Household Demand for Improved Sanitation Services: A Case Study of Kumasi, Ghana

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Executive Summary

This report describes the results of a large contingent valuation survey[1] conducted in Kumasi, Ghana, to estimate households' willingness to pay for two types of improved sanitation services: Kumasi ventilated improved put latrines (KVIPs) and water closets connected to a sewer system. Over 1,200 randomly selected households throughout Kumasi were interviewed about their current sanitation practices and expenditures, their knowledge of improved sanitation options, and their demand for better services.

The report describes several tests that were conducted to check the reliability of respondents' answers to the willingness-to-pay questions. The findings indicate that contingent valuation surveys can be successfully carried out in cities in developing countries for public services such as sanitation and that reasonably reliable information can be obtained on household demand for different sanitation technologies. The report shows how this information can be used to improve the process of sanitation planning in cities such as Kumasi (population about 600,000).

Most households in Kumasi are willing to pay more for improved service then they are currently paying for their existing sanitation system, but in absolute terms the potential revenues from households are not large -- on the order of $1.40 per household per month (about 1-2 percent of household income). The results of the study confirm that conventional sewerage is not affordable to the vast majority of households without massive government subsidies. On the other hand, it appears that only modest subsidies are required to achieve relatively high levels of coverage with KVIPs. This is because KVIPs are much cheaper than conventional sewerage and because most households are willing to pay about as much for a KVIP latrine as for a WC connected to a sewer.

[1] A contingent valuation survey is one in which respondents (or households) are interviewed and directly questioned about how much they are willing to pay for their preferences for improved services.

1. Introduction

Many cities in developing countries currently have no sewerage or other adequate sanitation system. In those that do have a sewerage system, it typically serves only a small minority of the population. This lack of adequate sanitation systems is already an enormous problem and is certain to become much larger. The urbanization of developing countries is proceeding at an astonishing rate. In 1950 the urban population of developing countries was less than 300 million; today it is about 1.3 billion. In 1990 about 300 cities in the world had populations of more than one million, but by the year 2000 the number will have increased to 400. In 1990 there were nine cities in developing countries with populations greater than 10 million; by 2000 that number will have doubled (United Nations, 1985). Two thirds of the population of Latin America is forecast to be living in cities of over one million by 2000.

Rapid urbanization in developing countries will create huge new demands for infrastructure services: water, sanitation, refuse disposal, and electricity. The vast majority of the funds required to provide this new infrastructure will have to come from the urban residents themselves (i.e., the beneficiaries). No other funding source of sufficient size can meet more than a small portion of the forecasted needs. The ESAs simply cannot finance the provision of infrastructure services for the 1.9 billion people expected to be living in cities in developing countries by 2000. The budgets of central governments in many developing countries are severely constrained by foreign debt and structural adjustment programs, and it is unrealistic to expect that they will be able to increase tax revenues that can then be channeled back to cities for infrastructure investments. Local municipal revenues are thus essential for financing infrastructure investments, and this revenue source is constrained by people's willingness to pay for improved services.

Sanitation planning for cities in developing countries has not kept pace with the implications of these demographic and financial changes. With few exceptions, neither donors nor national governments have looked carefully at the economics of investments in improved sanitation systems or at households' demand for sanitation services. This is in part because in both industrialized and developing countries, the public provision of wastewater collection and treatment has been heavily subsidized by government. The primary justification for such state involvement has been on public health grounds, that the health benefits obtained from a clean, sanitary urban environment accrue to all the city's inhabitants (and even to people living outside the city), and thus the costs of such a public service should be shared by all citizens. A standard argument is that individuals should not be permitted to make their own decisions on whether or not to dispose of their wastes in a hygienic fashion because the consequences of poor waste disposal affect not only themselves but others as well, and that this "externality" can be best dealt with by collective action.

This rationale for the public provision of sanitation services to the entire urban population assumes that some level of government has the revenue potential to finance such services, and that citizens in aggregate are able and willing to pay the taxes or fees necessary to provide them. Whether or not subsidies are justified from a public health or economic efficiency perspective, many central governments in developing countries simply do not have the financial resources to subsidize urban sewerage systems for everyone. Although the existing sewerage systems in urban areas in most developing countries tend to be heavily subsidized, they serve only a small fraction of the urban population. The recipients of these subsidies are almost always the middle and upper income classes. The poor are left to find individual solutions to their sanitation needs, often pit or bucket latrines or even no system at all.

Without subsidies from donors or central or state governments, investments in centralized sanitation solutions are limited by the municipal government's borrowing capacity, which is often quite small. Most municipalities in developing countries have very limited if any access to capital markets. Solutions put forward for urban sanitation problems must recognize such fiscal constraints. Unfortunately, the practice of sanitation planning has become a kind of routine, cookbook-style exercise that is out of touch with the realities that massive subsidies are unavailable and that the needs of the poor are not being met. The focus of most sewerage master planning exercises is largely on "supply-side" issues such as estimating the costs of constructing and operating the proposed system. A "master plan" of sewer lines and wastewater treatment plants is generally prepared, based on the assumption that everyone in the city will eventually have indoor plumbing, including a water closet, and will be connected to a sewer line. Planners and engineers need to know little more than a city's terrain, current population and population densities, and population growth rates to be able to design a typical sewerage master plan. Little attention is paid to consumer demand for such services because it is assumed that (1) everyone will want to connect to the sewerage system at whatever price is charged or (2) the public health benefits are so important to the community that the service will be so heavily subsidized and thus no one will have a reason not to connect.

If household demand for improved sanitation services is considered, it is usually done in a perfunctory way. Sometimes the proposed tariffs and connection fees are compared with some fixed percentage of household income. For example, if the monthly charges are less than 3 percent of household income, it is often assumed that the household has the ability (and willingness) to pay for the improved service.

Such simplistic assumptions about consumer behavior are increasingly being called into question. Evidence is accumulating from developing countries that the traditional kind of master planning exercise is not a productive way to analyze urban sanitation problems or to plan for improvements. Many sewerage systems have been built that people cannot afford to connect to and are thus not being used. Users are often unable to pay for even the operation and maintenance of large sewerage systems.

It is clear that existing master planning procedures are inadequate for addressing the complexity of sanitation problems in the emerging megacities, smaller towns, and secondary cities of developing countries. It is equally clear that the existing planning process needs to be changed to one that takes account of the demands of the beneficiaries. What has been less clear are the specific planning procedures that are needed. The objective of this paper in this report is to begin to fill this gap between sanitation planning practice and the planning approaches needed to address the present realities. Specifically, it illustrates how information on household demand for improved sanitation services can be collected using a contingent valuation survey, and it shows how it can be used to assist with planning sanitation investments. A case study was conducted in Kumasi, Ghana, to ascertain household demand for two sanitation technologies: (1) water closets (WCs) with a piped sewerage system and (2) Kumasi ventilated improved pit latrines (KVIPs). Although these sanitation technologies have their strengths and limitations, both represent a major improvement over existing waste disposal methods in Kumasi (see Appendix A for a brief description of a KVIP).

The paper is divided into eight chapters. Following this introductory chapter, Chapter 2 describes the housing and socioeconomic conditions in Kumasi and the existing water and sanitation situation. Chapter 3 describes the specific studies conducted in Kumasi, the research design, and the field procedures. The fourth chapter presents a more detailed description of the existing sanitation system in Kumasi based on the findings from the field work. The fifth chapter summarizes households' attitudes about the existing sanitation conditions and their knowledge of and preferences for improved sanitation technologies. Chapter 6 presents the results of the contingent valuation survey and show how much households are willing to pay for improved sanitation services. Chapter 7 compares households' willingness to pay with the costs of service and draw conclusions about the need for subsidies and the levels of service that are affordable and most appropriate for the citizens of Kumasi. The eighth chapter presents a summary of the findings and conclusions.

2. Socioeconomic, Housing, and Infrastructure Conditions in Kumasi

Kumasi, the second largest city in Ghana, is located in the center of the country and is one of the largest market centers in West Africa. The present population of Kumasi is about 600,000 and growing rapidly. Seventy percent of the population is Christian, and approximately one quarter is Muslim. Three main languages are spoken: Twi, Fanti, and English. To appreciate the nature and the magnitude of the sanitation problems in Kumasi, it is important to understand something of the housing, infrastructure, and economic conditions there.

2.1 Housing conditions in Kumasi

Living conditions in many parts of Kumasi are very crowded. About 95 percent of all households live in apartment buildings with other households, and 90 percent of all households live in a single room. The average size of a household in Kumasi is 4.6 persons, and the average number of people in an apartment building is about 50. Over 55 percent of households in Kumasi live in buildings with more than ten households (Figure 2.1), and more than one quarter of the households in Kumasi live in buildings with more than 60 people (Figure 2.2). There is no room for people to cook, wash, or bathe in their single rooms, so many of these activities take place in the courtyard of the apartment building or along the street.

Most of the households (89 percent) in Kumasi are renters. The majority of the population lives in single-story buildings or compounds,[1] but about one quarter of all households live in multistory buildings (Figure 2.3). Most housing is constructed of concrete blocks with a metal roof, but much of the housing stock is old and dilapidated. Rental housing is poorly maintained, in part because most of it is subject to strict rent controls (Malpezzi et al., 1989). Rents are set far below market value, so landlords have little incentive to either maintain existing buildings or construct new ones. In 1989, the average monthly rent for one room was the equivalent of only $1.50.

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1. A "compound" refers to a single-story multihousehold apartment, the most common housing type in Kumasi (Fig. 2.3).

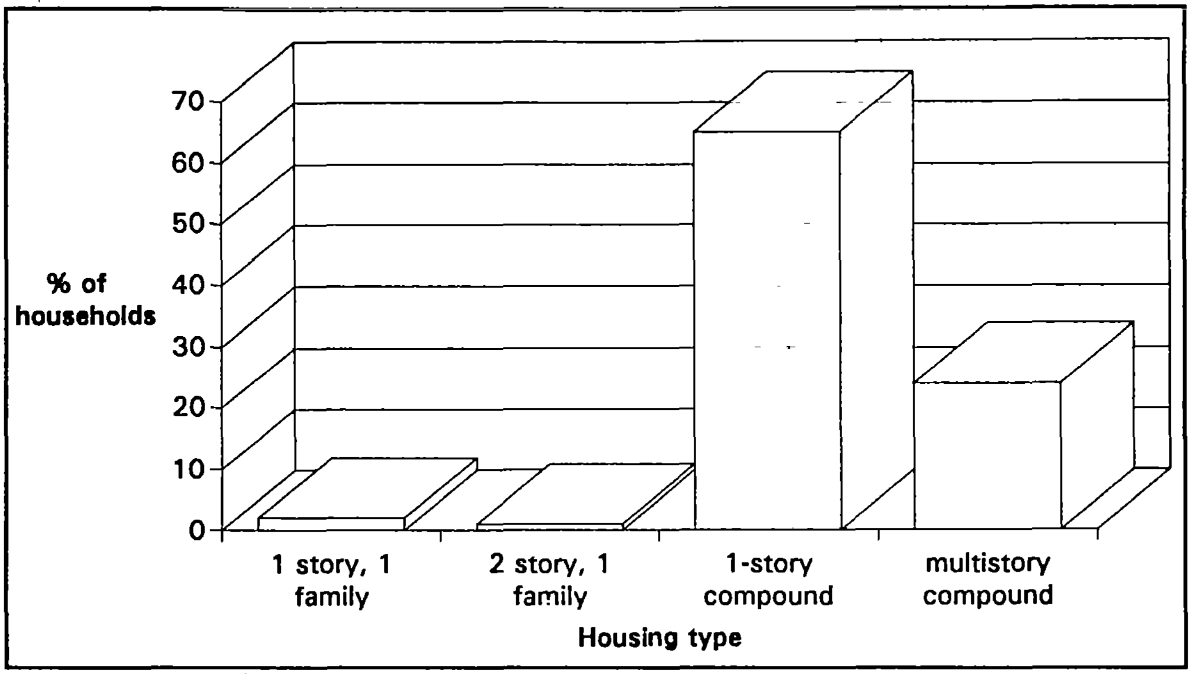

Figure 2.3 Housing types

2.2. Household socioeconomic characteristics

The poor overcrowded housing conditions in Kumasi are a result not only of rent control but also of the very low incomes in Kumasi. In 1987 per capita GNP in Ghana was about $390 (*World Bank, 1989*). Per capita annual income in 1987 was probably on the order of $300. Income is always difficult to estimate from surveys, but our estimates of per capita annual income in Kumasi in 1989 are considerably lower, about $180.

Other data confirm that the socioeconomic status of many households in Kumasi is very low. We found that in 1989 almost half of the households in Kumasi had either none or only one identifiable asset such as a radio, fan, sewing machine, cassette player, refrigerator, or motorcycle. Education levels, on the other hand, are relatively high. The majority of adults have at least a primary education (the average number of years of education is eight). Almost all households in Kumasi now have electricity, for which they pay, on the average, $1.63 per month.

2.3. Household water supply situation

Most households in Kumasi (about 58 percent) have access to a private connection to the municipal water supply system in their apartment building or house (Figure 2.4). The vast majority of these households share the connection with other households living in their apartment building or compound; only about 3 percent of the households in Kumasi live in a single-family dwelling with a private water connection solely for their use.

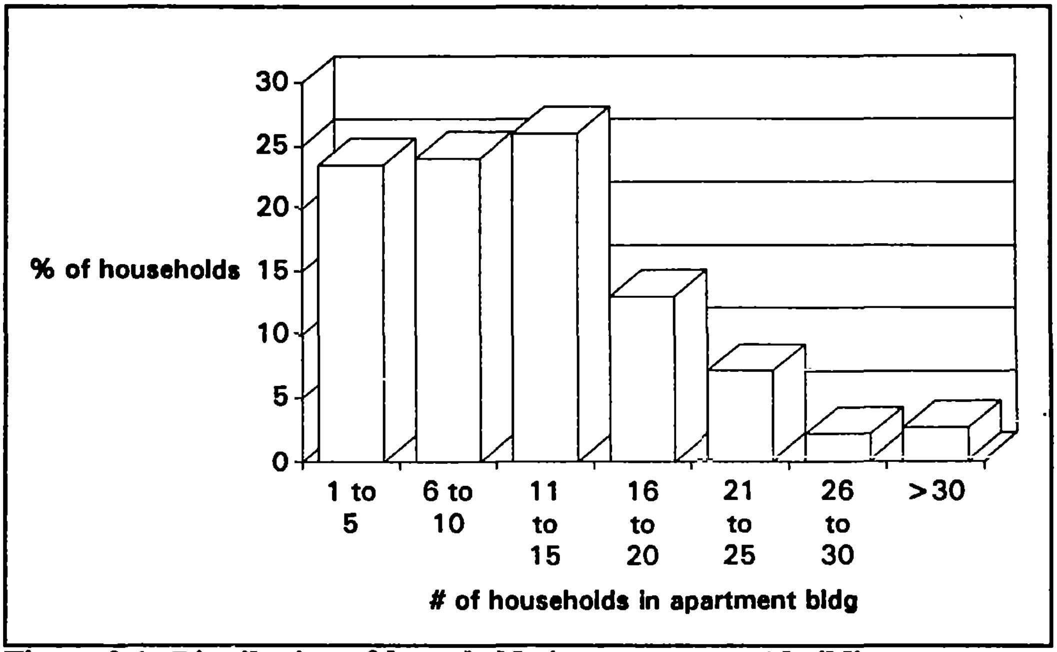

Figure 2.1 Distribution of households in an apartment building

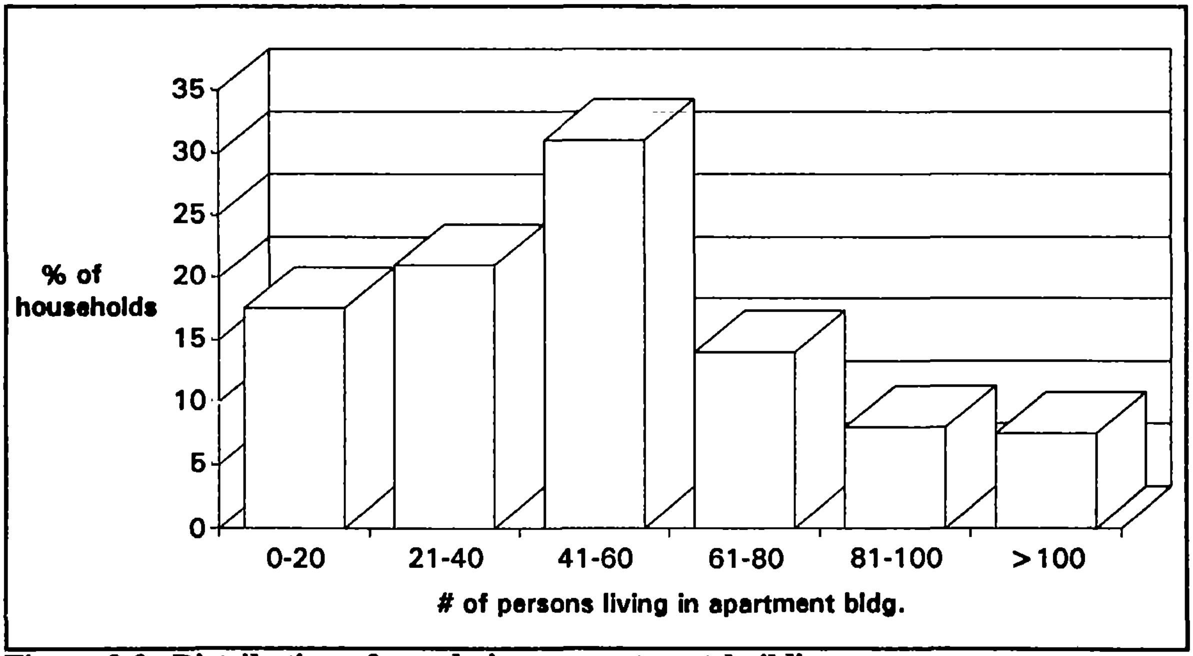

Figure 2.2 Distribution of people in an apartment building

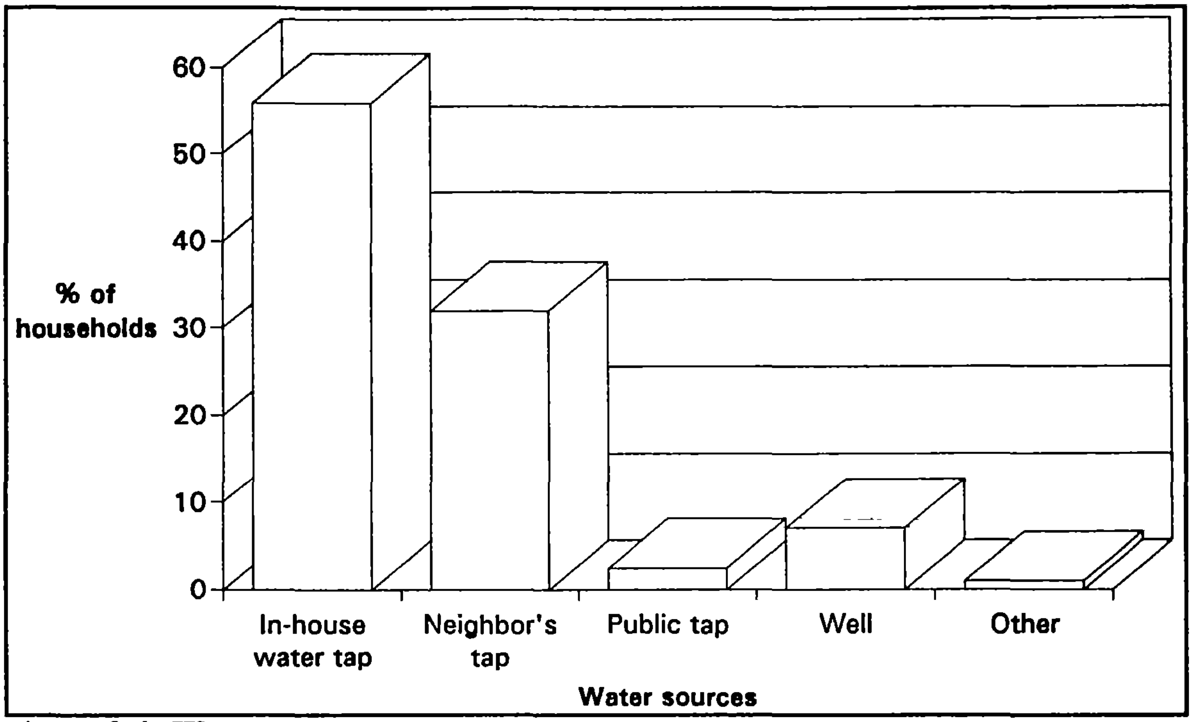

Figure 2.4 Water sources

On average, a household with a private connection shares it with ten other families. In most compounds there is a single tap in the communal courtyard, and people living inthe compound walk to the tap to collect water. Sullage water is disposed of outside the compound, usually into open drains on either side of the street.

Most private connections have meters (85 percent), and most of the meters are working (about 95 percent). An increasing block tariff structure is used to determine the building's water bill. The water bill for a private metered water connection is shared by the households in the building. On average, households with access to a private connection in their building pay about $1.13 per month for their share of the water bill. By and large the municipal water system is reliable and provides water of high quality. About 80 percent of the households with access to a private connection have water more than 8 hours per day, and almost everyone is satisfied with the quality of the water from the municipal system.

Another large group of the population in Kumasi (about 32 percent) purchases water from neighbors because they do not have piped water in their apartment building or compound. Because the piped distribution system reaches most areas of the city, households purchasing water from neighbors typically have to walk only a short distance to collect water (less than 50 meters one way on average). People buying water from neighbors are divided equally between those that pay a flat monthly fee for the right to collect water and those that pay by the bucket each time they fetch water. Households paying a flat monthly fee spend about $0.71 per month for water on average, but those buying water by the bucket spend much more, about $1.71 per month. Most of the remainder of the population relies on shallow wells (7 percent) or public taps (2 percent). Rainwater is seldom collected.

2.4 Sanitation system

Three main excreta disposal systems are used in Kumasi. Nearly 40 percent of the households use the 400 or so public latrines scattered throughout the city because they have no private facility in their building or compound. Ten public latrines serve the downtown-central market area and are very heavily used. All of the public latrines in the town center and about half of the public latrines in neighborhood areas charge adults $0.015 per visit; the other half do not charge. Children and the elderly are always admitted free. At the public latrines that charge, there is a ticket booth with an attendant who collects the money and who gives each person a piece of newspaper for anal cleaning. Most of the public latrines are over 30 years old and are in very poor condition; only 13 percent of those in neighborhood areas have a water tap.

Most of the public latrines (about 60 percent) are aqua privies (known locally as "bomber" latrines because of their tendency to accumulate methane, which occasionally explodes). Approximately 25 percent of the public latrines are bucket latrines. A few relatively new KVIPs are in use.The public latrines used to be owned and operated by the Kumasi Metropolitan Authority (KMA), but conditions at many of the latrines became so deplorable that responsibility for their management was assumed by local political party organizations called Committees for the Defense of the Revolution (CDRs). At the time of this study, neighborhood CDRs appointed the managers of many public latrines in Kumasi who in turn hired ticket attendants and cleaners.

About 25 percent of the households in Kumasi have access to WCs in their buildings, which are generally shared with other households. These WCs are not connected to a sewer (the only sewerage systems in Kumasi are for (1) hospitals and (2) the university campus, where a few buildings, dormitories, and faculty houses are connected). Most of the WCs empty into concrete septic tanks below ground, either next to the apartment buildings or inside the courtyards of compounds. Few (if any) of them are connected to proper drain fields; conditions are simply too crowded in most of Kumasi for the space required.

Another 25 percent of the population uses bucket latrines in their buildings. As with WCs, these facilities are typically shared with other households. Most buildings pay private cleaners to empty their bucket latrines, typically twice a week. There is no centrally organized system for the disposal of the excreta from the private bucket latrines, and most of the cleaners empty the waste into local rubbish dumps or nearby streams within 100 meters or so of the buildings from which the buckets are collected.

The remainder of the population has pit latrines (7 percent) or uses the bush (5 percent). Pit latrines are primarily found in low density parts of the city; they are not very practical for large multifamily dwellings because they fill up rapidly and there is no space available to dig additional pits. In the context of a city like Kumasi, the term "bush" is something of a euphemism; there is little unused open space within the city proper. Households using the "bush" may find places to defecate along local streams or drainage areas, or many simply use the open space around dilapidated or abandoned public latrines.

3. Study Design and Field Procedures

The field work for this research included several different kinds of studies and methods of data collection. The first phase focused on the public latrines and the desludging trucks operated by the Kumasi Metropolitan Authority; the second stage entailed an extensive household survey conducted throughout Kumasi.

3.1 Observations at public latrines

To obtain an estimate of the actual usage of public latrines, observers were placed at a random sample of 30 public latrines in neighborhoods and at all 10 public latrines located near the central market. Observers recorded each person who used the public latrine, the time of the visit, his or her sex, whether the person paid for a ticket, and whether the person was a child, elderly adult, or adult (not elderly). Each public latrine in the sample was observed for two consecutive days. Since most public latrines operated from 4:30 am until 10:00 pm, two observers were assigned to each latrine, one for the morning shift and one for the afternoon-evening shift. In total, data were recorded on about 84,000 visits to public latrines. These data records enabled us to estimate the average number of users, rates of use throughout the day, and the revenues collected by each of the public latrines in the sample.

3.2 Surveys of public latrine managers, latrine cleaners, and attendants

A series of interviews was carried out with people involved in managing, operating, and cleaning the 40 public latrines in the sample. Interviews were successfully completed with 37 latrine managers, 18 ticket attendants, and 25 cleaners (conservancy workers). Managers and attendants were asked questions about their daily revenues, operation and maintenance costs, and salaries and allowances for employees. It was thus possible to construct a general picture of the cash flow situation of different types of public latrines. Information was also collected on the facilities themselves, such as the number of holes in use and the type of waste removal system utilized.

3.3 Observation of operation of desludging trucks

The Kumasi Metropolitan Authority operates six desludging trucks that remove the wastes from some of the public latrines, private septic tanks, and apartment buildings with bucket latrines. Enumerators rode in each of the six trucks over a period of one week to determine where these desludging trucks collected wastes, the number of trips they made, their hours of operation, the number of workers employed, the prices they charged, and where they emptied the wastes. Using a logbook, enumerators kept records each time a truck stoped to pick up or unload waste, the payments for services, and any "tips" to the laborers on the truck or to the driver. In addition, the enumerators interviewed each of the drivers of the desludging trucks about their operations.

3.4 Household survey

Most of the field work for this research project was devoted to the design and implementation of a large household survey, the primary purpose of which was to collect information about existing sanitation practices and household willingness to pay for improved sanitation services. An initial version of a household questionnaire was developed over a three-week period of intensive experimentation in July, 1989. Approximately 50 household interviews and open-ended discussions were conducted with respondents throughout Kumasi. The household questionnaire was then pretested with 100 households.

The final survey questionnaire had four parts (a copy of one version of the questionnaire is included in Appendix B). The first consisted of several questions about demographic characteristics of the respondent and his or her household (such as the number of family members and whether the respondent was head of the household). The second part included questions about the household's existing water and sanitation situation: the type of facilities used, monthly expenditures, and the household's satisfaction with its existing sanitation facility, including perceptions of its cleanliness, privacy, and convenience. The third contained questions about the household's willingness to pay for improved sanitation facilities. The final part of the questionnaire contained questions about the socioeconomic characteristics of the household, including such items as education, income, ownership of assets, weekly expenditures, occupation, religion, and housing characteristics.

A two-stage, stratified sampling procedure was utilized to select a random sample of 1,633 households. The household survey was carried out over a five-week period in October and November, 1989. Twenty enumerators (16 men and 4 women) were each given one week of intensive training in the administration of the questionnaire. Enumerators were instructed in the precise translation of the questionnaires into Twi and were trained in how to ask questions and elicit answers. This training included extensive use of role playing. Each enumerator was observed in practice interviews and was tested on his or her ability to administer the questionnaires. Field supervisors returned to selected respondents after the enumerator reportedly completed the interview in order to verify that the enumerator had, in fact, interviewed the correct household and that the interview had taken place as reported.

Out of the total sample of 1,633 households, useable interviews were completed with 1,224 respondents. The overall response rate for those households that could be located was very high: only 4 percent refused to be interviewed (3 percent of the total number of households). Two percent of the completed interviews were discarded because of inconsistencies in respondent's answers.

4. Existing Sanitation System

4.1 Flows of money and waste in Kumasi

Figure 4.1 summarizes estimates of the amounts of money paid and human wastes generated in Kumasi's existing sanitation system. About 230,000 people in Kumasi are using public latrines, and they are spending approximately $57,000 per month for this service ($0.25 per month per capita). Only about half of this money ($29,000) is spent on managing and operating the latrines; the other half ($28,000) appears to be retained as profits by the CDRs. Despite their poor operation and maintenance and abysmal sanitary conditions, the public latrines thus represent a valuable capital asset, the control of which generates substantial economic rents for the CDRs.

Assuming that the average production of feces and urine is about 0.5 liters per capita per day, 3,600 m^3 of human waste are discharged per month into the public latrines, a small amount of which is from private bucket latrines (Mara, 1976). The data suggest that the desludging trucks remove at most 60 percent (1,900 m^3) of this waste from the public latrines (for which the managers of the public latrines pay the KMA and the laborers on the desludging trucks about $5,000 per month). The rest (1,700 m^3 per month) is discharged by the public latrines into the urban environment, generally via open street drains and ditches.

The desludging trucks carry the waste to a disposal site about 10 kilometers outside of town, which is also an open dump for solid wastes. The desludging trucks pull up to a spot in the parking lot and discharge their wastes over the side of a dropoff. The waste then runs in a small concrete-lined channel for a few hundred meters until it empties untreated into a local stream.

About 150,000 people have bucket latrines in their building or compound; they spend about $16,000 per month to have the buckets emptied a few times a week. Night soil from the buckets is disposed of in two ways: (1) latrine cleaners (or "conservancy laborers") come to the houses on a regular basis to collect the waste or (2) desludging trucks carry the waste to the dump. The majority of households with bucket latrines use private cleaners; only about 15 percent of the night soil is removed by desludging trucks.

The monthly per capita cost of private bucket latrines ($0.11) is much cheaper than public latrines ($0.25), and having a bucket latrine in the house is much more convenient than walking to a public latrine. Approximately 2,200 m^3 of night soil are removed from private bucket latrines per month. As illustrated in Figure 4.1, some of this is collected directly by desludging trucks (300 m^3) and some (200 m^3) is carried by cleaners to the public latrines and dumped into holding tanks, where some of it is picked up by desludging trucks. However, the vast majority (about 1,700 m^3) is simply emptied into neighborhood rubbish dumps or streams.

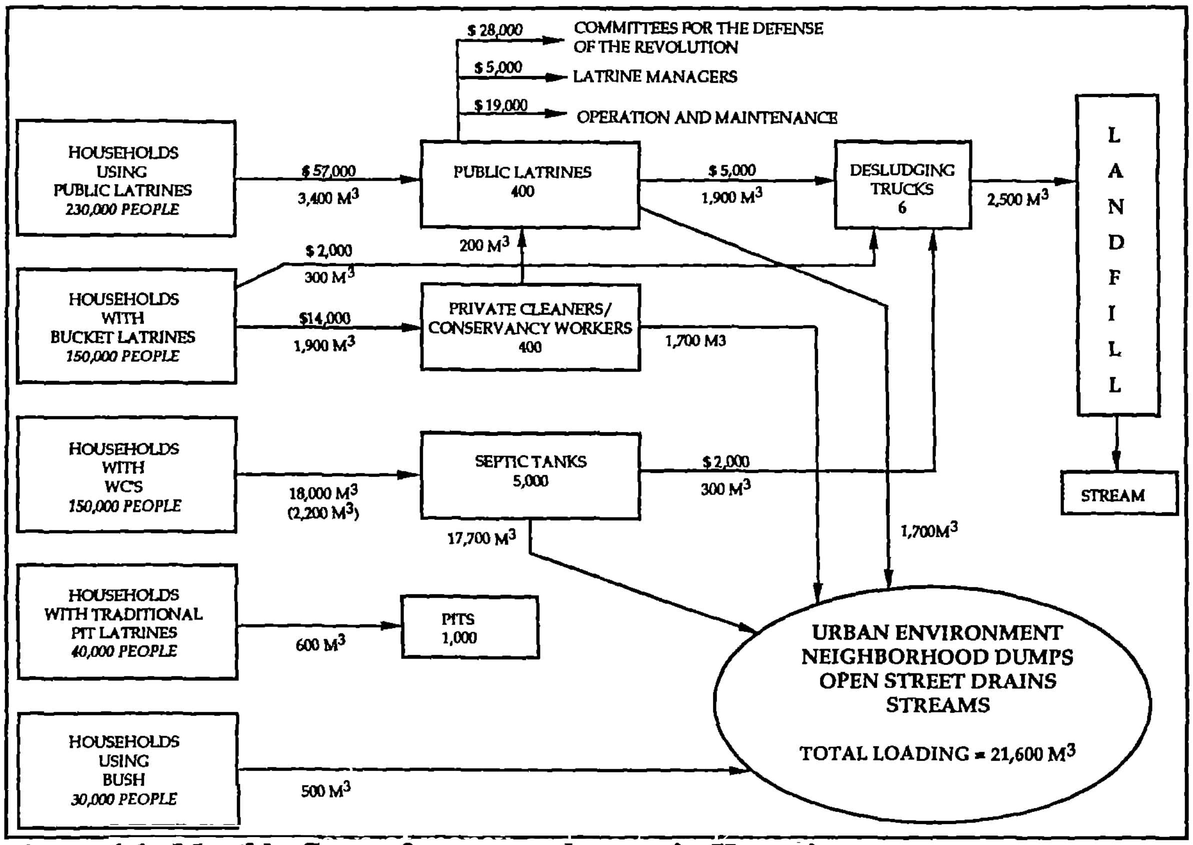

Figure 4.1 Monthly flows of money and waste in Kumasi

About the same number of people have access to WCs in their apartment buildings as use private bucket latrines. From the results of the household survey, it was estimated that there are about 5,000 septic tanks in Kumasi, about 40 percent of which appear to have never been emptied. These tanks routinely overflow and discharge their contents into street drains and ditches, making WCs one of the most poorly operated sanitation systems in the city. Respondents indicated that the other 3,000 tanks are cleaned on the average about once every ten months. It costs about $7 to have a septic tank emptied by a desludging truck. Households in an apartment building with WCs typically share this cost. With 3000 tanks emptied once every 10 months, the total cost of cleaning septic tanks in Kumasi is about $2,000 per month. This amounts to an operating cost of only about $0.02 per capita per month for all the users of WCs, including the cost of water for flushing. This low operating cost is counterbalanced by the higher capital cost of the WC and septic tank.

The total volume of wastes from WCs is much larger than from public latrines or bucket latrines, but this is mainly due to the large amount of water used for flushing. Assuming that people using WCs generate about 4 liters of waste per capita per day (0.12 m^3 per month per person), the wasteload from WCs is about 18,000 m^3 per month, over three times the volume from public latrines and private bucket latrines combined. The waste from WCs is less concentrated than that from public latrines and private bucket latrines, but its greater volume contributes to the widespread dispersal of pathogens and clearly poses a significant threat to public health. Only about 2 percent of this waste load from WCs is collected by desludging trucks and hauled to the dump. Most is discharged into open street drains or otherwise finds its way into the urban environment.

The 40,000 people using pit latrines generate about 600 m^3 of excrement and urine per month. Although this waste is not spread as widely throughout Kumasi as that from private bucket latrines, public latrines, and WCs, pathogens from the night soil in pit latrines are spread by flies and other insects. The 30,000 people who use the bush add an additional 500 m^3 per month of excrement and urine to the urban environment.

In summary, households are currently generating about 25,000 m^3 of human waste per month (including flush water for WCs), but only about 10 percent of it is removed from the city. The rest, 90 percent, is left in the urban environment until it decomposes, is carried away by small streams or drainage ditches, or dries and becomes airborne. In aggregate, households spend about $75,000 per month to use the existing sanitation system (most of this, about 75 percent, is spent for public latrines). Total household expenditures on sanitation thus amount to about $900,000 annually for a system that essentially moves untreated night soil small distances around the city without substantially reducing the public health risk or environmental impact it poses. Although this may seem like a lot of money, it is only about $1.50 per capita per year. In essence, people are spending very little for sanitation, and, correspondingly, are getting very poor service.

Part of the reason for this poor service is that over one third of the total household expenditures on sanitation are effectively being used to subsidize the nonsanitation activities of the CDRs. Instead of sanitation services being subsidized by the public sector as the theory of externalities would suggest, the public latrines are actually serving as "profit centers" for the CDRs. These monies are not being reinvested in the system of public latrines to improve or even maintain the existing level of service. However, even if the funds currently being removed from the sanitation system by the CDRs were spent on improving sanitation services, Kumasi would still have a huge sanitation problem.

4.2. Household Expenditures on Sanitation Services

On average, households using public latrines are spending about $1.14 per month on sanitation; households using private bucket latrines about $0.49 per month; and households with WCs about $0.06 per month. These costs cover operation only and do not include capital. Per household capital costs are highest for WCs and lowest for public latrines. Many households in Kumasi are paying more for sanitation than for water. Figure 4.2 shows the average percent of income spent on sanitation for households using different types of systems. Households using public latrines are spending on average about 2.5 percent of their income on sanitation; and households using bucket latrines are spending slightly more than 1 percent. It is interesting, however, to look at the frequency distribution of household expenditures on sanitation as a percent of income just for those

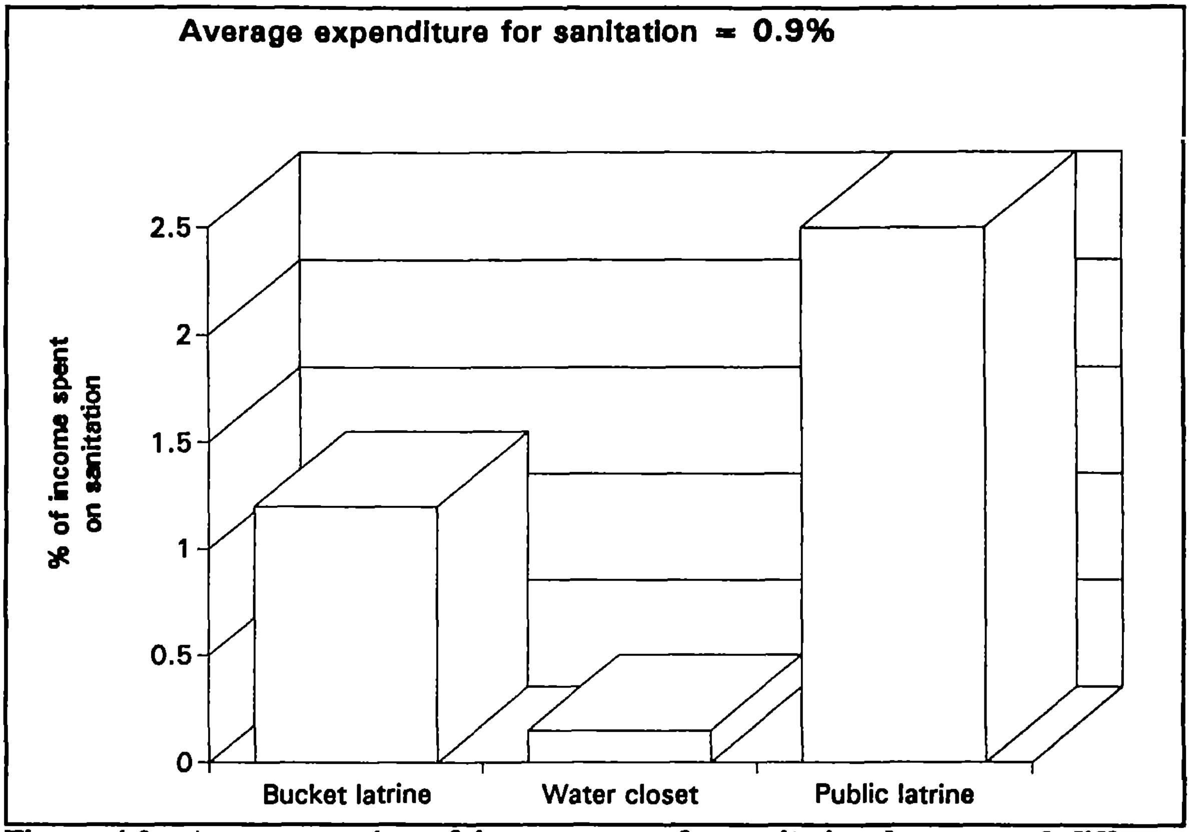

Figure 4.2 Average portion of income spent for sanitation by users of different systems

households using public latrines (Figure 4.3). These data suggest that about 36 percent of such households are already paying more than 2 percent of their income on sanitation and 14 percent are paying more than 4 percent.

The average household expenditure on water and sanitation combined is $1.85 per month, which is about 3 percent of average household income. The majority of households are spending less than $1.50 per month on water and sanitation. However, about 10 percent of the households are spending more than $4 per month for water and sanitation (more than 8 percent of their income).

The distorted housing market and the widespread use of public latrines lead to some peculiar household expenditure patterns. A typical household in Kumasi that relies on public latrines pays about the same amount each month for rent ($1.51), water ($1.26), sanitation ($1.14), and electricity ($1.63).

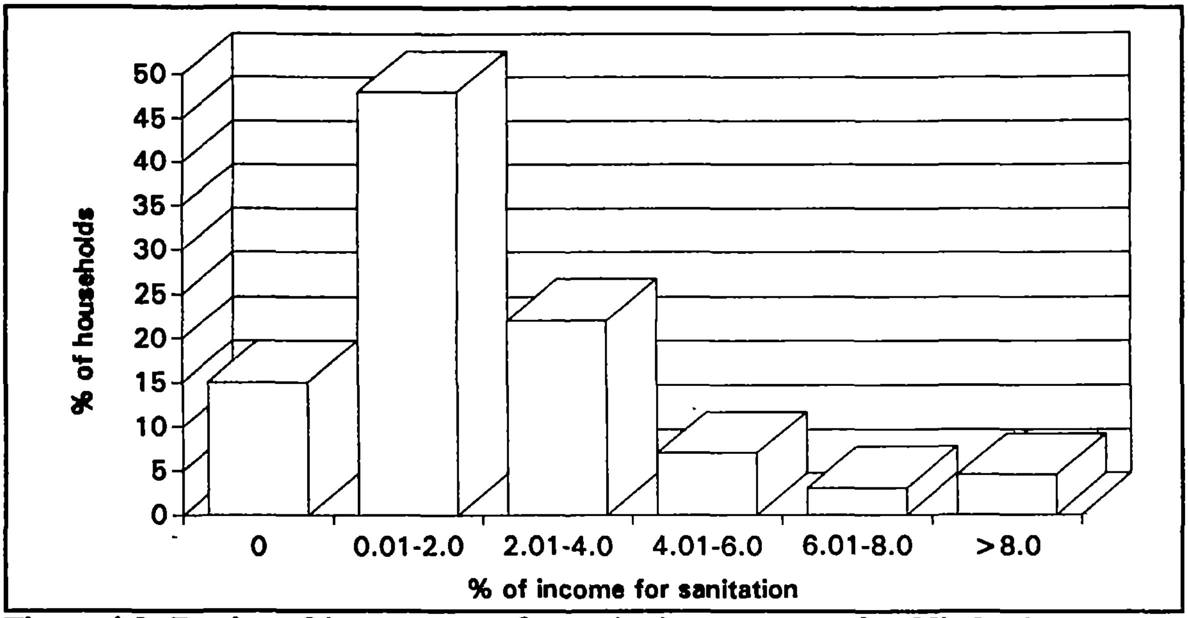

Figure 4.3 Portion of income spent for sanitation by users of public latrines

5. Household Attitudes about Existing and Improved Sanitation Technologies

To assess household demand for improved sanitation and how much households are willing to pay for it, it is necessary to understand how households perceive the advantages and disadvantages of their existing sanitation system and what they think about new sanitation technologies.

5.1 Household attitudes concerning the present sanitation system

Respondents in the household survey were asked to rate their existing sanitation system in terms of its cleanliness, privacy, and convenience. Their responses, presented in Table 5.1, suggest that the vast majority of people using private bucket latrines, WCs, or pit latrines feel that their sanitation system is either "good" or "fair" in terms of cleanliness, privacy, and convenience; very few feel that their existing sanitation system is "poor" in terms of any of these three characteristics. The results show clearly that respondents judge the public latrines to be the worst of the existing sanitation technologies in terms of these three measures. Fifty-four percent of the respondents using public latrines rated them "poor" in terms of privacy, and 70 percent judged them to be "poor" in terms of convenience. However, the majority of respondents using public latrines report that these latrines are "good" or "fair" in terms of cleanliness. Public latrine users' greatest concerns thus appear to be the inconvenience and lack of privacy involved in using the public latrines, not the adverse public health or environmental consequences of unsanitary disposal of human waste.

Users of private bucket latrines do not seem to perceive significant problems with this system in terms of cleanliness. This may be due to the fact that the buckets are emptied regularly and that people are not overly concerned with where they are dumped. In addition, they may not be aware of the health risks associated with the spread of fecal matter around houses resulting from the use of bucket latrines. One implication from this finding is that bucket latrine users may not value the social benefits accruing to the public from reductions in environmental pollution.[2]

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2. This may imply that when asked how much they would be willing to pay for improved sanitation, their responses would be motivated by self interest, with little concern for persons beyond themselves or their immediate families. In other words, their willingness-to-pay responses may be indicative only of the private benefits from improved sanitation. This suggests that the responses are probably a lower bound on the benefits of improved sanitation.

Table 5.1
Household Attitudes Regarding Existing Sanitation System

System	Poor %	Fair %	Good %
Public latrine			
Cleanliness	37	53	10
Privacy	54	44	2
Convenience	70	27	3
Satisfaction	71	28	1
Bucket latrine			
Cleanliness	6	47	47
Privacy	3	71	26
Convenience	8	63	29
Satisfaction	34	55	11
Water closet			
Cleanliness	3	31	66
Privacy	1	59	40
Convenience	3	52	45
Satisfaction	8	54	38
Pit latrine			
Cleanliness	4	52	44
Privacy	5	84	11
Convenience	18	70	12
Satisfaction	37	57	6

All respondents were also asked about their overall satisfaction with their existing sanitation system. Their answers in Table 5.1 are consistent with the attitudes expressed on cleanliness, privacy, and convenience. Only 1 percent of the respondents using public latrines reported that they were "very satisfied"; the majority (71 percent) said that they were "not satisfied at all." On the other hand, the level of satisfaction with the existing WC systems is quite high. Ninety-two percent of the households with WCs reported that they were "satisfied" or "very satisfied" with their sanitation system. Again, perhaps the most surprising result is the level of overall satisfaction with bucket latrines. Two thirds of the respondents using private bucket latrines said that they were "very satisfied" or "satisfied" with their system.

5.2 Respondents' knowledge of improved sanitation technologies

An attempt was made in the household survey to determine whether respondents knew about different kinds of improved sanitation technologies. The enumerators read descriptions to each respondent of both KVIPs and WCs connected to a sewer system; pictures were used to illustrate the major characteristics in both descriptions. Respondents were then asked whether they were familiar with KVIPs, WCs, and sewer systems; their responses are presented in Table 5.2. Because WCs are used throughout Kumasi by a substantial minority of the population, most people (88 percent) were familiar with them. There was also a surprisingly high level of knowledge about KVIPs. Although less than 1 percent of the population currently has a private KVIP, one third of the respondents said that they knew about this technology. This is probably because there have been several demonstration projects in the city and because KVIPs are used in several of the public latrines. Essentially everyone who knew about KVIPs also knew about WCs.

Table 5.2
Household Knowledge of Improved Sanitation Technologies

	Percentage of respondents familiar with
KVIP	34
WC	88
Sewer	12
All technologies	9
No technology	10

The least-known technology was the sewer system; only 12 percent of the respondents said that they knew what a sewer system was before the enumerator described it to them. These people probably learned about the technology because a sewer system is installed in parts of Accra, the capital of Ghana. A small minority of the respondents (10 percent) were not familiar with any of the technologies; only 9 percent knew about all three (WCs, KVIPs, and sewers).

5.3 Household preferences for improved technologies

All respondents who were not using a WC were asked the following question about their preferences for improved sanitation services: "If a WC (connected to a sewer system) and a KVIP each cost the same amount each month, which one would you prefer?" The expectation was that if the costs were equal, there would be clear preference for a WC, but this was not the case: respondents were about evenly divided. Forty-five percent indicated a preference for KVIPs, and 54 percent preferred WCs.

We attempted to determine whether there were any obvious patterns underlying these expressed preferences for WCs and KVIPs. For example, one might expect that higher income and more educated respondents would be more likely to prefer WCs, either because WCs might be considered a higher level of service or perhaps because WCs have value in terms of prestige or social status. A logit model was thus estimated to examine the relationship between households' preferences and socioeconomic and other characteristics of the household. The dependent variable is the household's expressed preferences for either a WC or a KVIP assuming that their monthly costs are equal; higher values of the dependent variable indicate greater preference for a KVIP compared to a WC. The independent variables that are used to explain the respondents' preferences include respondent characteristics (e.g., sex, age, education), household characteristics (e.g., income), and characteristics of the existing water and sanitation systems used by the household (Table 5.3).

Table 5.4 presents the results for two model specifications. The first, unrestricted model uses a list of 21 independent variables to explain household preferences. The second, restricted specification uses only four independent variables, all of which were significant at the 10 percent level in the unrestricted model.

The overall fit of the unrestricted model is not good; it cannot be confrmed that the parameter estimates are not equal to zero. Perhaps the most important and surprising results from this analysis are the factors that do not appear to influence household preferences. Respondents with high incomes or more wealth (as measured by the value of their assets) are not more likely to prefer WCs, nor do respondents with more education appear more likely to prefer WCs.

The research design permitted approximately half the respondents to think for a day about their demand for improved sanitation before answering the question regarding their preferences for improved sanitation technology. The variable characterizing this "time-to-think" effect was significant at the 10 percent level in the unrestricted model. However, in the restricted model, it was significant at the 5 percent level, indicating that respondents who were given a day to reflect on their answers were more likely to prefer KVIPs than respondents who were not given this extra time to think. One interpretation of this result is that, since the vast majority of respondents were not familiar with a sewer system, there was an initial enthusiasm for this technology (coupled with a WC) that diminished as respondents had time to consider it more carefully.

The overall restricted model is statistically significant at the 2 percent confidence level and thus is somewhat more interesting than the unrestricted model. Two other variables were significant in the restricted model at the 10 percent level: religion and home ownership. Non-Muslims and owners were more likely to prefer KVIPs than Muslims and tenants.

Table 5.3
Descriptions of Variables

Variable	Mean (std. dev.)	Variable description
Questionnaire design		
Time to think	0.24 (0.43)	1 = if respondent was given time to think 0 = no time to think
Respondent's characteristics		
Sex	0.59 (0.49)	1 = if respondent was male 0 = if female
Age	39.30 (12.29)	Age of respondent
Household head	0.85 (0.35)	1 = if respondent was spouse of head 0 = otherwise
Owner of house	0.11 (0.31)	1 = if respondent was owner of house 0 = if renter
Religion	0.22 (0.41)	1 = if respondent was Muslim 0 = otherwise
Household characteristics		
Household income	2.42 (1.91)	Monthly household income in 10,000 cedis*
Wealth	2.12 (2.09)	Number of assets
Years of education	8.59 (5.86)	Years of education of respondent
Trader	0.34 (0.46)	1 = if primary worker's occupation is trader 0 = otherwise
Office worker	0.06 (0.24)	1 = if primary worker's occupation is office worker 0 = otherwise
Household size	3.16 (2.23)	Number of persons in household (1 child = 0.5 adult)

Table 5.3
Descriptions of Variables *(continued)*

Variable	Mean (std. dev.)	Variable description
Housing characteristics		
Multistory housing	0.27 (0.44)	1 = if house is multistory building 0 = if single story building
Landlord living in house	0.56 (0.50)	1 = if landlord lives in the house 0 = otherwise
Water use practices		
Private water connection	0.57 (0.49)	1 = if private water tap is primary source 0 = otherwise
Expenditure on water	537 (1,002)	Monthly water expenditure per household (in cedis)
Sanitation practices		
Expenditure on sanitation	298 (404)	Monthly sanitation expenditure per household (in cedis)
Satisfaction level	0.13 (0.37)	1 = if respondent was very satisfied with current sanitation system 0 = otherwise
Knowledge about improved sanitation		
Knew sewer	0.16 (0.37)	1 = if respondent knew a sewer system 0 = otherwise
Knew no system	0.24 (0.42)	1 = if respondent did not know KVIP,WC or sewer systems 0 = otherwise
Quality of interview		
Other people listening	0.28 (0.45)	1 = if other people were listening during interview 0 = otherwise

* 1 = ¢350 (1989)

Table 5.4
Logit Models of Preferences for KVIPs or WCs

	Logit estimates	
Variable	Unrestricted model	Restricted model
Intercept	-0.13	-0.34 **
	(-0.33)	(-2.50)
Questionnaire design		
Time to think	0.38 *	0.49 **
	(1.62)	(2.44)
Respondent's characteristics		
Sex	0.36 *	0.21
	(1.71)	(1.35)
Age	0.00	—
	(0.04)	—
Household head	-0.17	—
	(-0.67)	—
Owner of house	0.55 *	0.45 *
	(1.72)	(1.73)
Religion	-0.32 *	-0.30 *
	(-1.73)	(-1.66)
Household characteristics		
Household income	0.05	—
	(0.98)	—
Wealth	0.00	—
	(0.57)	—
Years of education	-0.02	—
	(-1.02)	—
Trader	0.15	—
	(0.86)	—
Office worker	-0.25	—
	(-0.60)	—
Household size	-0.05	—
	(-0.94)	—

Table 5.4
Logit Models of Preferences for KVIPs or WCs *(continued)*

	Logit estimates	
Variable	Unrestricted model	Restricted model
Housing characteristics		
Multistory housing	-0.06	—
	(-0.30)	—
Landlord living in house	-0.07	—
	(-0.40)	—
Water use practices		
Private water connection	0.17	—
	(0.95)	—
Expenditure on water	-0.0002	—
	(-1.40)	—
Sanitation practices		
Expenditure on sanitation	0.0002	—
	(1.04)	—
Satisfaction level	0.24	—
	(0.59)	—
Knowledge about improved sanitation		
Knew sewer	-0.18	—
	(-0.72)	—
Knew no system	-0.32	—
	(-1.10)	—
Quality of interview		
Other people listening to interview	-0.067	—
	(-0.34)	—
Overall model statistics		
Sample size	707	707
Log (L)	-476.84	-482.02
Significance level	0.39	0.019

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level
Dependent Variable = 0 if respondent prefers WC
= 1 if respondent prefers KVIP

The numbers in parenthesis below the estimated coefficients are the calculated values of t-statistics

5.4 Reasons for preferring a sanitation technology

The results of the multivariate analysis (logit model) of the determinants of respondents' preferences for KVIPs or WCs if they were to cost the same amount indicate that there are few systematic relationships between respondents' preferences for improved sanitation technologies and household socioeconomic characteristics. This does not necessarily mean, however, that respondents' answers failed to reveal their true preferences. It is possible that respondents' preferences may not have been carefully considered, but that interpretation is considered unlikely for the following reason. After the enumerator asked the respondent the question about his preferences for a KVIP or a WC, the enumerator then asked the respondent to explain the reasons for his choice. This was an open-ended question; the enumerator did not prompt the respondent with possible answers. If the respondent had given a flippant answer and simply said whatever first came to his mind, it does not seem likely that he could have then offered a reasoned, coherent explanation of his expressed preference. In fact, respondents consistently gave sound, sensible reasons for their preference of KVIP or WC. For those respondents who preferred a KVIP, their reasons have been grouped into four categories: (1) WC uses more water; (2) KVIP is simple; (3) a WC will not work if the water system is inoperative and is thus less reliable than a KVIP; and (4) all other reasons. The category for "other reasons" groups together several different but sensible responses, such as the respondent wanted the stabilized sludge from the KVIP for use as a fertilizer.

Figure 5.1 shows the percentage of the respondents preferring KVIPs who gave each type of reason. Almost half (47 percent) of these respondents liked the idea that the KVIP did not use water. Some of these people (20 percent) were concerned about higher water bills that would result from a WC; an even larger number (27 percent) were worried about the fact that a WC would not function if the water system broke down. Another 20 percent liked the fact that the KVIP was simple. This answer can be interpreted as a comparison with WCs, which are more complex and require regular maintenance, particularly when subjected to heavy use by multiple households in multifamily buildings. Respondents in this category often expressed concern that children would break a WC and that a KVIP was simpler and less susceptible to abuse.

Similarly, for those respondents who preferred a WC, the reasons they gave have been grouped into three categories: (1) WC is connected to a sewer system; (2) WC is neat and clean; and (3) all other reasons. Figure 5.2 shows the percentage of the respondents preferring WCs who gave each type of reason. Over half (53 percent) of the respondents who preferred a WC liked the attributes of a sewer system. The characteristic of the sewer system that appealed most to this group was that the waste was removed from their house (i.e., the off-site disposal of wastes). This suggests, first, that even though most respondents did not know what a sewer system was before the interview, many people listened to the enumerator's description and understood how the sewer worked. Second, this reason also suggests that, to the extent that preferences for WCs depend on preferences for a sewer system, household preferences for WCs may not be very carefully considered (or strongly held) because the sewer system is a new technology and households have very

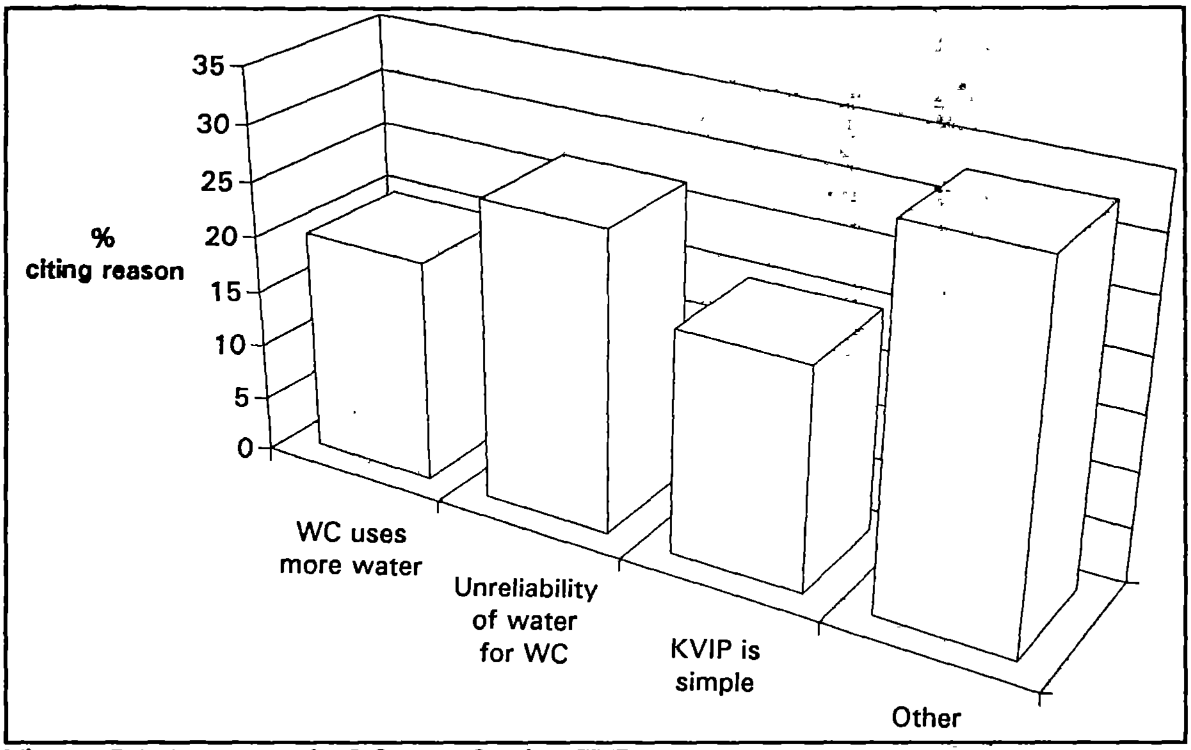


Figure 5.1 Reasons cited for preferring KVIPs

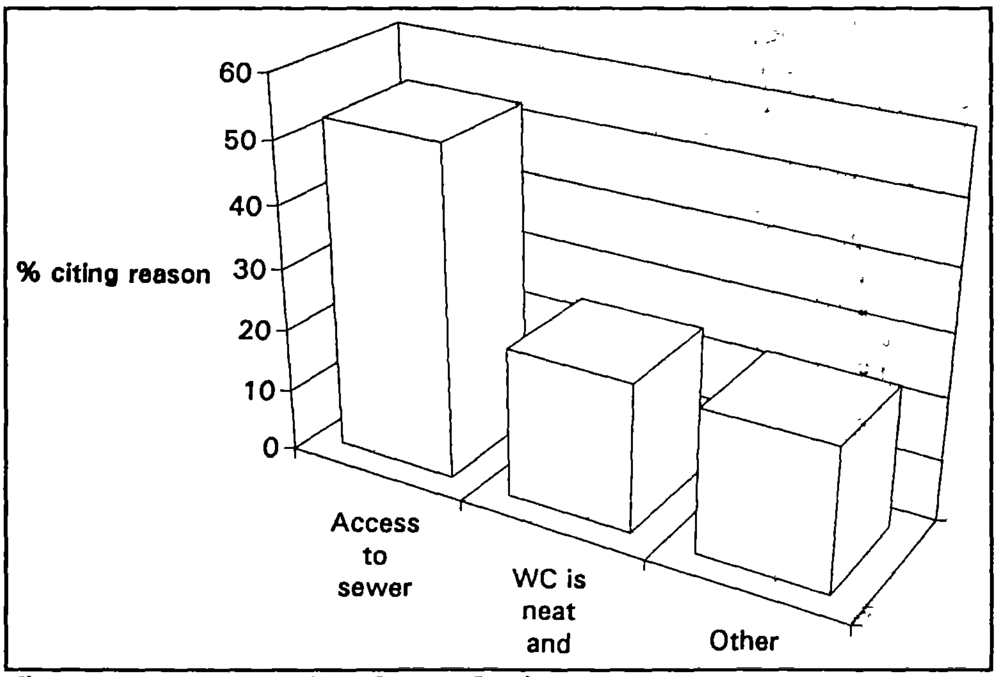


Figure 5.2 Reasons cited for preferring WCs

little experience with the problems which can arise with its use (such as clogged sewer lines).

Twenty-four percent of the respondents who preferred WCs said that WCs were neat and clean. This response was interpreted to be a desire for modern technology and a belief that a WC would improve their standard of living. In fact, there is no reason why a WC should be inherently neater or cleaner than a KVIP; that would depend on how well households in the building organize themselves to keep the facility in good order.

6. Households' Willingness-to-pay Bids for Improved Sanitation

6.1 The contingent valuation questions

Respondents were asked about their willingness to pay for five different types of services: KVIPs, WCs with sewer connections, sewer connections for households already with WCs, private water connections, and both a private water connection and a WC with a sewer connection for households currently without water. Each household was not asked its willingness to pay (WTP) for all five levels of service, but only for those relevant to its particular circumstances. For example, if a household had a water connection but did not have a WC, it was possible to ask the respondent about WTP for both a WC with a connection to a sewer and a KVIP. If a household already had water and a WC, it was not relevant to ask how much they would pay for a KVIP; rather, it was asked how much the household would be willing to pay to connect the WC to a sewer.

On the other hand, if the household did not have a private water connection, it would not make sense to ask how much the household would be willing to pay for a WC with a sewer connection because first the household would have to obtain a water connection. It would be possible, however, to have a KVIP without a water connection. In this case the enumerator first asked how much the household would be willing to pay for a water connection. Next, he or she asked how much the household would be willing to pay for both a water connection and a WC with a sewer connection. Finally he or she asked how much the household would be willing to pay for a KVIP. Table 6.1 summarizes the types of WTP questions asked of respondents with different water and sanitation situations.

Table 6.1
Different Types of Respondents and WTP Questions

1. Households with water and without a WC (N=406)

    WTP for KVIP
    WTP for WC + Sewer

2. Households with water and with a WC (N=295)

    WTP for a connection to a sewer

3. Households without water (N=523)

    WTP for KVIP
    WTP for Water
    WTP for Water + WC + Sewer

The enumerators described each of the relevant options by reading from a prepared text, and, for some of the options, by showing pictures to the respondents. A combination of "YES/NO" questions and a direct, open-ended question was used to elicit the respondent's maximum willingness to pay (this question format is termed an "abbreviated bidding procedure with follow-up"). The respondent was first asked whether or not he would choose to pay a stated monthly fee for one of the specified technologies (a question). In order to test whether respondents' answers were sensitive to the questionnaire design, the starting value of this initial fee was varied among respondents: some received a high starting value and others received a low value. A respondent who received a high starting value for one level of service or technology also received a high value for all subsequent levels of service in the interview.

The iterative bidding procedure had the following three steps, depending on whether the respondent received a high or low initial value:

Low Starting Value	High Starting Value
(1) Ask initial starting value; if NO, go to (3), if YES go to (2)	(1) Ask initial starting value; if NO, go to (2), if YES go to (3)
(2) Increase the initial value to the high starting value, and ask if respondent is willing to pay; then go to (3).	(2) Decrease the initial value to the low starting value, and ask if the respondent is willing to pay; then go to (3)
(3) Ask respondent for the maximum amount he is willing to pay for the service described.	(3) Ask respondent for the maximum amount he is willing to pay for the service described.

Let L and H denote the low and high starting values for a given technology. The first two steps in this question format allow us to classify each respondent's willingness-to-pay bids into one of the following three categories:

Category	Value for WTP	
1	$WTP < L$	
2	$L \leq WTP < H$	(6.1)
3	$H \leq WTP$	

This question format was used for each of the five services. The order of the questions about different services was the same for all respondents.

This procedure yields two types of information on respondents' willingness to pay for improved services. First, a respondent's answer(s) to the "YES/NO" questions place him in one of the three categories above. It is appropriate to discriminate among respondents willing to pay "high," "medium," and "low" amounts based on their answers to the questions. The open-ended, follow-up question provides a point estimate of the maximum amount a respondent is willing to pay.

Both renters and landlords were interviewed, and somewhat different introductory statements were required for each. In addition to the different versions for landlords and renters, for households with and without water, and for high and low starting points, the questionnaire was also designed to test whether one subset of respondents (renters with water) bid differently if they were given one day to reflect on their answers to the WTP questions. In total ten different versions of the household questionnaire were administered in the field. Which version a specific household in the sample received was randomly assigned; the enumerators had no control over it.

The questionnaires asked how much households were willing to pay for particular sanitation technologies given their existing sanitation situation, but did not ask households which service level they would choose if different fees were charged for each. It seems reasonable to assume that if a household bid more for a WC with a sewer connection than for a KVIP, then the household would choose the WC if the fees were the same for both. it is not known, however, which technology the household would choose if the fee for the KVIP were, say, half the fee of the WC.

6.2 How much respondents said they were willing to pay

Figure 6.1 presents households' mean WTP bids (based on the follow-up question) for the five types of service. As shown, households without a WC on average said that they were willing to pay about the same amount per month for a WC as for a KVIP ($1.43 vs. $1.47). Households with a WC said they were willing to pay slightly less than this for a connection to a sewer ($1.32). On average, households without water connections said that they were willing to pay $1.56 for a KVIP and $2.53 per month for both a water connection and a WC. This result suggests that the demand for water and sanitation is largely additive; i.e., that expenditures for one do not substitute for the other.

Table 6.2 summarizes the mean WTP bids for all five service levels for groups of households with different water and sanitation conditions. Households with private water connections but without a WC were asked their willingness to pay for both a KVIP and a WC with a sewer connection. On average, they were willing to pay about 6 percent more for a WC than for a KVIP. There were large differences in the mean WTP bids for KVIPs between households using public latrines and households using other sanitation systems. This was true for households both with and without water. For example, households with a private water connection using public latrines were willing to pay about 34 percent more for a KVIP than households with water and bucket latrines. This makes sense because

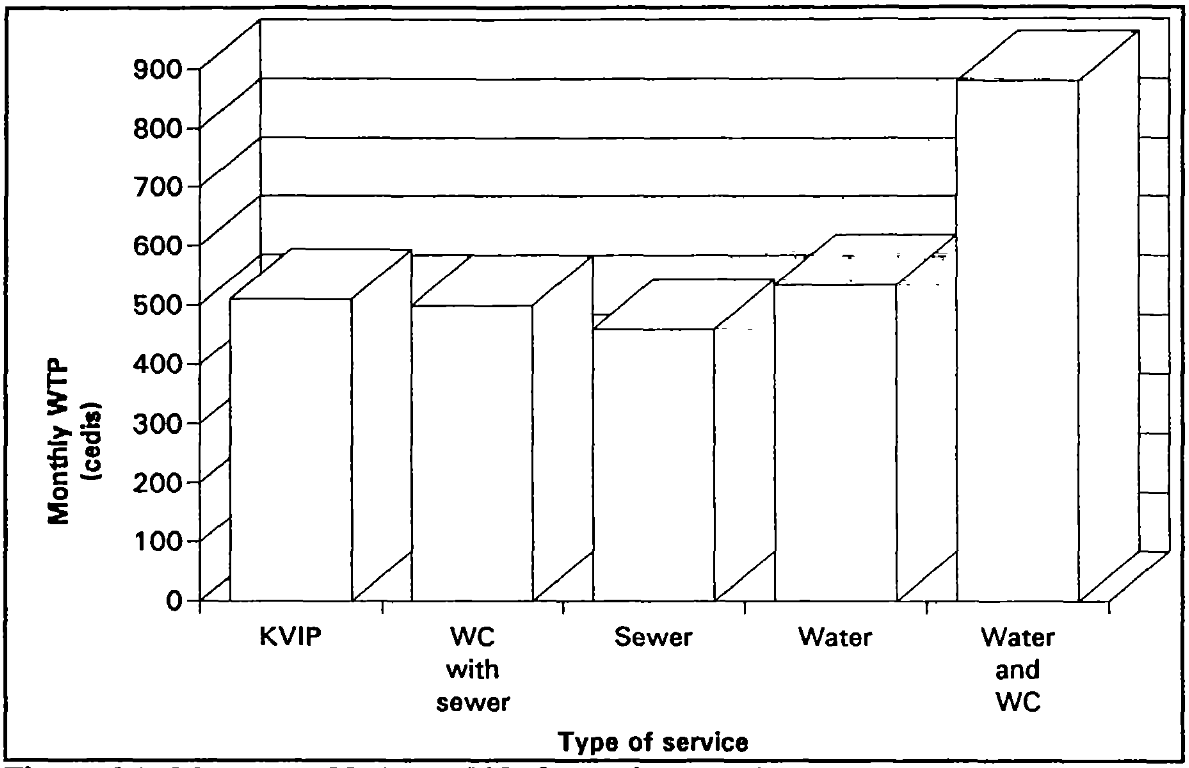


Figure 6.1 Mean monthly WTP bids for various services

households using public latrines are the most dissatisfied with their existing sanitation system and are currently spending the most for sanitation.

6.3 Determinants of the WTP bids

6.3.1 Models of the determinants of the WTP responses

We use the following simple conceptual model to describe a household's decision on whether or not to agree to pay for an improved sanitation system. Let V (·) be an individual's indirect utility function, the arguments of which are: attributes of the sanitation system including its monthly cost (Q), income (Y), the prices of other goods and services (P), and other socioeconomic characteristics and attitudes of the household which may affect (or serve as proxies for) tastes (SE). Consider a change in an individual's sanitation system from Q_0 to Q_1. The individual's willingness to pay (WTP) for this change is derived form his indifference between the following two indirect utility functions:

$$V\,(Y_0 - WTP,\ P,\ Q_1,\ SE) \;=\; V\,(Y_0,\ P,\ Q_0,\ SE) \qquad (6.2)$$

Table 6.2
Average Household WTP Based on Existing Sanitation

Existing sanitation	Willingness to pay ($/month) for KVIP	WC & sewer	Sewer connection	Water	WC & water
			Households with water		
Bucket latrine	1.17	1.25	—	—	—
Public latrine	1.57	1.67	—	—	—
Pit latrine	1.26	1.33	—	—	—
WC	—	—	1.32	—	—
Other	1.25	1.27	—	—	—
			Households without water		
Bucket latrine	1.07	—	—	1.71	2.60
Public latrine	1.51	—	—	1.12	1.90
Pit latrine	1.72	—	—	1.61	2.72
Other	1.35	—	—	1.33	2.08
Mean	1.47	1.43	1.32	1.56	2.54

This implies that an individual's WTP for an improvement in sanitation service will be a function of the proposed change in Q and of all the other factors which influence the individual's valuation of a change in Q:

$$WTP = f(Q_0, Q_1, Y_0, P, SE) \tag{6.3}$$

Three different types of multivariate models were used to analyze this relationship that describes the determinants of the WTP bids. Ordinary least squares (OLS) was used to explain the WTP bids obtained in response to the follow-up, direct question. The information on WTP obtained from respondents' answers to the questions was analyzed in two ways. First, a respondent's answer(s) were interpreted as defining interval estimates for his WTP. In other words, the respondent's WTP was assumed to fall into one of the categories defined by the high and low starting points in (5.1). No attempt is made to characterize or compare the relative magnitude of the WTP of respondents within a given category. This formulation is estimated using Stewart's maximum likelihood estimator for grouped data (1983).

The second method used to analyze the "YES/NO" responses to the questions was an ordered probit model. This approach assumes that the responses to the questions only provide an ordering of the preferences of respondents. In other words, if one respondent answered "YES" to a WTP question and another respondent answered "NO", the only information that is assumed to be obtained from these responses is that the first respondent was willing to pay more for the improved sanitation service than the second. In the ordered probit model, the endpoints of the intervals defining WTP are treated as parameters to be estimated. Each of these three approaches to the multivariate analysis progressively relaxes the assumptions about what information can be obtained from the contingent valuation survey about respondents' willingness to pay for improved sanitation services.

All three multivariate modeling approaches use the same four types of variables for explaining variation in WTP bids for a given sanitation technology: (1) characteristics of the questionnaire (e.g., whether a respondent was given a high or low starting point, or time to think); (2) characteristics of the respondent (e.g., sex, education); (3) socioeconomic characteristics of the household (e.g.,income); and (4) household's existing water and sanitation situation. The names and definitions of the independent variables used in the models of the determinants of the WTP bids are presented in Table 6.3, which also shows the expected signs of the parameters based on consumer demand theory. [In some cases, the expected signs are unknown, which is indicated by "?"].

6.3.2 Results of the analysis

Tables 6.4-6.8 present the results of the multivariate models of WTP bids for KVIPs, WCs with sewer connections, sewer connections (for houses with WCs), water, and water and WC with sewer connections (for houses without water), respectively. Each table includes the results for six different models. For the specific level of service (e.g. KVIPs in Table 6.4), results are presented for the three estimators (viz., OLS, Stewart Maximum Likelihood, and Ordered Probit). For each of the three estimators, two versions of the model are reported: (1) one which uses the complete list of independent variables (designated "C") as potential determinants of WTP and (2) one which uses a more restricted list of independent variables (designated "R"). This approach was used to see how sensitive the model results were to changes in model specification.

Overall, the multivariate results are remarkably robust. The results presented in Tables 6.4-6.8 show conclusively that the WTP information obtained from the contingent valuation survey for all five levels of improved service is systematically related to the socioeconomic characteristics of the household and the respondent in ways suggested by consumer demand theory and prior expectations. This is true regardless of the source of WTP information (i.e., answers to the "YES/NO" questions in the bidding game or the open-ended final question), the estimation method used, or the exact model specification.

The four explanatory variables with the consistently largest effects on WTP have clear economic interpretations: household income, whether the respondent owns the house or is a tenant, how much the respondent's household was spending on its existing sanitation system, and how satisfied the respondent was with his household's existing sanitation system. Households with higher incomes bid significantly more for all types of improved services than households with lower incomes. Owners bid much more for improved service than tenants, indicating a greater willingness to invest in their own property. Respondents who were paying more for and who were dissatisfied with their existing service bid more than respondents who were paying less and were more satisfied.

Two other explanatory variables which consistently have statistically significant effects on WTP are: (1) whether the resident has access to a private water connection in his house or apartment and (2) whether the respondent lives in a multistory building. Respondents with access to a private connection bid more for a KVIP than respondents without a private connection. This result is interpreted to mean that respondents who have essentially solved their water problem are now ready to pay to improve another basic service (viz. sanitation).

Households living in multistory buildings are willing to pay less for a KVIP than households living in single-story buildings. This makes sense because KVIPs are less convenient for individuals living in a multistory building than in a single-story building because a KVIP will always be located at ground level (unlike a WC). On the other hand, respondents living in multistory buildings with WCs were willing to pay more for a sewer connection than respondents with WCs living in single-story buildings. This may be because the holding tanks for the effluent from WCs were more likely to overflow in densely crowded areas with multistory buildings where they were more heavily used.

Perhaps the most surprising finding of these multivariate analyses is how little effect any of the social or cultural variables had on individuals' WTP for improved sanitation or water services. More educated respondents generally bid more than less educated respondents, but this effect is statistically significant in only a few of the models and its magnitude is always small. The sex of the respondent and whether the respondent is the head of household are almost never statistically significant, and the direction of these effects is mixed. The only case in which the age of the respondent influences WTP is for WCs with sewer connections: older respondents bid less for this type of sanitation improvement than younger individuals.

The results for the variable denoting the religion of the respondent are difficult to interpret. Whether the respondent was Muslim or non-Muslim had no effect on WTP for a KVIP or for a sewer connection. However, Muslims bid more for a WC with a sewer connection than non-Muslims; the magnitude of the effect was large and statistically significant. On the other hand, Muslims bid less for water than non-Muslims; in this case the effect was of moderate size and was also statistically significant.

Prior knowledge of the KVIP technology had no effect on the WTP bids for this sanitation service. However, respondents who had WCs and knew about sewers bid considerably more than respondents who did not know about this technology.

Table 6.3
Descriptions of Variables

Variable	Mean (std. dev.)	Variable description	Expected sign
Questionnaire design			
Starting value of iterative bidding	0.51 (0.50)	1 = bidding game used high point; 0 = low starting point	+
Time to think	0.24 (0.43)	1 = respondent was given time to think about willingness to pay; 0 = no time to think	?
Respondent's characteristics			
Sex	0.59 (0.49)	1 = respondent was male; 0 = female	?
Age	39.30 (12.25)	Age of respondent	?
Household head	0.15 (0.36)	1 = respondent was spouse of household head; 0 = otherwise	-
Owner of house	0.11 (0.31)	1 = respondent was owner of house; 0 = renters	+
Religion	0.22 (0.41)	1 = respondent was Muslim; 0 = otherwise	?
Knowledge	*	1 = respondent knows about the corresponding technology; 0 = otherwise	+
Household characteristics			
Household income	2.42 (1.91)	Monthly household income in 10,000 cedis	+
Wealth	33.19 (90.37)	Value in 10,000 cedis for assets of the household	+
Years of education	8.31 (5.39)	Years of education of respondent	+
Trader	0.34 (0.48)	1 = primary worker's occupation is trader; 0 = otherwise	-

Table 6.3
Descriptions of Variables *(continued)*

Variable	Mean (std. dev.)	Variable description	Expected sign
Office worker	0.23 (0.42)	1 = primary worker's occupation is office worker or professional; 0 = otherwise	?
Housing characteristics			
Multistory housing	0.27 (0.44)	1 = house is multistory building; 0 = single-story building	-
Landlord living in the house	0.55 (0.50)	1 = landlord lives in the house; 0 = otherwise	+
No. of households	11.1 (6.89)	No. of households living in a building	-
Water use practices			
Private water connection	0.43 (0.49)	1 = private water tap is primary water source; 0 = otherwise	+
Expenditure on water	4.42 (6.69)	Monthly water expenditure in 100 cedis per household	+
Sanitation practices			
Expenditure on sanitation	2.15 (3.53)	Monthly sanitation expenditure in 100 cedis per household	+
Satisfaction level	0.13 (0.34)	1 = respondent was very satisfied with current sanitation system; 0 = otherwise	-
Quality of interview			
Other people listening	0.28 (0.45)	1 = other people were listening during the interview; 0 = otherwise	?

* 34% of respondents answered they knew about KVIP; while 16% of respondents answered they knew about sewer system.

** $1.00= ¢350 (1989)

Table 6.4
Alternative Models for WTP Bids for KVIPs

Independent variables	Maximum WTP bids (OLS)				Known WTP intervals (Stewart ML)				Ordering of alternatives (Ordered probit)			
	[C]		[R]		[C]		[R]		[C]		[R]	
Intercept	255.6		200.1		294.7		218.7		-0.552		-0.736	
	(4.672)	***	(6.388)	***	(4.985)	***	(3.756)	***	(-2.299)	**	(-4.474)	***
Questionnaire Design												
Starting value of Iterative bidding	48.8		47.2		54.9		56.0		0.146		0.151	
	(2.604)	***	(2.589)	***	(3.038)	***	(4.207)	***	(1.739)	*	(1.815)	**
Time to think	-6.0		-15.0		-8.0		-1.9		-0.021		0.002	
	(-0.220)		(-0.562)		(-0.240)		(-0.042)		(-0.161)		(0.016)	
Respondent's characteristics												
Sex	-4.4		—		17.6		—		-0.047		—	
	(-0.175)		—		(-0.584)		—		(-0.408)		—	
Age	-0.9		—		-1.7		—		-0.005		—	
	(-1.101)		—		(-1.461)		—		(-1.247)		—	
Household head	14.5		—		0.4		—		0.002		—	
	(0.473)		—		(0.015)		—		(0.013)		—	
Owner of house	238.8		232.2		310.3		300.3		0.826		0.805	
	(6.854)	***	(6.991)	***	(7.116)	***	(10.099)	***	(5.074)	***	(5.169)	***
Religion	16.8		—		39.9		—		0.107		—	
	(0.745)		—		(1.182)		—		(1.032)		—	
Knowledge	-5.5		—		-3.0		—		-0.010		—	
	(-0.261)		—		(-0.214)		—		(-0.107)		—	
Household characteristics												
Household income (¢10,000)	42.6		42.7		54.1		55.5		0.144		0.147	
	(7.624)	***	(8.135)	***	(5.960)	***	(6.304)	***	(5.336)	***	(5.981)	***
Wealth (¢10,000)	0.1		—		0.2		—		0.001		—	
	(0.388)		—		(1.064)		—		(1.099)		—	
Years of education	4.8		5.3		8.5		8.3		0.023		0.021	
	(2.228)	**	(2.847)	***	(2.496)	***	(2.604)	***	(2.341)	***	(2.426)	***
Trader	-38.3		-25.1		-64.8		51.0		-0.175		-0.140	
	(-1.664)	*	(-1.291)		(2.583)	***	(-1.802)	*	(-1.712)	*	(-1.577)	
Office worker	-11.5		—		-38.5		—		-0.102		—	
	(-0.425)		—		(-1.344)		—		(-0.823)		—	

Table 6.4
Alternative Models for WTP Bids for KVIPs *(continued)*

Independent variables	Maximum WTP bids (OLS)				Known WTP intervals (Stewart ML)				Ordering of alternatives (Ordered probit)			
	[C]		[R]		[C]		[R]		[C]		[R]	
Housing characteristics												
Multistory housing	-60.7		-83.8		-50.5		-50.3		-0.134		—	
	(-2.094)	**	(-3.183)	***	(-2.051)	**	(-3.487)	***	(-0.956)		—	
Landlord living in the house	40.5		44.2		60.7		60.8		0.162		0.158	
	(2.029)	**	(2.289)	***	(4.909)	***	(2.352)	***	(1.815)	*	(1.805)	*
Number of households	-2.0		—		-4.4		-4.6		-0.012		-0.014	
	(-1.334)		—		(-1.842)	*	(-1.910)	*	(-1.817)	*	(-2.338)	*
Water use practices												
Private water connection	102.4		89.6		184.4		189.3		0.493		0.527	
	(4.587)	***	(4.179)	***	(5.959)	***	(5.444)	***	(4.749)	***	(5.379)	***
Expenditure on water (¢100)	NA		NA		NA		NA		NA		NA	
	—		—		—		—		—		—	
Sanitation practices												
Expenditure on sanitation (¢100)	28.2		28.0		28.8		28.4		0.077		0.075	
	(9.826)	***	(9.978)	***	(5.932)	***	(5.870)	***	(6.046)	***	(6.075)	***
Satisfaction level	-134.8		-146.5		-325.2		-322.7		-0.863		-0.824	
	(-2.808)	***	(-3.186)	***	(-4.369)	***	(-3.604)	***	(-3.315)	***	(-3.171)	***
Quality of interview												
Other people listening	-3.6		—		23.3		20.5		0.062		—	
	(-0.169)		—		(1.771)	*	(1.130)		(0.656)		—	
No. of observations	813		852		813		813		813		813	
R-square	0.339		0.330		—		—		—		—	
Adjusted R-square	0.322		0.321		—		—		—		—	
F-value	20.323		37.599		—		—		—		—	
Prob>F	0.000		0.000		—		—		—		—	
% predicted correctly	—		—		—		—		56%		55%	

Note; Values in ( ) indicate calculated t-statistics for coefficients. Two-tailed test were used.
***, **, and * indicate 1, 5, and 10% significant level, respectively.
[C] = Model with complete set of explanatory variables
[R] = Model with restricted set of explanatory variables

Table 6.5
Alternative Models for WTP Bids for WCs with Sewers

Independent variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Intercept	452.2	474.5	575.9	556.5	0.214	0.135
	(6.387) ***	(8.393) ***	(20.241) ***	(21.951) ***	(0.572)	(0.513)
Questionnaire Design						
Starting value of Iterative bidding	59.8	61.4	88.4	86.7	0.234	0.220
	(2.295) **	(2.371) ***	(2.463) ***	(2.086) **	(1.830) *	(1.774) *
Time to think	-24.0	-13.9	-29.3	-10.5	-0.080	-0.024
	(-0.849)	(-0.499)	(-1.022)	(-0.336)	(-0.565)	(-0.179)
Respondent's characteristics						
Sex	-14.1	—	-26.9	—	-0.072	—
	(-0.418)	—	(-0.752)	—	(-0.398)	—
Age	-3.7	-3.6	-6.2	-5.6	-0.016	-0.128
	(-3.007) ***	(-3.181) ***	(-4.006) ***	(-3.854) ***	(-2.551) ***	(-2.329) ***
Household head	-34.2	—	-64.4	—	-0.175	—
	(-0.836)	—	(-1.542)	—	(-0.817)	—
Owner of house	303.1	330.0	499.6	252.1	1.264	1.293
	(6.119) ***	(6.969) ***	(7.050) ***	(6.606) ***	(4.725) ***	(5.204) ***
Religion	97.4	89.1	166.3	153.9	0.439	0.368
	(3.051) ***	(2.860) ***	(4.228) ***	(3.941) ***	(2.783) ***	(2.478) ***
Knowledge	56.7	—	103.6	112.2	0.26	—
	(1.398)	—	(3.362) ***	(3.120) ***	(1.250)	—
Household characteristics						
Household income (¢10,000)	47.4	50.9	70.8	75.4	0.186	0.189
	(6.085) ***	(6.736) ***	(4.732) ***	(5.220) ***	(4.063) ***	(4.669) ***
Wealth (¢10,000)	0.5	—	0.9	—	0.002	—
	(2.904) ***	—	(2.561) ***	—	(2.553) ***	—
Years of education	0.5	—	0.3	—	0.001	—
	(0.186)	—	(0.062)	—	(0.048)	—
Trader	-72.8	-79.6	-118.1	-117.3	-0.316	-0.281
	(-2.274) **	(-2.688) **	(-4.289) ***	(-3.140) ***	(-1.796) *	(-2.083) **
Office worker	-85.6	-67.7	-85.2	-54.5	-0.230	—
	(-2.272) **	(-1.859) *	(-2.433) ***	(-1.341)	(-1.136)	—

Table 6.5
Alternative Models for WTP Bids for WCs with Sewers *(continued)*

Independent variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Housing Characteristics						
Multistory housing	-45.7 (-1.385)	— —	-27.8 (-2.122) **	-25.0 (-0.605)	-0.081 (-0.486)	— —
Landlord living in the house	25.7 (0.921)	— —	-5.7 (-0.223)	— —	-0.015 (-0.113)	— —
Number of households	-4.1 (-1.978) **	-5.7 (-3.013) **	-9.2 (-2.686) ***	-10.4 (-3.072) ***	-0.024 (-2.535) ***	-0.028 (-3.292) ***
Water use practices						
Private water connection	NA —	NA —	NA —	NA —	NA —	NA —
Expenditure on water (¢100)	0.9 (0.291)	— —	5.0 (0.860)	— —	0.013 (0.284)	— —
Sanitation practices						
Expenditure on sanitation (¢100)	26.5 (7.527) ***	25.6 (7.360) ***	32.3 (4.335) ***	31.9 (4.291) ***	0.084 (4.661) ***	0.079 (4.939) ***
Satisfaction level	-170.0 (-2.984) ***	-132.7 (-2.470) ***	-400.7 (-3.545) ***	-408.4 (-3.588) ***	-1.086 (-2.624) ***	-0.921 (-2.239) ***
Interview context						
Other people listening	9.3 (0.319)	— —	47.4 (4.269) ***	46.0 (2.781) ***	0.125 (0.897)	— —
n	401	401	402	402	402	402
R-square	0.448	0.427	—	—	—	—
Adjusted R-square	0.419	0.410	—	—	—	—
F-value	15.433	26.376	—	—	—	—
Prob>F	0.000	0.000	—	—	—	—
% predicted correctly	—	—	—	—	62%	59%

Note; Values in ( ) indicate calculated t-statistics for coefficients. Two-tailed test were used.
***, **, and * indicate 1, 5, and 10% significant level, respectively.
[C] = Model with complete set of explanatory variables
[R] = Model with restricted set of explanatory variables

Table 6.6
Alternative Models for WTP Bids for Sewers

Independent variables	Maximum WTP bids (OLS)				Known WTP intervals (Stewart ML)				Ordering of alternatives (Ordered probit)			
	[C]		[R]		[C]		[R]		[C]		[R]	
Intercept	249.4		288.2		270.2		300.2		-0.567		-0.292	
	(2.496)	***	(5.322)	***	(2.113)	**	(2.962)	***	(-1.312)		(-1.244)	
Questionnaire design												
Starting value of iterative bidding	88.4		83.2		129.0		113.0		0.301		0.231	
	(2.395)	***	(2.328)	***	(2.682)	***	(2.759)	***	(1.808)	*	(1.456)	
Time to think	-72.7		-95.0		-111.5		-117.2		-0.253		0.292	
	(-1.910)	*	(-2.661)	***	(-1.882)	*	(-2.154)	**	(-1.555)		(-1.821)	*
Respondent's characteristics												
Sex	31.5		—		63.2		53.2		0.147		—	
	(0.731)		—		(1.688)	*	(1.130)		(0.783)		—	
Age	-1.1		—		1.5		—		-0.003		—	
	(-0.628)		—		(-0.670)		—		(-0.366)		—	
Household head	77.2		—		167.2		166.0		0.391		0.337	
	(1.285)		—		(3.798)	***	(3.996)	***	(1.726)	*	(1.707)	*
Owner of house	119.7		—		336.2		273.4		0.759		0.501	
	(1.538)		—		(3.564)	***	(3.885)	***	(2.203)	**	(1.867)	*
Religion	-3.9		—		43.7		—		0.081		—	
	(-0.049)		—		(0.833)		—		(0.236)		—	
Knowledge	99.6		103.8		141.0		172.3		0.33		0.429	
	(2.326)	***	(2.588)	***	(3.396)	***	(4.155)	***	(1.807)	*	(2.578)	***
Household characteristics												
Household income (¢10,000)	52.8		58.8		48.1		57.2		0.111		0.135	
	(4.886)	***	(6.713)	***	(2.558)	***	(3.308)	***	(2.085)	**	(2.959)	***
Wealth (¢10,000)	-0.1		—		-0.2		—		-0.000		—	
	(-0.300)		—		(-0.682)		—		(-0.564)		—	
Years of education	2.2		—		3.5		—		0.009		—	
	(0.533)		—		(0.551)		—		(0.416)		—	
Trader	47.4		—		45.1		—		0.106		—	
	(1.029)		—		(1.144)		—		(0.499)		—	
Office worker	89.8		73.6		128.2		98.4		0.291		—	
	(1.907)	*	(1.986)	**	(3.968)	***	(3.623)	***	(1.349)		—	

Table 6.6
Alternative Models for WTP Bids for Sewers *(continued)*

Independent variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Housing characteristics						
Multistory housing	117.4	114.3	117.2	—	0.273	—
	(2.331) ***	(2.042) ***	(1.935) *	—	(1.283)	—
Landlord living in the house	-43.1	—	-77.3	-43.5	-0.167	—
	(-1.074)	—	(-2.098) **	(-3.588) **	(-0.944)	—
Number of households	-10.7	-11.6	-17.2	-12.8	-0.0396	-0.032
	(-3.073) ***	(-3.513) ***	(-2.830) ***	(-2.863) ***	(-2.585) ***	(-2.767) ***
Water use practices						
Private water connection	NA	NA	NA	NA	NA	NA
	—	—	—	—	—	—
Expenditure on water (¢100)	2.1	—	8.2	—	0.019	—
	(0.722)	— **	(1.577)	—	(1.385)	—
Sanitation practices						
Expenditure on sanitation (¢100)	81.6	91.2	170.4	202.7	0.393	0.452
	(2.922) ***	(3.422) ***	(3.636) ***	(3.698) ***	(2.207) **	(2.761) ***
Satisfaction level	-82.4	-73.8	-172.3	-162.6	-0.400	-0.337
	(-2.037) **	(-1.888) *	(4.025) ***	(-4.426) ***	(-2.156) **	(-1.900) *
Interview context						
Other people listening	46.3	—	82.9	64.4	0.191	—
	(1.082)	—	(5.245) ***	(4.811) ***	(1.051)	—
n	274	274	275	275	275	275
R-square	0.342	0.323	—	—	—	—
Adjusted R-square	0.290	0.300	—	—	—	—
F Value	6.606	14.073	—	—	—	—
Prob>F	0.000	0.000	—	—	—	—
% predicted correctly	—	—	—	—	59%	57%

Note; Values in ( ) indicate calculated t-statistics for coefficients. Two-tailed test were used.
***, **, and * indicate 1, 5, and 10% significant level, respectively.
[R] = Model with restricted set of explanatory variables
[C] = Model with complete set of explanatory variables

Table 6.7
Alternative Models for WTP Bids for Water

Independent variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Intercept	296.4	243.1	431.1	320.5	-0.182	-0.534
	(4.124) ***	(7.581) ***	(5.343) ***	(5.587) ***	(-0.585)	(-3.394)
Questionnaire design						
Starting value of Iterative bidding	-9.9	-1.8	-27.3	-25.2	-0.071	-0.068
	(-0.370)	(-0.070)	(-0.758)	(-0.598)	(-0.578)	(-0.575)
Respondent's characteristics						
Sex	-17.2	—	-22.4	—	-0.059	—
	(-0.475)	—	(-0.533)	—	(-0.364)	—
Age	-0.5	—	-2.0	—	-0.005	—
	(-0.398)	—	(-1.278)	—	(-0.979)	—
Household head	32.3	—	45.1	—	0.115	—
	(0.709)	—	(1.159)	—	(0.553)	—
Owner of house	228.1	229.0	306.6	295.1	0.784	0.741
	(4.751) ***	(5.178) ***	(5.045) ***	(6.669) ***	(3.676) ***	(3.895) ***
Religion	-63.5	-62.5	-92.1	-89.8	-0.237	—
	(-2.709) **	(-2.221) **	(-2.211) **	(-4.414) ***	(-1.609)	—
Household characteristics						
Household income (¢10,000)	34.7	38.5	43.6	51.3	0.113	0.128
	(4.183) ***	(5.173) ***	(3.185) ***	(3.084) ***	(2.860) ***	(3.516) ***
Wealth (¢10,000)	0.4	—	0.9	—	0.002	—
	(1.971) **	—	(2.225) **	—	(1.924) *	—
Years of education	7.4	7.4	10.4	11.0	0.027	0.029
	(2.393) **	(2.831) ***	(2.162) **	(2.335) **	(1.904) *	(2.292) **
Trader	-52.2	—	-111.5	-81.6	-0.290	-0.286
	(-1.602)	—	(-2.534) **	(-1.963) **	(-2.029) **	(-1.491)
Office worker	-1.6	—	-31.7	—	-0.090	—
	(-0.041)	—	(-0.712)	—	(-0.514)	—

Table 6.7
Alternative Models for WTP Bids for Water *(continued)*

Independent variables	Maximum WTP bids (OLS)				Known WTP intervals (Stewart ML)				Ordering of alternatives (Ordered probit)			
	[C]		[R]		[C]		[R]		[C]		[R]	
Characteristics												
Multistory housing	-96.5 (-1.760)	*	-119.3 (-2.396)	**	-228.8 (-4.575)	***	-227.2 (-8.044)	***	-0.571 (-2.413)	**	-0.606 (-2.531)	**
Landlord living in the house	-12.8 (-0.462)		— —		-1.8 (-0.073)		— —		-0.003 (-0.022)		— —	
Number of households	0.7 (0.330)		— —		0.1 (0.036)		— —		0.0003 (0.034)		— —	
Water use practices												
Private water connection	NA —		NA —		NA —		NA —		NA —		NA —	
Expenditure on water (¢100)	33.5 (12.498)	***	32.3 (12.483)	***	34.2 (5.249)	***	34.1 (5.265)	***	0.088 (5.092)	**	0.087 (5.112)	**
Sanitation practices												
Expenditure on sanitation (¢100)	12.9 (3.166)	***	13.9 (3.560)	***	13.7 (1.993)	**	13.8 (2.047)	**	0.035 (2.017)	**	0.034 (2.062)	**
Satisfaction level	-102.6 (-1.126)		— —		-230.5 (-2.930)	***	-177.0 (-14.055)	***	-0.636 (-1.562)		— —	
Interview context												
Other people listening	-15.6 (-0.518)		— —		-15.6 (-0.839)		— —		-0.041 (-0.283)		— —	
n	407		426		407		407		407		407	
R-square	0.488		0.475		—		—		—		—	
Adjusted R-square	0.464		0.465						—		—	
F Value	20.596		47.211		—		—		—		—	
Prob>F	0.000		0.000		—		—		—		—	
% predicted correctly	—		—		—		—		53%		54%	

Note; Values in ( ) indicate calculated t-statistics for coefficients. Two-tailed test were used.
***, **, and * indicate 1, 5, and 10% significant level, respectively.
[C] = Model with complete set of explanatory variable
[R] = Model with restricted set of explanatory variable

Table 6.8
Alternative Models for WTP Bids for Water and WC

Independent variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Intercept	471.8	478.1	456.0	344.7	-0.582	-0.571
	(4.585) ***	(11.222) ***	(4.062) ***	(4.245) ***	(-1.835) *	(-4.356) ***
Questionnaire design						
Starting value of	62.6	55.3	59.8	78.9	0.129	0.098
Iterative bidding	(1.638)	(1.516)	(1.965) **	(1.309)	(1.020)	(0.833)
Respondent's characteristics						
Sex	-38.9	—	17.8	—	0.044	—
	(-0.740)	—	(0.365)	—	(0.258)	—
Age	-0.3	—	-1.3	—	-0.002	—
	(-0.186)	—	(-0.598)	—	(-0.353)	—
Household Head	32.6	—	140.2	131.5	0.271	—
	(0.504)	—	(2.609) ***	(3.524) ***	(1.311)	—
Owner of house	423.9	407.6	577.0	539.5	1.047	0.976
	(6.354) ***	(6.505) ***	(5.357) ***	(6.784) ***	(5.097) ***	(5.441) ***
Religion	-77.5	-87.3	-75.2	-77.9	-0.158	—
	(-1.766) *	(-2.153) **	(-1.952) *	(-2.699) ***	(-1.045)	—
Knowledge	53.5	—	96.3	99.3	0.182	—
	(0.856)	—	(4.157) ***	(4.452) ***	(0.184)	—
Household characteristics						
Household income (¢10,000)	56.1	61.1	81.9	83.8	0.152	0.173
	(4.628) ***	(5.728) ***	(4.208) ***	(4.631) ***	(3.567) ***	(4.617) ***
Wealth (¢10,000)	0.0	—	0.2	—	0.000	—
	(-0.078)	—	(0.436)	—	(0.462)	—
Years of education	5.0	—	12.7	14.0	0.023	—
	(1.154)	—	(1.852) *	(2.161) **	(1.606)	—
Trader	-25.1	—	-60.0	—	-0.105	—
	(-0.538)	—	(-1.399)	—	(-0.705)	—
Office worker	82.9	—	70.6	95.8	0.133	—
	(1.530)	—	(2.146) **	(6.168) ***	(0.739)	—

Table 6.8
Alternative Models for WTP Bids for Water and WC *(continued)*

Independent Variables	Maximum WTP bids (OLS)		Known WTP intervals (Stewart ML)		Ordering of alternatives (Ordered probit)	
	[C]	[R]	[C]	[R]	[C]	[R]
Housing characteristics						
Multistory housing	-126.5 (-1.596)	— —	-290.9 (-6.860) ***	-303.0 (-8.888) ***	-0.532 (-2.116) **	-0.556 (-2.128) **
Landlord Living in the house	-26.5 (-0.666)	— —	-40.6 (-1.629)	— —	-0.074 (-0.528)	— —
Number of households	1.6 (0.520)	— —	-1.0 (-0.201)	— —	-0.002 (-0.209)	— —
Water use practices						
Private water connection	NA —	NA —	NA —	NA —	NA —	NA —
Expenditure on water (¢100)	51.7 (11.025) ***	50.8 (11.218) ***	63.6 (6.666) ***	62.2 (6.600) ***	0.117 (7.514) ***	0.116 (8.317) ***
Sanitation practices						
Expenditure on sanitation (¢100)	31.6 (5.558) ***	32.8 (5.982) ***	35.6 (3.543) ***	37.1 (3.756) ***	0.066 (3.498) ***	0.064 (3.726) ***
Satisfaction level	-3.5 (-0.026)	— —	-311.8 (-3.772) ***	-265.2 (-10.072) ***	-0.702 (-1.294)	— —
Interview context						
Other people listening	-106.0 (-2.427) **	-103.0 (-2.477) **	-90.8 (-1.738) *	-86.5 (-1.614)	-0.165 (-1.100)	— —
n	404	423	404	404	404	404
R-square	0.467	0.448	—	—	—	—
Adjusted R-square	0.442	0.438			—	—
F Value	17.808	48.166	—	—	—	—
Prob>F	0.000	0.000	—	—	—	—
% predicted correctly	—	—	—	—	59%	57%

Note; Values in ( ) indicate calculated t-statistics for coefficients. Two-tailed test were used.
***, **, and * indicate 1, 5, and 10% significant level, respectively.
[C] = Model with complete set of variables
[R] = Model with restricted set of variables

6.4 Tests of reliability and accuracy of willingness-to-pay bids

An obvious and important issue is whether the responses to the contingent valuation questions are reliable and accurate reflections of households' true preferences for improved sanitation services. It is impossible to know with complete certainty whether households' answers would be accurate predictors of behavior if respondents were actually confronted with the choices posed in the questionnaire, but different tests were carried out to check the reliability and accuracy of the WTP bids. None of these tests or checks (described below) provides any basis for believing that respondents gave implausible or hypothetical answers, or that they acted strategically. In general, the WTP models appear quite robust and the bids are systematically related to the variables that would be expected to explain demand based on economic theory.

6.4.1 Plausibility of the willingness-to-pay bids

One possible result of a contingent valuation study is that the respondents could give wildly unrealistic answers or simply refuse to answer the WTP questions. As an initial step in assessing the reliability and accuracy of WTP bids, it is important to note that this did not happen in Kumasi. Very few people refused to be interviewed, and of those who were interviewed, almost no one indicated an unwillingness to pay for improved sanitation services (i.e., bid zero). If substantial numbers of respondents gave "much higher" bids than the mean, this too would raise questions about whether their bids accurately reflected real budget constraints or whether they might be answering strategically. This did not happen either. Very few respondents gave WTP bids more than twice as much as the mean bid. Most respondents bid more for improved sanitation than they presently paid for their existing sanitation service. A simple consistency check of the data was made to compare each household's WTP bid with its current expenditure on sanitation (and, for some households, on water) to see which was greater (Table 6.9). Consider households which have water but not a WC. Seventy-five percent of these respondents gave bids for KVIPs that exceed their present sanitation expenditures. On the average, their present expenditures are $0.47 per month, and their average bids exceeded this amount by $1.00 per month. A similar pattern exists for all the proposed services. About 88 percent of all households said they were willing to pay for improved sanitation at least as much as the amounts they were currently spending.

About 12 percent of all respondents gave bids below their present expenditures; the majority of these use the public latrines. These respondents were asked an open-ended question about why they were willing to pay an amount less than their current expenditure. About 60 percent cited problems with cash flow. At present, since they pay for sanitation daily, these households are never confronted with a large bill for this service. However, with an improved system, the need to make a single monthly payment would pose problems. These results suggest that even the WTP bids of respondents who bid less than their current expenditure may be plausible (Whittington, 1990b).

Table 6.9
Comparision of WTP with Present Expenditures

	Percent (frequency) of households	Average* present expenditure	Average WTP* bid less average present expenditure
Households with water and without a WC			
WTP for KVIP > Current Expenditure	75	0.47	1.00
WTP for KVIP = Current Expenditure	12	0.73	0.00
WTP for KVIP < Current Expenditure	13	2.43	–1.43
WTP for WC + Sewer > Current Expenditure	75	0.50	1.06
WTP for WC + Sewer = Current Expenditure	11	0.65	0.00
WTP for WC + Sewer < Current Expenditure	14	2.25	–1.29
Households with a WC			
WTP for Sewer > Current Expenditure	97	0.08	1.26
WTP for Sewer = Current Expenditure	2	0.00	0.00
WTP for Sewer < Current Expenditure	1	0.31	–0.16
Households without water and without a WC			
WTP for Water > Current Expenditure on Water	67	0.62	1.10
WTP for Water = Current Expenditure on Water	15	1.13	0.00
WTP for Water < Current Expenditure on Water	18	2.43	–1.11
WTP for KVIP > Current Expenditure on Sanitation	74	0.57	1.16
WTP for KVIP = Current Expenditure on Sanitation	12	1.18	0.00
WTP for KVIP < Current Expenditure on Sanitation	14	1.89	–0.84
WTP for Water + WC with Sewer > Current Expenditure on Water and Sanitation	89	0.73	2.00
WTP for Water + WC with Sewer = Current Expenditure on Water and Sanitation	4	0.35	0.00
WTP for Water + WC with Sewer < Current Expenditure on Water and Sanitation	7	2.16	–0.86

* $/ month

6.4.2 Explanatory power of the models of the determinants of the WTP bids

The adjusted R^2 values for the restricted OLS models in Tables 6.4-6.8 range from 0.32 for sewer to 0.47 for water. Although these R^2 values indicate that much of the variation in the WTP bids cannot be explained by the models, these values are quite high for cross-section data from contingent valuation surveys and compare very favorably with the results of contingent valuation studies carried out in the United States and Western Europe. For example, Mitchell and Carson (1989) suggest that "the reliability of a CV study which fails to show an R^2 of at least 0.15, using only a few key variables, is open to question." These results from Kumasi clearly pass Mitchell and Carson's proposed standard.

6.4.3 Test for starting-point bias

If a respondent's WTP bid reflects his or her "true" value of the good or service, then it should not matter what initial amount (or "starting point") the enumerator uses to begin the bidding game. Figure 6.2 suggests that the starting point does indeed affect respondents' final bids for all five types of service, but that the magnitude of the effect is not large. For example, a high starting point raises the average respondent's WTP bid for KVIPs by about 67 cedis per month, which is about 13 percent of the mean bid. Figure 6.3 shows the frequency distribution of responses to the open-ended WTP question for KVIPs. Forty-one percent of the respondents' WTP bids fall into the two ranges (451-500 and 951-1,000) which include the two starting points (viz. 500 cedis and 1,000 cedis per month). For example, for bids in the range 451-500, substantial numbers of households gave responses which were as follows:

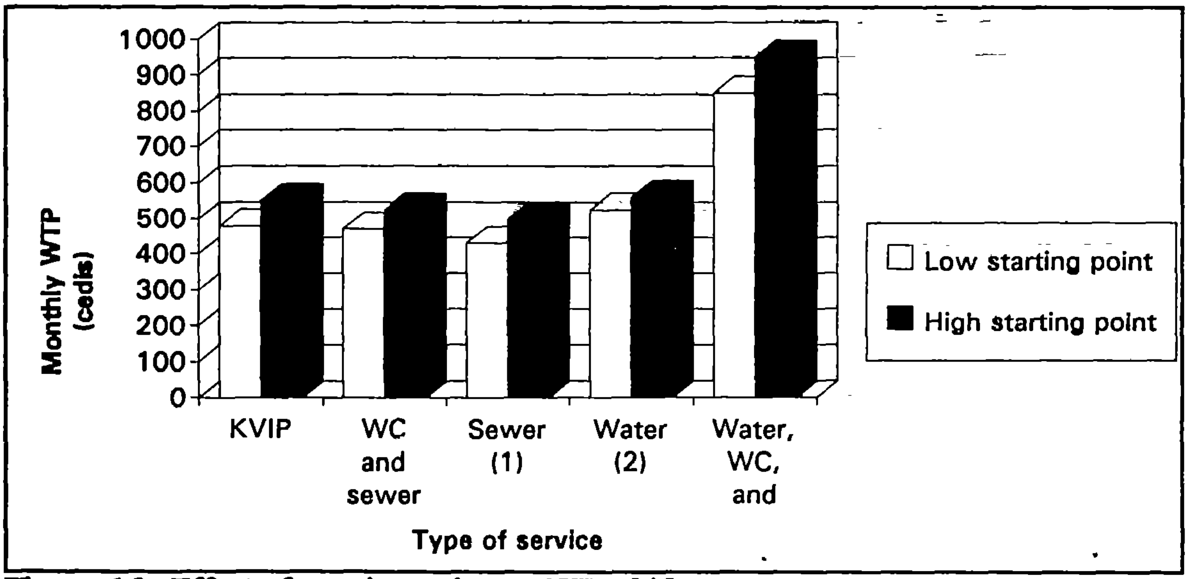


Figure 6.2 Effect of starting point on WTB bids

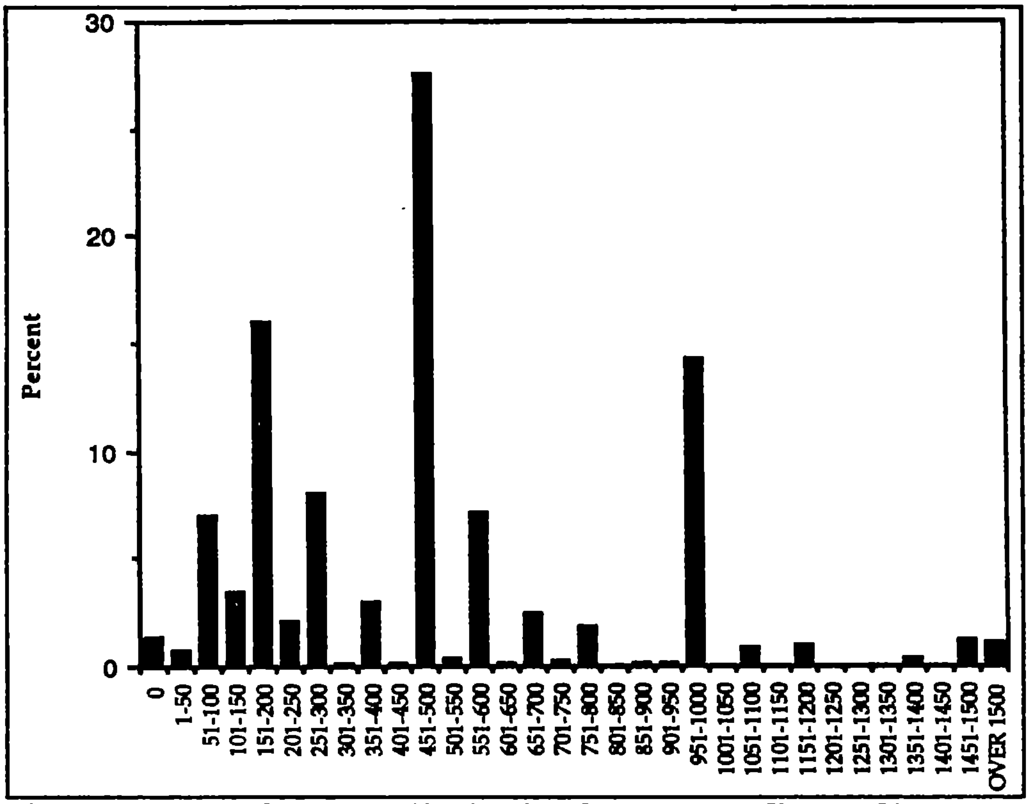


Figure 6.3 WTP frequency distribution for KVIP (cedis/month)

Question	Response
[Low starting point]	
1. If the price were 500 cedis per month, would you want to have access to a KVIP latrine?	Yes
2. What is the most you would be willing to pay per month?	500 cedis

or

Question	Response
[High starting point]	
1. If the price were 1000 cedis per month, would you want to have access to a KVIP latrine?	No

2. If the price were 500 cedis per month, would you want to have access to a KVIP latrine?	Yes
3. What is the most you would be willing to pay per month?	500 cedis

The frequency distributions for WCs with sewer connections, sewer connections, and water, show similar patterns. Respondents' answers tend to cluster around the 500 and 1000 cedis starting points. This suggests that the values mentioned in the bidding game influenced responses to the final open-ended question about maximum willingness to pay. Most respondents will not pay more than 500 cedis per month for any type of service; very few respondents are willing to pay more than 1000 cedis per month. However, for all three levels of sanitation service (i.e., excluding the bids for water), there are substantial numbers of respondents who indicate that their maximum willingness to pay is 150-250 cedis per month. In general, when a respondent answers "YES" when offered a service at a specified price, it is difficult to get him to raise his bid above this price by asking an open-ended follow-up question. On the other hand, if a respondent answers "NO" when offered the service at a specified price, an open-ended follow-up question may elicit a wide range of bids below the last specified price.

A more rigorous test of the effect of the starting point is provided by the multivariate analyses in which one of the variables (dichotomous) used to explain variation in the WTP bids indicates whether the respondent's starting point was high or low. The results of this test for starting point bias are summarized in Table 6.10. As shown, the results are mixed. Starting point bias is clearly present in the WTP bids for improved sanitation services (i.e., for KVIP, WC with sewer connection, sewer connection), but there is no evidence that the starting point affects the WTP bids for water. When improved water and sewer are offered together as a package of services, there is little evidence of starting point bias. One interpretation of these results is that respondents had a clearer sense of the value of water than of improved sanitation services and were thus less likely to be influenced by the proposed starting point.

6.4.4 Effect of giving respondents time to think

A test was carried out to determine whether respondents' WTP bids were affected by having time to reflect before giving their bids. Some respondents in the sample were given an extra day to think about how much they would be willing to pay for improved sanitation services; others answered the WTP questions immediately. (Due to logistical considerations, this test was carried out only for the subgroup of the sample who were tenants and had a private water connection). If having time to reflect did affect the answer, there are two main explanations for why this might occur (Whittington et al., 1992). First, the respondent might legitimately need time to carefully consider the financial and other ramifications of his or her decision. If this is the case, researchers conducting contingent valuation studies should always give respondents time to think in order to obtain the most accurate indications of household preferences. Second, respondents might use the extra

Table 6.10
Effect of Starting Point

	Full model	Restricted model
WTP for KVIP		
OLS	***	***
Stewart maximum likelihood	***	***
Ordered probit	*	*
WTP for WC with sewer		
OLS	**	***
Stewart maximum likelihood	***	**
Ordered probit	*	*
WTP for sewer connection		
OLS	***	***
Stewart maximum likelihood	***	***
Ordered probit	*	Not significant
WTP for water connection		
OLS	Not significant	Not significant
Stewart maximum likelihood	Not significant	Not significant
Ordered probit	Not significant	Not significant
WTP for water connection and WC with sewer		
OLS	Not significant	Not significant
Stewart maximum likelihood	**	Not significant
Ordered probit	Not significant	Not significant

Table entries indicate the level of significance of "starting point" as an explanatory variable.
***, **, and * indicate 1 percent, 5 percent, and 10 percent significance levels, respectively.

time to talk to their neighbors and strategize. If this were the case, the WTP bids of respondents who had time to think would be less accurate indications of their true preferences. In both cases, one might expect that respondents who were given time to think would bid lower than respondents who answered immediately.

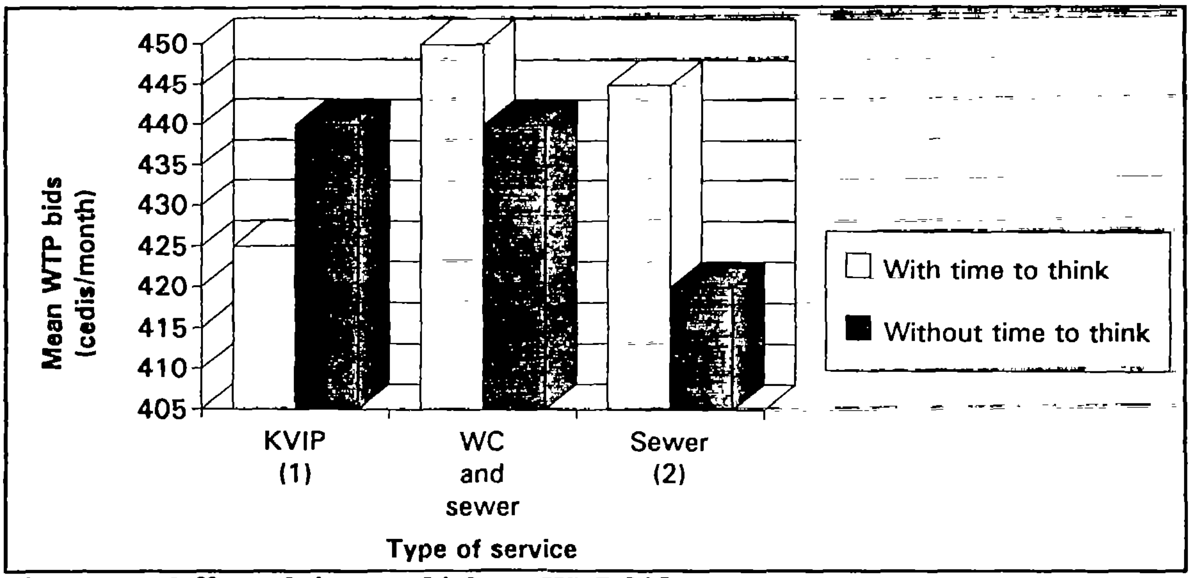


Figure 6.4 Effect of time to think on WTP bids

In fact, in this study there is little evidence that giving respondents time to think influenced their WTP bids. Figure 6.4 compares the mean bids of respondents who had time to think and those that did not for three classes of WTP bids (KVIP, WC with sewer, and sewer).

There appears to be almost no difference in the mean bids of the two groups for any of the levels of sanitation service. The results of the time-to-think test from the multivariate analyses are summarized in Table 6.11. The time-to-think variable shows no effect on the bids for KVIPs or for WCs with sewer connection for any of the three estimators or two model specifications.

The time-to-think variable is significant only for the bids for sewer connections by households with WCs; respondents who had extra time bid less than those that did not. This may mean that the more that people thought about sewer technology, the less influenced they were by the enumerator's description of it, and the less they liked it. However, the effect of time to think is not strong in three of the six models for sewer connections, and not apparent at all in one model. The absence of a time-to-think effect in two of the three groups of WTP bids (see Table 6.11) does not mean that the WTP bids are necessarily accurate, but it does indicate that the results are robust with respect to the way that the household interviews were conducted. The possibility of strategic bias resulting from giving respondents time to think can be ruled out. The fact that respondents gave consistent answers when they had time to think and when they did not increases confidence in the reliability of the results.

Table 6.11
Effect of Giving Respondents Time to Think

	Full model	Restricted model
WTP for KVIP		
OLS	Not significant	Not significant
Stewart maximum likelihood	Not significant	Not significant
Ordered probit	Not significant	Not significant
WTP for WC with sewer		
OLS	Not significant	Not significant
Stewart maximum likelihood	Not significant	Not significant
Ordered probit	Not significant	Not significant
WTP for sewer connection		
OLS	*	***
Stewart maximum likelihood	*	**
Ordered probit	Not significant	*
WTP for water connection		
	Not appplicable	Not applicable
WTP for water connection and WC with sewer		
	Not applicable	Not applicable

Table entries indicate the level of significance of "time to think" as an explanatory variable.
***, **, and * indicate 1 percent, 5 percent, and 10 percent significance levels, respectively.

6.4.5 Effect of the presence of people listening to the interview

Ideally each respondent would have been interviewed without other people listening. However, due to the crowded housing conditions in Kumasi, many times this was not possible. In approximately one quarter of the interviews, other adults listened as the interview was conducted. This fact was noted by the enumerator. It is possible that the presence of listeners may have biased a respondent's WTP bids, but the direction of the potential bias is unclear. Respondents may have been reluctant to indicate their ability to pay a large amount and may thus have bid low. Alternatively, they may have wanted to demonstrate their ability to pay to their neighbors and thus have bid high in an attempt to gain status.

A variable designed to test the effect of the presence of listeners was included in the multivariate analyses; the results are summarized in Table 6.12. As shown, the results are mixed and depend on the estimator used. The effect of listeners is never statistically significant in the ordered probit models and is statistically significant in only two of the OLS models (both cases are for water and WC with sewer connection). The effect of listeners shows up most strongly in the Stewart maximum likelihood models. The direction of the effect is not consistent. In the models of WTP bids for KVIP, for WC with sewer, and for sewer, it is positive, but in the models for water and for WC with sewer, it is negative. The parameter estimates are generally small.

We interpret these results to mean that the presence of listeners did not have much, if any, effect on the WTP bids. This suggests that the WTP bids are robust with respect to another variation in the interview context, and again increases confidence that WTP bids are not easily manipulated or influenced by contextual issues.

Table 6.12
Effect of the Presence of People Listening to the Interview

	Full model	Restricted model
WTP for KVIP		
OLS	Not significant	Not applicable
Stewart maximum likelihood	*	Not significant
Ordered probit	Not significant	Not applicable
WTP for WC with sewer		
OLS	Not significant	Not applicable
Stewart maximum likelihood	***	***
Ordered probit	Not significant	Not applicable
WTP for sewer connection		
OLS	Not significant	Not applicable
Stewart maximum likelihood	***	***
Ordered probit	Not significant	Not applicable
WTP for water connection		
OLS	Not significant	Not applicable
Stewart maximum likelihood	Not significant	Not applicable
Ordered probit	Not significant	Not applicable
WTP for water connection and WC with sewer		
OLS	**	**
Stewart maximum likelihood	*	Not significant
Ordered probit	Not significant	Not applicable

Table entries indicate the level of significance of "other people listening" as an explanatory variable. ***, **, and * indicate 1 percent, 5 percent, and 10 percent significance levels, respectively.

7. Analysis of Policy Options

How can information on households' willingness to pay be used to improve the current practice of sanitation planning? By providing cost estimates for KVIPs and WCs with a sewerage system and then comparing these costs with what people are willing to pay for them, it can be seen that the costs of both options are greater than households' willingness to pay and that public subsidies will be required if substantial progress is to be made in improving Kumasi's sanitation situation. Given the pervasive externalities involved in the sanitation sector, it is not difficult in principle to justify some level of subsidy. The obvious questions, however, are what sanitation technologies should be subsidized and what level of subsidy should be provided, given the financial constraints facing municipal authorities? How should the subsidies be distributed, and what level of subsidy is required to buy significant improvements in environmental quality?

7.1 Costs of improved sanitation options

7.1.1 KVIPs

The cost of a KVIP depends on several factors. These facilities can be built in different sizes, depending on the number of people they are designed to serve. As the number served increases, the number of cubicles and both the number and capacity of holding pits must also increase. There are economies of scale in the construction of KVIPs, so the cost per household will decrease as the number of households in an apartment building using a KVIP increases.

Households living in multifamily buildings would not each have their own KVIP; rather, they would share a latrine with other households. In Kumasi, it is assumed that up to eight households can share a single KVIP "module" (i.e., one hole with one pit in use and another hole with a second pit not in use). Although the size of a module's pits can be reduced for fewer than eight households, the cost savings are not large. Queue times, however, may be reduced as fewer households share a KVIP module, so there may be perceptible differences in the level of service provided by a KVIP serving, say, four households compared to one serving eight.

Table 7.1 shows the number of KVIP modules required in an apartment building for the assumed number of households and the estimated capital costs. For example, an apartment building with ten households would need two modules which would cost a total of about $600. Capital costs range from $250 for a one-module KVIP which serves a single household to $2,000 for a six-module facility that serves 45 households. The cost per household declines rapidly over the range of one to ten households (from $250 to $60). As the number of households increases above ten, cost per household continues to fall, but not as much. The respective costs per household for 20 and 45 families are $52 and $44.

Table 7.1
Capital Costs of New KVIPs

No. of households in building	No. of KVIPs to be installed	Total capital cost for entire building	Cost per household	Cost per KVIP module
1	1	$250	$250	$250
5	1	$393	$79	$393
10	2	$599	$60	$300
15	2	$829	$55	$415
20	3	$1,044	$52	$348
25	4	$1,248	$50	$312
30	4	$1,444	$48	$361
35	5	$1,633	$47	$327
40	5	$1,817	$45	$363
45	6	$1,997	$44	$333

Table 7.2
Capital Costs of Converting Existing Bucket Latrines to KVIPs

No. of households in building	No. of KVIPs to be installed	Total capital cost for entire building	Cost per household	Cost per KVIP module
1	1	$150	$150	$150
5	1	$236	$47	$236
10	2	$360	$36	$180
15	2	$497	$33	$249
20	3	$626	$31	$209
25	4	$749	$30	$187
30	4	$866	$29	$217
35	5	$980	$28	$196
40	5	$1,090	$27	$218
45	6	$1,198	$27	$200

Table 7.3
Capital Costs of Connecting Existing WCs to a New Sewer

No. of households in building	No. of WCs to be installed	Total capital cost for entire building	Cost per household	Cost per WC
1	1	$520	$520	$520
5	1	$2,400	$480	$2,400
10	2	$4,750	$475	$2,375
15	2	$7,100	$473	$3,550
20	3	$9,450	$473	$3,150
25	4	$11,800	$472	$2,950
30	4	$14,150	$472	$3,538
35	5	$16,500	$471	$3,300
40	5	$18,850	$471	$3,770
45	6	$21,200	$471	$3,533

If a building already has a bucket latrine, the cost of converting it to a KVIP would be less than constructing a new KVIP because the existing superstructure can still be used. Conversion of a bucket latrine to a KVIP essentially involves construction of pits and the installation of ventilation. The cost of converting a bucket latrine to a KVIP is approximately 60 percent of the cost of a new KVIP. Table 7.2 shows the capital costs of converting existing bucket latrines to KVIPs.

7.1.2 WCs connected to a sewer

The costs of providing WCs and sewerage are more difficult to estimate than the costs of KVIPs. The cost per household of the sewerage system (without treatment facilities) is probably on the order of $470-500 per household. To this must be added the cost of connecting apartment buildings to the sewer and installing WCs and indoor plumbing, where necessary. Table 7.3 presents estimates of the costs of constructing the sewerage system plus the cost of connecting apartment buildings that now have WCs to the sewerage system. Table 7.4 presents the capital costs of the sewerage system plus installation of new WCs for buildings that already have water. Table 7.5 presents similar information (i.e., for the sewerage system, building connections, and new WCs) for buildings presently without piped water. For buildings with piped water but without WCs, Table 7.4 shows that the costs per household vary from $720 (for a building with a single family) to $496 (for a building with 40 households). Since the majority of the costs in these cases is for the sewer system (not for installing WCs or connecting the building to the sewer), the cost per household is nearly the same for buildings with 5 or 45 families. For most size buildings, the cost per household of providing a WC connected to a sewer is about 11-17 times the cost of providing a household with a KVIP latrine if the building already has a bucket latrine, and 7-10 times the cost of providing a KVIP if the building does not have a bucket latrine.

Table 7.4
Capital Costs of Providing Sewered Service to Building with Water

No. of households in building	No. of WCs to be installed	Total capital cost for entire building	Cost per household	Cost per WC
1	1	$720	$720	$720
5	1	$2,600	$520	$2,600
10	2	$5,150	$515	$2,575
15	2	$7,500	$500	$3,750
20	3	$10,050	$503	$3,350
25	4	$12,600	$504	$3,150
30	4	$14,950	$498	$3,738
35	5	$17,500	$500	$3,500
40	5	$19,850	$496	$3,970
45	6	$22,400	$498	$3,733

Table 7.5
Capital Costs of Providing Sewered WC Service to Buildings without Water

No. of households in building	No. of WCs to be installed	Total capital cost for entire building	Cost per household	Cost per WC
1	1	$820	$820	$820
5	1	$2,700	$540	$2,700
10	2	$5,250	$525	$2,625
15	2	$7,600	$507	$3,800
20	3	$10,150	$508	$3,383
25	4	$12,700	$508	$3,175
30	4	$15,050	$502	$3,763
35	5	$17,600	$503	$3,520
40	5	$19,950	$499	$3,990
45	6	$22,500	$500	$3,750

Unlike the costs of KVIPs, the per household costs of WCs connected to a sewerage system are very dependent on the number of buildings which adopt the technology and connect to the system. For example, if only 20 percent of the apartment buildings in Kumasi decide to install KVIPs, the costs per building are no different than if 100 percent of the buildings installed KVIPs. However, if only 20 percent of the apartment buildings decide to connect to the sewerage system and they are scattered throughout the city, the costs per building are much greater than if all buildings connect.

The estimates presented in Tables 7.1-7.5 are for capital costs and do not include operation and maintenance costs. In this instance, the technology with high capital cost (WCs and sewerage) does not have correspondingly lower operation and maintenance costs. In fact, the monthly operation and maintenance cost for the WC and sewerage system would be substantially higher than for a KVIP latrine because a WC uses water and is more likely to break down. Thus, if operation and maintenance costs were included, the WC and sewerage system option would be relatively more expensive.

7.2 Matching supply and demand

This section of the chapter illustrate how information obtained from a contingent valuation survey of household demand for improved sanitation services can be used in the assessment of various sanitation options. The purpose is not to provide a detailed analysis of the choice between KVIPs and WCs with sewers in Kumasi, but rather to suggest the value of incorporating information on household demand for improved services in sanitation planning procedures.

This is not to suggest, however, that households' WTP bids accurately reflect the public health benefits of improved sanitation. If everyone in Kumasi used an improved sanitation system that disposed of excreta in a hygienic manner, the public health benefits would likely be large and would probably not be captured by households' responses to contingent valuation questions. This is because households are probably not fully aware of the health risks to which they are currently exposed by their existing sanitation practices (see Whittington et al., this issue). The WTP bids do appear to reflect households' *perceptions* of the value of improved sanitation options. Policy makers may not judge these perceptions to be accurate measures of welfare change. However, as is illustrated in the next section, to ignore households' perceptions of the value of improved sanitation options runs the risk of seriously miscalculating the financial feasibility of investments in improved sanitation.

A first step in a financial appraisal of improved sanitation alternatives in Kumasi is to compare the costs of KVIPs and WCs (with sewer connections) to household willingness to pay for the them. Such a comparison presents several difficulties. First, the WTP bids were obtained for single households, but tenant households cannot act independently; the landlord would decide whether or not to improve sanitation for the entire building. If a sewer system were constructed in the city, the landlord would decide whether or not to connect his building to it. Tenants may try to persuade the landlord to install an improved sanitation system, and they may promise to pay a certain amount each month toward the costs, but ultimately the decision rests with the landlord.

Second, the households in the building would all have to contribute to the cost of the new sanitation facility, similar to what is currently done in sharing water bills or paying for the emptying of bucket latrines. The problem is how to determine how much apartment buildings of different size (i.e., with different numbers of households) are willing to pay for improved sanitation. For purposes of illustration, it is assumed that the aggregate willingness to pay of households in an apartment building of a given size is equal to the average willingness to pay of households in apartment buildings of that size multiplied by the number of households in the building. The resulting WTP could be too high because it might not be possible to persuade all the households that gave low WTP bids to pay the average WTP amount.

Third, the estimates for improved sanitation technologies are for total capital costs, but WTP bids are in terms of the amounts households are willing to pay per month. If a household's discount rate (or time value of money) and the economic life of the investment are known, it is a routine exercise to convert total capital costs to monthly costs. Financial markets in Kumasi are, however, highly distorted, and it is difficult to infer much about households' rates of time preference or opportunity cost of capital from information on interest rates in the formal sector. Whether the estimated monthly WTP of an apartment building would be sufficient to retire a loan for the amount of its improved sanitation facility depends to a large extent on the assumed interest rate.

7.3 Required subsidies for KVIPs

Given these limitations, Tables 7.6 and 7.7 present cost, WTP, and required subsidy data for new KVIPs and for converting bucket latrines to KVIPs for an annual real interest rate of 30 percent and a loan period of three years. This real interest rate and loan period reflect current terms available to creditworthy borrowers in the 1989 informal financial market in Kumasi. In these tables total monthly costs for installing KVIPs are compared to monthly WTP for apartment buildings with different numbers of households living in them. If the building's aggregate WTP cannot cover total costs, the monthly shortfall is calculated, which in turn is used to determine (1) the lump sum subsidy per KVIP module, and (2) the lump sum subsidy per household that are required to make KVIPs affordable for the building.

For example, Table 7.6 shows that the monthly cost per household for a new KVIP latrine in a building with ten households based on the existing financial market in Kumasi is $2.54; the average WTP for a new KVIP in a building with ten households is $1.52 per household (Table 7.7 presents similar information for installing KVIPs in apartment buildings that currently have bucket latrines). The monthly cost per household is thus about $1.00 greater than the monthly WTP; therefore, the building requires about ten additional dollars each month to pay for the service. If the extra money is obtained in the

Table 7.6
WTP, Costs, and Required Subsidies for New KVIPs
Existing Financial Market (i=30%, n=3 yr)

No. of households in building	Average monthly WTP per household	Required monthly per household payment to cover costs	Required monthly subsidy per building to cover costs	Required lump sum subsidy per module to make KVIPs affordable	Required lump sum subsidy per household to make KVIPs affordable
1	$2.01	$10.61	$9	$203	$203
5	$1.67	$3.33	$8	$196	$39
10	$1.52	$2.54	$10	$120	$24
15	$1.44	$2.35	$14	$161	$21
20	$1.38	$2.22	$17	$132	$20
25	$1.33	$2.12	$20	$116	$19
30	$1.29	$2.04	$23	$133	$18
35	$1.26	$1.98	$25	$119	$17
40	$1.23	$1.93	$28	$132	$16
45	$1.20	$1.88	$31	$120	$16

Table 7.7
WTP, Costs, and Required Subsidies for Converting Bucket Latrines to KVIPs
Existing Financial Market (i=30%, n=3 yr)

No. of households in building	Average monthly WTP per household	Required monthly per household payment to cover costs	Required monthly subsidy per building to cover costs	Required lump sum subsidy per module to make KVIPs affordable	Required lump sum subsidy per household to make KVIPs affordable
1	$2.11	$6.37	$4	$100	$100
5	$1.52	$2.00	$2	$57	$11
10	$1.27	$1.53	$3	$31	$6
15	$1.12	$1.41	$4	$51	$7
20	$1.01	$1.33	$6	$50	$7
25	$0.93	$1.27	$8	$50	$8
30	$0.87	$1.23	$11	$64	$8
35	$0.81	$1.19	$13	$62	$9
40	$0.76	$1.16	$16	$75	$9
45	$0.72	$1.13	$19	$73	$10

form of a lump-sum subsidy for the KVIP unit, the building would need $120 for each installed KVIP, or in this case, a total of $240 since two modules are needed for ten households. If the subsidy is awarded on the basis of the number of households in the building, it would be $24 per household. For typical buildings in Kumasi, the required subsidy per KVIP module is about $120-130, which is equivalent to about one third of the total capital cost of a new KVIP module. As the number of households in a building increases, the average WTP per household decreases. This is more than counterbalanced, however, by the decrease in KVIP costs due to economies of scale.

How would these conclusions change if loan terms were closer to what one finds in an industrialized country? If loans were available at a real interest rate of 10 percent for 20 years, essentially no subsidies would be necessary to install KVIP latrines in Kumasi. This is true for almost all sized buildings (except for single residences) for both new KVIPs and bucket latrine conversions. In other words, if households could engage in financial transactions under terms considered to be more or less normal in industrialized countries, the household WTP for improved sanitation would be sufficient to pay the full costs of KVIPs. This is not to suggest that public authorities should intervene in the financial markets to solve the sanitation problem or offer subsidized loans for the construction of KVIP latrines, but rather to point out that household WTP for KVIP latrines is in fact quite substantial; it just does not buy much in the capital market conditions currently prevailing in Kumasi.

7.4 Required subsidies for WCs

There are three categories of houses to be considered for a piped sewerage system in Kumasi. The first includes houses that already have WCs; for them, it is only necessary to construct the sewerage system and make connections. The second category includes houses with piped water but without WCs; the third category includes houses that have neither WCs nor piped water. The cost per WC module of providing sewerage service to houses in the first category with ten households is about $2400; this cost increases by $200 per WC for buildings in the second category to cover the additional cost of providing WCs, and it increases another $50 per WC to cover the installation of piped water for houses in the third category.

Table 7.8 shows the average monthly WTP amounts per household for buildings in the first category (with WCs) plus the required monthly payments per household for a sewer connection based on the financial market in industrialized countries. The difference represents the required monthly subsidies per household. The corresponding lump sum subsidies per household and per WC module are also shown in Table 7.8. (These estimates assume that all of the houses along the route of the sewer are connected to it.)

Table 7.8
WTP, Costs, and Required Subsidies for Connecting Existing WCs to New Sewers
Improved Financial Market (i=10%, n=20 yr)

No. of households in building	Average monthly WTP per household	Required monthly per household payment to cover costs	Required monthly subsidy per building to cover costs	Required lump sum subsidy per module to make WCs affordable	Required lump sum subsidy per household to make WCs affordable
1	$1.71	$5.02	$3	$342	$342
5	$1.52	$4.63	$16	$1,614	$323
10	$1.43	$4.58	$32	$1,633	$327
15	$1.38	$4.57	$48	$2,476	$330
20	$1.35	$4.56	$64	$2,219	$333
25	$1.32	$4.55	$81	$2,095	$335
30	$1.30	$4.55	$98	$2,529	$337
35	$1.28	$4.55	$114	$2,373	$339
40	$1.26	$4.55	$131	$2,724	$340
45	$1.25	$4.55	$148	$2,564	$342

The required lump sum subsidy per WC module is substantial for all three categories of houses. This is because the bulk of the cost of the WC option is associated with the piped sewerage system, and this is required for all three categories of houses. For buildings with ten households, the required amount for all three categories is between about $1600 and $2000, assuming financing at terms similar to those available in industrialized countries. Since both a KVIP module and a WC module would each be designed to serve up to eight households, it is possible to compare required subsidies for piped sewerage and WCs with those for KVIPs. Whereas the required subsidy per module for KVIPs in apartment buildings of all sizes is about $50 to $200, based on local financing, the required subsidy per module for WCs is about $1,600 to $3,000. This large difference results from the high costs of piped sewerage compared to KVIPs and the fact that WTP bids for the two options are not very different.

7.5 Technology choice and the effect of subsidies on sanitation coverage in Kumasi

It is clear from this analysis that WCs with sewer connections require large subsidies in Kumasi; only about 20 percent of the cost could be covered by beneficiaries For the majority of houses in Kumasi (those with piped water but without WCs), a subsidy of about $360 per household would be required. For the present population of Kumasi, the required lump sum subsidy for WCs and a piped sewerage system would be about $47 million. Even if all households in Kumasi already had WCs and it were possible to borrow under terms similar to those in industrialized countries, the required lump sum subsidy for this technology would exceed $40 million.

If a subsidy in this amount is unavailable for Kumasi, then KVIPs are the only financially feasible sanitation technology. The population to be targeted for improved sanitation through the use of KVIPs consists of people living in buildings at present not served by WCs, an estimated 450,000 people . Figure 7.1. shows how the percentage of these households that could afford KVIPs changes with the amount of the subsidy per KVIP module under the existing informal financial market condition. For a subsidy of $100 per KVIP module, all of the households with bucket latrines (150,000 people) could afford a KVIP, but almost none of the households currently using public or pit latrines could afford one. Overall, between 30 and 35 percent of the households without WCs could afford KVIPs with this level of subsidy. At a subsidy level of $150 per KVIP, 65 percent of all households without WCs could afford a KVIP. Of this 65 percent, roughly half at present have bucket latrines and the rest use public latrines or the bush. A subsidy of approximately $200 per KVIP is required to insure that almost all the households presently without WCs would have access to KVIPs.

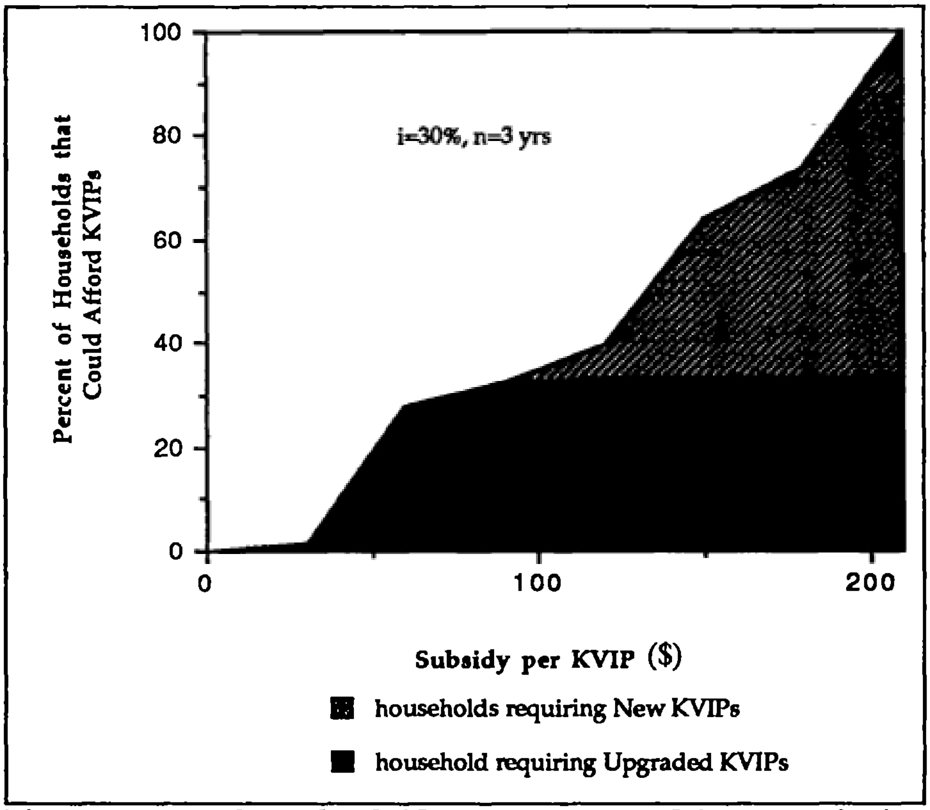


Figure 7.1 EFfect of subsidy per KVIP module on sanitation converage in Kumasi

The total subsidy required to install KVIPs in buildings not using WCs can be obtained by multiplying the subsidy required per building of a given size times estimates of the number of buildings of that size in Kumasi, and then aggregating across all sizes of buildings. Figure 7.2. shows the percent of households at present without WCs that could be served with KVIPs for different total subsidy levels under the existing financial market. All of the households in buildings using bucket latrines could be covered for approximately $1 million. A total subsidy of about $4 million would provide KVIP coverage for all households not currently using WCs.

In addition to the costs of converting to and installing KVIPs, it would be necessary to equip most of the septic tanks that serve existing WCs with soakaways to prevent them from overflowing. If a soakaway costs, say, $200, then the total cost for all 5,000 septic tanks in the city would be $1 million. Part of this cost would be borne by the present WC users, but some subsidy would be required.

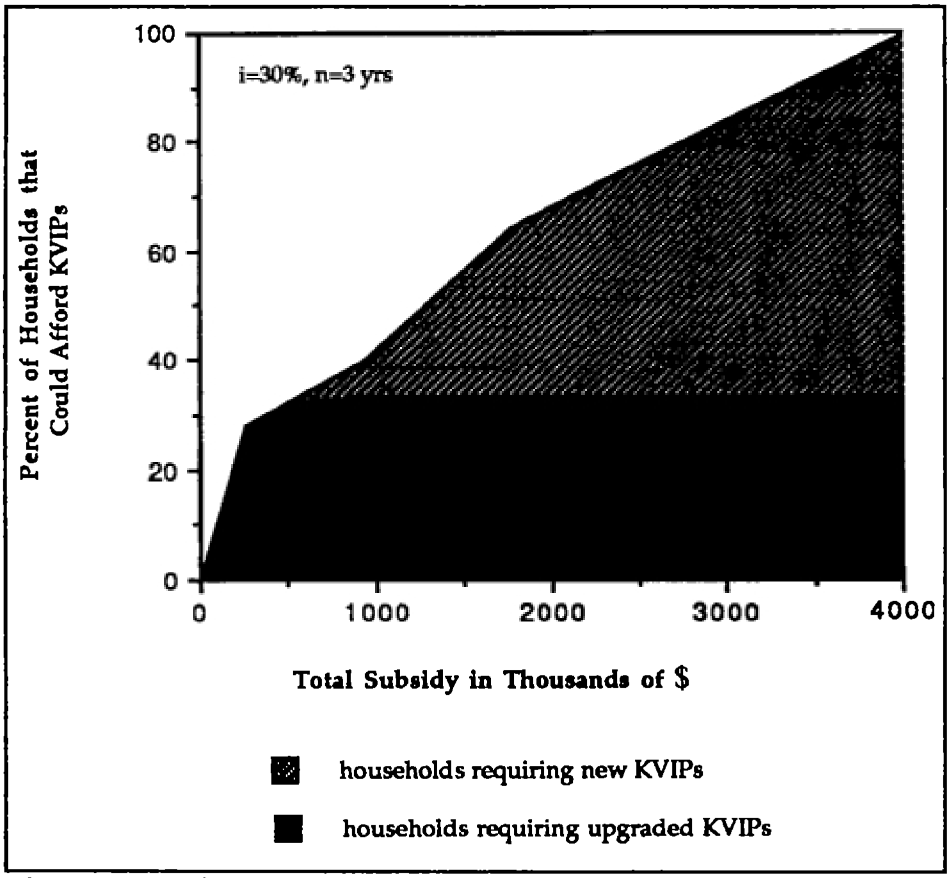


Figure 7.2 Effect of total subsidy for KVIPs on sanitation converage in Kumasi

8. Summary and Conclusions

Our survey of sanitation conditions in Kumasi revealed an appalling and, from a public health perspective, dangerous situation. Households are currently generating about 25,000 m^3 of human waste per month (including flush water for WCs), but only about 10 percent of it is removed from the city. The rest, 90 percent, is left in the urban environment until it decomposes, is carried away by small streams or drainage ditches, or dries and becomes airborne. In aggregate, households spend about $75,000 per month to use the existing sanitation system (most of this, about 75 percent, is spent for public latrines). Total household expenditures on sanitation thus amount to about $900,000 annually for a system that essentially moves untreated night soil small distances around the city without substantially reducing the public health risk or environmental impact it poses. Although this may seem like a lot of money, it is only about $1.50 per capita per year. In essence, people are spending very little for sanitation, and, correspondingly, are getting very poor service.

Part of the reason for this poor service is that over one third of the total household expenditures on sanitation are effectively being used to subsidize the non-sanitation activities of the CDRs. Instead of sanitation services being subsidized by the public sector as the theory of externalities would suggest, the public latrines are actually serving as "profit centers" for the CDRs. These monies are not being reinvested in the system of public latrines to improve or even maintain the existing level of service. However, even if the funds currently being removed from the sanitation system by the CDRs were spent on improving sanitation services, Kumasi would still have a huge sanitation problem.

Among households using public latrines, the greatest source of dissatisfaction was the inconvenience of using them, not the risks to public health which they posed. In fact, households using WCs and bucket latrines indicated that they were quite satisfied with their sanitation system, despite the fact that both systems resulted in the widespread dispersion of human excreta in the urban environment. Analysis of household perceptions of two improved sanitation technologies (WCs connected to sewers and KVIPs) suggests that households in Kumasi are quite open to simple, low-cost solutions to their sanitation problems: only about half of the households interviewed preferred a WC over a KVIP if the monthly costs were the same.

Our examination of the reasons households gave for preferring a KVIP or a WC suggests several messages which could be used in a social marketing campaign for promoting either sanitation technology. For the promotion of KVIPs, there seem to be two key messages: (1) KVIPs do not use water, and (2) KVIPs are very simple and will not break. Unlike WCs, KVIPs will work even when the water system is out of order and will not increase a household's water bill. For the promotion of WCs, the key selling point seems to be the advantages of a sewer system: that the waste will be automatically removed from the building and disposed of off-site.

The findings on household attitudes and preferences serve to emphasize one of the fundamental dilemmas planners face in sanitation planning in developing countries. Since the construction of sewers and treatment facilities is heavily subsidized, much of the financial cost to the household of providing itself with a WC connected to a sewer line is the cost of the WC itself, the associated indoor plumbing, and the space required for installing the WC. It is obviously much less expensive for a household to connect to a sewer line if it already has a WC than if it does not. However, households in Kumasi that now have WCs (and are not yet connected to a sewer line) are largely satisfied with the status quo. In a sense, they have already solved their perceived sanitation problem in terms of removing feces and urine from their immediate living space. Moreover, the public health advantages for these households of connecting to a sewer system are not clear unless other households discontinue using private bucket and public latrines, install WCs, and connect to the sewerage system as well.

The households most dissatisfied with the existing situation are public latrine users, and these are the people that it costs the most to serve with WCs and sewerage because they often lack indoor plumbing and space for a WC. Moreover, in Kumasi and in many other cities in developing countries, installing a WC will require installation of a piped water connection. Not only are the costs of service high for households presently without a WC, but these are typically the households least able to pay for improved service. The people who already have WCs in their homes generally have the most money to spend on sanitation improvements, but these are the people most likely to be satisfied with their existing situation.

This research provides additional evidence that contingent valuation surveys can be successfully conducted in cities in developing countries and that useful information can be obtained on household demand for public services such as sanitation. Multivariate analyses of the WTP responses compare very favorably with similar analyses carried out in industrialized countries. The multivariate analyses indicate that the principal determinants of households' willingness to pay for improved sanitation services are household income, whether the respondent's household is a landlord or tenant, the household's current expenditures on sanitation, and the respondent's level of satisfaction with the household's existing sanitation system. Neither the education level of household members nor social or cultural variables had much effect on households' willingness to pay. These results were robust with respect to the estimation technique used in the multivariate analysis and the exact model specification.

The experimental design incorporated numerous tests to check the internal consistency and reliability of the households' WTP responses, including a test for starting point bias and a "time-to-think" effect. None of these tests revealed reasons for serious concern about the reliability of the WTP responses. The multivariate analyses did indicate that the starting point of the abbreviated bidding game had a statistically significant effect on households' responses to CV questions, but the magnitude of the effect was small and not of any importance for policy.

From a methodological perspective, however, there was an interesting aspect about the evidence of starting point bias. The research revealed a potential problem with the use of the "abbreviated bidding procedure with follow-up" as an elicitation method. When a respondent was offered an improved service at a specified price, he could answer "Yes" or "No." In this study, if he answered "Yes," he was not likely to raise his bid above this specified price in response to an open-ended follow-up question. In this case, the open-ended follow-up question did not provide any additional information on the household's preferences. On the other hand, if the respondent answered "No" when offered the service at a given price, an open-ended follow-up question elicited a wide range of answers below the specified price. The apparent reluctance of respondents to offer a bid above the specified price will likely result in a downward bias in the mean of the WTP responses to the open-ended questions.

From a policy perspective, the results of the study indicate that conventional sewerage is simply not affordable to the vast majority of households in Kumasi without massive government subsidies. In retrospect this is perhaps not so surprising. What was less apparent before this research, however, was the widespread acceptance of KVIPs and the approximate levels of subsidy which would be required to achieve different coverage goals with a KVIP subsidy program. The results of the CV survey showed that most households were willing to pay about as much for a KVIP latrine as for a WC connected to a conventional sewerage system. The study also indicated that households' willingness to pay for water and for sanitation appear to be approximately the same order of magnitude and largely separable.

This study also identified two areas where additional research is needed on the application of the contingent valuation method (CVM) in developing countries to the problem of estimating household demand for improved sanitation services. First, the contingent valuation questions for alternative technologies were asked on a sequential basis, first for KVIPs and then for WCs. Research is needed to develop cost-effective ways of determining how households would choose between two or more options presented simultaneously at alternative prices.

Second, the unit of analysis in this research was the individual household. However, in cities such as Kumasi where improved sanitation facilities are provided for entire apartment buildings, the focus should arguably be on the collective decision of the group of households in building. In the initial phase of this study, some experiments were conducted to determine the collective willingness to pay of all residents in a building for improved sanitation services, but this approach proved impractical given time and resource constraints. Additional research is needed on the issue of how to obtain a realistic collective bid for improved sanitation services for a group of tenants living in one apartment building.

We do not believe it is possible to do serious economic appraisal of sanitation projects without the kind of detailed information on the current sanitation situation in a city and on households' willingness to pay for improved services, such as presented in this report for Kumasi. Too often economic analysis of sanitation projects is done in a perfunctory manner because information is not available on household demand for improved sanitation services. Sanitation improvements are expensive, and their public health benefits are large, and it is believed that the kind of information presented in this report should routinely be collected during the project preparation process in order to increase the chances of their success.

However, the results of the policy analysis highlight the importance of an additional issue. Sanitation facilities should be conceived as just one part of a package of services provided by an individual's housing. Because housing is typically expensive relative to a household's income, housing choices are more heavily influenced by capital markets than individuals' other consumption decisions. Distortions in capital markets and housing markets thus affect the demand for sanitation services. The information on household demand for improved sanitation services that was collected as part of this research assumes that households' expenditures on other housing services remain essentially unchanged. In other words, households were asked how much they would be willing to pay for improved sanitation services, with the implicit assumption that the existing rent control policies would remain in place.

If policy reforms were introduced to eliminate some of the distortions in the housing market, it is not possible on the basis of this analysis to forecast the impact of such changes on the demand for improved sanitation. Households might prefer to purchase more space rather than improved sanitation facilities. Alternatively, landlords would almost certainly be more likely to invest in improved sanitation facilities in their apartment buildings if they could raise the rent to market clearing prices. It is conceivable that the subsidies estimated to be required for widespread coverage of the population by KVIPs would be largely eliminated by the removal of rent controls in Kumasi. Sanitation planning thus cannot be effectively undertaken without close coordination with housing policy planning.

Similarly, the analysis shows that the subsidies required for KVIPs are greatly affected by the assumptions about financial market conditions. Policy reforms in the financial sector that would permit the operation of more efficient capital markets could have a direct and important impact on household demand for improved sanitation services. If policy reforms were introduced in both the financial and housing sectors, the household demand for KVIPs in Kumasi might increase dramatically without any public subsidies.

Perhaps the most important finding of this research is that a focus on "demand-side" issues in sanitation planning means much more than simply determining households' WTP for a limited range of technological options. Planners, engineers, and policy analysts working in the "sanitation sector" must take a broader perspective on the kinds of policy interventions which are necessary to improve sanitation conditions in cities in developing countries. A narrow focus on technological options and financing of government subsidies is likely to overlook important relationships between the demand for sanitation and the demand for housing and capital.

APPENDIX A: DESCRIPTION OF KVIP LATRINE

A "Kumasi Ventilated Improved Pit Latrine" is a private, sanitary means of waste disposal (Figure A-1). It is a dry system which does not use any water. A KVIP latrine can be built in different sizes to accommodate various numbers of households (Figure A-2). Each toilet room (or module) has two holes (only one of which is in use at a time) and can serve about eight households. The KVIP latrine can be built as a free-standing structure with its own roof, or it can be built into an existing room in a building. The excrement falls into one of two adjacent pits. When one pit is full, the users switch to the other. A pit is not emptied immediately after it becomes full. Rather the users wait for about two years until the excreta is decomposed and is fully safe to handle. At this point the stabilized waste can be safely used for fertilizer.

The KVIP is a permanent structure. The pits are of masonry and can be easily emptied and reused. The pits may be constructed to protrude into the street so that they can be emptied from outside the house, even though the KVIP itself is entered from inside the house or courtyard. The KVIP latrine has a vent pipe, which eliminates odors. Flies are effectively controlled by a fly screen at the top of the vent pipe. The air flow through the latrine draws flies to the top of the vent pipe where they are trapped and die. Properly designed and maintained, the KVIP is a safe, hygienic means of excreta disposal.

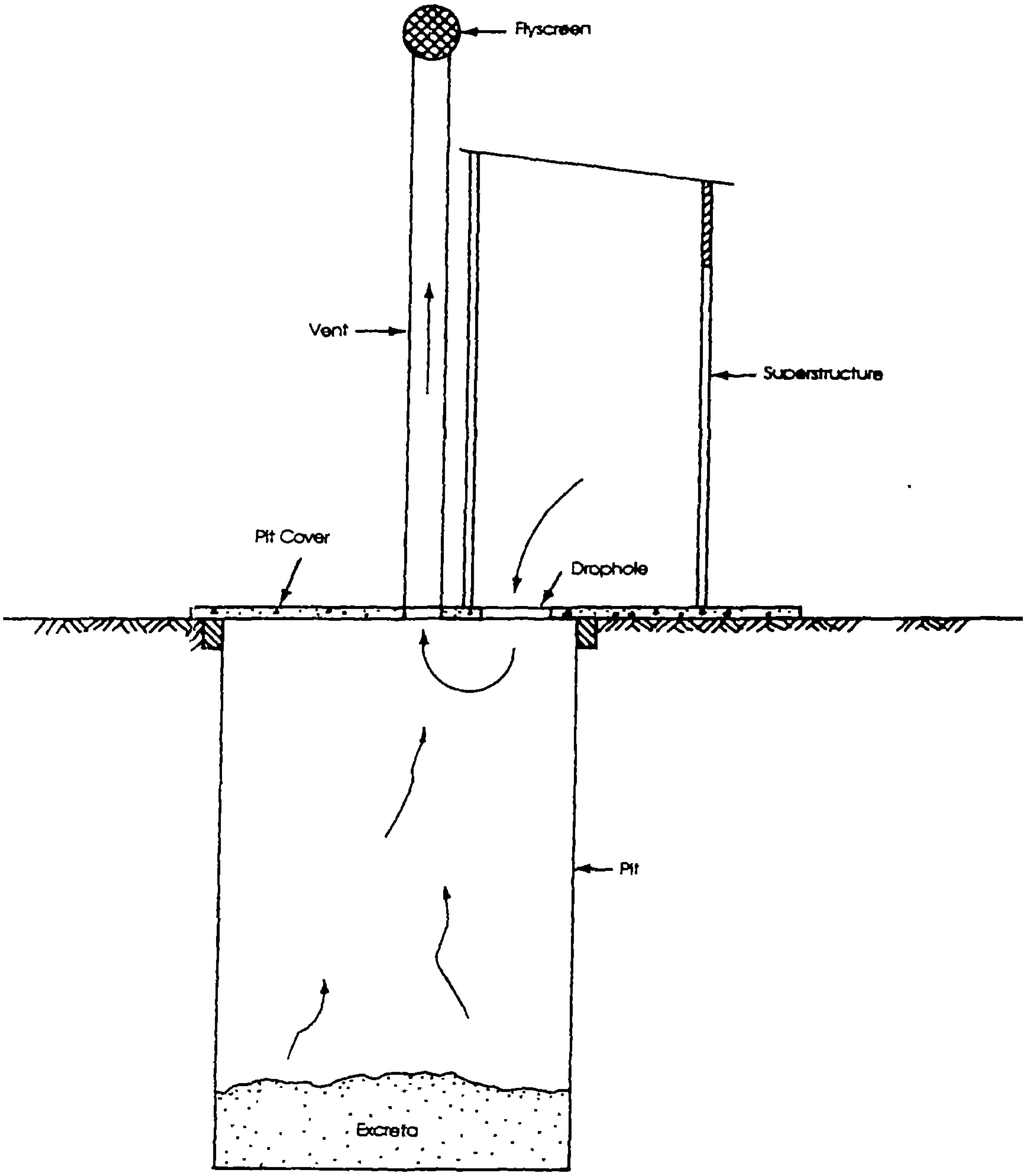
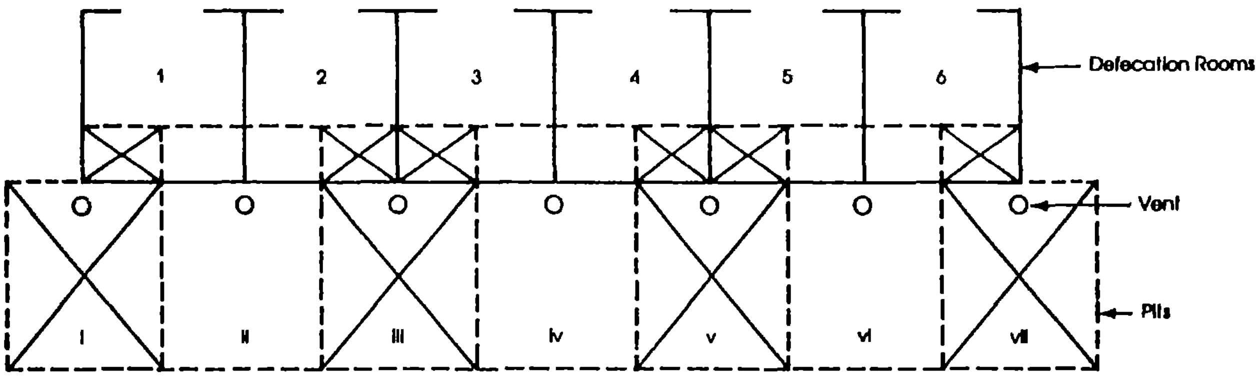


Figure A-1 VIP Latrine: Basic Components (Section View)



Note: Dropholes & pits in use are marked with a cross.

Figure A-2 Multiple Room Altering VIP Latrine (Plan View) (With 6 Defecation Rooms and 7 Pits)

APPENDIX B: HOUSEHOLD QUESTIONNAIRE *[PAGE 1 OF ORIGINAL]*
[FOR HOUSEHOLDS WITH A PRIVATE WATER CONNECTION OR YARD TAP]

NAME OF ENUMERATOR: ______________ DATE: ________

ENUMERATION AREA : ______________ VERSION NO. ____8____
[RETURN INTERVIEW]

HOUSE NO.: ______________ HOUSEHOLD NO.: ______

TIME START: ______________ TIME FINISH : _____

[ENUMERATOR: READ THE FOLLOWING INTRODUCTORY STATEMENT]

My name is ____________________, and I am working with the Kumasi Sanitation Project and the World Bank on a study of the sanitation situation in Kumasi. This neighborhood of the city has been selected as one of the areas for our study, and we are conducting interviews in houses around here. We would like to ask you some questions about your water and sanitation situation. We have received permission from the Kumasi Metropolitan Authority to conduct this study.

The interview will just take a few minutes. Your responses will help the Kumasi Sanitation Project, the KMA, and the World Bank to better understand your needs for improved water and sanitation services. Your answers will be completely confidential, and if at any time during the interview you want to stop answering questions, you are free to do so.

Would you be willing to be interviewed? YES / NO

In order to know what questions to ask you, I first need to know whether there is a private water connection or yard tap in this house. Do you have water here?
YES / NO

GO AHEAD WITH THIS QUESTIONNAIRE USE A DIFFERENT QUESTIONNAIRE

Du you pay rent? Or do you own this house?
Rent -- Go ahead with this questionnaire.
Own -- Use different questionnaire.

[ONLY THE HEAD OF HOUSEHOLD, WIFE, OR HUSBAND SHOULD BE INTERVIEWED]

1. Sex of respondent: MALE / FEMALE

2. Is the person being interviewed the head of household? YES / NO
3. Is this the spouse of the head of household? YES / NO
4. Is this a female-headed household? YES / NO
5. How many adults live in this household? (i.e., share meals together or share a common tenancy) NO. OF ADULTS __________

6. How many children live in this household? NO. OF CHILDREN ________

PART I: WATER SOURCES *[PAGE 2 OF ORIGINAL]*

[ENUMERATOR SAYS: "Now I would like to ask you some questions about your water situation."]

SOURCE NO. 1: PRIVATE WATER CONNECTION

1. Is the tap in this house working?

YES .... GO TO 3
NO .... CONTINUE

2. IF NO, why isn't it working?

Technical problem ____
Water cut off because water bill hasn't been paid ____ GO TO PAGE 4
Other (specify) ____

3. IF YES, how many hours per day is there water from the tap, on average?

Almost all the time ________
Number of hours per day with water ________

4. How much of your household's water would you say you obtain from the private connection or yard tap?

ALMOST ALL ____________
ABOUT HALF __________
VERY LITTLE __________

5. Does the tap have a meter? YES / NO / Don't Know

GO TO 8

6. If YES, does the meter work? YES / NO / Don't Know

GO TO 8

7. If YES, how often is the meter read?

Once a month _______
Other _______
Don't Know _______

8. How much was your water bill last month? (or your share of the water bill for this house/compound?)

Amount ________ cedis per month

9. What is your normal water bill?
(i.e., how much do you usually pay per month for water?)
Average water bill _________ cedis per month

[ENUMERATOR, IF THIS IS A SINGLE FAMILY HOUSE, SKIP QUESTION 10 AND GO TO QUESTION 11. OTHERWISE, CONTINUE.]

10. How do the tenants arrange to share the water bill?
(i.e., what system do they use to determine how much each household owes)

By Points _______________
By Household _______________
By Room _______________
Other (specify)_______________

11. Does the landlord sell water from the tap to people or neighbors who live outside the house?

YES / NO

GO TO NEXT PAGE

12. IF YES, does your landlord charge per bucket or a fixed fee per month to collect water from the tap?

Per bucket _____ GO TO 13
Fixed monthly fee _____ GO TO 14

13. IF PER BUCKET: How much does the landlord charge for...

Large bucket _______ cedis

Small bucket _______ cedis

GO TO NEXT PAGE

14. IF FIXED MONTHLY FEE: How much does the landlord charge neighbors per month?

cedis per month _________

Other (specify) _________

GO TO NEXT PAGE

[NOTE TO ENUMERATOR: ASK ALL RESPONDENTS THESE QUESTIONS, EVEN THOSE WITH PRIVATE WATER CONNECTIONS OR YARD TAPS *[PAGE 4 OF ORIGINAL]*

SOURCE NO. 2: NEIGHBORS WITH PRIVATE TAPS

1. Are there people in this neighborhood that provide water to their neighbors from private taps?

YES / NO / DON'T KNOW

GO TO PAGE 6

2. How do they charge for water?

Per bucket	______	GO TO 3
Fixed monthly fee	_____	GO TO 4
Water provided free	___	GO TO 5
Don't know	______	GO TO 5

3. IF PER BUCKET: How much do they charge per bucket?

Large bucket _______ cedis
Small bucket _______ cedis GO TO 5
Don't know _______

4. IF FLAT MONTHLY FEE: How much do they charge per month?

Cedis per month ___________
Other (specify) ___________ GO TO 5
Don't Know ___________

5. How far away is the nearest neighbor who sells water?

No. of Houses ____________
One-way travel time ____________
No. of yards (meters) ____________

6. Do you routinely buy water from neighbors or other individuals?

YES / NO

GO TO PAGE 6

7. IF YES, do you pay by the bucket or pay a fixed monthly fee?

Per bucket	_____	GO TO 9
Flat monthly fee	_____	GO TO 8
Don't pay	_____	GO TO PAGE 6

8. IF FLAT MONTHLY FEE: How much does your household pay per month to neighbors with private connections or yard taps?

cedis per month _____ GO TO PAGE 6

9. IF PER BUCKET: How much do they charge per bucket?

Large bucket _______ cedis
Small bucket _______ cedis

10. How many buckets does your household routinely (i.e., usually) buy per day ...

	Rainy season	Dry Season
No. of large buckets per day	________	________
No. of small buckets per day	________	________

11. How much money does your household routinely (i.e., usually) spend per day buying water from neighbors with private connections or yard taps?

	Rainy season	Dry Season
cedis per day	________	________

12. Do you know how much money your household spent last month buying water from neighbors by the bucket? (this amount should be what is routinely spent in addition to the payment for water from private connection or yard tap)

cedis per month ________
Don't know ________

[ENUMERATOR: NOW CALCULATE THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH BUYING WATER FROM NEIGHBORS BY THE BUCKET (multiply amount in question 11 by 30, or calculate the amount spent per day from questions 9 and 10.

13. Enumerator's estimate: cedis per month ____________________________.

IF THE AMOUNT YOU CALCULATE IS DIFFERENT THAN THE RESPONDENT'S ANSWER IN QUESTION 12 ABOVE, ASK ADDITIONAL QUESTIONS TO DETERMINE THE CORRECT AMOUNT. WRITE THE FINAL ESTIMATE OF THE HOUSEHOLD'S MONTHLY EXPENDITURE BUYING WATER FROM NEIGHBORS BY THE BUCKET BELOW. BE SURE THE RESPONDENT AGREES THAT THIS AMOUNT IS CORRECT.

14. Final estimate: cedis per month ________

GO TO NEXT PAGE

[NOTE TO ENUMERATOR: ASK ALL RESPONDENTS THESE QUESTIONS, EVEN THOSE WITH PRIVATE WATER CONNECTIONS OR YARD TAPS] *[PAGE 6 OF ORIGINAL]*

SOURCE NO. 3 : PUBLIC TAPS

1. Are there public taps in this neighborhood where people collect water?

YES / NO / DON'T KNOW

GO TO PAGE 8

2. IF YES, how far is the nearest public tap from this house?

No. of Houses ____________
One-way travel time ____________
No. of yards (meters) ____________

3. Is there a charge for water from the public taps?

YES / NO

GO TO 5

4. IF YES, how much do they charge per bucket from the public taps?

Large bucket _______ cedis
Small bucket _______ cedis
Other (e.g., flat rate) ____________________
Don't know ___________

5. Do members of your household routinely obtain water from the public taps?

YES / NO

GO TO PAGE 8

6. IF YES, how much water do members of your household usually collect from the public tap per day?

	Rainy season	Dry Season
No. of large buckets per day	________	________
No. of small buckets per day	________	________

[ENUMERATOR: IF WATER AT THE PUBLIC TAP IS FREE, GO TO NEXT PAGE]

7. How much money does your household routinely (i.e., usually) spend per day buying water from the public tap?

	Rainy season	Dry Season
cedis per day	______	______

8. Do you know about how much money your household routinely (i.e., usually) spends buying water from public taps?

	Rainy season	Dry Season
cedis per month	______	______
Don't know	______	______

[ENUMERATOR: NOW CALCULATE THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH BUYING WATER AT THE PUBLIC TAPS (multiply amount in question 7 by 30, or calculate the amount from questions 4 and 6).

9. Enumerator's estimate: cedis per month ________________________.

IF THE AMOUNT YOU CALCULATE IS DIFFERENT THAN THE RESPONDENT'S ANSWER IN QUESTION 8 ABOVE, ASK ADDITIONAL QUESTIONS TO DETERMINE THE CORRECT AMOUNT. WRITE THE FINAL ESTIMATE OF THE HOUSEHOLD'S MONTHLY EXPENDITURE BUYING WATER FROM NEIGHBORS BY THE BUCKET BELOW. BE SURE THE RESPONDENT AGREES THAT THIS AMOUNT IS CORRECT.

10. FINAL ESTIMATE: cedis per month ________

ENUMERATOR: CONFIRM THE RESPONDENT'S PRIMARY AND SECONDARY WATER SOURCE *[PAGE 8 OF ORIGINAL]*

11. Just so I'm sure I understand, your household gets most of its water from .... (check primary water source)

Private connection in house or compound	____________
From a neighbor's private connection/yard tap	____________
Public tap	____________
Well	____________
Other (specify)	____________

12. The second most important water source this household routinely uses is ....
(Check secondary data source; Check "No other source" if there is no secondary source used).

No other source	____________
Private connection in house or compound	____________
From a neighbor's private connection/yard tap	____________
Public tap	____________
Well	____________
Other (specify)	____________

PART II : HOUSEHOLD SANITATION PRACTICES

What type of sanitation system does this household most frequently (i.e., usually) use?

Facility in house:

Bucket/Pan Latrine	______	GO TO PAGE 10
WC	______	GO TO PAGE 12
Traditional pit latrine	______	GO TO PAGE 13
KVIP latrine	______	GO TO PAGE 14
Other (specify)	______	GO TO PAGE 14

No facility in house:

Use Public Latrine	______	GO TO PAGE 9
Bush	______	GO TO PAGE 14
Other (describe)	______	GO TO PAGE 14

FOR HOUSEHOLDS USING PUBLIC LATRINES : [PAGE 9 OF ORIGINAL]

1. How would you describe the condition of the public latrine your household uses in terms of :

cleanliness	....	GOOD / FAIR / POOR
privacy	....	GOOD / FAIR / POOR
convenience	....	GOOD / FAIR / POOR

2. How far away is the public latrine that your household most frequently uses?

No. of houses	___________
One-way walking time	___________
No. of yards (meters)	___________

3. How much does it cost an adult to use the public latrine?

cedis per visit ____________

4. How many times per day does each adult usually go to the public latrine?

No. of trips per day ______

5. What is the total amount of money that all the members of your household normally spend each day using the public latrine?

cedis per day ____________

6. Do you know how much money members of your household are spending per month using the public latrine?

Respondent's estimate: cedis per month	________
Don't know	________

ENUMERATOR: NOW CALCULATE THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH AT THE PUBLIC LATRINE (multiply amount in question 5 by 30).

7. Enumerator's estimate: cedis per month ________________________________.

IF THE AMOUNT YOU CALCULATE IS DIFFERENT THAN THE RESPONDENT'S ANSWER IN QUESTION 6 ABOVE, ASK ADDITIONAL QUESTIONS TO DETERMINE THE CORRECT AMOUNT. WRITE THE FINAL ESTIMATE OF THE HOUSEHOLD'S MONTHLY EXPENDITURE AT THE PUBLIC LATRINE BELOW. BE SURE THE RESPONDENT AGREES THAT THIS AMOUNT IS CORRECT.

8. Final estimate: ________ cedis per month

9. How satisfied are you with the public latrine you now use?

Very satisfied	________	
Satisfied	________	GO TO PAGE 14
Not satisfied at all	________	

FOR THOSE HOUSEHOLDS USING A BUCKET/PAN LATRINE IN THE HOUSE OR COMPOUND: *[PAGE 10 OF ORIGINAL]*

1. How would you describe the condition of the bucket latrine system in this house in terms of :

cleanliness	....	GOOD / FAIR / POOR
privacy	....	GOOD / FAIR / POOR
convenience	....	GOOD / FAIR / POOR

2. Do you share the latrine with other tenants in the house?

YES / NO

GO TO 4

3. IF YES, how many other households use the latrine ?

No. of households _____

4. Who arranges for the buckets/ pans that your household uses to be emptied?

Landlord ________
Self _______
Other (specify) _______

5. How often are the buckets emptied? ________________

6. How many full buckets must be emptied ? ________________

7. Who collects the buckets and empties them? ________________

8. Where are the buckets/pans emptied? _______________
Don't know _______________

9. How much does your household pay per month to have the buckets emptied (what is your share of the cost)?

cedis per month ________

10. To whom does this house pay the money for emptying the buckets?

CDR ________
KMA ________
Private cleaner ________
Other (specify) ________

ENUMERATOR: NOW CALCULATE THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH USING THE BUCKET LATRINE SYSTEM.

11. Enumerator's estimate: cedis per month ________________________________.

IF THE AMOUNT YOU CALCULATE IS DIFFERENT THAN THE RESPONDENT'S ANSWER IN QUESTION 9 ABOVE, ASK ADDITIONAL QUESTIONS TO DETERMINE THE CORRECT AMOUNT. WRITE THE FINAL ESTIMATE OF THE HOUSEHOLD'S MONTHLY EXPENDITURE ON THE BUCKET LATRINE SYSTEM BELOW. BE SURE THE RESPONDENT AGREES THAT THIS AMOUNT IS CORRECT.

12. Final estimate: ________ cedis per month

13. How satisfied are you with the bucket latrine excreta disposal system you now have?

Very satisfied	________
Satisfied	________
Not satisfied at all	________

FINISHED WITH HOUSEHOLD SANITATION PRACTICES SECTION : GO TO PAGE 14

FOR HOUSEHOLDS USING A WC WITH SEPTIC TANK : *[PAGE 12 OF ORIGINAL]*

1. How would you describe the condition of the WC in this house in terms of:
   - privacy .... GOOD / FAIR / POOR
   - cleanliness .... GOOD / FAIR / POOR
   - convenience .... GOOD / FAIR / POOR

2. Do you share the latrine (or WC) with other tenants in the house?

   YES / NO

   GO TO 4

3. IF YES, how many other households use the latrine (or WC) ?

   No. of households _____

4. Who arranges for the septic tank to be emptied?

   Landlord ______ Self ________ Other (Specify) __________

   Never been emptied __________ GO TO 13

5. Is the septic tank emptied by truck or manually?

   By a truck _____ Manually ______ Don't know _________

6. How often is the tank emptied ? ___________ Don't Know _____

7. Who empties the septic tank? ______________ Don't Know ___

8. Where is the sludge from the septic tank dumped? _______________

   Don't know _________

9. Does this household have to pay anything to have the septic tank emptied?

   YES / NO (landlord pays)

   GO TO 13

10. IF YES, how much do you have to pay? ___________ cedis

11. Do the other tenants also pay a share of the costs? YES / NO

    GO TO 13

12. IF YES, how is the bill shared among the tenants?

    By points ____ By household ____ By room ____ Other ____

13. How satisfied are you with the WC latrine you now have?

    Very satisfied ________

    Satisfied ________

    Not satisfied at all ________

FINISHED WITH HOUSEHOLD SANITATION PRACTICES SECTION : GO TO PAGE 14

FOR HOUSEHOLDS USING A TRADITIONAL PIT LATRINE IN THEIR HOUSE/COMPOUND: *[PAGE 13 OF ORIGINAL]*

1. How would you describe the condition of the pit latrine in this house in terms of:
   - cleanliness .... GOOD / FAIR / POOR
   - privacy .... GOOD / FAIR / POOR
   - convenience .... GOOD / FAIR / POOR

2. Do you share the latrine with other tenants in the house?
   YES / NO

   GO TO 4

3. IF YES, how many other households use the latrine ?
   No. of households _____

4. What do you plan to do when the pit latrine is full?

Dig a new pit	_____	GO TO 14	Have pit emptied	____	GO TO 5
Add lime	_____	GO TO 14	Don't Know	____	GO TO 5
Other (specify)	_____	GO TO 14			

5. How often is the pit emptied ? _____________ Don't know ____
   Never been emptied ____ GO TO 14

6. When the latrine pit is emptied, who arranges for this?
   Landlord ________ Self ________ Other (Specify) __________

7. Is the latrine pit emptied by truck or manually?
   By a truck ________ Manually ________ Don't know ________

8. Who empties the pit? ______________

9. Where is the sludge from the pit dumped? ____________________

10. Does your household have to pay anything to have the latrine pit emptied?
    YES / NO (landlord pays ____)
    GO TO 14

11. IF YES, how much does your household have to pay? _______ cedis

12. To whom does this house pay the money?
    CDR ____ KMA ___ Private contractor ______ Other (specify)_____

13. Do the other tenants also pay a share of the costs? YES / NO

14. How satisfied are you with the pit latrine system you now have?

    Very satisfied _____ Satisfied _____ Not satisfied at all ____

(a) FOR HOUSEHOLDS WITH A WC IN THEIR HOUSE ...... GO TO PAGE 20
(b) FOR HOUSEHOLDS WITHOUT A WC IN THEIR HOUSE ... CONTINUE

Tomorrow I would like to ask you some questions about how much your household would be willing to pay for an improved sanitation system. I would like to ask you about two possible types of improved sanitation systems.

[SHOW PHOTOGRAPH]

The first type of improved sanitation system is called a KVIP latrine, which is a ventilated pit latrine. This KVIP latrine would be private and have two holes (only one of which is in use at a time). It does not use water, but it could be built inside the house (on the ground floor). It can also be entered from inside the house. The excrement falls into one of two adjacent pits. When one pit is full, you switch to the other. The pit is not emptied immediately after it becomes full. You wait to empty the pit until the excreta is turned into manure which is safe to use in a garden. This takes about 2 years. The pit can then be emptied from the outside of the house.

This kind of latrine is specially designed so that if it is kept clean, it will not smell. It has a vent pipe to eliminate odors, and a fly screen to eliminate flies. The KVIP--a ventilated improved pit latrine--is not like an ordinary pit latrine. It is a permanent facility. What makes it permanent is that the two pits are lined and can be easily emptied and reused. Because the KVIP latrine has two pits, it does not have to be emptied very often and is thus very inexpensive to operate. It is a safe, sanitary means of excreta disposal.

I would now like to answer any questions you have about the KVIP latrine.

1. Were you familiar with a KVIP latrine before I came here?

YES / NO

[SHOW PHOTOGRAPH]

The second type of improved sanitation system is a WC in the house which you would share with other tenants. The WC would be private and there would be only one in the house (OR ONE ON EACH FLOOR IF THIS IS A MULTISTORY BUILDING]. It would be the responsibility of the tenants and the landlord to keep the WC clean. If it were kept clean, it would not smell.

The WC would be connected to a sewer line or pipe outside the house. This type of pipe is known as a sewer. The waste from the WC would flow into the sewer. The waste would not flow into a septic tank or holding pit, so it should not overflow or clog up. Therefore the household would not have the expense of emptying a septic tank or holding pit. In order to have a WC, a house must be connected to the water system.

I would now like to answer any questions you have about the WC and the sewer system.

2. Were you familiar with a WC before I came here?

YES / NO

3. Were you familiar with a sewer system before I came here?

YES / NO

KVIP latrines or for a WC connected to a sewer. I will come back tomorrow to discuss with you and to ask you some more questions.

Well, let us stop here for today. We are very grateful for your cooperation.

4. In order to be able to identify you tomorrow, may I please know your name?

Respondent's name: ______________________

[STOP THE INTERVIEW: MAKE AN APPOINTMENT TO RETURN IN ONE OR TWO DAYS]

TIME OF APPOINTMENT: ________________

[RECORD CHARACTERISTICS OF THE HOUSE TO HELP YOU FIND IT AGAIN.]

Characteristics of house:

END OF INTERVIEW FOR FIRST DAY

ENUMERATOR: THIS PART OF QUESTIONNAIRE IS NOT FOR FIRST DAY OF THE INTERVIEW.

(a) FOR HOUSEHOLDS WITH A WC IN THEIR HOUSE .... GO TO PAGE 21
(b) FOR HOUSEHOLDS WITHOUT A WC IN THEIR HOUSE ... CONTINUE

RETURN INTERVIEW

When I was here before, we talked about two kinds of improved excreta disposal systems: A KVIP latrine and a WC with a connection to a sewer system.

A KVIP latrine is a ventilated pit latrine [SHOW PHOTOGRAPH] This KVIP latrine would be private and have two holes (only one of which is in use at a time). It does not use water, but it could be built inside the house (on the ground floor). It can also be entered from inside the house. The excrement falls into one of two adjacent pits. When one pit is full, you switch to the other. When a pit is full, it can be emptied from the outside of the house.

This kind of latrine is specially designed so that it is kept clean, it will not smell. It has a vent pipe to eliminate odors, and a fly screen to eliminate flies. The KVIP -- a ventilated improved pit latrine -- is not like an ordinary pit latrine. It is a permanent facility. What makes it permanent is that the two pits are lined and can be easily emptied and reused. Because the KVIP latrine has two pits, it does not have to be emptied very often and is thus very inexpensive to operate. It is a safe, sanitary means of excreta disposal.

Do you have any questions about the KVIP latrine?

YES / NO

1. IF YES, record respondent's question:
(i.e., what question did the respondent ask?)

[SHOW PHOTOGRAPH]

The second type of improved sanitation system is a WC in the house which you would share with other tenants. The WC would be private and there would be only one in the house (OR ONE ON EACH FLOOR IF THIS IS A MULTISTORY BUILDING]. It would be the responsibility of the tenants and the landlord to keep the WC clean. If it were kept clean, it would not smell.

The WC would be connected to a sewer line or pipe outside the house. This type of pipe is known as a sewer. The waste from the WC would flow into the sewer. The waste would not flow into a septic tank or holding pit, so it should not overflow or clog up. Therefore the household would not have the expense of emptying a septic tank or holding pit. In order to have a WC, a house must be connected to the water system.

2. Do you have any questions about the WC or the sewer system?

YES / NO

3. IF YES, answer respondent's questions and record the questions below:
   (i.e., what question did the respondent ask?)

____

____

____

[ENUMERATOR: IF RESPONDENT ALREADY HAS A PRIVATE KVIP LATRINE IN HIS HOUSE OR COMPOUND, GO TO NEXT PAGE] *[PAGE 18 OF ORIGINAL]*

BIDDING GAME FOR A KVIP LATRINE: HIGH STARTING POINT

Suppose that the landlord was willing to install a KVIP latrine in this house for the use of the tenants if the costs could be recovered in a separate payment from the tenants. If the landlord installed a KVIP latrine, the excreta disposal system would be improved. There would be no initial charge or fee to have the KVIP latrine installed, only the monthly payment. You would have to pay this monthly payment as long as you lived in this house.

[ENUMERATOR: IF THE HOUSE HAS MORE THAN ONE STOREY, TELL THE RESPONDENT THAT THE LANDLORD WOULD INSTALL A KVIP LATRINE ON THE GROUND FLOOR]

(a) If the landlord asked you to pay 1000 cedis per month toward the KVIP latrine, would you want the landlord to install a KVIP latrine or would you prefer not to have a KVIP latrine?

YES - have landlord install a KVIP ______ GO TO (c)
NO - rather not have a KVIP latrine ______ GO TO (b)

(b) Suppose that instead of 1000 cedis that the monthly payment for the KVIP latrine were 500 cedis. Would you want the landlord to install a KVIP latrine or would you prefer not to have a KVIP?

YES - have landlord install a KVIP ______ GO TO (c)

NO - rather not have a KVIP ______ GO TO (c)

(c) What is the most you would be willing to pay per month to have a KVIP latrine in the house which members of your household could share with the other tenants?

MAXIMUM MONTHLY PAYMENT ____________

[ENUMERATOR: NOW WRITE DOWN THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH ON ITS PRESENT EXCRETA DISPOSAL SYSTEM FROM THE INFORMATION IN PART II ON HOUSEHOLD SANITATION PRACTICES.]

(d) Respondent's current monthly expenditure on sanitation from Part II :
cedis per month ________
(e) Is the respondent's current expenditure higher than his answer to (c)?

YES / NO

GO TO NEXT PAGE

IF THIS MONTHLY EXPENDITURE (d) IS HIGHER THAN THE BID IN (c) ABOVE, ASK WHY THE RESPONDENT IS WILLING TO PAY LESS FOR A KVIP LATRINE THAN FOR ITS EXISTING SANITATION SYSTEM. GIVE THE RESPONDENT AN OPPORTUNITY TO CHANGE HIS BID IN (c) ABOVE.

(f) Reasons given:____
(g) Respondent's revised bid ___________ cedis per month

BIDDING GAME FOR WC: HIGH STARTING POINT [HOUSEHOLD WITHOUT WC]

[Page 19 OF ORIGINAL]

Suppose the landlord was willing to install a WC in this house for the use of the tenants. The WC would be connected to a sewer system. The costs of the WC would be paid monthly by the tenants with their water bill.

[NOTE TO ENUMERATOR: IF THE HOUSE HAS MORE THAN ONE STOREY, TELL THE RESPONDENT THAT THE LANDLORD WOULD INSTALL A WC ON EACH FLOOR]

(a) If the landlord asked you to pay 1000 cedis per month for the costs of a WC, would you want the landlord to install a WC, or would you prefer not to have a WC?

YES - have landlord install a WC _______ GO TO (c)
NO - rather not have a WC _______ GO TO (b)

(b) Suppose that instead of 1000 cedis that the monthly payment for the WC were 500 cedis. Would you want the landlord to install a WC or would you prefer not to have a WC?

YES - have landlord install a WC _______ GO TO (c)
NO - rather not have a WC _______ GO TO (c)

(c) What is the most you would be willing to pay per month to have a WC in the house (on this floor of the house) which you could share with the other tenants?

MAXIMUM MONTHLY PAYMENT _____________ cedis per month

[ENUMERATOR: RECALL THE AMOUNT OF MONEY THE HOUSEHOLD IS SPENDING PER MONTH ON ITS PRESENT SANITATION SYSTEM: (d) ON PREVIOUS PAGE]

(d) Present monthly expenditure on existing sanitation from previous page

cedis per month _____

(e) Is the respondent's present expenditure higher than his answer to (c)?

YES / NO

GO TO (h)

IF THE PRESENT EXPENDITURE IN (d) IS HIGHER THAN BID IN (c) ABOVE, ASK WHY THE RESPONDENT IS WILLING TO PAY LESS FOR A WC THAN FOR ITS EXISTING SANITATION SYSTEM. GIVE THE RESPONDENT AN OPPORTUNITY TO CHANGE HIS BID IN (c) ABOVE.

(f) Reasons given :____

(g) Respondent's revised bid : _______ cedis per month

(h) If a WC and a KVIP latrine each cost same amount per month, which one would you prefer?

WC ___ KVIP ____
Don't Know ____ Neither ____

FINISHED WITH BIDDING GAMES -- GO TO PAGE 23

FOR HOUSEHOLDS WITH A WC AND A WATER CONNECTION

[PAGE 20 OF ORIGINAL]

Tomorrow I would like to ask you some questions about how much your household would be willing to pay for an improved excreta disposal system.

[SHOW PHOTOGRAPH]

Instead of having the WC in this house connected to a septic tank, it would be possible to have it connected to a system of publicly owned pipelines known as a sewerage system. Each pipe is known as a sewer. A sewer pipe could be put underground along the street near this house. Right now there is no sewer pipe under the street, but it would be possible to install one. If there were this kind of sewer under the street, your landlord could pay to have your WC connected to this pipe. The waste from the WC would flow into the pipe. The waste would not flow into a septic tank or holding pit, so it should not overflow or clog up, and there would be no tank to clean.

I would now like to answer any questions you have about a sewerage pipeline.

Did you know what a sewer system is before I came here ? YES / NO

I would like to think about how much your household would be willing and able to pay for a KVIP latrines or for a WC connected to a sewer. I will come back tomorrow to discuss with you and to ask you some more questions.

Well, let us stop here for today. We are very grateful for your cooperation.

1. In order to be able to identify you tomorrow, may I please know your name?

Respondent's name: ______________________________

[STOP THE INTERVIEW: MAKE AN APPOINTMENT TO RETURN IN ONE OR TWO DAYS]

TIME OF APPOINTMENT: ______________________

[RECORD CHARACTERISTICS OF THE HOUSE TO HELP YOU FIND IT AGAIN.]

Characteristics of house:

END OF INTERVIEW FOR FIRST DAY

<u>ENUMERATOR: THIS PART OF QUESTIONNAIRE IS NOT FOR FIRST DAY OF THE INTERVIEW.</u>

<u>RETURN INTERVIEW</u>

When I was here before, we talked about the possibility of connecting the WC that you use in this building to a sewer.

As we discussed, instead of having the WC in this house connected to a septic tank, it would be possible to have it connected to a system of publicly owned pipelines known as a sewerage system. Each pipe is known as a sewer. A sewer pipe could be put underground along the street near this house. Right now there is no sewer pipe under the street, but it would be possible to install one. If there were this kind of sewer under the street, your landlord could pay to have your WC connected to this pipe. The waste from the WC would flow into the pipe. The waste would not flow into a septic tank or holding pit, so it should not overflow or clog up, and there would be no tank to clean.

Do you have any questions about connecting the WC to a sewer?

YES / NO

IF YES, answer the respondent's questions and record the questions below: (i.e., what question did the respondent ask?)

____

____

____

BIDDING GAME FOR A SEWER CONNECTION: HIGH STARTING POINT

Suppose the landlord was willing to connect the WC which the tenants use in this house to a public sewer pipe. The cost of connecting to the sewer pipe would be paid monthly by the tenants as part of their water bill.

(a) If you were asked to pay 1000 cedis per month for the costs of a sewer connection, would you want the landlord to connect the WC to the sewer pipe, or would you prefer that the landlord not connect to the sewer?

YES - have landlord connect _______ GO TO (c)

NO - rather not connect _______ GO TO (b)

(b) Suppose that instead of 1000 cedis, the monthly payment for connecting the WC was 500 cedis. Would you want the landlord to connect the WC to the sewer pipe or would you prefer not to have it connected?

YES - have landlord connect _______ GO TO (c)

NO - rather not connect _______ GO TO (c)

(c) What is the most you would be willing to pay per month to have the WC connected to the sewer pipe?

MAXIMUM MONTHLY PAYMENT ____________ cedis per month

PART IV : EDUCATION, HOUSING CHARACTERISTICS, HOUSEHOLD ASSETS, OCCUPATION OF RESPONDENT *[PAGE 23 OF ORIGINAL]*

A. EDUCATION

1. What is the highest level of school which you have completed?
(Circle appropriate level)

None ______

Primary	1 ___	Middle	1 ___	Secondary	1 ___
	2 ___		2 ___		2 ___
	3 ___		3 ___		3 ___
	4 ___		4 ___		4 ___
	5 ___				5 ___
	6 ___				6 ___

University __________ Arabic school: no. of years ______
Teacher training __________
Other (specify) __________

2. What is the total number of years of school that you have completed?

No. of years ________

3. Are you married? YES / NO

IF NO, GO TO NEXT PAGE

4. What is the highest level of school which your spouse has completed?
(Circle appropriate level)

None ______

Primary	1 ___	Middle	1 ___	Secondary	1 ___
	2 ___		2 ___		2 ___
	3 ___		3 ___		3 ___
	4 ___		4 ___		4 ___
	5 ___				5 ___
	6 ___				6 ___

University __________ Arabic school: no. of years ______
Teacher training __________
Other (specify) __________

5. What is the total number of years of school that your spouse has completed?

No. of years ________

B. HOUSING CHARACTERISTICS

1. How many stories does this building have?
(i.e., how many floors does this building have, including the ground floor)

one-story _____
two-story _____
three-story _____
four-story _____
Other (specify)_____

2. What type of house is this?

one storey, single family _____
multistory, single family _____
single storey compound _____
multi-storey tenement _____

3. Does the landlord live in this building? YES / NO

4. How many households live in this building?
(including the landlord & his relatives)

No. of households_____

5. Does this house have electricity? YES /NO
GO TO 9

6. IF YES, how many electrical points does hour household have?

No. of points _______

7. What was your electricity bill last month?
(i.e., your share if you do not have your own meter)

__________ cedis per month Don't Know ___

8. What is your monthly rent? __________ cedis per month
__________ don't pay rent

9. How many rooms does your household rent here?
(including lounge ____________) No. of rooms ______

10. Type of materials used to construct this house:

WALLS:
Cement blocks _____
Swish mud _____
Bricks _____
Other (specify) _____

ROOF:
Corrugated iron ______
Corrugated asbestos ______
Other (specify) ______

Floor:
Concrete _____
Other (specify) _____

C. HOUSEHOLD ASSETS

[PAGE 25 OF ORIGINAL]

11. Does this household own any of the following items?
(Indicate number of items owned)

	NUMBER OF ITEMS
Radio	______________
Electric cooker	______________
Sewing machine	______________
Fan	______________
Refrigerator	______________
Bicycle	______________
Telephone	______________
Television	______________
Water Heater	______________
Kenti Cloth	______________
Automobile	______________
No. of Goats	______________
No. of Sheep	______________

D. OCCUPATION

12. How many adults in this household have employment or are self-employed? (i.e., how many are working)

NUMBER OF PEOPLE WORKING __________

13. Indicate the occupation of each employed person in the following table. [DON'T FORGET TO INDICATE THE SEX OF EACH PERSON LISTED]

		OCCUPATION					
PERSON NUMBER	SEX M/F	UNSKILLED LABORER	SKILLED LABORER	OFFICE WORKER	TRADER	PROFES-SIONAL	OTHER
1.							
2.							
3.							
4.							

14. How much money would you estimate all the members of your household spend per week, not including rent?

Cedis per week ____________________

15. Please indicate the monthly income of each employed person in the household mentioned above. [i.e., in Question 13]

WORKER NUMBER	MONTHLY INCOME PER WORKER (CEDIS)						
	<5000	5000-9,999	10,000-14,999	15,000-19,999	20,000-29,999	30,000-39,999	>40,000
1.							
2.							
3.							
4.							

16. Are you Christian or Moslem?

Christian ____ Moslem ____ Other ____

17. AGE OF RESPONDENT : No. of years ______

If respondent does not know or does not answer, check most likely category:

<20 years ________
20-29 years ________
30-59 years ________
>60 years ________

FINISHED WITH INTERVIEW

<u>FOR ENUMERATOR ONLY:</u>

18. Was the person who responded to the questions irritated or nervous during the interview?
YES / NO

19. Do you think the respondent made an effort to tell the truth?

ABOUT THE WTP BIDS	YES / NO
ABOUT THEIR INCOME	YES / NO

20. How would you rate the overall quality of this interview?

GOOD / FAIR / POOR

21. How many other people were listening while you conducted this interview with the respondent?

No. of other people listening ________

22. DO YOU HAVE ANY COMMENTS YOU WOULD LIKE TO MAKE ABOUT THE RESPONDENT'S ANSWERS TO THIS QUESTIONNAIRE? IF SO, PLEASE RECORD THEM BELOW AND ON BACK OF QUESTIONNAIRE:

APPENDIX C:

COST ESTIMATES OF IMPROVED SANITATION TECHNOLOGIES

To analyze different policy options for improving the sanitation situation in Kumasi, it was necessary to develop cost functions for the KVIP, sewer, and water closet technologies most likely to be used. For the most part, these technologies will be shared by households living in the same building. Cost functions were thus developed which relate the costs of each sanitation technology to the number of households living in a building and sharing the same system. For example, costs per household of each of 20 households living in a common building and sharing KVIPs will be different than the cost per household in a building with 3 or 4 households. The developed cost functions provide values for the initial construction costs in US dollars; they can also be used to develop cost estimates on a per building basis.

C.1. Costs of KVIPs

A KVIP module includes a pit and superstructure. Each module is assumed to be capable of serving up to 8 households. The module can be modified by changing the pit size and number of holes to serve a range of 1 to 8 households. A building with between 9 and 16 households would require 2 modules.

Most households living in buildings which have existing bucket latrines already have a superstructure that can be used if the latrines are converted to KVIPs. The cost of converting existing bucket latrines to KVIPs is less than building completely new KVIPs. Some economy of scale can be achieved in the construction of larger KVIPs (both new and upgraded). The cost to each household sharing a large KVIP designed for 8 households is substantially less than the cost of a KVIP for only 1 or 2 households. Likewise, the costs of installing multiple modules on the same site exhibit economies of scale because certain construction components of each module can be shared.

Based on interviews with private contractors and informal discussions in Kumasi, it appears that a new KVIP module designed for 8 households would cost about $500 and an additional module at the same site would cost an additional $350. An upgraded KVIP module converted from an existing bucket latrine would cost approximately $300; an additional upgraded module at the same site would cost an extra $225.

We assume 1 KVIP module serves 1 to 8 households; 2 modules serves 9 to 16 households; 3 modules serves 17 to 24 households, etc., and that the cost function has the form:

$$C(H) = a\,H^{b}$$

where:

C = Construction cost in $
H = Number of households served
a and b are constants.

For new KVIPs we assume that, C(8) = $500, and C(16) = $500 + $350 = $850. The cost function for new KVIPs is then

$$C = 95\ H^{0.8}$$

from which the average cost per household (C/HH) is

$$C/HH = 95\ H^{-0.2}$$

For upgraded KVIPs, C(8) = $300, and C(16) = $525, from which a = 57 and b = 0.8. The cost function for converting existing bucket latrines to KVIPs is then

$$C = 57\ H^{0.8}$$

from which the average cost per household is

$$C/HH = 57\ H^{-0.2}$$

Unfortunately, these functions (because they are continuous and pass through the origin) give erroneous estimates for fewer than 8 households. For example, C(1) = $95 for a new KVIP, which is unrealistically low. Hence, the following costs are assumed for between one and seven households:

Number of Households	New KVIP Cost ($)	Upgraded KVIP Cost ($)
1	250	150
2	286	171
3	321	193
4	357	214
5	393	236
6	429	257
7	464	279

C.2. Sewer and Water Closet Costs

Because sewers must be constructed throughout a city in order for individual households to have access to them, predicting the costs per household of this sanitation option is more difficult than for KVIPs. The cost functions we used are based on several assumptions. First, the costs are for construction and do not include O&M. Second, the cost estimates assume that the sewer system is designed and built to accommodate the households presently living in the city. If a sewer is constructed to provide service for a certain number of people and far fewer connect than anticipated, then the cost of the system per household for the people that connect would be very high. Third, the estimates do not include excess capacity to accommodate future population growth. Fourth, estimating the costs of a sewerage system requires considerable information about the physical attributes of the terrain and the cost of labor and materials. Such detailed information was not available, and the cost estimates used here are based on cost functions for sewerage systems in other countries (*Gallagher, D. and D.T. Lauria, 1988)*. These cost functions are as follows:

$$L/P = 82\ (\text{Density})^{-0.49}\ (\text{Persons/Hookup})^{-0.55}$$
$$C/L = 0.22\ D^{1.2}$$

where L is length of pipe in meters, P is population, D is the average diameter of the sewer in millimeters, and C is sewer cost in US dollars. Density refers to population density in persons per hectare. Hence, L/P is the required length of sewer per person in meters, and C/L is cost per unit length of the sewer in $ per meter. Persons/Hookup refers to the average number of people living in a building. Based on the data from the household survey, the average number of persons/hookup is 50. The density is approximately 150 people per hectare.

Solving the first equation for Kumasi, we have L/P = 0.8, which implies that about 0.8 meter of sewer is required per person. For 600,000 persons, total length of the sewer would be about 480,000 meters. For the second equation, we assume that the average diameter pipe in the sewer network is 200 mm (8 inches) for which the cost is about $130 per meter of length. Hence, the total sewer network is estimated to cost about $61 million.

The costs from the equations cover laying pipe to the entrance of each building. Water closets would have to be installed within each building to actually provide WC service. The cost of installing the WC modules would follow a pattern similar to the installation costs for the KVIPs, yet each module is less flexible than a KVIP and thus would be a fixed cost. (A WC module serving 1 household would cost the same as a module serving 2 or 3 households.) Large buildings would require a number of separate WC modules to insure adequate service.

A WC module is defined as the plumbing and fixtures (including the connection to the city sewer line) that could be shared by 1 to 8 households. If a building does not have a water connection, water will need to be added to the building before the WC modules can be installed. The approximate cost of installing one WC module in a building with water is $250; in a building without water, the cost is estimated to be $350. Once water has been added and one WC module has been installed, the cost of installing each additional WC module would be about $200. The cost for connecting buildings with existing WCs will include an initial $50 connection fee plus the per household sewer costs. The total initial installation costs for the households adopting a WC with a sewer connection is the sum of the sewer cost ($470/HH) plus the per household cost of the WC module installation. The latter will depend on the number of WC modules and the number of total households served. The assumed function for total WC cost (C(H)) and cost per household (C/HH) are as follows:

For Buildings Without Water

$$C(H) = 470\,H + (350 + 200 * (1 - \mathrm{INT}(H/8.01))) \quad \text{or,}$$
$$C(H)/\text{household} = 470 + (350 + 200 * (1 - \mathrm{INT}(H/8.01)))\,/\,H$$

For Buildings With Water

$$C(H) = 470\,H + (250 + 200 * (1 - \mathrm{INT}(H/8.01))) \quad \text{or,}$$
$$C(H)/\text{household} = 470 + (250 + 200 * (1 - \mathrm{INT}(H/8.01)))/H$$

For Connecting Existing WCs to Sewers

$$C(H) = 470\,H + 50 \quad \text{or,}$$
$$C(H)/\text{household} = 470 + 50/H$$

where INT is a function that denotes the integer portion of a number. For example, $\mathrm{INT}(0.5) = 0$, and $\mathrm{INT}(2.8) = 2$.

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