi* (1986), self-organized systems were considered outside the scope of the central planning of the government. Communal agricultural systems are not necessarily new to Vietnam; however, their institutional arrangements historically included, to a large degree, a system of government control and intervention. What makes the current case studies unique is that they are not well studied in the context of waste management and exhibit some similarities to the design principles.

3.2.1 Design Principle 1. Clearly Defined Boundaries

Ostrom (1992) notes that "defining the boundaries of the CPR and specifying those authorized to use it can be considered a first step in organizing for collective action; if either of those boundaries are unclear, no one knows what is being managed or for whom." This relates to the provision of waste management where there is a clear definition of community. Within this study, communities were clearly defined based on their municipal government and collection user fees. Waste collectors familiar with households and defined routes of collection, become familiar with residents through the daily waste and occasional fee collection. They are therefore alerted to unfamiliar faces as non-residents. This signifies a closure to outsiders as it eliminates benefits to those outsiders who do not contribute (the benefit being the free disposal of waste).

3.2.2 Design Principle 2. Proportional Equivalence between Benefits and Costs

This principle suggests that the user fee or cost be in line with the production of household waste and be justified in two ways. The first would be by volume or by number of bags. Those individuals who generate more household waste would then pay more, i.e. if a household produces two bags then they would pay twice the fee of those households that generate one bag. Conversely, the fee could be based on the number of household residents;

i.e. if there are four residents in a household then their fee would be double that of a household with two occupants.

3.2.3 Design Principle 3. Collective-Choice Arrangements

Community residents are allowed and encouraged to participate in discussions regarding the waste system, provide input to the management organization and to call attention to problems they may have.

3.2.4 Design Principle 4. Monitoring

When a community resident witnesses other residents dumping waste at an inappropriate time or place, then they may call the attention of the organization to confront the resident regarding their actions.

3.2.5 Design Principle 5. Graduated Sanctions

Individuals who are caught by other residents through their monitoring efforts or who do not pay the user fee may face graduated sanctions. As well, individuals who do not participate in the system may be excluded from other communal activities. This exclusion may encourage residents to participate.

3.2.6 Design Principle 6. Minimal Recognition of Rights to Organize

Communities are allowed to devise their own institutions and waste management systems and are not challenged by external governmental authorities.

4 Results

4.1 Socioeconomic Profile

The study focused on three community settlements chosen for inclusion in the field surveys. Results show that the study communities are not homogeneous groups in terms of their occupation, housing status, number of residents or size of household (Table 1).

Minh Khai, Nhan Chinh and Than Cong precincts are located within 30 kilometres of Hoan Kiem District, central Hanoi. Minh Khai precinct, Tu Liem District is located in the south-

west of the city across a set of train tracks and has the smallest population of the three communities. When surveyed in July 2002, there were 127 households and approximately 1200 residents in Minh Khai. The average (*n*=49) number of residents per household was five while the average (*n*=49) household size was 49m² (Table 1). All of the houses in the community are permanent. Many are single floor residents; these are often 2-3 room cement structures with adjacent courtyards containing fruit trees, vegetable gardens, and sometimes livestock and pit dug compost areas. There are a number of new multi-story houses being built. Many of these newer complexes do not have courtyards or gardens. All households in the community have 2-3 metre high cement walls surrounding them; many have broken glass or other sharp objects embedded along the top of the walls. In addition, all households have gates they lock in the evenings. Closed sewer systems are rudimentary and many households drain liquid waste into open sewers along the public streets. Many residents report that the sewer systems are old and frequently clogged. Often household liquid waste remains stagnant in the open street-side sewers and tends to be a breeding ground for insects as well as being attractive to vermin. Many of the streets are cement; however, there are still some dirt or gravel streets. All streets are very narrow, no wider than one car width.

The majority of residents own their houses while a small percentage rent (Table 1). The renters are mainly students attending a nearby university. There are some businesses in Minh Khai including some smaller stores selling foodstuffs and a few restaurants or food stalls. A school and a small hospital have been built; however, there is no market and people must travel along the main road towards Hanoi in order to trade goods.

Nhan Chinh precinct is closer to central Hanoi and has a substantially larger population than Minh Khai. With 18, 000 residents, the average (*n*=50) household (68m²) is larger than in Minh Khai (25m²). There are fewer single floor residents in Nhan Chinh, many households are between 2 and 5 stories high built in a 'tube style' common to much of urban Vietnam. Although the overall population of Nhan Chinh is higher than Minh Khai, there are, on average, only four individuals per household. Few houses have productive fruit trees or vegetable gardens;

however, there are many more food-stalls and stores selling foodstuffs than in Minh Khai. In addition, there is a daily market with produce from rural districts.

Table 1. Profile of household survey respondents.

	Minh Khai	Nhan Chinh	Than Cong
Estimated Population	1200	18 000	10 000
Gender Interviewed (Male/Female) (*n*=49)	54.5 / 45.5	41.4 / 58.6	46.3 / 53.7
Housing Status (%)			
Owners	91.8	85.7	92
Renters	8.2	14.3	8
Individuals/Household(No.)	5	4	7
Size of Household (m^2) (*n*=50)	25	68.3	43.1
How much agricultural land do you farm (m^2)/year? (*n*=49)	1800	1400	0

Unlike Minh Khai, Nhan Chinh is not as physically separated from the rest of Hanoi. It is surrounded by other large precincts and by a number of main street arteries and therefore services and general food stores, snack shops and tailoring workshops serve a much larger population. As in Minh Khai, 2-3 metre cement walls topped with embedded glass or other sharp objects surround all houses. The sewer facilities are relatively new and more substantial than in Minh Khai. While they do run along the street side, they have been covered with cement blocks that help to minimize odours. A majority (85.7%) of the precinct's population own their houses while the remaining 14.3% are renters; as in Minh Khai, some of these houses are occupied by students, renting while attending a nearby university. There is a school and a hospital as well as a large rubber factory and each draw employees from within the community as well as outside.

The population of Than Cong, Dong Da District is 10,000 and there are approximately 1,200 households housing an average of 7 individuals each. The average house size (*n*=50) (43m^2) falls roughly between each of the other communities. Most of the houses are multi- story, with very few single story houses. With a sizeable population and proximity to central Hanoi, this community contains a diversity of economic and social activities in the midst of its residential areas. There are a number of schools, a hospital clinic and a variety of small businesses ranging from general food stores, restaurants and foods stalls to beauty parlours and video shops, tailors, repair shops, some small factories and motorcycle and vehicle repair garages. Approximately 92% of residents own their houses while the remaining 8% are renters. Although there is a

university nearby, none of the renters are students. Like Minh Khai and Nhan Chinh, residents of Than Cong all have cement walls surrounding their households. Again, the tops of the walls are embedded with glass or other sharp objects to act as a deterrent to entry. Interestingly, in Than Cong and Nhan Chinh, most household gates were locked at all times, and had to be opened either by someone from inside or by key. In contrast, while many residents of Minh Khai did state that they locked their doors at night, most gates were unlocked during the day. Than Cong had a more adequate wastewater sewage system, most households have relatively new sewer pipes, and the street side sewers are covered by cement blocks.

When asked the main occupation of the household, a marked difference in responses between Minh Khai and the other two communities became obvious (Table 2). Overwhelmingly, 53% of respondents listed that one of their main forms of income was through agricultural. Although data was not collected regarding the type of agricultural production, informal interviews suggested that most respondents grew rice, many growing 2 or 3 harvests a year. Some community members did grow fruits and vegetables that are later sold at a roadside market while other produce is often traded informally within the community. Qualitative observations suggest that a number of households were also involved in rearing livestock. However, it was not determined whether this livestock was for sale or home consumption. Interestingly, there was one farmer from Nhan Chinh who indicated that he had to travel to reach his agricultural land. Given their proximal location within the periurban areas of Hanoi, it is not surprising that only one resident of Nhan Chinh or Than Cong was involved in agriculture. Casual observations indicate there is little available land or green space or agricultural land surrounding either precinct; however, where there was open or communal space, it was often littered with plastic bags, rusted metals and other debris. Many of the respondents indicated they were labourers; those from Minh Khai often reported that they either travelled into more central districts of Hanoi or outer developing precincts to find employment. They cited that they were often involved in construction of new buildings such as hotels, stores or houses. The frequency of respondents indicating they were labourers differed by 25% in the three communities. However, there were more respondents indicating they were retired in Nhan Chin and Than Cong than in Minh Khai (Table

2.). Upon compilation of the data and informal interviews, there may have been a misinterpretation of this question as it is unlikely, given the social linkages within families, that retired individuals would necessarily live alone. There were few storeowners, workers, restaurant owners, mechanics, teachers or secretaries in Minh Khai and the number of storeowners was higher in Nhan Chinh than Than Cong. Furthermore, there were no mechanics included in the surveys of Minh Khai or Than Cong.

Table 2. Survey response of main household response in Minh Khai, Nhan Chinh and Than Cong (n=49).

What is the main occupation of your household? (%)			
	Minh Khai	**Nhan Chinh**	**Than Cong**
Agriculture	53.0	2.0	0.0
Labourers	22.4	32.6	47.7
Retired	6.1	20.4	20.4
Store Owner	6.1	18.3	11.4
Education	4.1	0.0	0.0
Furniture	6.1	0.0	0.0
Exporter	2.0	0.0	0.0
Store Worker	0.0	8.1	0.0
Restaurant Owner	0.0	8.1	6.8
Mechanic	0.0	12.2	0.0
Teacher	0.0	0.0	6.8
Secretary	0.0	0.0	6.8

The socioeconomic variations in the profiles of survey respondents including housing status, number of individuals per household, size of households, use and size of agricultural land and occupation in the three communities, has an important influence on some of the patterns of perceptions of environmental conditions within the community as well as individual responsibilities and community responsibilities regarding the environment.

4.2 Community-Based Solid Waste Management Organization Profile

4.2.1 Minh Khai

4.2.1.1 Structure of the Organization

Minh Khai community annually elects one representative to be included in all community-based organizations, unions or associations recognized by the local government (Figure 4). This

individual is not considered a government official; however, remittance of 100,000 Vietnamese Dong (VND)/month ($10.00 Canadian Dollars (CAD)/month) is provided by the local government. The number of 'terms of office' for this position is unlimited and its responsibilities include: participation in organizational discussions, liaison or representative of organizations when in discussion with the local government, an ombudsman where community members are able to express their ideas and opinions about issues in the community. Those ideas or suggestions presented in each organization may then be presented to the local government for further discussion. Likewise, government policies are often transferred to the community via the community representative. Some minor details of this position include the maintenance of the community's loudspeaker system and organizational details of the use of the community hall for meetings, the announcement of community meetings and the routine of changing the bulletin board outside the People's Party Office.

In order to be elected, the candidate must obtain 51% of the community's vote. There is no official campaign; each candidate is simply selected based on his or her relations with others in the community. Voting by one member of each household is voluntary, thus it does not require the participation of all community members.

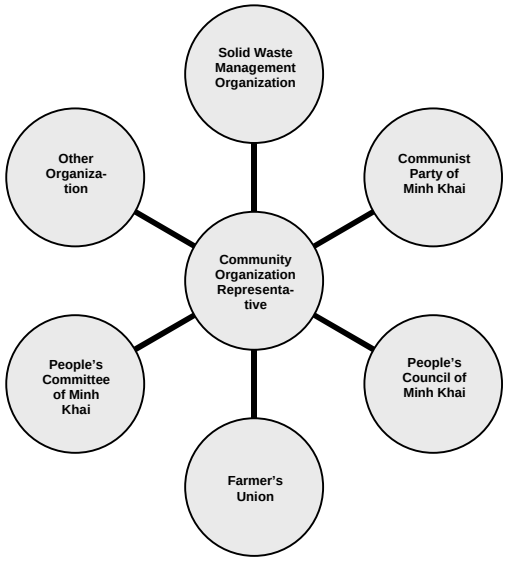

Figure 4. Structural representation of community organizations in Minh Khai.

In particular, the community organization representative is responsible for the community's solid waste management organization; this group includes five members from the greater Minh Khai community including both the head and vice-head of the Women's Union (Figure 5). The organization's leader has the official authority to either overturn or institute any policy or decision made in the community or at community meetings as he sees fit. However, in depth discussion indicates that this authority has never been exercised. All decisions are made collectively; if they are such that the community is affected by their outcome, then a community referendum is held. Other, minor decisions such as the allotment of collection routes are discussed internally by the organization's six members. Although there were frequent meetings including the entire community at the project's implementation, this frequency is no longer necessary; meetings are now held approximately every 6 months.

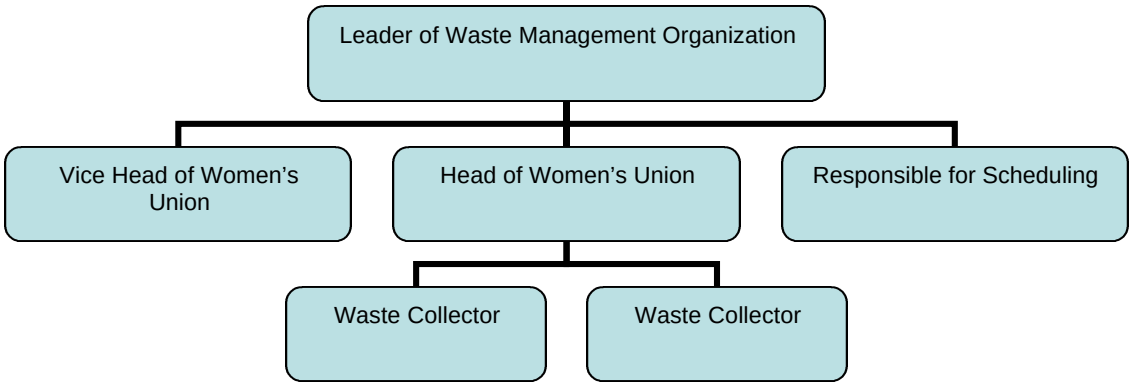

Figure 5. Minh Khai's community-based solid waste management organizational structure.

The leader of the Women's Union is responsible for overseeing day to day collection activities of the waste collectors; she ensures that collectors complete their tasks along the prearranged routes and within the predetermined time. Both the head and vice-head of the Women's Union are responsible for: encouraging community participation in the collection system, conveying ideas about waste separation into organic and inorganic waste and discussing

with residents issues regarding the appearance and health of the local environmental. A third woman is responsible for assisting scheduling as well as ensuring the community hall is in order before meetings. These women are elected annually by a 51% vote by members of the local Women's Union.

On alternate days, collectors are responsible for collecting waste from those households participating in the system as well as sweeping all public streets, collecting fallen branches and leaves and occasionally repainting religious sites. Residents know the approximate time collectors will make it to their houses and when the collector rings a bell hung from the dust cart, residents bring their waste to the street and place it in the dust cart. At this time, any information regarding changes in collection times etc. are relayed to residents. Although waste collectors are not responsible for collecting waste left on the street, they often do clean or collect it. This is primarily because no one else is responsible for its collection. If collectors are confronted by dissatisfied residents, they direct them to the head of the Women's Union; if problems cannot be solved at this level, then the organization's leader is called. Waste collection is not a primary source of employment for collectors; it is a supplemental form of income. In both instances, the collectors are economically quite marginalized relative to other residents. Waste collection fees add 150,000VND ($15CAD) per month to their livelihoods.

To make a decision, the leader of the waste management organization gathers people together; meetings are announced using the loudspeaker system or by informal communication between the collectors and residents. Most meetings begin with the leader addressing the issue or problem and then discussing any related opinions or possible solutions. These opinions or solutions may be his or may come from discussion with residents in the community. As a part of his responsibilities, he is constantly interacting with other community members; this interaction may be either through formal organizational meetings or informal discussion when he walks though the streets. Once others have had a chance to voice their opinions there is a show of hands to vote on an outcome. Votes are considered conclusive when 70% of the participating members agree. If only one suggestion is made to solve the problem and the community does not agree, they may vote against it; this procedure may continue until a new idea is agreed upon.

4.2.1.2 History of the Organization

As of 1998, there was no system of solid waste management in the community. The local government did not acknowledge there was a waste problem. Waste was usually burned, fed to livestock or buried and organic waste was incorporated into agricultural fields or ponds. Streets were often dirty and full of waste. In most cases, residents took the responsibility of cleaning the street in front of their household. The waste management project was implemented primarily because an increasing number of plastic bags and wrapping was blowing about or being burned in households. In October 1999, the local Women's Union, in cooperation with the community organization representative, developed a experimental trial of waste collection. The Women's Union initiated a daily, curb side waste collection system. The outcome of a two month trial period was that a majority of the 60 women in the Union no longer wanted to participate. As a result, they hired two women from within the Union who would be responsible for collection. The community was informed after lengthy discussions. In December 1999, a fee of 300VND/person/household/month ($0.03CAD) was deemed an appropriate fee and the formal system was initiated. After a few months, community participation in the system increased to its current level of 97%. Nonetheless, changes have occurred within the system. After the first phase of the project, a general community meeting agreed that, given the amount of work, the collection fee be raised to 400VND/person/household/month ($0.04CAD) in 2001; after discussion, the fee was again increased to its current rate of 500VND person/household/month ($0.05CAD). At one community meeting, it was determined that everyone in the community pay the same fee, one deemed to be both an appropriate income for the collectors to collect garbage on alternate days and substantial enough to purchase maintenance supplies such as dustcarts, boots, brooms and gloves for the collectors. Biannual fee collection is a coordinated effort between the organization's leader and the head of the Women's Union. Fees are collected house by house based on the scheduling representative's log book listing participating members.

4.2.1.3 Community Participation in Minh Khai's Waste Collection System

As of July 2002, community participation was ninety-seven percent. It has increased slowly over the project's four years; individuals who do not participate are encouraged to do so by their neighbours, community leaders, and family in the community. The 3% who do not participate said they felt capable of dealing with waste themselves. According to interviews, this unwillingness to participate is partially due to the fact that they do not want to pay for the service. One resident said that he is able to incorporate his daily waste into his livestock production and sees no need to pay others to collect it from him. In addition, there are a number of known free riders (students renting houses in the community) who, according to an interview with one of the waste collectors, put their garbage outside other households in the belief that the waste will be collected. There is some discrepancy as to whether the student renters or the house owners are responsible for the collection fee. Each party feels that the other should be responsible; hence, free-riding continues and the collector has no choice but to collect the waste. Although residents are not legally obligated to participate, free riding is slowly being eliminated as residents become aware of those who free ride and contact the organization to deal with the situation. In order for the participation rate to have climbed to its current rate, other, participating residents and members of the Women's Union have been successful in describing the system's benefits thereby encouraging members to participate.

The community and organization does not look favourably on outsiders who enter the community and collect recyclables. The organization's position is that these people do not contribute to the community, and yet derive income from the sale of the recycled material. These outsiders do not contribute anything to the community. Furthermore, the organization feels that they create a mess in the community's dump as they open bags attracting stray animals. It is generally acknowledged and accepted by the community that any marketable recyclables given to the waste collectors are to be used to supplement their income. On average, collectors earn approximately 10,000 VND/month ($1.00CAD) through their sales.

4.2.2 Nhan Chinh

4.2.2.1 Structure of the Organization

The Nhan Chinh Model Group of Solid Waste Collection is comprised of 18 members. This includes one organizational leader, two vice leaders and 15 collectors (Figure 6). The leader is responsible for the overall supervision of both the vice leaders and the waste collectors. Problems with collectors or the services are to be brought to the attention of the vice leaders; in the event that they cannot adequately deal with the situation, the leader is informed and makes the final decision in settling the conflict. Collectors are responsible for daily, curb side waste collection and street sweeping.

Organization members are selected from the greater community's citizen's group. The local People's Party is responsible for the selection. This voluntary citizen group is comprised of members of the community; in most instances, members are from community groups such as the local Veteran's Union, Women's Union etc.

Within the waste management organization, the leader and vice leader are responsible for hiring collectors; the community's collection team is composed entirely of women from the local Women's Union. As a full time occupation, collectors earn between 550-600,000 VND ($55-60CAD)/ month; these earnings account for 90% of the collection fees; 10% of this fee goes to the leader and vice leaders of the organization. While the Hanoi URENCo. initially subsidized the purchase of eight dustcarts, the remaining ten carts and brooms, shovels, uniforms and dust masks have been purchased with the revenues from the collection fees.

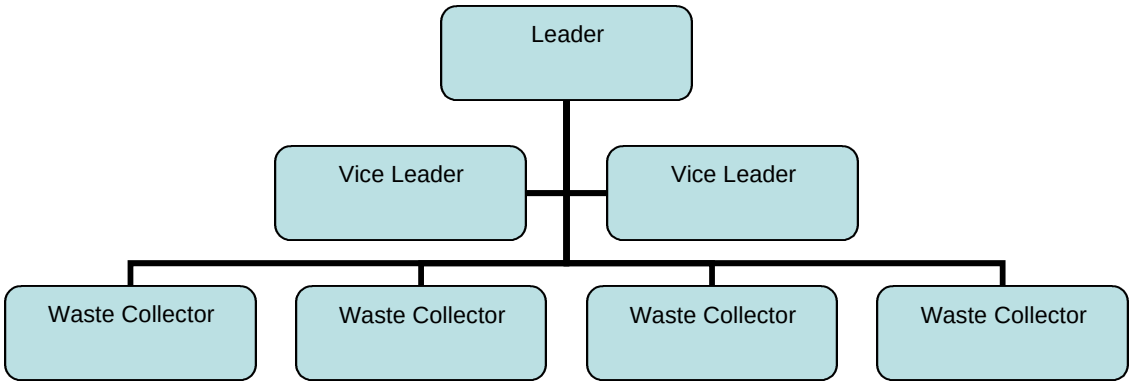

Figure 6. Nhan Chinh's solid waste management organizational structure.

Although the organization is considered community-based, it exists under the direct control of the local government. In actuality, the organization plays the role of a facilitator as all final decisions are made by the local People's Party. In the event that people do not agree with government decisions or have suggestions to improve upon them, they may approach the organizational leader either informally or at a formal community meeting. The leader, in agreement with the organization (including the waste collectors) may then raise the issue with the local People's Party who in turn may decide to address the problem or dismiss it. Further, although community members are able to communicate their ideas and opinions to the leader of the organization, according to the leader, no one from the community has either made any suggestions to improve the system or voiced any complaints. There are no formal meetings within the community dealing with the community's solid waste management; any related issues can be brought up at other larger community meetings. Broadcasts or informal discussions between collectors and residents are the most common methods of informing residents of any changes to the system or at community meetings where waste issues are to be addressed. However, according to the leader, waste management is seldom an issue at these meetings.

Currently, clean water, better sewer systems and pollution from the rubber factory seem to be the issues most commonly addressed.

Waste is collected once a day; usually between 6 and 8 am. Collectors ring a bell hung from their dustcarts. A total of approximately 54 dustcarts are pushed to one of a number of transfer points within the community. These designated locations have ample room for the transfer of waste between the collector's dustcart and a larger garbage truck. Secondary waste removal of approximately 27m³ generated by the community daily is conducted by the Than Long Company. This private company, subsidized by Hanoi URENCo. then transfers the waste to the Nam Son landfill, which serves much of greater Hanoi. There is no source separation in Nhan Chinh and therefore residents bring both organic and inorganic waste to the collectors. There is no formal source separation program in Nhan Chinh or Hanoi. Furthermore, given the limited number of households with working gardens, composting and therefore source separation would not be beneficial.

4.2.2.2 History of the Organization

Prior to 1995, there was no system of waste collection in Nhan Chinh. The local environment was quite polluted with many plastic bags in the community's pond and littered throughout the streets and public areas. Most households burned, buried or threw their waste into streets or surrounding fields. There was a community dump but because no one was officially responsible, it went unattended and was often burning or smouldering. Under the government instituted 'socialization' process, in 1996, the People's Committee initiated a 'non-governmental' project – 'Model of Solid Waste Management in Nhan Chinh Village'. This pilot project was developed under the authority of the local People's Party. Because of the community's small population size, approximately 5 collectors were hired. However, as the population and volume of solid waste increased, the organization hired additional collectors. Throughout Hanoi, collection fees are set at a maximum 1000VND/person/household/month ($0.10CAD). As such, the Nhan Chinh organization has charged this same rate since the program's introduction in 1996. Collection fees are sought monthly by the collectors. The

organization believes that this is the most appropriate method as it builds a trust between the collectors and residents. Often collectors are perceived as being poor and residents mistrust them. Still, it is the view of the organization that relationships and perceptions can be strengthened between the parties. The residents trust the collectors when the resident's waste is collected at the correct time and the streets are swept in the community; in return, the collector trusts the resident when the resident pays the monthly collection fee.

4.2.2.3 Community Participation in Nhan Chinh's Waste Collection System

According to the organization, between 1996 and 1998, participation in the project was limited. For just over a year, many people did not see a need to financially participate in the new system. Residents often felt that they were more comfortable with their usual disposal methods. Since then, participation has increased to approximately 70%. Nonetheless, there are no legal requirements for people to participate. In fact, according to the organization's leader, there are many 'free riders' in the community who put their waste in front of other people's houses believing the collector will assume it belongs to that house. In many instances, this has led to larger conflicts between neighbours; in some situations, the outcome has been positive where a neighbour begins participating in the collection system. Unfortunately, the collector must collect waste from all public areas otherwise stray animals often distribute it throughout the community. In addition, there are residents who throw waste into a number of common areas or abandoned buildings or sites. Commonly, migrant waste pickers enter the community often collecting waste from the community's waste transfer point. Some have arrangements with collectors to travel with them on their routes. Through this informal relationship, they are allowed to collect marketable recyclables and in return provide the collector with a financial incentive. Officially, the organization does not allow waste pickers to enter the community; however, in reality, they are indifferent, and leave it to the discretion of individual collectors to decide whether they can or can not enter the community.

4.2.2.4 Pilot Project to Ease Community Conflict

Conflicts between collectors and residents are primarily a result of the collectors not being able to complete their route without having to take their waste to the transfer point. Historically, route length was in line with the volume of waste generated. Collectors were able to complete the route, take their waste to the transfer point where a truck from the Than Long Company would meet them. They would then begin a second route if necessary. However, due to both an increasing population and an increasing volume of waste generated in the community, scheduling problems have resulted and collectors now must wait for up to 3 hours to transfer their waste. Conflicts often arise when the collector is not on the route when the resident expects them to be. In an attempt to minimize this conflict, the Hanoi URENCo. has begun a second pilot project in the community to increase efficiency. A ramp with a large bin has been placed at a few of the transfer points; this now allows collectors to dump their bins and continue with their routes. This saves them having to wait to transfer their waste and its subsequent secondary removal. Although it has only been operational for a few months, the pilot project appears to be successful.

4.2.3 Than Cong

4.2.3.1 Structure of the Organization

The *Than Cong Successful Sanitation and Environment Cooperative* was established from the district People's Committee (Government Decision: 0012TX) in December of 2000. This robust organization includes an executive committee, a labour division and a working division. The executive committee is comprised of one leader assisted by two vice leaders. There is also a planning department. The labour division consists of 12 garbage truck drivers who work in cooperation with 8 waste collectors. There are also approximately 20 labourers who assist at the transfer points; they are not formally employed by the Than Cong Cooperative; however, they assist in the transfer of dust carts to garbage trucks and in return are eligible to collect marketable recyclables (Figure 7). It must be noted that, upon initial observation, the Than Cong Cooperative appears quite large; however, members of the executive and working divisions are primarily

employed by the government, and the Than Cong Successful Sanitation and Environment Cooperative project is a component of their larger daily work load. Many employees are employed by the local People's Party. The collectors are employees of URENCo. and work full time under the authority of the Cooperative.

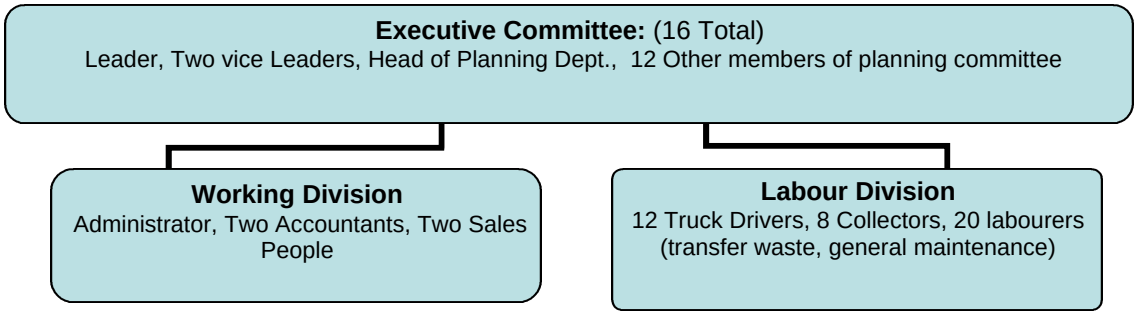

Figure 7. Than Cong's solid waste management organizational structure.

Internal decisions are made by a collective agreement within the executive committee. Input from other divisions is uncommon; however, issues or ideas must first be heard by members of the planning committee. Once approved or deemed appropriate, they are relayed to the leader and vice leaders of the cooperative. At this point, the leader may call a meeting of the executive committee to make a decision. In 2000, the executive committee, comprised of members of the local People's Party, Hanoi URENCo. and Doste elected the current leader. This position is considered permanent until death.

If residents of Than Cong have suggestions or input for the organization, they are able to relay this information through waste collectors, or even members of the executive committee. In addition, the Women's Union holds a position in the executive committee; they are responsible for finding waste collectors and other labourers from the community. It is therefore possible for members of the community to relay information through members of the Women's Union.

Financially, the Cooperative is subsidized by the local government. Wages for members of the Executive and Working Divisions were not provided for this study; however, wages for those in the labour division were. According to URENCo. policy, drivers are paid 1,000,000

VND/month, ($100.00 CAD), collectors are paid 600,000 VND/month ($60.00 CAD), while some of the formally hired labourers are paid 500,000VND/month ($50.00 CAD).

4.2.3.2 History of the Organization

Prior to the Government Decision (Government Decision: 0012TX, 2000), Company #4 of the Hanoi URENCo. was responsible for waste collection and transfer from Than Cong to the Nam Son landfill. However, under the same 'socialization' process responsible for the initiation of the Nhan Chinh Model of Solid Waste Management, The Than Cong Cooperative was started. Since its inception, the Cooperative has maintained the same 1000VND person/household/month ($0.10CAD). In addition, the Cooperative's policy is that those under the age of 5, members of the police force, poor people (as recognized by the local government) and war veterans do not have to pay for collection. Fee collection once every three months is the responsibility of three individuals; primary collection is by a member of the collection team; fees are then turned over to the leader of the Labour Division who in turn gives the money to a member of the executive committee. Besides the waste collectors and the local Women's Union representative, all members of the organization are hired from outside the community.

4.2.3.3 Community Participation in Than Cong's Cooperative Waste Collection System

According to the Head of the Planning Department for the Than Cong Cooperative, as of June 2002, approximately 752 of 1200 houses or 63% of the community participated in the waste management system. It is the view of the Cooperative that they have seen a marked increase in the number of residents participating in the system in the past year. He suggests that the current system is more efficient and provides a better service to the community than did URENCo's Company #4 (even though workers are still employees of URENCo.). This is primarily because the organization is only responsible for this community and Company #4 was responsible for a greater area. The Cooperative believes that when people see an improvement in the appearance of the community they will be more willing to financially participate in the Cooperative's collection system. Although participation is not legally required, if a waste collector observes a resident

throwing waste out at an inappropriate time or in an inappropriate public space then they may inform a member of the executive committee. In turn, the resident may be fined (informally) by members of the executive committee and thereby encouraged to participate in the system.

The Cooperative supports the efforts of waste pickers in the community by allowing them to collect waste at transfer sites. However, to be a recognized waste picker, they must have prior approval from the local government and the waste Cooperative. It is the view of the Cooperative that a maximum of three waste pickers, who must also be residents of the community, be allowed at any one time to minimize competition between the waste pickers and provide an adequate income for the collectors.

4.3 Community Perceptions

With regard to general participation in community affairs, a majority of those who responded believed they were well informed about local affairs. Awareness of local affairs was in reference to government decrees and decisions, existence of community groups, and awareness of others residents' general health, well-being and participation in local organization. Over 90% of residents in Minh Khai said that they felt they were well informed; this is higher than respondents in Nhan Chin and Than Cong (Table 3A). Only 60% of respondents in Than Cong said they were well informed of local affairs, leaving over 30% saying they were uninformed (Table 3A).

According to a number of residents, a common way of receiving local information is over a loudspeaker or public announcement system. These are present in all of the communities visited. In addition, often bulletin boards are posted outside the local People's Party Office. According to one resident, television and radio are important sources; however, these do not usually include information about local affairs, but rather city or province-wide information for all citizens of Hanoi. Further, respondents of all communities indicated that the most common way of receiving information was through word of mouth, informal communication with friends and neighbours at home and at work.

When asked how decisions in the community were made, there was a high degree of variation in responses. Approximately 60% of individuals surveyed in Minh Khai said that decisions affecting them were made after the community leader asked group members their opinion and input before making a final decision (Table 3B). Informal conversations indicated that community participation in decisions was often based on outcomes of community meetings; the topics of these meetings range in nature and not all individuals in the community participate in all meetings. However, individuals did feel as though they had an input into decisions affecting their welfare. It must be noted that some decisions are made from higher authorities such as the Hanoi People's Party, or other provincial jurisdiction and therefore community participation in decisions is not warranted. Furthermore, 20% of respondents in Minh Khai believed that the community was responsible for decision making (Table 3B).

A community meeting in Minh Khai usually consists of a variety of proposals by a member in charge of a particular community organization. The various proposals are voiced either by the head of the community organization or by members of the community who have made the head of the organization aware of their ideas and have asked to speak at the next meeting. After discussion, a vote by one member of each household is made by raising a hand in favour of one of the proposals. Hands are counted and this often, but not always, reflects the outcome. There was a low percentage of individuals in Minh Khai who indicated they were unsure of how decisions were made.

Although individuals in Nhan Chinh gave relatively similar answers to those respondents in Minh Khai, 30% indicated they thought the local government leader decided and informed the community, believing they had limited involvement in community decisions (Table 3B). Nonetheless, 45% of respondents indicated that they did have an input into the decisions; as in Minh Khai, an in-depth interview indicated that community meetings were organized similar to those in Minh Khai where individuals were able to participate in discussions regarding decisions that would ultimately affect them. In contrast to both of these communities, individuals in Than Cong indicated overwhelmingly (79%) that the local government leader makes decisions and then informs the community of his or her decision (Table 3B). Only 10% of those surveyed believed

that their input could alter or affect a government decision and 2% indicated that they felt decisions were made after group members held a discussion (Table 3B).

Formal involvement in community committees or organizations appears to be related to the perceived level of involvement individuals have in community decision making. There are marked differences between Minh Khai and the other two communities. Specifically, all survey respondents participate in at least one committee whereas 27% and 29% of respondents from Nhan Chinh and Than Cong respectively indicated their lack of affiliation with any organization (Table 3C). Approximately 31% and 30% of respondents from Minh Khai indicated they were local Communist Party Members and members of a local Older People's Union respectively (Table 3C). In contrast, only 9% and 7% of individuals from Nhan Chinh and Than Cong respectively said they were members of these organizations (Table 3C). Not surprisingly, 10-11% of respondents in Minh Khai indicated they were members of a local farmer's union and cooperative while affiliation in the remaining communities was less than 2% (Table 3C). Upon qualitative observation, it appears as though there is a relationship between individuals who are members of local organizations and their involvement in a participatory decision making process. To summarize, all individuals in Minh Khai indicated they were affiliated with at least one community organization. Similarly, over 90% felt they were well informed about local affairs and approximately 60% felt they had a substantial role to play in the outcome of community decisions (Table 3C). At the other end of the spectrum, 29% of respondents in Than Cong indicated that they had no affiliation with any community organization or committee. Subsequently, 33% indicated they were not well informed about local affairs and approximately 79% believed that they were not able to contribute to the outcome of decisions in the community (Table 3C).

Table 3. Results of household survey regarding community participation in local affairs.

	Minh Khai	Nhan Chinh	Than Cong
A. Would you say that you are well informed about local affairs? (%)			
Yes	91.7	83.0	60.4
No	4.2	10.6	33.3
Not sure/Choose not to say	4.2	6.4	6.3
B. When there is a decision to be made in the community, how does this happen?			
The local government leader decides and informs the community	16.3	30.4	78.7
The community leader asks group members their opinion then makes a decision	59.2	45.7	10.6
The group members hold a discussion and decide together	20.4	13.0	2.1
Not sure/Choose not to say	4.1	10.9	8.5
C. Have you been involved in any of the following committees?			
People's Committee of Minh Khai	0.0	3.0	1.0
People's Council of Minh Khai	0.0	0.0	1.0
Communist Party Member	31.0	9.0	7.0
Women's' Union	2.0	6.0	6.0
Veteran's Union	6.0	2.0	1.0
Youth Union	2.0	0.0	2.0
Worker, family Union (labour union)	11.0	1.0	2.0
Older People's Union	30.0	9.0	7.0
Farmer's Union	11.0	2.0	0.0
Cooperative - Rice, Wheat etc.	10.0	2.0	0.0
Other Organization	9.0	4.0	1.0
No Affiliation	0.0	27.0	29.0

The survey asked households to list three common issues that had been raised in the community at Party or community organized meetings (Table 4). Between 10 and 18 individuals from each community indicated that a limited awareness regarding the local environmental had been addressed and, that as an important issue, it had been addressed a number of times. During informal conversations, respondents in Minh Khai indicated that a few years ago, the Women's Committee initiated environmental discussions during other meetings. Because of interest on the community's part, the local Women's Union includes environmental discussions as a component of their regular meetings. Presently, the Minh Khai Women's Union includes environmental discussions approximately every 6 months. In conversation with residents of Nhan Chin and Than Cong, they stated that environmental awareness raising campaigns have been conducted by the local People's Party, and the Women's Union has been institutional in encouraging individuals to pay more attention to their local environment. However, it appears that neither community has been as proactive as Minh Khai regarding the frequency of

discussions of the local environment. A general observation made by the author was that the waste collectors are the most important individuals for conveying ideas of environmental protection to local residents because waste collectors often deal with women from the household, who, for the most part, are responsible for daily cleaning.

Perhaps the second most common concern was the improper timing of waste collection (Table 4). Individuals in all communities are responsible for taking waste out at the appropriate time. Although waste collectors do attempt to collect waste at regular times, according to one collector in Nhan Chinh, this is often difficult. She explained that because the collectors must unload their waste carts into a larger truck, they are thus dependent on the timing of the truck drivers. It would be impossible for them to continue to collect waste because their carts are full and there are a limited number of dustcarts. She continued by explaining that she was in a difficult position when this happened because often residents got angry with her for being late.

Seventeen residents in Minh Khai reported there was an increasing number of a plastic and nylon bags in the community (Table 4). A waste collector in Minh Khai reported that although the community has had plastics (bags and wrapping material) for a long time, the volume has increased. This use of plastics has had a detrimental impact not only on the public environment, as these bags tend to blow through the streets, but the escalating volume has also increased the rate at which the community dumpsite was filling up.

In addition, there was expressed concern for the open sewer system in Minh Khai. While the systems in Nhan Chinh and Than Cong are, according to residents, not perfect, the street-side sewers are covered. According to a waste collector in Nhan Chinh, these covers minimize smells and reduce the likelihood biting insects will breed.

Table 4. Common issues addressed by respondents in Minh Khai, Nhan Chinh and Than Cong precincts.

List up to three common issues that came up in your community in the past year?	Minh Khai	Nhan Chinh	Than Cong
Increasing population in the community	9	6	5
Limited space remaining for current community dump and limited land available for a new dump	18	0	0
Individuals in the community take their waste out at inappropriate times and therefore the collector doesn't remove the waste until the following day	11	8	16
Collectors often do not pick up waste (leave it in street), sometimes the collectors do not sweep all the streets	5	12	8
Sewer grates don't have covers, stagnant water smells, is unhealthy and attracts flies and mosquitoes	5	2	4
Sewers tend to get stuck, back up into households	16	4	0
Volume of waste (household) is increasing in community (more plastics)	17	2	5
Poor quality of dustcart	1	2	0
Clean water well for community	6	8	9
Lack of concern shown by local government regarding environmental issues such as a new dumpsite and sewer grates	4	2	1
Lack of environmental awareness by individuals within the community	18	14	10
Common area where a building was destroyed collects a lot of garbage, people throw it there and no one is responsible for cleaning it up	0	11	0
Rubber factory (Golden Star Rubber) pollutes water as well as pollutes air with burning rubber fumes, generally, smells from factory pollute air	0	6	0
Market is very dirty and is very unhygienic because waste collectors are not responsible for cleaning it	0	10	0
Dirty, dusty streets because many streets are not yet paved, still open dirt this can make it difficult for collectors to get down streets	0	0	14
Roads are in poor condition and have many large holes that collect water and are unhealthy because biting and other insects breed there	0	0	10
Often garbage isn't collected by trucks at proper times	0	4	20
Electricity not always on	0	0	8

Community-based waste management initiatives have an immediate impact on the environmental conditions of the community. They help consolidate the cooperative relationships between neighbours for other collective activities. This can be seen in Table 5A where over 80% of respondents in Minh Khai and Nhan Chinh indicated that they had joined more than twice in the past year to address issues described in Table 4. Although 63% of surveyed residents of Than Cong indicated they had joined once to address a common issue, only 26% said they had done so more often (Table 5A). When asked the methods communities used to address or solve a local problem, the majority of respondents in all communities said they contacted their local government People's Party Committee member. Interestingly, 17% and 20% of individuals in Nhan Chinh and Than Cong respectively said that they would contact the media when they wished to solve a problem (Table 5A).

Table 5. Methods and actions taken by community members in response to local issues.

A. How often in the past 12 months have you joined together with others In your community to address common issues	**Minh Khai**	**Nhan Chinh**	**Than Cong**
Never	6.3	2.0	10.9
Once (1)	12.5	14.0	63.0
A Few Times (2-5)	35.4	40.0	6.5
Frequently (5+)	39.6	32.0	8.7
Not Sure	6.3	12.0	10.9
B. In the past 12 months, have you taken any of the following actions in an attempt to solve a local problem? (Selection of one or more of the following)			
	11.1	18.3	6.3
Contacted the appropriate community organization to deal with the problem	14.8	20.8	8.3
Contacted your local government People's Party Committee member	37.0	20.8	45.8
Attended an action group or association	13.0	12.5	0.0
Made newspapers, radio and/or TV. interested in the problem	1.1	17.1	20.8
Thought about it but did not act	13.0	10.4	18.8

Although 42% of surveyed residents in Minh Khai indicated that the community was a place where neighbours looked out for one another, 37.5% said that it was not and 20% chose not to answer the question (Table 6A). In contrast, fewer than 70% of those surveyed in Nhan Chinh and Than Cong said that in general, people looked out for one another in the community.

More than 75% of individuals surveyed in the all communities said that in the past 6 months they had done a favour for a neighbour and, more than 68% indicated that neighbours had in turn done a favour for them (Table 6A and B).

Table 6. Community reciprocity.

A. Would you say that this community is a place where neighbours look out for each other?	Minh Khai	Nanh Chinh	Than Cong
Yes	41.7	68.8	66.7
No	37.5	14.6	27.1
Don't know/Choose not to answer	20.8	16.7	6.3
B. In the past 6 months, have you done a favour for a neighbour?			
Yes	89.6	77.1	91.5
No	2.1	16.7	8.5
Don't know/Choose not to answer	8.3	6.3	0.0
C. In the past 6 months, have any of your neighbours done a favour for you?			
Yes	79.2	68.8	80.9
No	6.3	20.8	19.1
Don't know/Choose not to answer	14.6	10.4	0.0

4.4 Resident Perceptions of Community-Based Initiatives

Community-based waste management organizations develop through an overall effort of community development. This is especially notable in Minh Khai as another community organization, the local Women's Union, was in part, responsible for the introduction and sponsorship of waste management as a community-based initiative. However, the same cannot be said for Nhan Chinh or Than Cong. In fact, the Model of Solid Waste Management in Nhan Chinh was initiated by the Hanoi URENCo... under the direction of JICA (Japan International Cooperation Agency) in hopes that, proven efficient, city wide replication of the case study model could be initiated. In Than Cong, the local People's party was responsible for the introduction of a private institution responsible for waste management. Nonetheless, with regard to the environment and waste management, respondents in all three communities believe that the environmental image of the local environment, both natural and built, was important to very important (Table 7A). Only 4.5% and of respondents in Nhan Chinh felt indifferent towards the environmental image of the community and no one reported that they felt that the image was not important (Table 7A). When asked specifically whether waste management and collection was important, only 6.3% of respondents in Nhan Chinh indicated that they were indifferent to the

system or organization (Table 7B). The remaining respondents felt that these were important issues in the community. Overwhelmingly, 86%, and 85% of respondents in Minh Khai and Than Cong reported that they felt the issue was very important while just under 60% in Nhan Chinh felt it was important (Table 7B). Trends were similar when respondents were asked how important the organization was to their house, as opposed to its importance to the community in general. Over 80% of respondents in Minh Khai and Than Cong respectively thought that the organization was very important to their household, between 2% and 8.5% indicated that it didn't make a difference to them; however, no one indicated that they felt the organization was not important to their household (Table 7C).

Table 7. Perception of environment and community-based waste management organization.

A. Do you think the environmental image of your community is important?	**Minh Khai**	**Nhan Chinh**	**Than Cong**
Very Important	87.8	36.4	57.7
Important	12.2	59.1	42.2
Indifferent	0.0	4.5	0.0
Not Important	0.0	0.0	0.0
B. Do you think garbage and waste management and collection are important issues in your community?			
Very Important	85.7	58.3	84.8
Important	14.3	35.4	15.2
Indifferent	0.0	6.3	0.0
Not Important	0.0	0.0	0.0
C. How important is the waste management organization to your household?			
Very Important	81.6	45.8	82.9
Important	16.3	50.0	8.5
Indifferent	2.0	4.2	8.5
Not Important	0.0	0.0	0.0

The provision of waste collection and transfer by the community organization can have a substantial impact on the local environment. It can increase the community appearance, increase the value of personal property and improve the health and wellbeing of community residents. Approximately 35% of respondents in Minh Khai believed that since its inception, the provision of a collection system had improved their health (Table 8A). Informal discussions with residents suggested that people felt that because they did not have to breathe fumes (the by-product of waste burning) their health had improved. Furthermore, it appears that because of less waste in

the streets, there are fewer mice and rats which may carry disease. In addition, perhaps because people do not see waste lying in the streets as often, there is a greater sense of pride in the community which may indirectly affect an individual's overall health and well-being - benefits between 1 and 25% (Table 8A). Notably, 40% of respondents in Than Cong reported feeling that the waste management system had no impact on their health (Table 8A).

It appears that the waste management system has little impact on a community's agriculture and livestock production. Although residents in Minh Khai are primarily involved in agricultural production, over 50% of respondents indicated that its provision had no impact; nonetheless, approximately 47% said it had up to a 50% impact (Table 8A). In a discussion with a farmer, he mentioned that before the system's establishment, there were always nylon bags blowing around the fields which forced the farmers to stop their tasks and remove the bags. Similarly, one farmer mentioned that before the system existed, people often threw or buried waste in the fields; again, this forced the farmer to have to collect the waste. He did mention that it was not a big problem to have to collect the garbage; however, he has to do it less frequently now that waste gets collected regularly.

Finally, many residents felt that the community's appearance had improved by 50% since the system was established. Notably, 28% of respondents in Nhan Chinh felt that their communities' appearance had improved between 76-100% (Table 8A).

The majority or residents indicated that the provision of waste collection by the community organization had a minimal effect on the household. Nonetheless, between 30-50% of respondents did say that they thought that there had been a slight reduction in the cost associated with painting their steps, sweeping their steps or the street in front of their house (Table 8B). One woman indicated that, because she did not have to sweep the street in front of her house any more, she had more time available to do other household tasks; indirectly, this may perhaps be a positive economic return from the waste collection system.

Table 8. Impacts and economic affects of community-based waste management systems.

A. To what extent (%) do you think the provision of a solid waste management system affects the following?	Minh Khai (%)					Nhan Chinh (%)					Than Cong (%)				
	0	1-25	26-50	51-75	76-100	0	1-25	26-50	51-75	76-100	0	1-25	26-50	51-75	76-100
Health	10.2	8.2	18.4	28.6	34.7	19.1	29.8	12.8	19.1	19.1	40.8	36.7	12.2	4.1	6.1
Agriculture and Livestock	52.1	27.1	20.8	0.0	0.0	22.5	20.0	17.5	20.0	20.0	21.3	57.4	14.9	2.1	4.3
Real Estate	61.2	16.3	16.3	6.1	0.0	42.9	22.9	8.6	2.9	22.9	41.7	41.7	12.5	2.1	2.1
Community Appearance	0.0	27.1	50.0	22.9	0.0	9.5	21.4	28.6	11.9	28.6	30.0	50.0	14.0	0.0	6.0
B. To what extent (%) does it affect your family expenses (VND/$) with regard to the following?															
Painting/General Maintenance (walls, steps etc)	45.8	35.4	18.8	0.0	0.0	38.1	33.3	16.7	2.4	9.5	62.5	33.3	4.2	0.0	0.0
Washing (clothing)	62.5	35.4	2.1	0.0	0.0	46.5	34.9	4.7	2.3	11.6	54.2	41.7	2.1	0.0	2.1
Sweeping (courtyard, entrance, street)	10.2	53.1	36.7	0.0	0.0	37.0	15.2	17.4	21.7	8.7	34.9	44.2	18.6	2.3	0.0
Dust/ Odour Removal (incense etc)	41.7	37.5	20.8	0.0	0.0	43.5	23.9	8.7	6.5	17.4	43.2	27.3	15.9	9.1	4.5

4.5 Resident Participation in Community-based Waste Management Decision Making

Forty-nine percent of residents in Minh Khai said they felt positive about their ability to influence the decisions about the waste management system (Table 9A). One resident said that because the community was relatively small, many members of the community regularly attended more than one organization's community meetings and therefore were able to actively participate in discussions about community affairs. She explained that when the system first began there were lots of problems with it but over time and after many meetings, problems are slowly being addressed and negotiated. She feels that the system is slowing improving in part because of her attendance and participation in discussion about the system and the community. A relatively similar trend is present in Nhan Chinh where approximately 22% of respondents said there was a high spirit of participation in decision-making (Table 9A). Roughly half (53%) of the respondents indicated that although they did feel included in decision making arrangements, they were happy with having a collection service and did not necessarily want to be involved in the decision making process. In contrast, more than half (63%) of the respondents in Than Cong said that did not feel as though they were included in the decision making process at all (Table 9A). After interviewing a number of residents, it was clear that although residents did not feel a part of the decision making process, they did not feel that they needed to be and they were confident that those community members who were responsible would represent the community's best interests. They were satisfied with the provision of a service.

Over 95% of the respondents of Minh Khai indicated that they thought that by working together people in the community were able to influence decisions regarding the community's waste management system (Table 9B). Residents in Nhan Chinh felt similar as 87% of respondent's agreed that they too could influence decisions affecting their waste collection system (Table 9B). Than Cong residents (53%) indicated that they were indifferent to working together regarding waste management (Table 9B). Many interviews provided similar answers to those recorded in Nhan Chinh where individuals wished the system to work well; nonetheless, they stated that the government would provide proper collection service. In summary, they felt

others (their local government) would look out for their best interests and ensure that the waste collection system was adequate.

Interestingly, when asked about decisions regarding waste collection, payment or disposal, respondents in Minh Khai provided similar results to those listed in Table 3. regarding community participation in local affairs. Approximately 60% of respondents stated that when a decision is made in the community, the community's waste organization leader asks group members their opinion then makes a decision. In the same way, 61% of respondents indicated that decisions regarding waste management were made after the community leader asked group members their opinion (Table 9C). In contrast, only 10% of respondents in Than Cong indicated that, regarding a general community decision, the community leader asks group members then makes a decision (Table 3C). Dissimilarly, when a decision about waste collection is made, 69% of respondents indicated that the community leader asks group members their opinion then makes a decision (table 9C). Despite their responses, respondents in Than Cong indicated that they felt the community had low spirit for participation and many were indifferent to working together (Table 9).

Table 9. Survey results of residents perceptions about the communities waste management system.

A. Overall, how would you rate the spirit of participation in decision making for waste disposal in your community	Minh Khai	Nhan Chinh	Than Cong
Very Low (0-20%)	2.0	6.4	25.5
Low (21-40%	8.2	17.0	38.3
Average (41-60%)	36.7	53.2	31.9
High (61-80%)	24.5	17.0	4.3
Very High (81-100%)	24.5	6.4	0.0
B. Do you think that by working together, people in this community can influence decisions about waste management?			
Strongly Agree	52.1	44.7	10.9
Agree	43.8	42.6	16.5
Indifferent	0.0	12.8	53.0
Disagree	4.2	0.0	8.7
Strongly Disagree	0.0	4.3	10.9
C. When there is a decision to be made concerning waste collection, payment or disposal, does the entire village get called for this purpose or would the community leaders make the decisions themselves?			
The local government leader decides and informs the community	20.4	36.2	25.0
The community leader asks group members their opinion then makes a decision	61.2	48.9	69.2
The group members hold a discussion and decide together	16.3	4.3	1.9
Don't know/not sure	2.0	10.6	3.8

4.6 Outcomes

In Minh Khai, residents were asked their opinions regarding the merits and effectiveness of the leader of the waste management organization. Ninety percent of the respondents indicated that the leadership was somewhat effective to very effective (Table 10A). Of this number, 47% though that the leader was very effective. Comparable responses were given in Nhan Chinh and Than Cong, where 91% and 95% respectively indicated they felt the current leader was, at least, somewhat effective (Table 10A). Approximately 30% of those respondents thought the leader was very effective. Furthermore, over 50% in Minh Khai, 34% in Nhan Chinh and 71% in Than Cong thought the current system was more efficient than the last system (Table 10B). While, the URENCo. had previously been responsible for waste collection and transfer in Than Cong, the same cannot be said for Minh Khai or Nhan Chinh. Prior to the current system, households were solely responsible for their own waste disposal. Usually disposal involved burning, burying or throwing waste into common areas or abandoned land in the community. Some households

indicated that they still preferred to deal with their waste themselves. However, they agree that since the inception of the current system the community's appearance had improved. Nonetheless, because some individuals did not work in the community, it was difficult to take the waste out at the appropriate time. When they left it out early in the morning before going to work, often stray dogs or animals got into the garbage and sometimes the waste collector would not collect it. Other residents indicated that although the collection fee was relatively low, they did not want to participate financially in the system. In a few instances, people said that the level of work done by the collectors was not worth their money.

A majority of respondents (77%) in Minh Khai felt that since the initiation of the community's waste management project, their knowledge and awareness of local environmental issues such as air, water and soil pollution had increased (Table 10C). Furthermore, individuals said that although there were no formal discussions about the negative health effects of poor disposal methods, many agreed they were more aware of the cleaner local air now that only a fraction of the previous waste was now being burned. That said, 63% of respondents from Than Cong said that they were no more aware of local environmental pollution than prior to the system. These responses from Than Cong are comparable to those provided in Table 8 where 40% indicated they did not think the waste management system had any impact on their health (Table 8A, 10C).

Finally, only 4% of respondents in Minh Khai said they did not think the physical image of the community had improved since the projects inception (Table 10D). The majority of respondents believed the image had improved between 26-50% while 19% thought it had improved between 51-75%; ironically, no one indicated that the physical image of the community had improved more than 75% (Table 10D). More importantly, approximately 30% and 21% in Nhan Chinh and Minh Khai respectively reported that they did not think the physical image of the community had improved at all (0) (Table 10D). Nonetheless, 20% and 25% indicated that the image had improved between 51 and 75% (Table 10D).

Table 10. Perceived outcomes of community-based solid waste management systems.

A. How effective is the leadership of the current waste management organization?	Minh Khai	Nhan Chinh	Than Cong
Very Effective (67-100%)	46.9	31.9	35.6
Somewhat Effective (34-66%)	42.9	59.6	60.0
Limited Effectiveness (1-33%)	10.2	8.5	4.4
B. Is it…than the last system ?			
More Effective	55.8	34.8	71.1
Same Effectiveness	30.2	32.6	22.2
Less Effective	2.3	4.3	6.7
Don' Know	11.6	28.3	0.0
C. To what extent has the implementation of the community's waste management project increased your awareness of environmental issues in your community ex. air, water and soil pollution, smells, health etc.)			
0	0.0	37.0	63.0
1-25%	77.1	43.5	32.6
26-50%	18.8	8.7	4.3
51-75%	2.1	10.9	0.0
76-100%	2.1	0.0	0.0
D. By how much (%) do you think the physical image of the community has improved since the project's implementation?			
0	4.2	29.5	20.8
1-25%	33.3	31.8	43.3
26-50%	43.8	13.6	6.3
51-75%	18.8	20.5	25.0
76-100%	0.0	4.5	4.6

5 Discussion - Applying the Design Principles

5.1 Design Principle 1 – Clearly Defined Boundaries

The degree to which boundaries are defined varies between the three communities. In part, the physical boundaries of Minh Khai clearly define it as a distinct community. Surrounded by agricultural fields, and set off the main road, community residents are able to easily identify outsiders or non residents in the community. Similarly, given its small population, it is easy for collectors and organizational leaders to clearly distinguish who the system is being managed for thereby ensuring benefits derived from the system remain in the community. This is much more difficult in Nhan Chinh and Than Cong where, although municipal boundaries exist on paper,

physical boundaries between communities are often vaguely delineated by a road or path. Furthermore, large populations of 18,000 and 10,000 respectively make it difficult for collectors to recognize outsiders and outsiders conducting business in the community make it difficult to eliminate non participants from benefiting. Nonetheless, though Minh Khai may appear to be a well defined community with closed boundaries, conflicts with a contiguous community are ongoing. The adjoining community does not have any form of waste management system; as a result, they still burn or bury much of their waste. However, many individuals bring their waste to Minh Khai's dump contributing to its increasing volume. As the dump is located on the outskirts of the community, it is difficult to definitively say which members of this adjacent community are responsible for dumping their refuse although members of the local government are in the process of addressing the conflict. Nonetheless, this has been an ongoing problem since Minh Khai established the dump at the initiation of the project.

In any case, Ostrom (1992) mentions that simply closing the boundaries is not enough and the presence of outsiders is of limited relevance. What is of relevance is participation within the community. Benefits to residents are derived when they financially participate in the community's collection system; however, it is difficult to prevent public goods benefits such as clean public streets and air from going to all. In addition, those individuals who do not participate in the system but leave their waste in the street knowing the collectors will inevitably collect it are present in all communities in this study, Therefore, although physically closed boundaries are an asset, further institutional rules are necessary such as collective choice arrangements and monitoring .

5.2 Design Principle 2 – Proportional Equivalence Between Costs and Benefits

According to decisions by the Hanoi government and URENCo., the maximum individual waste collection fee is 1000VND/person/month. As a result, Nhan Chinh and Than Cong have made this their fee; however Minh Khai has set a lower fee of 500VND/person/month for their community's service. In this way, each organization has established what it considers to be an appropriate cost for the benefits of having frequent curb side waste collection and street cleaning.

According to relevant community-based solid waste management cost and benefit literature (SANDEC, 1996), 'per person' payment systems are cheaper and more effective than alternative 'by volume' payment, which may be more easily applied to other resource user systems (Ostrom, 1992). Nonetheless, a number of shortcomings were evident in the communities in this study.

Communities exhibit socioeconomic heterogeneity and the ability of some residents to pay for the system is greater than for others (Lall *et al*., 2002). While the cost of the collection system is relatively low, several other needs within the households often receive a higher priority. Data asking whether people thought the system was affordable was not collected. However, surveys in Indonesia (SANDEC, 1996) indicate that housing, food, clothing, and education receive higher priorities than does solid waste. Poorer households are perhaps less willing to participate in a system than richer households. Similarly, within each community, rates and composition of household waste varied considerably in place and time. According to waste collector interviews in all three communities, higher income households in Minh Khai had a greater generation rate than poorer households and, the proportional content of paper, plastic, glass and metal was higher. Therefore, the percentage of compostable waste and waste density values appear to decline with increasing income but, the cost remains the same for all who participate in the three systems. In this way then, those who receive the highest benefits (collection and disposal of waste), do not necessarily bear any more cost.

Furthermore, household payment multiplies according to the number of household residents; consequently, conflicts over the number of paying residents per household are common in Than Cong. According to interviews, collectors can roughly determine, based on the daily generation of household waste, how many residents there are. Commonly at fee collection time, residents pay for fewer residents, arguing the lower fee is appropriate for the number of residents. While collectors in Nhan Chinh reported that this occurs occasionally, collectors in Minh Khai stated that this has never happened.

5.3 Design Principle 3 – Collective Choice Arrangements

Community residents are allowed and encouraged to participate in discussions regarding the community's waste system, provide input to the management organization and feel confident that their problems will be addressed. Residents of Minh Khai felt as though they had a greater input into community decisions than residents of Nhan Chinh or Than Cong; a majority believed that general community decisions were made only after a discussion with the community. In contrast, the vast majority of Than Cong residents believed that decision making was not collective, rather dictated by the community government leader. Furthermore, there was a dramatic difference in the spirit of participation for the waste management system in each community. While half of Minh Khai felt a great sense of participation in decision making, half of Nhan Chinh felt a moderate sense of participation and the majority of residents in Than Cong had a markedly low spirit for participation. Therefore, individual perceptions of how they contribute to decisions and discussions may be indicative of the overall level of participation in the collection system. In other words, in Minh Khai where the spirit and perceived level of participation in decision making was high, the system's participation rate was 92%. In Nhan Chinh, where residents felt somewhat included in decision making, the participation rate was 70%. Finally, in Than Cong, where residents felt they had little input into collective choice arrangements, participation in the system was 63%.

Most households surveyed in Minh Khai believed they had a great deal of input and influence in the community; as a result, they felt more incentive to participate in discussions. Although considerable debate in the community has often led to a lack of any concrete decisions, these situations have not seen any residents drop out of community organizations and meetings are most often attended by a majority of community members. At the same time, in Than Cong, most residents assumed all decisions were made by the government; in many cases, residents were in support of this system and felt it the most appropriate. As a result, they did not feel it necessary to participate in discussions, hence, community discussions and participation in community groups is limited relative to individuals in Minh Khai or Nhan Chinh.

In addition, collective choice arrangements and use rules differ greatly in the three communities. In Minh Khai, annual, community wide elections determine the head of the community organizational leader. In contrast, the head of Than Cong's organization is an authoritative position, held until death. As a result, authorities in Than Cong have a greater degree of determining powers than leaders in Minh Khai or Nhan Chinh. Rules in Minh Khai change with the people. A community majority can replace leaders and institute new rules in the process. This system limits any one leader's power to exercise, make, enforce or modify rules. In contrast, the authority in Than Cong maintains a greater freedom to exercise, make, enforce or modify rules, based on both the structure of the organization and perceptions of residents. It is possible for decisions and often new rules to be made unchallenged indicating the beginning of a trend toward a new working rule for either the community or the collectors.

5.4 Design Principle 4 - Monitoring

Monitoring other people's behaviour with regard to their disposal of waste is common in all communities. When a neighbour, waste collector or member of the organization witnesses another resident disposing of their waste in a public space, they reportedly either discuss this with the neighbour themselves or, in some cases, discuss this with a member of the organization. In Minh Khai, discussion within the Women's Union is common; collectively, Women's Union representatives discuss with and encourage those individuals who do not follow the rules to do so. According to one member of the Women's Union, they usually talk about the local environment and why the community is responsible for keeping it clean and minimizing their effects on it.

Monitoring can also be in reference to employees of the system. According to the leader of the Nhan Chinh's waste management organization, "It is difficult to manage the collectors because they are often not very honest with the collection fees". He acknowledges that it is difficult to take their jobs away from them because they depend on them for their livelihoods. However, the level of dishonesty has increased; as a result, the leader and vice leaders are soon to be in charge of collecting the fees from participating residents. Such employee monitoring can

also be of organizational leaders; one such interview produced an unfavourable opinion of the community leader. She stated that although she was suppose to receive a certain amount to have her dustcart repaired, she was never granted the money; as a result, she was forced to pay for the repairs herself; furthermore, she was seldom given the money she was suppose to get to purchase a new broom, face mask etc. In her opinion, the leader of the organization kept the money for himself. In addition, she said that she received approximately 80% of the collection fees. The remaining 10% got added to the leader's portion of 10%. Unfortunately, in such cases, effective monitoring rarely generates any changes. As many collectors are economically marginalized within the community, there is little incentive to try and change or report organizational dishonesty because, in most cases, with the position of waste collection, also comes a perception of mistrustfulness and therefore waste collectors fear loosing their jobs if they speak out against members in the organization.

5.5 Design Principle 5 – Graduated Sanctions

Graduated sanctions for not abiding by the rules of the system vary in each community. In Minh Khai, individuals may be excluded from other community groups or functions, In Nhan Chinh, members may face discussion with members of the waste management organization. Or, in Than Cong, residents who do not follow the rules are often encouraged by members of the organization to abide by the rules. There are no monetary sanctions in any of the communities.

5.6 Design Principle 6 – Minimal Recognition of Rights to Organize

With a minimal recognition of rights to organize, communities are allowed to devise their own institutions and waste management systems. Under the Hanoi People's Committee's Project of Socialization – The Collection and Disposal of Solid Waste in Hanoi – No. 404 KH-GTCC, the Department of Transportation and Public Works set out to "encourage individuals and community stakeholders to participate in solving environmental issues, improving the solid waste collection service effectively and properly". And, "little by little, reduce the State subsidy in this aspect". This statement is a general guideline under which any community-based

organization may initiate a waste management project. This system is exemplified in Nhan Chinh, where the system of waste management was initiated as a model to ideally be applied in other areas of Hanoi. Nonetheless, of the three communities in this study, the waste system in Minh Khai is perhaps under the least scrutiny of the local government. While the organization's leader is directly responsible to the local government, ideas and organizational policies have been instituted with minimum input from the local government. As noted, Nhan Chinh is under close scrutiny of the local government as well as of Hanoi. That said, the organization is able to alter rules and change policy; officially, they must have approval from the local government to do this and in this way play the role of a facilitator. However, informal changes in the system are common and go without notice or sanction from the government. In Than Cong, the private system is entirely accountable to the government. There is little recognition of rights to organize within this community organization; most policy and rules are similar to those of Hanoi URENCo.

6 Inferences

This study was based on only three case studies; nonetheless, it does provide a good indicator of the situation and involvement of communities in community-based solid waste management in and around Hanoi. Specifically, it can be said that where people do not perceive the relationship between waste collection or cleaning of public space and an improved community appearance and the local environment with subsequent health benefits, they are less willing to participate in the system.

Where organizations promote collective action and resident participation in decision making, residents are more willing to participate in the system. Similarly, a lack of communication between communities and the government (in the larger case studies – Nanh Chinh and Than Cong) may influence people's perceptions of the environment and waste management as it limits the community's sense of ownership of the system.

Finally, there appears to be a lack of transparency in roles, responsibilities and obligations in the larger communities. In some instances, collectors are unaware of the

responsibilities of others within the organization and similarly, community residents are often confused about the organizational members' responsibilities.

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Appendix A – Photographs of the Study Sites

Picture 1. A waste picker with her collection of plastic bottles etc.

Picture 2. A URENCo. employee of the Than Cong Successful Sanitation and Environment Cooperative navigating the hectic streets of Than Cong, Dong Da District

Picture 3. One of Minh Khai's two waste collectors on her morning route

Picture 4. Minh Khai's waste collector at the community dump -a source of conflict with a contiguous community

Picture 5. Open street sewer in Minh Khai is a common topic of discussion at community meetings

Picture 6. “Free-riders” leave organic and inorganic waste on street forcing collectors to collect and transfer waste

Picture 7. Construction material and waste left on street in Than Cong

Picture 8. Waste Cart used by members of the Minh Khai Women's Union collection organization