ALTERNATIVE ARRANGEMENTS FOR WATER SUPPLY IN URBAN AREAS

CASE STUDIES FROM KARACHI, PAKISTAN

By

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A Doctoral Thesis Submitted in Partial Fulfilment of the Requirements for the Award of Doctor of Philosophy of Loughborough University

March, 2005

ACKNOWLEDGEMENT

This dissertation has been made possible by the help, assistance and advice of various individuals and institutions. I am deeply indebted to my supervisor, Dr. M. Sohail Khan, for his invaluable guidance and support. His insightful remarks at the various stages of the work were catalytical in improving the quality of work.

I am thankful to Engr. Abul Kalam, Vice-Chancellor, NED University for having allowed to carry on with my Ph.D. dissertation and keeping faith in my being that I shall be able to complete it by 2004 despite my work schedules. I also express my gratitude to the NED library staff for extending support to my various and rather urgent demands for obtaining literature.

Thanks are also due to the WEDC staff for their help in finding relevant literature during the initial stages of this work. I extend my gratitude to my staff members, Shamim for typing and managing the records and Younus for assisting me in all the field studies.

Last but not the least, I am thankful to all my family members for their kind support throughout the course of this dissertation.

DEDICATION

This thesis is dedicated to Humera, my wife for her patience and support during the various stages of work and to my mother for her unabated encouragement throughout my career.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
APA	American Psychological Association
CBOs	Community Based Organisations
CDGK	City District Government Karachi
DHA	Defence Housing Authority
ICIJ	International Centre for Investigative Journalism
KDA	Karachi Development Authority (now defunct)
KDP	Karachi Development Plan
KMC	Karachi Metropolitan Corporation (now defunct)
KPT	Karachi Port Trust
MGD	Million Gallons Per Day
MPECD	Master Plan and Environmental Control Department (of KDA)
NGOs	Non Governmental Organisations
O&M	Operation and Maintenance
OECD	Organisation for Economic Cooperation and Development
OPP-RTI	Orangi Pilot Project – Research and Training Institute
PECHS	Pakistan Employees Cooperative Housing Society
PPP	Public Private Partnership
PSP	Private Sector Participation
QKAEMP	Quetta Katchi Adadis Environmental Management Programme
SCM	Supply Chain Management
SITE	Sindh Industrial and Trading Estate
TMA	Town Municipal Administration
UN	United Nations

UNCHS	United Nations Centre for Human Settlements (Habitat)
UNCRD	United Nations Centre for Regional Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCAP	United Nations Economic and Social Commission for Asia and Pacific
UNICEF	United Nations Children Fund
UNMDP	United Nations Millennium Development Project
WASH	Water and Sanitation for Health
WEDC	Water Engineering Development Centre (Loughborough University)
KWSB/WSD	Water and Sanitation Department/Karachi Water and Sewerage Board
WSP	Water and Sanitation Programme
WSSCC	Water Supply and Sanitation Collaboration Council

ABSTRACT

Urban water supply, normally managed by the utilities, is conventionally facilitated through underground piped system. In most of the developing countries, the piped water supply is not sufficient to fulfil the need of communities. Communities in such localities resort to the usage of alternative modes of supply. These modes include boreholes, water tankers, vending through donkey carts, suction pumps or informal drawing from water mains. These alternative modes are used in different arrangements which extend service to consumers through ways and means not formally integrated in the conventional procedures.

Studies on urban water supply have cover the supply modes, procedures, projects and programmes undertaken by the utilities. Literature is available on water vending in urban and peri urban areas. However there appears a knowledge gap in literature related to the alternative arrangements of water supply. This dissertation explores the research question as to why and how consumers in urban areas resort to the usage of alternative arrangements in water supply. The context of fact finding in this exercise is Karachi. 524 questionnaires, 14 focused group meetings and 10 interviews with stakeholders groups spread in three case studies were used as a key set of instruments to generate data for analysis. While deriving arguments, the dissertation builds up its research design to study the existence, performance and impacts of such arrangements through case studies. The research is based on multiple case studies method to focus on the dominant procedures of water supply in the city. It identifies mutually agreed arrangements between consumers and service providers and assesses the possibilities of their integration in the formal procedures. Three case studies are included in this dissertation. Fieldwork comprised of collection of both qualitative and quantitative data. The main aspects of the study are status of water supply service, factors affecting water supply modes, machinery and equipment as well as linkage of piped supply with alternative arrangements.

The study concludes that consumers in different categories had to obtain water supply from alternative arrangements, formally as well as informally. Piped water supply remained as the most desirable mode despite the reliefs received through alternative arrangements. Such alternatives have not been integrated, though complemented, in the formally recognized modes of supply. Possibility of integration was found feasible in some respects such as awami tanks and commercial water tankers. The dissertation also highlights the need of future research in related fields.

Key words: Urban water supply, alternative arrangements, water vending, frequency, reliability, access to supply.

1. INTRODUCTION AND BACKGROUND

1.1 Structure of the Thesis

This introductory chapter provides the overall context for the dissertation. In the opening part, it outlines the structure of the thesis. Thereafter the arrangements of urban water supply are discussed. The commonly prevailing procedures are also explained therein. The chapter describes the relationship between the conventional piped water supply and alternative arrangements. Organisation of chapters in this thesis has been outlined in this description.

Chapter-01, currently under discussion, introduces the area, context and topic of research. Premise of urban water supply is outlined with respect to relevant global debates. Arrangements of urban water supply have been discussed from the contextual references of developing countries. The existence of alternative water supply arrangements has been highlighted with mention of their basic characteristics. Purpose of the research is presented towards the conclusion of the chapter under the subhead of 'summary'.

Chapter-02 is based on the literature review with reference to the topic of the research. The theoretical premise, wherein the alternative water supply arrangements were found to be embedded, has been studied. Organisation theory and supply chain management were studied for their theoretical relevance to the topic of research. The literature was referred for its discussions on public and private sectors and their relationships to water supply arrangements. The recurring issue whether water is a public good or a saleable commodity is also covered in the chapter. Characteristics of services providers are discussed in the head of organisational arrangements for supply. Conditions affecting flexibility and performance are also dealt.

Chapter-03 describes the methodology adopted in this research. The research premise is outlined which led to the hypothesis and research questions. A logical framework was drawn to explain the linkup of hypothesis with argumentation. Research methods were studied for their relevance to the research questions under consideration. Multiple case studies method was adopted after its appraisal. The case studies were identified with corresponding data collection strategies.

Chapter-04 begins discussion on the findings of the research. The first case study has been presented in this chapter. It focuses on water supply in planned and unplanned locations. The description outlines the findings from the fieldwork both with reference to single unit residences and apartments.

Chapter-05 is about the bulk consumers of the utility and its retail beneficiaries. After explaining the context of bulk water operations and structure of service provision, the case study provides details about the bulk supply service by identified providers. Issues in bulk supply have been discussed in the same reference.

Chapter-06 is about the findings of the case study on awami tanks (people's tanks) in Orangi Town which is a low income neighbourhood in Karachi. The process of operations and perceptions of stakeholders have been documented and analysed.

Chapter-07 is about the analysis of alternative water supply arrangements with reference to case studies. Analysis has been conducted around the perceived status of water supply service, modes, factors affecting the service, frequency and perception of adequacy, machinery and equipment, personnel, uses and choices of alternative arrangement.

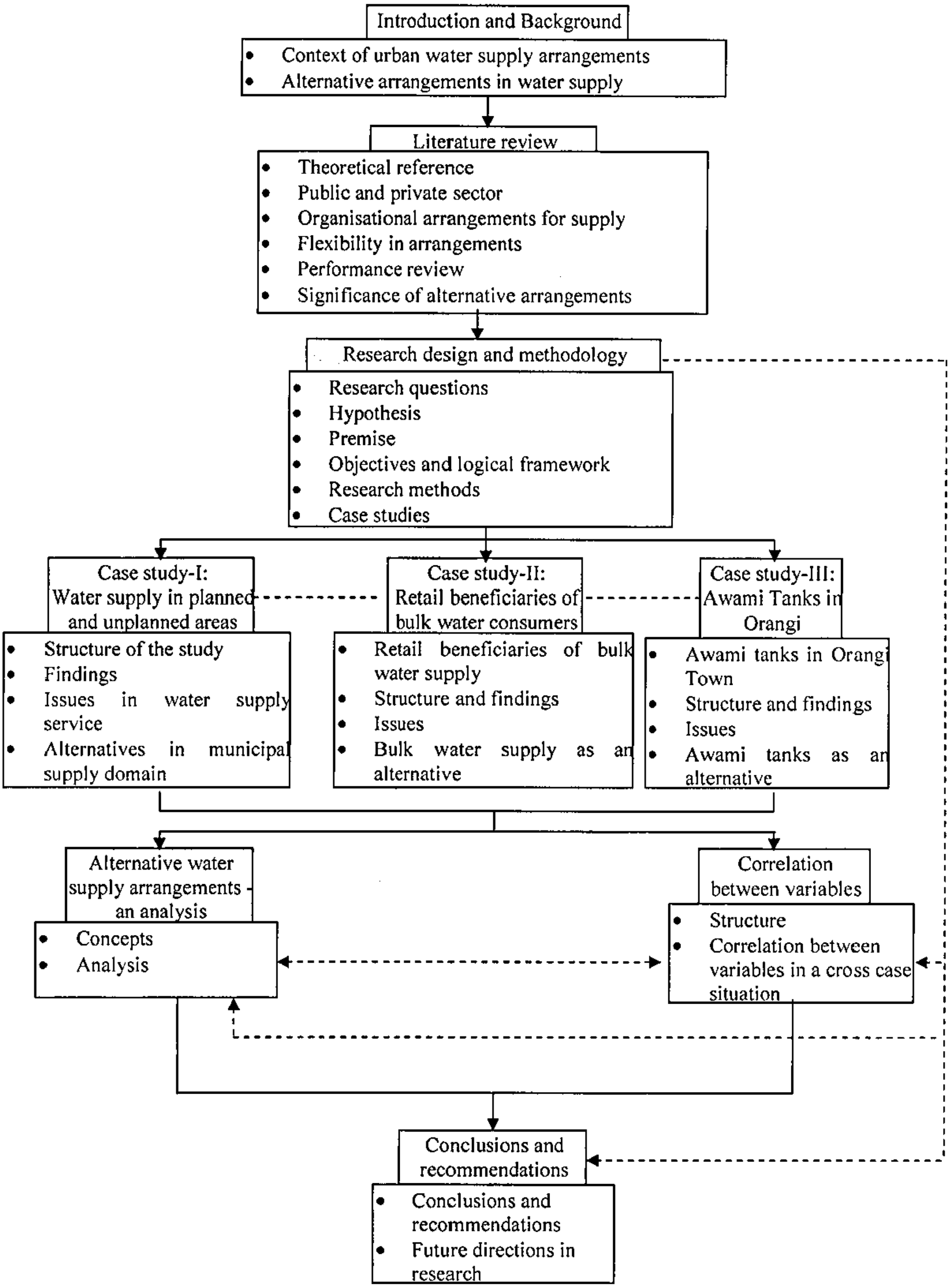
Chapter-08 is about correlations between the various cases along the research. In other words, it focuses on cross case analysis. The analysis of planned, unplanned and bulk water supply has been undertaken in this chapter. The analysis in this sequence also makes a reference to the case of awami tanks.

Chapter-09 presents the conclusions and recommendations based on the research. It also delineates the future direction of research.

The structure of the thesis has been presented in Figure 1.1 which is self explanatory.

Figure-1.1

Structure of the Thesis



1.2 General Overview of Water Supply

Water supply issues, particularly drinking water supply, are acquiring frontline importance mainly due to the gravity of the prevailing situation. In 1995, 29 countries with populations totalling 436 million experienced water stress or scarcity. By 2025 about 48 countries will do so and the number of people adversely affected will exceed 1.4 billion, the majority would belong to least developed countries. An estimated 3 billion people will be living in water-stressed countries in 2035 (UNEP, 2002). In addition, many countries with limited water availability also depend on shared water, which increases the risk of friction and social tensions (Briscoe, 1997). Two such cases include the rivers Euphrates, Jordan, and the Nile, Egypt (World Bank, 2002b). Fast growing urbanizations, especially in the regions of the developing world, is a major issue. For instance, in Asia-Pacific, urban population is growing at a rate of 2.4 percent annually. However the region shows a dismal picture in terms of availability of safe water to its urban inhabitants (Table-1.1). Pakistan, from the selected countries shown in the table, has a high percentage of people in her urban areas without access to safe drinking water.

TABLE-1.1
ASIA-PACIFIC: URBAN POPULATION WITHOUT SAFE WATER SUPPLY – SELECTED COUNTRIES

No.	Country	Urban population range without access to safe drinking water* (in millions)	Percentage of urban population without access to safe drinking water
01.	Solomon Island	0-5	18
02.	Bhutan	0-5	6
03.	Papua New Guinea	0-5	40
04.	Malaysia	0-5	4
05.	Lao PDR	0-5	46
06.	Cambodia	0-5	35
07.	Sri Lanka	0-5	12
08.	Nepal	0-5	33
09.	Afghanistan	0-5	60
10.	Thailand	0-5	13
11.	China	0-5	1
12.	Bangladesh	0-5	18
13.	Philippines	0-5	15
14.	Pakistan	5-10	36
15.	Myanmar	5-10	61
16.	Vietnam	5-10	32
17.	Indonesia	15-20	32
18.	India	34.5	15

* Population without access in millions (and as a percentage of total urban population).

Source: UNEP, 2002

Urban households invariably possess a comparative advantage in terms of access to water supply than rural households. A study conducted in 15 countries revealed that 59 percent urban households had access to water taps in comparison to only 12 percent rural households (Komives, 1999). In addition, the generally existing problems pertinent to urban growth and development have had a deep impact on infrastructure components, including water supply (UNDP/UNESCAP, 1996). Rapid growth of primate cities, rise in urban population, anomalous increase in the type and magnitudes of urban settlements, limitations of essential infrastructural options, inadequate capacity of existing institutions related to service delivery and the growing emphasis on transparency and sustainability in urban governance are matters that have had a bearing on water supply situation particularly in the developing countries

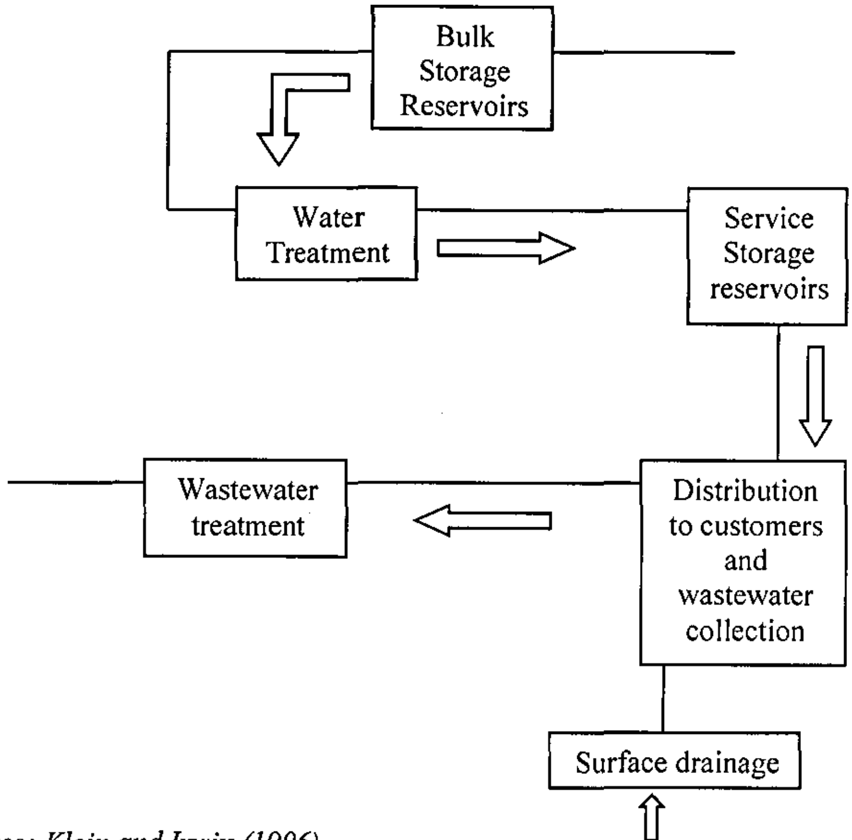
[UNEP (2002), UNESCAP (1996), Hasan (2002), Komives et.al. (2001) and Llorente and Zerah (2003)]. Water needs are also on a rise due to depleting sources, changing environmental conditions, expanding industrial and agricultural need and also an upward mobile life styles mainly in urban populations [Wegelin-Schuringa (2003) and Hunter (1998)].

These urban populations make use of several types of arrangements for water supply (Satterthwaite et.al., 1998) in relation to the prevailing urban management system, regulatory framework, consumer needs (and demands) as well as the corresponding response of the providers.

1.3 Arrangements of Urban Water Supply in Developing Countries

In various general accounts [for example (Khanna, 1977)], piped water supply is referred as the conventional arrangement for the service. Historical accounts also prove this argument, however confirming the existence of other arrangements. Klein and Irwin (1996) reported that piped water supply has had a slow spread. Reliance on water vendors was essential till 18th Century in Europe. Piped water system could win a comparative advantage as it costed 10 to 20 percent of the total cost incurred through vending supply. In few countries such as UK and Canada, competing piping systems were introduced. Water supply system normally consists of a source, bulk storage reservoirs, water treatment/filter, service storage reservoirs, piped distribution to consumers with an eventual link up to waste water management system (see Figure-1.2).

Figure-1.2
Main Components of Water and Sewerage Systems



Source: Klein and Irwin (1996)

However the actual adoption of combination of modes has varied from place to place depending upon the local conditions. Stower (1979) informed that water supply arrangements have been basically dependent upon several factors. Nature of core sources of supply, control and management of the source, distribution network, socio economic characteristics, patterns of distribution, tariffs and pricing as well as institutional mechanisms were few important mentions. Singh (2003) reported the case of India. Although 85 percent of urban population possessed access to some source of supply, only 20 percent of this value were found fit for drinking. This observation is in close follow up of the statistics for India mentioned in Table 1.1. Traditional modes such as rain water harvests were also used in some cities. Komives et.al (2002) confirmed from their study that households without access to tap/piped connection obtained water through multiple modes. Direct access to unimproved sources (river and streams etc.), community taps or yard taps (provided by municipalities), wells of different kinds, vendors and rain water collection were a few options. The study showed that about 2.4 percent of households resorted to water vending as their routine arrangement for water supply. Sharma (2003) also confirmed the existence of multiple modes of water supply in urban areas with a specific reference to India. Urban areas in Goa and Tamil Nadu relied heavily on water vending as a useful arrangement. This had put ground water sources in great demand, often leading to extensive extraction. 21 percent of urban water was supplied through ground water resources in these areas. Peri urban areas in New Delhi were usually found to be deficient in water supply. Utility in New Dehli planned to serve its low-income communities by initiating a proper vending system [Thompson et.al, (1998) and Weglin-Schuringa, (2003)]. Lorente and Zerah (2003) have reported that public sector utilities have been the main planners and managers of water supply service although in developing countries there is a growing tendency to involve private providers, particularly in South America and Africa. Most of the low income households have to rely on more than one modes in terms of water supply arrangements. Management procedures also change and adapt to local conditions [Lobina and Hall (2000)].

Some 25 percent of the urban population of Latin America and at least 50 percent of the urban population of Africa were not connected to the official utility networks and relied on alternative sources for their water supply [Snell (1998) and Collignon (1999)]. Studies have shown throughout the developing world that most of the urban poor depended on non-official providers for water and sanitation services. These providers, which included small-scale entrepreneurs and community-based organisations, sustained themselves with government resources and survived only by offering services which the customers wanted and were willing to pay for. Satterthwaite et. al (1998) found out that alternative arrangements, whether vending or any other form of 'illegal' source, usually costed higher than the piped supply in the same context (Table-1.2).

TABLE-1.2

RATIO OF UNIT COSTS OF WATER FROM PIPED CONNECTIONS AND VENDORS

Source	Ratio	Coverage
Crane (1994)	14:1 – 20:1	Jakarta, Indonesia
Chogull and Chogull (1996)	34:1	Tegucigalpa, Honduras
David and Ionesco (1998)	13:1	Manila, Philippines
Fass (1993)	5.5:1 – 16.5 – 1	Port-au-Prince, Haiti
Whittington et. al (1991)	35:1 – 300:1	Onitsha, Nigeria
ADB (1993)	62:1	Bandung, Indonesia
ADB (1993)	23.3:1	Karachi, Pakistan
ADB (1993)	19.9:1	Ho Chi Minh, Vietnam

Source: Satterthwaite et.al. (1998).

The unit costs normally depended upon the density of neighbourhoods, cost of bulk water quantities, operational cost ingredients including fuel and establishment, structure and functioning of the water utilities and scale of subsidies available to urban water supply sector. The assessment of comparative unit costs is in itself a well defined area of research.

Despite their importance, however, little research has been done on independent water providers and they were seldom included in larger projects (WSP, 1998 a&b). Initial studies in some Latin American and African countries have been followed up by regional conferences of independent providers and ongoing networking to identify common issues and opportunities. The studies not only underlined the widespread existence of the independent providers and their key role in providing water and sanitation to large numbers of urban households, but also the variety of organisational and technical formats in their service provision (Nigam, 1999).

A proper piped water supply system generally requires a critical mass of consumers to fulfil its feasibility. This critical mass is dependent on the contextual conditions such as the availability of a source of supply, tariffs, cost of supply and probabilities in recovery of service charges. When a piped system is not found feasible, small-scale providers assume this opportunity. Some small-scale operators (like the aquateros in Asuncion, Paraguay) (Toyano, 1999) offer high quality water at lower costs than larger companies even in cases where official providers subsidize user payments. Given a business friendly environment, independent providers have been found to develop new technologies, market strategies and product line with particular emphasis on reduced cost and extending access to low-income clients. Independent providers can meet the needs of specialized market niche at both the high and low ends of the income scale (Collignon, 1999).

Boring/tubewells have been the options where the ground water reserves were found to be potable. Such cities made use of boring options that were located close to river basins or locations where water re-charge rate was satisfactory. In Pakistan, Quetta has been an example where almost the whole supply remains dependent upon ground water sources (QKAEMP, 2000).

On the basis of the above-mentioned review of literature, two figures are derived to depict the various arrangements of water supply and corresponding options (Figure-1.3 and 1.4). Some common definitions also evolve from this description.

Figure-1.3
Options in Water Supply – A Flow Diagram

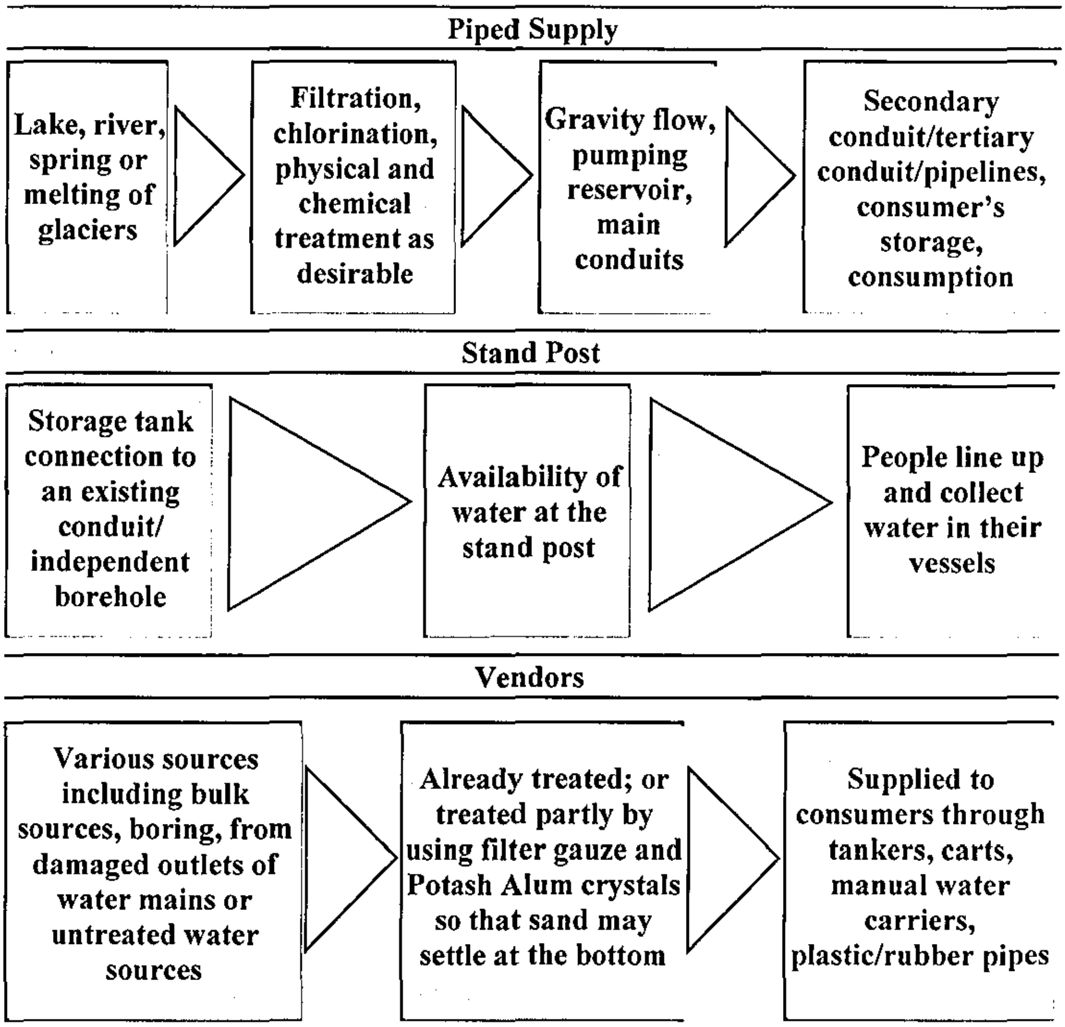


Figure-1.4
**Water Supply Arrangements in Urban Areas –
A General Description**

	Production	Distribution	Consumption
Conventional piped supply by utility	• Source such as lake, river, desalination plant, or ground water or any sweet water body commissioned for the purpose.	• Piped supply.	• Consumed by authorized beneficiaries as per terms and conditions prescribed.
Unconventional supply by utility	• Source such as lake, river, desalination plant, or ground water or any sweet water body commissioned for the purpose.	• Stand posts. • Kiosks. • Tankers/carts. • Manual carriers. • Thefts from mains. • Capitalizing on seepage/leakage. • Association with valve operator in a piped system.	• As a benefit to informal settlements. • As a relief to authorized subscribers. • Vendors who associate with utility/other staff. • Quasi operators/petty thiefs.
Vending	• Conventional source • Illegal source such as unauthorized bore holes, untreated water from a prohibited source or simply a broken main.	• Stand posts. • Kiosks. • Tankers/carts. • Manual carriers. • Thefts from mains. • Capitalizing on seepage/leakage. • Association with valve operator.	• Areas where piped supply is not available. • Augmenting conventional supply. • Peri-urban areas where piped service is not available.
Re-selling	• From an authorized conventional source/connection. • From vending source.	• To neighbours/nearby residents/ occupants.	• Re-selling to vicinity users on mutually agreed terms and conditions.
Self generation	• Unauthorized boreholes. • Untreated water from a source such as pond or river.	• Various vending means.	• Supply to users on mutually agreed conditions.

Source: Author's interpretation based on the feedback acquired from Nigam (1999); Collignon (1999); Snell (1998), Toyano (1999), Thompson et.al (1998), Llorente and Zerah (2003), Weglin and Schuringa (2003) and Lobina and Hall (2000).

Piped water supply refers to the most conventional form in this regard. It comprises underground water pipes used as a means of supply from the municipal source to the house of the consumer. After the sequential stages of filtration and other treatment, water is supplied through pipes to the connected consumers.

Stand post refers to a community/locality water supply facility, normally located along a publically accessible location. Consumers have to fill and transport water from the stand post to their houses using available means. In this mode, the water utility taps are strategically located in accordance with the city demands.

Re-sellers are such consumers who receive supply greater than their demand so that such excess water is sold to neighbours usually through manual means.

Vendors are entrepreneurs who own and/or operate equipment for storage, supply, pumping and transportation. They also have access to any appropriate source of water. Animal carts, tankers, manual water carriers and even informal suppliers through plastic 'surface pipes' are the common modes employed in the process.

1.4 Alternative Arrangements in Water Supply

As discussed in 1.3, an urban water supply arrangement is conventionally referred as piped water supply. Under usual situation, piped water supply is found to be efficient, cost effective and reliable (Komives, 2002). The extensive donor support to urban water supply projects also confirms this fact (for example, World Bank 1998). However alternative arrangements under various conditions and in different contexts do exist, as discussed in the previous sub-head and shown in Figure-1.3. Literature exists on the supply of water to peri-urban areas, refugee settlements, squatters, shiftee settlements and similar underprivileged locations in cities (Lemos et.al., 2002). However it is found that other city locations also rely on alternative arrangements for water supply for different reasons (Sharma, 2003), as discussed hereafter.

For the adaptability of an alternative approach to water supply, effectiveness of the arrangement and its desirability by the user is essential, as researched by Lemos et. al. (2002). They further elaborated that the complexion of such arrangements may not necessarily correspond to typical public or private collaborations. 'Not for profit' sector also helps in developing and operating these arrangements. The case from Indonesia (World Bank, 2002) also reinforces this argument. While piped water supply was the most obvious mode applied in urban areas, it was not able to provide universal coverage. Till 1994, 24.5 percent urban population was served by proper piped water connections (including 4.5 percent that depended on water stand posts). The rest had to resort to some alternative source that varied from ground wells to vending. Most of these service providers belonged to small scale. Another interesting arrangement of alternative water supply was observed in Singapore, as reported by Fong and Nazaruddin (1996). This arrangement aimed at an alternate source of water supply to augment for the increasing demand. Urban storm water was collected in two reservoires. It was integrated in the existing distribution to the end users.

Llorente and Zahra (2003) reported from the Indian urban context that alternative sources were normally availed by residents of low income settlements despite the fact that water is supplied to urban dwellers by public utilities. As many as 80 percent of slum dwellers relied on atleast two sources of supply. These urban dwellers had to spend a sizable part of their incomes on acquiring water from any of the available sources to survive.

1.5 Summary

This chapter has introduced the major foci of the dissertation. The structure of the dissertation is outlined in the beginning. The context of urban water supply has been outlined from the reference of developing countries. The various arrangements of water supply are defined in relevance to their contextual existence and nature of service provision. Considering piped water supply as a pre-dominant arrangement, the various alternative arrangements that were found in urban water supply have been introduced. The chapter lays down the premise to be explored through literature review which is done in the following chapter.

2. LITERATURE REVIEW

From the discussions in Chapter-1, it is adequately clear that issues related to alternative arrangements in urban water supply included unconventional supply by utility, vending, re-selling and self-generation (Figure-1.4). Many arrangements were found to be unconventional and quasi-legal as well. However limited literature was available that directly focused on unconventional set of arrangements. A common factor in these arrangements was the consumer – provider relationship of varied nature. A relevant body of literature was critically reviewed from the standpoint of consumer – provider relationship that emerged as the central spine of this dissertation work. The relationship was viewed from the perspectives of public and private sector, organisational arrangements for supply, flexibility in arrangements, performance review and alternative arrangements. These perspectives have been outlined from the feedback obtained from the literature itself. Theoretical reference interlinking the alternative arrangement and organisational theory as well as supply chain management is the opening part of this chapter. The construct of subheads from 2.2 onwards presents the relevant aspects of the background theory as the beginning premise. Thereafter the pertinent factors related to the context of water supply have been dealt to provide a direct interface with the theoretical reference.

2.1 Theoretical Reference

Water supply has been considered a service that remained essential for the survival of any settlement, particularly urban areas. Provision of water supply normally depended upon the geo-physical conditions of a city, socio-economic conditions, technical, institutional and administrative arrangements (Saleth and Dinar, 2000). Diversity in these factors gave rise to a wide variety of water supply arrangements that evolved to respond to contextual conditions. A detailed discussion on the arrangements of water supply is presented in Chapter-1. It is also a well known fact that sources of water are finite and face pressure for their intensive utilization due to rising human need (UNCRD, 1998). Thus the mechanism of service provision needs to be reviewed periodically to assess the forthcoming demand and corresponding supply arrangements in a scientific manner.

The review of literature on urban water supply, dealt in this chapter, reveals that it can be categorized into three heads. Water supply systems at the municipal level dealing with its related issues such as production, treatment, distribution, storage, pricing, operation and maintenance, cost recovery and consumer concerns; approaches, ways and means of the small scale water providers in urban and peri-urban areas and the supplementation of water supply through alternative means. Literature is usually available in the form of project documents, reports, articles and research papers published in journals for the first category [Wegelin-Schuringa (2003) and Lorente and Zerah (2003)]. For the second category, literature is now being generated in the form of reports, articles and papers especially those commissioned in the recent past [for example Snell (1998); Toyano (1999); Nigam (1999) and Collignon (1999)]. Availability of literature in the third category is rather limited, being a combination of municipal supply and vending/any other arrangement. Thus a definite knowledge gap exists in this domain which requires research to stretch the understanding about its various pertinent issues. Few studies and sources of literature however refer to this domain. Satterthwaite et.al (1998) have reported that in situations where people do not have access to formal centralized systems of water supply (and sanitation), they would adopt a variety of alternative strategies in order to satisfy their needs. Lobina and Hall (2000) refer to public owned enterprises as an alternative arrangement for water supply to urban areas. Therefore, being a potential set of arrangement for water supply, it is appropriate to study the alternative arrangements in this sector. Lemos et.al (2002) have outlined the desirability and effectiveness of alternative arrangements for provision of water and wastewater services, demonstrated through a case study.

From the nature of urban water supply and review of its various supply arrangements, it is evident that two categories of stakeholders are apparent – providers and consumers. The former collectively includes municipal agencies/utilities, water treatment bodies, regulatory, management and revenue collection bodies. Formal and informal service providers are also included in this category. The later includes consumers comprising domestic, commercial, industrial, institutional and other categories (Klein, 1996). The relationship between these two categories of stakeholders can be theoretically linked to the body of *organisational theory* which deals with issues related to interface of consumers and service providers (Harmon and Mayor, 1986). The reasons to focus on the organisation theory as the premise for this research are several. An organisation is defined as a group of human beings that is aimed to follow a set of common goals (Jones, 2001). Similarly organisation theory refers to the principles that are applied to structure any group of people around a common set of goals (Jones 2001; Daft, 2001). Organisation theory has its evolving link with both public and private sectors (Runciman, ed. 1978). This aspect is crucial for creating a premise of relationship with water supply planning which involves the public and private sectors in different capacities. Organisation theory has a direct link with human relations, its various characteristics and attributes (Barnard 1938). This is an aspect which is vital in water supply management where stakeholders are related to the services with different attitudes, aspirations and behavioral characteristics. Organisation theory depicts sizable flexibility to accommodate different types and formats of organisations as well as relationships (Robbins, 1983). This is a crucial aspect from the standpoint of water supply related stakeholders in various contexts. Anomalies of relationship and behaviours of various kinds often exist between stakeholders. Organisation theory deals with processes of different kind. Different arrangements of water supply and its management display emphasis on process and its various stages. Traditional variables of performance such as efficiency, effectiveness and stakeholder satisfaction are of significant mention in the discussion on organisation theory (Heffron, 1989). These variables are crucial in the case of water supply and corresponding management to a sizable extent. A review of the various aspects of this theory, that demonstrates its link with arrangements of water supply, is outlined below.

In the build up of the organisation theory, philosophers and practitioners from different professional backgrounds have contributed. Early input came from sociologists such as Weber which was added upon by other professionals such as Barnard, Taylor and Fayol (Haynes, 1980). Their contributions can be reviewed in a simultaneous manner as according to some experts (Haynes, 1980), organisation theory has little chronological significance.

Organisation theory is often regarded as a twentieth century creation. During the initial half of twentieth century, it was based on very general abstractions with a focus on private sector. It was argued that the state should possess the qualities of a good business administrator (Fayol; 1949). The role of state and private sector was found to be complimentary in administration, particularly with reference to state managed services/enterprises. Fayol (1949), who based his arguments on a study of French Post and Telegraph Services, concluded that the state should restrict itself to giving general policy directions. Provision of actual services should be out-sourced to private providers by means of state concessions limited to a term of years. Taylor (1947) emphasized that management and organisation are scientific disciplines. Detailed evaluation and analysis of every management function is therefore vital with a systematic structure to organize its working. Weber explained the characteristics of bureaucracy as an important ingredient of organisational functioning (Runciman, 1978). Specified functions, assigned job descriptions, strict system of super and subordination and relevance to the cultural milieu of the respective context were some qualities of bureaucracy stated in this reference.

Several contributions were made to the body of organisation theory thereafter [Campbell (1977), Hatch (1997) and Hodge et.al. (2002)]. Barnard cited the importance of informal and formal organisations. Cooperation amongst the participating individuals was a key pre-requisite for Barnard [Harmon and Mayor, 1986] as he laid emphasis on human relations in the interpretation of the organisation. According to him, 'an organisation comes into being when there are persons able to communicate with each other and willing to contribute action to accomplish a common purpose' (Harmon and Mayor, 1986: p.105). Taylor (1947), however in his attempt to outline the duties of scientific management, laid down a few points. He was of the view that in an organisational structure, the duties of a staff member's work must be scientifically worked out. The training of the workman should be done in correspondence to the set of tasks assigned to him. The division of responsibilities between the workforce and management also required to be streamlined. As the literature related to water supply shall point out, this aspect was particularly important in the smooth running of water utilities. Where workforce had not been able to perform according to laid down charter of responsibilities, it led to deterioration of service and eventually very dire policy options such as privatization (Ahmed and Sohail, 2004).

Organisational theory had been criticized at certain ends for not being responsive to individuals and their internal social relations. It was also criticized for being too much concerned with organisational structure and less bothered about the larger peripheral forces that shape the overall organisational culture (Donaldson and Preston, 1995). For this argument Barnard (1938) had pointed out that activities in an organisation cannot be coordinated unless there is the disposition that allows a personal act to an impersonal system. He firmly believed that "organisations are cooperative systems that coordinate the efforts of individuals towards a purpose (p.105)". Barnard delineated the role of informal organisations which also needed to be viewed as they contribute unconsciously towards coordinated activities vis a vis the formal which gave rise to consciously coordinated activities [Robbins (1983) and Campbell (1977)]. Organisations led to productive outputs of human inputs. Common goals were followed by a group of people bound by some form of a basic organisational structure to give rise to such outputs. In reference to the water supply formats, this was exactly what was found out from the review of various examples. The supply was delivered in several organisational formats depending upon the contextual conditions [Snell (1998), Collignon and Vezina (2000) and Haarmeyer and Mody (1997)].

In other words, the organisation can be considered a cooperative enterprise aimed to achieve a commonly shared goal. Barnard went on to describe formal and informal organisation. According to him, "informal organisation gives rise to the ability to understand without words. Informal organisation tends to maintain cohesiveness through regulating the willingness to serve and the stability of objective authority. It also helps maintain feelings of personal integrity, self respect and independent choice" (Harmon & Mayor, 1986: p.109).

Among the discussions, several aspects pertinent to organisation theory are outlined [(Weber, 1990), (Barnard, 1938), (Schary and Skjott, 2000)]. Debates around public and private sector, flexibility, performance review, organisations and their relationships and linkages in supply services have been found relevant to the issues of alternative modes of water supply.

2.2 Public and Private Sector

2.2.1 General

Organisation theory addresses the various performance and composition related issues of the public and private sector institutions. Theoreticians such as Weber (Runciman, 1978), Taylor (1947), Barnard (1938) and Hodge et. al. (2002) have attempted to create the link of organisation theory with public administration – the key administrative entity in public sector. Weber has defined bureaucracy as a key element of public administration where officials with requisite skills wield the overall power of organisation. Weber's interpretations of bureaucracy depict it as a structured framework where the responsibilities are articulately defined. Thus the organisational functions exist within the bureaucracy itself according to organisational hierarchy. This form of organisational behaviour is most commonly observed in public organisations (Weber, 1947 and 1990). However, in this organisational background, Weber has attempted to construct ideal types of bureaucratic organisations, possessing characteristics that can be the outcome from various types of associations. It is however obvious that the real life examples possess only a few of the characteristics outlined in this connection (Runciman, 1978). Weber has laid greater emphasis on the knowledge aspect because he believes that bureaucratic domination only becomes possible when attempted through knowledge.

2.2.2 Public and Private Organisations – Some Characteristics

Public administration which is a vital ingredient of the public sector functioning, was criticized by several theoreticians. Hatch (1997) analysed the working of bureaucracies amongst public organisations and eventually drew conclusions. Inability to recognize and relate to informal organisations, weak communication due to hierarchical patterns, limited/incomplete utilization of human potential due to mistrust, conservative approach to adapting innovative solutions have been the key reasons cited for the declining bureaucratic performance. Barnard (1938) however, emphasized the need to understand the importance of informal organisation in conjunction with formal organisation. Both the concepts have been found to carry their respective merits of application. It is vital that they are studied and applied in the respective set of conditions wherever appropriate. Water utilities, wherever work in association with independent water suppliers in various urban contexts around the world, depict an example of the combination of formal and informal organisation [Collignon and Vezina (2000)].

In these discussions, it is also argued that administrative and organisational merits are the same – atleast in the general sense – for the public and private sector (Hardy, et.al. 2003). In other words [Rainey et.al (1976)], it was observed that the organisational approaches for public and private sectors possessed many overlappings. Deeper studies reveal a few distinctions between the two sectors [Thompson (1998) and Hall and Quinn (eds) (1983)]. Public organisations derive revenue from politically determined apportionments from the public funds while private organisations entirely depend upon market performance. Besides public organisations face greater criticisms and legal constraints compared to private organisations. Environmental transactions by the public organisations are confronted with greater public scrutiny compared to private counterparts. Public organisations have vague and often confusing goals with a dullness in working approach. Private organisations are normally found to be innovative. Similarly public employees have low work satisfaction and organisational commitment. Criteria to judge the performance often varies to some extent. For instance, for duty clerks in an office, the presence in the office itself is a duty despite the overall output generated in the stipulated time (Rainey et.al, 1976).

Hasan (1992) critically outlined characteristics of public organisations. Inflexible behaviour, reduced incentive for high personal achievement, goal displacement, poor internal and external communications and lack of adaptive capacity are some points in this respect. This is a typical criticism that is cited against various categories of public organisations including utility agencies. It leads to a case for bringing about organisational changes including privatization (Heffron, 1989). The scenario however remains wide open for an objective and critical evaluation of public and private sector organisations, particularly utilities, for their comparative merits in organisational effectiveness. This need for comparison, which is beyond the scope of this dissertation, however leads to the probability that a combination of the two sectors may be a useful organisational solution in several contexts including utilities. Studies related to pubic private partnerships shall be a useful reference to this debate.

2.2.3 Water Supply in Relation to Public and Private Sector

One of the fundamental issues in the debate on public and private sector is the status of water – whether to consider it as a free commodity or a tradable good (Rivera, 1996). This aspect is particularly crucial because it has a direct bearing on the legitimacy of various options and arrangements as well as the institutional setup delivering water. Gleick (1998) argued in favour of establishing water as a human right. By referring to international law, declarations and state practice, he made a case to establish water as a fundamental human need. Although major declarations, laws or state practices did not directly specify water as a human right, interpretations derived from them showed that right to minimum quantities of water is essential. For instance in the Rio Summit of 1992, priority was given to the satisfaction of basic needs and ecosystems. It was also established that on an average 50 litres per person per day is the bare minimum requirement (UN, 1992). Gleick (1998) further argued that if advised through a relevant international organisation, it shall become obligatory on all the states to create favourable social, economic and institutional conditions to ensure the provision of water, at least the basic quantities. In the same respect it is contended that poor people consume water for free. On the contrary, poor people have to pay more and under unflexible conditions due to the restrictive nature of supply arrangement. Poor people rely on vending where payments have to be normally made directly and on upfront basis [Nickson, (1997); Franceys, (1997) and Johnstone and Hearne (1998)]. Several studies done on this aspect have established this argument.

Rogerson (1996) has outlined the international debates related to the willingness of the consumers – especially low-income groups – to pay for the water supply services. It is important to note that a substantial literature related to this aspect is based on studies initiated by the World Bank (see WSP, 1998a). Vital studies (WSP, 1998b and WSP, 1997) contend the myth that poor people do not pay for water. It is evident that poor people have been paying for water supply since the origin of their settlements mainly to vendors. However vendors charge high prices which become a burden on the common people. In some cases (Snell, 1998), vendors are the employees of the water utility. This factor creates an element of uncertainty as such people cannot manage long lasting solutions/association. Positive aspect is the free enterprise and freedom to benefit from a vendor. In the cases reviewed such as Onitsha, Nigeria [Thompson et.al, (2000) Mashaueri and Katko, (1993) and World Bank (1990)], people were paying substantially to their service providers.

The above points from literature review show that the poor have been paying for the water supply service to the existing set of service providers according to mutual agreements. In fact the poorest of the poor were found to be paying more (WSP, 1998b). This finding can set the premise for any useful institutional analysis.

It is important to note that piped water supply system spread at a slow pace in the European cities. Klein (1996) informed that water vendors were indispensable in almost every town of the world, making the service a private enterprise. Since vending was facilitated through animal drawn or mechanically steered vehicles, it had the flexibility to reach various urban locations. The prices were adjustable according to level of service and frequency. The invention of piped water supply was soon applied at a very swift pace due to efficiency and cost effectiveness (Table 2.1).

TABLE-2.1
PRICES OF WATER VENDORS
VS. PRICES OF PIPED WATER SUPPLY (IN US CENTS/M^3)

	Vendors	Piped Water
Bandung	616	9.9
Jakarta	185	17.2
Manila	187	10.5
Karachi	175	7.5
Ho Chi Minh	151	7.6

Source: Asian Development Bank, 1993.

With the rise and consolidation of municipal bodies in service provision, piped water supply was seen as the common option to serve the urban population. Some low-income settlements, which received water from vendors, were also targeted for upgradation through piped water supply projects on the basis of contextual conditions. For instance, in Lebanon, Awali – Beirut conveyor project was planned to impact low-income households, replacing dependence on vending by piped water supply (World Bank, 1998a). While the project did not possess any direct anti poverty focus, it was expected to have positive inputs on the low-income households that used to spend substantially on the purchase of water from vendors during service interruptions. It is normally expected from a bank project that it would reduce and finally eliminate informal vendors for being prohibitively expensive. Performance of the system usually provides the actual measure of success. If the clientele is well served, the project is deemed satisfactory. Otherwise the vendors continue to act as the alternative service provider for the un-serviced or under-serviced clientele. The report indicated the possibility of integrating informal vendors with formal private contractors as the former have not been accorded this opportunity (Whittington et. al, 1998).

In Latin American contexts such as Paraguay, urban water supply was traditionally managed by public utilities. It was found to be inefficient. To remove inefficiency it was privatized and handed over to private companies (Toyano, 1999). A typical reservation cited in such situations was that public monopolies were replaced by private monopolies as a single company controlled the overall operation of the utility. As reported by Toyano (1999), the private companies tend to curb operations of informal small scale providers, causing hardship for low income households. Even when public water enterprises were service providers, the factor of monopoly remained. Collignon (1999) mentioned that in African cities, municipalities looked after access to water to the low income settlements. Soon national water companies were formed and controlled all the urban water affairs. Thereafter the municipalities also shed the responsibility of managing the standpipes which were an important component in water supply provision to the poor settlements. Obviously these monopolies may have had little accountability towards the users which ultimately leads to decline in service and overall management downfall (O'Looney, 1992).

- Piped system through a public utility evolved as conventional municipal alternative.
- Status of water as a public good or saleable commodity has been broadly discussed in literature.
- To maintain efficiency of service, public and private sectors have developed various alternatives.

It is obvious from the discussion that monopoly was not a guarantee to the service (Lobo, 2000). This was also in reference to the African case studies (Collignon and Vezina, 2000) where clientele – especially low-income groups – was contented to buy small quantities of water without passing through the hassle of dealing with billing systems.

In contrast, competition was a much better way to ensure fair rates and efficient service compared to administrative supervision, as researched by Collignon and Vezina (2000). They also informed that formal provision of water was done through state sponsored monopolies, both in the public and private sector. Small scale providers in Guatemala and Paraguay were found to operate at prices down to 1.4 times the official utility prices due to competition

(Solo, 1998a). Normally one body was given the opportunity to acquire sole rights for water provision. The clientele was predominantly upper and middle classes with very few members of low income groups. Standpipes were a very useful means to provide water to poor households. In some cities such as Ouagadougou, they served as many as 59 percent of the city population, largely poor. Supplementary sources such as providers through boreholes also supplemented the supply quantities. In some cases such as Abidjan the water company had given license to few hundred households to resell water. Many unlicensed re-sellers also continued to operate in the market. Door to door delivery was also facilitated by many small scale operators who normally charged higher rates than the standpipe distribution. From the wide variety of contractual conditions discussed in the paper it was apparent that independent providers greatly adjusted to the contextual conditions of the area, including mutual competition, according to the demand of their service (WSP, 1998b).

Public and private sectors can develop a wide variety of alternative arrangements for facilitating water supply. Saade-Hazin (2001), Lobo (2001) and Magadagela (2000) have refered to various cases related to public private partnerships in water. It was pointed out that as less as 10 percent of total world population in the formal sector was provided with water through private operators, thus a tremendous opportunity remained for public private partnership exploration. Concerns and issues related to public private partnership, as outlined in the above references included the nature of accountability mechanisms for controlling/regulating private operators; controlling natural monopolies in water supply services; finance and performance; making public private partnership tailor-made and responsive to communities; increasing knowledge on regulation; dealing with entrepreneurial risk and the comparative merits of private operators. It is also outlined that complete privatization may not be the only solution (Ahmed and Sohail, 2000). There was a broad range of options available in this reference [Waiser, (1996) and Van der Berg and Katakura (1999)].

Critically referring to the argument that public and private sector can evolve working relationships in more than one ways, several aspects need to be addressed in this context. The literature has shown the limitations of relying entirely upon public sector (Ahmed and Sohail, 2000; Rivera, 1996). It has also shown that private sector alone does not possess the entire capacity of service delivery (Collignon, 1999). Properly designed public-private partnerships (PPP) become one of the solutions (Lobo, 2000). As the above references have dealt in their respective context, the contextual realities shall play a formidable role in determining the exact structure and working mechanism of a PPP.

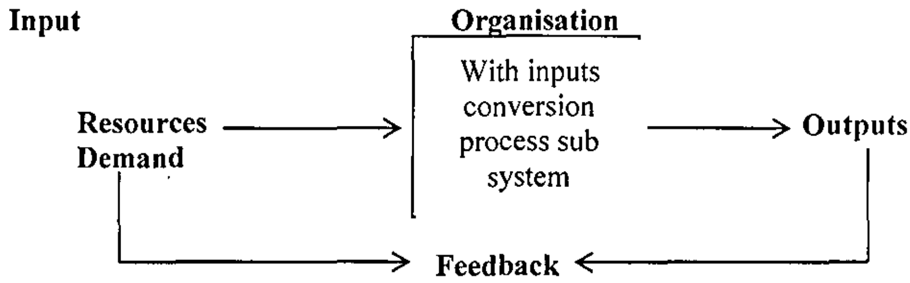
2.3 Organisational Arrangements for Water Supply

2.3.1 General

The previous subhead dealt with the public and private sector characteristics in relation to water supply arrangements. This subhead focuses on the theoretical premise determining the type of organisational framework for such arrangements.

According to Heffron (1989), there were many theoretical references that provide the framework for the construct, behaviour and performance of an organisation. Open systems theory viewed all organisations as open systems. These organisations evolved and developed dynamic and interdependent relationships with their environment. The organisations received inputs from their environment and converted them into outputs which were transmitted to the environment (Figure-2.1). Besides Allison (1984) laid down the case for a decision premise. He argued that the decision premise was the key term that focused on the common denominator for a wide variety of inter-related terms that affected decision making as a process. These terms refered to several variables that constituted the components in the organisational theory including personnel and other non-personnel ingredients. Robbins (1983) argued that problems acted as a compelling force to act. The problem solving process became the generator of organisational values which normally sustained the organisation for a sizable period of time.

Figure-2.1
Input-Output Relationship



Source: Heffron (1989).

Chandran (1998) specified a 'sound', 'specific' and dynamic organisational structure. Choice of correct objectives, identification of work [to achieve the objectives], organisation of the group related work, establishing clear assignments as well as establishing the methods and procedures that may help achieve the objectives of the organisation were some ingredients. Mahoney (2002) pointed out that it is essential in an organisation that consists of a group of individuals that all the members have a cooperative approach compared to a competitive approach. This aspect helps to raise productivity of the organisation. Mahoney further mentioned that decentralization as an organisational option functions well when incharge/manager of every decentralized unit has full authority of taking and implementing decisions. Haynes (1980) described organisations as living organism with different forms of informal relationships inbuilt within themselves. Critically comparing these parameters of organisational structure with the water supply system explored in the literature review, it is obvious that those organisational contexts where they were followed [see Stower (1999) for direct assistance to self help projects initiated in Kenya] yielded positive outputs. However in situations where organisational principles were not appropriately applied showed negative outputs (Lobina and Hall, 2000).

2.3.2 Organisational Arrangements for Water Supply

As discussed in Chapter-01, consumers and providers were the two essential categories of stakeholders associated with water supply and its arrangements. There were several alternative arrangements through which water was produced and supplied to consumers. Water vendors and small scale providers constituted major alternatives. Whittington et.al (1988) conducted a study based in two countries, Kenya, East Africa and Honduras, Central America. The study was structured to document water vending practices; examine whether water vending was an alternative of supply; identify the circumstances in which water vending was an appropriate alternative of water supply system and to show how data on water vending could be used to improve water supply planning generally.

The study specified three types of vendors; wholesale vendors – who obtained water from some source and sold it to distributing vendors; distributing vendors – who obtained water from a source or wholesale vendor for selling to consumers, and direct vendors who sold water from a source to consumers coming to the source to purchase water [WSP (1999) and Whittington and Swarna, (1994)]. While this analogy may be valid for the study under discussion, it may not be sufficient to describe all types of contexts which resort to water vending as a practice. It is therefore vital that for conducting each study, a fresh conceptual framework is drawn to include all the alternatives of water supply including water vending to obtain a holistic outcome.

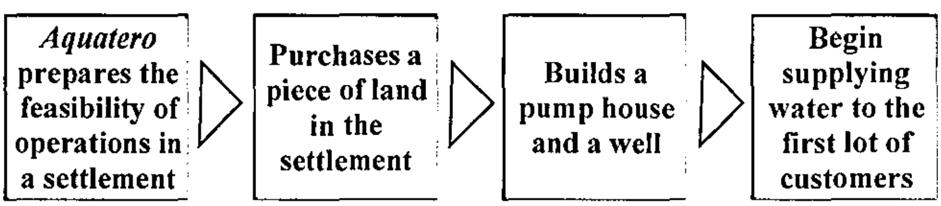
- Alternatives developed with the involvement of beneficiary communities are likely to sustain.
- Local organisations effectively evolve alternative means to supply water to beneficiaries.
- Re-selling water is a commonly acceptable mode in many parts of the world.

Snell (1998) conducted a study of 20 small scale providers in different parts of the world including Africa, Asia and Latin America. Small-scale water providers provide water to peri-urban communities, left out neighbourhoods and settlements. Supply of clean water at affordable rates with a margin of profit is the usual practice. Although these actors were the main providers, their existence was ignored by municipalities and other state authorities. Categories included providers in permanent partnership with water utilities; pioneers who brought water from their own sources; mobile water truckers, caterers and carriers and owner/operator/franchisers of bathing facilities (Mitter, 1999). Dichotomies such as piped water versus water delivered by vehicle; water from a water company versus from a small scale provider; systems managed by a community versus system run by a private entrepreneur, whether construction is financed by the system's owner/operator or the principal donor were outlined as the basis of the case studies included in the document. In creation of infrastructure, the choices of the components finally constructed was not necessarily framed by the local communities or local councils. Management and maintenance of infrastructure and its utilizations remained prime issues [Zaroff, and Okun, (1984) and Kinnear, (1987)]. The results therefore entirely depended upon the compatibility of the infrastructure, its immediate need meaning whether the community needs to utilize that piece of infrastructure and the overall financial viability of the authority. In Srilanka, community-contracting system which emerged in 1980s for developing small pieces of infrastructure, was an example [Sohail (ed.), (2001)]. Obviously as the decision-making prerogative was not tied up with the final choice to construct, the usefulness of the outcome could be termed as doubtful.

Standpipes and kiosks were alternative arrangements devised to provide water to low income communities. Their effectiveness depended on many factors. Snell (1998) narrated that standpipes and kiosks were the next most expensive source, as cited from the examples in Kiberia, Kenya, Mopti, Mali and Aquateros, Paraguay [Toyano, (1999) and Solo (1999)]. The supply source to beneficiary relationship was vital for maintaining sustainability. The unchecked expansion of kiosks in the case of Kiberia made them entirely un-profitable. With 650 kiosks in an area of less than 2.5 sq. km., the profitability of the enterprises was lost. Unreliable service also made them a less dependable outlet. Same considerations were also valid for the standpipes of Mopti, although the main infrastructure was co-financed by the government/donors. In such cases, the profitability and economic/ technical/managerial performance had not been able to evolve into a reliable and efficient enterprise. Again, the said article had not highlighted the respective socio-cultural aspects of these enterprises in relation with their respective context. Source of supply also affected the working of standpipes and kiosks. Where the source was efficiently connected to the outlet, output improved. Apparently stand-posts dependent upon unreliable piped supply or kiosks dependent on unpredictable filling from trucks could not be effective (Collignon, 1999).

Toyano (1999) documented the performance of *'aquateros'* (small scale providers) in Paraguay, Latin America. He reported that *acquateros* operate primarily in the peri-urban areas. Few inner-city areas were also included. Traditionally they made use of underground water by using a well, pump house, piping of polyethylene or any other low cost hosing system. The development process was entirely private. In some cases there was competition even within the same locality. *Aquateros* arranged and adjusted the service provision according to the individual problems of their customers. They made full investment also including the corresponding risk. The customer paid a connection fee which actually amounted to partial profit of the *aquatero*. The cycle of operation of an aquatero is as follows in Figure 2.2:

Figure-2.2
Performance Cycle of Aquateros



Source: Toyano (1999) – description translated into diagrammatic form.

Several issues that have been outlined in this study need discussion. The *aquateros*, on the basis of their experience in water supply service, can be termed as water entrepreneurs atleast for the small scale localities. However their operation entirely depended upon the availability of a reliable source of water without any hindrance. When ascertained, the distribution, maintenance and cost recovery became the foremost responsibility of the *aquateros* in which they were well versed [WSP (1998b) and World Bank, (2002)].

Collignon and Vezina, (2000) pointed out the continuing vitality of independent providers even in situations where decentralized provision was planned. According to this study, independent providers were defined as those service providers who possessed independent link with the source and their consumers in an urban area. Independent operators remained significant even in situations where water supply was handed over to local authorities at a decentralized level. Independent providers have been found to expand their business. In Dakar, private sector providers have invested heavily in the expansion of existing network related to the urban poor. This also helped in providing employment to a sizable number of workers. In Africa as a whole, it was found that at least 06 out of 10 cities were served by independent providers (Collignon and Vezina, 2000). Unprecedented moves by local government, particularly with reference to expropriation of land from independent providers, became counter productive.

The above account confirmed that vending and re-selling contribute to the service delivery mechanism in low-income localities (Jenkins, 1988). Therefore they needs to be made a part of a pro-active strategy firstly to strengthen their level of service and efficiency, and then to lead to the development of a rational framework for controlling the vending business and re-selling as a whole. There was a myth that poor people were 'very' poor to pay for water. The reality was that the poor people were already paying for water and perhaps the poorest were paying the most [WSP (1998b) and WSP (1999)]. Examples of water vendors from Jakarta, Peru and locations in Central/South America and Africa confirmed this fact. In situations where people were not directly contributing cash, they were putting up labour and time as the parameters of their input.

Home connection was mentioned as a low cost option of water supply/vending by Snell (1998). The availability of home connection as an option for reliable and affordable water supply was limited, atleast in the African case studies discussed. The home connection had other limitations of benefiting the low-income households, not highlighted in the paper. For a house connection to be provided, the status of the settlement/neighbourhood needed to be recognized by the concerned state institution, either *de-facto* or *dejure*. Priority of supply to low income settlements versus others also made a difference on the level of service in the case of home connections. Planned areas possessed a better chance to acquire home water connection due to their legal status (Dinar and Subridmanian, 1998).

Most of the water produced for re-sale came from public source which varied from boreholes, existing water reservoir or a river passing nearby (Collignon and Vezina, 2000). Private re-sellers obtained the water from these resources. In many African cities including those covered in the study (Collignon and Vezina, 2000), the supply arrangement was such that there was one upstream water company/agency and many small-scale entrepreneurs. There were several arrangements associated to it. Small scale providers delivered water through handcarts, donkey or horse pulled carts, plastic tubings/pipes from houses in the neighbourhood and water trucks. As mentioned by Snell (1998), standpipes constituted an important component of water supply arrangement in African cities, despite being expensive compared to other choices. Water re-sellers also further included standpipe vendors, licensed and unlicensed water re-sellers and entrepreneurs for door-to-door delivery. Due to the freedom to be found in any contract, the small-scale providers had the flexibility to adapt any system which they considered suitable to them for their economic benefit [WSP (1998a), Alfaro, (1997) and Solo et.al., (1998)].

Katko (1991) outlined the concepts of selling and re-selling water through various combinations of modes. While currently this issue was grave for developing countries, it was quite a useful outlet of provision of water in some of the industrialized countries also. Several studies have been conducted in the past to document and analyse the issues related to supply of vended water. Lima, Peru; Port-au-Prince, Haiti; Tegucigalpa, Honduras; Ukunda, Kenya; Onitsha, Nigeria; Ouagadougou, Burkina Faso and several similar contexts were studied. The paper presented two case studies; Morogoro Tanzania and sub urban area of Beira, Mozambique. In Morogoro, the water re-selling was done by the private connection owners at reasonable prices (WSP, 1998b). They had responded to the need and evolving market generated by area residents. For transportation of water, tailor made/improved wheelbarrow was used by the community.

The summary of the arguments raised in the above-cited literature highlights three key points. There were several institutionalized outlets in the form of licensed kiosks operation. This fact highlighted the formalization of a largely informal business. Sustenance of vending system mostly depended upon the capacity of target households to pay for the level of service aspired. Reselling water was officially forbidden in several cases. However it took place whenever the mutual agreement existed between buyer and seller.

2.4 Flexibility in Arrangements for Supply

2.4.1 General

Barnard (1938) defined flexibility as a means to accommodate any deviation from stipulated management procedures to benefit consumers and providers. Organisational theory provided the appropriate theoretical premise for the co-existence, shared infrastructure and operational ingredients (Allison, 1984). The theory also provided a premise for public organisations to share a common goal with private organisations of similar origin and background. Raube (1974), while describing the principles of organisation, emphasized upon the flexibility of organisation. He was of the view that the organisation, whether public or private, should be adaptable to changing internal or external conditions. This flexibility was extended for various types of anomalous situations. For the organisational format, this capacity to adapt becomes all the more vital due to the rapidly changing situations of both the context and management input. Flexibility to accommodate independent providers by utilities was found to be missing in several examples, as discussed in section 2.2.

Organisational flexibilities can be acquired through several ways. Hofstede and Kassem (eds) (1976) stated that the necessary flexibility within a work plan can be obtained either by seeking modification or relaxation in the applicable rules or by developing alternatives that could suit to the given set of conditions. Even in the earlier discourses such as, Barnard's interpretation (1938), organisational flexibility was much stressed. He even went on to emphasize the application of different modes of communication in private, informal and formal, as well as public organisations. Leader of the organisation may assign some of his work force to maintain organisational communication, securing essential personnel for various type of service and also the formulation of purpose and objective. Similarly in the internal – horizontal discourse within the public sector may be allowed to stave away the hierarchy and invite inter organisational dialogue for consultation to reach to the final decisions. A simple model depicting this characteristic of flexibility was developed by Heffron (1989) equating inputs and outputs as discussed earlier. While the relationship between the inputs and outputs may remain conventional, the manner in which the organisation itself converts the inputs comprising human and material sources is flexible.

Role of small-scale water vendors was vital for service provision to low income communities. Due to their scale of operations, informal arrangements and the acceptable conditions of service for the body of users they were dealing with, the role of small scale operators became all the more vital.

2.4.2 Flexibility in Water Supply Arrangements – A Review

Whittington et.al (1988) emphasized that flexibility of arrangements in supply was a key factor in dealing with alternative sources (Bendahmane, 1994). The study entailed reasons due to which people subscribed to alternate sources of supply. Better quality of water, ensuring physical convenience and augmenting the supply remained the underlying factors that determined the choices. A major determinant was the availability of options. In a situation where supply was from a single source or a monopolistic control, the choices naturally diminished (Collignon and Vezina, 2000).

In several cases cited in the literature, it was found that alternate sources displayed the elements of flexibility. Snell (1998) refered that truckers and carriers provided a tailored service with a sizable flexibility to accommodate the consumer's need. This service was found to be partially regulated. The truckers had to operate under the contextual conditions which determined their efficiency of operation and profitability of enterprise. Truckers supplied to those who needed water at the rates that were mutually negotiated, contrary to their officially prescribed mandate which bound them to deliver at designated locations. The informal arrangements of their operation (in most contexts), fluctuations in demand and concurrent effects on the prices, availability of water at sources and the conditions governing it were some factors that had a critical bearing on the output of such mobile modes of water vending. This required objective studies to generate useful insights about the overall operation of this form of enterprises. Besides the risks that were inbuilt in the operations of this mode also required to be accounted for on the basis of their respective intensity. Flexibility of operations was often compromised when privatisation was launched at the behest of single large companies (Brook, 1997). Privatisation attempt of water utility in Karachi did not account for small scale contractors managing water tankers. As per normal practice, the privatisation was an open ended process fostered by donor agencies wherein the international water companies had full access. These companies had the managerial experience to fulfill all the pre-requisites to participate. These pre-requisites were normally prescribed by the concerned regulatory bodies under assistance from the related donor agencies (Ahmed and Sohail 2004). However, apparently the small-scale (or even large-scale) vendors did not have the capacity to follow or fulfil all the administrative terms and conditions in the bidding process. The scale, profile and organisational culture usually allowed large scale national (if any one existed) or foreign companies to bid. The openness and equal opportunity of such competition therefore remained questionable. Besides the determination/fixation of regulatory conditions for privatisation may only appear workable if based on the feedback on the actual operational conditions. Therefore, when privatisation process was on, the understanding of the operation of small scale providers was utmost vital. Where private operators were able to acquire working knowledge and insight about small scale providers, the service delivery remained efficient. In short, privatisation process may not be narrowly viewed as a conventional tender/bidding related process. It must be viewed on the basis of the contextual situation potentials, constraints and sustainability aspects [Abdala, (1997) and Hicks (1999)].

To ensure supplies of essential quantities of water in the instance of privatisation was an important consideration. This arrangement could be handled through cross subsidisation among various user categories, as outlined by Nigam, (1999). This aspect demanded flexibility of approach to address the need of lesser privileged user categories. Such an option could only be applied where there was a strong enforcement mechanism available in practice. Nationally prescribed subsidies to ensure provision of essential quantities of water in South African case was an example (Magadegeda, 2000). However, in many developing countries, where even cost recoveries of water supply services were lagging far behind the targets, cross subsidisation did not take place. Lack of flexibility thus adversely affected less privileged user categories in this situation. The paper drew a lesson that government would remain the main supplier/actor in the water supply service. If this argument was accepted then the wide-ranging privatisation drives of water utilities would become questionable. It required a fresh appraisal as also pointed out by Mayer, (1994) around the contextual realities confronted along each national or local situation.

- Alternative arrangements normally displayed flexibility.
- Flexibility was limited for small scale operators who did not possess the possibility to scale up their operations.

Flexibility remained a constrained parameter for small-scale operators, as outlined by Collignon, (1999). In Port-au-Prince, Haiti street peddlers, water carriers, water trucks earned from US$ 2.00 to US$ 600.00 per week at the maximum. Formal operators could earn US 30,000/- to US $ 50,000 per week. As mentioned earlier, the small-scale private operators did not have the capacity to raise their scale of supply where they could earn high profits. They served small number of users hence small returns (Jenkins, 1988).

Solo (1998) mentioned that when privatisation of water supply was undertaken, small-scale enterprises were not accounted for. Due to their informal nature of operation, such enterprises did not get any kind of recognition from the state and the water systems operations/companies that obtained concession/other kind of contracts. Thus a very vital outfit of water provision service went uncounted due to lack of flexibility in the conduct of privatisation.

Re-selling of water is considered as an arrangement that flexibility stretches the benefit of consumption to those not formally linked to a utility. Reselling water acquired through a utility or other source was often discouraged. Collignon (1999) however outlined several advantages of reselling. Resale subscribers were normally discouraged from operations although it was a vital link in water vending. It benefited those neighbours who mutually sold water to each other. In situations where water was charged on a per unit basis, the supplying company got a disadvantage (Katko, 1999). This was due to the fact that the additional profit accrued on reselling did not go to the selling company. The re-selling person would pocket it informally, thus maximizing individual flexibility. However in situations where the water charges were levied on the basis of property (type or area) then re-sale of water was not perceived as a problem pertinent to the loss of revenue.

Reselling had been emphasized as a viable alternative especially for facilitating basic quantities of water (Solo, 1998). In places where water of lesser quality was available from any other source, re-selling augmented for drinking and cooking usages – as normally observed in African examples. This measure implies to the existence of flexibility in water supply management at domestic/consumer level. Multiple choices was an important aspect in the study of these African cities. In majority of the cases, people had more than one choice to obtain water. Although a main network – ran by the water company/concessionaire – remains, the option of independent water providers, other choices such as neighbours, wells and springs were accessible. Affordability and convenience had been found as the key variables that led to any decision formulation.

Whittington et.al (1988) further reinforced this argument. The study explained that there existed multiple type of arrangements for water distribution. These formats relied on different equipment such as tanker trucks, pushcarts, animal carts, plastic jerry cans with covers, wooden and steel barrels and pottery jars.

The choice and usage of equipment entirely depended upon the conveniences of the service provider and buyer, need and extent of water quantities and the affordability status of people to pay for a particular grade of service provided by the vendor.

2.5 Performance Review

2.5.1 General

Performance of an organisation is a vital attribute which needs to be assessed scientifically. Raube (1974) outlined several parameters which were considered essential in the performance of an organisation. Establishing clear lines of authority; specifically defined reporting mechanisms; written records of responsibilities and authorities; corresponding link up between responsibility and authority; responsibility of the higher rank personnel for the acts of subordinates; optimum delegation of authority, minimizing the levels of authority; limiting the functions of workers to as minimum tasks as possible; limiting the span of control of individual personnel; maintaining simplicity and flexibility in the organisation were some of the key points for ensuring a positive output in an organisation. A good organisation kept optimum channels of communication at all levels. Performance was also dependent on the fact that it was open to changes. Clear distinction was needed between advisory and command related functions. Raube (1974) also emphasised upon the fact that self-fulfillment of staff was a key motivating factor in the performance of an organisation.

Allison (1984) stressed close link between the overall societal system and the organisational performance. He further stressed that diverse organisations often changed with time. In this respect the organisations also became capable of solving the issues such as system identity by establishing boundaries with the adjoining environment. In other words the organisations were able to define the distinction of their working with the rest of the surrounding milieu. This aspect was adequately reflected in the case study of awami tanks discussed in the later part of the dissertation.

Barnard (1938) indicated that in an informal organisation the communication was diffused because it was often the ability to understand without a formal description or narrative. He also defined efficiency in the framework of organisational working. According to him, efficiency had a broader meaning. "The efficiency of cooperation...... depends upon what it secures and produces on the one hand, and how it distributes its resources and how it changes motives on the other" (p.114). Heffron (1989) stressed that articulately defined goals were a means for an organisation to be effective. In addition, the effectiveness of an organisation depended upon its structure, technology, relationship with environment, its use of strategic planning and treatment to its employees.

In the same respect, different theoretical approaches assigned different criteria to assess organisational effectiveness. These approaches were related to goal, human resource, internal process and political systems. Each had its own criteria to measure the effectiveness [Scott (1977); Campbell (1977)].

2.5.2 Performance Review of Alternative Arrangements in Water Supply

An important point in reviewing performance of alternate sources was the nature and access to the modes of supply. In Karachi, it was reported that more than 30 percent of supply was lost due to line losses and thefts primarily done by the water vendors (KWSB, 2002). It had been found that places where ground water was freely accessible, it gave rise to a thriving business. Sharma (2003) reported that farmers in Goa and Tamil Nadu, India were found abandoning their farming business and resorting to water sales to the nearby urban localities [WSP (1999)]. Vending business that relied on ground water sources was not commonly perceived as illegal. Therefore such operations continued unabated. These arrangements did not require heavy investments. It gave rise to optimum profitability.

Vending enterprises that adopted a market based approach were likely to sustain. Aquateros of Paraguay were successful at a small scale without having a direct experience of up-scaling their enterprises to any larger extent (Toyano, 1999). Expansion of enterprise was also an issue in performance and sustainability. Snell (1998) identified constraints to the expansion of water vending enterprises. Lack of access to credit, transparent procedures for handling money, arrears due to non-payments, pirate connections and security in the face of unfair competition were the constraints pointed out. This list can be expanded depending upon the respective contextual conditions. For instance, in the case of Pakistan, the issue of recognition of water vending as an enterprise has been significant. Since the whole operation was usually regarded – at the formal level – an emergency arrangement, therefore it did not receive the necessary investment support and/or technical backstopping vital to run such kind of enterprises. This factor was also highlighted by other case examples (WSP 1999a).

Snell (1998) mentioned some measures that may be used to examine the performance. Commercial approach, roles of community based organisations, technical innovation, awareness raising in health related issues, possibility of independent water production and the ability to offer installment plans were the main factors cited for the purpose. However missing aspects, which are usually vital in the functioning and sustenance of water vending, were the institutional acceptance and support by the concerned regulatory/ administrative authority pertinent to water (WSP, 1998a). In addition the compatibility of water provision modes with the levels of social acceptance played a vital role in survival of the enterprise. If alternative arrangements were freely used without any kind of social barrier, they were likely to sustain. For instance in Karachi donkey carts were used to supply water to shops in a very posh locality. The users accepted this alternative very reluctantly as no other option was available (Ahmed and Sohail, 2003b). Water vending was effective when it facilitated provision of an appropriate service to the consumers at a price affordable to them. When options were a bare minimum, any available arrangement was momentarily accepted, as found in Karachi (Ahmed and Sohail, 2003b). Such arrangements were replaced whenever any better alternative was accessed by consumers (UNICEF, 1999). Collignon (1999) explained that water supply service was considered to be unprofitable if the revenues were less than minimum specified benchmarks which were contextually determined. Argument remained that whether the cost benefit relationship was the only or atleast dominating criteria or there were other factors such as demand for service or social acceptability related to this point.

- Social acceptance of a supply arrangement determined sustainability of a mode.
- Such approaches that were financially viable continued to survive.
- Small scale operators had to deal with operation and maintenance since it related to their performance.

Small scale operators, who contributed substantially towards development of alternative sources of supply, had recurring operation and maintenance issues that governed their performance. Maintenance of systems for the small-scale operators was a major issue. At times the desired level of expertise was not available. In other cases, the maintenance was delegated to state/semi-state authorities that did not possess the proper technical capacity for the job. Besides operators at the small-scale did not have any possibility of allocating enough finances for routine maintenance. In fact, this became the major reason that the overall performance level of the small-scale operators did not rise beyond a certain service delivery level and to a commercial viability status (Collignon, 1999).

Small-scale operators displayed several performance merits in the domain of alternative sources of supply. It was agreed that 'small-scale operators tend to be customer driven, financially viable, and ready to apply innovative technologies and marketing methods, as dealt by Solo, (1998). They provided appropriate solutions at appropriate plans, assumed all investment risks and reached the poor. They charged market prices, covered the costs and respected willingness to pay'. It is further agreed that private entrepreneurs had atleast a near to hundred percent efficiency level. Investments, operating and administrative costs were very low compared to a public utility/private company (Katakura, 1998). It must be remembered that these merits applied until a certain scale only.

Small-scale operators thrived on personal capital. They barely received any kind of help/financial assistance from a financial source. Even in underground infrastructure that was laid down by the operators, it was done through their own input and capital (Snell, 1998).

Small-scale suppliers were basically independent of public sector water suppliers although in majority of the cases they operated through some joint mechanisms (Das, 2003).

While Solo (1998) strongly supported the case for small-scale enterprisers effectively, several aspects need to be included. The modus operandi of integrating small-scale and informal enterprises was not included in the discussion which was an important consideration in this respect. The variety of formats available for institutional organisation of the water vending enterprises were also not described. Issue of choice of options was not outlined that may have led to an objective assessment of the process.

Contractual arrangements and their follow-ups were vital in the case of alternative arrangements of supply. Collignon and Vezina (2000) surveyed several cases and found that they were not up to the mark. In most of the cities studied, the water companies entered into contracts with independent providers. However it was observed that in most of the cases the terms and conditions were not strictly observed. They were adjusted according to the convenience of the operators/independent providers. Governments have also attempted to create professional groups of independent providers (Komives, 1998). But in comparison to the government supported organisations, the trade related groups formed by the independent providers remained greatly effective in the overall respect.

Operational characteristics of independent providers showed that these operations were mainly run by men with very few exceptions such as in Ouagadougou (Collignon, 1999). A reason was the hard physical labour required in such trades. Most of the hand carriers belonged to rural areas due to the reason that this trade did not require extraordinary skills such as salesmanship. Standpipe operators in most cases commanded position of respect in the society. Investments in most such cases came from family savings and/or saving clubs which operated on cooperative basis. The small-scale operators obtained contributions from the households they served to invest in the system. Bank loans were not accessible to them. Operators also minimized investments to offset the charges on losses. They also diversified operations to safeguard their enterprises. Such operators maintained a low profile and remained in the informal sector. These operators made several adjustments. Economic collusions also emerged in cases of need. Trade unions were also formed wherever the operators found it feasible (Haarmeyer and Mody, 1997).

Administrative and technical constraints contributed towards raising the cost. The independent providers normally provided service compatible to the needs/paying capacity of the clientele (World Bank, 1998).

Case examples from Africa showed that non profit and community based arrangements could lead to higher costs due to mistakes and wasteful expenses. This observation was made on the basis of results obtained in Collignon and Vezina (2000).

When water was drawn from city source by vendors, the water quality was found to be of the same status as any other locality served by piped supply (Ahmed and Sohail, 2003e).

Socio economic development also resulted from alternate enterprises when dealt as a community scale outfit. Mathew (1991) discussed the socio-economic aspects of water selling with a focus on the urban locations of Nyala and El-Geneina, West Sudan. It provided a comparison between the service delivered through the traditional methods and new water kiosks developed through the development project's assistance. Several factors were identified with respect to alternative sources of water. The per unit utilization of water depended upon the distance from which it was being carried. Such households drew greater advantage which were associated to more than one source of supply. In the above-cited locations, kiosks, well and vendor were the three options. This was apparently because of the reason that reliability of one source was not considered upto the mark. Long waiting time and technical problems affected the smooth running of the kiosks based distribution. Water vendors continuously adjusted their level of service including prices according to prevailing market conditions. Governmental control for price standardisation was not considered viable for the operations of the vendors. The supply outlets such as kiosk only sustained and functioned when managed by communities. In situations where an external management was given the charge, it did not survive as experienced in this case. A very vital lesson offered by this case example was that the water supply system acted as an instrument of community mobilisation which not only showed its potential in respect of water supply but surely possessed the capacity to be transformed towards other related issues collectively faced by the people.

The literature outlines several variables that may be considered to assess water supply arrangements. Access to the source of supply, perception of legality of service/settlement, social acceptance of the supply arrangement, economic sustainability, relationship of utility and small-scale providers, existence of private entrepreneurship in the sector, integration of vending into the main stream system, scale of supply arrangements, administrative environment and catalytical impact of vending on communities were the important parameters found through the literature review.

2.6 Alternative Arrangements – Organisational Theory/Supply Chain Contexts and their Significance

2.6.1 General

Urban water supply service and its various arrangements could be co-related with the organisation theory and supply chain management at three levels; objectives, categories of stakeholders and performance characteristics. The water supply service, whether managed by a utility or any other set of providers, aimed at servicing its customers to a basic level of satisfaction (Thompson et.al; 2000). For utilities it was a matter of public accountability which normally existed in different formats in different contexts. For private providers, it was linked with the commercial benefit and sustenance of business prospects [(Klein and Irwin, 1996); (Matthew, 1991); and (Katko, 1991)]. Supply chain, as a process, was adapted to changing conditions according to realities of production and concurrent demand for the good or service. Thus the chain was likely to transform its *modus operandi* according to an agreeable procedure (Poirier, 2002).

The framework of this research was adequately embedded within the reference of organisational theory. Water supply arrangements, as stated in the hypothesis in chapter-3 were representative of a complex organisational structure which is not formally defined in many cases (Hatch, 1997). Human relations, nature of internal communication within the actors, alternate modes of service delivery by providers up to the bearable level of acceptability by the consumers were a few ingredients of the organisational system. Consumers and providers in water supply have a simple premise of relationship. Providers produced a service and consumers consumed it. The stakeholders were linked through demand and supply equation. In a theoretical domain within the framework of organisation theory, supply chain explained this phenomenon in an explicit manner. Supply Chain (SC) could be defined as the integration of planning and control of materials and product flow from supplier to customer (Schary and Skjot-Larson, 2000). According to another interpretation, supply chain was all that happened to a product from 'dirt to dust' [Ayers (ed), 2001]. A supply chain consisted of all stages involved, directly or indirectly, in fulfilling a customer's request. Supply chain not only included the manufacturers and suppliers but also transporters, warehouses, retailers and customers themselves (Chopra and Meindl, 2001). In the same respect, 'supply chain management (SCM) was defined as the design, maintenance and operation of supply chain processes for satisfaction of end-user need (Kasarda, 2001). Another interpretation of the supply chain management was that 'it was the systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for purposes of improving the long term performance of individual companies and the supply chain as a whole' (Mentzer et.al., 2001 p.2). In each of these descriptions, the emphasis had been laid on the users' satisfaction and orienting the process according to their needs and requirements. In other words, customer satisfaction remained the under lying objective while designing and applying a supply chain management practice.

2.6.2 Water Supply Alternatives and Organisation Theory/SCM – An Interface

Evolving from the context of business and commerce, supply chain management was defined as a set of organisations directly linked by one or more upstream and downstream flow of products, services and/or finances from a source to a customer (Mentzer et.al.eds., 2001). Another definition interpreted supply chain as a network of organisations that were involved through upstream and downstream linkages, in different processes and activities that produced value in the form of products and services in the hands of customers. On the other hand, it provided the much needed flexibility to describe the prevailing diversity as well as changing patterns of urban water supply arrangements and their alternatives. The purpose of Supply Chain Management (SCM) was to improve customer value and satisfaction. SCM philosophy focused on 'a systems approach to viewing the channel as a whole; strategic orientation towards cooperative effort to synchronize and converge intra firm and inter firm operational and strategic abilities into a united whole and a customer focus to create unique and individualized sources of customer value, leading to customer satisfaction' (Mentzer et.al, 2001). Supply Chain Management activities included integrated behaviour, mutually sharing information, mutually sharing channel risks and rewards, cooperation, same goal and same focus of serving the customers, integration of processes and partners to build and maintain long-term relationships (Schary and Skjot – Larsen, 2000). These principles were in correspondence with the service delivery mechanism of water supply found in several urban areas, as shall be viewed in the following accounts. Figures 1.3 and 1.4 also relate to this definition, while describing water supply options.

SCM had several characteristics. It envisaged the total satisfaction of customers thereby obtaining optimum effectiveness and achieving the highest possible level of efficiency (Schary and Skjot-Larson, 2000). SCM ran through optimum cooperation of participating actors. The working of SCM depended upon several pre-requisites. Appropriate flow and use of information, recognition of mutual dependence as a basis for fostering partnerships, shorter processing time, strategic positioning of various facilities and careful management of the sequence of operation were vital in this respect (Schary and Skoyt-Larsen, 2000); Ayers, 2001; Chopra and Meindel, 2001).

As mentioned in this description, the theoretical premise of organisation and thereafter supply chain was structured around variables which were of direct correspondence with the water supply planning and management. In order to understand this scenario, Figure-2.3 explains this inter-relationship under the heads of the basic objective, categories of stakeholders and performance characteristics. Various modes and arrangements of urban water supply adjusted the service entirely to the satisfaction, acceptability and even affordability of the client. This is in direct consonance with organisation theory and SCM, which adapted to the changing demands, conditions and contextual characteristics.

Set of key stakeholders, as discussed in organisation theory and water supply was entirely similar. Broadly, the providers of the service and users formed the two main categories in water supply. Due to changing modes and inclusion of new set of actors, the users were often termed as consumers – mainly in a situation where provision of a service was directly related to a commercial enterprise. Organisation theory and SCM normally comprised suppliers of raw materials and products/services as well as customers. No matter how complex or spread out it may be, the main categories remained the same (Donaldson and Preston, 1995).

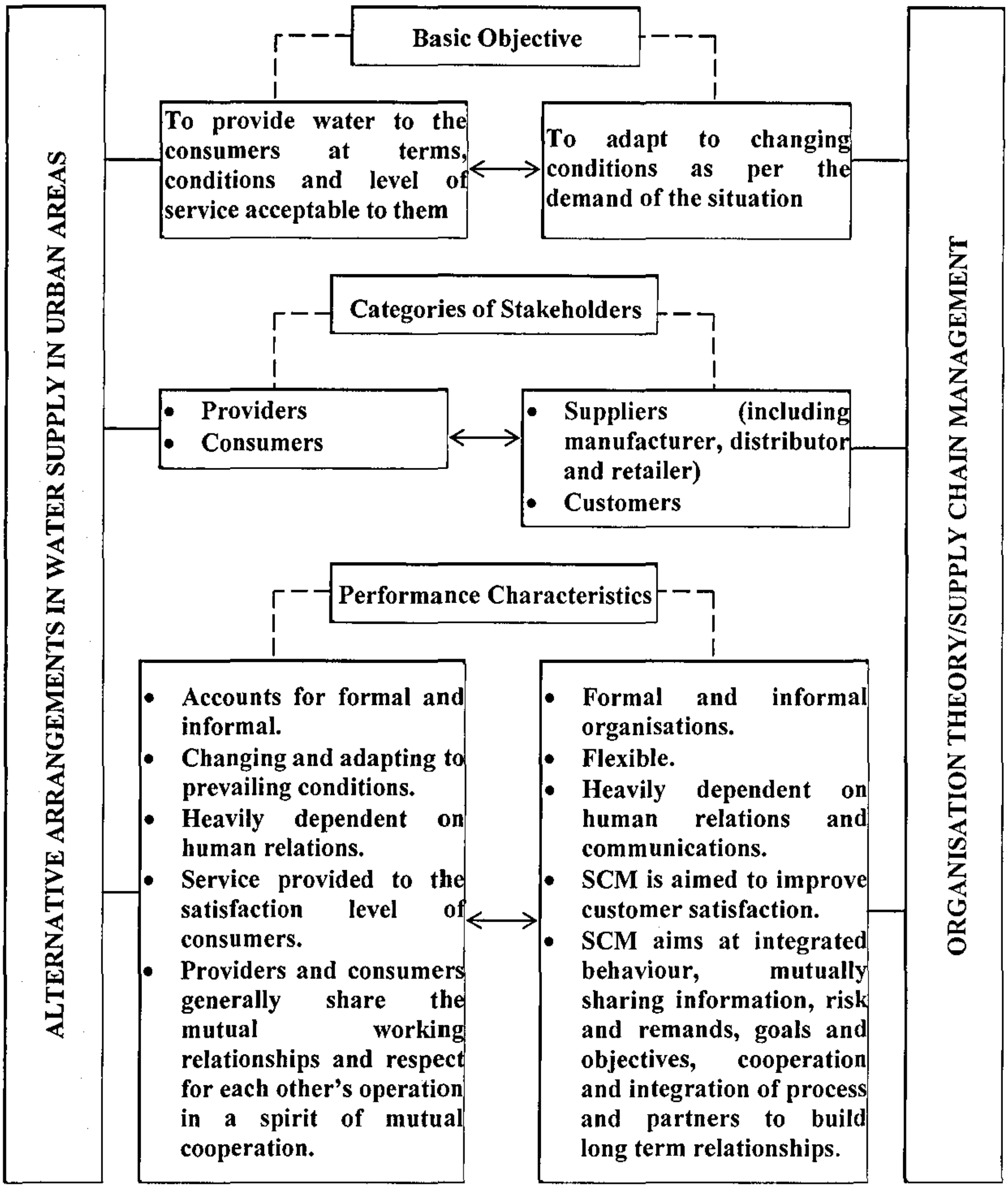
The characteristics normally outlined to judge the performance of both water supply and SCM were in correspondence with each other as per references cited in sections 2.1 to 2.6. The water supply service was based upon both formal and informal types of organisations. Broadly referring, the water utilities and concerned departments constituted the formal organisations whereas water vendors and their enterprises were generally informal in nature. Literature clearly endorses the recognition of formal and informal organisations in the domain of organisation theory and SCM (Barnard, 1938 and Schary and Skoyt-Larsen, 2001). The alternative water supply arrangements adapted to the changing conditions. For instance, in places where piped supply system did not function, small-scale vending enterprises evolved to provide necessary quantities of water to the consumers (Snell, 1998; Toyano, 1999; Nigam, 1999).

Water supply service through alternative means depended greatly upon the human relationships. The development of enterprise and its scale of success often entirely depended upon the human relationships between service providers and consumers (Nigam, 1999). SCM and organisation theory also relied upon the effective human relationships (Barnard, 1938). Improvement of service provision up to the level of satisfaction of clientele was a mutual attribute of alternative water supply services and organisation theory as well as SCM. In particular reference to alternative arrangements in water supply, it was found that after the fulfillment of subsistence level supply, the service providers attempted to improve the service level to attract better business prospects (Snell, 1998; Toyano, 1999). Since the success of the enterprise was mutually beneficial to all the stakeholders, the providers and consumers shared a congenial working relationship [(WSP, 1998b) and Mashaueri and Katko (1993)].

Upon review of the theoretical accounts, it was found that the alternative arrangements for water supply can be logically equated with the ingredients of organisation theory and supply chain management (Figure-2.3). It constitutes the relevant premise to accommodate the theoretical construct of water service provision.

Figure-2.3

Alternative Arrangements in Water Supply in Correspondence with some Ingredients of <u>Organisation Theory and Supply Chain Management</u>



2.6.3 Alternative Supply Arrangements – A Review

As apparent from the literature reviewed in the previous section, water supply was undertaken through a variety of formats other than the conventional system. Some of these formats were visible through the literature including conventional supply, vending, re-selling, self generation/private generation – through procedures which were not documented. These alternatives to conventional supply were important as they catered to a variety of consumer groups, not necessarily marginal/low income communities. The literature provided reference to several areas of interface between existing modes of supply (refer section 2.1 for details) that required exploration and fact finding to study their potential, outreach, capacity and constraints in addressing water supply issues.

Thompson et.al (2000) have based their findings and analysis on the drawers of water study. 16 sites in 09 urban centers of East Africa were included in the exercise – also encompassing Nairobi and Dar-es-Salam. Generally the water supply service deteriorated in the sites studied from between 1967-1997 (the times when actual data was collected for the research). A vital change that emerged was the sharp rise in private water vending practices through a number of modes including kiosks and piped supplies. The study also infered that most of the research conducted in this domain was based on water's relationship with disease, financing of infrastructure and control of water resources. It presented the case that little work was done on the various aspects of domestic water use. Little base line information was available pertinent to domestic water use. It was either project based or confined to specific programmes only. Need for research on alternative arrangements thus remained vital.

- Alternative arrangements were vital as they ensured supply of water to consumers at an acceptable condition.
- Alternative service providers evolved working relationships with the utility to serve their clientele.

The study revealed that the situation of water supply service had deteriorated in the overall terms. While marginal improvements were registered in some parameters such as diversity of water supply sources, it declined in reference to most of the parameters. Per capita consumption of water, reliability of water supply sources and the time spent per trip to acquire water generally showed a decline. However, although this study may be regarded as one of the pioneering attempts in the context of East Africa, further details need to be included to obtain an overall view of the situation of water vending/water supply in the East African case studies. In this respect the inclusion of level of service and the overall quality of water – in comparative terms (both with respect to sites and also sources) – need to be studied.

Review of the literature showed that water supply research had focused upon policy issues of supply and distribution; institutional arrangements; legal, cost, price and administrative and managerial aspects; water quality; affordability by different cross sections of the society; water supply in relation to urban poor/peri urban areas and the various programmes and projects that have been undertaken by the respective governments to improve the urban water supply situation (WSP, 1998a; World Bank, 2000; Jellinek, 2002). Sectoral studies undertaken by consultants on behalf of the donor agencies and governmental bodies largely covered the water supply managed and controlled by the governmental bodies formally. Similarly independent researchers who covered the performance of informal water suppliers usually focused upon the issues related to urban poor, under privileged communities, peri urban settlers and their status with respect to water consumption (IDC, 1999). These researches, in some of their deliberations, categorized the arrangements of water supply under 'formal' and 'informal' (World Bank, 2002; Collignon, 1999; Snell 1998; Toyano, 1999). In other interpretations, the distinction was made on the basis of 'public' and 'private'. However empirical evidences from field studies showed that the provision of water supply services through 'public' or 'formal' modes had several in-built procedures where the public/formal management resorted to informal practices (WEDC, 1999; Katko, 1987 and Katko, 1990; Mathew, 1999). These practices played a vital role in making the existing supply arrangement function to the satisfaction of the consumers. Similarly the alternative water supply arrangements have various areas of action where public/formal and private/informal stakeholders entered into working relationships (if not partnerships in the strict sense of the term) to facilitate the supply to the satisfaction of end users (Kinnear, 1987; Narain, 1998b). The literature showed the gap in dealing with the theoretical premise of alternative arrangements and their relationship with main stream supply (Foster, 1998). The significance of alternative arrangements in the context of water supply service needs to be explored through basic research to establish its position in the theoretical framework. For this reason it constitutes a viable niche where scientific inquiry shall suitably contribute to the addition in the existing body of knowledge.

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The literature review undertaken in chapter-2 clearly establishes the existence of alternative water supply arrangements. A knowledge gap exists about the supplementation of water supply through conventional and unconventional means as refered in section 2.1. It has also been highlighted in the literature which generated the key research question stated in section 3.4. Evidences derived from literature have helped develop the premise of research outlined in section 3.2 and the guiding hypothesis stated in section 3.3.

This chapter explains the research design and methodology developed for the dissertation. The framework, evolved from chapters-1 and 2, has been used as the premise for the research design. This chapter also lays down the research questions that have been formulated from the background review and literature. The research design for this dissertation comprises the choice of case studies as per the methodology worked out for this exercise; structure of data collection procedures; presentation of the case study findings and analysis that eventually leads to conclusions. An outline of the research design is presented in Figure-3.1:

Figure-3.1
Outline of Research Design

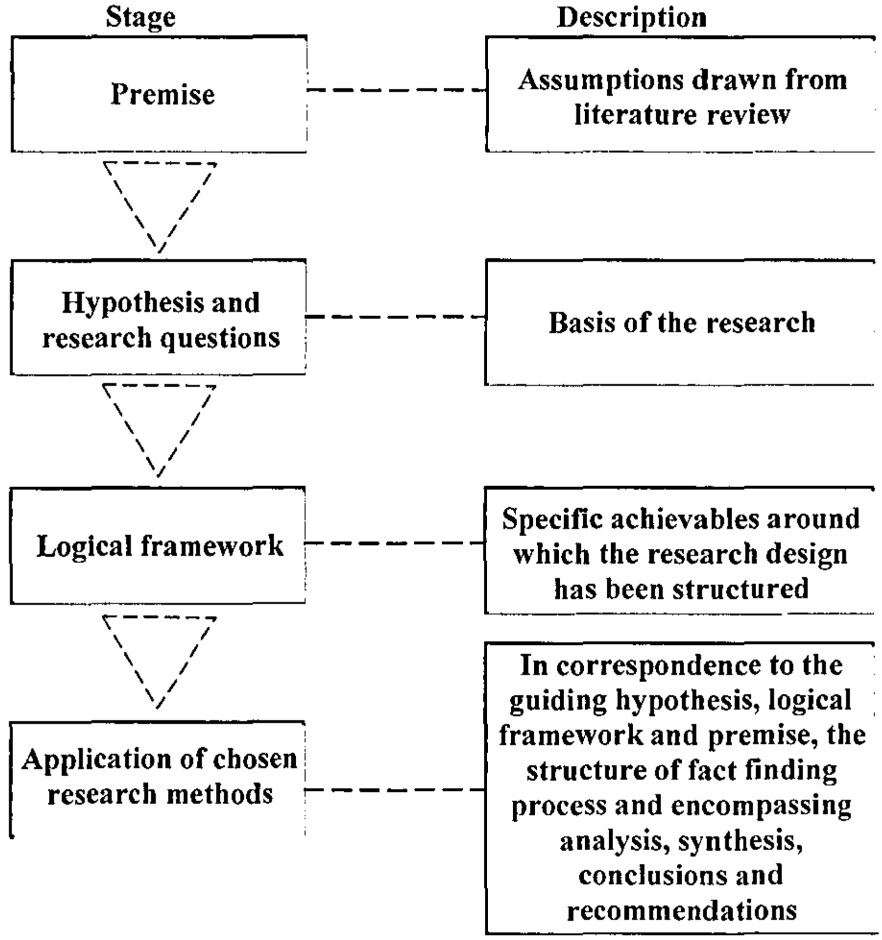


Figure-3.1 presents the concise depiction of the research process being worked out for the study. This outline is translated into the various stages that have been organized to carry out the research. The structure of case studies is done specifying the fact-finding tools in correspondence with sources of information. Deriving key points from the literature, the research design is structured around a guiding hypothesis. Hypothesis is then translated into objectives and logical framework that explicitly lays down the argumentation. Appraisal of research methods and choice of case studies are done as the detailing aspect of research design.

3.2 Premise

The study builds upon the premise that is evolved from literature on the topic of research in the context of the study (sections 2.1-2.6). It is mentioned as below:

(i) Water is a saleable commodity which is traded without direct recognition of the transaction in any formal sense.

(ii) Urban poor have to pay more than the middle and upper income groups.

(iii) Vending operations are more expensive compared to piped water supply.

(iv) While working interaction exists at various levels of public and private sector actors, there is very limited formal relationship between the public sector actors and their corresponding private operators.

(v) Institutionally sanctioned piped water connection to a household is the only available arrangement of water that is recognized in accordance with the provisions of water supply procedures administratively laid down in the existing systems.

3.3 Hypothesis

The literature review (sections 2.1-2.6) and the premise of research indicates the existence of several arrangements for water supply. This has led to the formulation of a guiding hypothesis. The research process is guided by this hypothesis which is mentioned as follows:

> **'Consumers in urban areas obtain water through many modes which depend upon alternative supply arrangements not integrated in formal procedures'.**

The hypothesis lays down the position for the argument around which the structure of research has been formulated. The entire attempt at fact finding, analysis and conclusions formulation shall emanate from the hypothesis to test its validity or otherwise.

3.4 Research Questions

The literature review, premise and guiding hypothesis refer to the formulation of research questions for exploration. The research questions provide the basis of fact finding and information gathering in correspondence to the objectives of the research. They may originate in different variables such as 'what', 'why', 'where', 'when', 'who' and 'how'. Case study research mostly focuses on 'how' and 'why' type questions. One of the main purposes of a literature review is to identify the relevant research questions that must be addressed during a research exercise. As Yin (1994) points out that the literature review basically generates the questions for a research exercise and not answers. The same pre-requisite is applied in the literature review in this exercise, presented in earlier chapters. Besides the research questions help in evolving or choosing the most appropriate research method by providing a clue to that effect.

Vaus (2001) emphasizes that the focus of the research question need to be established while formulating it. This may involve several types. Descriptive questions may be broken into researchable heads. Explanatory research questions need to identify the causes and/or consequences to be included for investigation. This exercise has made use of both 'what' and 'why' type of variables which are appropriately embedded in the design.

The fundamental research question that is addressed in this dissertation is 'why consumers resort to alternative arrangements for water supply'. The research question is based on the knowledge gap outlined in the theoretical reference discussed in section 2.1. This question is inter-related to several questions pertinent to status and characteristics of urban water supply. Basic understanding about the water supply system, modes, influencing factors, machinery/equipment and perceptions of consumers about supply arrangements is evolved as a response to these questions. The research questions are listed below:

- What is the status of water supply, as perceived by concerned stakeholders.
- What are the modes of water supply.
- What are the factors affecting water supply.
- What is the frequency of water supply through various modes.
- What is the machinery and equipment used in water supply.

- What are the characteristics of alternative arrangements of water supply.
- What is the staff and personnel related to water supply.
- What is cost recovery in alternative arrangements.
- Can alternative arrangements be recognized as formal.
- What are the possibilities of integration into formal system.

These research questions are translated into variables and parameters for study (Figure 3.2).

Figure-3.2
Research Questions and Variables

Research Questions	Translation into Variables and Parameters
Perceived status of water supply service.	• Economic good. • Pubic good.
Modes of water supply	• Piped water supply. • Boring hole. • Tanker from utility (KWSB/WSD). • Commercial tanker supply. • Manual water carrier. • Others (with specific references).
Reasons for resorting to alternative means (adequacy of supply).	• Adequacy of supply. • Inadequacy of supply. • Absence of piped supply. • Disconnection of services. • Supply in low quantities. • Supply in low qualities. • Others (with specific reference).
Factors affecting water supply.	• Legal status of house/settlement. • Legal status of water supply. • Reliability of supply. • Quantity of water. • Quality of water. • Access to water. • Others (with specific references).
Frequency of water supply.	• 24 hours. • Daily. • Alternate day. • Twice a week. • Once a week. • Less than once a week. • Others (with specific reference).

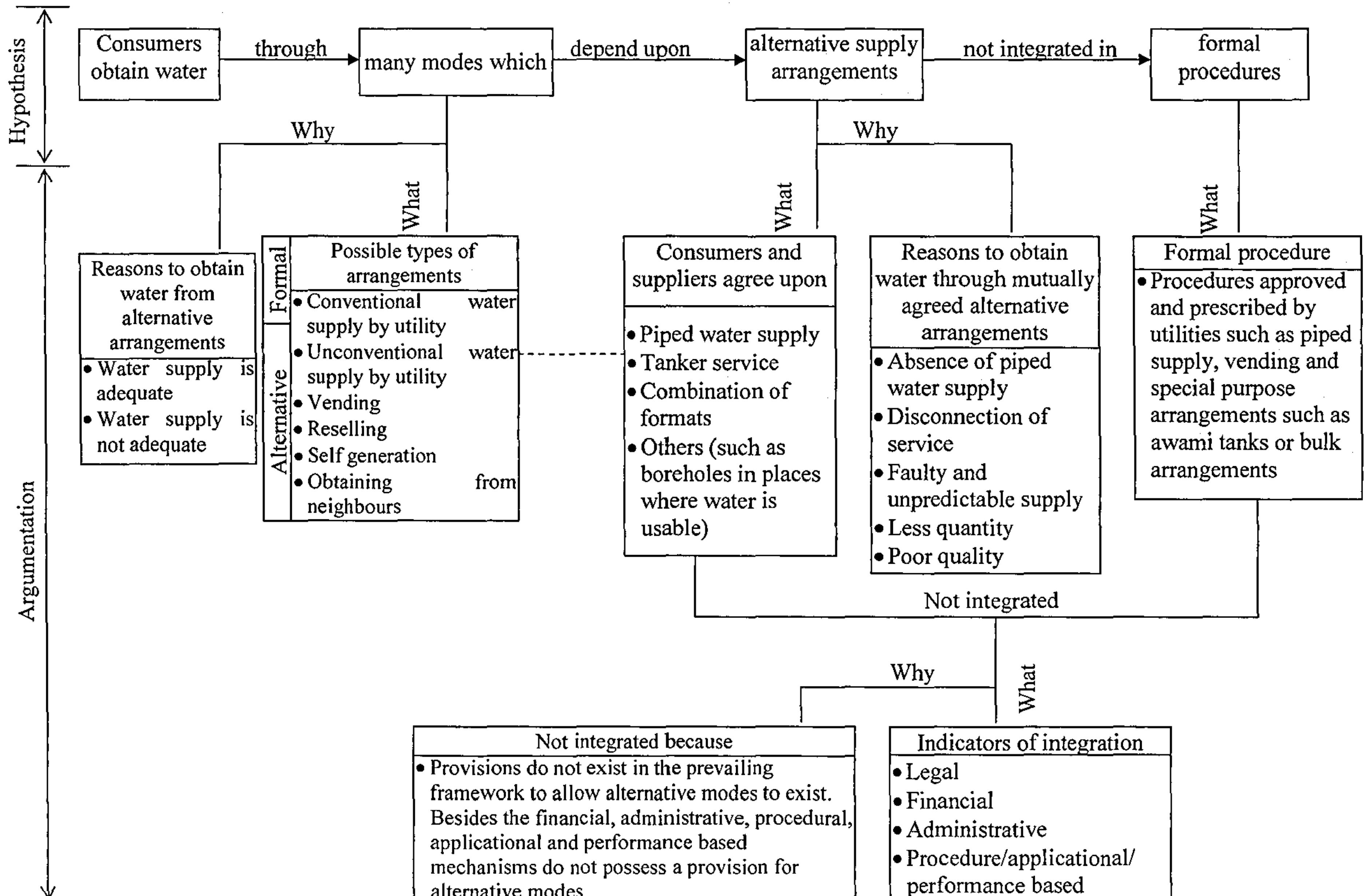
Continued on page 60...

Research Questions	Translation into Variables and Parameters
Machinery and equipment related to water supply.	• Water motor. • Suction pump. • Overhead tank. • Underground tank. • Filter. • Valving system. • Others (with specific reference)
Characteristics in alternative modes.	• Rapid supply. • Enhanced water quantities. • Appropriate rates/charges. • Acceptable quality. • Others (with specific reference).
Staff related to water supply.	• Plumber. • Valve man. • Chowkidar (watchman). • KWSB/WSD staff. • Area Nazim/Councellor (Mayor/local representative). • Others (with specific reference).
Costs recovery in alternative arrangement.	• Bill paid. • Bill not paid
Recognition of alternative modes.	• Recognized. • Partly or informally recognized. • Not recognized.
Possibilities of integration into formal practice/system.	• Yes. • No.

3.5 Logical Framework

The guiding hypothesis is further translated into a logical framework (see Figure-3.3). The framework is a means to develop argumentation leading towards the explanatory and exploratory issues of forthcoming research. This shall provide a framework for sequencing the research design that is structured around the research questions and corresponding parameters.

Figure-3.3: Logical Framework



3.6 Choice of Research Methods

Research questions identified in Figure 3.2 and 3.3 need to be investigated in a structured manner. Several alternative methods are available in the social and applied sciences for conducting research around a specified hypothesis and corresponding objectives. However most of such methods possess general underlying commonalities which are extrapolated to generate results according to the nature of the research exercises. For instance, Phillips and Pugh (1999) describe that a dissertation normally rests upon three types of theories; background theory, focal theory and data theory, eventually leading to a contribution to the existing body of knowledge. Background theory refers to the field of study in which the dissertation is being done. A focused literature review is one of the most appropriate ways of dealing with this stage of work. Focal theory refers to the questions of research in a precise manner which usually emanate out from the guiding hypothesis. The 'what' and 'why' questions are adequately addressed at this stage also laid down in the Logical Framework (Figure-3.3). Data theory provides the justification for the relevance of the material that shall be collected and used to support the thesis. Although the nature and magnitude of data may differ according to study depending upon the topic and discipline, appropriateness and reliability of the data collected remains the underlying principle. This eventually leads to a scientific and step-by-step verification of the hypothesis constructed as the starting point of the exercise.

Most situations in research in social sciences utilize combination of qualitative and quantitative methods of fact finding according to different prevailing research strategies. Yin (1993) outlines five strategies in relation to the basic form of research questions addressed (Figure-3.4).

Figure-3.4
Relevant Situations for Different Research Strategies

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Source: Yin (1993)

As the figure illustrates, the choice of the strategy largely depends upon the type of research questions considered. Whereas all the strategies outlined are linked up to exploring questions in one way or the other, they have a few shortcomings. For instance, surveys, history and archival records usually reveal the patterns of occurrence of a particular phenomenon. Therefore the search of the information from these records provides the basis for developing predictions related to the said phenomenon. However in open ended exploratory exercises, experiments or case studies are more suitable. In social sciences, since the focus remains on non-laboratory research, the case studies provide a useful tool for undertaking the exploration process.

3.7 Multiple Case Studies Method – An Appraisal

Case study is a method employed in social science research when causal relationships are considered (Yin, 1993). According to one definition, it can be defined as "an empirical inquiry in which the number of variables exceeds the number of data points" (Yin, 1993 p.32). This definition evolves from a pre-existing confusion about case studies in which they were confounded with plain data collection methods alone. In actual, case studies rely on multiple sources of information and evidence focusing on the same issue. It is a distinct research method with its own analytical routines. Data collection strategies are a part of the larger exercise of case study design.

As the case study is the main method of research, therefore it is vital to outline its essential characteristics. Below is presented a condensed set of characteristics of case study research:

(a) Case studies are useful when the researchers desire to define topics broadly; cover contextual conditions not simply limiting to specific phenomena and rely upon multiple sources of evidence.

(b) Case studies are flexible to make use of several research tools including surveys, experiments, analysis of archival records and historiography.

(c) Case studies can be linked up to various types of theories such as factor theories, explanatory theories or descriptive theories according to the respective origin of the work (Yin, 1993).

(d) Case studies tend to understand the various points within a context.

(e) Cases in case study design are selected strategically and/or statistically.

(f) Case studies achieve explanation by review and analysis of several variables within a case. Multiple cases are often used to replicate results, not for causal explanations (Vaus, 2001).

(g) For research questions posing 'how' and 'why' as the focus, case study research makes a suitable choice.

(h) Case study research comprises all encompassing methods with logic of design incorporating specific approaches to data collection and data analysis.

On the basis of the background of research strategies reviewed, it is decided to use a research strategy comprising multiple case studies. There are several reasons for this choice. Firstly, the case studies constitute the specific research method for addressing research questions pertinent to well defined examples bound by contextual parameters. That is to say that examples such as *awami* tanks, bulk water consumers and municipal water supply in planned and unplanned locations shall be some of the specific cases dealt through this approach according to the research questions framed for each. Sample surveys shall be used to document the response of the cross-section of stakeholders in relation to the water supply alternatives.

Secondly, the multiple case studies that draw from the combination of sample surveys are capable of responding to possible constraints that may be faced during the course of this research. Absence of any previous study in this area of water supply, very limited availability of up-to-date information from the utility and an overall politically volatile environment in the context of working are a few possible constraints that are being encountered. And thirdly, in a situation where very limited information is available to cover the process at least in the contextual perspective, the multiple case studies shall be able to generate the empirical evidence to test the validity or otherwise of the guiding hypothesis.

It is appropriate to note that multiple case studies have been viewed as an established method [Yin (1994) and (1984)]. Vaus (2001) endorses the fact that multiple case studies can be used as appropriate ingredients for research. The complexities and anomalies normally in-built in contexts like Karachi can be adequately addressed in this method due to the inherent flexibility that it possesses to respond to such situations. These issues are dealt at the stage of case study design. It may also be noted that multiple cases can provide a much stringent test of a theory. It can also help verify the conditions under which a theory may or may not hold. It must however be considered that while dealing with multiple case studies, the design and execution of each case study should be done as an exclusive exercise. Thereafter comparisons, if designed and desired, may be undertaken (Vaus, 2001; Yin 1993).

3.8 Identification of Case Studies

The structural considerations of the case study design are largely based on Vaus (2001). Several issues have been identified for the consideration of a case study preparation exercise. In order to make a case study appropriately focused onto the testing of the theory, several methodological issues are vital. The design of the case study must ensure the internal validity. Provision of detailed account of the concerned events, detailed description of historical and contextual background; keen observation of doing a case study itself are a few pertinent measures that need to be accounted for in the design. The factors pertinent to external validity of the exercise require consideration. Ways and means have to be sought for obtaining statistical and theoretical generalizations according to the appropriate end. A form of replication logic must also be evolved to help produce similar results for similar variables and conditions. The case study design must also possess an element of practical reality. Selection of cases, working out the number of cases capable of scientifically approaching the hypothesis, necessary preparatory work and related practicalities must be given due consideration (Figure-3.5).

Figure-3.5

Case Study Design – Some Structural Considerations

	Issues	**Description**
Methodology Issues	• Internal validity	
	Idiographic explanation nomothetic explanations	Full explanation to focused events. Partial explanation to focused events.
	Wholes, not parts	Complete account of the case to the best achievable extent.
	History and Maturation	Encompass the historical and contextual accounts.
	Reactive effects	Doing of a case study shall produce an impact on the case itself.
	• External validity	
	Theoretical and statistical generalizations	Statistical generalization is achieved by using representative random sample. Theoretical generalization involves generalizing from a study to a theory.
	Replication	Replication logic – an experiment can produce similar results if done with similar variables and prevailing conditions.
	Strategic selection of cases	Careful screening of the cases before their selection. Strategic selection of cases can contribute to literal and theoretical replication
Methodology Issues	• Sampling method of case selection	Selecting such cases that shall provide an appropriate test for the given theory.
	Number of cases	Adequate number of cases that can help in building up confidence in the findings.
	Case screening	Appropriate selection requires reasonable groundwork.
	Cost and access	Practicalities of cost and access must be kept intact.
	• Number of investigators	Consistency must be maintained. Uniform process and producers must be adopted for similar conditions.
	• When to go into the field	When the research questions are properly framed.
	• Presenting case studies	Set of cases – generalizations, the proportions and the questions they answer.
Ethical Issues	• Privacy	Researchers need to respect the privacy and public life that is guarded by the individuals.

Source: Vaus (2001)

The identification of case studies has been based upon the logical framework of the research (Figure-3.3) which draws from the guiding hypothesis, sequence of argumentation and the evolving research questions. In order to address the scope of the dissertation work, three case studies have been undertaken. Study of water supply in Karachi's planned and unplanned urban areas; retail beneficiaries of bulk water supply arrangements and awami tanks in a low-income settlement were identified as the case studies (Figure-3.6). The choice of the case studies was based on a criteria mentioned in the figure.

Study of water supply in Karachi's planned and unplanned settlements is selected to establish the baseline characteristics of water supply and the dominant modes with their scale of operation, source of supply and administrative status. This study shall also help generate desired feedback for studying consumer choices in subscribing to a particular format of water supply. Bulk water consumers, on the basis of a study carried out, showed a relatively better grade of service (Ahmed and Sohail, 2003b). Thus it makes a relevant choice for exploration in this context. Awami tanks are an emerging arrangement of water supply in the informal settlements of Karachi. As this mode constitutes an important arrangement of supply, therefore it is selected as a case study (Figure-3.6).

Figure-3.6
Identification of Case Studies

Case Studies	Criteria for Choice
Water supply in Karachi urban area (including planned and unplanned areas)	• The base line characteristics of water supply in the city can be established from this study. • General performance of the various arrangements of municipal/water supply in Karachi in planned and unplanned areas, including vending options can be studied. • Overall reference for comparison with various arrangement of water supply can be provided.
Bulk water consumers (planned settlements)	• Relatively better scale of service compared to other arrangements. • Reflects a better scale of cost recovery (with the exception of government organizations) and institutional performance than the utility itself.
Awami Tanks (unplanned settlements)	• An emerging alternative of water supply in informal settlements which is now expanding in numbers and locations.

3.9 Data Collection Strategy

Due to the complexity of the issues targeted in this study, absence of base line information in many domains and the heterogeneity of contacts, data collection strategy has been expanded to include a varied range of instruments for information collection (Figure-3.7). In the same reference the outputs of these fact-finding exercises vary to a considerable extent. The study comprised 524 questionnaires, 14 focused group meetings and 10 interview sessions with stakeholder groups in the three chosen case studies.

Figure-3.7
Data/Information Collection Profile

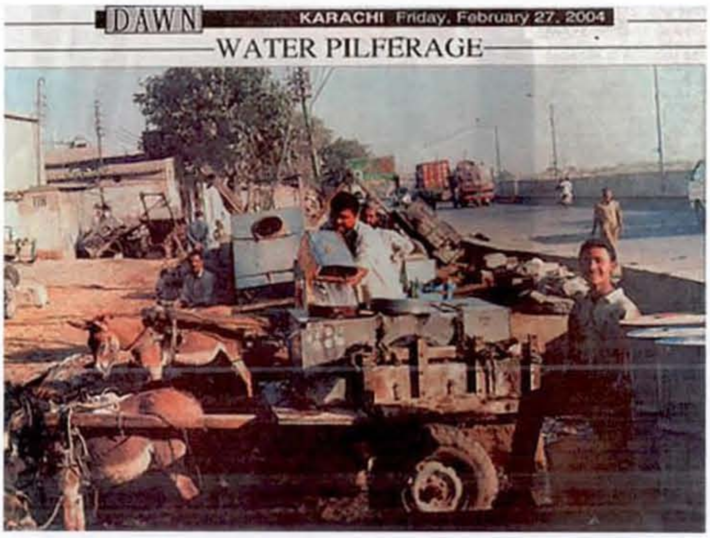
Case Study	Information Collection Tools	Frequency	Location	Output
Water supply in planned urban areas in Karachi.	• Literature review/desk study. • Pilot survey. • Structured survey.	260	• Federal 'B' Area • Gulshan-e-Iqbal • Nazimabad • Gulistan-e-Jauhar • PECHS	• Tables • Transcriptions of descriptive feedback (provided by focused groups).
Water supply in unplanned urban areas in Karachi.	• Literature review/desk study. • Pilot survey. • Structured survey.	210	• Orangi Town • Neelam Colony, Clifton • Bengali Para • Sherpao Colony • Machar Colony	• Tables • Transcripts of descriptive feedback (provided by focused groups).
Awami Tanks in Karachi	• Literature review • Pilot survey. • Semi-structure questionnaire. • Focused group.	22	• Orangi Town	• Tables • Transcripts
Retail beneficiaries of bulk water supply in Karachi	• Literature review. • Pilot survey. • Structured survey. • Focused groups discussions.	32	• Defence Housing Authority • Gulshan-e-Hadeed • Steel Town • Lalazar	• Tables • Transcripts

3.10 Concepts

Few concepts are described below which are pertinent to the hypothesis, research questions and logical frame mode of the research (Figure-3.1-3.3).

3.10.1 Consumers

Consumption of water is universal. The vital issue is the manner in which the relationship to the source of supply is developed. The evidences gathered from the literature, study of the context and case studies suggest two main types of consumers; formal and informal. The formal consumers can be defined as those users of a legally and administratively valid water supply service who access it according to a prescribed manner. Residents of planned areas provided with piped water supply or its administrative alternative in the form of tanker supply; squatter settlement residents who live in regularized (or regularizable) abadies possessing a water stand post or any other form of supply such as awami tanks and such residents/temporary dwellers who obtain water from an authorized source are termed as formal consumers. Such users who obtain water through sources and arrangements that are not legally or administratively valid are termed as informal consumers. The water users from broken mains or quasi-legal hydrants/boreholes are placed in this category. In the scope of this study, only the domestic consumers are dealt. The observations have shown that upon the study of ongoing informal (and rather quasi-legal) operations, the authorities undertake temporary regularizations. For instance, the officials in Baldia town locality started charging the people who were otherwise stealing the water from a broken water main (see photograph). The types of water consumption are several including industrial, commercial, agricultural and others. They are not covered in this study. It may also be noted that all the other categories of consumers may be subdivided further within their own cadres.



Source: Dawn, 2004

3.10.2 Urban Areas

Presently, the area falling in the jurisdiction of Karachi City District is classified as the urban area for the city. After the promulgation of Sindh Local Government Ordinance, 2001, the multiple municipal jurisdictions have atleast been unified. However different agencies continue to perform the urban and land management functions as prescribed before. The procedures and formats of supply to these areas shall be discussed in Chapters 4-6.

3.10.3 Mutually Agreed Arrangements

The mutually agreed arrangements refer to the actual method through which the water supply is accessed by the consumers. The usage of suction pumps, supply of water through awami tanks to some select unplanned settlements and supply through various modes of water vending/sharing from the neighbours constitute this heading. The agreement needs to be viewed at two levels. There are incidences when the water utility observes an ongoing informal practice. It then decides to accept some of these attempts as spot practices approved for application in that sector or locality. The design and development of awami tanks is an example. The second level of agreement is normally undertaken by the community members and the staff of water utility. In some cases, it becomes a quasi-legal activity since it continues under the acceptance of the staff members of the utility. However such practices do not qualify to be upscaled to become a water supply arrangement in an organized form. The spot payments for small scale acquisition of water in Baldia and similar other locations are an example (Ahmed and Sohail, 2003b).

The reason for the emergence and sustenance of these options are several. They reflect the potential of consumers to evolve a supply arrangement that is mutually acceptable to them as well as the suppliers. There are many occasions in which the water is acquired free of charge from the neighbours. This normally happens when an emergency arises and the neighbours have good mutual relations. In apartments, this is more commonly found where the distances and logistics favour this occurrence. The ultimate intensity of the pressing need sometimes forces the utility to adopt a flexible approach to accommodate some of these happenings (Ahmed and Sohail, 2000). In situations of acute water crises, the utility temporarily accepts the anomaly in a supply arrangement.

3.10.4 Integration

Integration into the conventional procedures of water supply has several aspects to be considered. The review of various ongoing mutually agreed arrangements, outlined through case studies, suggests that those arrangements where the water utility acknowledges an ongoing practice with a possibility to upscale it can be integrated in the supply format. The examples of tanker supply to various areas and awami tanks in different unplanned settlements are the examples. Despite the fact that they are accepted as a practice, it is not a binding on the utility to take an initiative to undertake integration of that procedure. It however continues to happen and is accepted by the actors concerned. The utility usually integrates it into a service delivery arrangement. For instance, water supply through commercial tankers evolved as an emergency practice that grew to become almost standard procedure of supply. In areas where the underground infrastructure is either totally dilapidated or non-existing, the residents cannot survive without tanker supply.

In the case of awami tanks, it is now observed that this format of service is expanding to new locations such as Manzoor Colony (KWSB, 2004). Apparently the key reason for this expansion and eventual integration with the conventional procedure was the need for a water supply arrangement which had mutual acceptability. The authority did not have any reservation in the provision of water while the users/consumers found it to be an appropriate minimum choice.

It is also vital to note that such practices which are found to be quasi-legal and detrimental to the interests of the utility as well as consumers are not attempted for integration. The ongoing practices of suction pumps installed upon piped connections, water supply from boreholes, water vending through informal hydrants or collecting water permanently through leakage points are found to be such practices. Although the utility is not able to control these practices, apparently due to limited capacity of enforcement, connivance of staff at lower levels, inability to extend the supply to all the aspiring clientele and the tendency to delay the cases on their spot merits make these options continue (Annexure-14). However the existences of these options do not make the utility undertake the acceptance/approval of the options concerned. Some of these options, such as suction pumps are not entirely preferred by the consumers themselves. They create a possibility of a legal action from the utility. They also have to be maintained/managed on a regular basis and consume extra electricity. However it was found (reported by the consumer) that the supply can not be accessed without the installation of these pumps.

4. FINDINGS – CASE STUDY-I: WATER SUPPLY SERVICE IN PLANNED AND UNPLANNED AREA

4.1 Introduction

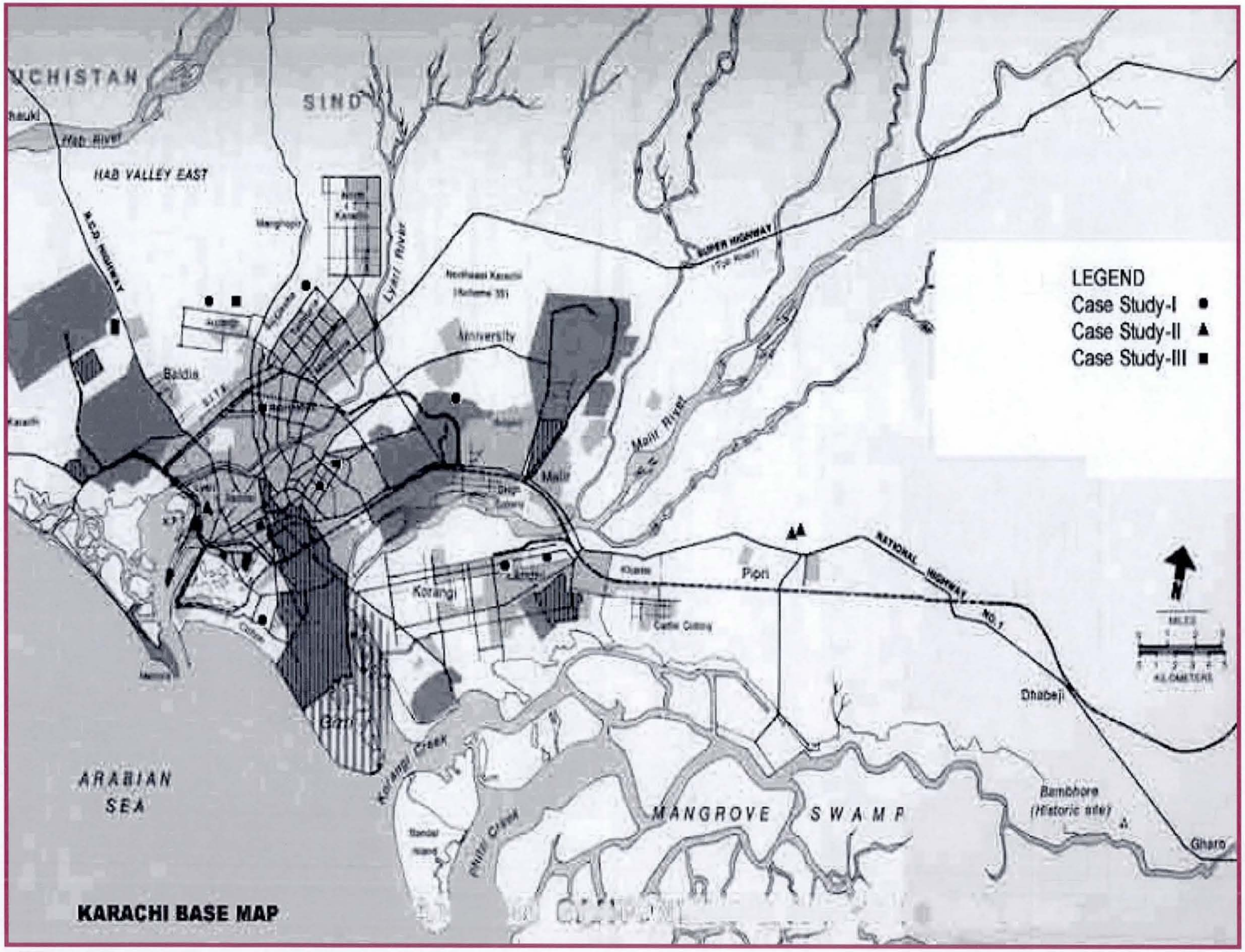
After highlighting the knowledge gap pertinent to alternative arrangements in water supply, chapter-3 outlined the premise of the research questions to be explored within a logical framework (Figure 3.3). A research design was prepared that was structured on case study method. To address the hypothesis and research questions, three case studies were selected. The chapters 4-6 provide details of case studies undertaken under the framework of research design.

This chapter presents the findings of the first case study which is about water supply in planned and unplanned areas. The chapter provides water supply information related to five planned and five unplanned locations in Karachi. Several issues have been covered in the study which include profile, status, modes, arrangements for alternative sources of supply, factors affecting supply, frequency, adequacy, machinery and equipment, reasons to use alternative arrangements, choice of alternative sources, personnel, water charges and options.

Water supply system in Karachi is largely dependent upon external sources, some of which are as far away as 150 kilometers. According to the KWSB/WSD (WSD-CDGK), there are four main sources of water supply to the city. They include Indus with an average supply of 435 million gallons per day (mgd), Haleji-20 mgd, Dumlottee wells – 5 mgd and Hub – 100 mgd though normally depending upon accumulated water through rainfall. Water is brought to Karachi through a massive conveyance system from the Indus river, Haleji lake, Hub and Dumlottee wells. This water is supplied to the consumers in two arrangements; direct supply to retail consumers and supply to bulk consumers (Map-1) (KWSB, 2004). Across an estimated overall demand of 820 mgd, the total supply stands at 460 mgd – with occasional re-charging of

Hub river source. Several new projects have been in pipeline for increasing supply of water. It may be noted that the water utility prepares its own supply strategy for different demand situations throughout the year. Normal procedures of responding to consumer demands include adjusting the frequency and quantities of supply, managing the pumping operations to an optimum level and augmenting the supply by using its own or contracted water tankers to the households in need (KWSB, 2002 and 2004). To obtain the needful quantities of water, the households also make some arrangements on self help basis. Resorting to boreholes, obtaining water from donkey cart suppliers, tankers and other vending means are some of the options. The supply from boreholes is not accounted for in the total quantity of supply because it is not considered as a legally valid source by KWSB/WSD, as reported by the residents and also observed in the field work. From this background, it is evident that the alternative supply arrangements normally mean the adjustment of transmission through utility managed sources and system with the same sources – the only exception is random extraction of ground water through boreholes as discussed later in this chapter.

The settlements in Karachi can be categorized into two major divisions – planned settlements and unplanned settlements. The planned settlements are those schemes that have been developed and managed either by the state institutions or by the commercial private sector under the control of state institutions. As a common practice, the infrastructure was laid down by the concerned agency during the phase of development (KMC, 1990). Thus all the planned settlements do possess infrastructure related to water supply. The unplanned settlements generally include katchi abadis (squatter settlements) of various kinds. In unplanned settlements, the water supply infrastructure comes through isolated projects or programmes (KMC, 1990). Thus the arrangement of supply is different in both types of settlements.


LEGEND
Case Study-I ●
Case Study-II ▲
Case Study-III ■
KARACHI BASE MAP
ARABIAN SEA
MANGROVE SWAMP
SIND
HAB VALLEY EAST
Hab River
Lyari River
Malir River
SUPER HIGHWAY
NATIONAL HIGHWAY NO. 1
University
Baldia
Malir
Korangi
Korangi Creek
Phitti Creek
Pipri
Dhabeji
Bambhore (Historic site)
Gharo
MILES
KILOMETERS

MAP-1

4.2 Structure of the Study

4.2.1 Planned Areas

The conventional municipal water supply service applies to the various residential schemes that were developed by various authorities, agencies and societies over the period of time. Commonly referring, they include Karachi Development Authority (KDA) (now defunct), Pakistan Employees Cooperative Housing Society (PECHS) and other societies, Sindh Industrial and Trade Estate (SITE), Nazimabad, Liaquatabad, Korangi, Landhi, Malir Colony and several other locations. The KWSB (now WSD) manages the water supply to these areas through its network. Initially, at the time of development of such schemes, an internal retail distribution system was laid down by the concerned development agency. The water utility then provided the main connection to the network. The supply was managed and monitored by the concerned utility. It also happened that the water utility extended services to those areas/localities which were planned and developed but did not possess a viable water supply system. Thus the water utility created secondary and tertiary infrastructure for provision of water to the target households. The water utility charged its consumers according to tariff structure worked out for the category of users. Normally the combination of pumping and gravity flow is adopted as the method to supply water. The charges are flat and users pay them annually. In case of service breakdown, the WSD is obliged to provide water through contracted tankers. The usual arrangement of water supply in single unit residences and apartments is outlined in Figures-4.1 and 4.2.

Figure-4.1
Conventional Municipal Supply to Single Unit Residences in Planned Areas

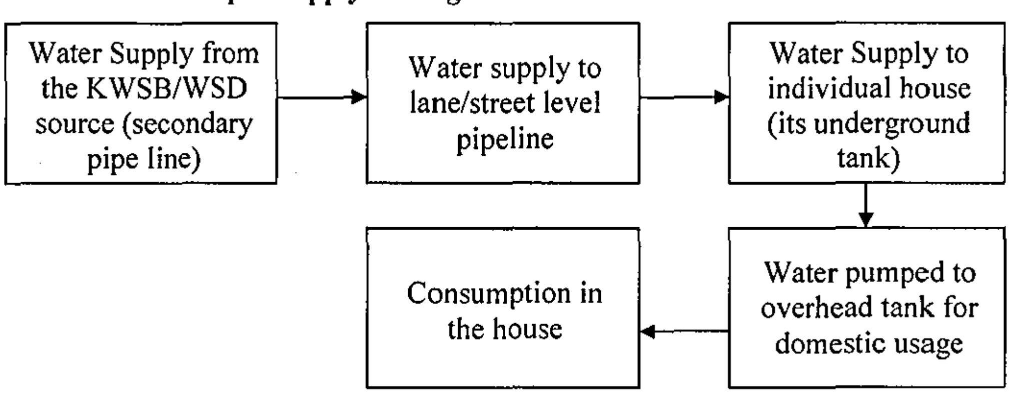
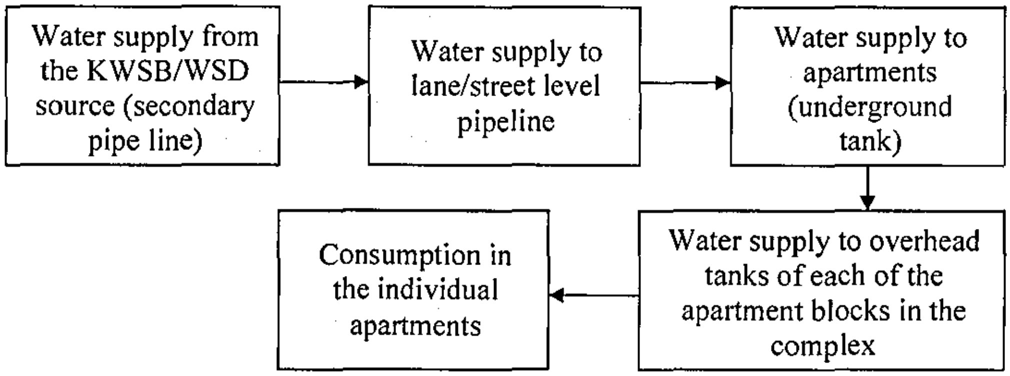


Figure-4.2

Conventional Municipal Supply to Apartments in Planned and Unplanned Areas



The choice of case studies was based upon the pilot studies conducted in the various planned settlements, discussions with the WSD-KWSB staff and literature review related to Karachi [for example Hasan (2002), Ahmed, N. and Sohail, M. (2000) and KWSB, (2000)]. Draft versions of the questionnaires, now appended in Annexures 1-5, were used to obtain feedback. Trained enumerators with experience in social surveys were assigned the task under the guidance of the author. 14 locations were covered that included neighbourhoods in different geographical locations, socio-economic profile and age. Finalization of the neighbourhoods was done on the basis of geographical spread, socio-economic diversities age of the settlements and varying levels of water supply services. In the process, the questionnaires were also finalized from the feedback obtained from the respondents.

On the basis of pilot surveys, the following planned areas were chosen for studies:

(i) Federal 'B' Area

(ii) Gulshan-e-Iqbal

(iii) Gulistan-e-Jauhar

(iv) Nazimabad

(v) PECHS (Pakistan Employees Cooperative Housing Society)

(vi) Saddar

- Federal 'B' Area – It is a scheme planned and developed by the Karachi Development Authority (KDA) and inhabited since late 1960s onwards. The locality is a combination of apartments, single unit houses and locations of mixed landuse. It is a locality of lower to middle income groups with occasional houses/residences belonging to high income groups also.

- Gulshan-e-Iqbal – It is a scheme planned and developed by Karachi Development Authority in 1965. However allotments, construction and habitation could only begin around mid 1970s. The locality is a combination of apartments and single unit housing with new and modified appearance. Gulshan-e-Iqbal is a typical locality of middle to high middle income groups.

- Nazimabad – It is an old neighbourhood which was developed immediately after Pakistan came into being in 1947. As the incoming refugees were in dire need of housing, a flexible approach to settlement was adopted to swiftly plan and develop several locations including Nazimabad. It now accounts for lower middle to middle income residents, mostly refugees from India. It comprises apartments, single unit residences and a variety of mixed landuse.

- Gulistan-e-Jauhar – Planned in 1980s, Gulistan-e-Jauhar is presently the hub of new construction and development. It comprises high rise and medium rise apartments, single unit housing, double unit housing and several other building types. It is one of those planned locations which are under serviced for water supply by KWSB/WSD. It is inhabited by middle and lower middle income groups.

- PECHS – Pakistan Employees Cooperative Housing Society (PECHS) was developed as a middle to upper middle income locality during early 1950s onwards. It now accommodates higher middle income group with few incidences of residence of the lower/middle income groups. Due to expanding trend of conversion of residential property to commercial/other uses, the density of the locality is continuously rising.

- Saddar – It was covered for the study of apartments only. This area is the city centre of Karachi since British colonial times. It is experiencing a change in its land use and activity profile. From the hub of retail commercial and cultural activities, it is becoming a transit camp and warehousing location. Many multi storeyed apartment projects are also located.

In the course of the study, structured surveys were conducted in these areas with users/households/residents. 200 questionnaires were completed in planned settlements from the residents. In addition, 60 questionnaires were completed from the residents of apartments which make a vital category of housing in Karachi. Information was also acquired from the KWSB/WSD staff, area elected representatives, water vendors and representatives of press reporting on developmental/infrastructural issues. 12 respondents were covered in this phase of study (Annexures 01-06). This information has been organized, tabulated and presented in the next sub-head. The feedback acquired from the other stakeholders was compiled in the form of survey notes based on specific checklists prepared on the basis of pilot studies.

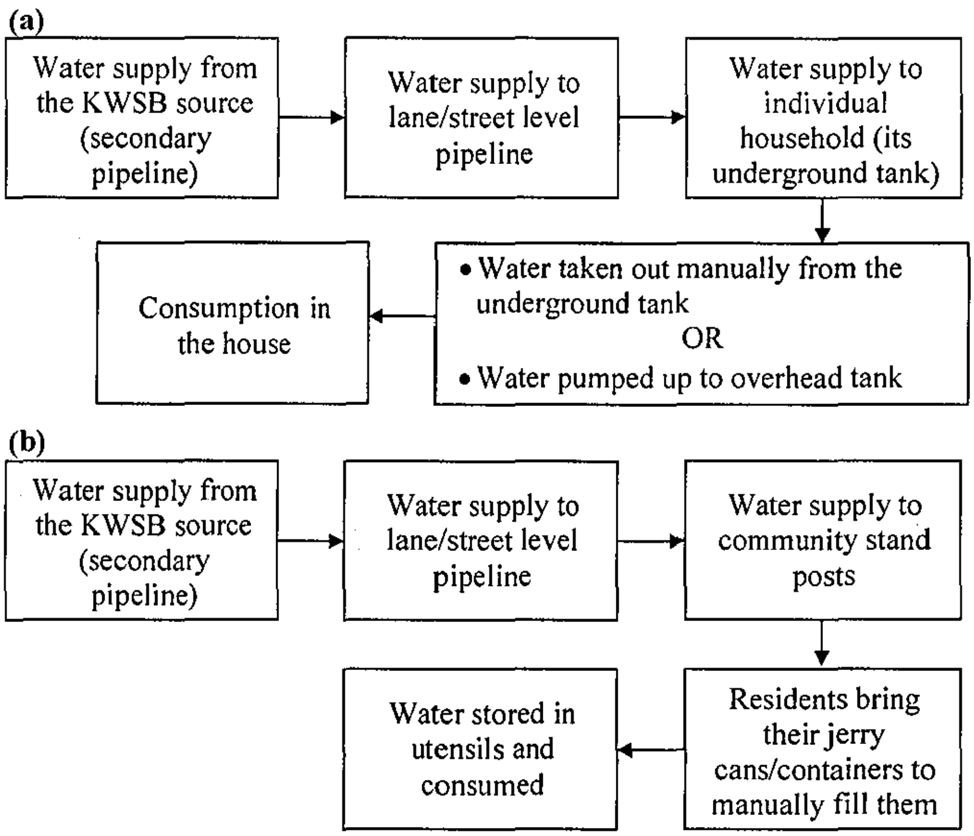
4.2.2 Unplanned Areas

Unplanned areas are commonly termed as *katchi abadis* (squatter settlements). They are spread out in the entire city and now account for over 45 percent of the total city population (Hasan, 2002). These settlements started developing immediately after 1947 when Pakistan came into being and Karachi became its first capital. The format of development broadly comprised three approaches. The squatters formed through unorganized invasion of vacant land were among the initial examples. These types of settlements were formed when a group of people squatted on an empty parcel of land and started living without necessarily the patronage of any individual or political group.

The layout of such settlements was found to be haphazard without considerations of proper development. Locationally most of these squatter settlements were found close to the city centre. However due to the fact that these invasions did not take the various administrative safeguards into account they were often bulldozed and evicted from the site. Provision of basic services was also a major issue in these cases.

Organized invasions formulated the second category. They took place when one or more group of people who were in need of housing got together and squatted on an empty piece of land (Hasan, 1992 and 2002). The organized invasion was marginally better than unorganized invasion. Although the impact on the layout and morphology was negligible, the organized invasions produced settlements that were organically developed and continued to grow. Laying infrastructure in these settlements also posed a problem. Usual format of water supply is outlined in Figure-4.3.

Figure-4.3
Conventional Municipal Supply to Single Unit Residences in Unplanned Areas



Illegal subdivision were a popular system of informal settlement formation. In this category, state or private land was occupied by land grabbers who subdivided it similar to planned localities. Prospective owners would then occupy such settlements. Later stages included acquisition of services and obtaining legal status from government.

The choice of case studies was based on the pilot studies conducted in various unplanned settlements, discussions with the WSD-KWSB staff, literature review and feedback from earlier works by the author in similar location [for example Ahmed, N. and Sohail, M. (2003e)]. Draft versions of the questionnaires, now appended in Annexures 7-9 were used to obtain feedback. Trained enumerators with experience in social surveys were assigned the task under the guidance of the author. 15 locations were covered that included squatters in different geographical locations, socio-economic profile and age. Finalization of the neighbourhoods was done on the basis of geographical spread, socio-economic differences, age of the settlements and water supply situation in the area. In the process, the questionnaires were finalized from the feedback of pilot study work.

Following unplanned locations have been included in the study of single unit residences and apartments:

(i) Orangi Town
(ii) Neelum Colony, Clifton
(iii) Bengali Para, Korangi
(iv) Sherpao Colony, Landhi
(v) Nusrat Bhutto Colony, North Nazimabad
(vi) Lyari
(vii) Khadda

- Orangi Town – It is one of the largest squatter settlements in Karachi. It comprised a planned township which was later expanded to a full fledged squatter. The survey broadly covered the newer locations in Orangi such as Ghaziabad, Gulshan-e-Zia and Mansoor Nagar.

- Neelum Colony – This katchiabadi is located in South. It is at the edge of Clifton which is a high income locality. This locality evolved as a service sector settlement and accommodates low income groups.

- Bengali Para – There are several scattered settlements of illegal/quasi legal entrants from Bangladesh who have come to work in Pakistan. These settlements often exist as pockets between existing settlements and are considered as squatters. They depend upon the existing system of infrastructure already present in the adjoining localities. The Bengali Para covered in this study is located in Korangi.

- Sherpao Colony – It is a typical illegal subdivision in the industrial areas of Landhi and Korangi. It is inhabited by low income inhabitants.

- Nusrat Bhutto Colony, North Nazimabad – It is a squatter settlement located in the vicinity of North Nazimabad which is a planned neighbourhood. The settlement evolved in 1960s along the hilly terrains and spread in the same manner. Nusrat Bhutto Colony now stands regularized by the competent authorities.

- Lyari – It is one of the oldest low income settlement which has experienced densification along its various locations. Most of the residences are regularized and densified. Labour classes and medium scale entrepreneurs typically resided in this area.

- Khadda – It is an old pre-British settlement that evolved as a worker housing area. It became densified due to the overall pressure of the land market situation in the neighbourhood. A peculiar phenomena of informal high-rises developed in the area. They comprised multistoreyed accommodation for natives and new immigrants to Karachi.

Structured questionnaires were used to obtain feedback from the residents/users/households in these localities. In all, 150 questionnaires were completed in unplanned settlements which were transcribed and tabulated. Information was also acquired from KWSB/WSD staff, elected local representatives, water vendors, CBOs, local correspondents and area politicians. 09 informants were covered during this phase of work. These feedbacks were acquired through informal interviews and discussions which were transcribed and edited in the form of transcripts.

The surveys were conducted during April-September, 2003. This period is normally considered as the time when water is in great demand due to summer season.

For both the planned and unplanned areas, the surveys were conducted in Urdu. English versions of the questionnaires are placed in Annexures 1-9. In some cases, they also used local dialects to have improved communication. Face to face interviews were carried out with the head of the household or a senior member. Normally the first, middle and last houses of chosen lanes were targeted for interviews to obtain representative response about the water supply service at varying locations. Within the neighbourhood, the lanes were chosen in the same manner to obtain different levels of service within the settlements.

4.3 Findings

4.3.1 Planned Settlements

(a) Single Unit Residences

Figures 4.4(a&b) describe the residents profile of planned settlements and a surveyed household.

Figure-4.4(a)
Residents Profile – Planned Settlements

The locations covered in the planned settlements included Federal 'B' Area, Gulshan-e-Iqbal, Nazimabad, Gulistan-e-Jauhar and PECHS in Karachi. 80 percent of the residents were house owners. They belonged to different occupations including government service, bankers, electrician, business, private service, shopkeepers and others. Household size varied between 03 to 21 depending upon the family circumstances.

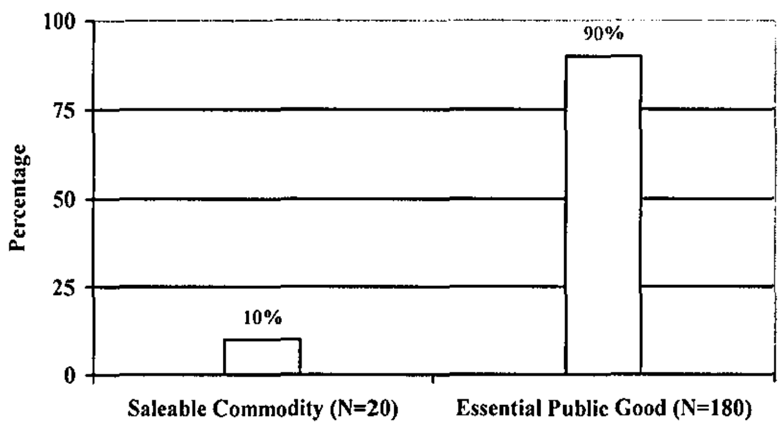
Figure-4.4(b)
Gulshan-e-Iqbal, Karachi – Single Unit Residence
Profile of a Surveyed Household

The household of Mr. 'A' who was an aviation engineer, resided in Block-5, Gulshan-e-Iqbal. The house comprises three bedrooms, with attached bathrooms/dining space, TV lounge, kitchen and a store. An overhead tank and an underground tank also existed in the house. The total covered area was 3200 sq.ft. approx. The household comprised a husband and wife with three teenaged children. A maid servant was employed as a help on a full time basis as a domestic help.

Daily chores that involved consumption of water included cooking, drinking, washing utensils, washing clothes, bathing and watering of plants that existed in the pots. Occasional chores involved washing the house floor-including car porch – washing the car once a week and washing window glasses. Neatness and cleanliness showed that the household members were articulate in life styles involving sizable amount of water. Lifestyle also reflected usage of optimum water quantities due to daily washing of clothes; washing greasy pans, dishes and utensils and daily bathing habits of the inhabitants. Water was obtained through piped supply on alternative days with suction pump. Water tankers had to be contracted occasionally during summer season. The household reported supply as satisfactory.

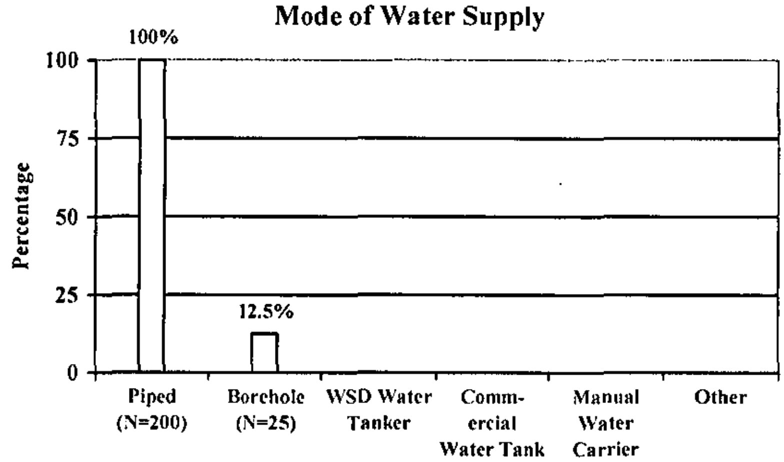
- A sizable sample considered water as an essential public good (Figure-4.5). Several observations were cited by the respondents in this reference. Water was considered as a gift of God/nature and a commonly needed entity. Those who considered water as a saleable commodity further contended that only service charges may be levied by the utility without converting it into a business.

Figure-4.5
Status of Water Supply



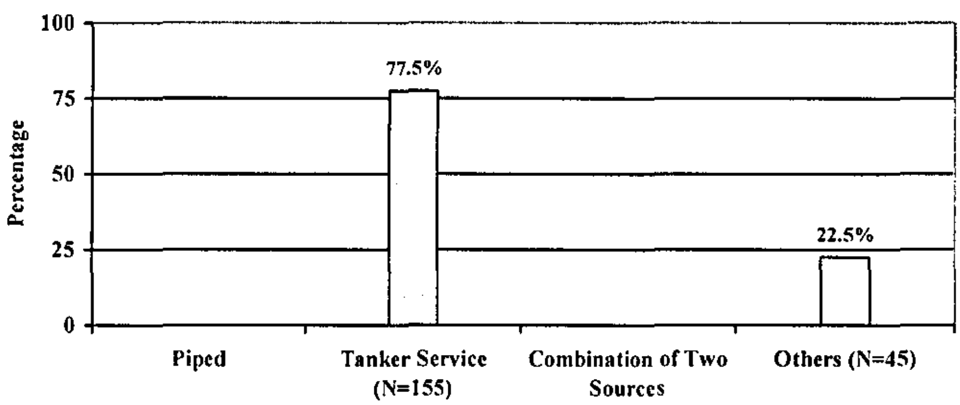
- Residents resorted to multiple modes of supply. Piped water supply and boreholes were common options (Figure-4.6). As mentioned in the later descriptions, the supply from piped sources usually functioned with the assistance of suction pumps. This turned the otherwise conventional arrangement into an alternative. It may be noted that since the residents reported to use more than one mode at a time, the total of percentages shall not add up to 100.

Figure-4.6
Mode of Water Supply



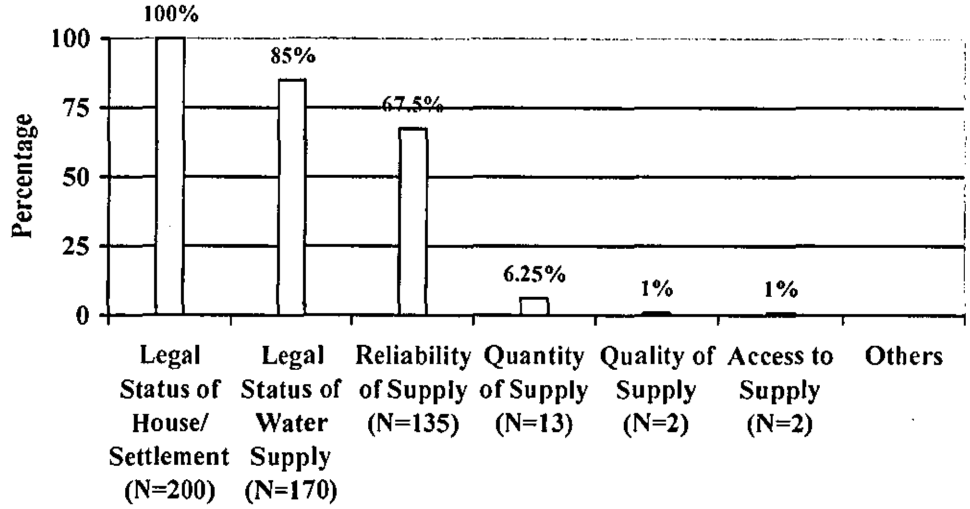
- A very sizable number of households resorted to tanker service as a mode of alternate supply (Figure-4.7). As residents reported to use more than one mode at a time, the total of percentages shall not add up to 100.

Figure-4.7
Arranements for Alternative Sources of Supply



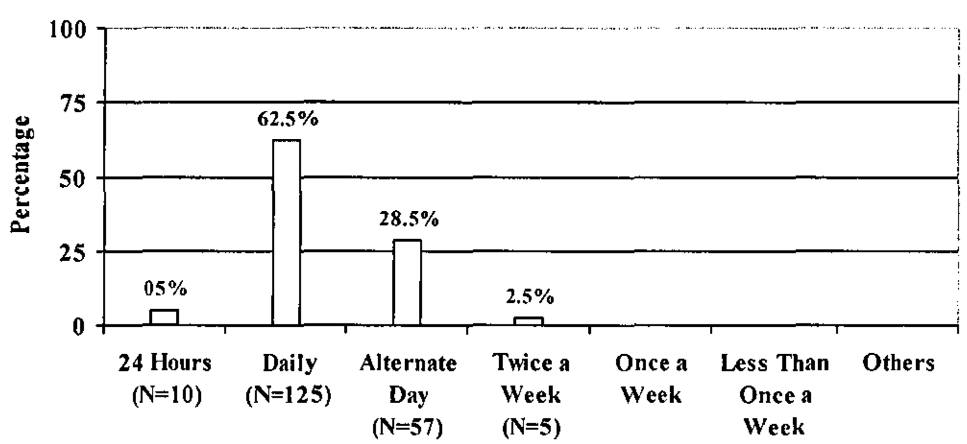
- Several factors were reported to affect the water in the planned settlements. Legal status of house/settlements, legal status of water supply service and reliability of supply are the few variables in this regard (Figure-4.8). Due to more than one answers, the values do not add to 100.

Figure-4.8
Factors Affecting Water Supply



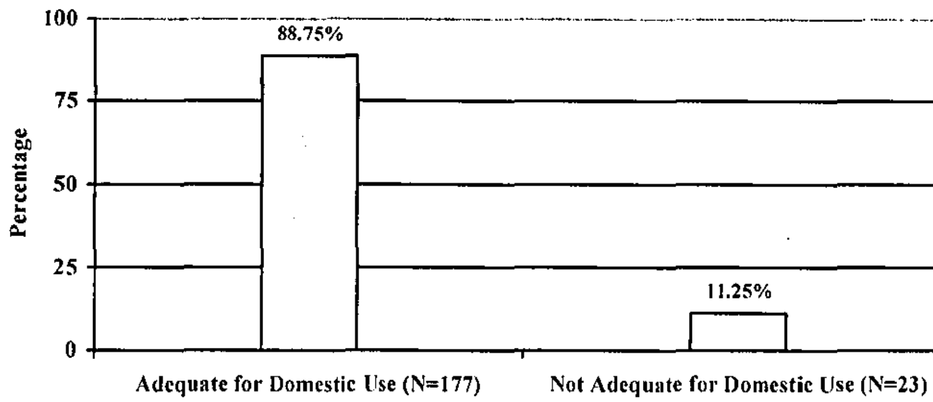
- Very few houses reported a 24 hours supply. Most of the households receive water on daily basis while few received on alternate days (Figure-4.9). The percentages do not add up to 100 percent as the respondents gave more than one answers.

Figure-4.9
Frequency of Water Supply



- People generally believed that water supply is satisfactory (Figure-4.10).

Figure-4.10
Adequacy of Water Supply



- Households in planned houses made use of several machinery and equipment such as water pumping motors, suction pump, overhead tank and underground tank were some of the vital components available in this reference (Figure-4.12). Due to this visible change, the process of the supply changed as shown in Figure-4.11(a). Suction pumps are simple mechanical devices that are installed to suck the water from a piped source of supply whenever the water is released in the network. They are locally manufactured and available in different power ranges from ½ horse power to 10 horse power. They function by utilizing electricity. It was reported by many surveyed households that the use of suction pumps was first introduced by those households that were located at the tail end of any supply network branch. Due to apparent loss of supply pressure and availability, the tail end households received less quantities of water. In order to augment to the available supply quantities, the suction pump was used by such households. Soon thereafter, this became a usual practice for a sizable majority of the households in an attempt to increase the available supply quantities. The use of suction pumps became important in various type of localities for different pretexts. Weak supply pressures, unscheduled frequencies of supply, irregular timings and limited supply quantities were the main reasons for the usage of suction pumps in planned areas. In addition to the above factors, the suction pumps are used in squatters to illegally connect and obtain water from the pipes supply to nearby planned areas [see Figures 4.11(b and c)]. It was also observed by the surveyors that the installation and use of suction pumps was improvised according to prevailing local requirements in an area (see photographs on pages 122, 123 and 124).

Figure-4.11(a)
Existing Arrangement of Municipal Water Supply to Single Unit Residences in Planned Areas

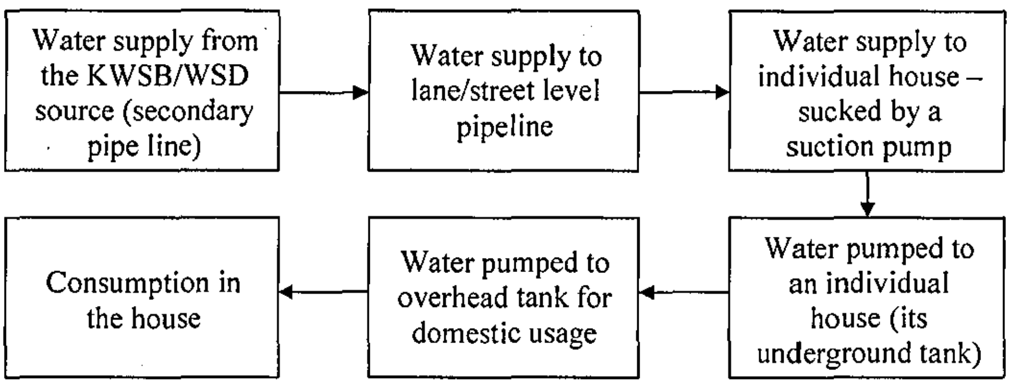


Figure-4.11(b)
Diagram Showing the Operation of a Suction Pump in a Typical Single Unit Residence in a Planned Area

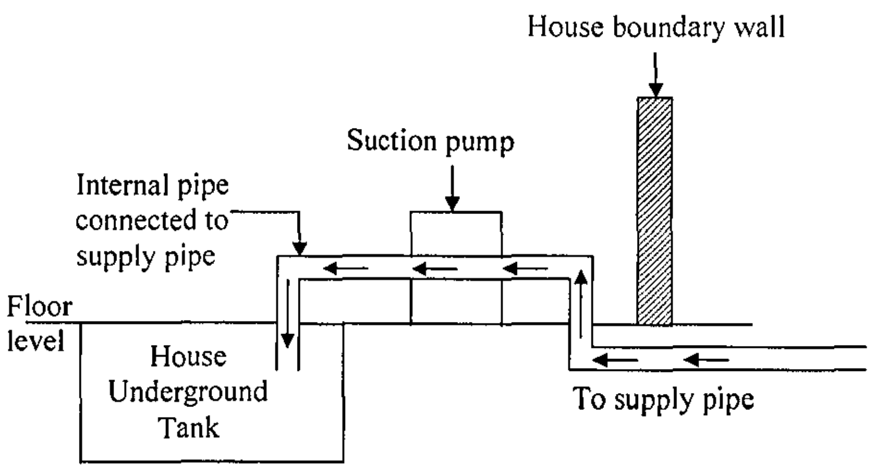


Figure-4.11(c)
Diagram Showing the Operation of a Suction Pump in a Typical Single Unit Residence in an Unplanned Area

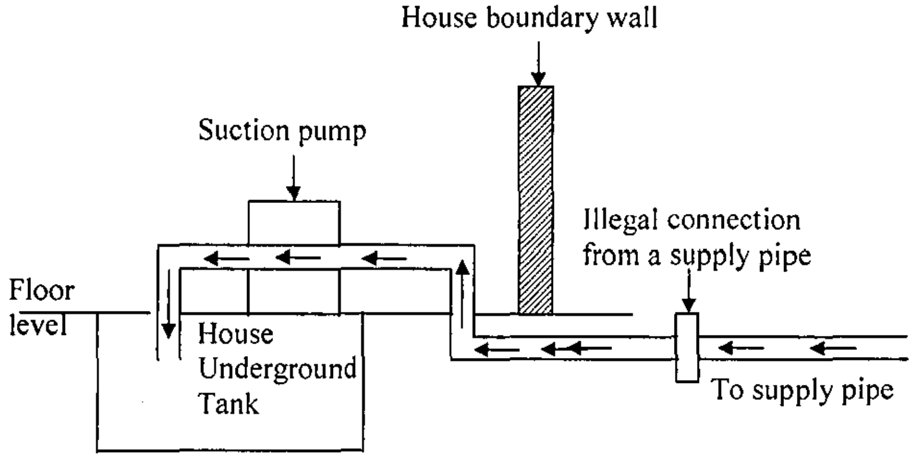
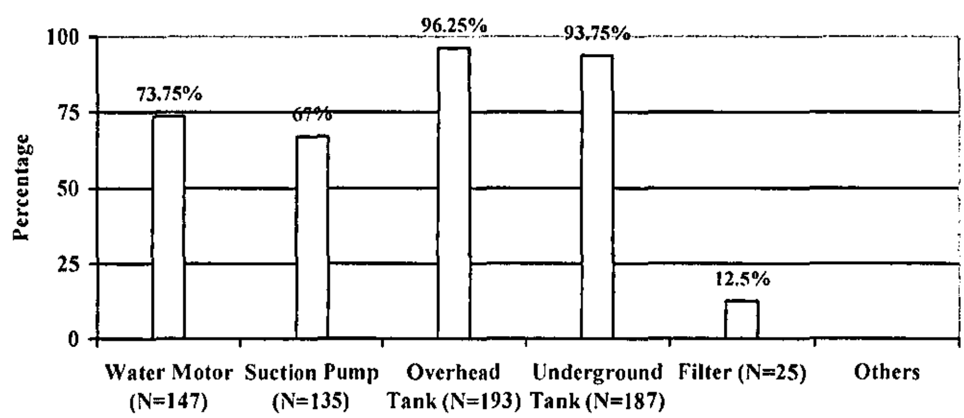
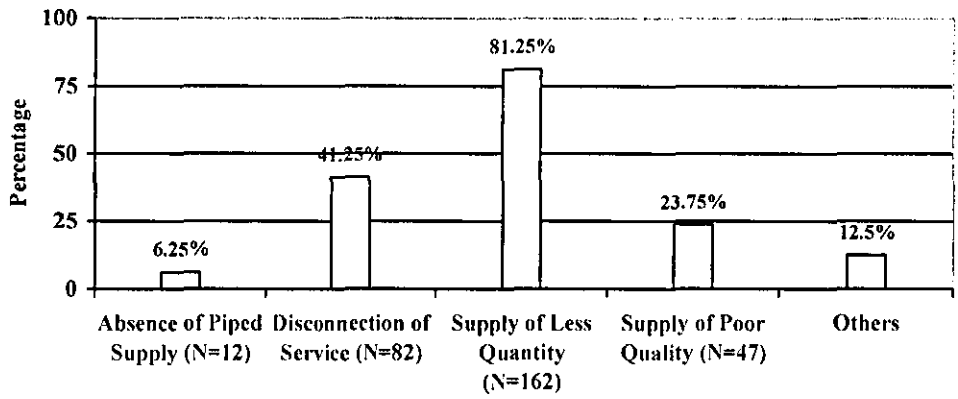


Figure-4.12
Machinery and Equipment Related to Water Supply



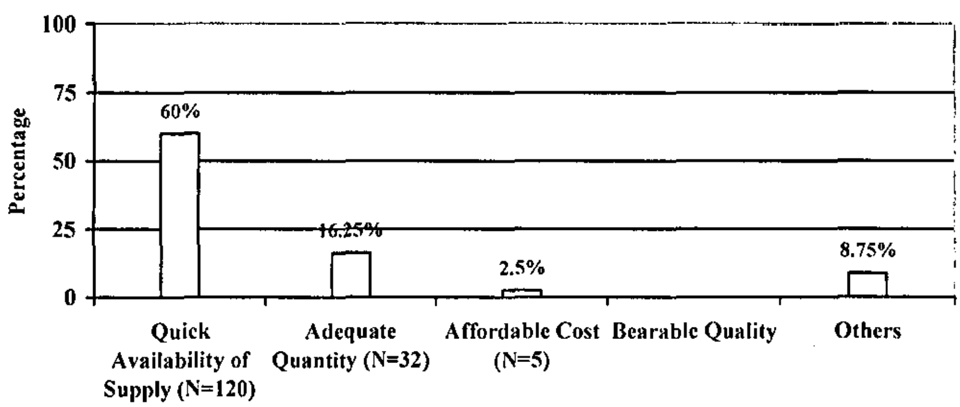
- The most important reason cited for resorting to alternate modes of supply included supply of less quantities, disconnection of services from time to time and supply of poor quality of water (Figure-4.13). In some cases, people obtained water from alternative sources to fulfil special needs such as during festivals, parties and any other celebrations/occasions. More than one reasons were cited by the people in this reference.

Figure-4.13
Reasons to Use Alternative Arrangements



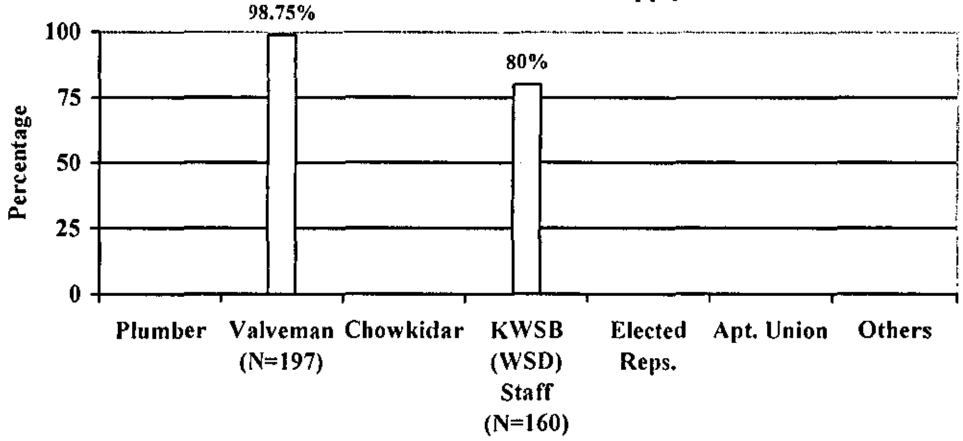
- Rapid availability of water and supply of adequate quantities made the vital factors for the choice of alternate arrangements (Figure-4.14). In few cases, personal links of household with a service provider also affected their choice.

Figure-4.14
Choice to Use Alternative Arrangements



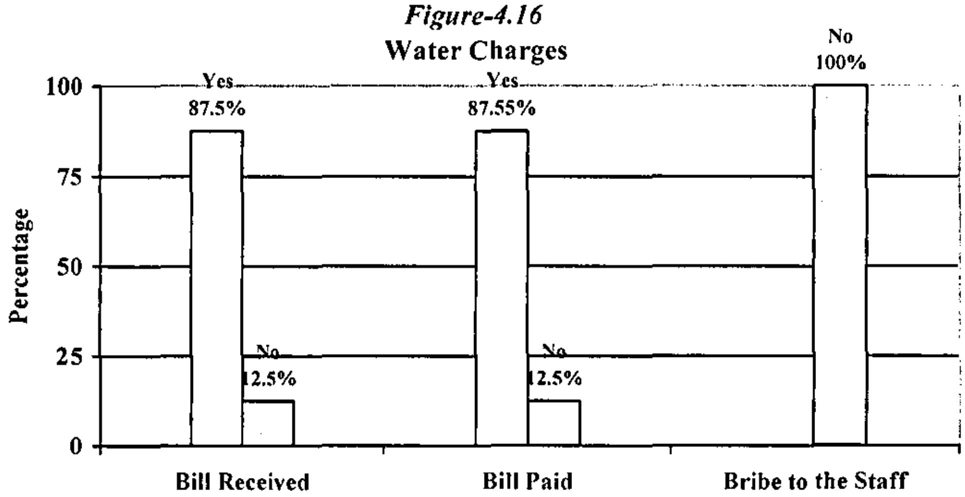
- Valveman and KWSB/WSD staff were the two vital cadres of personnel/staff related to water supply (Figure-4.15). More than one staff categories were cited by the respondents.

Figure-4.15
Personnel Related to Water Supply



- A sizable number received and paid the bill (Figure-4.16). Few households purchased commercial tankers in case of dire need. No traces of bribery was reported in the case of billing. It was due to the reason that water bills were calculated on a standard pattern that depended on the category of housing. Therefore not much room existed for corruption at this stage. Thus the responses were apparently accurate in this respect.

Figure-4.16
Water Charges



(b) Apartments

Figure 4.17(a) introduces the case study locations under this category. Figure 4.17(b) provides the pattern of usage of water by a surveyed household.

Figure-4.17(a)
Residential Profile – Planned Settlements – Apartments

The apartments in planned location included Saddar, Gulistan-e-Jauhar and Gulshan-e-Iqbal. 80 percent of the residents surveyed were owners. They belonged to different occupations including government service, private services, technicians, professionals and self employed personnel. The household size varied from 02 to 10.

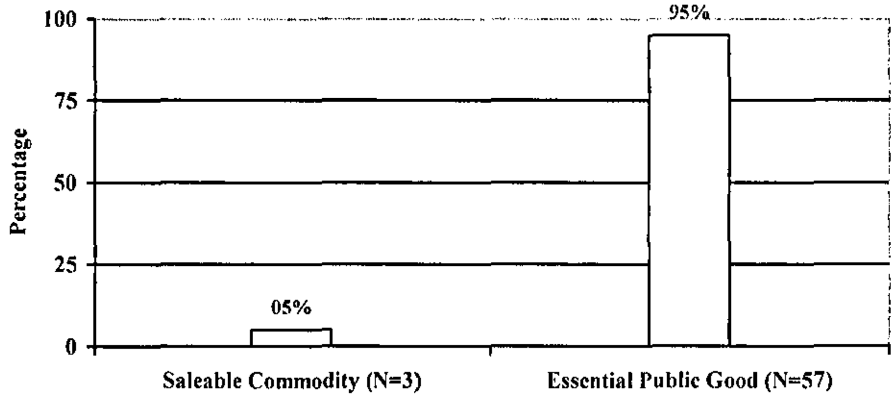
Figure-4.17(b)
Gulistan-e-Jauhar, Karachi
Profile of a Surveyed Household Living in an Apartment Block

The household of Mr. 'C', who is a salesman in a firm, resided in a newly constructed apartment complex. The apartment was located on the third storey and comprised three bedrooms with attached bathrooms, a lounge space, a formal drawing room space, kitchen and a store. Total area was 1500 sq.ft. Family members included wife and two boys of 10 and 13 years and 02 unmarried sisters of the husband in late 20s. The apartment building had an overhead tank which received water from the mix of borehole supply and occasional piped supply from the suction pump. The said household obtained separate water for drinking and cooking from manual water carriers (vendors). It was stored separately in the kitchen in jerry cans.

Daily chores that involved usage of vended water included cooking and drinking. Other routine chores were performed by the routine supply. Household was very cautious about the usage of water. Most of the household chores were performed during the early morning time when water supply was usually available. Quality of water was a major concern.

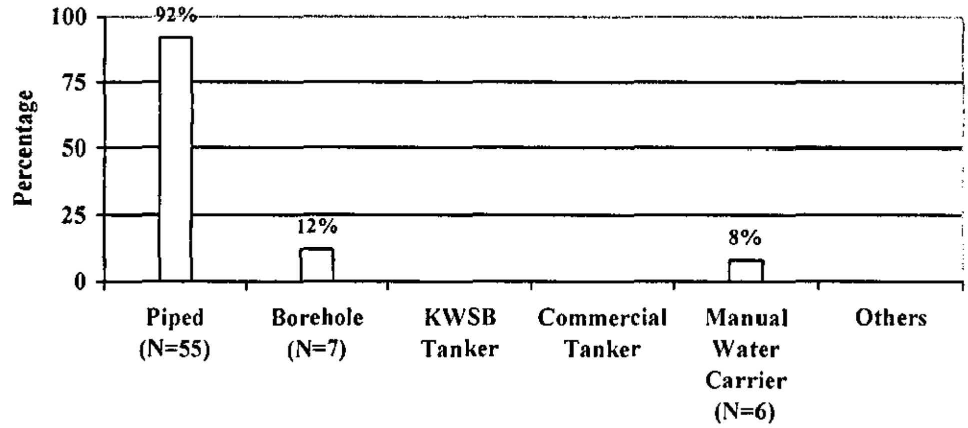
- A significant majority considered water as an essential public good (Figure-4.18).

Figure-4.18
Status of Water Supply



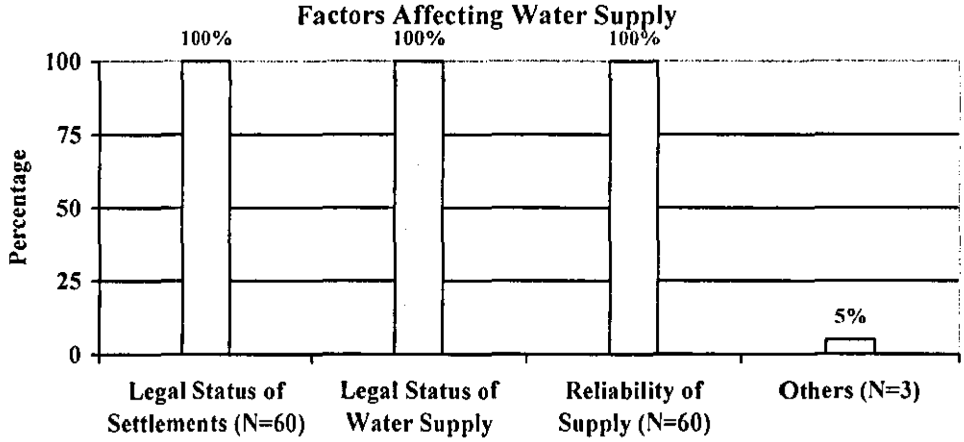
- Piped water supply was the common mode followed by borehole supply (Figure-4.19).

Figure-4.19
Mode of Water Supply



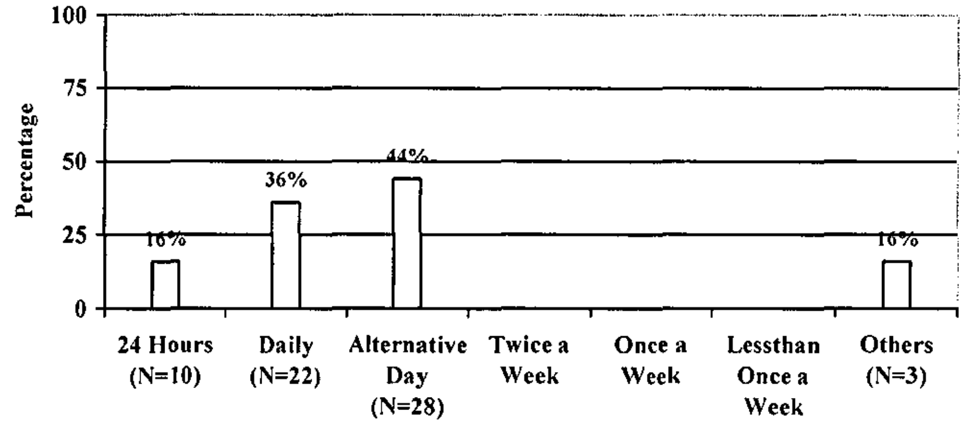
- Legal status of the settlements, legal status of water supply and reliability of source and the few important factors affecting water supply (Figure-4.20). In few cases, the location of the apartment block affected the supply. The blocks located at a higher topographical level received less water compared to those located at a lower level.

Figure-4.20
Factors Affecting Water Supply



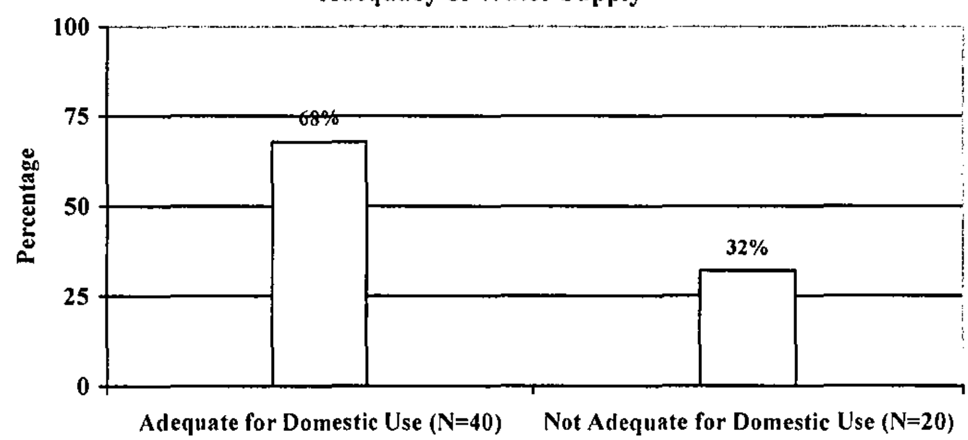
- Frequency of alternate day, daily and 24 hours supply was observed in the sample (Figure-4.21). In few cases, frequency was adjusted with nearby apartment complexes through mutual understanding.

Figure-4.21
Frequency of Water Supply



- Most of the residents found the supply adequate for domestic use (Figure-4.22).

Figure-4.22
Adequacy of Water Supply



- Apartment underground tank, overhead tank, suction pump and water pumping motor were some of the commonly used machinery and equipment (Figure-4.23). Many apartment dwellers installed storage tanks within their apartments to prevent any long standing shortage. Suction pumps were vital to obtain water from the pipelines. However owners were found reluctant to speak about their existence due to potential legal action. Existing arrangement of water supply in apartments is outlined in Figure-4.24.

Figure-4.23
Machinery and Equipment Related to Water Supply

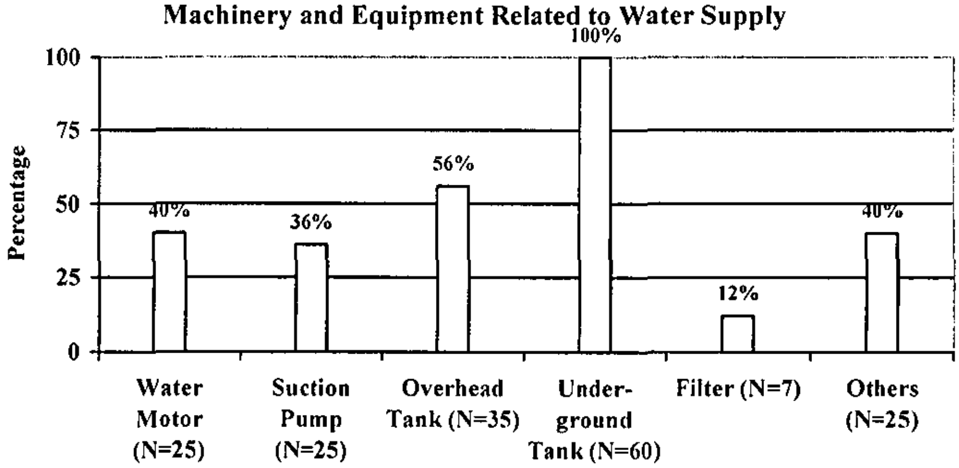
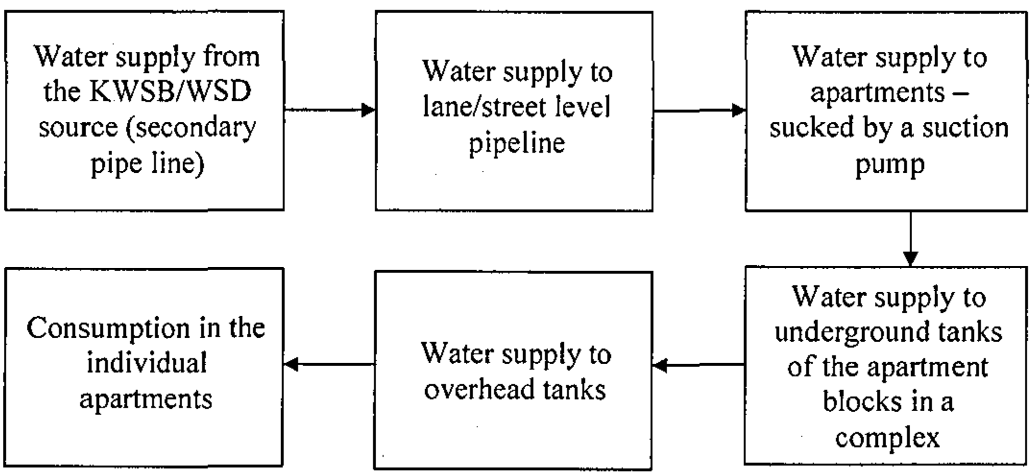
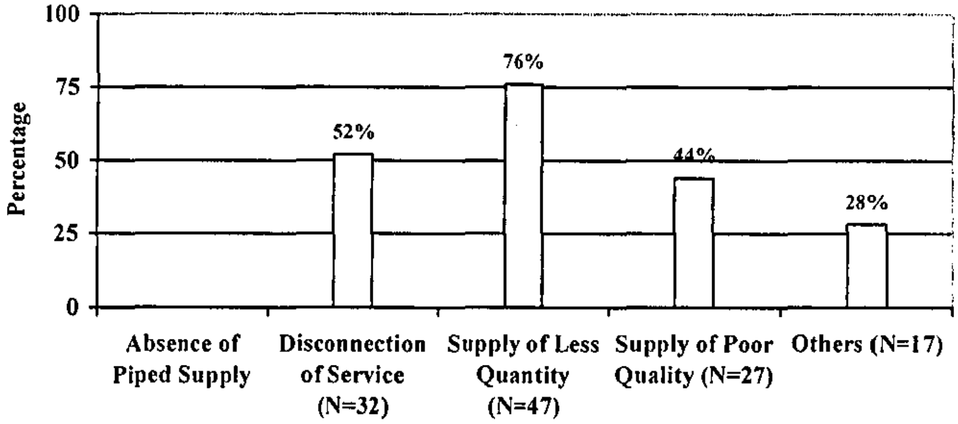


Figure-4.24
Existing Arrangement of Municipal Supply to Apartments in Planned and Unplanned Areas



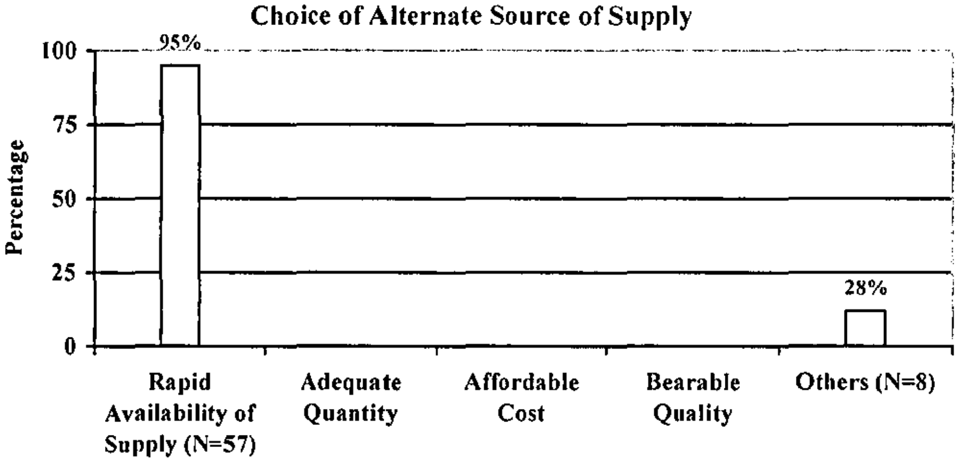
- Supply of less quantity, disconnection of service and supply of poor quality are the reasons for resorting to alternative arrangements (Figure-4.25). Unreliable frequency and unpredictable timings of supply also made reasons to obtain water from alternative sources. It may be noted that since the residents reported to use more than one mode at a time, the total of percentages shall not add up to 100 percent.

Figure-4.25
Reasons to Use Alternative Arrangement



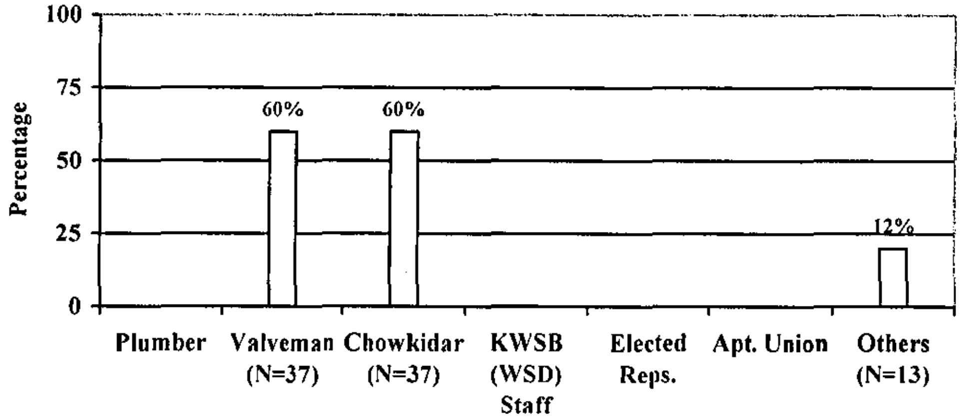
- Rapid supply makes a reason to choose an alternate mode of supply (Figure-4.26). Convenience to access any alternative made a consideration in this respect.

Figure-4.26
Choice of Alternate Source of Supply



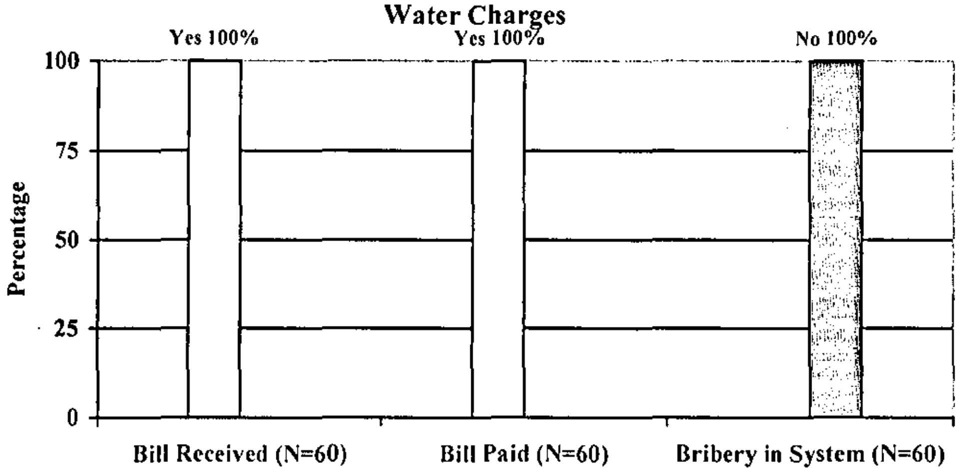
- Valvemen and apartment watchmen (chowkidars) played a vital role in the supply of water to these apartments (Figure-4.27). In some instances, the apartment dwellers obtained services of small-scale vendors who supply water through Suzuki vans and inbuilt motor pumps.

Figure-4.27
Personnel Related to Water Supply



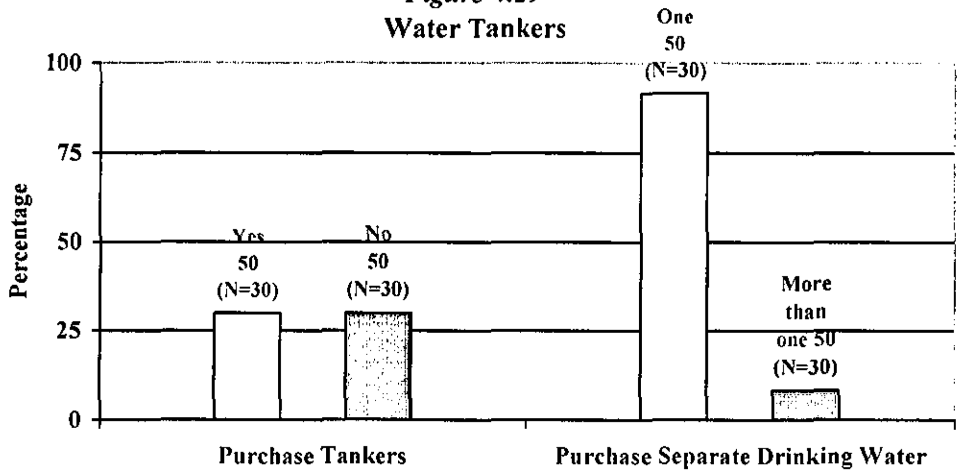
- Almost every apartment resident received and paid the bill (Figure-4.28).

Figure-4.28
Water Charges



- About half of the sample purchased one tanker per week (Figure-4.29). Of the 30 households that reported to purchase tanker loads of water, 15 households reported to buy one tanker per week while the remaining 15 bought more than one tanker per week. It depended on many factors. The households that had a lesser need due to smaller household size reported purchase of one tanker per week. Lesser affordability status or difficulty in purchasing water tankers were the other attributes. A tanker load could vary from 1200 gallons to 3600 gallons. However, as the households discussed in this category belonged to apartments, it meant a 1200 gallons tanker which was purchased by each household through respective apartment unions. Storage capacities in the underground tanks were reported to be sizable. The households were found to purchase additional quantities of water to deal with the potential risk of not receiving piped water supply or even tanker supplies during peak summer season. Purchase of water per unit time was not necessarily proportional to consumption.

Figure-4.29
Water Tankers



The maintenance and management unions of the apartments in planned locations were interviewed.

- It was found that all the apartment unions had connections of piped water supply. However in case of arrangements of alternatives, tanker service was pre-dominantly adopted. The factors affecting water supply included legal status of house/settlement plan water supply connection and reliability of source were some of the key factors. Rapid availability and also adequate quantity were vital factors in this respect.

4.3.2 Unplanned Settlements

The survey of unplanned settlements was carried out in Sherpao Colony; Bengali Para – Korangi; Sector 11½, Orangi; Nursat Bhutto Colony and Neelum Colony, Clifton in Karachi. Geographical diversity, varying socio-economic characteristics, cultural backgrounds and availability of different water supply arrangements were the key considerations for choosing these settlements.

The survey and fact-finding comprised the responses of 150 residents of unplanned settlements which was obtained through a structured questionnaire appended in Annexure-07. This sample also included the response of 60 residents of apartments developed in informal settlements covered separately. The feedback through structured questionnaire was also required from the residents of apartments in unplanned settlements including Khadda, Aligarh Colony and Lyari (Annexure-08). In addition to the structured surveys, the feedback on the issues was also required from key informants. There list and feedback is placed in Annexure-09. The following are the findings:

(a) Single Unit Residences

- The residents usually belonged to the category of house owners (Figure-4.30). The heads of household were normally employed in low scale jobs, self employed in different services or small scale traders. The members of households also showed great deal of diversity between the range of 01 to 20.

Figures 4.30 (a & b) describe the residents profile of single unit residences in unplanned settlements and a surveyed household.

Figure-4.30(a)
Residents Profile – Unplanned Settlements

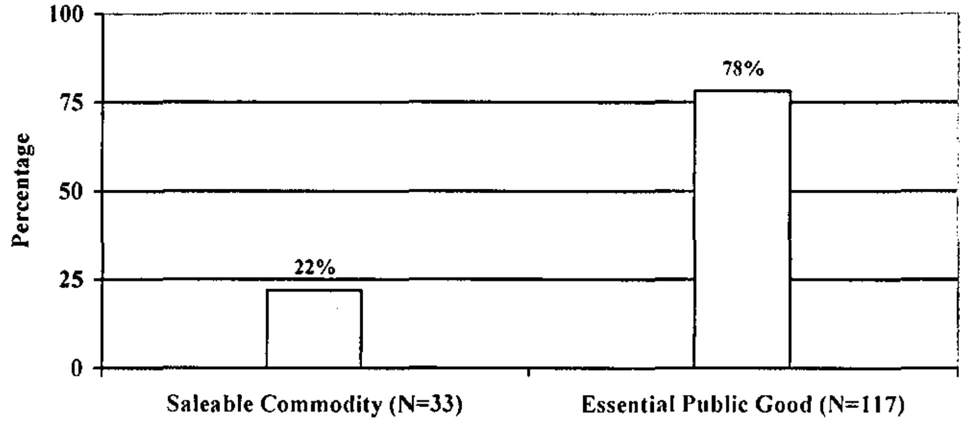
The katchi abadis surveyed in this exercise included Sherpao Colony, Landhi; Bengali Para, Korangi, Millat Colony, Orangi Town; Nusrat Bhutto Colony, North Nazimabad and Neelum Colony, Clifton, Karachi. 88 percent of the surveyed residents were house owners. They belonged to different occupations including petty shopkeepers, tailors, mill workers, push cart vendors, small scale entrepreneurs, drivers, masons, fruit vendors and even students. The household size varied from as small as 02 to 23, depending upon the peculiar family circumstances.

Figure-4.30(b)
Orangi Town, Karachi – Single Unit Residence
Profile of a Surveyed Household

The household of Mr. 'B', who was a shop keeper, resided in Gulshan-e-Zia in Orangi Town. The house comprised three rooms with tin sheet roofing, a paved verandah and unpaved open space. There was a common toilet and common bathroom. Kitchen was along the semi covered paved space. A fibre glass water tank was placed on metallic stand and connected to an underground tank built near the main door of the house. Household members included a husband and wife with two boys of 10 years and 14 years, a widow auntie of the husband with her two daughters of 06 and 08 years respectively. Although the house was linked to a piped supply network, the water could only be obtained once a week through a suction pump. Water was also obtained through donkey carts or tankers.

- The majority of households considered water as an essential public good. They had several views in support of their replies. The residents considered water as an essential commodity without which survival was impossible. It was regarded as a 'gift' of the nature therefore pricing it may not be a viable idea. Perception of rights was however different for other conventional necessities of life such as food, clothing, shelter or even security. Households did not consider access to these entities as 'right' – rather it was understood that only after contributing a corresponding labour, these entities could be obtained (Annexure-13). However the households who considered it as a saleable commodity, came up with this response with some reservation. It was realized that water supply does possess a cost which is essential to provide this service. It was however observed that the concerned utility must only charge the actual cost breakup of the service without any kind of excess billing or taxation (Figure-4.31).

Figure-4.31
Status of Water Supply



- The study of the mode of supply clearly revealed that several households rely on more than one modes of supply. Piped water supply was the most common option in association with boreholes and commercial water tankers. In few cases the households resorted to water supply from the donkey carts or pickup vans. In the focused group meeting it was found that during dire needs they obtained essential quantities of water from their neighbours, nearby hospitals, and similar establishments, boreholes, water vendors or carts. It was safely estimated that 30 percent of the households have to depend on more than one source of supply (Figures-4.32 and 4.33). Households also obtained water through petty vendors who sold it in jerry cans. In other cases water was acquired from nearby planned localities where supply was optimum and mutual relationships developed between the two types of households. Usually such supply was free of cost. Breaking an existing water main to obtain water was another visible source in some cases.

Figure-4.32
Mode of Water Supply

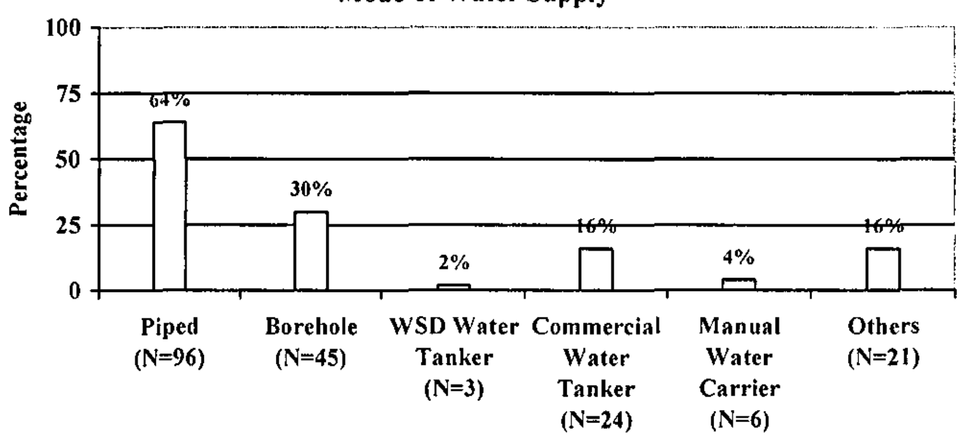
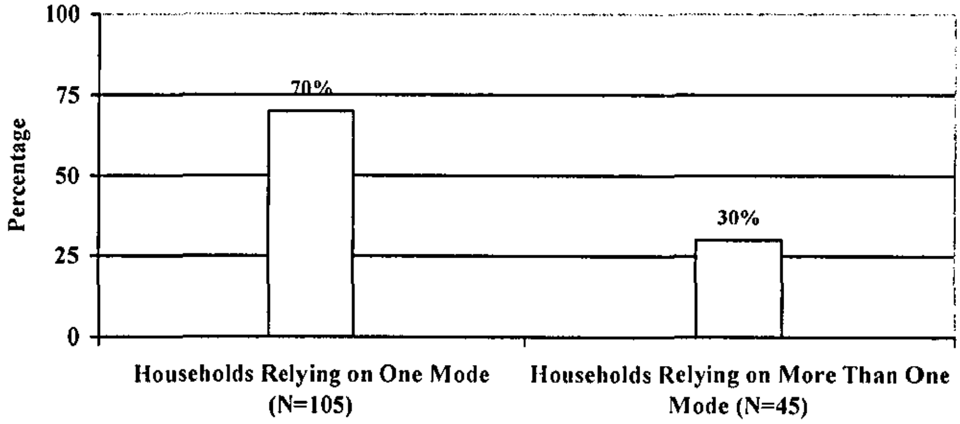


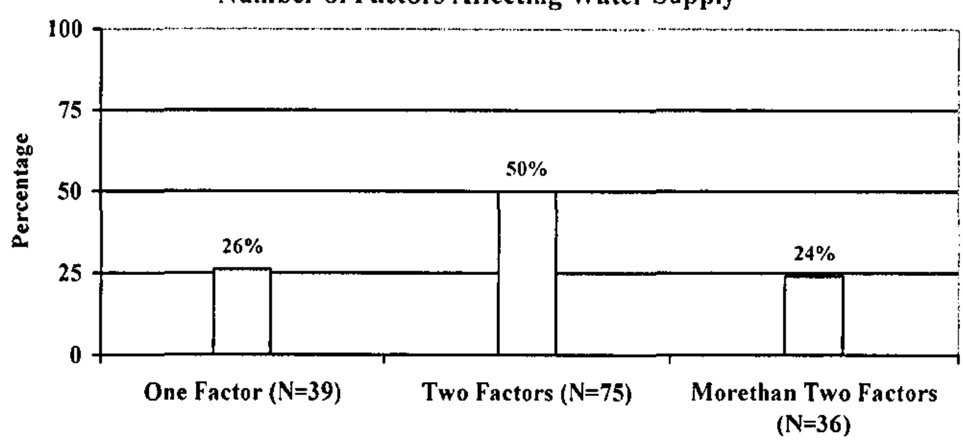
Figure-4.33
Households and Mode of Supply



- Arrangements for alternate supply were several in squatter settlements. Borrowing/fetching from neighbour, borehole, donkey carts, internal water vending are a few options. In few cases, the tankers were also used.

- The households cited several factors that were identified to affect water supply. The legal status of settlement, legal status given to water and the quantity of supply were found to be the main cited sources for supplying water. In the same respect the residents considered more than one factor as responsible for the affects on water supply (Figure-4.34).

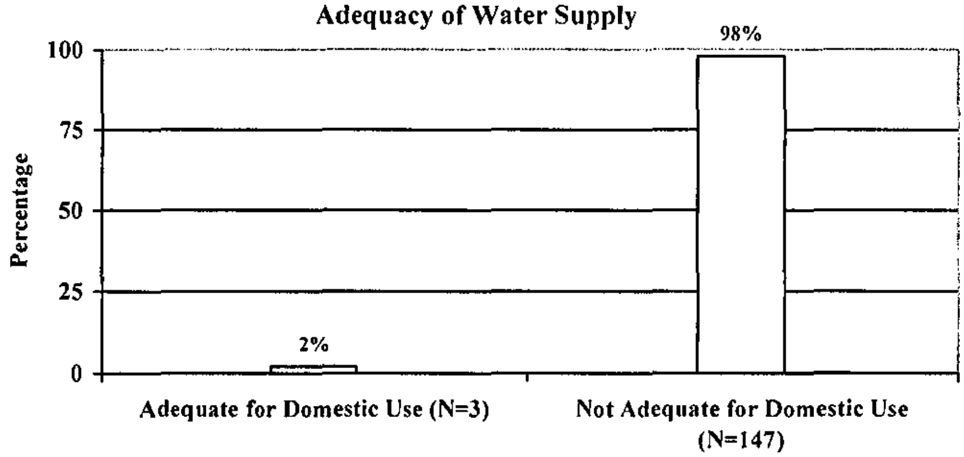
Figure-4.34
Number of Factors Affecting Water Supply



- A very large number of respondents considered the prevailing water supply as inadequate (Figure-4.35).

Figure-4.35

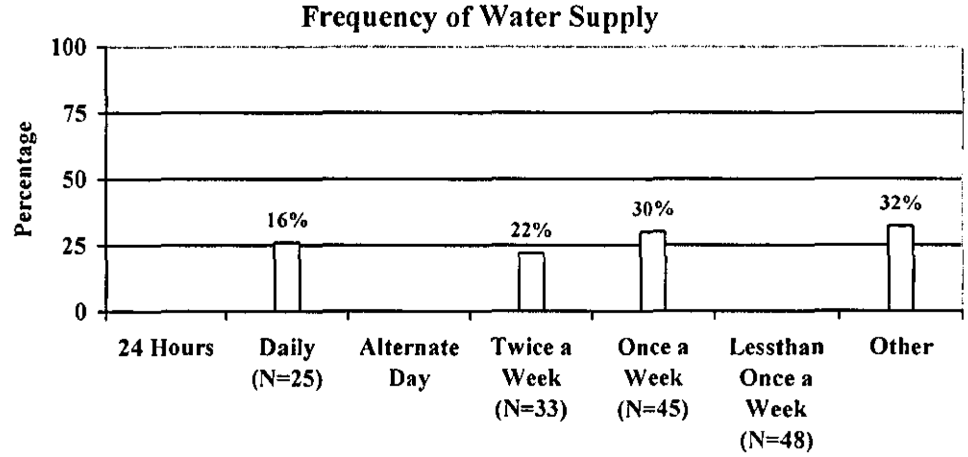
Adequacy of Water Supply



- The water supply frequency was found to be very disorganized. 16 percent respondents reported a daily supply. However 22 percent reported a supply obtained twice a week. A substantial number of respondents could not give a satisfactory answer as the frequency was not established for them (Figure-4.36).

Figure-4.36

Frequency of Water Supply



- The availability of essential water related machinery and equipment was found to be deficient in these squatter settlements. This factor was apparently due to a number of reasons. For instance, 16 percent houses possessed water-pumping motors. Lack of proper electric supply could be attributed as one possible reason in this case. A very large number of households had to subscribe to suction pumps to pump in the water from the outside line. The survey results also showed that residents had to resort to several alternative arrangements to deal with the potential shortage or scarcity of water. Jerry cans, drums, metal containers, special tanks constructed at the ground level, plastic containers etc. were some of the common entities found in the household (Figure-4.38). Many households made use of long plastic or rubber pipes to obtain water from the water lines passing through a nearby location. Jerry cans transported through push carts or donkey carts, tanks made up of plastic or fiberglass for domestic storage and diesel pumps where electricity was inadequately available were other components reported by the households. Existing arrangements of water supply are outlined in Figure-4.37.

Figure-4.37
Existing Arrangement of Municipal Water Supply to Single Unit Residences in Unplanned Areas

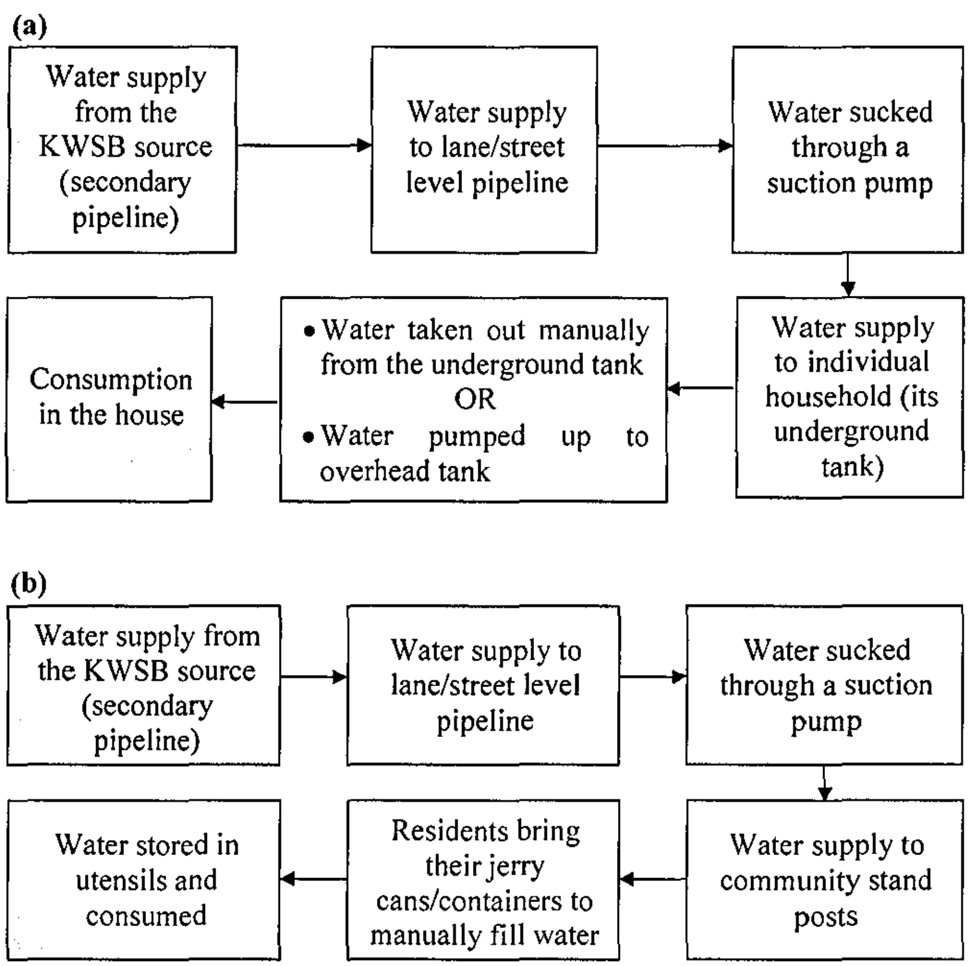
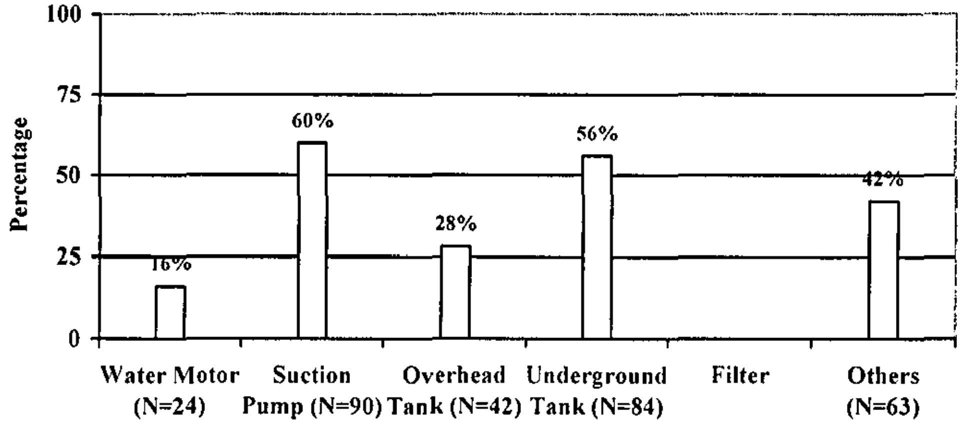


Figure-4.38

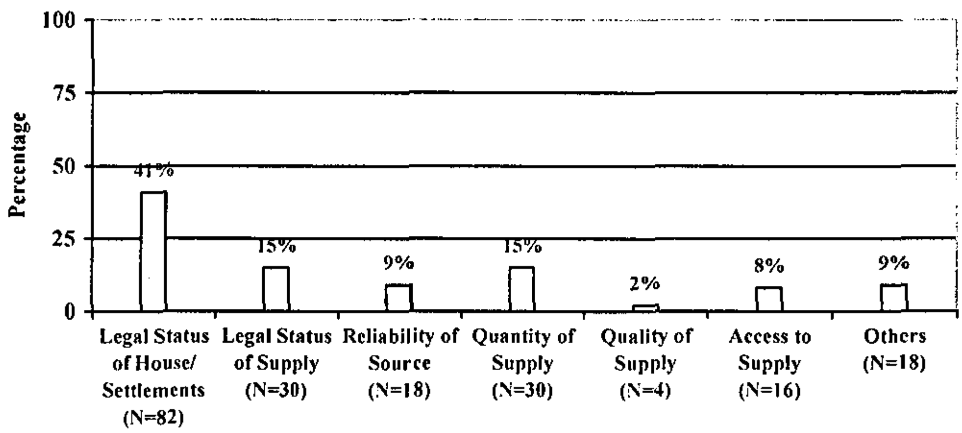
Machinery and Equipment Related to Water Supply



- Legal status of house, settlement and water supply; quantity and access were the main factors affecting supply (Figure-4.39). Nearness to a passing water main as also a visible factor that affected water supply. Such localities where road and streets were developed in a satisfactory manner had better chances of linking to a water supply network compared to the other localities.

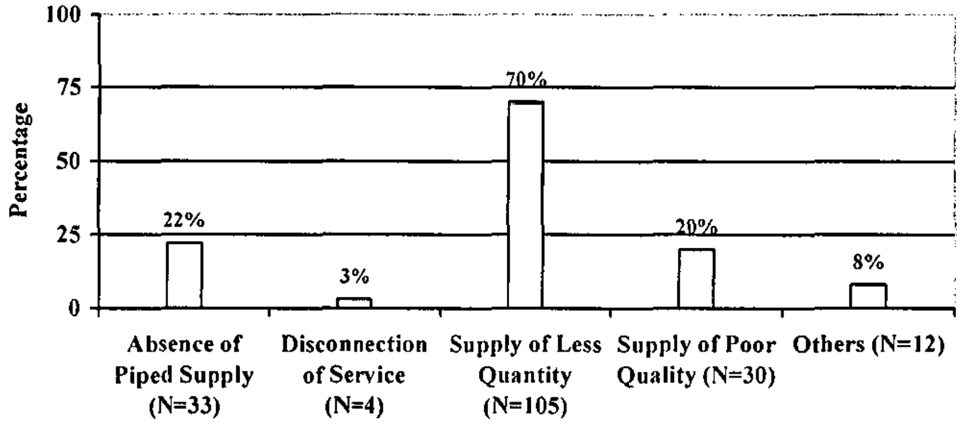
Figure-4.39

Factors Affecting Water Supply



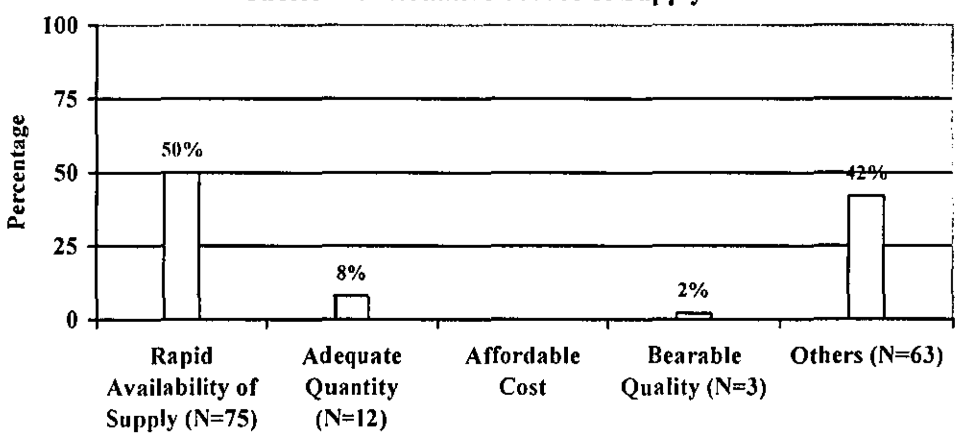
- Among the reasons to resort to alternate sources of supply, the supply of less quantity of water was most obvious. Other reasons included absence of piped supply and supply of poor quality of water (Figure-4.40). Few households used alternative arrangements due to unpredictable frequencies of supply.

Figure-4.40
Reasons to Use Alternative Arrangements



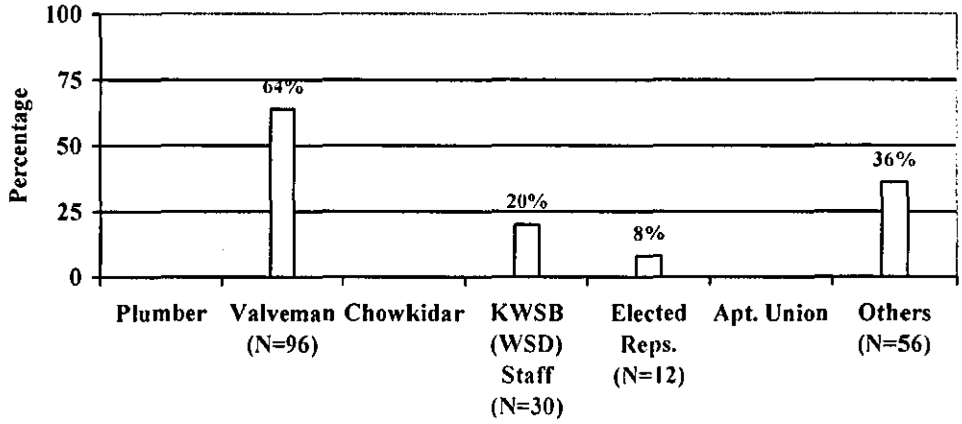
- One of the dominant reasons to subscribe to a specific type of water supply was the ready availability of it. Several diversified modes were also accounted for in this situation. Fetching water from the neighbours; obtaining water from a nearby hospital; accessing a water source relying on boreholes; donkey carts; purchasing it from a petty vendor and water tankers from a commercial source were among the few alternatives (Figure-4.41). Capacity to access and manage the supply through an alternative source was also found to be a vital factor. For example, water tankers were only accessed by those households that possessed a capacity to store enough quantities.

Figure-4.41
Choice of Alternative Source of Supply



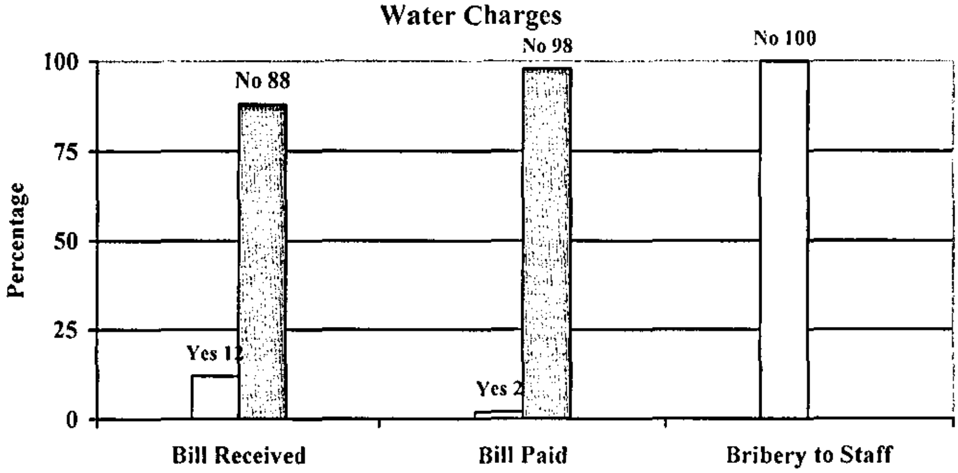
- In reference to the personnel related to water supply, valveman played the most vital role. This comprised the release of appraise quantities of water to the settlement. KWSB/WSD staff had a limited role in the distribution of water. Other actors related to supply include water vendors, donkey cart operators and tanker operators (Figure-4.42). Local touts and agents that had a clandestine link with the KWSB/WSD staff played a role in facilitating supply.

Figure-4.42
Personnel Related to Water Supply



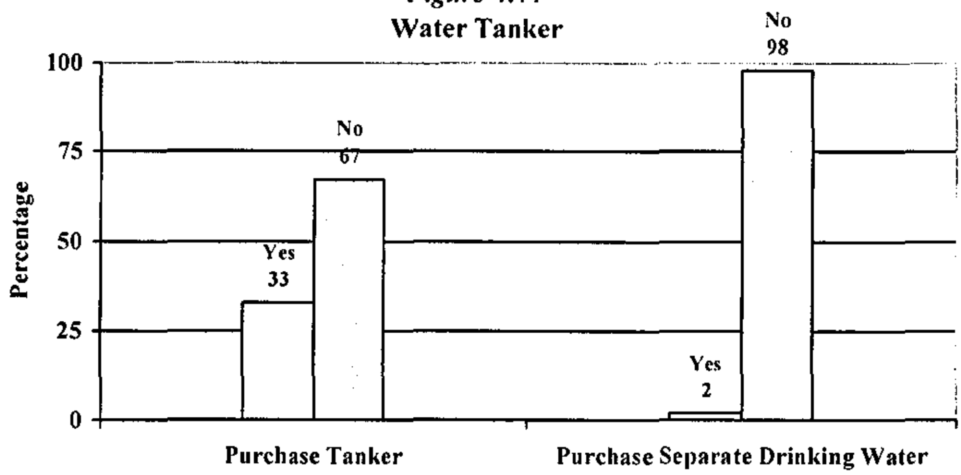
- A very small number of residents received water bills and very few paid it. At the billing stage no bribery was detected (Figure-4.43).

Figure-4.43
Water Charges



- A sizable number of households purchased commercial water tankers for routine consumption (Figure-4.44).

Figure-4.44
Water Tanker



(b) Apartments

- The survey was spread to 60 respondents. It targeted residents of apartments located in unplanned settlements. The respondents were predominantly owners with very few tenants. The areas included Lyari and Khadda. The respondents belonged to several occupations including shop keepers, office workers, technicians, salesmen and even unemployed. Figure 4.45 (a&b) describe the residents profile of apartments in unplanned settlements and a surveyed household.

Figure-4.45(a)
Residents Profile –
Unplanned Settlements – Apartments

The apartments in unplanned settlements were located in different streets of Lyari and Khadda Area. The residents were mostly owners with a proportion of 80 percent. The residents belonged to different occupations including shopkeepers, small scale businessmen, taxi drivers, salesmen, office staff and similar trades, household size varied from 03 to 19 in some unusual cases.

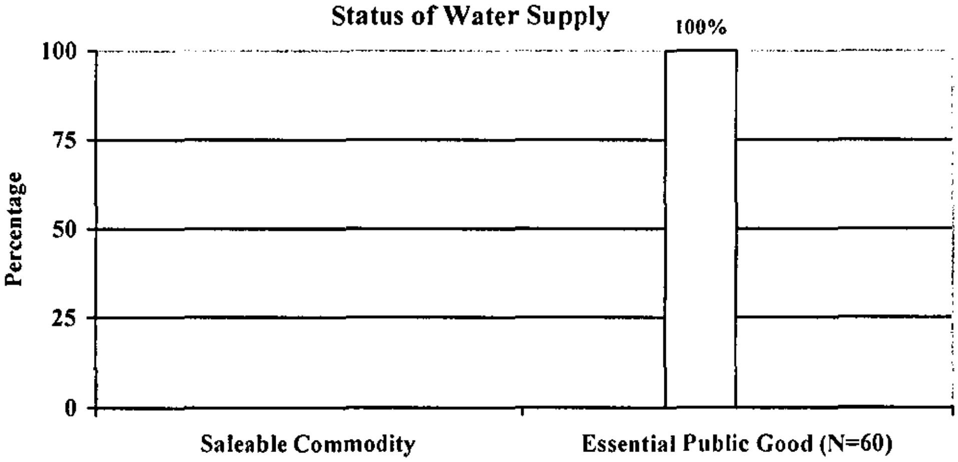
Figure-4.45(b)
Lyari, Karachi
Profile of a Surveyed Household Living in an Apartment Block

The household of Mr. 'D'resided in an apartment block located on Chakiwara Road in Lyari. The accommodation comprised three rooms, a lounge one common and one attached bathroom and a kitchen. The apartment building was 05 storeyed with the surveyed unit located on its third storey. Nine members lived in the house including three children below the age of 10 years. Water was receieved through a mix of boring and piped + suction sources. However a traditional manual water carrier supplied water for drinking and cooking every alternate day. Large jerry cans of plastic were used for storing water.

Daily chores involving supply from the manual source included drinking, cooking and dish washing. Other routine chores were carried out by using the supply from the boring/piped source. The unpredictability of supply frequency affected the household chores. The female members of the household particularly reported about the sudden disconnection of piped service leading to greater expenses on the vending supplies. Being a location situated at the farthest end of the piped supply network, Lyari received less water than comparable locations. However no accurate data of actual water availability to Lyari is available with the utility (KWSB, 2004).

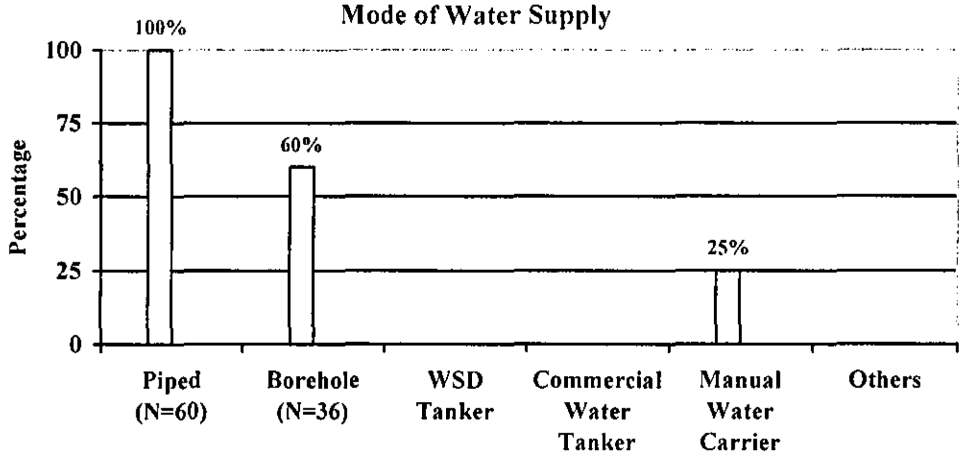
- The entire sample considered water as an essential public good (Figure-4.46).

Figure-4.46
Status of Water Supply



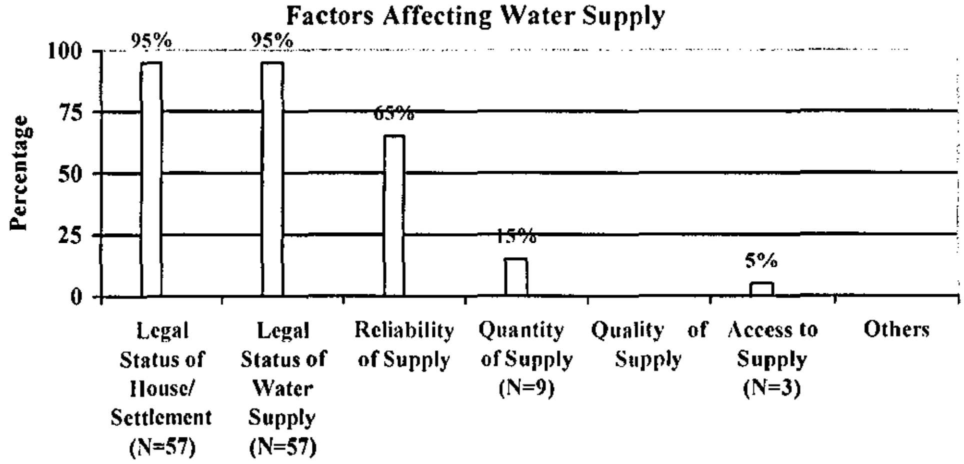
- Every respondent was linked to a piped water supply. In addition the residents considerably relied on boreholes and manual water carriers (Figure-4.47).

Figure-4.47
Mode of Water Supply



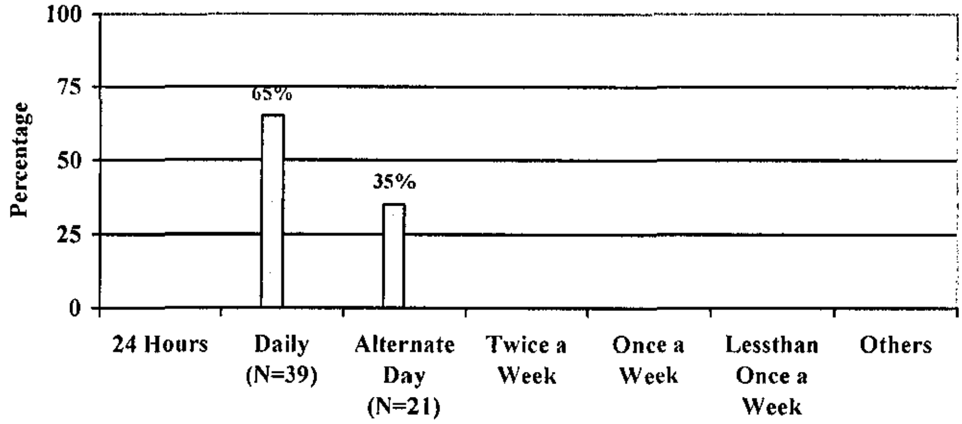
- Several factors were reported to be affecting water supply. Legal status of house/settlement as well as water supply was found to be more effective. Another factor that was found to be important was the reliability of source (Figure-4.48).

Figure-4.48
Factors Affecting Water Supply



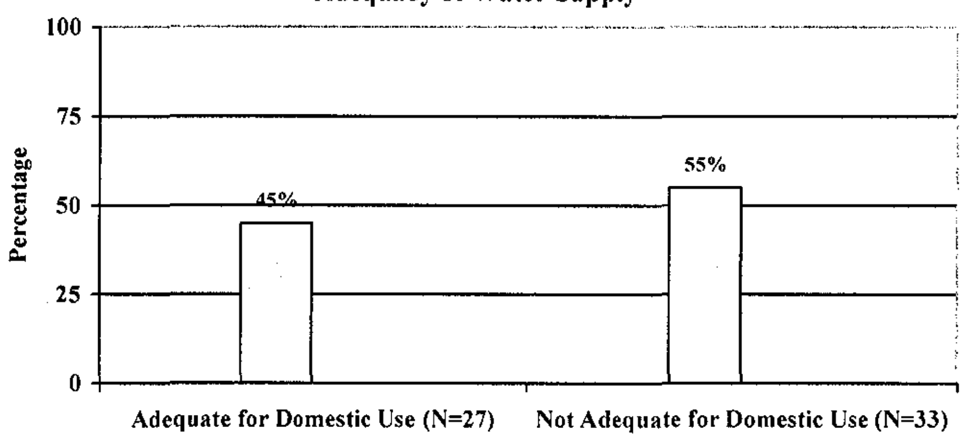
- The frequency of water supply was reported to be on a daily basis and alternate days (Figure-4.49).

Figure-4.49
Frequency of Water Supply



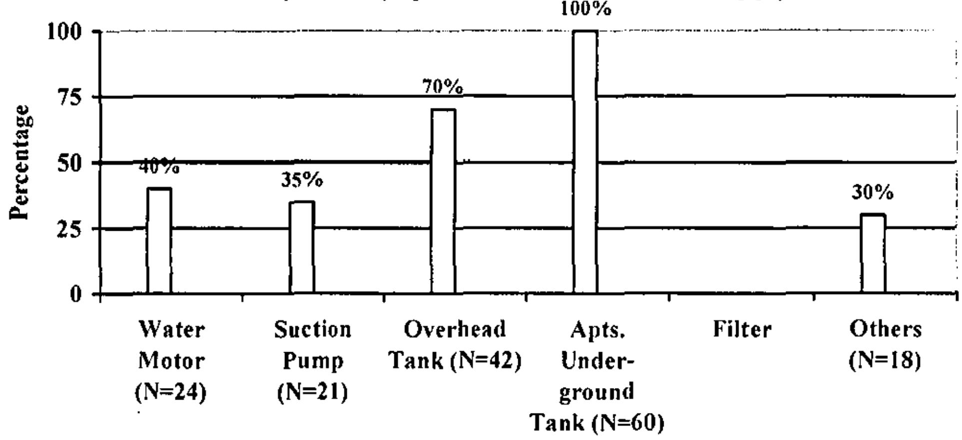
- About the same number of respondents considered water supply as adequate for domestic use or otherwise (Figure-4.50).

Figure-4.50
Adequacy of Water Supply



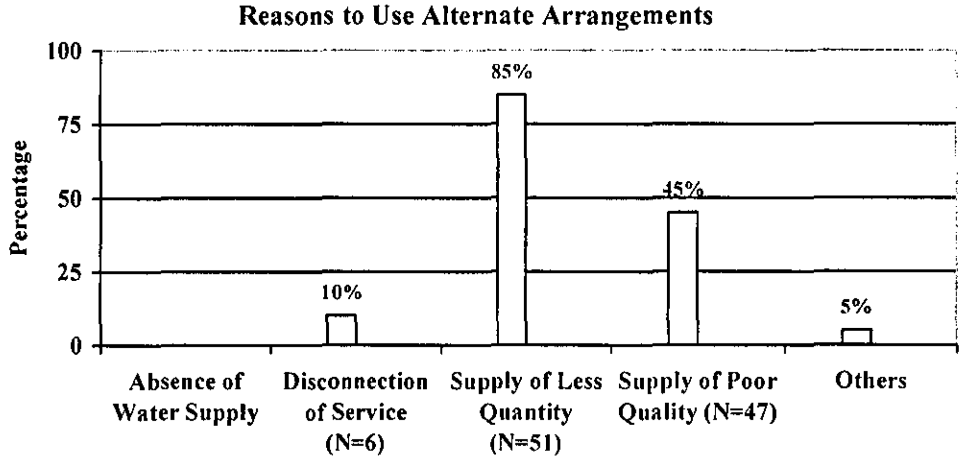
- The households had to rely on variety of machinery and equipment related to water supply. Water pumping motor was used by a reasonable number of residents. Suction pump was also used to acquire the desired quantities of water. All the households had an underground tank and majority of them had an overhead tank (Figure-4.51). Inbuilt storage tanks and movable vessels including jerry cans were some other regularly used articles found in use by the apartments.

Figure-4.51
Machinery and Equipment Related to Water Supply



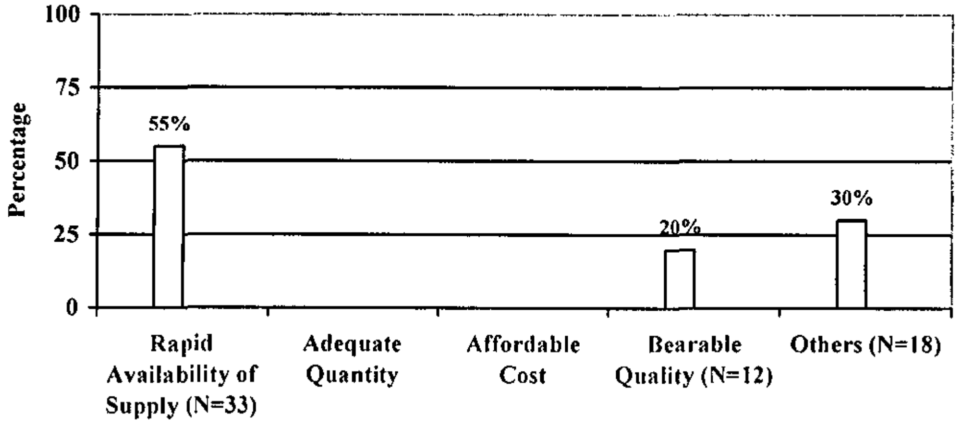
- Several reasons were cited by residents to use alternate arrangements. Disconnection of service, supply of less quantity and poor quality were found to be the common reasons in making this choice (Figure-4.52).

Figure-4.52
Reasons to Use Alternate Arrangements



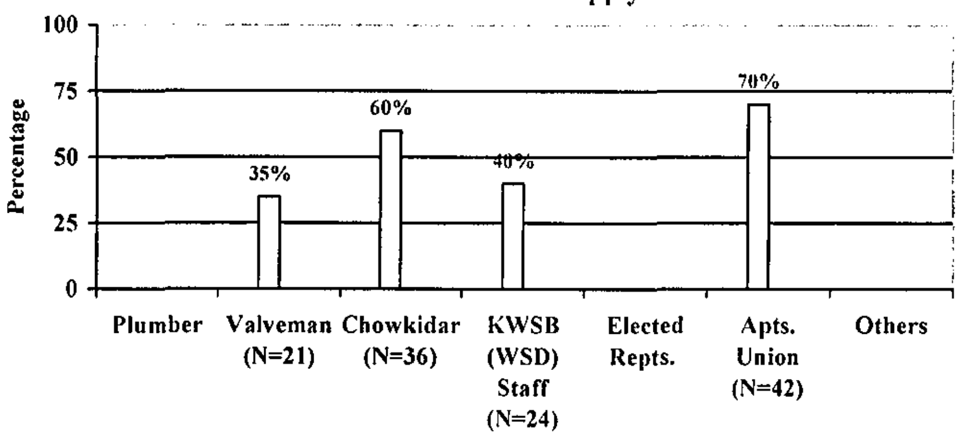
- Choice of alternate source was governed by rapid availability and a bearable quality. Some residents also resorted to boring outlets (Figure-4.53). Personal links of households with accessible service providers also affected the choice of alternative modes.

Figure-4.53
Choice of Alternative Source of Supply



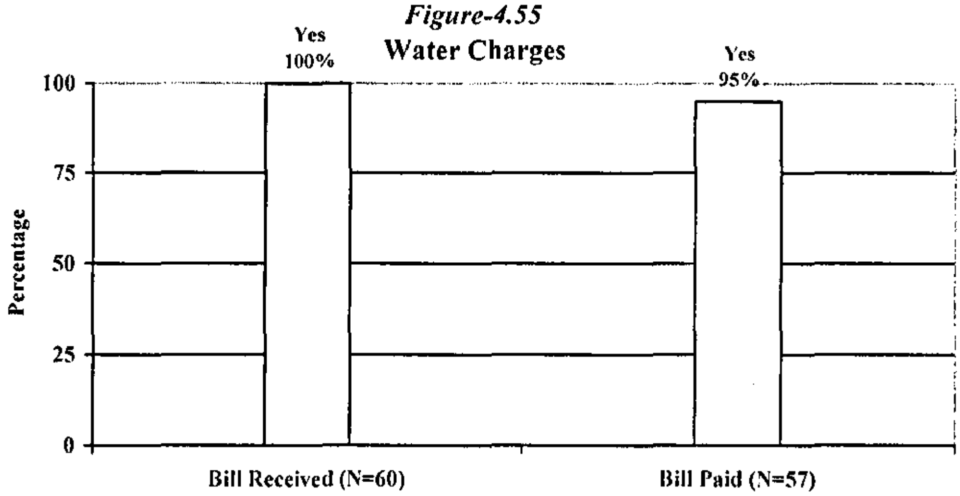
- In apartments, watchman (chowkidar) had a role to play. He managed the water supply infrastructure at the internal level. Valveman and KWSB/WSD staff also had a role to play in supplying water to these apartments (Figure-4.54).

Figure-4.54
Personnel Related to Supply



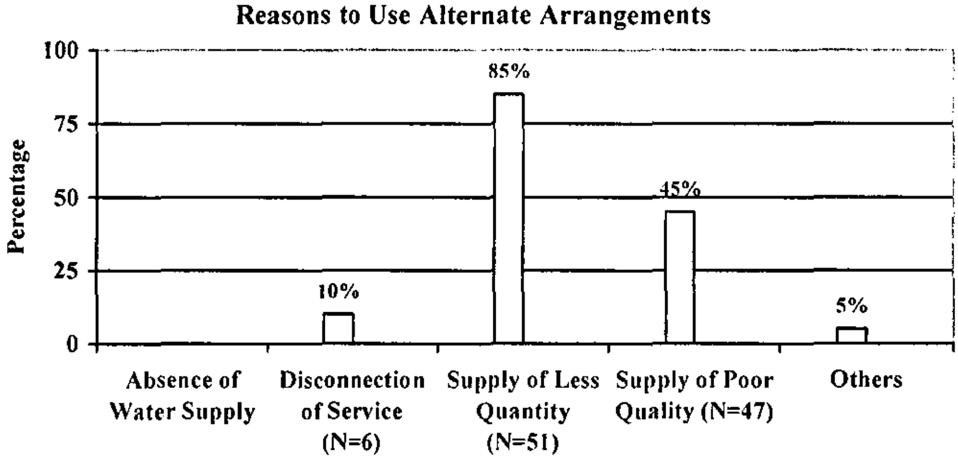
- The situation of payment of bills was reported to be satisfactory. Every household received the bill and a vast majority also paid it (Figure-4.55).

Figure-4.55
Water Charges



- In situation of water supply scarcity, the residents largely acquired water through their own means. Neighbours, manual water carriers and relatives residing in the vicinity made up the usual list (Figure-4.56).

Figure-4.56
Reasons to Use Alternate Arrangements



4.4 Issues in Water Supply Service

This section shall cover the findings of both the planned and unplanned settlements that have been dealt in the course of this study:

4.4.1 Profile

The sample derived from both the planned and unplanned settlements covered a very wide range of the urban area of Karachi. The households included examples from lower to middle income group with different socio-economic orientations, background and sizes. This approach helped in including the households from diverse background and varying characteristics. It has helped in obtaining the viewpoint of households of a diverse range.

4.4.2 Status

As outlined in section 2.2, the debates around the status of water are a fundamental issue in relevant literature. Therefore it evolved as a research question for this dissertation as mentioned in section 3.3. Basic definitions of the terms 'essential public good' and 'saleable commodity' have been defined with reference to questionnaires in Annexures (1-5) and (7-10) for this case study.

'Essential public good' has been defined as the good which is to be provided by the state as its essential responsibility. For example, maintenance of law and order in the country is a public good facilitated by the law enforcement agencies.

'Saleable' Commodity' has been defined as a good that has a tag price or tariff for its transaction. For example, electricity supply is a saleable service available to consumers who pay for it. Following is a concise description of the feedback from the findings of first case study in this reference.

A very sizable number of people considered water as an essential public good by residents of the planned settlements, apartments in planned settlements, unplanned settlements and apartments in similar locations. The perceptions were commonly shared by the residents irrespective of their type of dwelling settlement, status of water supply and related affairs. The people were of the view that since life cannot exist without water, it should be treated as a public good and supplied to every one without any exclusion.

4.4.3 Modes

Modes of water supply and their characteristics are the directly related factors that lead to the creation of alternative supply arrangements as discussed in sections 2.2, 2.3 and 2.4. It therefore made a research question for this dissertation outlined in section 3.3 and explored through the case studies.

- Planned areas have normally full piped supply coverage while unplanned areas have partial coverage.
- In the absence or lack of desirable level of performance of piped supply, consumers resorted to alternative arrangements.

This factor depended upon the type of settlement under study. In single unit housing in planned area, there was a universal coverage of piped water supply. This was due to the reason that these schemes had been developed by various civic agencies over the period of time. Provision of a water supply connection was a pre-requisite in the routine development work undertaken in these locations. Few households, where the supply was reported to be irregular, resorted to develop boreholes to acquire additional quantities of water. The same situation applied to apartments in planned localities. The only exception was the case of manual water carriers who would traditionally supply potable water to apartments in Saddar area which is the city centre. Such water supply was often used for drinking and cooking purposes in cases when the quality of piped water was not appropriate for the purpose.

Residents in unplanned settlements had to rely on multiple modes with a sizable number relying on piped water. Boreholes, tankers, manual water carriers and other forms of water vending were normally used in limited proportions. Those settlements which received water supply lines as a consequence of any regularization scheme or rehabilitation work were able to benefit from piped supply – although having a piped connection was not a guarantee to water supply alone. Piped supply, bore holes and manual water carriers were the main modes of supply in the apartments located in unplanned settlements. Over the period of time, the apartment dwellers of older locations in the city developed a relation with manual water carriers who would climb up to upper storeys to supply to their clientele. When the piped supply became common, the manual providers continued to have their business for some limited scale. The households were found to make a choice of alternative arrangements according to the respective options available to them as well as financial and physical convenience to access the said modes.

4.4.4 Arrangements for Alternative Sources of Supply

In planned settlements, the residents resorted to tanker service as a majority case. This was also found in apartments. The reason was that the water supply service was linked up to the KWSB/WSD which also managed the hydrants and commercial tankers that filled water from it. Therefore the residents found it appropriate to approach the hydrant and acquire tankers according to their requirements. It was also found that those households which had a valid water connection and paid water bill received the benefit of obtaining the tanker on a standard rate. The water supply from a KWSB/WSD hydrant through a tanker was of acceptable quality. Therefore the residents of planned areas found it convenient to resort to this choice. In few limited circumstances, the residents also took small quantities of water from the neighbours.

- Alternative arrangements were dependent on various factors including flexibility, acceptance by consumers and options available to providers.

The situation in unplanned settlements was different. The arrangement for alternative source largely depended on the access of the mode by the consumers. A large number of options were therefore found to function. These options referred to keeping the flexibility of supply so as to manage scarcity without getting stuck with any singular option. The same situation applied to apartments in unplanned locations. The manual water carrier plays an important role in supply of water both under normal as well as scarcity situations. In addition, neighbours also tend to help each other in cases of hardship.

4.4.5 Factors Affecting Water Supply

- Legal status of house/ settlements, legal status of water supply and the reliability of supply were found to affect the service.

Three factors were reported to affect the supply strongly; legal status of house/settlements, legal status of water supply and reliability of supply. The residents considered that if a settlement was officially developed and recognized, its chances of accessing an appropriate water supply arrangement were optimum. The water connection as well as back up service are usually tied up together. Legality of the water service itself is an issue of consideration. In Karachi, the only legal entity to grant water supply connection is the KWSB/WSD. Therefore people regarded it as a vital factor to have access to its network. The reliability of the supply arrangement was another important aspect in this reference. If the settlement and water supply access were legal and the actual mechanism of supply was not reliable, consumers suffered from a poor service level. This was found in Gulistan-e-Jauhar locality of Karachi.

In the unplanned settlements, the emphasis on legal status of settlement and the water supply remained vital. In addition, the residents also cited quality of water as an important factor especially in places where it has become a problem (Figures 4.52 and 4.53). During discussion it was found that in several locations the mixing of potable and sewerage water causes problems. This was also due to the old lines and the same path for their transportation. The apartment dwellers in unplanned settlements, however, considered legal status of settlements and water supply system, reliability of source and quantity of supply as the key factors that govern water supply in these localities.

4.4.6 Frequency

Planned areas received water according to the system which was laid down for their localities. Thus in most instances, supply in 24 hours, daily supply or alternative day supply was found (Figure 4.5). The same situation was found in the case of apartments in planned areas (Figure 4.15).

- Daily or alternate day supply was commonly found in planned areas.

Situation was different in unplanned areas. The frequency of supply was found to be disorganized. 16 percent households reported a daily supply while 22 percent received water twice a week and 30 percent only once a week. 32 percent of the households had several explanations towards this variable. Absence of a water supply line; total lack of supply since several years and weak flow pressure which could not reach slightly higher altitude locations were some of the common problems (Figure 4.28). In apartments, the situation was different. There were 65 percent households that received a daily water supply while 35 percent received it on every alternate day. People were found to be resorting to different modes to acquire water (Figure 4.39).

4.4.7 Adequacy

Perception of adequacy greatly varied across the sample and type of settlement. 'Adequacy' was defined as the availability of such a quantity of water through the arrangements normally applied by the household which was considered sufficient for usage per unit time (as applied in the questionnaires in Annexure 1-5 and 7-10). This obviously was a specific perception and varied from categories of settlement and also the various households covered in each category. Despite the various reservations, 88.75 percent households considered the water supply as adequate for their domestic consumption. Similarly 68 percent of the apartment dwellers in planned areas considered water as sufficient for daily consumption. In contrast, 98 percent of residents in unplanned settlements considered the water supply as inadequate for their daily use. Similarly 55 percent apartment dwellers in the unplanned settlements found the water supply as not adequate for domestic usage. Apparently the difference between planned and unplanned settlements was due to the existence of relatively reliable system/management procedure or otherwise which prevailed in the respective area.

- Upon application of catalytical support of suction pumps, water supply was rated as adequate in planned area consumers. For unplanned areas this percentage was comparatively low.

4.4.8 Machinery and Equipment

The common ingredients in this case were found in almost every households. They included water pumping motors, overhead and underground

- Suction pumps boosted supply to planned and unplanned areas.

tanks and filters. A significant presence noticed in planned settlements was the suction pumps (67 percent) in the individual households in planned areas (Figure 4.7). A suction pump is a electric power pump that is installed on the main water connection line to the household to suck the water into the house. The installation of this device is absolutely illegal according to KWSB/WSD rules as it tampers with the normal supply pressures/potentials. This probably made the reason that households reported a satisfactory status of water supply in-terms of domestic consumption. About 36 percent of apartments also resorted to the use of suction pumps for fulfilling their daily requirements (Figure 4.17). It can be assumed that since the suction pumps were universally installed, some households may not have reported the existence of these devices due to the fear of penalization by the utility.

The suction pumps were also installed by residents of unplanned settlements. As per survey, 60 percent of the households in unplanned locations resort to the case of suction pump to acquire the routine quantities of water (Figure 4.29). Similarly, apartment dwellers in unplanned settlements also used suction pumps to acquire water (Figure 4.41) (photographs).

4.4.9 Reasons to Use Alternate Arrangements

- Supply of less quantity, absence of supply or its disconnection were reasons to adopt alternative arrangement.

Supply of less than desired quantity of water was the reason for use of alternate source. This was cited by 81.25 percent of residents in planned settlements (Figure 4.8). Other reasons included disconnection of supply services from time to time and supply of poor quality of water. This factor was observed in older locations where water supply and sewerage lines passed through the same path. The apartments in planned locations also gave emphasis on the same factors. The difference was that supply of less quantity of water was cited as the most pressing factor (Figure 4.18). 'Acceptance (of quality)', as derived from relevant questionnaires in Annexure (1-5 and 7-10) was refered as the bearable level of water supply which could be consumed by the consumers. This factor varies from location to location because communities possessed varying capacity to accept a water quality. For example, it was found that saline water was acceptable to residents of Gulistan-e-Jauhar because better quality options were not accessible to them. The same was not acceptable to residents of PECHS who resorted to expensive tanker supply options due to better income status.

In unplanned settlements also, the supply of less quantities was cited as a major problem. About 70 percent cited it as a key factor. Absence of piped supply and supply of poor quality of water were the other important factors. In apartments in unplanned areas, the same factors were cited (Figure 4.56). The difference was in the value of frequency and the fact that absence of piped supply was not outlined as a problem.

4.4.10 Choice of Alternate Sources

Choice of alternate source of supply was governed by the factor of rapid availability in planned settlements. A source that could be readily accessible for water supply gave rise to an immediate choice. The other important factor was adequate quantity of supply (Figure 4.9). Apartment dwellers in planned settlements had the same outlook (Figure 4.19).

In unplanned areas, the situation was slightly different. While 50 percent residents agreed to a source that could be readily accessible, they also looked at the locational convenience which was linked up to the area under consideration. Thus a multiple choice range from neighbours to water vendors was considered across the convenience factor and availability in that locality (Figure 4.32). The case of apartments was also in the same line as found in unplanned settlements. However the apartment dwellers also cited quality as a factor since the unplanned locations in older city areas had sub standard options normally available to them (Figure 4.43).

4.4.11 Personnel

- Valvemen and chowkidar (watchman) were important personnel.

In planned settlements, valveman was cited as the most important staff member along with other officials of KWSB/WSD. This staff had the key role of releasing the supply by regulating the valve on the main distribution lines (Figure 4.10). Valvemen possessed the vital information about the availability of water supply in piped net works at varying timings. They had the control to open the valves and divert supplies to sub-neighbourhoods according to this information. While the management of WSD-KWSB normally provided supply schedules for different neighbourhoods, valvemen would informally alter them according to their choices. These choices were usually influenced by the petty bribes paid to them by concerned area residents but never formally reported or recognized (Annexure-13). In apartments, the chowkidar (watchman) of the apartment complex was also cited important with the valveman due to the fact that he was responsible for supply in the internal premises of the apartments (Figure 4.20).

In unplanned settlements, valvemen and KWSB/WSD staff were considered as important staff. Other actors such as vendors were also given importance in the setup since they also helped in the supply of water to the households (Figure 4.33). In apartments in unplanned settlements, along with these actors, the residents also considered the apartment unions as an important player. This was due to the fact that the union facilitated many services for the dwellers and dealt with the day to day affairs of the supply dynamics (Figure 4.44).

4.4.12 Water Charges

- Consumers normally paid bills when they received the service.

In planned areas, a sizable majority reported to receive and pay the bills. This applied to both the single unit residence and apartments (Tables 4.11 and 4.21).

Situation was different in unplanned areas. Due to inadequate coverage by the utility a sizable number of people neither received the bills nor paid it (Figure 4.34). However in apartments in unplanned areas, people received and paid the bill (Figure 4.45).

4.4.13 Options

In planned locations, people resorted to tanker supply as the key alternative option. In apartments the residents partially resorted to tanker supply. Other options basically remained individual management of the crises by the people themselves. In unplanned areas about one third sample adopted tanker supply (Figure 4.35). The others resorted to smaller scale vending options such as donkey cart based suppliers. In apartments in unplanned settlements the people acquired water through their own means. Few cases reported the acquisition of tankers (Figure 4.46).

The consumers have to pay upfront to the water tanker operators. No credit relationship was found or reported during the fact finding phase. In terms of level of service, tankers offer convenient choice for those consumers who possess the capacity to benefit from them. Tankers are available in the capacities of 1200, 2000, 3000 and 6000 gallons (WSP, 1998b). Usually single unit residences and apartment dwellers in planned areas were found to possess the capacity to benefit from this arrangement. Unplanned settlements only benefit from tankers when they have underground tanks and adequate storage capacity (Figure 4.29).

4.5 Alternatives in a Municipal Supply Domain

Premise for the usage of alternative arrangements in supply is stated in the description of research questions (section 3.4 and figure 3.2) and guiding hypothesis (section 3.3). From the review of the municipal supply, it is found that various types of alternatives exist that continue to augment the municipal supply (Figure-4.45 and 4.57). It is also found that even under the routine municipal supply, a sizable clientele can not access the municipal supply without the alternative of suction pumps (see photographs). These devices create an extra-ordinary privilege for all those who are able to install it in the network. It was also found that there was no distinction between the planned and unplanned settlements towards the use of alternative modes. The only variations that were worth noting were the frequencies in the usage of alternate modes as well as the number of modes applied. In the case of unplanned settlements, the number of modes applied were found to be more diversified compared to planned settlements.

Figure-4.57
Water Supply Arrangements in Planned and Unplanned Areas in Karachi

	Production	Distribution	Consumption
Piped supply by utility (KWSB/CDGK)	• Indus source • Hub river source • Dumlottee wells • Haleji lake	• Piped supply through electro-mechanical pumping at different levels	• Consumed by beneficiaries legally connected to system • Consumed through tanker supply through KWSB/WSD or authorized commercial tankers • Consumed by beneficiaries in some localities through special arrangements (standposts/awami tanks)
Supply illegally derived from distribution network	• From the existing piped network obtained from the sources mentioned above	• Standposts • Donkey carts • Tankers • Manual carriers • Suction pumps	• Consumed by authorized beneficiaries who use suction pumps to access the supply • Consumed by beneficiaries who illegally obtain water by damaging pipes
Self generation	• Unauthorized boreholes • Untreated water from a source	• By house owner/occupant directly from the source • Through various vending means	• Self consumption supply to consumers on mutually agreed arrangements
Vending	• KWSB/WSD hydrants • Illegal hydrants • Damaged water mains	• KWSB/WSD tankers • Commercial tankers • Donkey carts • Manual water carriers • Illegal piped supply means (leakage, seepage or theft) • Association with valve operator	• Localities not yet connected to piped supply • Localities where piped supply is disconnected • Localities where water supply is irregular and deficient

Continued on page 124...

	Production	Distribution	Consumption
Retail beneficiaries of bulk consumers	• Allocated quantities of supply according to contractual details of agreement with utility	• Piped supply through electro-mechanical pumping at various stages • Tankers (owned and operated by bulk consumers) • Commercially operated tankers	• Consumed by retail beneficiaries of bulk water consumers
Awami Tanks	• Allocated quantities of supply through water tankers from KWSB/WSD Hydrants under Rangers monitoring	• Through jerry cans and canisters carried manually or through small hand carts or push carts • Through plastic/rubber pipes from tanks to near by households	• Consumed by tail end settlements of the city (examples include Mansoor Nagar, Gulshan-e-Zia, Gulshan-e-Bihar

Figure-4.58
Water Vending in Karachi
(1 USD = Rs. 60 approx.)

Transporta-tion/Mode of Supply	Filling/Source	Customers	Range of Selling Price (average price tag for ~ 500 liters)	Range of Costs, Income and Profit	Remarks
Commercial Water Tank	• KWSB/WSD hydrants • Leakage points • Wells • River beds • Informal hydrants/ tanks (Rs. 80-120 per tanker)	• Vendors • Residents • Squatter areas/main storage tanks • Private storage tanks/water shops • Hotels/ restaurants	• Rs. 200-250 (for 1200 gallon capacity tanker) • Rs. 300-450 (for 2,400 gallon capacity tanker) **~Rs. 20**	**Capital cost:** Bedford tanker (second hand): Rs. 300,000-500,000 Hino-Isuzu (new and second hand): Rs. 600,000-1,500,000 **Daily operational cost:** Rs. 700-1,000 (including maintenance, wages, informal payments) **Daily income:** Rs. 1,500-2,000 **Daily profit:** Rs. 800-1,000	• Operates on more than 100 percent operational profit • Owned and operated by influential people
KWSB/ WSD Water Tanker	• KWSB/WSD hydrants (free of cost)	• Areas where water is deficient (community tanks wherever available)	• Rs. 50-100 **~ Rs. 07**	Cost borne by KWSB/WSD **Informal income:** Rs. 50-100 per trip **Profit:** Rs. 50-100 per trip	• Very few tankers reach low income areas and after much delay • Number of tanker trips are inadequate compared to the areas having scarcity of water

Continued on page 125...

Transporta-tion/Mode of Supply	Filling/Source	Customers	Range of Selling Price (average price tag for ~ 500 liters)	Range of Costs, Income and Profit	Remarks
Donkey Cart	• Spill points • Leakage points • River beds • Informal hydrants/tanks/valve positions (Rs. 5-20 per trip)	• Locality kiosks/vendors • Residents • Hotels and restaurants	• Rs. 50-70 (for a 60-80 gallon tank) • Rs. 3-5 per small container • Rs. 10 per 16 gallon container **~ Rs. 80**	**Capital cost:** Donkey: Rs. 8,000-10,000 Cart Rs. 1,500-2,000 **Daily operational cost:** Rs. 50-60 (including tyre puncture + fodder) **Daily income:** Rs. 350-500 **Profit:** Rs. 300-440	• Usually possess regular/permanent clients • Self owned • Directly accessible to users due to small size/volume • Poor quality of water (often contaminated water is also supplied)
Push Cart	• Spill points • Leakage points • Community stand posts • Nearby planned areas • Informal hydrants/ tanks (Rs. 5-10 per trip)	• Water shops/vendors • Residents • Hotels and restaurants	• Rs. 3-5 per container (10 containers per cart trip) **~ Rs. 30**	**Capital cost:** Rs. 1,500-3,000 (cart + containers) **Operational cost:** Rs. 20-40 **Daily income:** Rs. 200-300 (for 6 trips) **Daily profit:** Rs. 180-260	• Self owned • Regular clients • Poor quality of water (when filled from stagnant sources) • Limited scale of supply
Bhishtee (manual water carrier)	• Community stand posts • Mosques • Leakage points	• Residents • Restaurants and hotels	• Rs. 5-10 (for two containers) **~ Rs. 50**	**Capital costs:** Rs. 50-100 **Daily income:** Rs. 50-70 **Daily profit:** Rs. 50-70	• Self owned • Regular clients • Relatively better quality of water
Under-ground tank owners in locality	• From commercial water tankers (Rs. 250-300 for 1200 gallons)	• Residents • Restaurants of the locality	• Rs. 2-3 per minute's flow (1 gallon per minute) **~ Rs. 275**	**Capital costs:** Construction of tank + motor + pipes) Rs. 200,000-300,000 **Operational cost:** Rs. 1,500-2,500 **Daily income:** Rs. 2,000-3,200 **Daily profit:** Rs. 500-700	

Source: WSP (1998b)

In situations where even the frequency of water supply was on daily basis, the alternatives were accessed to augment the shortfall that remained between the various modes of supply. Perception of adequately was found to be incongruent with some other variables such as the reasons to resort to an alternate choice, installation of suction pumps and the choice of alternative options (for details, please see section 4.4).

Manhole on a sewerage line

Water valves being destroyed due to the movement of trunks

Water obtained through pumps and transported through carts

Water valve where the cover is not present

Manhole from where water line is also passing

Illegal water supply from an existing conduit – water venders are benefiting from its operations

Water line passing through the nullah

Illegal water vending from the source of Metroville


Suction pump fixed in an apartment – an enclosure constructed to protect its visibility from outsiders


View of Suction pump and other accessories

High Income Area – an apartment block


Suction pump in a new apartment


A view of a tank and suction pump


A hand pump in upper Gizri Area

Suction pump in a high income apartment block

Borehole well in a Gulzar-e-Hijri location

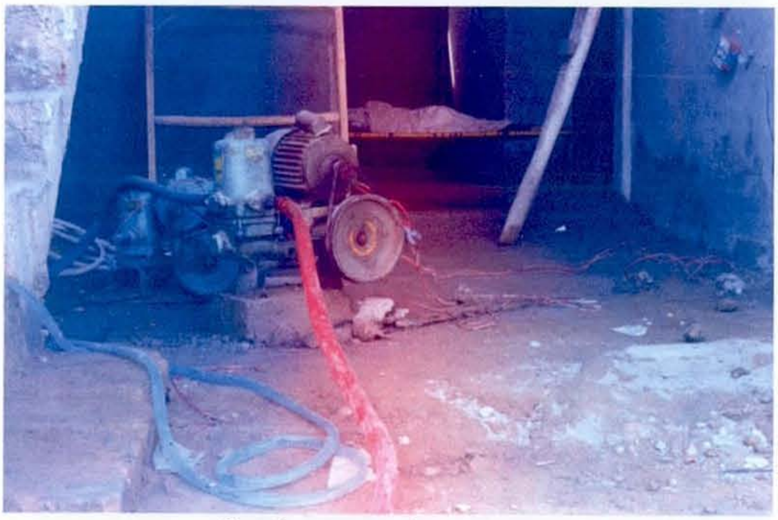
Water being transported from an underground tank to overhead tank

Suction pump in Orangi

A Suction pump in a squatter settlement

A suction pump in a squatter settlement

View of a squatter settlement where people have installed new water motors



Suction pump in a squatter

5. CASE STUDY-II: RETAIL BENEFICIARIES OF BULK WATER CONSUMERS

5.1 Introduction

The application of research methods pertinent to the case study research outlined in sections 3.6-3.9 was done in chapter-4. It explained the water supply situation in four distinct contexts. They included planned/unplanned settlements and apartments in planned/unplanned areas. Analysis was done leading to a critique on alternative arrangements. The current case study of retail beneficiaries of bulk supply is based on the same premise, structure and organization.

This chapter begins introducing the case study of retail beneficiaries of bulk water consumers. After providing the basic definitions, the characteristics of the locations are outlined. The structure of the case study is introduced followed by findings. The issues pertinent to the case study are highlighted that comprise administrative arrangements, frequency of supply, adequacy, apparatus and machinery, occupancy characteristics, role of bulk consumer, operation and maintenance, water charges, role of elected local bodies, comparative characteristics, impact of location on supply and combination of sources and reliance on alternatives.

Bulk water consumers are a generally prescribed typology with no strict classification available with the City District Government of Karachi. According to KWSB/WSD (2001), the consumers possessing a water connection of 2" dia or more are placed in the category of bulk water consumers. There is a separate unit within KWSB/WSD that manages and oversees the bulk water supply system. Several type of bulk consumers exist in the city. Commercial consumers connected to a water line constitute the first category. Similarly commercial consumers possessing a water connection of appropriate diameter form the second category. Third category comprises unconnected industrial consumers while fourth category comprises connected industrial consumers. Unconnected consumers are defined as those consumers who have not formally obtained a water connection of desired diameter from the water utility, however, receive the water supply of required quantity/level of service through terms and conditions mutually agreed between the KWSB/WSD and the consumer. Fifth category comprises domestic consumers with installed water meters. Sixth category comprises industrial/commercial consumers with installed water meters. A seventh category includes government/public sector installations of various kinds. Public installations include all kinds of government offices, accommodations and properties other than industrial or infrastructural enterprises which are separately accounted for. Military installations including cantonments and bases constitute the eighth category. However this category does not include the residential estates developed by the armed forces for their serving and retired personnel. A ninth category includes such residential societies, areas and estates that acquire water in bulk from KWSB/WSD and then distribute it to their allottees through their own network. This category has formed the basis of the present study. However, information is not completely available on all of these categories. This classification is deduced from the records and files of KWSB/WSD and such data which has not been published or publicized.

Bulk water supply constitutes about one third of the total revenue received by WSD (see Table-5.1). Therefore it constitutes an important segment of the service in terms of revenue generation. Contractual arrangements through which a bulk water supply is provided usually changes according to the demand or the consumers profile (Ahmed and Sohail, 2003b). For instance, Pakistan Steel Mills has constructed a large part of trunk supply infrastructure from their own resources to ensure an uninterrupted water supply. Similarly other organizations make specific contractual arrangements for supply of bulk water.

TABLE-5.1
BULK WATER SUPPLY – ESTIMATES OF RECEIPTS (1999-2000)

Year	Receipt (in Rupees in million)	Total Receipts (in Rupees in million)	%age of Total Receipts
1998-1999	830.00	2305.00	36%
1999-2000	905.50	2504.233	36.16%

Source: Ahmed and Sohail, (2003b)

The terms of reference for the large-scale consumers are usually formulated according to the specific requirements of the consumer. These terms of reference include the nature and extent of services to be provided by the KWSB/WSD as well as the billing, recovery and tariff conditions. The terms of reference of the military installations is kept strictly confidential. Consumer's specific requirements prevail even in the contractual conditions. It is reported that in some cases, proper terms of references did not exist. The bulk consumers have been existing historically eversince the evolution of an organized water supply service in Karachi. In all the various institutional forms and formats, the bulk consumers have been availing the service with the usual revisions of tariffs and billing modes as prescribed by the local government (KWSB, 2002).

A standard procedure of bulk supply connections is adopted for the relatively medium and small-scale consumers. No hard and fast definition exists for large, medium or small-scale consumers. However, according to KWSB (2002), small scale bulk consumers are those whose requirement is less than 100,000 gallons per day; medium scale are those who consume less than 500,000 gallons and large scale are consumers who use more than 500,000 gallons. The consumers notify their respective water requirement which is approved by the KWSB/WSD after necessary review. They continue to obtain the water according to the prescribed rates and tariffs. Whereas the backup supply, maintenance and upkeep is in the normal clauses of the contracts, it is seldom fulfilled by KWSB/WSD in situations of breakdowns or scarcity of water. Very large-scale consumers have to construct part of the supply infrastructure themselves. For medium and small-scale consumers, KWSB/WSD provides the connections up to the property line. Internal piping and management is done by the consumers themselves.

With the exception of the very large-scale consumers, a standard rate of tariff prevails for bulk consumers. The tariff is specified into four categories (see Table-5.2). With very few exceptions, the bulk consumers found the tariff as satisfactory. Industrial and commercial consumers are willing to pay higher tariffs for extended water quantities. However, as water is in limited supply, their demands cannot be met. Almost all the consumers have arrangements to carry out routine operation and maintenance of the infrastructure provided in their respective premises. The WSD/CDGK staff provides backup support although this is only valid in crises management. When any breakdown occurs only then the KWSB/WSD staff undertakes repairs.

TABLE-5.2

REVIEW TARIFF OF BULK WATER SUPPLY
(Amount in Pak Rs.) 1 USD=Rs. 58.00 (approx)

No.	Category	From 1st Apr. 1981	From 1st Dec. 1985	From 1st Jul. 1989	From 4th Aug. 1992	From 1st Nov. 1994	From 1st Jul. 1995	From 1st Nov. 1996	From 1st Apr. 1998
1.	Commercial/ industrial not connected with water line	6.5% NARV	9.75	15.00	23.00	30.00	39.00	49.00	49.00
2.	Commercial/ industrial connected with water line (un metered)	9% NARV	13.5	21.00	32.00	42.00	55.00	69.00	69.00
3.	Metered domestic (per 1000 gallons)	1.96	5.50	8.50	15.00	20.00	26.00	34.00	44.00
4.	Metered industrial/ commercial (per 100 gallons)	1.96	9.00	14.00	25.00	33.00	43.00	56.00	73.00

Net Annual Rental Value (NARV) – it is a measure to determine the basic market value of the concerned property.

Water bills sent to the consumers also include the relevant government taxes as applicable.

Source: KWSB, 2001.

A focused study of bulk water consumers revealed several issues. Despite the fact that there is a growing demand of bulk consumption of water due to increase in clientele, WSD-KWSB has been unable to induct all the new applicants in this category. A clear evidence of this fact are the various apartment projects in Gulistan-e-Jauhar which could not get bulk connections from the utility (Annexure-13). In a research study undertaken by Ahmed and Sohail (2003b) on bulk consumers, many related aspects were highlighted. The bulk water supply sector possesses tremendous demand potential and has sound commercial feasibility. According to the estimates based on the interviews with bulk consumers and KWSB staff, there is a minimum unfulfilled demand of 100 mgd in the bulk sector which is rising at a rate of about 10 percent. Planned projects and enterprises in the commercial and industrial sector are a citation in this regard.

The WSD-KWSB has several managerial deficiencies in its bulk water operations. They adversely affect the trust of the consumers. Information regarding the closure of water services is not properly communicated to the consumers. Similarly the operation and maintenance plan of WSD-KWSB, which demands service closures, is not shared with the consumers and thus affects their operations.

Most of the government agencies and authorities do not pay their dues promptly and hide behind their bureaucracy. The WSD-KWSB had ultimately to suffer from such unethical practices. The DHA is one example of a consumer that remained a defaulter of WSD-KWSB for a considerable period of time.

Bulk connections are prone to water thefts. Often the bulk lines are broken and water is stolen. The line to Quaid-e-Azam International Airport is an example. In addition leaks are a common problem which further reduces the quantity of water actually supplied.

The absence of accurate metering is a concern for consumers. They remain skeptical of the amount supplied and are hesitant to pay the full amount. The

KWSB has yet to convert all the bulk water supply connections to metered outlets.

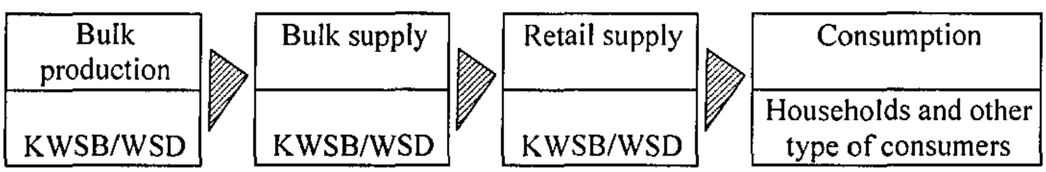
The bowser (tanker) service, which is run as the emergency or relief option in cases of breakdown or shortage, is grossly inadequate. Over time the operational fleet of KWSB bowsers has reduced considerably; at present it is less than 20. The bulk consumers have to manage and maintain a fleet of bowsers of their own. Alternatively the bowsers are obtained from the water vendors/contractors operating in the market. This is an added disadvantage to the consumers.

WSD-KWSB inherited a large number of bulk consumers from KDA and KMC. There are many lacunae that exist in the contractual agreements that need to be revised, but due to managerial inefficiency it has not been done. In the majority of cases the WSD-KWSB suffers because of these contractual shortcomings.

5.2 Retail Beneficiaries of Bulk Water Supply

Under the normal system of water supply in which the WSD extends supply directly to retail consumers, the whole management and operation is dealt by the department up till the boundary of the household (Figure-5.1). This clearly establishes a one to one relationship of service provider and end user in which all matters pertinent to the supply are dealt by the department itself.

Figure-5.1
WSD-CDGK Retail Supply Procedure



In the case of bulk water consumer, it entirely depends upon the nature of operations the bulk consumer is involved with including the scale of operations and corresponding consumption, number of resident households to which water is provided, management of the overall supply system and the inbuilt subsidy, if any.

There are several bulk consumers of KWSB/WSD who obtain water in bulk and provide it to their respective residents according to terms and conditions laid down for the purpose. These bulk consumers include housing authorities, port authorities, industrial estates, cooperative housing societies, apartment associations, large-scale enterprises such as Pakistan Steel Mills or Railways and many more. Retail beneficiaries of these bulk consumers include the households or residents located within the specified jurisdiction or area limits of these agencies. These retail beneficiaries are supplied water according to the respective management arrangements. The procedure of service delivery is slightly different from the KWSB/WSD (Figure-5.2).

Figure-5.2
Bulk – Retail Supply

Bulk production	Bulk supply	Bulk acquisition	Retail supply	Consumers
KWSB/WSD	KWSB/WSD	Bulk consumer	Bulk consumer	Households and other type of consumers

These households belong to various categories of income, occupation and sizes. The consumption pattern of the households also varies from location to location. From the preliminary observations, a varying level of service was found in the residents serviced by the bulk consumers. Accordingly a diverse opinion was observed that was documented and analysed for each of the bulk consumers covered.

5.3 Structure and Findings

The objective of this study was to document and analyse the performance of various bulk consumers in providing water supply service to their retail beneficiaries. The study also addressed the level of satisfaction and related variables such as frequency of water supply, mechanisms of supply, operation and maintenance back up as well as the role of elected municipal and appointed administration at the union council and town level.

The study covered a sample of three bulk consumers in the city of Karachi. A total of 32 retail beneficiaries were included in the study through a structured questionnaire that is placed in Annexure-12. The questionnaire was prepared on the basis of a pilot survey conducted in some of the locations included in the exercise.

In addition, four focused group discussions were held with the KWSB/WSD staff related to bulk water supply service, management of two of the bulk water consumers (who shared their views on the condition of anonymity) and the town municipal administration of Saddar Town in the southern part of Karachi (where Defence Housing Authority is located – a key bulk water consumer). The team was briefed about the methodology of the whole exercise and the overall focus of the study in the same respect. The whole feedback was transcribed, translated and finally edited into main text of the case study.

5.3.1 Residents in Defence Housing Authority (DHA)

- Water is inadequately supplied. Suction pumps are essentially installed.

Households pre-dominantly belonged to upper income groups. Houses were constructed of a detached, single or double storey type. Piped supply was the main planned mode which was normally released for one hour from 9.00 a.m. to 10.00 a.m. It was not adequate for daily needs. This was augmented by water tankers obtained either commercially or from DHA. In addition to the main water supply infrastructure including underground and overhead water tanks, piping, pumping motors and valves, almost every household had installed a suction to suck water from the outer lines. Although entirely illegal, the water supply from the outer pipe cannot reach the houses unless a suction pump was installed. Alternate water supply was facilitated through tankers. Annual water bills are regularly paid. The elected representatives had no role in the overall management of water supply.

5.3.2 Residents in Steel Township and Gulshan-e-Hadeed

Lower middle and middle-income groups resided in these localities. Water supply was facilitated by Pakistan Steel. Piped supply was the only available system. Water was supplied twice a day at 5.00 a.m. to 8.00 a.m. and 2.00 p.m. to 5.00 p.m. or 5.00 p.m. to 8.00 p.m. Supply was generally adequate for the normal household requirements. Water charges were directly deducted from the salary of the employees. Local government representatives had no role to play in the water supply matters.

5.3.3 Residents in Lalazar

Lalazar was an upper income locality in the south of the city. It received water supply through Karachi Port Trust which was a bulk consumer of KWSB/WSD.

- Alternate arrangement of tanker supply has to be frequently used.

Upper income group households reside in this locality. Piped water was the main source of supply however very rarely water was received through the pipes. It was found to be totally inadequate for the domestic requirements. Piping system was worn out and dilapidated which was repaired neither by KWSB/WSD nor Karachi Port Trust (KPT). The KPT charged for the supply of water tankers to the household. Suction pumps were installed to facilitate some water supply from the pipes. Alternate water supply was facilitated through tankers. No role was observed for the elected representation of the local government.

5.3.4 Management of Defence Housing Authority

Defence Housing Authority was a residential location originally allocated for serving and retired Defence personnel which was now inhabited by upper income groups. Began in 1954, the area had been developing fast. As a residential locality, DHA had faced problems of bulk supply from KWSB/WSD. While the daily need was 8 mgd, the supply was far less than this figure. Poorly maintained infrastructure at the end of KWSB/WSD, overall monopoly to determine the quota of supply and an overall uncertainty directly affected the supply. DHA has its own maintenance staff to look after the internal distribution system including the pumping process. Future need shall rise to 10 mgd, hopefully KWSB/WSD would increase its supply.

5.3.5 Management of Pakistan Steel

Pakistan Steel was a heavy industrial complex located along Pipri, an eastern sub urban location of Karachi. It had a sizable residential area for its staff and management called as Steel Town. Another residential neighbourhood was developed for the growing number of the employees and associated personnel known as Gulshan-e-Hadeed. The management of Pakistan Steel undertook the provision of all kind of infrastructure in these two locations including the water supply.

As the entire industrial process and the auxiliary activities utilized water to a considerable extent the management of Pakistan Steel obtained a bulk connection from Karachi Development Authority (now defunct) in 1978. The entire infrastructure related to water was developed by Pakistan Steel on its own resources. This included 16 km canals, 2 km pipes, pumps houses, filter plants, a complex network of water mains and water reservoirs. Atleast 11,000 households are provided water connections within the jurisdiction of Pakistan Steel. Presently the water need is 20 mgd while the future need may rise to 60 mgd. About one fourth of the total water is supplied to the residential connections (Ahmed and Sohail, 2001).

Till present time, the management of Pakistan Steel found the performance of WSD as satisfactory. However, the supply tariff was found to be very high – Rs. 73/- per 1000 gallons given the fact that the entire infrastructure has been developed and maintained by Pakistan Steel.

5.3.6 Management of Karachi Port Trust (KPT)

As the main port authority, KPT used to supply water to the ships and other vessels, a duty it still performs. It had several residential locations and quarters in its administrative jurisdiction including Lalazar – an upper income residential area. KPT faced an acute shortage of water. Across its estimated need of 35 mgd, it received only 0.7 mgd. Shortages have been compensated through tanker supplies. KPT provided tanker supply to its domestic consumers, however, this was less than the actual need. It provided ½" connection with meters to its domestic consumers, however, due to lack of pressure, the system did not function. The quota of supply for KPT was required to be drastically enhanced by KWSB/WSD.

5.3.7 KWSB/WSD Staff Related to Bulk Supply

Several staff members of the bulk supply department of KWSB/WSD were invited to a focused group in February 2003. They highlighted several key issues confronting the bulk supply. Illegal connections within the bulk supply network; old and aging system without adequate improvements; public sector agencies refusing to pay water bills; high cost of water supply compared to the billing rates; pressures from the armed forces to continue supply despite the non payments; mal practices on the part of trade unions are some of the common problems faced in this section.

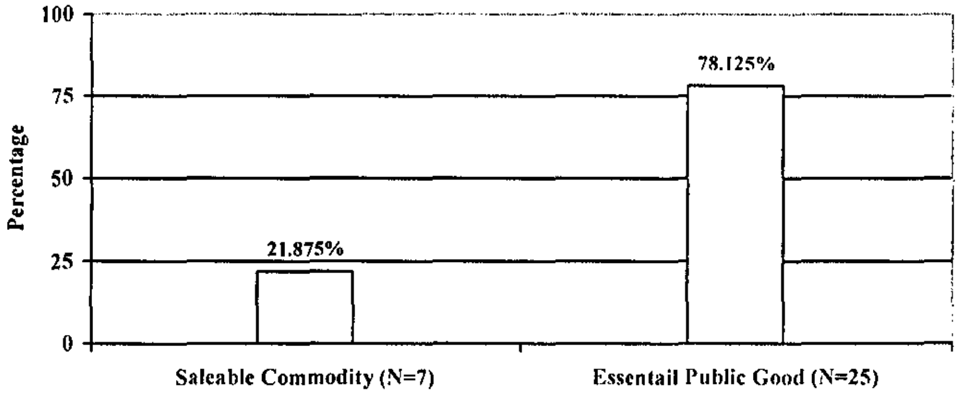
Besides, in the case of retail consumers of KWSB/WSD, the supply performance varied greatly. Locations close to water mains received better supply compared to the distant locations which suffered line losses and low pressures. The recovery of water bills in KWSB/WSD covered areas was also very low. Rampant usage of suction pumps was well known to KWSB/WSD staff. They opined that water, when supplied through lines, cannot reach consumers without suction pumps. However it is administratively illegal.

5.3.8 Survey of Retail Beneficiaries of Bulk Water

The survey of 32 retail beneficiaries was conducted along the locations serviced by bulk consumers. The findings of the survey are as under:

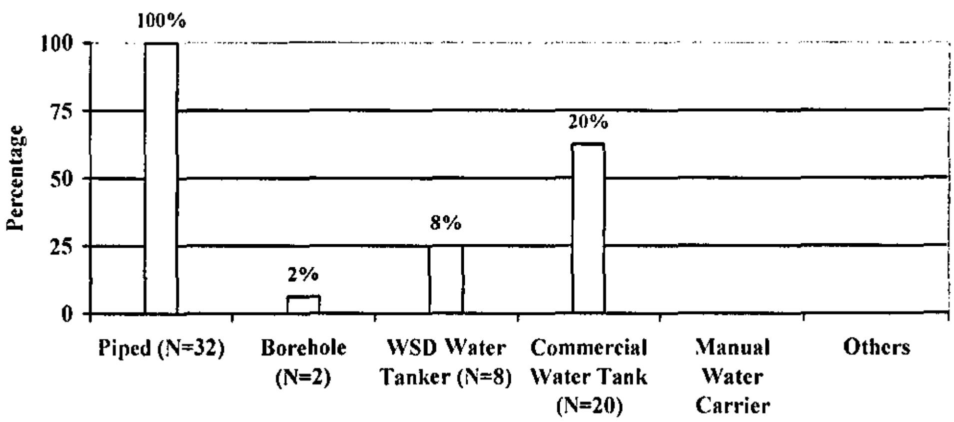
- A sizable number of beneficiaries considered water as an essential public good (Figure-5.3).

Figure-5.3
Status of Water Supply



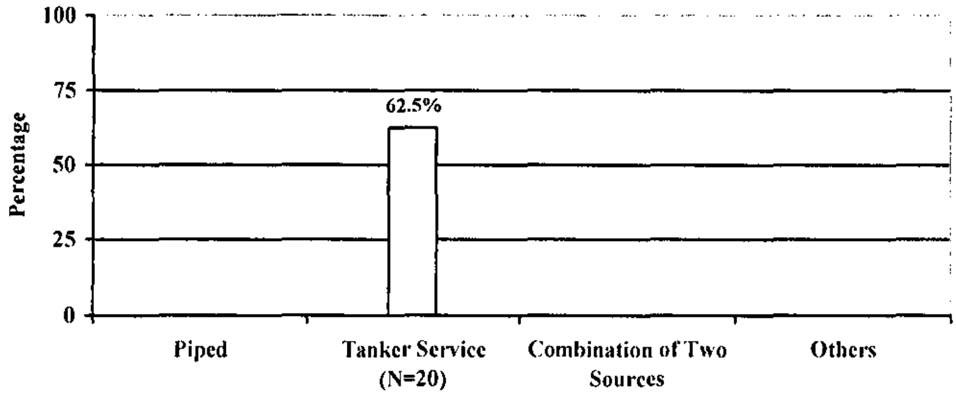
- As apparent, every household surveyed was connected to piped water supply connection. In addition, a sizable number had to rely on commercial water tankers (Figure-5.4).

Figure-5.4
Mode of Water Supply



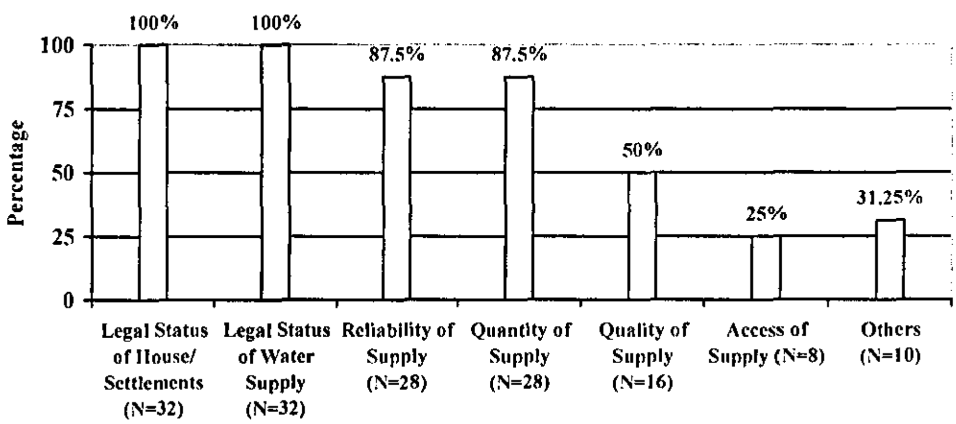
- In situations where piped water supply failed to function, the key alternative arrangement was tanker supply (Figure-5.5). As there were more than one responses, the figures do not add up to 100.

Arrangements for Alternative Sources of Supply



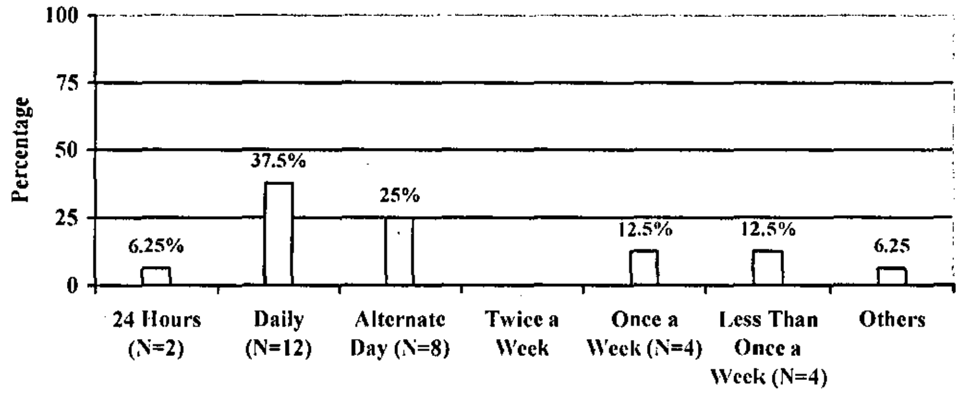
- Many factors were reported to affect water supply. Legal status of house/settlement and water supply service itself, reliability and quantity of supply were of foremost consideration (Figure-5.6). Some respondents also considered condition of underground infrastructure and nearness to the pumping source as factors that affected the supply.

Figure-5.6
Factors Affecting Water Supply



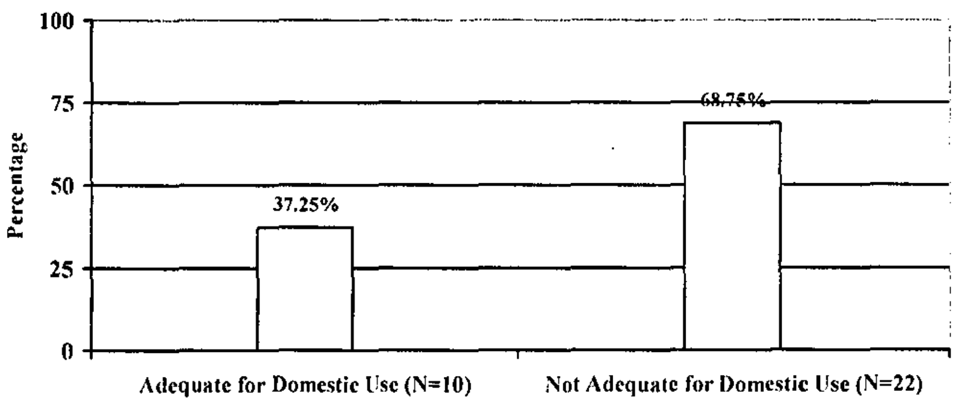
- Daily supply was received by a portion of the sample. Others benefited from alternate day and lesser frequency of supply (Figure-5.7). As there were more than one responses, the figures do not add up to 100.

Frequency of Water Supply



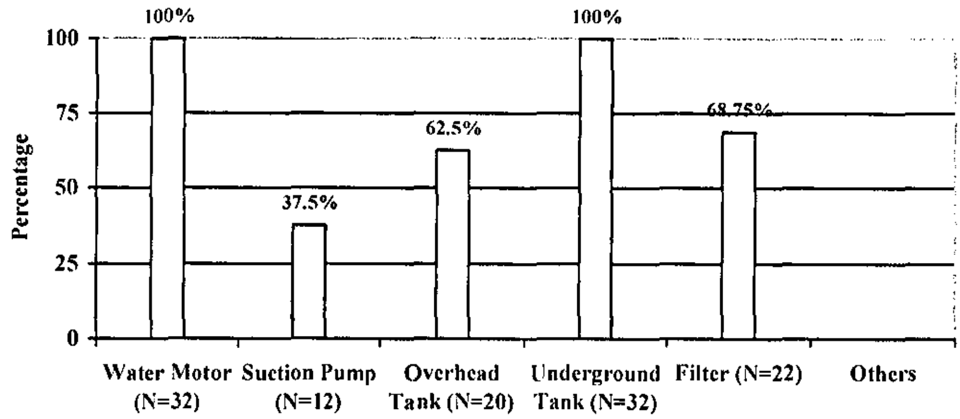
- A sizable number of consumers considered the supply not adequate for domestic usage (Figure-5.8). As there were more than one responses, the figures do not add up to 100.

Adequacy of Water Supply



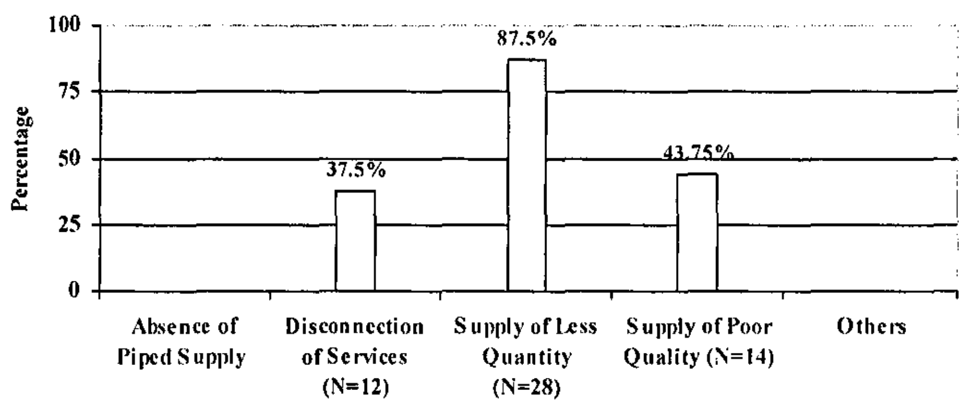
- The usual set of machinery and equipment was generally found in the system. Many households also reported the existence of suction pumps (Figure-5.9). The respondents of Defence Housing Authority were however elusive about the existence of suction pumps.

Figure-5.9
Machinery and Equipment Related to Water Supply



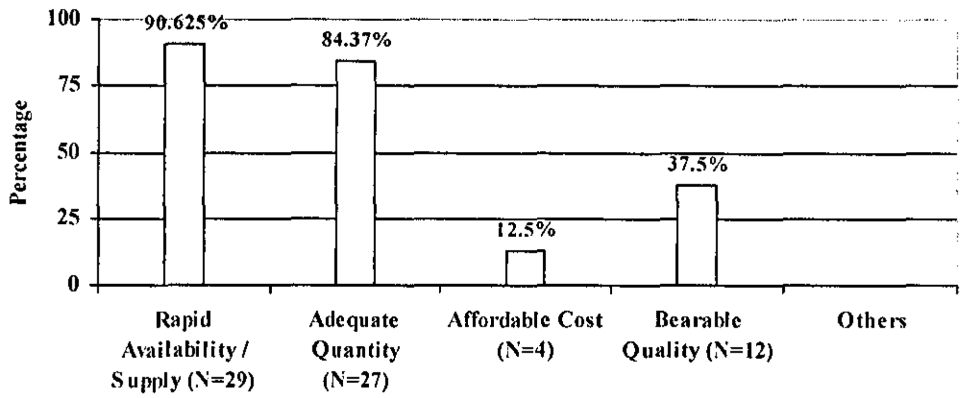
- Households resorted to the use of alternate means due to the supply of less quantities of water. In a sizable number, supply of poor quality was also considered as a viable option (Figure-5.10). As there were more than one responses, the figures do not add up to 100.

Figure-5.10
Reasons to Use Alternative Arrangements



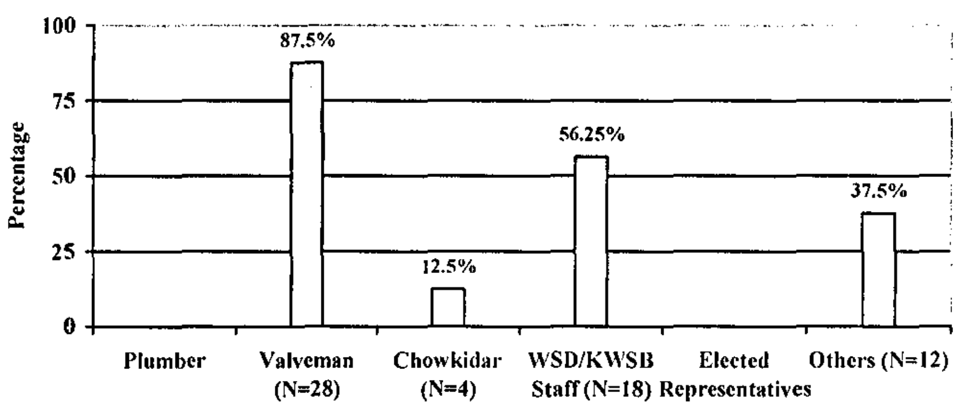
- Rapid availability and availability of adequate quantity were two key parameters that served as deciding factors for alternative arrangements (Figure-5.11). As there were more than one responses, the figures do not add up to 100.

Figure-5.11
Choice to Use Alternate Arrangements



- Valvemen and KWSB/WSD staff were considered as important staff members (Figure-5.12). Touts and agents of valvemen and KWSB/WSD staff was another mention in this respect. As there were more than one responses, the figures do not add up to 100.

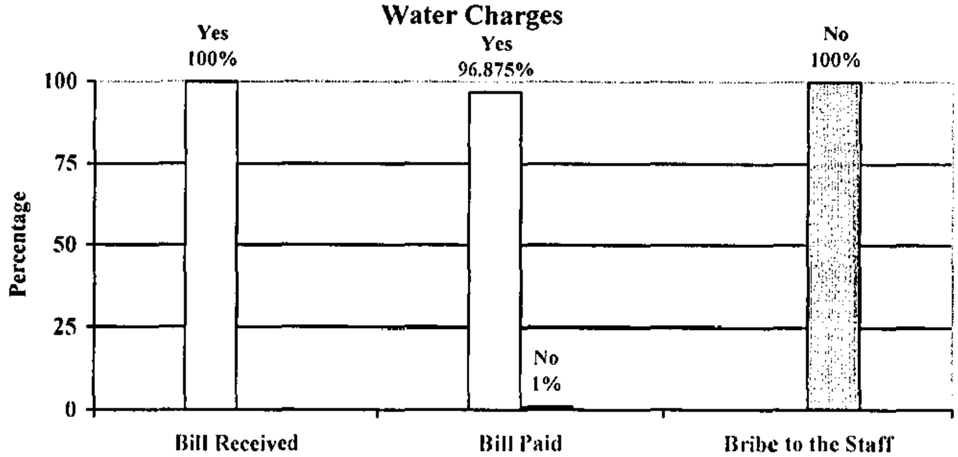
Figure-5.12
Personnel Related to Water Supply



- Almost all the consumers received and paid water bills (Figure-5.13).

Figure-5.13

Water Charges



Consumers received and paid the bills. No evidence of bribery was reported.

5.4 Issues in Bulk Water Supply and Consumers

5.4.1 Administrative Arrangement for the Provision of Water

The agencies acting as bulk consumers that possessed retail beneficiaries have made well-defined administrative arrangements for the supply of water. The retail beneficiaries register with the bulk consumer for the water supply service. The bulk consumers make administrative arrangements for obtaining bulk supplies from KWSB/WSD. The arrangement usually depended upon the mutually agreed terms. It has been observed that locations where the number of retail beneficiaries was rising such as in DHA, the supply from the bulk consumer often fell short. However the supply had been reported as satisfactory where the number of bulk consumers was within a stipulated limit. Examples of Steel Township and Gulshan-e-Hadeed are worth mentioning.

5.4.2 Frequency of Supply

There was a drastic difference found in the frequency of supply in different bulk consumers. In DHA there were several samples which received water for 1-2 hours on alternate days. Often this frequency was missed out. However in Steel Town and Gulshan-e-Hadeed, the supply was daily uptill 7 hours. In some cases the water was supplied twice a day during morning and evening hours.

5.4.3 Adequacy

> • Inadequacy of water supply was also dependent on scale of consumption and life style of residents.

The adequacy of water supply varied greatly. Residents of DHA normally complained about inadequacy of supply. However at times this could also be attributed to the high amount of consumption due to large lawns and even swimming pools or aquariums in such houses which required greater amount and frequency of supply. On the contrary, the households in other locations found the supply as generally adequate. These residences were small to medium sizes in the built up area and often had very small or no green spaces for extra consumption of water.

5.4.4 Apparatus and Machinery

> • Suction pump was invariably installed by consumers where supply was short.

Almost all the single or double unit housing types covered in this study had an underground and overhead tank which served as the main reservoirs for storage and flow of water. A standard type water pumping motor was also universally installed to pump the water from the underground tank to the overhead tank. However in locations where water supply was inadequate or the pressure of supply was low to fill the underground tank, a suction pump was also found to be installed by the residents. This device, which was meant to suck the water from the outside pipelines is illegal in nature and created an imbalance in the overall performance of the water supply system. The staff was aware of the installation of these devices but did not take any action against such residents apparently due to the influence of such households or connivance by the staff itself. These devices were abundantly detected in the residences of DHA. The residents were of the view that if these devices were not attached to the network of supply, they would not receive any trace of water at all. In contrast residents of Steel Town and Gulshan-e-Hadeed did not require to use any suction pumps as the supply was satisfactory without any pressure loss or reduction in quantity.

5.4.5 Type of Residence/Occupancy

The areas covered in the study primarily included single unit or double unit type residences on varying plot sizes. In DHA, the residences varied from 500 sq. yds to 2000 sq. yds. plot sizes. Consequently, the consumption pattern of water also differed. In large plot sizes, the proportion of lawn/garden space was invariably large requiring greater quantities of water. Whereas the number of household members was few, the utilization of water in large quantities was due to other accessories such as swimming pools, fish ponds, fountains or sprinkler devices. In comparison, the residents of localities such as Gulshan-e-Hadeed and Steel Town comprised single or double unit housing on 80, 120, 240 and 400 sq. yds. The consumption of water was structured mostly along the routine functions such as washing, cooking, bathing with very little amount used for gardening.

5.4.6 Role of Bulk Water Consumer

- Role of bulk consumers was not commensurate to the requirements of retail consumers.

The bulk consumer was authorized to obtain water from KWSB/WSD for distribution to the entire number of its retail beneficiaries. The bulk consumer allocated the water connection upon formal application and also undertook operation and maintenance of the system at the locality level. The bulk consumer also made estimations for the future water supply needs of its residents. The response about the performance of bulk consumers was mixed. Locations where the supply was found adequate for domestic consumption rated the bulk consumer as efficient. In other locations where bulk consumers could not arrange for comparable quantities of water were severely criticized. The bulk consumers were also criticized for not responding to crisis situations – where tanker supply became unavoidable.

5.4.7 Operation and Maintenance

With the exception of Lalazar area, the residents were found to be satisfied with the area level operation and maintenance of water supply related infrastructure. However, during the focused group meeting with KWSB/WSD staff, the rising use of suction pumps and illegal diameter pipes were among the main management problems. Since people were very influential, no enforcement of penalty could be undertaken in such circumstances.

5.4.8 Water Charges

- Consumers paid water dues.
- Performance of KWSB/WSD staff was similar as found in other case study areas.

The water bills/charges were reported to be regularly paid without any default. The people found the charges to be satisfactory. Apart from the routine charges, these people often had to obtain water through water tankers which depended upon the number of tankers purchased per unit time. In the case of Steel Town or Gulshan-e-Hadeed, the deductions were made from the salaries of the concerned allottees. In most cases the charges were found to be affordable.

5.4.9 Role of Elected Local Bodies

Water supply management and maintenance was a clearly identified responsibility of elected local representative. However in almost all the areas surveyed, the local institutions have not taken any practical or administrative measure to affect the water service in their respective constituencies. People were unhappy because they had developed numerous expectations including improved water supply service. However, the Town Municipal Administration (TMA) were criticizing the fact that neither any funds have been allocated to them for the operation and maintenance nor any authority to participate in the policy making process related to water.

5.4.10 Views of Stakeholders

Residents were satisfied in locations where water supply service was functioning well. However, the areas where water supply was provided amidst problems made the residents unsatisfied. Elected representatives wished to participate in the water supply affairs but were allegedly denied entry by the present group of technocrats running the utility. The staff members of the utility were of the view that unless the basic issues of supply are not resolved including shortage and even distribution, the grievances of retail beneficiaries shall remain.

5.4.11 Comparative Scenario of Water Supply (with Other Case Studies)

Basis of this comparison was the dialogue with WSD staff response. It was observed that the water supply performance in areas served by WSD directly was not very different from those served by bulk consumers. The areas which lied on the access of water mains had a relatively better water service. However such areas where the supply system was old, densification/addition of households had taken place or lied at the tail ends of the network, displayed a poor water supply service. A sizable difference, however, was the recovery of water charges. The recovery was more efficient for the retail beneficiaries of bulk consumers than the WSD retail consumers.

5.4.12 Impact of Location on Supply

From the survey, it was found that the locational characteristics have had a sizable impact on the overall supply characteristics to retail beneficiaries. The locations that were closer to the source or the main conduit received a relatively better supply. They included Gulshan-e-Hadeed and Steel Town. As covered in the section 5.3.5, an exclusive water conduit was installed for serving the Steel Mills and the adjoining residential areas. Thus the possible reason for a relatively improved supply was the nearness and subsequent optimum pressure and quantity of water. In contrast, the houses in DHA or Lalazar area were farther away from the main water conduit, apparently at the tail end of the supply. Thus the supply was affected due to this particular factor.

5.4.13 Combination of Sources and Reliance on Alternatives

In locations where the supply had been found adequate, the area residents relied entirely on the piped supply as the singular mode. In Steel Town and Gulshan-e-Hadeed, the households entirely relied on piped water supply. However, in locations where the piped supply was unpredictable, alternative sources were utilized. In DHA, the residents acquired tanker supply in the events of shortage and peak summer seasons. Similarly the piped supply was exploited to an exaggerated extent by using suctions pumps to extract extended quantities of water during available supply.

5.4.14 Subsidy/Cost of Supply

Apparently the rates of supply charged from the retail beneficiaries were approximately the same as charged from KWSB/WSD. However the only difference in some cases was that the charges were deducted from the salary or the allowances released to the employees. The scale of recoveries were apparently better than the normal billing processes.

5.5 Bulk Water Supply as an Alternative

A well defined set of variables had evolved from the research questions outlined in section 3.4 (Figure 3.2) and guiding hypothesis in section 3.3 (Figure 3.5). This case study was designed to explore these variables according to the research design in chapter-3. It is abundantly clear from the case study that the consumers and suppliers (of different kinds) perceived water as an economic good which could be acquired after spending appropriate resources. The fact that the combination of modes were used for obtaining domestic supplies was a prove in itself. In DHA and Lalazar, the consumers had to resort to informal arrangements such as suction pumps to acquire water in the required quantities. Consumers were of the view that since the supply frequency was low and incongruent to the needs and a definite cost was incurred in either water bills or payment to tankers, the water supply could be regarded as an economic good.

Reliance on a combination of sources comprising piped supply, tankers and boring became inevitable in such areas which faced shortage and irregular frequency of supply.

The factors controlling the water supply in the case study locations were several. Proximity to the source of supply or its conduit, overall layout of pipelines and their repair and maintenance; the total quota of bulk supply and quality of water supplied were the factors found to be vital in controlling the supply in this case study.

The preferential characteristics in an alternate arrangement included the reliability to address the needs, acceptable charges and a reasonable quality. In terms of personnel, the valvemen regulating the supply frequencies at lane/house level have a key role to play. Bills and charges were found to be paid in majority of instances.

The water utility, that is KWSB/WSD, partially recognized the alternative modes. The supply through water tankers that originated from the designated KWSB/WSD hydrants were recognized. However the supply from illegal hydrants and bore holes was not recognized. From the prevailing situation, it was obvious that the possibilities of integration were remote since no recent initiative had been taken by any stakeholder.

6. CASE STUDY-III: AWAMI (PEOPLE'S) TANKS IN ORANGI TOWN

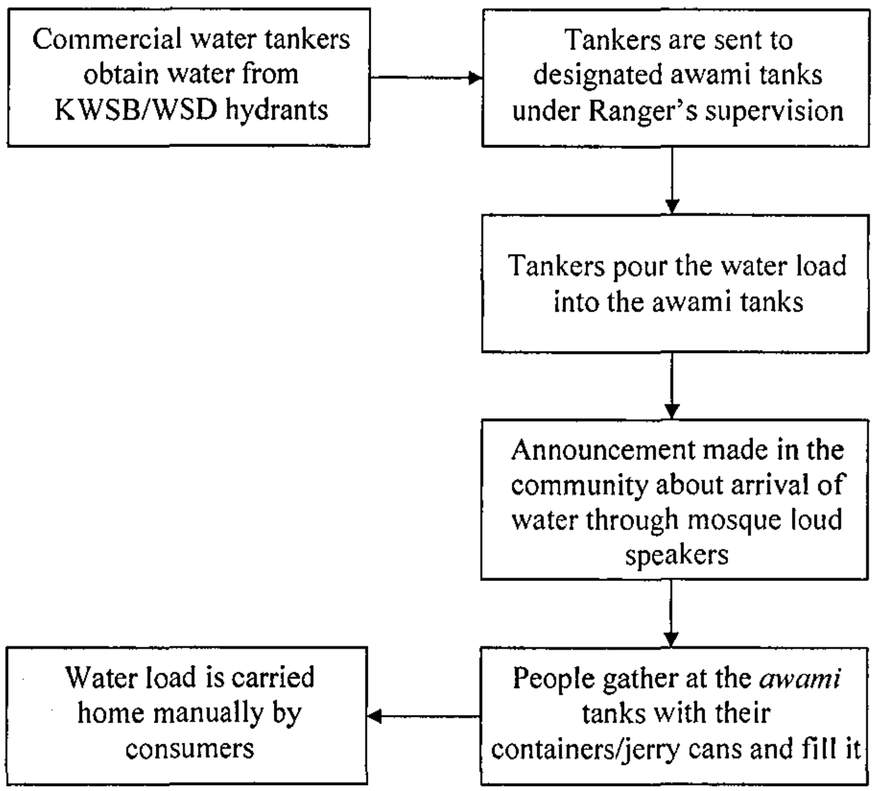
6.1 Introduction

The earlier two case studies were based on field research in both planned and unplanned localities. In a sizable number of examples, there was piped system laid and maintained for different levels of service. The case study under discussion in this chapter covers a location which is the largest squatter in the city. Many basic amenities including piped water supply were not found during pilot phase of work. This situation led to the creation of *awami* tanks in the locality.

This chapter presents the case study of awami (people's) tanks located in Orangi Town, Karachi. The background leading to the evolution of this alternative is briefly described. Profile of awami tanks is presented with details of service delivery. The case study was based on a questionnaire-based field study of 22 awami tanks. Besides, focused group meetings were also held to obtain the feedback of stakeholders (Section 6.3.5). Commonly prevailing issues such as overall shortage, price of vended water, quantity, quality, physical conditions of awami tanks, their performance and possibility of upgrading awami tanks were also studied.

Awami tanks are a form of storage structures that are either developed by the city administration to facilitate the supply of basic quantities of water to tail end areas or constructed at sites of communal belongings such as mosques. *Awami* Tanks (or people's tanks) can be also defined as the underground water tanks built to store and distribute water to the local community members. They exist in several types. The underground tanks that are normally constructed in neighbourhood mosques or churches have also been used as *awami* tanks. This was one of the earlier options of community based water storage and distribution in situations of shortages or ruptures in supply. Other public locations such as graveyards or common neighbourhood or open spaces have also been utilized for such tanks through a purpose built construction. In few cases, residents have allowed the use of their house tanks as *awami* tanks for the benefit of other community residents. However this has been possible where the size of the tank was large enough to store 1-2 tanker loads of water which was approximately 6000 gallons. In addition to these types which were built by the people through their own resources, the Rangers have also built *awami* tanks on public open spaces. The process of water supply through awami tanks is mentioned in Figure 6.1.

Figure-6.1
Water Supply Through *Awami* Tanks
Flow Diagram



The concept and operation of awami tanks is entirely welfare oriented as found out from the study. The supply of water to awami tanks is facilitated through KWSB/WSD tankers under the supervision of Rangers (paramilitary force). While it may appear unusual for a military organization to manage a water supply service component, there were several reasons for it. The Rangers were deployed by the civic administration in different city areas for routine maintenance of law and order as well as assistance in the management of some utilities. Water supply service was also affected due to the interference of powerful interest groups who intended to benefit their own political constituencies. The service of tanker supply to low income areas such as Orangi were also grossly mismanaged due to the influence of the same groups. Thus Rangers had to be called to root out the interference of such elements. Supply of water and allocation of quota to different areas was directly carried out under Ranger's supervision (Ahmed et.al., 2003d). However, in cases of scarcity, the people of the locality pool together the cost of commercial tanker load of water and access them independently. In reference to the existing water supply arrangements, the awami tanks constitute an unusual example as they provide service to areas that do not have any piped supply (Figure-4.47). The case study addresses the research questions outlined in section 3.3 with a descriptive approach. The variables derived out of the research questions in Figure 3.2 are correspondingly addressed in this case study adopting a descriptive pattern. These findings are included in the cross case analysis done in Chapter-7. Through an empirical assessment, the case study broadly proves the guiding hypothesis presented in section 3.3 with its details evolving out from the analysis of fact finding that appears in the following heads.

6.2 Awami Tanks in Orangi Town

The *awami* tanks display example of an existing public private partnership under an informal contractual means. They are found in Orangi Town and few other squatters. Orangi Township is situated in the Orangi hills in the western part of Karachi. It is the city's largest *katchi abadi* or 'squatter' settlement and covers an area of more than 8,000 acres. For the most part, the township was created by land-grabbers and middlemen through the illegal occupation and subdivision of state land (Hasan, 1992 and 2002).

Although the Orangi Township was initiated primarily as a planned settlement and later expanded as a *katchi abadi* (squatter settlement) since 1965, the piped water supply could only be provided since 1984. Geographically, Orangi is located in western part of the city which was linked up to the Hub River source. This river, which is a rain fed stream, was used as a water supply source since 1982, primarily for the western areas (KDA-MPECD, 1990). The project was completed in three phases and became operational in 1995. During this period the supply was largely adequate and proved as a major cause of rapid expansion of the settlements in Orangi. However due to poor rainfall during the past, the water level in Hub fell down. The supply was directly affected. Due to this continuing crises it reached to a status of zero supply in late 1990s. At present, the western areas of the city in general and Orangi in particular are severely affected due to absence or reduction of water supply from Hub. While there are no exact estimates available about the water need of Orangi, it was empirically calculated as 60 million gallons per day (mgd), as cited by KWSB (2001). Two measures have been taken by the KWSB/WSD and city administration to deal with the shortages. These measures include supply through tankers and up-gradation/modification of pumping facilities through Indus source. The tanker service has been linked up to various modes of water provision. In reference to the second measure, several improvements have been done. Up-gradation of North East Karachi pump house to increase the pumping capacity from 25 mgd to 50 mgd, construction of 25 mgd pump house at Khawaja Ajmer Nagri (of direct benefit to Orangi), inter connection of 48" and 36" dia pipes (to link up Karachi's western localities with Indus source network) have been completed. Installation of new valves, sinking 12 tube wells in Orangi (plus Baldia, Manghopir and Surjani Town) and construction of 50 water storage tanks of 10,000 gallons each in Orangi (and Baldia) were also proposed as a means of further improvement (KWSB, 2001). The plan to built the stipulated 50 tanks of 10,000 gallons each could not materialize. The KWSB/WSD/Rangers constructed a few tanks in different locations with 6000 capacity. The phenomena of *awami* tanks viewed in this thesis is somewhat different. These structures were built as an instant solution to address the immediate need of water supply. Table-6.1 provides details about the evolution, ownership and management of the tanks.

Lane level water distribution pipes were laid down in Orangi on an ongoing basis and under the auspices of various programmes. During the initial period of elected local government (1979-1992), these pipelines were laid down by the area councilors through the development funds provided to them by the

Karachi Metropolitan Corporation (KMC) (now defunct). As a consequence of such ongoing efforts, a sizable part of Orangi localities had a piped network of water even in some of the remote locations such as Ghaziabad, Gulshan-e-Zia and Gulshan-e-Bihar during the period when water supply situation was satisfactory. The shortage that emerged after the drying up of Hub source became severe during 1990s. The pipe lines were damaged beyond the possibility of repairs. Thus pressing needs of daily water supply had to be addressed on an emergency basis. The city and provincial administration decided to extend water supply through tankers to different water scarce areas in Orangi. Initially this responsibility was entrusted to the KWSB/WSD. It was advised to supply water through its own fleet of tankers as well as its contractors during 1997-98. However the KWSB/WSD was not able to perform this function. Lack of initiative, local political influences and differences with commercial operators on supply rates were some of the main reasons for this situation. As the situation was becoming tense almost leading to water riots, the administration later decided to entrust this responsibility to Pakistan Rangers which are a paramilitary force (Ahmed and Sohail, 2003e).

The Rangers carried out a survey of the affected areas. The survey revealed that the water supply could be facilitated effectively if some area nodal points are developed to store and distribute the water supplied through the tankers. It was also found that the political influence on the routines of supply need to be curbed which Rangers were able to do due to their military clout. The Rangers found out few locations where small scale community tanks were existing. In other areas, the mosques and churches had underground tanks already constructed. The respective mosque or church committees agreed to allow the use of their underground tanks as communal water supply reservoirs (Ahmed and Sohail, 2003e).

The Rangers undertook a final survey of the water deficient areas and then started providing water through their own tankers. Each tanker contained water load equal to 200-250 canisters (1200 gallons). According to a set time table, the water was then supplied to the people. The system is still working.

6.3 Structure and Findings

In this research, documentation and analysis of 22 awami tanks was done in 2000 and updated in 2002. The locations covered included Ghaziabad, Gulshan-e-Zia, Mansoor Nagar, Gulshan-e-Bihar and Raees Amrohvi Colony – all in Orangi Town.

As the starting exercise, an observational survey of several low-income settlements was carried out. In this survey, several other Orangi locations were found to be containing *awami* tanks with similar structure and operational profiles. However the present case study only includes the locations mentioned above. The team of researchers initially established contacts with the *awami* tanks operators from whom a feedback for an earlier research was undertaken. They were approached for obtaining an update on the current performance and operational status. The checklist/questionnaire used for this study are placed in Annexure-14.

The list of stakeholders related to *awami* tanks was prepared. They included the users, operators, local councilors/*nazims*/*naib nazims*, local politicians, KWSB/WSD staff, Pakistan Rangers, local organizations, tanker operators and hydrant management staff. In addition to fact finding from individual representatives of the stakeholders, one focused group meeting each was held at Gulshan-e-Zia and Gulshan-e-Bihar, both in Orangi Town (Section 6.3.5). In these meetings, the issues focusing on the checklists were discussed at length. In order to document the current status of the *awami* tanks, a selected photographic profile was prepared to highlight the various issues dealt in this research. This work was completed between April-July 2002. However, some later stage updating and verification was also continued in August and September 2002. In addition to these two types, there were new tanks constructed either by people through self-help or by the Rangers (Table-6.1).

6.3.1 Profile

TABLE-6.1

AWAMI TANKS: EVOLUTION, OWNERSHIP AND MANAGEMENT

No.	Location	Built by	Management	Ownership
01.	Gulshan-e-Zia	Built in 1989 by the Rangers (through contribution of people/mosque)	A community elder and *Imam* (prayer leader) runs it.	Owned by the *Madrassah* (local seminary) and mosque.
02.	Gulshan-e-Zia	Built in 1990 by the people through self help.	A community elder manages it on behalf of the community; Rangers monitor supply through the tankers.	Owned by the people/graveyard committee.
03.	Gulshan-e-Zia	Built in 1982 by the people.	Runs on self-help by the people of the area.	Owned by the people.
04.	Gulshan-e-Zia	Built 10 years before through the help of *Thalawala* (local building component manufacturer)	*Thalawala* is responsible.	*Thalawala.*
05.	Gulshan-e-Zia	Before 11 years it was made by *Mohalla* (sub neighbourhood) committee through contributions.	*Mohalla* committee is responsible for its operation.	*Mohalla* committee.
06.	Gulshan-e-Zia	Before 10 years by the Mosque Committee.	Mosque committee.	Mosque Committee.
07.	Gulshan-e-Zia	Before 12 years, the block maker volunteered the construction.	*Mohalla* committee.	*Mohalla* committee.
08.	Gulshan-e-Zia	Before 2 years it was built by the Mosque committee.	Mosque committee.	Mosque committee.
09.	Ghaziabad	This tank was made by Mosque committee 10 years ago.	Mosque committee.	Mosque committee.
10.	Muslim Maywati Colony, Ghaziabad	1½ years before established by Mosque committee.	Mosque committee.	Mosque committee.
11.	Ghaziabad	Mosque committee build this tank 1 year ago.	Mosque committee.	Mosque committee.

Continued on page 162...

No.	Location	Built by	Management	Ownership
12.	Ghaziabad	One year before it was established.	Shopkeeper is responsible.	Shopkeeper.
13.	Christian Colony, Ghaziabad	A local philanthropist made this tank one year ago.	Local philanthropist and with two helpers.	Local philanthropist.
14.	Christian Colony, Ghaziabad	Local philanthropist made it 10 years ago.	Local philanthropist is responsible.	Local philanthropist.
15.	Muslim Colony, Ghaziabad	Built 8 years ago by the government.	Mosque committee.	Mosque committee.
16.	Yaqoobabad	It was made 1 year before by community contributions.	Community elders.	Community elders.
17.	Yaqoobabad	Established 4 months before by few community elders.	Community elders.	Community elders.
18.	Mansoor Nagar	Established 6 months before by Rangers.	*Mohalla* committee.	*Mohalla* committee.
19.	Mansoor Nagar	Made 7 years before through the help of Orangi Pilot Project.	Local philanthropist is responsible.	Local philanthropist.
20.	Mansoor Nagar	Built by *Mohalla* committee in 1983.	*Mohalla* committee.	*Mohalla* committee.
21.	Mansoor Nagar	Made up in 1990 by a community philanthropist.	Community philanthropist.	Community philanthropist (allowed his house tanks to be utilized for community benefit).
22.	Mansoor Nagar	Before 14 years it was established. A local elder made it for the mosque.	Mosque committee.	Mosque committee.

Water was supplied to *awami* tanks through commercial water contractors enlisted with KWSB/WSD/Pakistan Rangers. The contractors filled the tankers from authorized hydrants and supplied the water to designated *awami* tanks according to frequency decided by the Rangers. Water and transportation charges for this supply were reported to be paid by Pakistan Rangers. After the supply was received in *awami* tanks, people acquired water from these tanks in canister or jerry cans. The water was transported to the houses manually. Each *awami* tank was meant to serve its own area residents which were informally defined (Table 6.2).

6.3.2 Water Supply Details

TABLE-6.2
DETAILS OF WATER SUPPLY THROUGH AWAMI TANKS

S. No.	Amount of water acquired at a time	Frequency of acquisition	Frequency of acquisition by users	Views on the provision of water through awami tanks
01.	6000 gallons	Once in 15 days (through the vehicle of Rangers)	As per need	It is a good solution. It has provided relief to the people to a considerable extent.
02.	6000 gallons	One in 07 days (through the vehicle of Rangers)	As per need	Inavailability of water has led to this situation. Awami Tanks are a temporary relief.
03.	6000 gallons	One in 07 days (through the vehicle of Rangers)	As per need	Founded in 1982 due to inavailability of water. Initially the police used to provide water, now the Rangers do it.
04.	600 gallons of 16½ kg.	Supplied by the Rangers.	Thrice a week.	Because of poor community, these tanks were established by the Rangers and others.
05.	250 canisters of 16 kg.	After every 2 days.	After every 2 days.	Initially for the settlement, there is no facility for gas, water and electricity. In the last government gave this last option.
06.	About half a tanker.	Once in a week.	Once in a week.	There was shortage of water. This tank was made through community contribution.
07.	175 jerry cans (1200 gallons)	After 2-3 days.	After 2-3 days.	There was shortage of water. This tank was made through community contribution.
08.	6000 gallons from Islam Chowk through Ranger.	Only one time in 15 days.	Only one time in 15 days.	There was shortage of water. Mosque committee built this water tank.
09.	4500 gallons supplied from Islam Chowk through Rangers.	Weekly supply.	Weekly supply.	Because of lack of piped water supply, this option was developed.

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S. No.	Amount of water acquired at a time	Frequency of acquisition	Frequency of acquisition by users	Views on the provision of water through awami tanks
10.	3000 gallons through Ranger from Islam Chowk.	Weekly one or half tanker.	Weekly one or half tanker.	Because of lack of piped water supply, this option was developed.
11.	4000 gallons from Islam Chowk through Rangers.	Twice a week.	Twice a week.	Scarcity and purchasing was difficult for poor community so these tanks were established.
12.	14000 gallons from Islam Chowk through Rangers.	3 days availability.	3 days availability.	Private tanker price was very high, which was beyond the range of poor. This led to awami tank's construction.
13.	6000 gallons from Islam Chowk through Rangers.	3 days a week.	3 days a week.	The poor people paid about 1000 rupees only on water. So these tanks were made.
14.	6000 gallons from Islam Chowk through Rangers.	After one day.	After one day.	The poor people paid about 1000 rupees only on water. So these tanks were made.
15.	600 gallons from Islam Chowk through Rangers.	Weekly one time.	Weekly one time.	Poor could not afford such heavy expenditure so these tanks were established.
16.	3000 gallons from Islam Chowk through Rangers.	After 3 days.	After 3 days.	Water was expensive, so these tanks were established.
17.	6000 gallons from Islam Chowk through Rangers.	After 3-4 days.	After 3-4 days.	Because of shortage and expensive water, these tanks were established.
18.	3000 gallons from Islam Chowk through Rangers.	Once in a week.	Once in a week.	Private tankers were expensive so these tanks were established.

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S. No.	Amount of water acquired at a time	Frequency of acquisition	Frequency of acquisition by users	Views on the provision of water through awami tanks
19.	Total 1000 gallon from Islam Chowk through Rangers.	After two days.	After two days.	Because of shortage of water, these tanks were made.
20.	6000 gallons from Islam Chowk through Rangers.	3 days a week.	3 days a week.	There was no piped water supply, so these tanks were established.
21.	6000 gallons from Islam Chowk through Rangers.	After 2-3 days.	After 2-3 days.	Due to decrease of supply from Hub source and low purchasing power possessed by poor, these tanks were established.
22.	6000 gallons from Islam Chowk through Rangers.	Once in a week.	Once in a week.	Shortage of water and the government delayed response to the poor community persists.

The amount of water acquired by the awami tanks varied depending upon the circumstances (Table 6.2). It ranged from 600 gallons to 14000 gallons. The quantities normally depended on the schedule of supply worked out by the Rangers for different awami tanks. The frequency of supply also varied and ranged between alternate day supply to once in 15 days. This schedule also depended upon the schedule worked out by the Rangers for various locations. The users were allowed to take water from the awami tanks as per need. However in some cases, it was commensurate with the supply frequency to the tank itself. It was also found that once the water was poured by tankers into the awami tanks, the local prayer leader (*imam*) would announce through loud speakers. The people would gather and collect water according to their need. Users had diverse viewpoints on the alternative (Table 6.3). Considering the option as a satisfactory alternative; considering awami tanks as a temporary relief; recognizing community efforts for building the tank; lamenting the ineffectiveness of piped supply; a solution parallel to private tankers, useful option for drinking water supply and cost effectiveness of water from these tanks were some of the common viewpoints. Distribution of water to people was done in a flexible manner. Usually people took water according to their needs. Announcement about the availability of water was made on the mosque loudspeakers. People gathered and collected water in canisters/vessels according to their needs. In some cases, a motor was used to help distribute water. In few cases, 8-10 cans per family were made available. Regarding problems, most of the people wished to have an efficient piped water system in place. Few also emphasized on the daily availability of water (Table-6.3).

TABLE-6.3
WATER DISTRIBUTION, PROBLEMS AND POSSIBLE SOLUTIONS

S. No.	Distribution of water through awami tanks	Problems and issues related to awami tanks	Possible solutions
01.	People carry water in boxes/canisters manually. No problems encountered.	Not a major problem. Frequency needs to be improved.	Not known.
02.	25 houses @ 10 canisters per house for each tanker trip.	Less water supply is often a problem.	Pipe line need to be repaired. Source to be connected.
03.	Public announcement on mosque loudspeaker. People come and collect it.	Mr. Khushi Mohammad (prayer leader) helps in the provision of water.	Pipeline exists but the supply in the pipeline is not existing.
04.	There is no system. People take water on their own responsibility.	There is no problem in the existing system. Piped water supply should be ensured.	Pipe water supply should be ensured.
05.	People take water according to their need.	Need for a bigger tank; Piped water supply should be ensured.	Piped water supply showed be ensured.
06.	On community own responsibility.	Bigger tank is the need.	Need is higher.
07.	On community own responsibility.	Bigger tank is the need.	Need is higher.
08.	Public announcement on mosque loud speakers. Community is free in their need fulfilment.	Land availability by the government.	Expenses of Awami tank should be spend on the improvement and maintenance of pipe lines.

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S. No.	Distribution of water through awami tanks	Problems and issues related to awami tanks	Possible solutions
09.	Distribution is through motor.	These tanks are temporary solution. Pipe line water supply should be ensured.	Piped water supply should be ensured.
10.	Announcement through loud speakers.	Water should be supplied according to community need.	---
11.	Announcement through loud speakers, then people take on their own responsibility.	Pipe lines are completely out of order.	Pipe line from these tanks will improve the situation.
12.	Community is free to fulfil their demands.	Daily water tanker and pipeline should be repaired.	Pipeline should be repaired.
13.	Community is free in their demands.	Through pipeline, will improve the situation.	Pipe line should be repaired.
14.	Community is free in their demands.	Pipe water supply be redesigned.	Pipe line should be repaired.
15.	8-10 cans per family are available.	Daily supply should be ensured.	Supply through pipe line will improve the situation
16.	People's own responsibility.	Daily availability will improve the situation.	Daily availability.
17.	People's own responsibility.	Daily 3000 gallons will improve the situation.	3000 gallons availability per day.
18.	People's own responsibility.	Repair of the pipeline will improve this situation.	Pipeline should be repaired.
19.	People's own responsibility.	Oil mixing is a common problem (water quality).	Pipeline should be repaired.
20.	People's own responsibility.	Timing is the problem.	Pipeline should be repaired.
21.	On people's own responsibility.	There is no problem in Awami tank.	Pipeline should be repaired.
22.	On people's own responsibility.	Two tankers weekly will be sufficient.	Pipeline should be repaired.

6.3.3 Operation, Maintenance and Finances

The overall review of the awami tanks revealed that no payment of any kind was involved in this exercise (Table 6.4). As the tankers were sanctioned by the Rangers, they delivered water to the designated tanks without charging the communities. Due to vigilance of the Rangers, underhand payments or prices were curbed. In some cases the mohalla (neighbourhood) committee collected some money to undertake the routine maintenance of the awami tanks. In other cases, the mohalla or mosque committees undertook the repairs. People were found generally satisfied about the performance standards. Few respondents however commented that this system shall only work till such time the Rangers were controlling the situation. Not much assurance could be ensured in the post Rangers regime.

TABLE-6.4
WATER RELATED FINANCES & OPERATION & MAINTENANCE

S. No.	Who pays for the water distributed through awami tanks	Financial recoveries from the awami tank system	Handling of money for awami tanks	Operation and maintenance of awami tanks	Overall performance standards
01.	No payment is involved. In the past medrassah used to pay when commercial tankers were purchased.	No one recovers any money from any one.	Nil	Mosque/Medrassah looks after it. Only affluent people used to pay in the past.	Satisfactory.
02.	No payment is involved. Mohalla people contribute for maintenance/repairs.	No one recovers any money from any one.	Rs. 40/- per week are collected totally by the mohalla committee from willing households.	Mohalla Committee looks after it.	Overall system is satisfactory. However quality of water is not good.
03.	No payment is involved.	No one recovers any money from any one.	Nil	A community elder facilitates supply of water. People operate and maintain.	After 3-4 tanker supply, the tank is cleaned and repaired.
04.	No payment involved.	No recoveries. No spending of money on repair.	Nil	Mohalla Community is responsible for maintenance, cleanliness and supervision.	Satisfactory.

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S. No.	Who pays for the water distributed through awami tanks	Financial recoveries from the awami tank system	Handling of money for awami tanks	Operation and maintenance of awami tanks	Overall performance standards
05.	No payment involved.	No recoveries.	Mohalla Committee collect some reasonable amount for repair.	Mohalla Committee.	Satisfactory.
06.	No payment.	No recoveries.	Supply is free of cost.	Government responsibility.	Satisfactory.
07.	No payment.	No recovery.	Supply is free of cost.	Mohalla committee.	Satisfactory.
08.	No payment.	No recovery.	Supply is free of cost.	Masjid committee Rs. 50/- spent by our own pocket per week.	Satisfactory.
09.	No payment.	No recovery.	Supply is free of cost.	Masjid committee.	Satisfactory.
10.	No payment.	No recovery.	Supply is free of cost.	From the fund of the mosque.	Satisfactory initially but now the picture is different.
11.	No payment.	No recovery.	Supply is free of cost.	Spent by people.	Water is easily available results are not satisfactory.
12.	No payment.	No recovery.	Supply is free of cost.	Spent by people.	Pipe water supply should be ensured.
13.	No payment.	No recovery.	Supply is free of cost.	Spent by people.	Pipe water supply should be ensured.
14.	No payment.	No recovery	Supply is free of cost.	Spent by people.	Satisfactory.
15.	No payment.	No recovery	Supply is free of cost.	Through self help basis.	In present condition, it is good solution.
16.	No payment.	No recovery	Water provided free of cost.	Spent through self expenditure on maintenance.	Not satisfactory.

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S. No.	Who pays for the water distributed through awami tanks	Financial recoveries from the awami tank system	Handling of money for awami tanks	Operation and maintenance of awami tanks	Overall performance standards
17.	No payment.	No recovery	Water provided free of cost.	40-50 rupees spent by people.	It is not the proper solution.
18.	No payment.	No recovery	Water provided free of cost.	Community is responsible for repair.	It is good but the results should be improved.
19.	No payment.	No recovery	Water provided free of cost.	Through contribution the repair will be done.	The system will work till the Rangers are here so pipe water supply should be ensured.
20.	No payment.	No recovery	Water provided free of cost.	Through Masjid committee through contribution from people.	Satisfactory.
21.	No payment.	No recovery	Water is free of cost.	Through self-help.	Temporary system. Pipe supply should be ensured.
22.	No payment.	No recovery	Water is free of cost.	Masjid Committee.	It should be improved.

6.3.4 Perceptions about Water Supply Services

The perception of people about water as a tradable good were mixed. Few people regarded it as not possible. Many others recognized it as already a business. Some respondents contended that people were poor and they were unable to pay. About the possibility of instituting public private partnership, some people considered it to be a difficult option. The others believed that the adoption of public private partnership will improve the situation. People regarded the agencies (KWSB/WSD) as responsible for poor water supply and no supply in some cases. Political pressure by powerful groups to divert water to their own areas, faraway distance of the settlement from the water reservoir/pumping source and the relatively (perceived) less important status of the area in comparison to other areas were cited as reasons for poor supply and management of water.

TABLE-6.5
PERCEPTIONS ABOUT WATER SUPPLY SERVICES

S. No.	Perception on poor supply and management of water	Perception on the roles and responsibilities in the water sector	Perception on people's roles and responsibilities	Possibility of a PPP as a result of awami tanks	Can water be traded as a good?
01.	Has been persisting historically.	Piped water supply should be procured.	For awami tanks people should acquire water through discipline.	Difficult option.	People are poor. They can not pay.
02.	Has been persisting historically.	Piped water supply should be procured.	People are cooperative.	Difficult option.	People are poor. They can only pay in dire circumstances.
03.	As it is a poor area, nobody cares.	Now there is relief due to Rangers. It works. But if this is commercially done the people will face problems.	People are cooperative.	Not possible.	Not possible.
04.	Administrative inefficiency.	Rangers are the best option. Pipeline water supply should also be regulated through Rangers.	Through contribution the community repair the line, but the results are zero.	Not possible.	Not possible.
05.	Contract system and political group is responsible for its working.	Rangers performance is good. Pipe line supply should also be given to the Rangers.	People are co-operative.	Many cause profiteering.	Through other agencies.
06.	Because of shortage of water in the area.	Flexibility by KWSB/WSD will improve the service.	Should care about cleanliness and co-operative behaviour.	PPP will improve the situation.	Enterprise will not be possible.
07.	Agencies did not pay any attention towards the repair of pipe lines.	Pipe water supply should improve the situation.	Money saver system for poor.	For improvement PPP is essential.	Not possible.
08.	It is good but not a permanent solution for the problem. KWSB/WSD responsible for poor water supply.	Efficient water supply, maintenance and repair are responsibilities of water board.	Awareness of people is very good.	The system is possible.	Not possible through the Awami tank system.

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S. No.	Perception on poor supply and management of water	Perception on the roles and responsibilities in the water sector	Perception on people's roles and responsibilities	Possibility of a PPP as a result of awami tanks	Can water be traded as a good?
09.	Honest people will improve the situation. KWSB/WSD responsible.	Honest and responsible people will improve the situation.	The people should have to be co-operative and wait for their delivery.	The system is possible.	The system is still a business.
10.	Administrative responsibility.	Availability of water should be ensured, so that the system will work.	The people should have to be co-operative and wait for their delivery.	The system is possible.	Water supply is still a business.
11.	KWSB/WSD inefficiency.	Role of KWSB/WSD is negative.	People are cooperative but are not satisfied by the working of Awami tank.	Not awarded.	Through PPP it is possible.
12.	KWSB/WSD inefficiency.	Along with Rangers KWSB/WSD should also boast its efficiency.	People are cooperative.	Not possible.	Commercial trend will improve the efficiency.
13.	Because of the political reason, supply is affected.	The departments should maintain the Awami tank system.	People are cooperative.	PPP is possible.	After privatisation it will change its shape towards business.
14.	Lack of cooperative behaviour and poor community are the main constraints.	Rangers efficiency is running good.	People are cooperative.	PPP is possible.	Through privatisation it is possible.
15.	Distance between *awami* tank and the settlement will create the problem.	Public participation should be ensured.	Community should think about timing and work cooperatively.	PPP is possible.	Through privatisation it is possible.
16.	Administrative inefficiency.	Timing is important for the working of the system.	Community is co-operative.	Not possible.	Private sector made water a business.
17.	Administrative inefficiency.	Rangers is the best option.	Community is eager for the working of the system.	Not possible.	Not possible.

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S. No.	Perception on poor supply and management of water	Perception on the roles and responsibilities in the water sector	Perception on people's roles and responsibilities	Possibility of a PPP as a result of awami tanks	Can water be traded as a good?
18.	Administrative inefficiency.	Rangers is the best option. Water board should give security about pipeline water supply.	Sometimes shortage of water creates problems. Availability should be ensured on daily basis.	On daily basis PPP is possible.	Presently, water is traded in low income areas.
19.	Administrative inefficiency.	KWSB/WSD does not feel its responsibility.	Community is co-operative.	PPP is not possible.	Presently, water is traded in low income areas.
20.	Administrative inefficiency.	Availability should be made proper.	Availability is good, there are no problems regarding people.	PPP is not possible.	Presently, water is traded in low income areas.
21.	Administrative inefficiency.	Supply should be improved.	Community is co-operative.	PPP is not possible.	Not possible.
22.	Administrative inefficiency.	KWSB/WSD and Ranger should feel their responsibility.	The people have a cooperative nature.	PPP is not possible.	Not possible.

6.3.5 Stakeholders Responses to Awami Tanks Service

In the second phase of work, stakeholders, response was directly acquired. In all seven categories of stakeholders were contacted. The summary of responses are outlined below.

(a) Area Residents

Area residents comprised this category. The residents were not satisfied with the quantity of water supplied since it could hardly cater to the drinking water need. They were also not satisfied receiving water twice a week as an average. Since the number of residents was rising, this frequency of supply was found to be much below the desired level. It was a matter of growing concern among the residents that they had to pay a substantial amount for obtaining water tankers for substandard water which could not be used for drinking. The piped network was available in some of the households but the supply was non-existing. Thus in any case people had to resort to a combination of *awami* tanks (for obtaining drinking water which was not available through any other source) and tankers from illegal hydrants.

The quality of water, however, was found to be satisfactory since no other source was observed to be providing drinkable water to the residents. There was a great deal of inconvenience faced by the residents due to unpredictable timings of supply which was found to coincide mostly at late night and early morning hours.

- Consumers were satisfied with the free delivery of water.
- Less than required quantity of supply was a concern.
- Awami tanks were considered as a temporary alternative. Piped supply was the ultimate aspiration.

According to the user's feedback in some cases, lack of a proper management system for acquiring and distributing water from the *awami* tanks caused a great deal of confusion and even quarrels (Table 6.4). As the water tanker would arrive, people would flock to the site creating problems in acquiring water in an organized manner. However in places where a locality elder or a small community organization was handling the matter, situation was found to be reasonable.

A substantial advantage of the water supplied through the *awami* tanks, which was reported by the area residents, was the fact that water from the *awami* tanks was free of cost (Table 6.2). No payment of any sort was made to any of the stakeholders. Thus the residents found the option as largely suitable to their socio-economic status.

Places where people were organized normally undertook the operation and maintenance on their own. It was regarded as their own asset. On the contrary, places where the people did not consider the *awami* tanks as their common asset gave rise to poor maintenance and swift decay. Besides, the users also reported the damage done to the streets and lane, due to intense movement of heavy trucks. People considered this to be a major handicap and side effect of the supply to *awami* tanks (Table 6.4).

Locational advantage was noticed by the residents. Households situated in the close proximity of *awami* tanks benefited more by the *awami* tanks than the faraway options. They could arrange for more trips to and from the *awami* tanks. However places which were higher in terrain or at a farther end had to bear the disadvantage (Table 6.5).

The role of Rangers in the supply was found to be largely efficient. Rangers have been able to streamline the distribution of water to *awami* tanks on a continuing basis. Their monitoring and control of the tanker operators has been instrumental in bringing discipline to the overall process of supply. With a few exceptions, where the role of Rangers was criticized for serving a few selected households, their role has been positive in the functioning of *awami* tanks. The local organisations were highly critical of the absence of any role extended by the *Nazims* (Mayor)/*Naib Nazims* (Deputy Mayor)/Councillors. Some of them however were of the view that *Nazim*/Councillors should not be involved in the water distribution process because their involvement will cause political interference with various rival groups in the area (Table 6.5).

In some places where the system of *awami* tanks has been operational for a few years, improvements in the level of service have also been experienced. For instance, in some locations in Sector-11½, Orangi, the supply frequency in some areas has improved. Registration of some *awami* tanks by Rangers Authorities and a marginal rise in the level of water in Hub Source were cited as the reasons for this improvement. Local organizations were concerned over the fact that tanks built by the government are ill-maintained since the people do not own these structures. They only repair them when it is extremely urgent (Table 6.5).

For instance in Gulshan-e-Zia, one *awami* tank supplies water twice a week per household. Each time the quantity is 10-12 canister loads (150-180 litres). If one considers the daily supply per capita per day at family size of 06 members, the value comes to 8.6 litres. The minimum standard developed by Water and Sanitation Programme is 63 litres per capita per day. Thus the supplied amount was one-seventh of what was ordinarily required.

Absence of organisation or caretaker along some sites was another worth noting factor. The places where any kind of organisation was available to look after the distribution, the overall performance of *awami* tank including the frequency of supply was better than others. Even in otherwise heterogeneous communities, such as Raees Amrohvi Colony, the presence of a care taker was of use. In this community, Christians, Punjabis and Pathans were the users who wished to have separate access to drinking water due to their cultural orientations. Due to the presence of a caretaker, the organization worked reasonably well.

(b) Local Councilors/*Nazims* (Mayor)/*Naib Nazims* (Deputy Mayor)

The elected representatives did not possess the jurisdiction to affect water supply in their official capacity. Neither Rangers nor KWSB/WSD had any institutional obligation towards them. They were however of the view that since water was a core developmental issue, therefore their inclusion in the process was extremely vital. The elected representatives were skeptical of the role of Rangers who, according to them, exercised nepotism in the allocation of water tankers to the various areas. They also criticized the governments lack of initiative for not devolving KWSB/WSD to the local level which would have caused a great deal of change. However local councilors/*nazims* did not enjoy enough trust of their communities who almost unanimously agreed that the councilors/*nazims* should not have any director executive role in water supply through *awami* tanks. In sum, the elected representatives have yet to prove their usefulness, both to the people and authorities responsible for supply.

(c) Local Politicians

Generally referring, the local politicians were skeptical of *awami* tanks utility. They were of the view that the overall system of water supply should be improved by rehabilitating the piped supply system and also increasing the quantity. People have to maintain the overall system of *awami* tanks themselves without any outside support. In their view, the overall water supply position has sharply deteriorated due to rising number of people. The local politicians viewed with concern the performance of Rangers. They criticized them for being irregular and not even just in their treatment to different user groups.

A point made by the politicians was regarding the poor planning and faulty execution of the major water supply works carried out in these locations. The consideration of a large reservoir on a hill top in Orangi was done with an objective to supply water to the adjoining areas through gravity flow. However the reservoir itself required to be filled through pumping devices which were difficult to run due to shortage/rupture of electricity. Besides the quantities of water needed to fill the said tank was not available in Orangi. Thus this massive investment of Rs. 140 million could not generate the desired results.

The politicians assigned greater importance to the revival and strengthening of the piped water supply system. They considered the *awami* tanks as a very interim solution with no potentials of long term sustenance.

(d) KWSB/WSD Staff

The KWSB/WSD staff was found not keenly involved with the process of water supply to the *awami* tanks. It had several reasons. The KWSB/WSD was not comfortable with the takeover of hydrant affairs by the Rangers. It was considered as an intrusion in their working authority. While KWSB/WSD extended support in the identification of locations for *awami* tanks, it did not take initiatives to expand its role beyond the bare minimum required. The supply of water to *awami* tanks was an entirely humanitarian effort which had a limited scope at least in the near future. Therefore KWSB/WSD did not assign any importance to this operation. A sizable number of users were defaulters of KWSB/WSD water bills. KWSB/WSD was not prepared to extend any further assistance than the bare minimum possible.

(e) Pakistan Rangers

Local commander and his staff participated in this discussion. Initially the task of supply through tankers was assigned to KWSB/WSD, but this department could not run it successfully. This assignment was transfered to Pakistan Rangers. To deal with the issue, Pakistan Rangers with the help of Army, constructed 105 community tanks of 6000-10000 gallons capacity in different localities including Orangi Town. Due to this facility, locals of the area started getting fresh and sweet water close to their residences through community water tanks.

Major part of these areas comprised of *katchi abadies* (squatter settlements). More than 60 percent of population/areas were without proper infrastructure of water supply lines. Some facts found by the Rangers are mentioned as under:

- Frequency of supply: 2200 tankers of 1200 gallons capacity are delivered on daily basis.
- Quantity of water made available at a time: 2.64 MGD.
- Hours (night and day time delivery): 18 hours (from 0600 hours to 2200 hours).
- Management of *awami* tank: Rangers in coordination with Town *Nazim*, Union Council (small sub-neighbourhood) *Nazims* and Councillors.
- Money/financial contribution for water purchase: This scheme is funded by Pakistan Rangers.
- Operation and maintenance of the tanks: Pakistan Rangers/Councillors.

Role of Rangers in the supply to *awami* tanks included organising the functioning/operation of hydrants and monitoring the distribution of water tankers in assigned area through Rangers deployed in area. Suggestions for improvement in the performance of *awami* tanks included distribution of water tanker through elected members of the area and enhance water supply hours. KWSB/WSD must ensure supply through properly maintained infrastructure of water supply lines. *Awami* tanks are considered a temporary solution to give a timely respite to general public.

(f) Local Community Organizations

The local organizations accepted the temporary utility of *awami* tanks in the absence of piped water supply. These organisations, which also included such mosque committees that managed *awami* tanks, were concerned about the low quantities of water supplied to *awami* tanks. Despite the fact that the routine operation and maintenance was done by the area resident/local organization, the governmental agencies have been adamant in not increasing the quota of water supply to *awami* tanks. Thus the people only resorted to *awami* tanks in situation of dire need only. They demanded the supply through the piped system in the eventual setup.

It was found that these committees, and the public spirited members and office bearers of such organizations, took up the responsibility of follow up of water supply to the *awami* tanks. They had various tasks to perform. Follow up with the Rangers to send the tankers on time, operation and maintenance of *awami* tanks, management of distribution and the related chores are all performed by these committee members. It was obvious that the system was functioning due to the continuous efforts of the *mohalla* committee members. However these committees were largely informal and at times possessed no formal organizational structure. However their role was vital in assessing the overall supply situation in the area.

The local organizations considered *awami* tanks as a temporary solution. The ultimate hope was to acquire piped water supply at a certain time in future. This aspiration had evolved due to the overall background of urban living which most of the residents possessed. Carrying water manually from any location was viewed as a sign of under development and could only be accommodated as a make shift arrangement. There was an absolute consensus of respondents from all the localities that they wanted to have only piped supply as the final option.

(g) Tanker Operators

- Various alternative modes of supply existed in Orangi. Water tankers and donkey cart operators were a few categories.
- Awami tank supply was found useful for drinking and cooking as the water quality was comparatively better.

Awami tanks were constructed by Rangers and other stakeholders in Orangi several years ago. These tanks were built mostly in such areas where water supply situation was very poor. The tankers supplied water to the *awami* tanks under a contractual arrangement with Rangers. The supply was made at the rate of Rs. 300 for 1200 gallons tanker, 450 for 2400 and Rs. 700 for 3600 gallons vehicle. These rates were the same for tanker supply for other localities. It was usually tough to work in these areas. People often get very hostile towards the tanker staff. The supply slips were received from the Rangers staff deputed at the hydrants. The supply was made according to slips received.

No payment was received from the area residents. All the payments were made by the Rangers on a periodic basis. Some tankers obtained water from Sakran, a location at the border of Sindh and Balochistan provinces. The water was taken out through tube well from underground. This water was saline in nature. This hydrant was illegal in nature. Water tankers were sold to households, construction sites and commercial buildings. Its rate was less than the water supplied from KWSB/WSD hydrants. The tankers were regularly harrassed by police. They had to pay a small share of the price charged for the tanker. Residents acquired tankers according to the size of their underground water tanks. Usually 1200 gallons tankers were in demand. These tankers cost Rs. 200/- and are supplied on cash payment basis from Sakran source. Such tankers did not supply to *awami* tanks as that was done by the contracted water tankers through Rangers supervision. According to the supply system worked out by the Rangers/government agencies, the rates of supply through the officially designated hydrants were fixed as follows:

1200 gallons water load	Rs. 250.00 (USD 4.5 approx.)
2400 gallons water load	Rs. 450.00 (USD 7.5 approx.)
3600 gallons water load	Rs. 700.00 (USD 12 approx.)
6000 gallons water load	Rs. 1100.00 (USD 19 approx.)

These loads were applicable for those individuals and communities that wished to purchase these tankers through the Rangers. However since the tanker contractors were associated with Rangers to serve compulsory demands for which they were paid a fixed rate by the government, they had very little possibility to sell sweet water on commercial terms.

The saline water which was obtained from the informal water hydrants such as Sakran was sold at a slightly low price. However, the average price remained as follows:

1200 gallons water load	Rs. 200.00 (USD 3.00 approx.)
2400 gallons water load	Rs. 300.00 (USD 4.00 approx.)
3600 gallons water load	Rs. 500.00 (USD 6.00 approx.)

This price was almost three times the billing cost of water fixed by KWSB/WSD, that was Rs. 73 per 1000 gallons. Therefore the area residents found it very difficult to purchase water, being low-income communities.

6.4 Issues in Water Supply through Awami Tanks

The overall status of work supply has been found below satisfactory level. Orangi Town is situated in western Karachi. Its main source of water supply was Hub River which went dry around 1996-97. Although the attempts were made to connect it to the main stream Indus source which supplied water to the rest of the city, they were not enough. The tail end settlements continued to receive only negligible water supply. The government undertook several developments pertinent to these shortcomings of the area. Water supply pipelines were laid down in these areas to help receive adequate water. They became worn out because of inavailability of adequate water. The physical conditions of most of such pipes required repair before they could be utilized. The government also built a 100,000 gallons water reservoir in Ghaziabad. The tank was built by KWSB/WSD and the connection of supply was obtained from the Hub River source. However, as the source itself had dried out, the water reservoir did not function. For all practical purposes, the tail end settlements that included Gulshan-e-Zia, Ghaziabad, Mansoor Nagar, Gulshan-e-Bihar, Rais Amrohi Colony and Frontier Colony faced acute scarcity of water with almost no piped supply. Whatever little supply come was entirely insufficient for the total use.

6.4.1 Overall Shortage

The overall shortage of water was an issue commonly found in all the localities studied. This shortage was caused due to several reasons. Much of the study area was linked to the Hub River source, as mentioned earlier. As Hub was entirely dependent upon rainfall which was not adequate during the recent past, it went almost dry. Besides, when the water level rose and the water was released into the pipelines, the water was greatly lost in the way because most of the pipelines had been broken down due to their inoperational status and lack of maintenance. Thus the water supply could not function effectively. Similarly places which were at the tail end did not receive water as it was stolen on the way through illegal connections. Absence of adequate pumping facilities was also a reason commonly reported and observed in the study.

6.4.2 High Price of Vended Water

Water vending in Orangi and other locations was taking place at two levels; through Rangers regulated KWSB/WSD hydrant or through informal hydrants. Transportation of water was facilitated through the tankers. People therefore obtained water from two sources in these areas – drinking water from the *awami* tanks while they purchase water from commercial water tankers from the informal sources. This water expenditure is about Rs. 600-700 per month on the average.

From this situation it was obvious that the governmental input for water supply is totally inadequate and unreliable. The residents have to spend a sizable amount on the purchase of water for daily use activities other than drinking. Water from *awami* tanks, provided at no cost, cater to the need of drinking.

6.4.3 Low Quantity

Overall water supply, both from the pipe lines (wherever present) and *awami* tanks, were in extremely low quantities. Wherever water supply was undertaken through lines, its duration of supply did not exceed 15-30 minutes. This supply, was at the frequency of once in ten days on an average. Elsewhere it was either less or simply non-existing. Similarly the overall frequency of supply from the *awami* tanks was much low. The quantity of water and scale of scarcity also depended upon the number of households per *awami* tanks obtaining water at a time. The quantity obviously decreased when the households per tank were high in number. This measure led to the distrust among the users about the usefulness of *awami* tanks as a mechanism.

6.4.4 Poor Quality

Water obtained from informal sources was obtained through various illegal boreholes made by water entrepreneurs. Hydrant at Sakran is an example. The water so obtained was either brackish or saline and certainly not fit for drinking. Due to inavailability of options, the area residents purchased these tankers for all the other uses except drinking. Thus daily chores such as bathing, washing and even cooking were done in this water. Due to its high salt contents, the water caused skin and other kind of diseases which were spreading fast. Besides in situations where *awami* tanks provided inadequate water, the residents were sometimes forced to drink saline water which was found to be injurious to health.

6.4.5 Physical Condition of *Awami* Tanks

The physical conditions of most of the *awami* tanks was found to be below satisfactory level. Several common problems were identified. Leakage from the *awami* tanks was common. In some cases the leakage was sizable but since the water was distributed immediately after its arrival, therefore the storage time was reduced leaving a limited possibility of leakage. Similarly several tanks had been designed and executed without following the basic principles of construction. Such tanks showed general state of dilapidation and decay.

6.4.6 Performance of *Awami* Tanks

There are several aspects that need to be reviewed regarding the performance of *awami* tanks. In terms of timings of supply from the hydrants to the *awami* tanks, the performance was below satisfactory because the timings were not at all fixed. The water tanker would arrive at any time even during the early morning or late night hours. This caused a great deal of inconvenience to people since they had to wait for a significant period of time and also adjust their routines and immediate domestic chores according to the supply timings of water. This caused a considerable inconvenience because people got late to their places of work after attending to their water supply needs. Also it added to the fatigue. During supply in the night, the women folk were not able to obtain water due to restrictions on their mobility during night times. The overall quantities of water obtained from the *awami* tanks each time was rather meager. It has been found that the water quantities available did not exceed 10-12 canister loads or 200 litres per household. This water quantity was divided over a period varying from two days to seven days in different locations. In either case, this quantity was barely able to even contribute to the drinking water need. The related chores of cooking and even washing daily use utensils could not be carried out. In places where the supply frequency was unpredictable, people used commercially obtained saline water for drinking which caused severe health hazards.

Awami tanks were often located at a distance. The area residents had improvised small-scale carts to manually push the water filled in tin or plastic containers. However the amount of fatigue was rather enormous. For instance if a household possessed three containers then it had to make three to four trips to transport 10-12 canister loads of water. It also included the labour of filling and loading the containers from the tanks and inside the household – all fairly labour intensive chores. For this reason many households only utilised the option of *awami* tank under dire circumstances. The *awami* tanks were augmented by commercial tankers. Under no circumstances did the *awami* tanks constitute a complete option. They could only be utilized when supply of water from other sources fulfilled the household requirements other than drinking, and in some cases cooking.

6.4.7 Possibility of Upgrading *Awami* Tanks

A vast majority of respondents were in favour of improving the overall performance of *awami* tanks by addressing their existing problems. The commonly cited measure of upgradation was either building a larger sized *awami* tank in the area or increasing the existing capacity of the tank and connecting them to a piped network leading to houses. It was also stressed that the frequency of supply should be increased at least to a daily basis. There was a consensus among all the residents that *awami* tanks were not a permanent solution and therefore required to be considered as a temporary measure only to meet the emergency needs of the residents.

6.5 *Awami* Tanks as an Alternative

Interface with the research questions (section 3.4) and guiding hypothesis (section 3.3) is done in this description. It can be concluded that *awami* tanks were fulfilling the most important need of drinking water supply to all the locations where they were built while water vendors of different types provided water for other uses that was not fit for drinking under any circumstances. Thus wherever *awami* tanks were built, the potable water from the KWSB/WSD hydrants was made available to the residents. In other words, *awami* tanks were contributing towards the overall public health of the area residents to a reasonable extent.

People generally regarded water as an economic (tradable) good. This observation was based on their perception of vending which was a key source of supply to the households. The area residents of Orangi Town, perceived the service of *awami* tanks as a temporary measure. They were not regarded as a permanent solution even in the most water deficient pockets. Perception of a water supply service remained that of an underground piped system. Despite the fact that such pipes have been laid down in almost all the localities and that due to overall scarcity of water, these pipes were not performing at all, the popular perception remained. Another fact was that the *awami* tanks were constructed as an experimental solution to ongoing problems – atleast according to people's perception. People

- While acquiring service from informal sources of vending, people have to pay more than corresponding formal service.
- Awami tanks offered a limited relief in terms of quantities.
- Quality of water from awami tanks was acceptable for drinking and other domestic uses.
- Awami tanks needed repairs and renovation in several cases.
- Frequency of supply was unpredictable due to heavy load on hydrants.
- Awami tanks were perceived as a temporary solution since piped supply was the main aspiration.
- Nazims and councilors were indifferent as they did not have control on supply system.

considered the real problem as the inavailability of water, corruption, mismanagement and misplaced distribution priorities.

In the localities served by awami tanks, the residents did not possess many options to subscribe to any combination of water supply. An overall shortage of water, lack of possibility to supply through piped means and remote location in the context of the city were the reasons in this respect. As awami tanks were facilitated by the government agencies (Rangers + WSD), it was considered as an important example of supply in situations where WSD could not fulfil its responsibilities of extending piped service.

With a very few exceptions, the area residents were satisfied with the management and monitoring of Rangers. There were several factors that have helped build up this image. Rangers were an outside agency with apparently no specific stakes in the local affairs. Thus, it was believed, that they treated all the area residents uniformly without prejudices. Previously, distribution of water from the hydrants was greatly influenced by local and city level political groups. It gave rise to favoritism on the basis of political affiliations in the process of service provision. Such people who were against a certain powerful group were made to suffer. Rangers were able to control it. Besides Rangers, with their military clout, were also able to control the performance of water tanker operators/tankers and streamline the charges which were totally arbitrary during the initial stage. They were also able to check the KWSB/WSD's employees who were not performing their duties of hydrant management.

Due to the operation/movement of tankers – both KWSB/WSD and private commercial, the roads and streets have been greatly damaged. The tankers are heavy vehicles with additional loads of water. Roads in Orangi, in most of the cases, have not been properly developed. Thus due to frequent movement of these heavy vehicles, they got damaged. Besides at the level of streets and lanes, the sewerage manholes and their covers were sometimes located at the edge of the street sides. As they were at or slightly above the surface level, they got damaged due to the movement of these vehicles. Thus it added to the overall urban management cost of the area.

The *awami* tanks that were built by the government through Rangers were lying in a greater dilapidated state. Area residents and communities did not own these tanks. They expected that the government would look after their operation and upkeep. Thus, since the government did not have enough funds to look after these infrastructure components, they were left to their fate. It also happened that when the condition of an *awami* tank deteriorated to a great extent, it was abandoned (see photographs).

In another situation, such tanks in which area residents had to contribute, people looked after the tanks to an optimum level. The reason remained that people had an obligation to oversee the performance of an investment that was made by themselves.

The *Nazims* and Councillors were largely indifferent to the process of water supply through the *awami* tanks. With very few exceptions where *Nazims* have been able to support the repair, maintenance and even construction of some tanks, the overall input of *Nazims* and Councillors was not existing. Besides, since the *Nazims* and Councillors belong to strong political groups, people do not want *Nazims* and Councillors to be involved in the process.

Piped system, which has been laid down in the area during various programmes and eras, had become completely dilapidated. Non utilization for many years, lack of maintenance and limited age of performance were the main reasons. In some cases uneven settlement pattern and soil anomalies also caused damages to the piped system. Continuing scarcity had also contributed in the dilapidation of the piped system. It was not found to provide any supply service at present. Besides, the piped system had been destroyed beyond repairs in many cases.

People desired to have bigger sized *awami* tanks because in their perception with limited quantity of tanker water, it was not possible to supply continuously to the households.

Inappropriate timings of supply caused a great deal of anxiety among the residents. The people had to keep awake late in the night causing hardship for young men going to work, or children going to schools. Besides, in some locations, it also caused problems of security.

Gulshan-e-Zia, Orangi Town: Information and view points being obtained from the stakeholders.

Awami Tank no. 13 in Orangi Town where people have gathered to collect water.

Awami Tank No. 20 in Orangi Town, where people are satisfied with performance.

Orangi Town: External view of awami tank no. 110/A.

Sector 11½, Orangi Town; view of tank

Orangi Town: Internal view of tank no. 3

View of Tank no. 13: A young girl filling water

Orangi Town: Area residents moving out to obtain water from Awami Tanks.

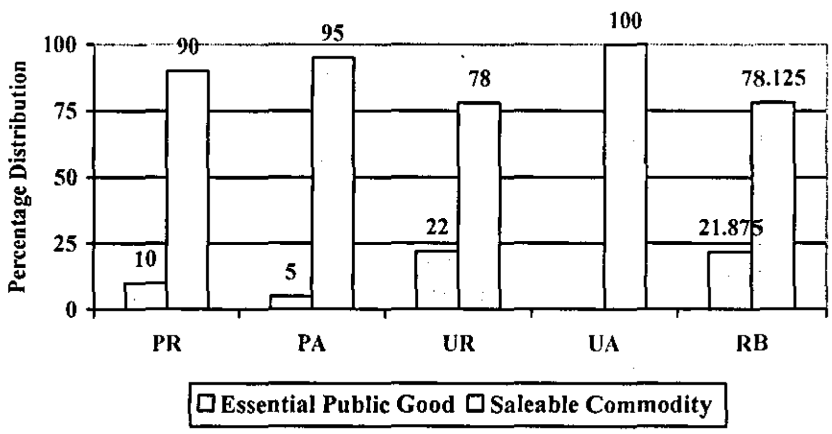
7. ALTERNATIVE WATER SUPPLY ARRANGEMENTS – A CROSS CASE ANALYSIS

This chapter presents the analysis of the findings drawn from the case studies of municipal water supply to planned and unplanned settlements, retail beneficiaries of bulk water supply and awami tanks. This cross case analysis shall address the research questions outlined in Figure 3.2.

The analysis is based on the quantitative findings presented in Chapter 4 and 5. The areas covered in these cases had a piped supply service already existing with varying level of performance. Thus a cross case analysis was possible to be carried out based on common grounds. Multiple bar diagrams are developed to depict the findings of the data. The case of awami tanks did not possess a functioning piped water service. However since it existed as a distinct water supply arrangement, it was included in the research with fact findings done on a descriptive premise. These findings are analysed in Chapter-6.

7.1 Status

Figure-7.1
Status



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

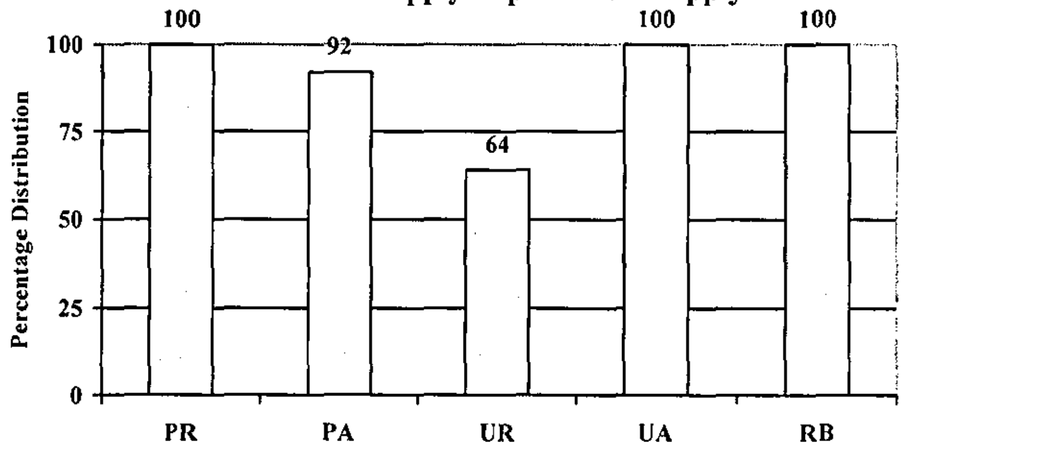
Water was essentially considered as a public good by all the categories of residents (Figure 7.1). However the statistics reflect a variation in the percentages. A sizable majority of respondents in planned settlements (PR) including retail beneficiaries of bulk supply (RB) considered it as a public good without any dispute. The reason that led to this response included the piped accessibility of supply for which daily payments were not made. Only in locations where water was augmented through tanker supply gave this indication to people of its linkage with money/payment for its service. The same also applied for apartments in informal settlements. The sample belonged to areas close to Lyari where people largely depended on the government for provision of essential service. Some of the residents of other *katchi abadis* considered water as a saleable good due to the day to day payments made for various available options in the respective cases.

The respondents were also asked to give reasons for their reply. Those who considered water as an essential public good had several reasons. Essential need of water for human survival; water as nature's divine gift to mankind; right of people to have access to some minimum quantities of this divine gift to mankind; right of people to have access to some minimum quantities of supply and Islamic belief that water should not be traded for profit were some observations given by respondents. Those respondents who considered water as a saleable commodity also cited several reasons for it. Need to charge to offset the expenditures incurred on the supply; maintaining the system (which requires finances); financing the institutional expenditures and subsidizing for the poor by more the others in an appropriate manner were the common observations. In both the categories of respondents, it was agreed that water supply can not be considered as a profit making enterprise. Whenever deemed as a profit making enterprise, it must be regulated.

7.2 Mode of Water Supply

Figure-7.2

Mode of Water Supply: Piped Water Supply



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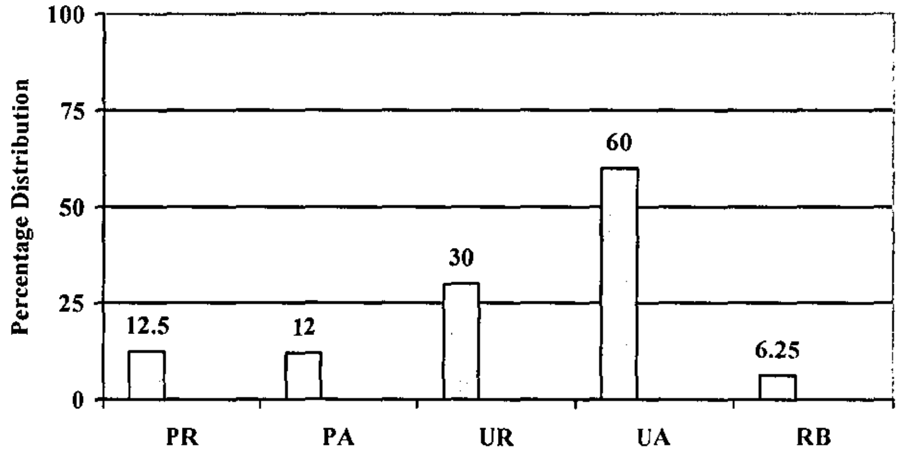
Access to piped water supply network was found to be optimum. A sizable number of surveyed households were connected to piped water supply (Figure 7.2). Field observations and discussion with the area residents however revealed more information. Planned settlements had a uniform procedure of acquiring water connection. This was done at the time of construction of house. In the case of areas covered by bulk supply, the house owners were advised to apply for a water connection after the construction of the house was completed. Upon completion of the formalities, the concerned authority would allow connection to the individual house. At the time of development of the scheme, the residents would apply for the connection and obtained it after payment of dues. In unplanned settlements, water supply schemes were initiated by various concerned institutions such as Sindh Katchi Abadies Authority, Karachi Metropolitan Corporation, municipal councillors and even through donor funded projects. In some cases, people had informally laid down the pipes connected to the nearby main. However availability of a formal or informal connection was not a guarantee to the availability of supply and that too in required quantity.

Figure-7.3
Mode of Water Supply: Boreholes



PR: Planned – Single Unit Residences **PA:** Planned – Apartments
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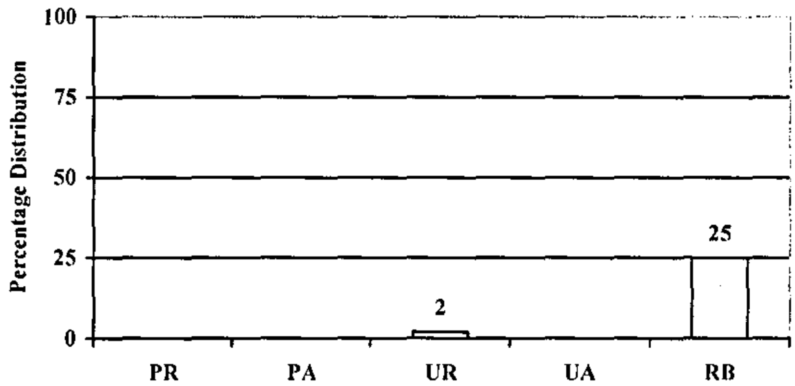
Water supply through boreholes was found to be a sizable mode (Figure 7.3). Boreholes were basically the tube wells which were sunk in the ground to draw ground water for consumption. Spot checks and the views of the residents clearly revealed that the quality of water was undrinkable with the exception of instances reported by very few households. However under conditions of scarcity of water, the water from these sources was used for other purposes such as house cleaning, washing, and other similar tasks. The digging of wells was done by private contractors who were well versed in their tasks. The single unit residence owners would undertake this work on their own while in the case of apartments, the apartments unions undertook this task. This mode was found to be sufficiently prevailing in planned and unplanned single unit residences. In planned areas, it was found that in some locations, it was used as an alternative to the piped mode of supply. Places where the water supply was reported to be uneven/irregular, or the quantity of piped supply was below the desired level, the residents resorted to boreholes. Very few boreholes were reported in the areas covered by bulk water supply. The reason was that the quality of ground water was highly brackish and unfit for any kind of domestic consumption. Few households reported to experiment the boreholes but abandoned them upon finding the water as unusable. Two of the locations namely Defence Housing Authority and Lalazar were in close proximity of the sea. Therefore it was found that due to an apparent percolation of sea water in the sub soil/ground strata, the quality may have been rendered unusable. In the case of unplanned areas, the dependence on alternative modes was obviously found to be high. Among the various alternatives available, boreholes were found to be a mode which could be controlled by the users. However the issue pertinent to quality of water was also valid. In the apartments in unplanned areas, the water supply for non-drinking uses largely came from boring sources. People resorted to other modes including piped supply for drinking water purposes.

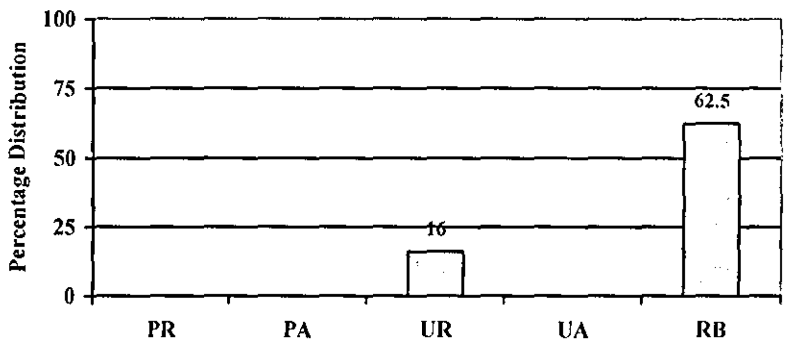
Figure-7.4
Mode of Water Supply: KWSB/WSD Tankers



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The KWSB/WSD now owns very few tankers of its own (Figure 7.4). These tankers were used to provide water to locations on emergency basis. Therefore the sample showed that in only unplanned single unit residences, a very small fraction reported the supply from KWSB/WSD tankers. It was however reported by the retail beneficiaries of bulk water supply that the concerned land owning and management agency provided tanker supply through tankers owned and operated by itself. DHA and KPT owned some tankers and provided supplies in cases of dire needs. However since the volume of demand was very high and the fleet owned by the concerned authority was small therefore this service grossly fell short of the requirements.

Figure-7.5
Mode of Water Supply: Commercial Water Tanker

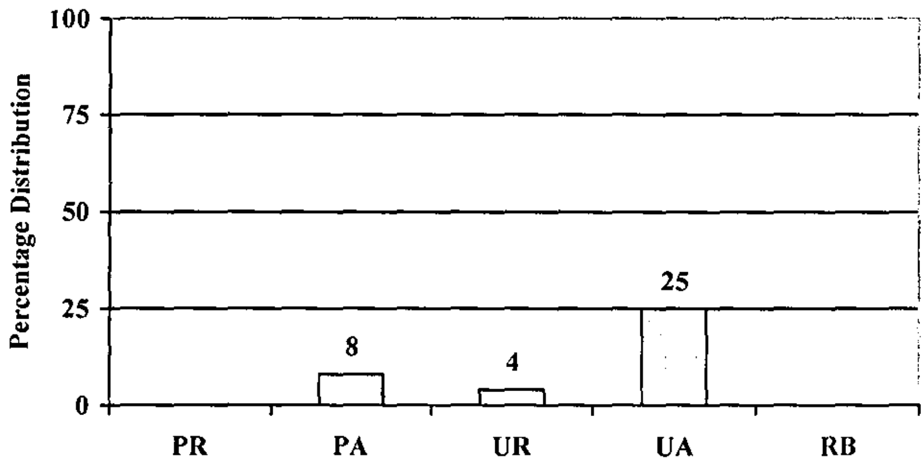


PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single Unit Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The commercial tankers were the tankers plied by commercial contractors and obtained water from KWSB/WSD controlled hydrants (Figure 7.5). The residents in unplanned residential settlements reported it as a mode of water supply. This was due to the reason that the residences in other locations did not consider commercial tankers as a routine supply mode. It was cited as an alternative normally used for emergency when the routine service would not operate at its optimum. The retail beneficiaries of bulk water supply in DHA and Lalazar areas had to heavily rely on commercial water tankers. The overall piped supply frequency and quantity were found to be much below the desired level. Also since most of these households belonged to upper class groups, they had a substantially high water consumption level. Thus the dependence on commercial water tankers was considerably high.

Figure-7.6

Mode of Water Supply: Manual Water Carrier



PR: Planned – Single Unit Residences
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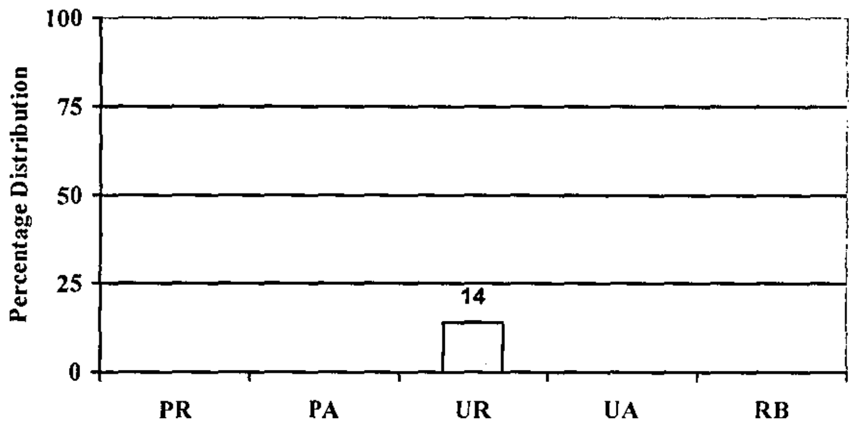
RB: Retail Beneficiaries of Bulk Supply

Manual water carrier was another mode of supply that existed historically in the older settlements of Karachi. Later it was found in other parts of the city depending upon the need and availability of options. In apartments in planned settlements it was found in few locations. This mode usually augmented for drinking water since several decades as reported by the residents in focused group meetings. The apartments in unplanned locations had to depend on these modes due to a number of reasons. In some cases, the quality of water was reported as in appropriate for drinking purpose. In some cases, the internal distribution system within the building was found to be deficient. Observations also revealed that the overhead tank was not properly serviced through water pumping motor due to frequent power fluctuations and breakdowns. Besides since the apartment welfare associations were not found to be existing in these type of complexes, the households had to resort to their own individual water service.

Figure-7.7
Mode of Water Supply: Other Modes



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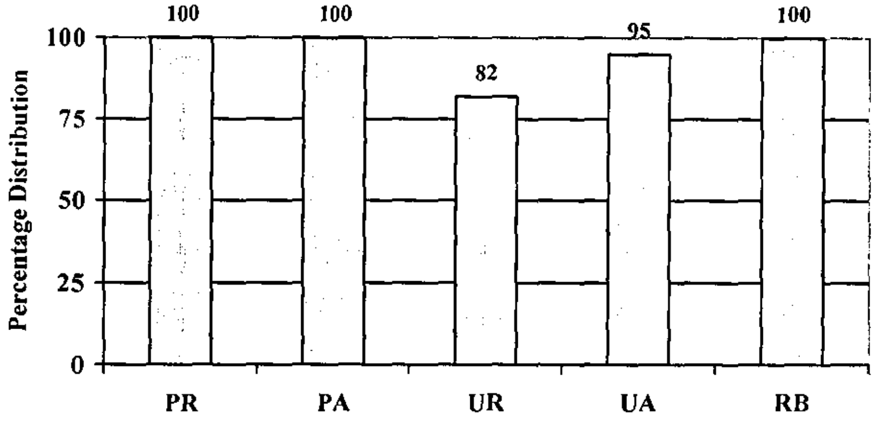
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The modes other than those conventionally cited had some existence in single unit residences in unplanned areas (Figure 7.7). When added upon with focused group meetings it was found that these modes were found in Bengali Para, Korangi, Orangi Town and Nusrat Bhutto Colony. In Orangi, Suzuki pickup trucks sold water to prospective households through a main tank fitted in it. In the other locations, water was supplied through the donkey carts. These donkey carts filled water from broken water mains from the nearby planned localities. Bengali Para was a relatively new settlement. It had to acquire water from vending arrangements only. Orangi Town had piped connections. However usual scarcity made the people use such vending options.

7.3 Factors Affecting Water Supply

The analysis of the factors affecting water supply through a cross case analysis is in follow up of the research design outlined in Chapter-3. In Figures 3.1-3.3 that describe research questions and logical framework, the study of these factors is very clearly identified. In the framework, the findings and analysis pertinent to factors of supply correspond to the 'what' type research question.

Figure-7.8
Factors Affecting Water Supply:
Legal Status of House/Settlement



PR: Planned – Single Unit Residences
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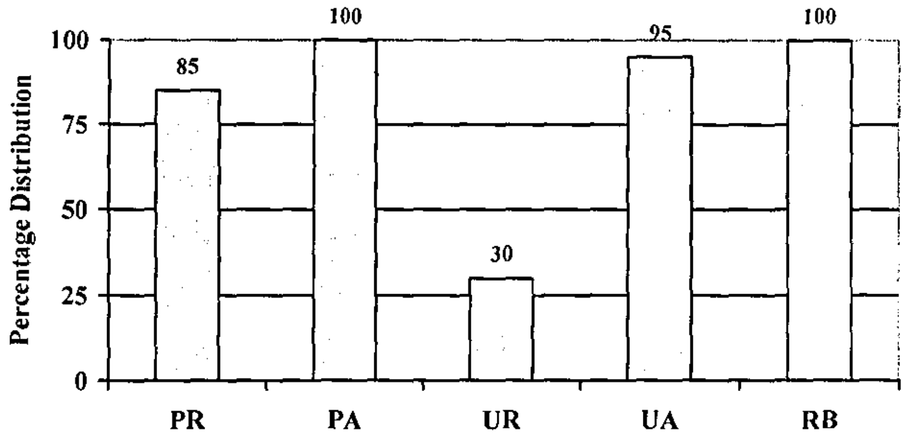
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The respondents in both planned and unplanned settlements as well as bulk consumer areas were of the view that the legal status greatly affected the water supply (Figure 7.8). The legality of the house provided the residents with the basic rights to access the piped water supply. In planned settlements and bulk consumers, this meant the completion of all the formalities of leasing and other ownership documents. In unplanned settlements it meant the regularization of *katchi abadi* with respect to the concerned statutes. Once regularized, investments by the government agencies could become possible in the area. In the chosen sample, all the settlements were of regularized status except Bengali Para. It was for this reason that it had no piped supply and had to entirely rely on vending options.

Figure-7.9
Factors Affecting Water Supply:
Legal Status of Water Supply



PR: Planned – Single Unit Residences
PA: Planned – Apartments
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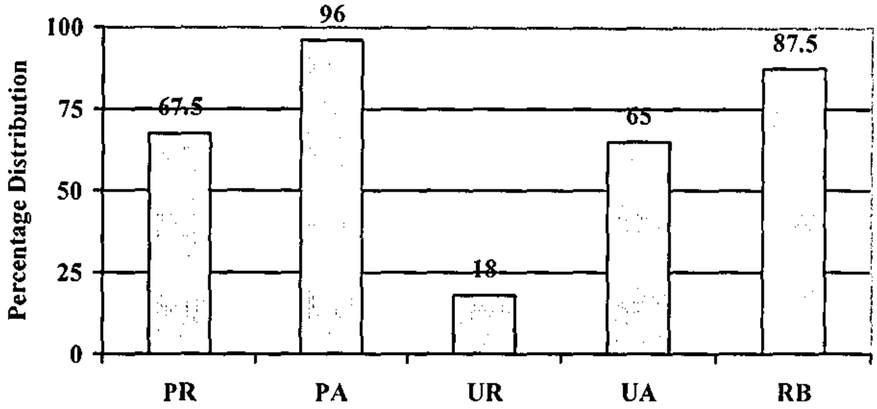
RB: Retail Beneficiaries of Bulk Supply

It is interesting to observe that with the exception of residents in unplanned settlements, the other consumers considered legal status of water supply as an important factor that influenced the service (Figure 7.9). This aspect coincided with the fact that these categories of consumers largely accessed water from the piped sources – controlled and operated by the water utility. Since the only legally valid option of supply was through the utility, either through piped water supply or water tankers, it was obvious to refer this aspect as the only legally valid option. In unplanned settlements, the mode of supply varied and depended largely upon the locational characteristics. Water was even acquired from informal means. For this reason, the residents did not consider it as a factor that could affect water supply.

Figure-7.10
Factors Affecting Water Supply:
Reliability of Supply

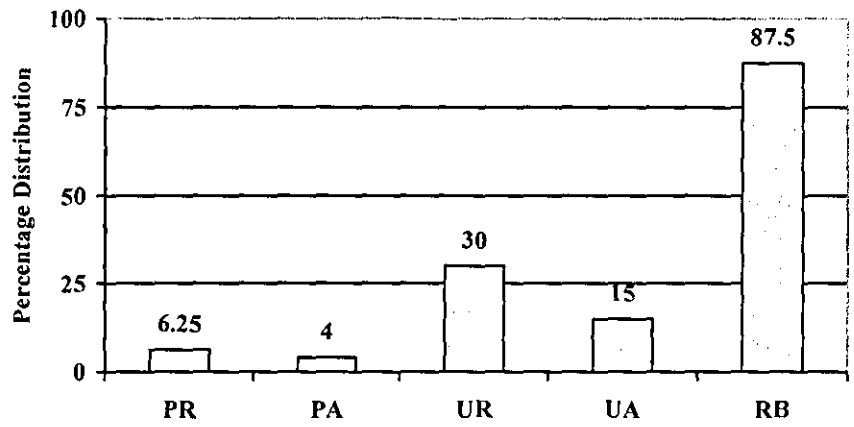


PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single Unit Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Reliability of supply was considered as an important factor by the residents of apartments in planned and unplanned settlements as well as single unit residences in planned areas (Figure 7.10). The factor of reliability was perceived to affect water supply. During discussions in the focus groups in the localities, it was found that reliability was normally perceived as uninterrupted supply in the desired quantities and frequency. In other words, uninterrupted supply was a factor perceived to affect the water supply status. This factor, however, comprised several aspects which were not governed by the intra-locality factors such as the network of pipes or household level storage. Availability of water at the city/neighborhood scale and its distribution priorities in different locations in the jurisdiction of utility close to that neighborhood also affected the nature of supply to a specific area. The city scale supply was found to change due to overall shortage, breakdowns or the performance variations observed by the staff who had a direct impact on reliability (for instance the role of valve men/KWSB/WSD staff). Many neighbourhoods served by bulk consumers often had poor levels of service due to a variety of reasons. Poor and dilapidated pipe network, limited quota of water supply, thefts and internal mismanagement of water were a few issues that have been frequently found in locations such as Defence Housing Authority and Lalazar. The residents in the unplanned settlement did not consider the reliability of supply from the utility as an important factor. The main reason behind this position was that they received water supply from various sources not necessarily piped. The reliability of piped supply or otherwise did not bother them in several ways.

Figure-7.11

Factors Affecting Water Supply: Quantity of Supply

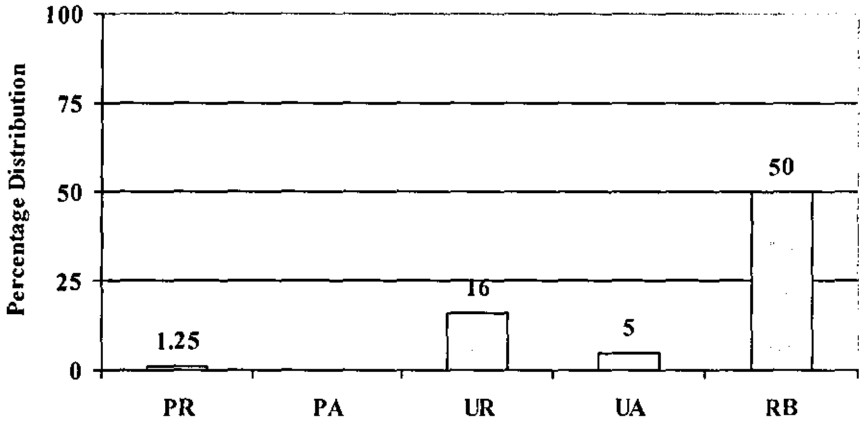


PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The quantity of supply was cited as a factor affecting supply by a sizable number of residents in unplanned settlements as well as apartment dwellers in unplanned settlements (Figure 7.11). The reason was that these locations had to rely on boring and tanker supply in addition to piped water. The net quantity of water, in view of unplanned settlement dwellers, was an important factor. The scarcity of water from one source and the concurrent need to resort to the other source was perceived as an important aspect of water supply procedures. The residents in planned areas perceived that they did not get reasonable quantities of water for their consumption. Quantitative information related to water consumption in individual households could not be ascertained as there was neither water meters at the consumers door steps nor the meter installed at the supply conduit. Quantity however made an important variable to judge the level of service in places where the supply was reported to be precarious. Retail beneficiaries of bulk consumers are an example. Planned areas were, however, better in receiving a satisfactory quantities of supply compared to unplanned locations.

Figure-7.12

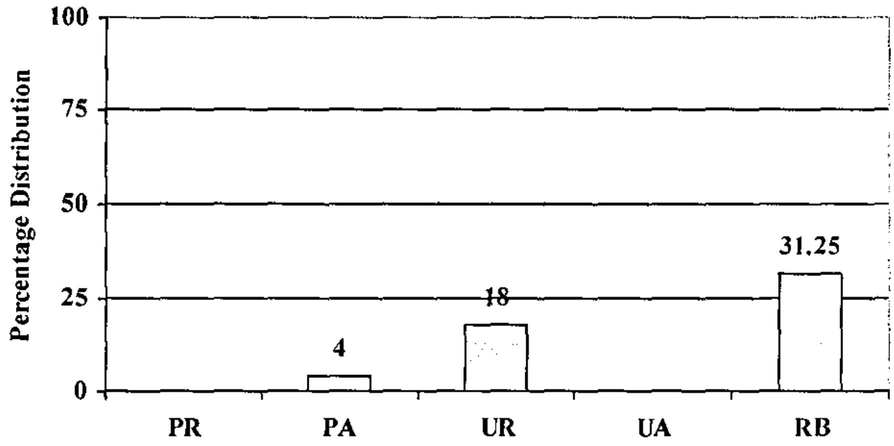
Factors Affecting Water Supply: Access to Supply



PR:	Planned – Single Unit Residences	**PA:**	Planned – Apartments
UR:	Unplanned – Single Unit Residences	**UA:**	Unplanned – Apartments
RB:	Retail Beneficiaries of Bulk Supply		

Access to supply was judged with reference to all the modes of supply (Figure 7.12). This variable was not perceived as an important factor because the residents of both planned and unplanned locations had access to service of some kind, piped or otherwise. Some residents of unplanned settlements cited concern because even the vending sources posed a problem of accessibility. In locations served by bulk consumers, the quota of water supply, thefts and internal mismanagement of water were a few issues that have been frequently found in locations such as Defence Housing Authority and Lalazar. That is to say that not always the vending sources were accessible to them. Since vending at small scale itself was dependent on various factors such as the availability of ground water for on-ward supply; opportunities to draw water from the broken mains or the possibility of acquiring water tankers from designated hydrants. This made the reason for some respondents to cite access to supply as an influencing factor.

Figure-7.13
Factors Affecting Water Supply: Other Factors



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

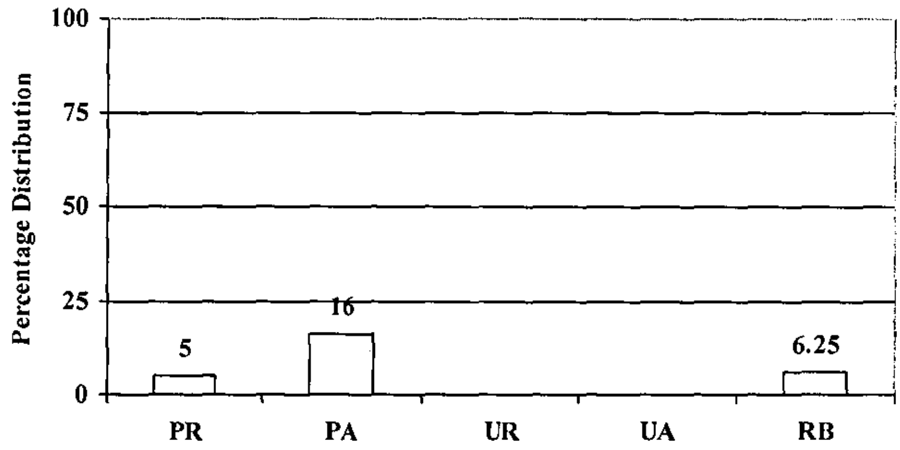
In the survey, some other factors were also highlighted by residents in planned area apartments and unplanned area single unit residents (Figure 7.13). Some people in Bengali Para, Korangi were of the view that water is not in short supply – it has to be procured after search and effort. Pipe lines in the areas were either broken or outdated. Thus despite the supply released, it did not reach the real needy. It was reported as a desperate situation. In apartments in planned areas, the residents were concerned about the declining O & M standards. The water pipelines were laid several years ago which were never repaired. Thus due to rising pressure of population density and other reasons, the pipelines were found to be damaged. Thus in this situation, the supply was likely to be affected by this defect even if the water was available at the source. This also reflected upon the condition of water supply infrastructure which was found to be devoid of any operation and maintenance over the period of time, as mentioned in literature review. Retail beneficiaries of bulk consumers cited that the back door relationships with concerned officials helped some residents to acquire more water.

7.4 Frequency of Water Supply

The cross case analysis with reference to frequency of water supply evolves from the research design explained in Figures 3.1-3.1 in Chapter-3. It addresses the 'what' type question as mentioned in the logical framework.

Figure-7.14

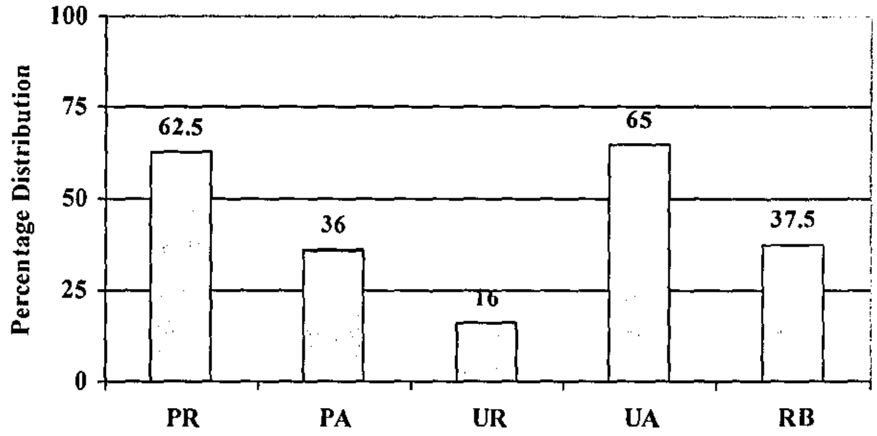
Frequency of Water Supply - 24 Hours



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The near ideal water supply for 24 hours was extremely limited and may have had varying reasons for its existence in the small portion of the sample that reported it (Figure 7.14). As discussed earlier, the synchronization of different stages of water supply have had a reason for it. If water from the source was received at a regular frequency – daily or alternate day – the capacity of houses to store was adequate to provide water uninterrupted to the end consumer at the tap. However, given this configurations a small portion of residences and apartments in planned settlements had a 24 hour water supply.

Figure-7.15
Frequency of Supply: Daily Supply



PR: Planned – Single Unit Residences
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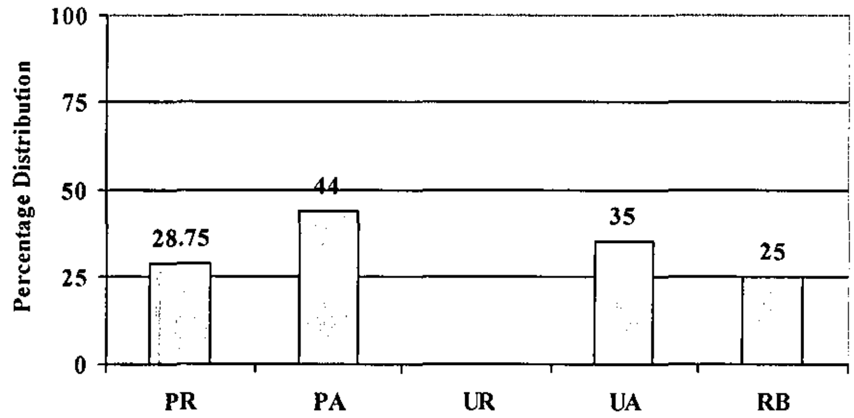
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

In the same manner, the water was received daily by a sizable number of households in both planned and unplanned locations (Figure 7.15). In planned areas, the supply was provided daily to a sizable number of households in single unit residency. In planned area apartments this frequency is slightly higher. The reason could be the usage of such suction devices which could obtain water in excess quantities. The reason for daily supply in unplanned single unit residences and apartments was the limited capacity to store the water; limited quantity of supply during each interval and possibly nearness to the source/supply. In the case of apartments in unplanned settlements, the dependence on piped and borehole supply could be a possible reason. The frequency of supply in Steel Town and Gulshan-e-Hadeed was better since the Steel Mills was near the main source of supply. The internal pipe network was also reported to be of satisfactory level.

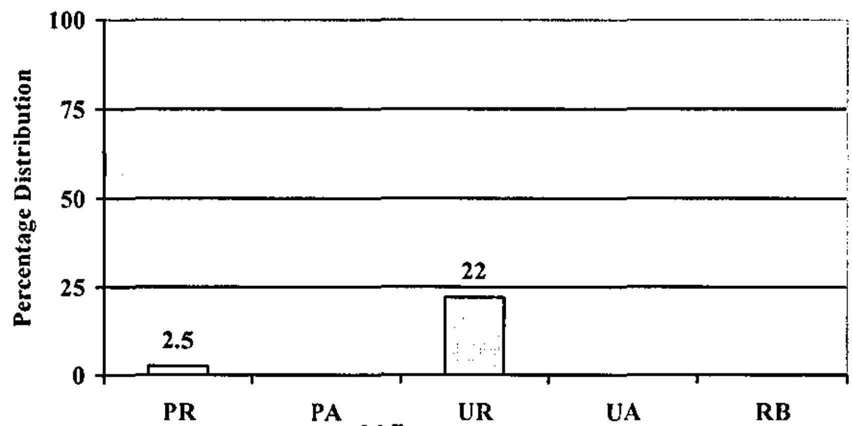
Figure-7.16
Frequency of Supply: Alternate Day



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

A substantial number of consumers, except residents in unplanned areas, receive supply on alternate day (Figure 7.16). For the planned and bulk consumer (DHA and Lalazar) areas, it was a supply management option which has been worked out by the water utility. This is based on the logic that supply of this magnitude can be sufficient to be stored in the underground tanks of the users. This also evolves from the fact that the utilities do not have adequate quantity of water to be supplied daily to all of its connected residents. In apartments in unplanned locations, the same factor applies. Water is obtained through piped supply and boreholes. Care is normally taken not to over draw water from boreholes than the appropriate quantities.

Figure-7.17
Frequency of Supply: Twice a Week



The supply frequency in unplanned locations was found to be dismal (Figure 7.17). Those locations which were linked up to any kind of piped supply received it once or twice a week. In some cases, this was due to tail end locations of these settlements such as Orangi. Old and dilapidated infrastructure was the other cause where supply was disrupted due to inappropriate piping system. The low priority and poor management of supply was another common barrier.

Figure-7.18
Frequency of Supply: Once a Week

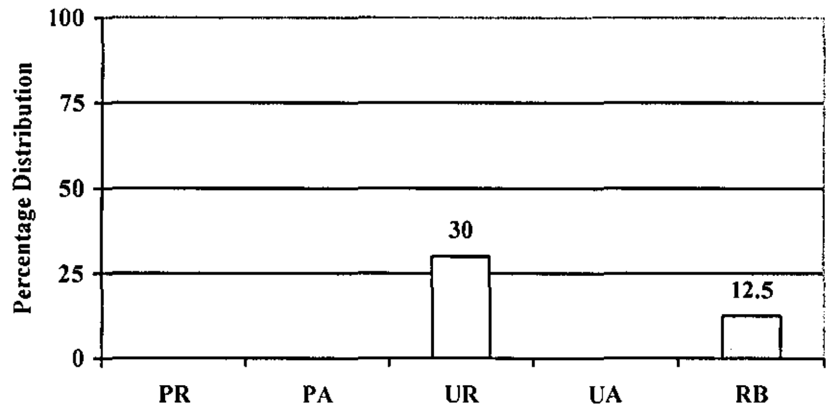
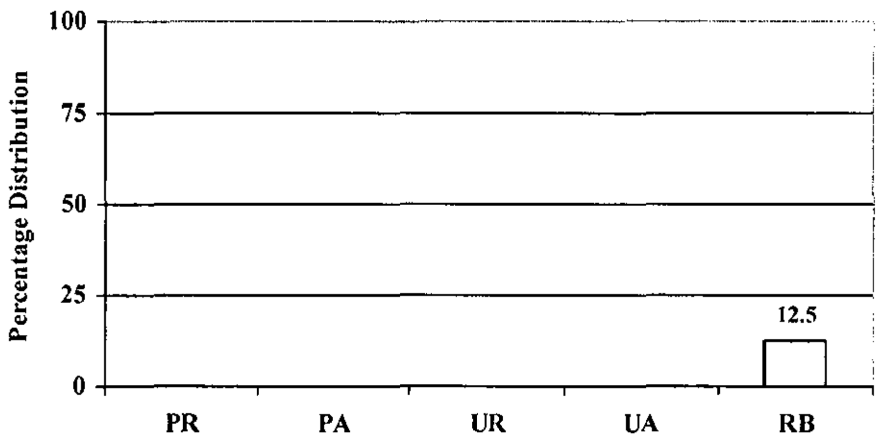
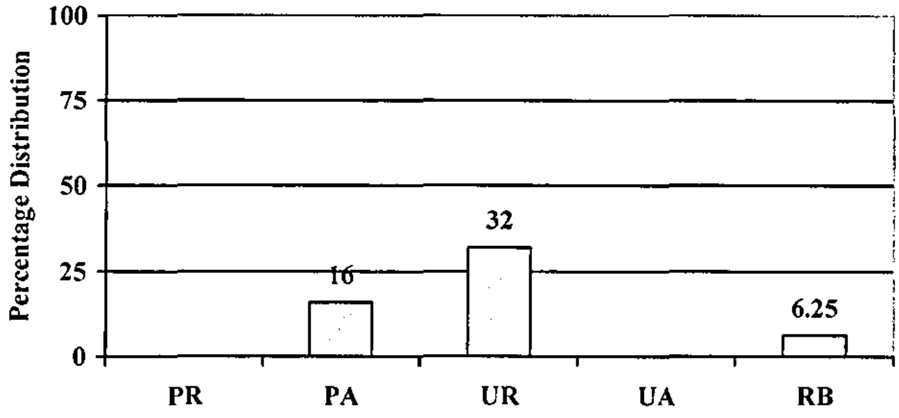


Figure-7.19
Frequency of Supply: Less Than Once a Week



PR:	Planned – Single Unit Residences	**PA:**	Planned – Apartments
UR:	Unplanned – Single Unit Residences	**UA:**	Unplanned – Apartments
RB:	Retail Beneficiaries of Bulk Supply		

Figure-7.20
Frequency of Water Supply: Other Measures of Frequency



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Several responses were recorded which came from the residents of single unit residents in unplanned areas and apartment dwellers in planned areas (Figures 7.18-7.20). In Bengali Para, Korangi, the residents were of the unanimous view that the water supply pipelines did not exist in the locality. Few respondents in Orangi Town reported that due to non existence of water supply lines altogether, there was no piped water supply since 1990. Some residents of Nusrat Bhutto Colony mentioned the topographical peculiarity of the settlement. They were of the concern that due to hilly terrain, the piped water supply was not able to reach the houses, when ever pumped. Apartment dwellers in some of planned areas complained that they did not receive piped supply at all. Reasons for each observation were different. The Bengali Para settlement was not leased and therefore non regularized. It was obviously not earmarked for developmental works. Thus no pipe line could be laid down. Similarly Orangi also had anomalies in water supply infrastructure. Tail end settlements such as Nusrat Bhutto Colony usually experienced weak frequency and flow since the water is already drawn away during the path of its flow. Observations showed that places where suction pumps were installed too close to one another in adjoining apartment projects, they experienced shortage or absence of supply.

7.5 Adequacy of Supply

The cross case analysis with reference to adequacy of supply is in correspondence to the logical framework (Figure 3.3) embedded in the research design. The outcome of this analysis addresses the main research question as to why consumers try to access alternative water supply arrangements.

Figure-7.21
Adequacy of Water Supply:
Adequate for Domestic Use

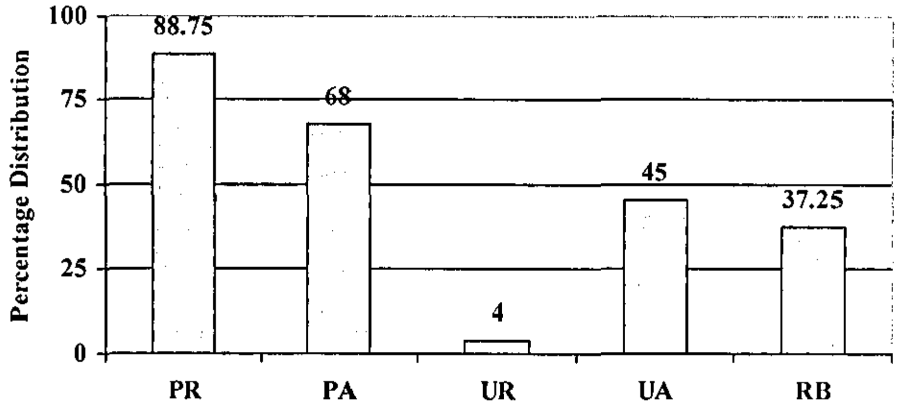
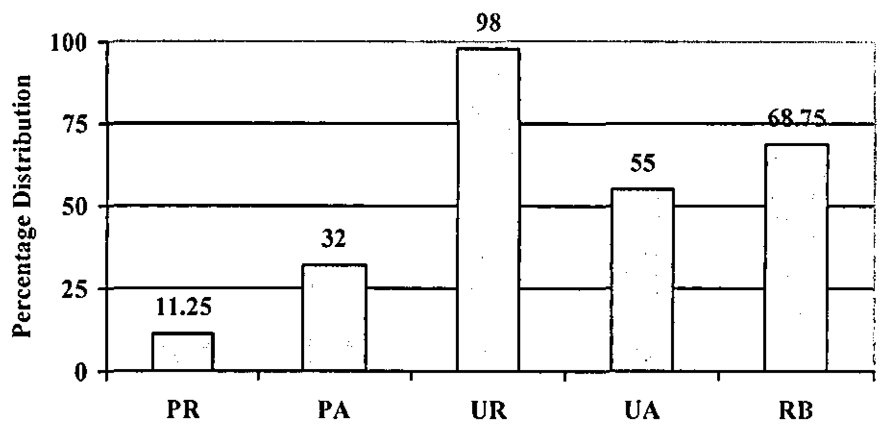


Figure-7.22
Frequency of Supply:
Not Adequate for Domestic Use



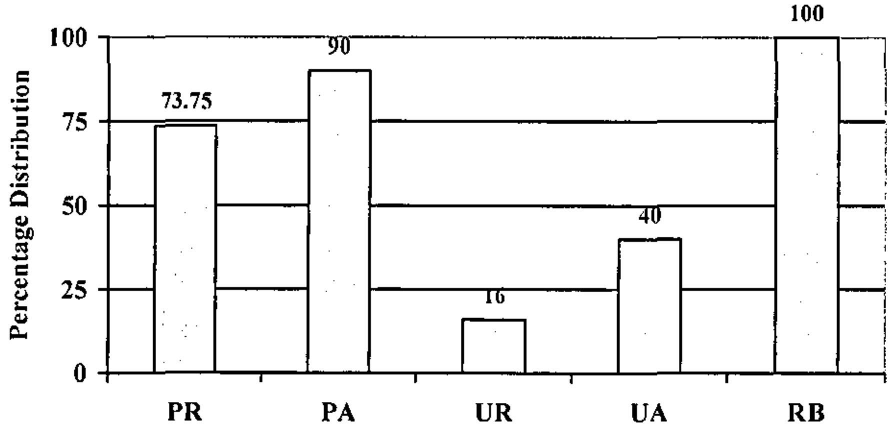
PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single Unit Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The adequacy of water for domestic use must be viewed from the contextual characteristics of each category of settlement/housing (Figures 7.21-7.22). It may also be taken into account that the response to adequacy was based on the respondents individual perception and view point. It could not be based on any quantitative information because it simply did not exist. The supply of water data as well as consumption information was all adjusted according to generalization and approximation. Water utility even billed its consumers on the premise that atleast it has extended its piped water supply component to the residents/domestic users. A substantial proportion of households in planned settlements found the supply as adequate. The obvious reason was that the amount of water obtained through the piped source – and its manipulation through suction pumps – apparently fulfilled their demand to a considerable extent. Even in situations where alternatives such as boring or tanker supply were approached, the desired quantities of water were acquired from the arrangement. The apartment dwellers in planned locations demonstrated a slightly different scenario. There were about one third residents who did not consider the supply as adequate. There were several reasons for this understanding. As the internal occupancy status of apartments was different from one another, therefore the perception also varied, the household sizes were found to be between 2-21 people. Obviously the consumption would be different. Besides, due to problems in the status of legality and administrative reasons, few apartment projects had to experience disconnection of service. Since there were several internal factors involved in the supply, storage, pumping and connections within the apartment projects, the possibility of inadequate supply has been appropriately mentioned. Areas close to the Steel Mills reported an adequate supply due to the fact that the water was managed locally without any outside hindrance of water utility. Residents in other localities such a DHA and Lalazar found the supply as deficient for reasons already outlined earlier in sections 7.3 and 7.4.

The residents of the unplanned settlements did not consider the supply as adequate. As the information related to other variables showed that these consumers had to resort to more than one source to augment the water needs in daily domestic life. Considerable effort in terms of daily time and management input went into resolving this issue. However the overall available quantity of water supply from multiple sources remained short in comparison to the need. Apartment dwellers also considered the water supply arrangement as inadequate. The quantity of water supplied through pipes or any other means was short of the desired inputs. On the other hand, the management inputs needed to obtain water from the various available sources were also accounted for in this description. The water which was eventually obtained from these combination arrangements largely fell short of the actual demand in the designated territory/settlement.

7.6 Machinery and Equipment

Figure-7.23
Machinery and Equipment Related to Water Supply: Water Pumping Motor



PR: Planned – Single Unit Residences
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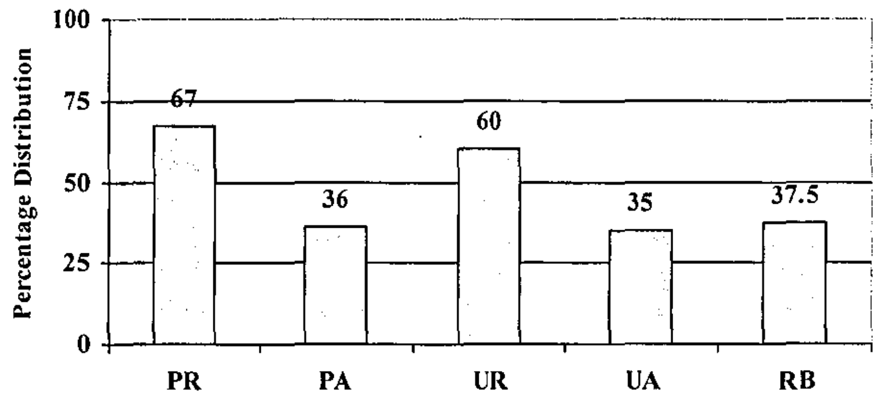
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The majority of households in planned and bulk consumer settlements reported the existence of water pumping motors (Figure 7.23). This device pumps up the water from underground to overhead tanks. In planned areas it was found in almost every house. However few respondents did not reveal its existence as it was placed close to the suction pump which is considered a clandestine activity. This device was essential for the function of normal plumbing mechanism in the houses. In apartments, it was reported at the apartment scale by all the respondents. Similarly in the case of unplanned settlements, the number was low. In several locations people used metal tanks due to scarcity or non availability of electricity. Therefore the pumping motors were less used. In apartments in unplanned settlements, the water motors were installed, however, the people perhaps did not report their existence. Two reasons were found for this state of affairs. Many apartment dwellers had connected their water motors to illegal connections of electricity. Therefore they did not discuss its existence in public. Besides some of the apartment owners had placed the water motors close to the suction pump. Therefore they hesitated in reporting its existence. However it is obvious that the existence of these devices was a near must in any multi-storeyed construction. Localities served by *awami tanks* also possessed these motors to pump up the saline water from the underground tank to overhead tank wherever electricity was available.

Figure-7.24
Machinery and Equipment Related to Water Supply: Suction Pump



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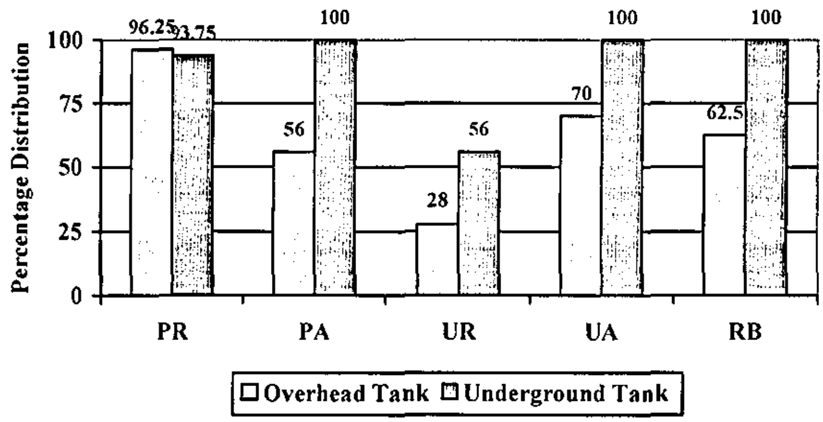
Suction pump is a device that is installed on the water supply connection (Figure 7.24). It sucks the available water, from the external pipe lines with great pressure inside the house in which it is installed. The residents of planned areas were candid about its installation and function. They were of the view that due to weak supply pressure and limited duration of supply, the underground tank cannot be properly filled unless it is linked up with a suction pump. According to them, even the KWSB/WSD staff was open to discuss the issue of suction pumps. They admitted that it was now being used by large number of households. In planned areas, people applied suction pumps almost as a common practice. It was due to the fact that their ownership was legal and that the reliance on piped water was substantial. It may also be seen that water need of different building types, income groups and localities was different. Therefore planned areas, represented in this sample, with better income groups had a higher percentage of the usage of suction pumps. Upper income areas in bulk consumer locations have also installed suction pumps. The apartment dwellers also resorted to the usage of suction pumps but did not reveal it. Connecting suction pump with illegally obtained electric connections was obviously the main reason behind it. In unplanned settlements, a sizable number of residents resorted to the usage of suction pumps. Weak pressure, short hours of supply and desperate need were some reasons for its application. In apartments of unplanned settlements, suction pumps were used in lesser numbers. The sewerage and water lines were close to each other. Thus there remained the technical problem that if potable water was pumped in, sewage may also enter. Thus these dwellers resorted to either manual water carriers or the neighbours.

Figure-7.25
Machinery and Equipment:
Overhead/Underground Tanks



PR: Planned – Single Unit Residences
PA: Planned – Apartments
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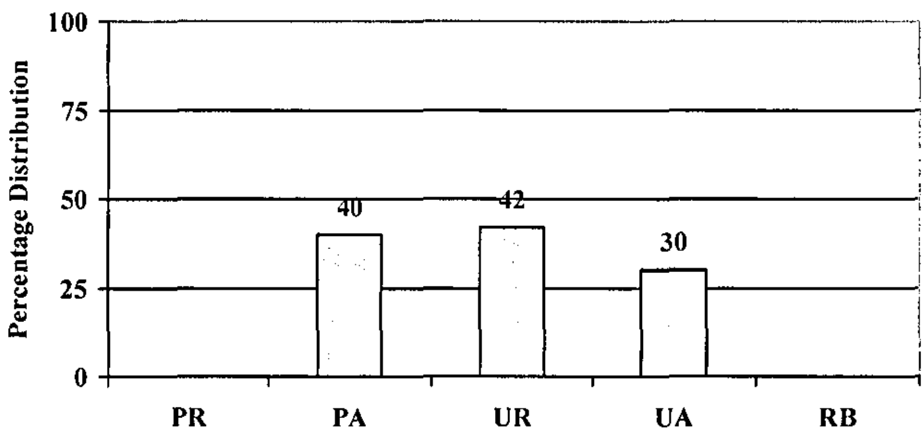
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Overhead tanks are an important component of in-house plumbing to facilitate water supply (Figure 7.25). Planned settlements obviously had it in substantial number – almost in every house or apartment block. It was obviously found in planned residences and apartments. People usually reported its existence. In unplanned localities, it varied. Places where electricity was universally available people have the choice of overhead tanks. It was also observed in the survey that a sizable number of surveyed households possessed overhead tanks.

The underground tanks were obviously reported in greater numbers than overhead tanks. The significance of underground tank was that they act as a mini reservoir of water inside the house. Almost every household tried to construct underground tank on priority. It existed in unplanned settlements also although the size and quality of construction varied. Normally an underground tank is made with a storage capacity of 6-7 days of water consumption. However no hard and fast rule was applied in the construction of underground tanks. In very poor localities people used other options such as fibre glass or metal tanks. However apartments in planned and unplanned areas showed the existence of underground tanks.

Figure-7.26
Machinery and Equipment:
Other Machinery and Equipment

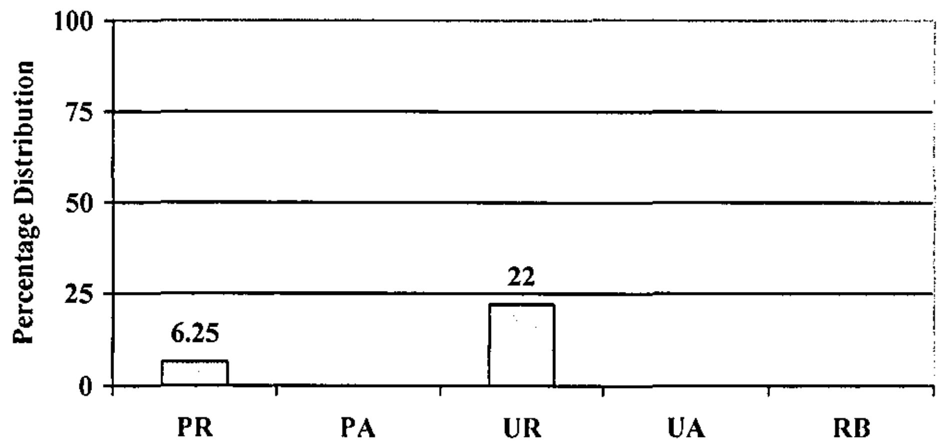


PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

The other normal devices and construction used by consumers varied tremendously (Figure 7.26). For instance, in unplanned areas consumers made special attempts towards acquisition and storage within available means due to the precarious situation of water supply. Installation of hand pumps, procuring and filling drums of fibre glass or metal, construction of small scale concrete tanks, jerry cans of plastic, earthenware pots etc were the commonly used articles in this respect. Consumers wanted to enhance their storage whenever the water would come down abundantly. This was again done to offset the fear of shortage and discontinuation of supply. In apartments, the residents took the same precautions. They made extra storage tanks inside the bathrooms to be used in cases of emergencies or break down in service. In planned settlements, the residents normally installed filtration devices to purify the water to some degree. However its use was not reported as being less conspicuous. The apartment dwellers in planned areas were found to be using the same strategy of extra metal tanks inside apartments to deal with any shortage during emergency situations.

7.7 Use of Alternative Arrangements

Figure-7.27
Reasons to Use Alternative Arrangement:
Absence of Piped Water Supply



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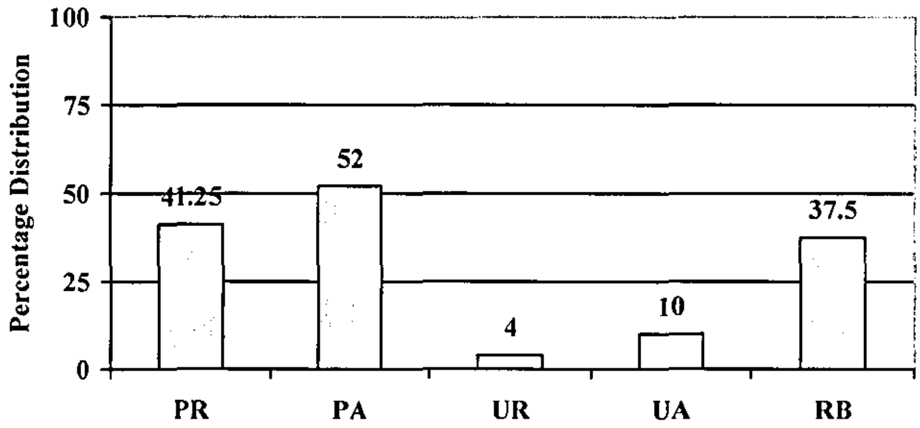
RB: Retail Beneficiaries of Bulk Supply

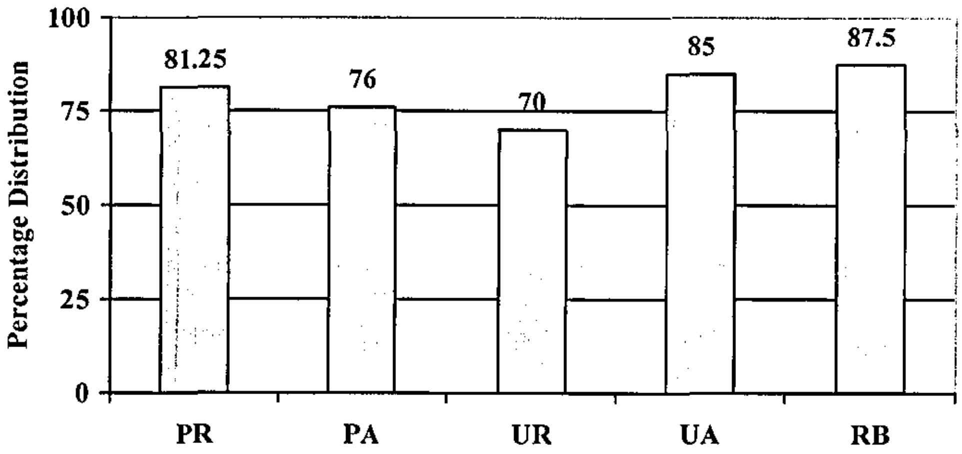
Among the reasons for using an alternative arrangement, absence of piped water supply was cited by some dwellers of unplanned settlements, such as Bengali Para in Korangi (Figure 7.27). So far they had no possibility of obtaining a piped connection without regularization of the tenure of their locality. Some residents in planned settlements also cited this issue. The reason was that despite the availability of piped connection water was not supplied through it.

Figure-7.28
Reasons to Use Alternative Arrangements: Disconnection of Service



Disconnection and/or discontinuation of service was obviously a major factor cited for resorting to use alternative arrangements (Figure 7.28). It was substantially found in planned settlements for different reasons. In some cases the service was discontinued due to an overall shortage or breakdown. Administrative disputes between water utility and consumers were also reasons in this regard. A sizable number of apartments reported this problem. However, it was found that several disputes evolved from this situation, mostly of administrative and financial aspects. This issue was not so much highlighted in unplanned areas as they were not entirely dependent on the distribution of piped water supply.

Figure-7.29
Reasons to Use Alternative Arrangements:
Supply of Less Quantity



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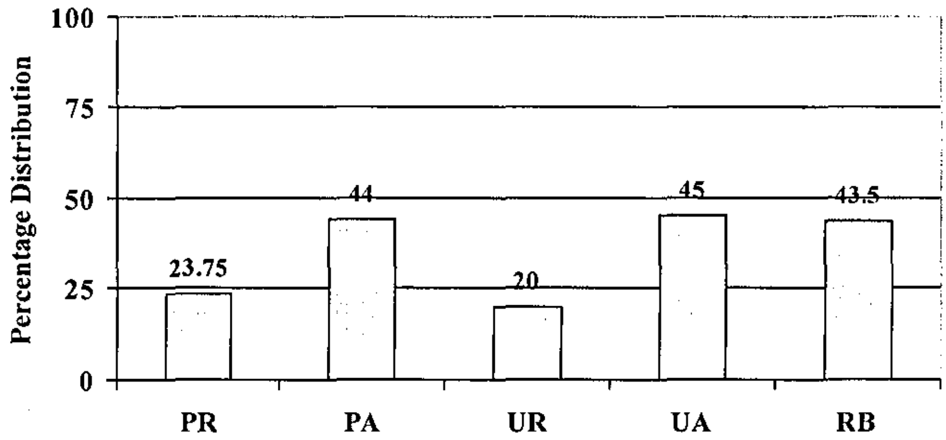
RB: Retail Beneficiaries of Bulk Supply

The fact that less quantity of water was supplied to consumers led to their resorting to alternative sources as the common denominator (Figure 7.29). Although the nature of response to this variable was very much similar, it must be kept into view that the perception of the quantities anticipated by each category of consumer was different. The planned bulk consumer based in high income area residents obviously had a greater consumption of water which was conventionally proportional to the size of plot on which the house was constructed as per KWSB/WSD prescription. The usage in apartments was slightly low, however, it also depended upon the covered area of the unit. Some water is also earmarked for communal usage in the case of apartments. The usage of water in unplanned settlements is less compared to planned areas however no quantitative data or study exists in this respect. It is an area where research may be conducted to fill the existing knowledge gap.

Figure-7.30
Reasons to Use Alternative Arrangements:
Supply of Poor Quality



PR: Planned – Single Unit Residences
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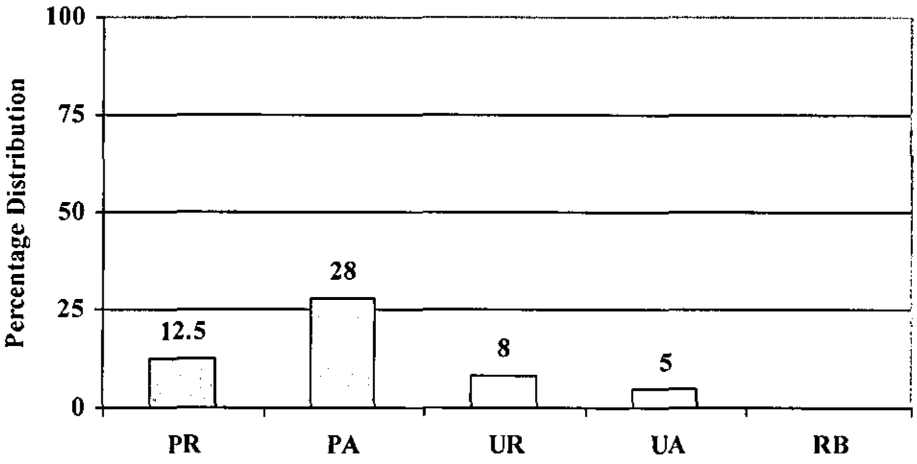
Quality of water also posed a reason for resorting to alternative means in some areas (Figure 7.30). In the apartments in Gulistan-e-Jauhar where piped water supply quantity was reported to be low from water utility source, the borehole water was supplied which was saline and not acceptable for drinking purposes. The people bought tankers and resorted to other forms of vending to augment for this important usage. The residences in planned and bulk consumer settlements also experienced the same problem at a lesser scale. The unplanned settlements where water was not of acceptable standards for domestic consumption due to salinity contents or mixing with impurities created a premise for usage from alternative sources. Apartments in unplanned settlements experience the same problem with greater intensity. It has been found through observations and various news reports that the water supply infrastructure in Lyari and adjoining areas was fairly dilapidated. Thus the piped supply got mixed with sewage which flows in proximity to water lines. Due to constant seepage and related problems, the consumers reported the mixing of water with sewage that gave rise to a demand for acceptable water in the end. Thus consumers were forced to resort to alternative sources.

Figure-7.31

Reasons to Use Alternative Arrangements: Other Reasons



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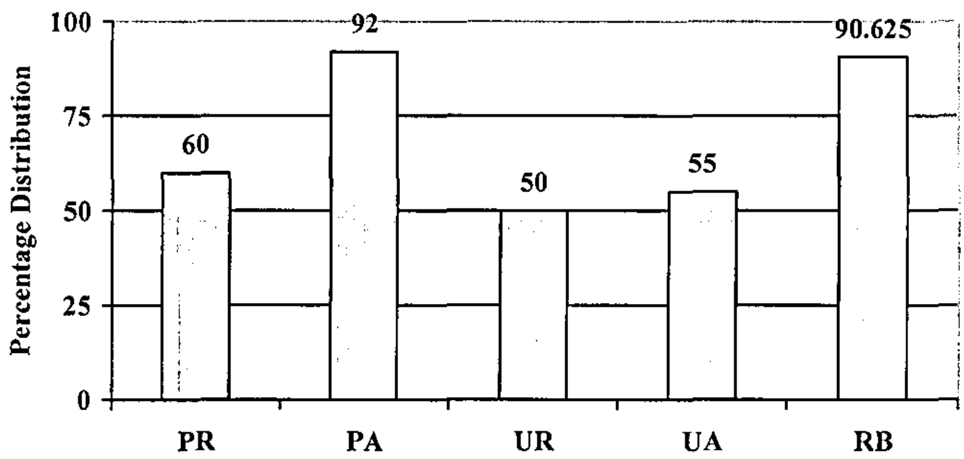
Many other factors were cited by the consumers to resort to alternative arrangements of water supply (Figure 7.31). In the case of unplanned settlements, a problem faced by the residents was the low pressure in supply. Installation of multiple suction pumps in the way of normal supply and the location of households at the tail end of service. This was due to the fact that locationally, the unplanned settlements were normally located along the outer periphery. Thus water supply was provided after feeding the inner planned areas before reaching squatters. Resorting to multiple suction pumps remained the only possibility. Case of Nusrat Bhutto Colony was an example which was situated at the outskirt of North Nazimabad – a planned settlement. In the apartments in unplanned settlements, the quality of water was an important factor. Residents were of the view that since water supplied through the pipeline was poor in quality due to apparent mixing with sewage, it could not be used for drinking purposes. Thus the water for drinking had to be essentially acquired from alternative sources. This made great sense as the apartments surveyed were located in Khadda and Lyari areas where the supply network was in a dilapidated condition. Single unit residents in planned areas had several reasons for choosing alternatives to water supply. Less pressure in water supply; defects in pipelines and mixing of water with saline sources were a few common factors. Loss of pressure was normally attributed to various intermittent suction pumps installed in the areas. These pumps affected the normal performance of flow to a great extent. In many localities that were old, the water supply network was seldom monitored, repaired or improved. The only repairs came in the case of an emergency or a breakdown. Thus the supply was affected due to ruptures, seepages and often breakdown in water pipes. In Karachi, road carpeting was also noted as a damaging phenomenon for underground infrastructure. Although not directly reported by the respondents, it was a factor of concern. In the case of apartments, abrupt disruption of supply without notice was reported as a common factor. The residents were of the view that since the water utility did not release any information of water supply disruption, they were caught unaware and had to take emergency/on the spot measures to augment water supply. However such events appeared mostly during the peak summer seasons.

7.8 Choice for Alternative Resources

Figure-7.32
Choice for Alternative Sources: Rapid Availability/Supply



PR: Planned – Single Unit Residences
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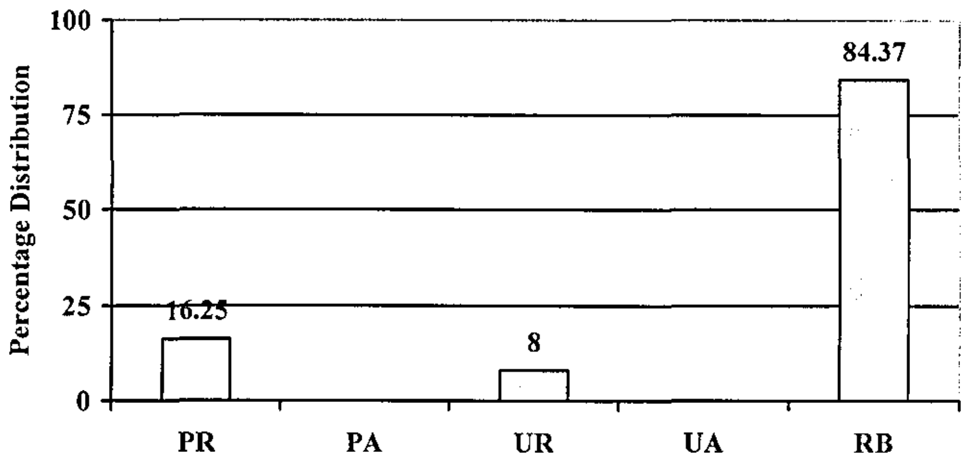
Ready availability of water was cited as an important factor to choose an alternative source of supply (Figure 7.32). It was strongly emphasized by the apartment dwellers in planned settlements and bulk consumers. It can be linked up to the fact that apartments were mostly managed through their respective associations/unions which had to respond to the needs of the residents on an instantaneous basis. Residents in other categories also emphasized on this factor because timely availability was normally perceived as an important attribute towards efficiency.

Figure-7.33
Choice of Alternative Arrangements:
Adequate Quantity



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Quantity was a concern for residents of single unit housing in planned settlements to some extent (Figure 7.33). The reason was that quantity of supply was important in cases where the dependence on a supply arrangement was for a long term. In cases where a short term dependence was observed, quantity was not perceived as a viable parameter.

Figure-7.34
Choice of Alternative Arrangments: Affordable Cost

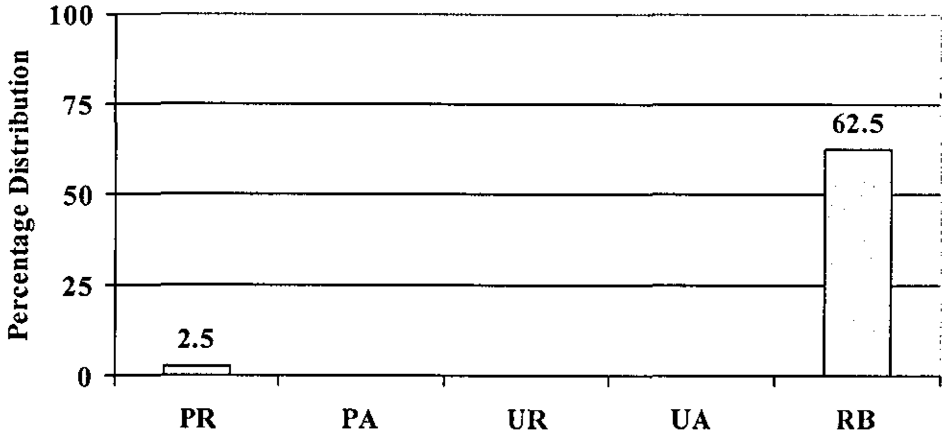
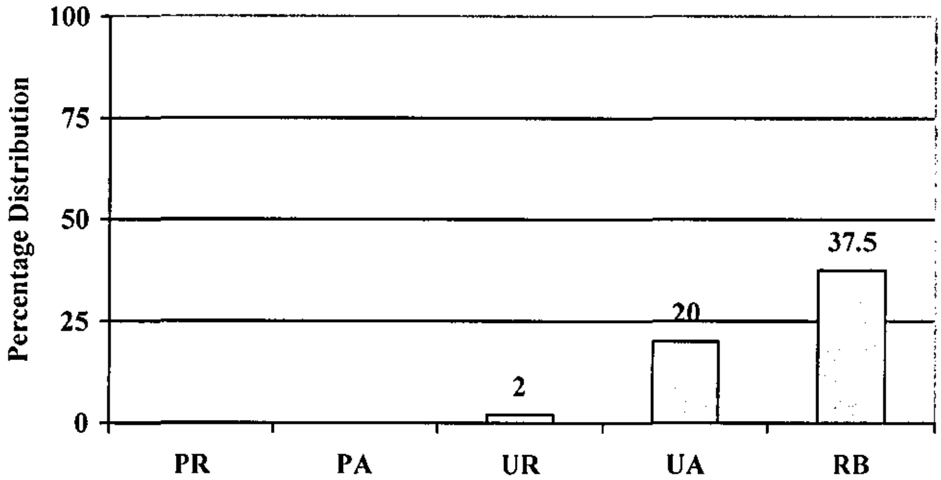


Figure-7.35
Choice of Alternative Supply: Bearable Quality



PR: Planned – Single Unit Residences **PA:** Planned – Apartments
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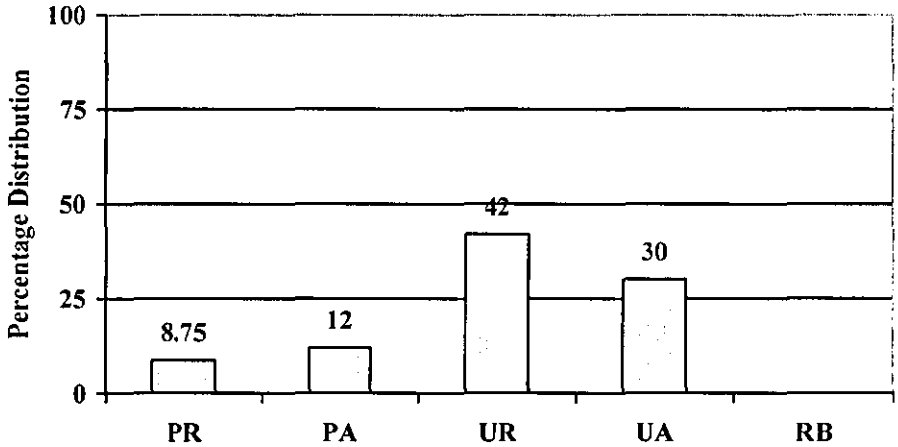
It is important to note that affordability was not cited as a factor by any category of respondents except retail beneficiaries of bulk consumers (Figure 7.34). It implied that water being an essential good has to be obtained without regarding cost as a factor. The retail beneficiaries of bulk consumers had to spend sizable amounts on vending sources due to poor service from piped sources.

Figure-7.36
Choices for Alternative Arrangements: Other Incentives

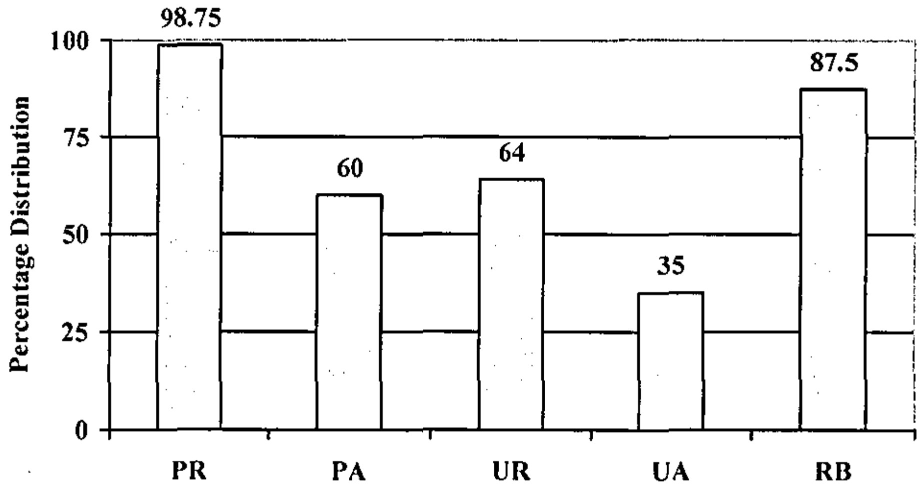


PR:	Planned – Single Unit Residences	**PA:**	Planned – Apartments
UR:	Unplanned – Single Unit Residences	**UA:**	Unplanned – Apartments
RB:	Retail Beneficiaries of Bulk Supply		

Several other factors were cited, mainly by residents in unplanned and bulk consumer settlements (Figures 7.35-7.36). They mentioned that there is no hard and fast rule to obtain water. Availability of water under most favourable conditions on specific instants made the logic of choice. They confirmed to the availability of wide variety of modes and arrangements. Boreholes and borrowing from neighbours were the common choices. This relates to the fact that the approach or access to water supply alternatives was normally need driven, not pre-determined through any institutionally prescribed arrangement. In other words, it was entirely informal in nature. The same analogy applied to apartment dwellers in unplanned settlements. In apartments and single unit residences the other main factor cited for the choice of alternatives was its responsiveness of the source even at odd hours and holidays. Usually commercial tankers fulfilled this need. In bulk consumer areas where very old infrastructure existed, people were concerned about maintaining the infrastructure to get proper quality of water.

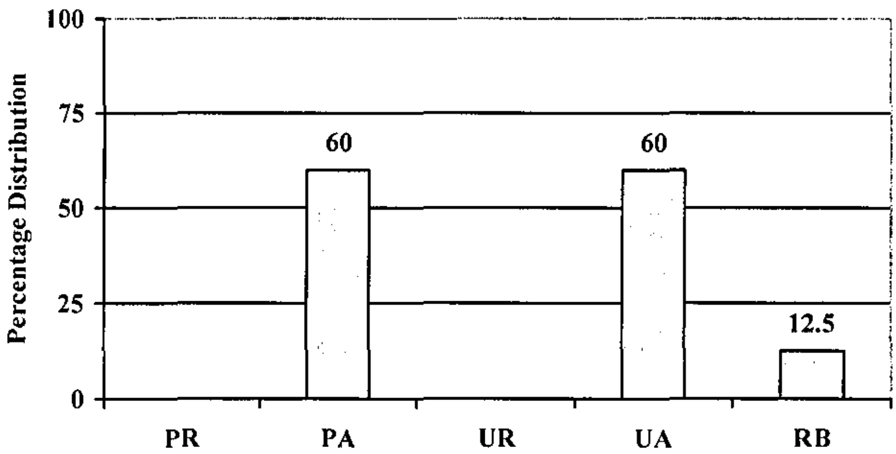
7.9 Personnel Related to Water Supply

Figure-7.37
Personnel Related to Water Supply: Valvemen



Valvemen of KWSB/WSD were identified as the most important personnel (Figure 7.37). They were the key staff that facilitated supply at the lowest scale, that is from sub neighbourhood to household level. They determined the duration, frequency and routes of water supply. Although the senior staff of the utility were crucial, it was the valveman who played the most crucial role in providing or otherwise the water supply.

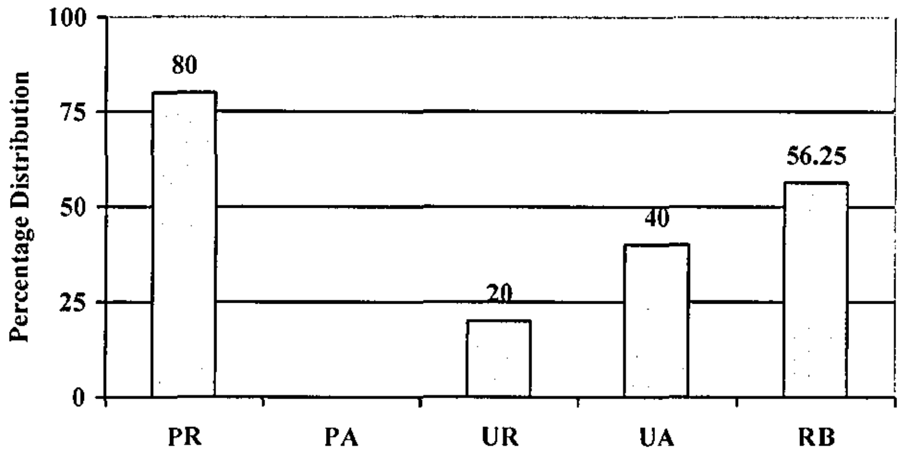
Figure-7.38
Personnel Related to Water Supply: Chowkidar



PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single Unit Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

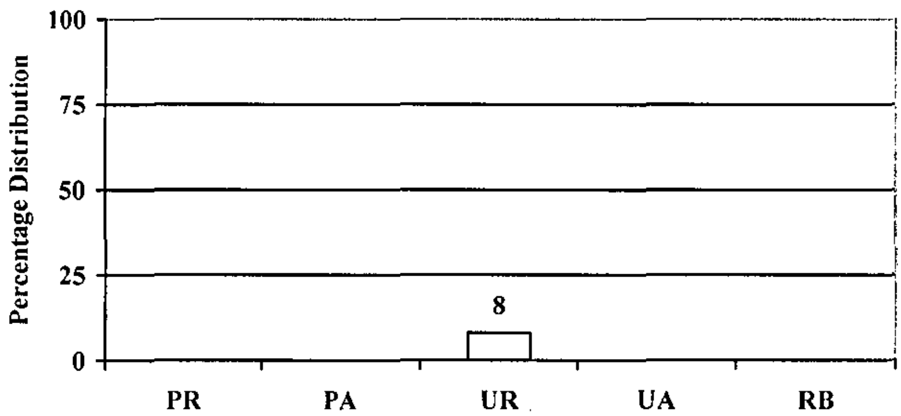
Chowkidars (watchmen) in apartments were vital personnel (Figure 7.38). They operated the suction pumps, liaised with valvemen, facilitated water to individual apartment blocks within the apartments. They were hired by the apartment association for their specific services in the respective apartments themselves.

Figure-7.39
Personnel Related to Water Supply: WSD/KWSB Staff



The residents of both apartments and single unit residences were reasonably cognizant of KWSB/WSD staff and its importance (Figure 7.39). For a wide variety of water supply related tasks and problems, it was understood that it could be effectively addressed by the utility only.

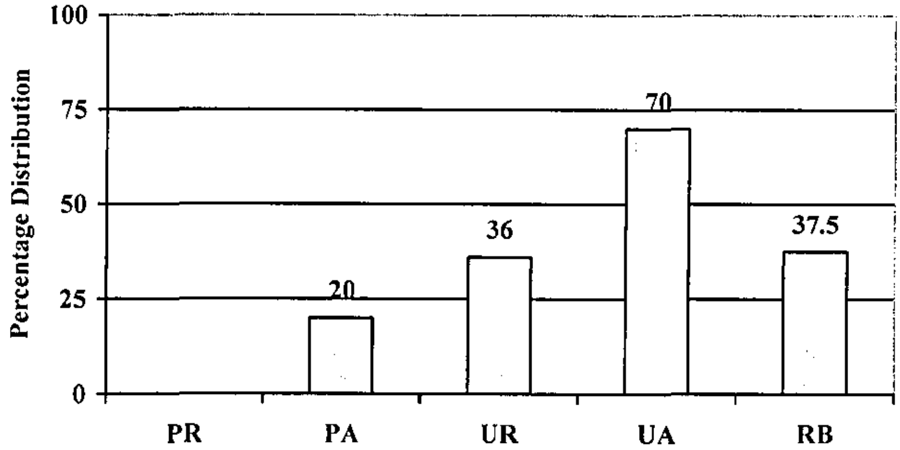
Figure-7.40
Personnel Related to Water Supply:
Elected Representatives



PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single Unit Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Local elective representatives were found to possess no effective role simply due to the reason that the KWSB/WSD was not fully devolved to City District Government of Karachi (Figures 7.40-7.41). The elected representatives have yet to acquire their respective control on the various functions.

Figure-7.41
Personnel Related to Water Supply: Other Personnel



PR:	Planned – Single Unit Residences	**PA:**	Planned – Apartments
UR:	Unplanned – Single Unit Residences	**UA:**	Unplanned – Apartments
RB:	Retail Beneficiaries of Bulk Supply		

Water vendors and manual water carriers were the main categories for this variable. The cross case analysis is a follow up of the research design where response to the research questions is analysed. As the findings were in accordance with the data collection strategy, it created a comparative premise to analyse the results.

7.10 Lessons Learnt

The analysis done in the case studies was done according to the research design laid down in chapter-3 under the guiding hypothesis (section 3.3) and research questions (section 3.4 and figure 3.2). The response to the main research question that 'why consumers resort to alternative supply arrangements' shall be dealt during and after correlations between variables are established. Several sub-research questions that add case study based knowledge include perceived status of water supply, modes, factors affecting water supply, frequency, machinery and equipment, staff and personnel as well as characteristics of alternative arrangements. Lessons learnt from the cross case analysis done in this chapter adequately address these questions. Many important lessons have evolved in the process. Study of relationships between set of variables using correlations and regression has been undertaken in Chapter-8 to expand the analytical work around the research questions. Salient lessons learnt from the cross case analysis are outlined below:

Consumers who had to pay upfront for water supply services regarded water as a saleable commodity. The act of spot payment to the service provider helped develop a perception that water is not a free entity. In contrast, the consumers who obtained supply through piped sources which were conventionally billed considered it as a public good. This was so because the bill was assumed as a 'tax' and not a water charge (Annexure-13).

Availability of a piped water connection was considered as a link up to that mode of supply, whether functional or dysfunctional. In some cases, piped connection did not supply any water at all. However it was still hoped that some time such connection would yield a supply.

Non drinking functions were often carried out by using boreholes. The water quality from boreholes was very poor. Thus it was not found fit for drinking. However other functions like washing and bathing continued with this source.

The retail beneficiaries of bulk water supply had to heavily rely on water tankers in upper income locations. This was so because the piped supply did not generate any supply in several areas. Thus the supply from tankers was considered as a routine option for this category of consumers. In addition traditional modes such as manual water carrier served the upper storeys of apartments in unplanned areas due to peculiarity of service need. Donkey carts were useful where less quantities were required.

The water supply in all the case studies was found directly dependent upon the legal status of the settlement and supply arrangement as well as reliability. The planned settlements with legal validity of their existence and connection obtained the piped supply according to normal procedures. The factor of reliability evolved from the combination of city and neighbourhood level arrangements. Due to the overall pressure on the tanker supply, the priority of supply to awami tanks obviously became low as they are supplied for free. In cases where city level supply was satisfactory but internal network was dilapidated, the reliability was affected. Similarly, an efficient neighbourhood piped network was not found useful where supply from source was unpredictable. In the case of retail beneficiaries of bulk supply, quantity and access to supply were also vital due to their limited benefit from piped sources.

Piped supply was organized around daily and alternate day supply frequency. This was developed on the premise that the storage capacity of underground and overhead tanks was sufficient to store water for two days consumption.

Quantity of supply and frequency determined the perception of adequacy by the consumers. Thus consumers of single unit planned and unplanned settlements and apartment dwellers in unplanned settlements reported adequacy. Similarly such consumers who had connection of piped supply but did not receive water through it, considered access to supply as a major issue. Retail beneficiaries of bulk supply and apartment dwellers in unplanned areas faced this situation.

Suction pumps were a commonly found device used by the consumers to access the piped water supply. This supply was adversely affected due to over subscription, thefts and leakages. Low pressures were also reported during focused group meetings. The only possible way to access it was to use these pumps to increase the probability of hooking on to a supply. The availability of electricity was a vital factor in the success of this arrangement.

The consumers constructed underground and overhead tanks as a means to have sufficient storage to mitigate any unpredictable situation. In this pretext, enhanced storage could also be considered as an extension of alternative supply arrangement. The reason to access an alternative supply arrangement were several. When piped supply was disconnected, the consumers had to obtain the entire quantity through alternative arrangements. In situation where consumers obtained less than the desirable quantity, they augmented the supply by obtaining remainder quantities from alternative arrangements. In some cases, poor quality of supply from a mode makes consumer acquire water from another mode for drinking, cooking and similar cases. *Awami* tanks served that purpose in some parts of Orangi.

Rapid availability of alternative supply and adequate quantities were important characteristics that influenced the choice of alternative arrangement. In case of retail beneficiaries of bulk supply, who had to obtain water from alternative sources on a continuous basis, affordability was also a vital consideration.

Valvemen, who regulated piped supply at street/household level; watchmen (*chowkidar*) who organized/regulated supply at apartment blocks/individual apartments and KWBS/WSD staff who dealt with the overall affairs of water supply were found to be the key personnel related to water supply due to their respective levels of influence on the performance of piped supply networks.

8. UNDERSTANDING RELATIONSHIPS

8.1 Introduction

The cross case analysis, using multiple bar diagrams was presented in Chapter-7. It provided a comparative picture of the case studies across the various variables that were investigated in the research work. In order to study the relationships between the variables outlined in the research design in Chapter-3, correlation was used as the statistical method. The reason to study correlations stemmed out from the research design. In this cross case analysis, the guiding hypothesis was closely examined from the standpoint whether consumers and providers had mutually agreed arrangements that led to an acceptable supply. The issues pertinent to integration possibilities of alternative arrangements were also reviewed especially in dealing with legal aspects of supply and settlement. The logical frame in Figure 3.3 provided a set of variables which were to be tested for their degree of relationships. The correlations were found to be a useful method to study the statistical relationship between the various set of variables to see how the responses to 'why' and 'what' issues could be obtained. In other words, correlations were considered a useful means of cross case analysis for case studies which were statistically based on the same variables and referred to the same structure of data collection and organisation. Straight line summary of data is drawn from select cases based on regression analysis which is presented along with each corresponding table. These diagrams help understand the relationships in a graphical form. Three diagrams each are taken from each of the categories of strong, average, weak and very weak correlation values. Thus findings from the case study I & II were used for studying correlations. According to Trochim (2001), 'a correlation is a single number that describes the degree of relationship between two variables' (pp. 272). The correlation factor remains between -1 and 1. The range between these two limits justify the extent, positive or negative relationship between the contending variables. Correlation (r) which is nearer in value to +1 shows a stronger relationship between variables. Similarly when 'r' is nearer in value to -1, it shows a weaker relationship. In this study, the research questions have been translated into variables (Figure 3.2). Basic regression analysis provide the possibility of the occurrence of the relationship in the future. In respect of the case studies, they have been equated to establish their relative degree of relationship with each other. This exercise is undertaken for such variables which either have a direct relationship amongst each other or possess some apparent link up.

8.2 Correlations With 'Piped Water Supply'

TABLE-8.1
CORRELATION BETWEEN PIPED SUPPLY AND INSTALLATION OF SUCTION PUMP

Category	Piped Supply (x)	Suction Pump (y)	xy	x^2	y^2	Correlation (r)
PR	200	135	27000	40000	18225	
PA	57	22	1254	3249	484	
UR	96	90	8640	9216	8100	0.952
UA	60	21	1260	3600	441	
RB	32	12	384	1024	144	

A strong relationship was found between the existence of piped water supply and suction pump (Table 8.1). It implies that wherever the piped water service is provided, a sizable number of users resort to drawing water through suction pumps. It also coincides with the fact that the people have to resort to its usage without which access to water becomes a difficult proposition. The regression diagram shows that the predicted and actual line coincide significantly. The probability value in regression analysis and the trend evident from the plot in Figure 8.1 shows that the suction pumps shall continue to be an important device to make the piped water supply function.

Figure 8.1
Regression Analysis: Y1 versus X1 (Based on Table 8.1)

The regression equation is: Y1 = - 13.3 + 0.779 X1

Predictor	Coef	SE Coef	T	P
Constant	-13.32	15.52	-0.86	0.454
X1	0.7789	0.1453	5.36	0.013

S = 19.21 R-Sq = 90.5% R-Sq(adj) = 87.4%

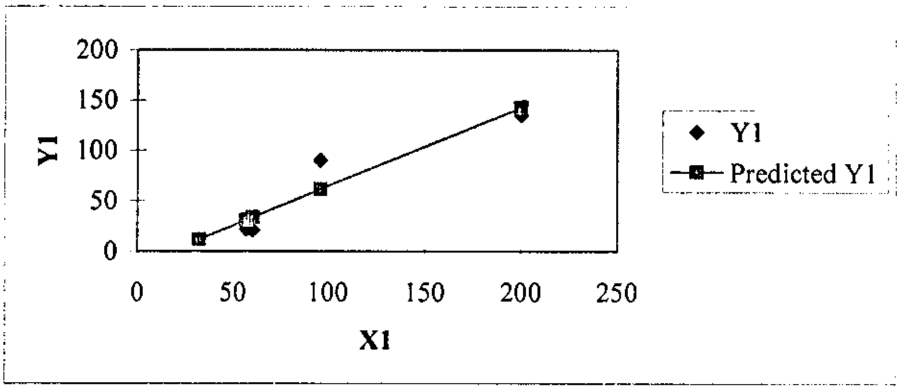


TABLE-8.2
CORRELATION BETWEEN PIPED SUPPLY AND RELIABILITY OF SUPPLY

Category	Piped Supply (x)	Reliability of Supply (y)	xy	x^2	y^2	Correlation r
PR	200	135	27000	40000	18225	
PA	57	60	3420	3249	3600	
UR	96	9	864	9216	81	0.806
UA	60	39	2340	3600	1521	
RB	32	28	896	1024	784	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Piped water supply was focused to be correlated to reliability of supply to a sufficient grade (Table 8.2). It was found that with the provision of water supply through the pipes, a reliable service shall normally emerge. The regression analysis outlined in Figure 8.2 also affirmed that piped supply shall remain a reasonably reliable mode. Diagram shows that the predicted and actual lines coincide to a considerable extent.

Figure 8.2
Regression Analysis: Y2 versus X2 (Based on Table 8.2)

The regression equation is: Y2 = 1.3 + 0.595 X2

Predictor	Coef	SE Coef	T	P
Constant	1.26	26.95	0.05	0.966
X2	0.5949	0.2522	2.36	0.099

S = 33.34 R-Sq = 65.0% R-Sq(adj) = 53.3%

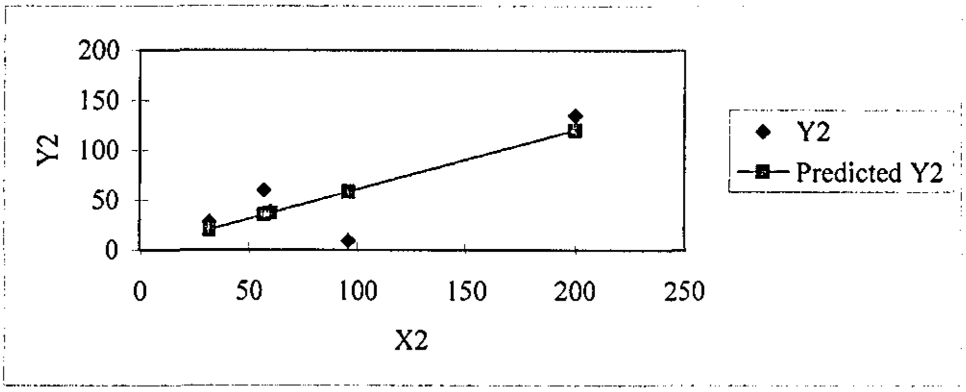


TABLE-8.3

CORRELATION BETWEEN PIPED SUPPLY AND QUANTITY

Category	Piped Supply (x)	Quantity of Supply (y)	xy	x^2	y^2	Correlation r
PR	200	162	32400	40000	26244	0.977
PA	57	47	2679	3249	2209	
UR	96	105	10080	9216	11025	
UA	60	51	3060	3600	2601	
RB	32	28	896	1024	784	

Piped supply had a very strong correlation with quantity (Table 8.3). This implied that the most significant value of quantity was only ensured through piped supply system.

TABLE-8.4

CORRELATION BETWEEN PIPED SUPPLY AND ALTERNATE DAY SUPPLY

Category	Piped Water Supply (x)	Alternate Day Supply (y)	xy	x^2	y^2	Correlation r
PR	200	57	11400	40000	3249	0.750
PA	57	28	1596	3249	784	
UR	96	0	0	9216	0	
UA	60	21	1260	3600	441	
RB	32	8	256	1024	64	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Alternate day supply was found to be in average correlation with piped supply (Table 8.4). This frequency obviously depended upon the decision of the water utility to restrict the water supply due to expanding demand and limited capacity to meet it. Regression diagram in Figure 8.3 and corresponding probability value affirm that the piped water supply and alternate day supply are likely to maintain an average relationship.

Figure-8.3

Regression Analysis: Y4 versus X4 (Based on Table 8.4)

The regression equation is: Y4 = 0.6 + 0.250 X4

Predictor	Coef	SE Coef	T	P
Constant	0.58	13.59	0.04	0.969
X4	0.2497	0.1272	1.96	0.144

S = 16.82 R-Sq = 56.2% R-Sq(adj) = 41.6%

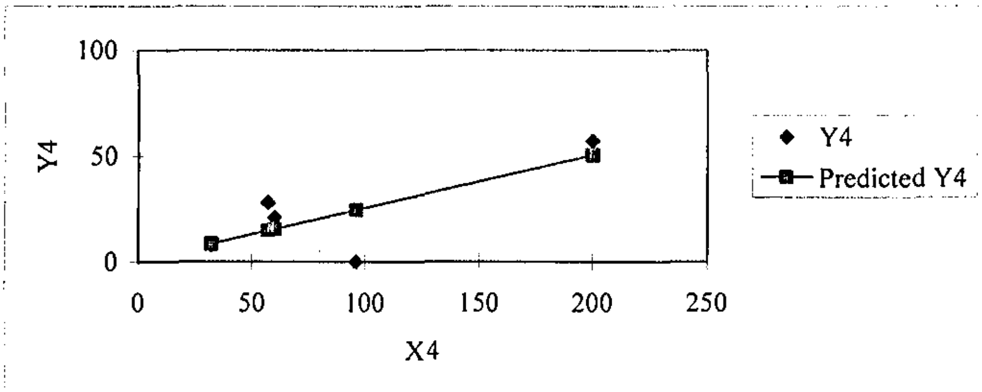


TABLE-8.5

CORRELATION BETWEEN PIPED SUPPLY AND DAILY SUPPLY

Category	Piped Supply (x)	Daily Supply (y)	xy	x^2	y^2	Correlation r
PR	200	125	25000	40000	15625	0.946
PA	57	22	1254	3249	484	
UR	96	24	2304	9216	576	
UA	60	39	2340	3600	1521	
RB	32	12	384	1024	144	

Piped supply was found to possess a strong correlation with daily supply (Table 8.5). This referred to the fact that only piped supply was an appropriate mode to facilitate daily supply of water.

TABLE-8.6
CORRELATION BETWEEN PIPED WATER SUPPLY AND TWICE A WEEK SUPPLY

Category	Piped Supply (x)	Twice a Week Supply (y)	xy	x^2	y^2	Correlation r
PR	200	5	1000	40000	25	0.207
PA	57	0	0	3249	0	
UR	96	33	3168	9216	1089	
UA	60	0	0	3600	0	
RB	32	0	0	1024	0	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Piped supply was found to possess weak correlation with twice a week supply frequency (Table 8.6). With the exception of few residents in unplanned settlement that were several with this frequency, others did not report this frequency. Figure 8.4, showing the regression, confirm that this frequency is not likely to emerge for piped supply.

Figure-8.4
Regression Analysis: Y6 versus X6 (Based on Table 8.6)

The regression equation is: Y6 = 3.6 + 0.045 X6

Predictor	Coef	SE Coef	T	P
Constant	3.60	13.11	0.27	0.802
X6	0.0450	0.1227	0.37	0.738

S = 16.23 R-Sq = 4.3% R-Sq(adj) = 0.0%

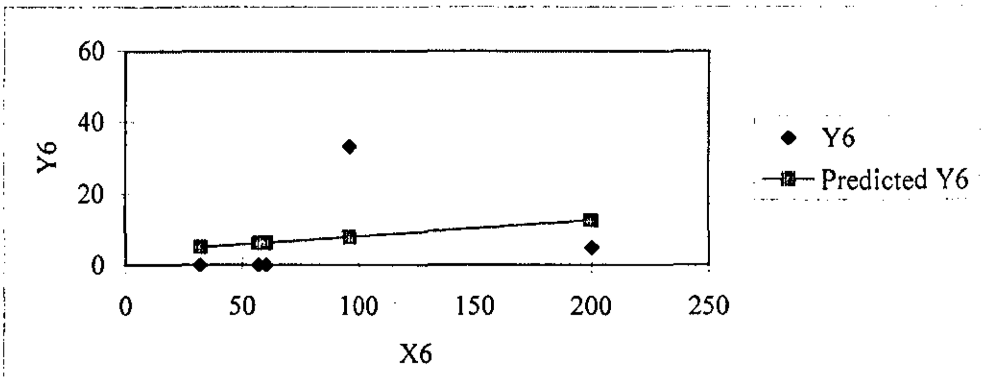


TABLE-8.7
CORRELATION BETWEEN
PIPED SUPPLY AND ADEQUACY OF SUPPLY

Category	Piped Supply (x)	Adequacy of Supply (y)	xy	x^2	y^2	Correlation r
PR	200	177	35400	40000	31329	0.899
PA	57	40	2280	3249	1600	
UR	96	3	288	9216	9	
UA	60	27	1620	3600	729	
RB	32	10	320	1024	100	

Piped supply and adequacy had an average correlation (Table 8.7). Where piped supply is available, it is likely to generate adequacy.

TABLE-8.8
CORRELATION BETWEEN PIPED SUPPLY
AND LEGAL STATUS OF WATER SUPPLY

Category	Piped Supply (x)	Legal Status of Water Supply (y)	xy	x^2	y^2	Correlation r
PR	200	170	34000	40000	28900	0.847
PA	57	60	3420	3249	3600	
UR	96	15	1440	9216	225	
UA	60	57	3420	3600	3249	
RB	32	32	1024	1024	1024	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Piped supply and legal status of supply had a very strong correlation (Table 8.8). A sizable sample usually received the supply through legally valid procedures.

TABLE-8.9
CORRELATION BETWEEN PIPED SUPPLY AND LEGAL STATUS OF SETTLEMENT

Category	Piped Supply (x)	Legal Status of Settlement (y)	xy	x^2	y^2	Correlation r
PR	200	200	40000	40000	40000	0.934
PA	57	60	3420	3249	3600	
UR	96	41	3936	9216	1681	
UA	60	57	3420	3600	3249	
RB	32	32	1024	1024	1024	

Piped supply and legal status of settlement had a strong correlation (Table 8.9). Almost the entire sample believed that piped water supply can only be obtained if the settlement possesses legal status.

8.3 Correlations With 'Adequacy of Supply'

TABLE-8.10
CORRELATION BETWEEN ADEQUACY OF SUPPLY AND COMMERCIAL WATER TANKERS

Category	Adequacy of Supply (x)	Commercial Water Tankers (y)	xy	x^2	y^2	Correlation r
PR	177	0	0	31329	0	-0.572
PA	40	0	0	1600	0	
UR	3	24	72	9	576	
UA	27	0	0	729	0	
RB	10	20	200	100	400	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Adequacy of supply and commercial water supply had a negative correlation of sizable factor (Table 8.10). This again established the fact that adequacy is difficult to achieve through tankers. Regression analysis also show that the possibility of tankers facilitating adequate water supply does not arise (Figure 8.5).

Figure-8.5
Regression Analysis: Y10 versus X10 (Based on Table 8.10)

The regression equation is: Y10 = 13.8 - 0.0968 X10

Predictor	Coef	SE Coef	T	P
Constant	13.775	6.587	2.09	0.128
X10	-0.09678	0.08016	-1.21	0.314

S = 11.49 R-Sq = 32.7% R-Sq(adj) = 10.3%

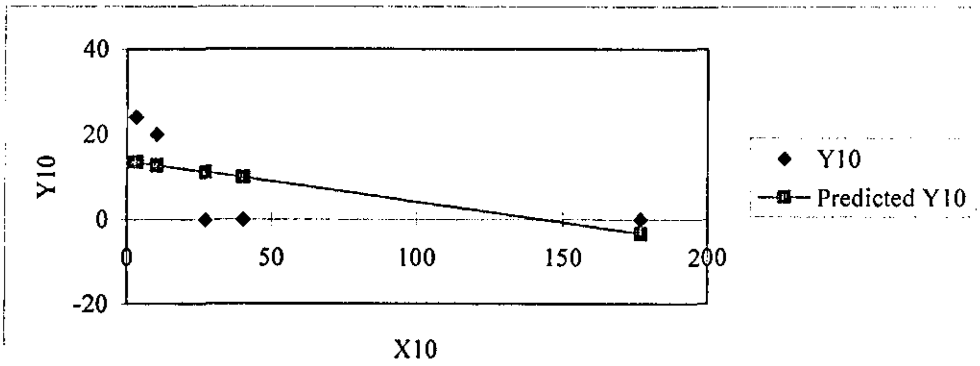


TABLE-8.11
CORRELATION BETWEEN
ADEQUACY OF SUPPLY AND BOREHOLES

Category	Adequacy of Supply (x)	Borehole (y)	xy	x^2	y^2	Correlation R
PR	177	25	4425	31329	625	
PA	40	7	280	1600	49	
UR	3	45	135	9	2025	-0.015
UA	27	36	972	729	1296	
RB	10	2	20	100	4	

Adequacy and borehole had a negative correlation (Table 8.11). It was established that the adequacy was neither perceived nor acquired through borehole supply. Regression analysis show that boreholes shall not be able to generate on adequate measure of water supply (Figure 8.6). The predicted line does not show any significant relationship with the existing variables.

Figure-8.6
Regression Analysis: Y11 versus X11 (Based on Table 8.11)

The regression equation is: Y11 = 23.2 - 0.004 X11

Predictor	Coef	SE Coef	T	P
Constant	23.20	12.18	1.91	0.153
X11	-0.0038	0.1482	-0.03	0.981

S = 21.24 R-Sq = 0.0% R-Sq(adj) = 0.0%

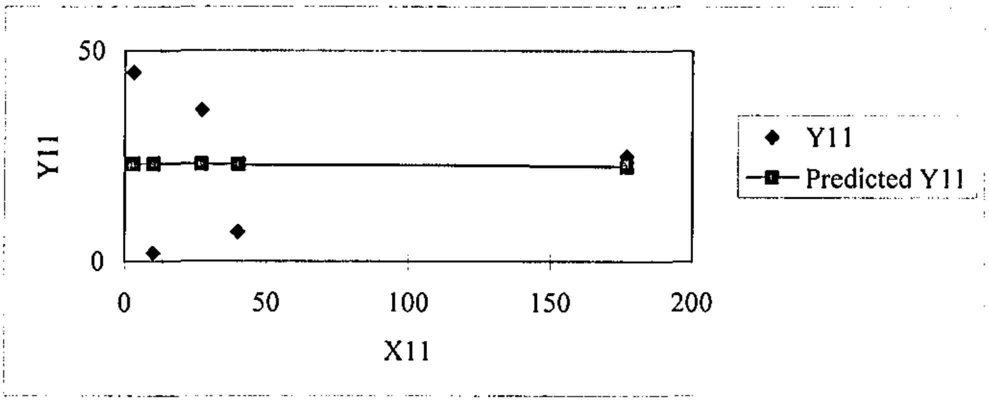


TABLE-8.12
CORRELATION BETWEEN ADEQUACY OF SUPPLY AND VALVEMEN

Category	Adequacy of Water Supply (x)	Valvemen Playing an Important Role (y)	xy	x^2	y^2	Correlation r
PR	177	197	34869	31329	38809	
PA	40	37	1480	1600	1369	
UR	3	96	288	9	9216	0.849
UA	27	21	567	729	441	
RB	10	28	280	100	784	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was an average correlation between adequacy of water supply and the valvemen playing an important role (Table 8.12). It was generally believed that the valveman can influence the supply at the local scale to a considerable extent.

TABLE-8.13
CORRELATION BETWEEN
ADEQUACY OF SUPPLY AND KWSB/WSD MEMBERS

Category	Adequacy of Supply (x)	KWSB/WSD Staff Members (y)	xy	x^2	y^2	Correlation r
PR	177	160	28320	31329	25600	
PA	40	0	0	1600	0	
UR	3	30	90	9	900	0.936
UA	27	24	648	729	576	
RB	10	18	180	100	324	

There was a strong value of correlation found between adequacy of supply and the KWSB/WSD staff playing an important role (Table 8.13). It was normally understood that the KWSB/WSD staff had a vital role to play in streamlining the distribution of the supply at the recent scale.

TABLE-8.14
CORRELATION BETWEEN
ADEQUACY OF SUPPLY AND RELIABILITY OF SUPPLY

Category	Adequacy of Supply (x)	Reliability of Supply (y)	xy	x^2	y^2	Correlation r
PR	177	135	23895	31329	18225	
PA	40	60	2400	1600	3600	
UR	3	9	27	9	81	0.981
UA	27	39	1053	729	1521	
RB	10	28	280	100	784	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was a strong value of correlation between adequacy and reliability of supply (Table 8.14). It was generally established that reliable sources could generate adequate measure of supply.

8.4 Correlations With 'Water as Saleable Commodity'

TABLE-8.15
CORRELATION BETWEEN
WATER AS SALEABLE COMMODITY AND BOREHOLES

Category	Water as Saleable Commodity (x)	Boreholes (y)	xy	x^2	y^2	Correlation r
PR	20	25	500	400	625	0.547
PA	5	7	35	25	49	
UR	33	45	1485	1089	2025	
UA	0	36	0	0	1296	
RB	7	2	14	49	4	

Perception of water as a saleable commodity which was shared by a few and boreholes had an average correlation (Table 8.15). Obviously boreholes costed for their installation and operation which may have helped create this perception.

TABLE-8.16
CORRELATION BETWEEN WATER AS SALEABLE COMMODITY AND COMMERCIAL WATER TANKERS

Category	Water as Saleable Commodity (x)	Commercial Water Tankers (y)	xy	x^2	y^2	Correlation r
PR	20	0	0	400	0	0.554
PA	5	0	0	25	0	
UR	33	24	792	1089	576	
UA	0	0	0	0	0	
RB	7	20	140	49	400	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Perception of water as a saleable commodity and its linkage to water tankers showed an average value of correlation (Table 8.16). This refers to the fact that those residents who acquired water through some form of selling/vending operation did not necessarily acquire it from commercial water tankers.

Regression diagram in Figure 8.7 show an average relations with many points not coinciding with the perception that water is a saleable commodity.

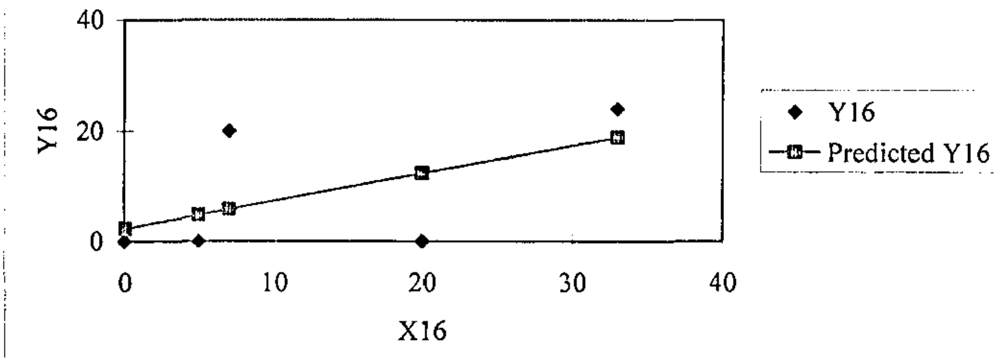
Figure-8.7

Regression Analysis: Y16 versus X16 (Based on Table 8.16)

The regression equation is: Y16 = 2.28 + 0.501 X16

Predictor	Coef	SE Coef	T	P
Constant	2.282	7.698	0.30	0.786
X16	0.5014	0.4354	1.15	0.333

S = 11.67 R-Sq = 30.7% R-Sq(adj) = 7.5%



8.5 Correlations With 'Legal Status of Supply'

TABLE-8.17

CORRELATION BETWEEN ESSENTIAL PUBLIC GOOD AND LEGAL STATUS OF WATER SUPPLY

Category	Essential Public Good (x)	Legal Status of Water Supply (y)	xy	x^2	y^2	Correlation r
PR	180	170	30600	32400	28900	0.716
PA	55	60	3300	3025	3600	
UR	117	15	1755	13689	225	
UA	60	57	3420	3600	3249	
RB	25	32	800	625	1024	

There was an average value of correlation found between the perception of water as an essential commodity and the legal status of water supply (Table 8.17). It was due to the understanding that water supply needed to be arranged through legal means while it was considered as an essential good.

TABLE-8.18
CORRELATION BETWEEN LEGAL STATUS OF SUPPLY AND ONCE A WEEK SUPPLY

Category	Legal Status of Supply (x)	Once a Week Supply (y)	xy	x^2	y^2	Correlation r
PR	170	0	0	28900	0	-0.516
PA	60	0	0	3600	0	
UR	15	45	675	225	2025	
UA	57	0	0	3249	0	
RB	32	4	128	1024	16	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

A weak correlation was found between legal status of supply and supply frequency of once a week (Table 8.18). The reason was that those households which benefited from legal supply obtained it at better frequencies than this value.

TABLE-8.19
CORRELATION BETWEEN LEGAL STATUS OF SUPPLY AND TWICE A WEEK SUPPLY

Category	Legal Status of Supply (x)	Twice a Week Supply (y)	xy	x^2	y^2	Correlation r
PR	170	5	850	28900	25	-0.343
PA	60	0	0	3600	0	
UR	15	33	495	225	1089	
UA	57	0	0	3249	0	
RB	32	0	0	1024	0	

A negative value of correlation was found between legal status of supply and supply frequency of twice a week (Table 8.19). The reason was that those residents who benefited from legal supply obtained it at better frequencies than this value.

TABLE-8.20
CORRELATION BETWEEN
LEGAL STATUS OF SUPPLY AND ADEQUACY OF SUPPLY

Category	Legal Status of Supply (x)	Adequacy of Supply (y)	xy	x^2	y^2	Correlation r
PR	170	177	30090	28900	31329	0.991
PA	60	40	2400	3600	1600	
UR	15	3	45	225	9	
UA	57	27	1539	3249	729	
RB	32	10	320	1024	100	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was strong value of correlation between legal status and adequacy of supply (Table 8.20). This was due to the fact that those who had legal connections had better chances of accessing adequate quantities of water.

TABLE-8.21
CORRELATION BETWEEN
LEGAL STATUS OF SUPPLY AND ONCE A WEEK SUPPLY

(V) Legal Status of Supply

Category	Reasons to Use All Quantity of Supply (x)	Once a Week Supply (y)	xy	x^2	y^2	Correlation r
PR	162	0	0	26244	0	0.228
PA	47	0	0	2209	0	
UR	105	45	4725	11025	2025	
UA	51	0	0	2601	0	
RB	28	4	112	784	16	

A weak correlation was found between once a week supply and legal status of supply (Table 8.21). It is established that where legal status of supply exists, lower frequencies may be few. Plot in the diagram does not show link between the predicted and actual trend. The Figure 8.8 shows many deviating points. Thus it is predicted that once a week supply may not be an appropriate frequency.

Figure-8.8
Regression Analysis: Y21 versus X21 (Based on Table 8.21)

The regression equation is: Y21 = 3.3 + 0.082 X21

Predictor	Coef	SE Coef	T	P
Constant	3.33	18.79	0.18	0.871
X21	0.0823	0.2030	0.41	0.712

S = 22.21 R-Sq = 5.2% R-Sq(adj) = 0.0%

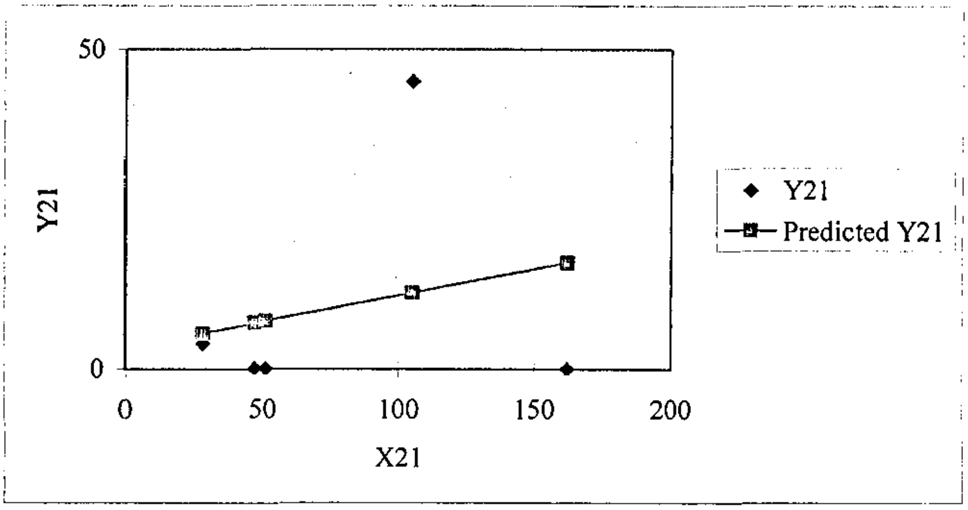


TABLE-8.22
CORRELATION BETWEEN
LEGAL STATUS OF SUPPLY AND DAILY SUPPLY

Category	Legal Status of Supply (x)	Daily Supply (y)	xy	x^2	y^2	Correlation r
PR	170	125	21250	28900	15625	0.959
PA	60	22	1320	3600	484	
UR	15	24	360	225	576	
UA	57	39	2223	3249	1521	
RB	32	12	384	1024	144	

PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single United Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was a strong value of correlation between daily supply and legal status of supply (Table 8.22). The residents possessing access to legal supply had optimum possibility of having a daily supply frequency. Regression diagram also show that the probability of occurrence is very high for a legally valid supply to generate daily supply (Figure 8.9).

Figure-8.9

Regression Analysis: Y22 versus X22 (Based on Table 8.22)

The regression equation is: Y22 = - 4.3 + 0.729 X22

Predictor	Coef	SE Coef	T	P
Constant	-4.30	10.74	-0.40	0.716
X22	0.7290	0.1249	5.84	0.010

S = 15.13 R-Sq = 91.9% R-Sq(adj) = 89.2%

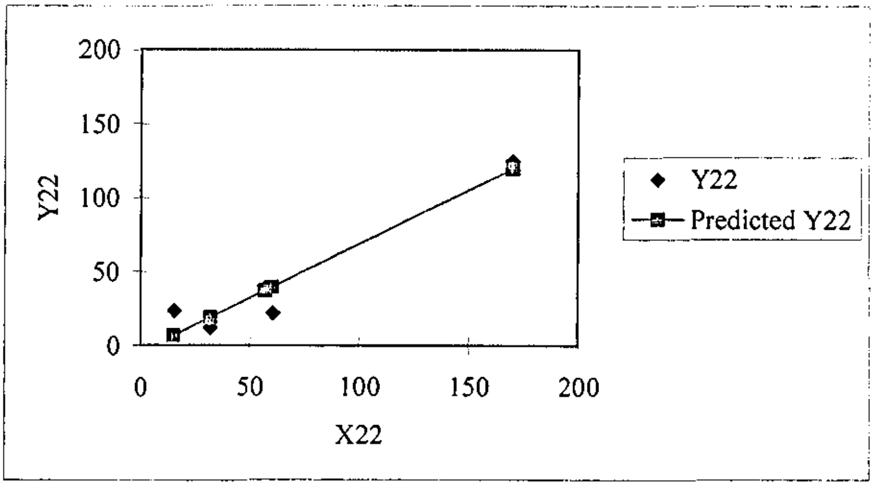


TABLE-8.23

CORRELATION BETWEEN
LEGAL STATUS OF SUPPLY AND ALTERNATE DAY SUPPLY

Category	Legal Status of Supply (x)	Alternate Day Supply (y)	Xy	x^2	y^2	Correlation r
PR	170	57	9690	28900	3249	0.951
PA	60	28	1680	3600	784	
UR	15	0	0	225	0	
UA	57	21	1197	3249	441	
RB	32	8	256	1024	64	

There was a strong value of correlation between the legal status of supply and a frequency of supply on alternate days (Table 8.23 and Figure 8.10). It was established that given the water supply situation by the utility, the usual supply stood at an alternate day frequency.

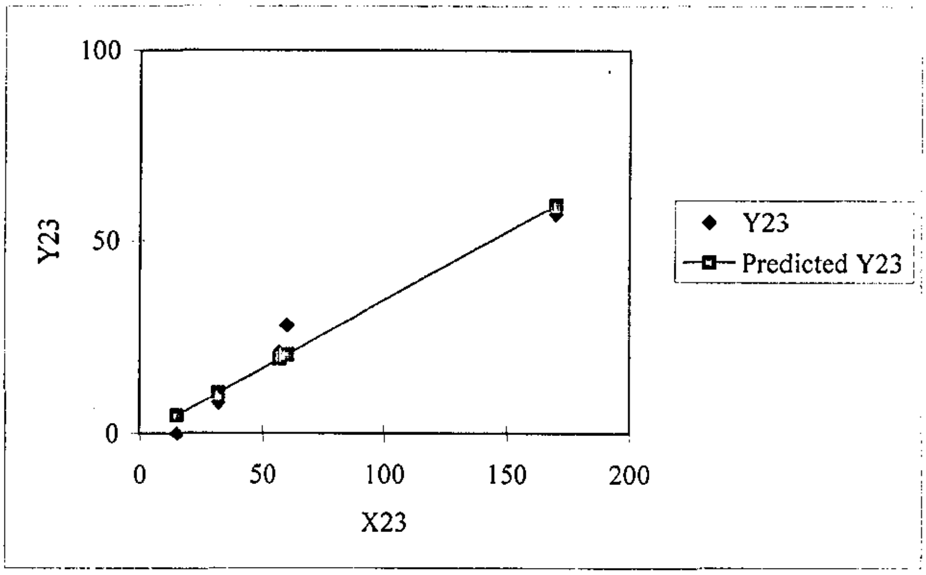
Figure-8.10

Regression Analysis: Y23 versus X23 (Based on Table 8.23)

The regression equation is: Y23 = - 0.89 + 0.355 X23

Predictor	Coef	SE Coef	T	P
Constant	-0.887	3.934	-0.23	0.836
X23	0.35459	0.04574	7.75	0.004

S = 5.543 R-Sq = 95.2% R-Sq(adj) = 93.7%



8.6 Correlations With 'Disconnection of Service'

TABLE-8.24

CORRELATION BETWEEN DISCONNECTION OF SERVICE AND COMMERCIAL WATER TANKERS

Category	Disconnection of Service (x)	Commercial Water Tankers (y)	xy	x^2	y^2	Correlation r
PR	82	0	0	6724	0	
PA	32	0	0	1024	0	
UR	3	24	72	9	576	-0.551
UA	6	0	0	36	0	
RB	12	20	240	144	400	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was a negative value of correlation between disconnection of service and commercial water tankers supply (Table 8.24). This implied that the instance of disconnection of service was not caused by commercial tanker operators.

TABLE-8.25
CORRELATION BETWEEN
DISCONNECTION OF SERVICE AND VALVEMEN

Category	Disconnection of Service (x)	Valveman (y)	xy	x^2	y^2	Correlation r
PR	82	197	16154	6724	38809	
PA	32	37	1184	1024	1369	
UR	3	96	288	9	9216	0.810
UA	6	21	126	36	441	
RB	12	28	336	144	784	

There was an average value of correlation found between the disconnection of service and the input of valveman (Table 8.25). This refered to the understanding that valveman had a strong role in the disconnection of water supply. An average value of relationship was found to exist between the disconnection of service and valvemen (Figure 8.11).

Figure-8.11
Regression Analysis: Y25 versus X25 (Based on Table 8.25)

The regression equation is: Y25 = 26.4 + 1.83 X25

Predictor	Coef	SE Coef	T	P
Constant	26.39	30.44	0.87	0.450
X25	1.8301	0.7640	2.40	0.096

S = 50.05 R-Sq = 65.7% R-Sq(adj) = 54.2%

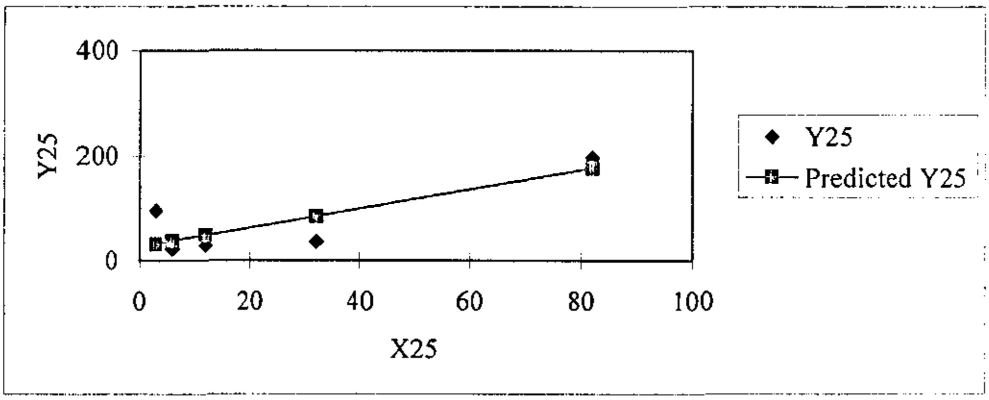


TABLE-8.26
CORRELATION BETWEEN
DISCONNECTION OF SERVICE AND KWSB/WSD STAFF

Category	Disconnection of Service (x)	KWSB/WSD Staff (y)	xy	x^2	y^2	Correlation r
PR	82	160	13120	6724	25600	0.865
PA	32	0	0	1024	0	
UR	3	30	90	9	900	
UA	6	24	144	36	576	
RB	12	18	216	144	324	

PR: Planned – Single Unit Residences **PA:** Planned – Apartments
UR: Unplanned – Single United Residences **UA:** Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was an average value of correlation found between the disconnection of service and the input of KWSB/WSD staff (Table 8.26). It was obviously believed that KWSB/WSD staff had a role in the disconnection of service.

8.7 Correlation With 'Absence of Supply'

TABLE-8.27
CORRELATION BETWEEN
ABSENCE OF SUPPLY AND BOREHOLE

Category	Absence of Piped Supply (x)	Borehole (y)	xy	x^2	y^2	Correlation r
PR	12	25	300	144	625	0.544
PA	0	7	0	0	49	
UR	33	45	1485	1089	2025	
UA	0	36	0	0	1296	
RB	10	2	20	100	4	

There was an average value of correlation between absence of piped supply and usage of boreholes (Table 8.27). This implied that while some residents resorted to the usage of boreholes, others had the option of accessing other modes.

TABLE-8.28
CORRELATION BETWEEN ABSENCE OF PIPED SUPPLY AND COMMERCIAL WATER TANKERS

Category	Absence of Piped Supply (x)	Commercial Water Tankers (y)	xy	x^2	y^2	Correlation r
PR	12	0	0	144	0	0.776
PA	0	0	0	0	0	
UR	33	24	792	1089	576	
UA	0	0	0	0	0	
RB	10	20	200	100	400	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was an average value of correlation between absence of piped supply and commercial water tankers (Table 8.28). This related to two target categories of unplanned residential areas and bulk supply areas.

8.8 Correlation With 'Quantities of Supply'

TABLE-8.29
CORRELATION BETWEEN QUANTITIES OF SUPPLY AND DAILY SUPPLY

Category	Quantity of Supply (x)	Daily Supply (y)	xy	x^2	y^2	Correlation r
PR	13	125	1625	169	15625	-0.165
PA	3	22	66	9	484	
UR	15	24	360	225	576	
UA	9	39	351	81	1521	
RB	28	12	336	784	144	

There was a negative value of correlation between daily supply frequency and quantity as a measure affecting supply (Table 8.29). It was generally obvious that daily supply may not ensure such quantities of water that could be considered as sufficient quantity.

TABLE-8.30
CORRELATION BETWEEN
QUANTITY OF SUPPLY AND ALTERNATE DAY SUPPLY

Category	Quantity of Supply (x)	Alternate Day Supply (y)	xy	x^2	y^2	Correlation r
PR	13	57	741	169	3249	-0.383
PA	3	28	84	9	784	
UR	15	0	0	225	0	
UA	9	21	189	81	441	
RB	28	8	224	784	64	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

There was a negative value of correlation between quantity of water as a factor affecting supply and alternate day supply (Table 8.30). This meant that among the factors that affected supply, quantity of supply was a factor that had little or no bearing to be generated through an alternate day supply.

TABLE-8.31
CORRELATION BETWEEN
QUANTITY OF SUPPLY AND TWICE A WEEK SUPPLY

Category	Quantity of Supply (x)	Twice a Week Supply (y)	xy	x^2	y^2	Correlation r
PR	13	5	65	169	25	0.081
PA	3	0	0	9	0	
UR	15	33	495	225	1089	
UA	9	0	0	81	0	
RB	28	0	0	784	0	

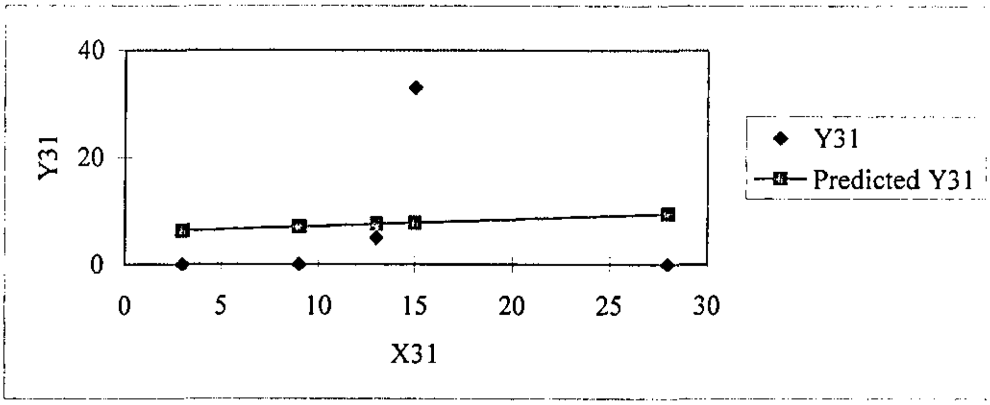
There was a feeble value of correlation between quantity as a factor affecting supply and frequency of supply at twice a week (Table 8.31). The two hardly matched with one another. The regression diagram also ascertained a weak relationship (Figure 8.12).

Figure-8.12
Regression Analysis: Y31 versus X31 (Based on Table-8.31)

The regression equation is: Y31 = 5.9 + 0.126 X31

Predictor	Coef	SE Coef	T	P
Constant	5.89	14.21	0.41	0.706
X31	0.1259	0.8923	0.14	0.897

S = 16.53 R-Sq = 0.7% R-Sq(adj) = 0.0%



8.9 Correlation With 'Qualities of Water Supply'

TABLE-8.32
CORRELATION BETWEEN
QUALITY OF SUPPLY AND FILTER INSTALLATION

Category	Supply of Poor Quality (x)	Filter Installation (y)	xy	x^2	y^2	Correlation r
PR	47	25	1175	2209	625	0.187
PA	27	7	189	729	49	
UR	30	0	0	900	0	
UA	27	0	0	729	0	
RB	14	22	308	196	484	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Very little relationship was found between filter installation and quality of water (Table 8.32). Those who reported poor quality seldom had filters installed in their houses.

TABLE-8.33
CORRELATION BETWEEN QUALITY OF SUPPLY AND BOREHOLE SUPPLY

Category	Quality of Supply (x)	Borehole Supply (y)	xy	x^2	y^2	Correlation r
PR	2	25	50	4	625	-0.577
PA	0	7	0	0	49	
UR	2	45	90	4	2025	
UA	0	36	0	0	1296	
RB	16	2	32	256	4	

There was a negative correlation of average value found between quality of supply and boreholes operation (Table 8.33). This was due to the apparent understanding that boreholes generated poor quality of water.

TABLE-8.34
CORRELATION BETWEEN RAPID AVAILABILITY OF SUPPLY AND VALVEMEN

Category	Availability of Supply (x)	Valvemen (y)	xy	x^2	y^2	Correlation r
PR	120	197	18600	14400	24025	0.975
PA	57	37	2109	3249	1369	
UR	75	96	7200	5625	9216	
UA	33	21	693	1089	441	
RB	29	28	812	841	784	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Rapid availability of supply had a strong correlation with the performance of valvemen (Table 8.34). This meant that the valvemen had sufficient capacity and control to change the course of supply according to his desire.

TABLE-8.35
CORRELATION BETWEEN
RAPID AVAILABILITY AND COMMERCIAL TANKERS

Category	Rapid/Quick Availability of Supply (x)	Commercial Water Tanker (y)	xy	x^2	y^2	Correlation r
PR	120	0	0	14400	0	-0.213
PA	57	0	0	3249	0	
UR	75	24	1800	5625	576	
UA	33	0	0	1089	0	
RB	29	20	580	841	400	

Rapid availability of supply had a weak correlation with commercial water tanker (Table 8.35). This implied that while the commercial water tankers happened to be an alternative mode of supply, they did not provide a time efficient service to consumers.

TABLE-8.36
CORRELATION BETWEEN RAPID SUPPLY AND SUCTION PUMP

Category	Quick/ Rapid Supply (x)	Suction Pump (y)	xy	x^2	y^2	Correlation r
PR	120	135	16200	14400	18225	0.95
PA	57	22	1254	3249	484	
UR	75	90	6750	5625	8100	
UA	33	21	693	1089	441	
RB	29	12	348	841	14	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Rapid availability and suction pump had a strong correlation (Table 8.36). This was due to the operation of suction pumps. It was obvious that the operation of suction pumps was entirely essential for the quick availability of supply. In other words, suction pumps served as a useful alternative arrangement for time efficient supply.

TABLE-8.37
CORRELATION BETWEEN
RELIABILITY OF SUPPLY AND VALVEMEN

Category	Reliability of Supply (x)	Valvemen (y)	xy	x^2	y^2	Correlation R
PR	135	197	26595	18225	38809	0.744
PA	60	37	2220	3600	1369	
UR	9	96	864	81	9216	
UA	39	21	819	1521	441	
RB	28	28	784	784	784	

Reliability of supply had an average correlation with valvemen (Table 8.37). This meant that if valvemen cooperated with the consumers, the service was reliable.

TABLE-8.38
CORRELATION BETWEEN
RELIABILITY OF SUPPLY AND KWSB/WSD STAFF

Category	Reliability of Supply (x)	KWSB/ WSD Staff (y)	xy	x^2	y^2	Correlation R
PR	135	160	21600	18225	25600	0.853
PA	60	0	0	3600	0	
UR	9	30	270	81	900	
UA	39	24	936	1521	576	
RB	28	18	504	784	324	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Reliability of supply had an average strong correlation with KWSB/WSD staff (Table 8.38). This meant that these personnel played a vital role in influencing the routine supply arrangement.

TABLE-8.39
CORRELATION BETWEEN
RELIABILITY OF SUPPLY AND COMMERCIAL WATER TANKERS

Category	Reliability of Supply (x)	Commercial Water Tankers (y)	xy	x^2	y^2	Correlation R
PR	135	0	0	18225	0	-0.679
PA	60	0	0	3600	0	
UR	9	24	216	81	576	
UA	39	0	0	1521	0	
RB	28	20	560	784	400	

PR: Planned – Single Unit Residences
PA: Planned – Apartments
UR: Unplanned – Single United Residences
UA: Unplanned – Apartments
RB: Retail Beneficiaries of Bulk Supply

Reliability of supply had a very weak correlation with commercial water tankers (Table 8.39). It establishes that while tankers are an alternative mode of supply, there level of service is not reliable. The Figure 8.13 also showed actual variables moving away from the predicted line. Therefore little relationship shall emerge between the reliability of supply and commercial water tankers.

Figure-8.13
Regression Analysis: Y39 versus X39 (Based on Table-8.39)

The regression equation is: Y39 = 18.0 - 0.169 X39

Predictor	Coef	SE Coef	T	P
Constant	17.957	7.330	2.45	0.092
X39	-0.1689	0.1053	-1.60	0.207

S = 10.28 R-Sq = 46.2% R-Sq(adj) = 28.2%

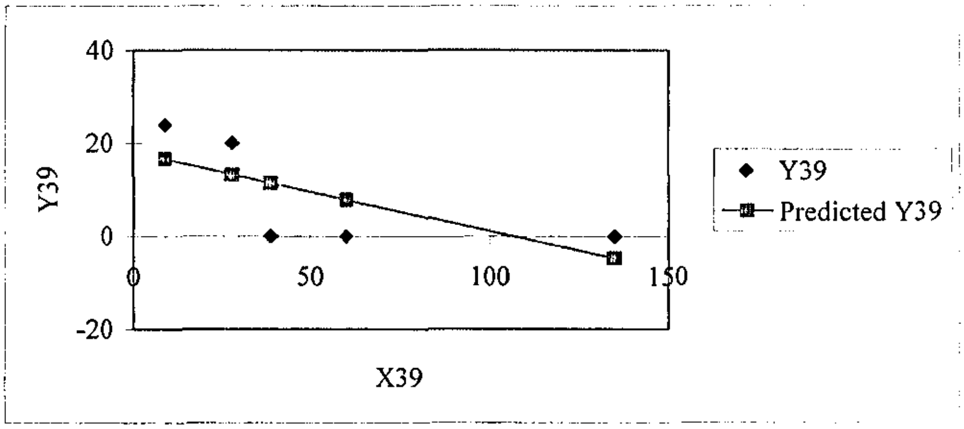


TABLE-8.40
CORRELATION OUTPUTS

Variable	Variable	Correlation	Remarks
Piped water supply	Suction pump	0.952	Strong correlation
	Reliability	0.806	Average correlation
	Quantity	0.977	Strong correlation
	Alternate day supply	0.750	Correlation
	Daily supply	0.946	Strong correlation
	Twice a week	0.207	Weak correlation
	Adequacy	0.899	Average correlation
	Legal status of supply	0.847	Average correlation
	Legal status of settlement	0.934	Strong correlation
Adequacy of supply	Commercial water tankers	-.0572	Very weak correlation
	Boreholes	-0.015	Very weak correlation
	Valvemen	0.849	Average correlation
	KWSB/WSD	0.936	Strong correlation
	Reliability of supply	0.981	Strong correlation
Water as a saleable commodity	Boreholes	0.547	Average correlation
	Commercial water tankers	0.554	Average correlation
Legal status of supply	Essential public good	0.716	Average correlation
	Alternate day supply	0.976	Strong correlation
	One a week supply	-0.516	Very weak correlation
	Twice a week supply	-0.343	Very weak correlation
	Adequacy of supply	0.0991	Strong correlation
	Daily supply	0.959	Strong correlation
Disconnection of service	Commercial water tankers	-0.551	Very weak correlation
	Valvemen	0.810	Average correlation
	KWSB/WSD staff	0.865	Average correlation
	Boreholes	0.544	Average correlation
Absence of supply	Commercial water tankers	0.776	Average correlation
Quantities of supply	Alternate day supply	-0.383	Very weak correlation
	Twice a week supply	0.081	Weak correlation
Quality of supply	Filter water installation	0.187	Weak Correlation
	Borehole	-0.577	Very weak correlation

Continued on page 259...

Variable	Variable	Correlation	Remarks
Rapid/ Quick availability of supply	Valvemen	0.975	Strong correlation
	Commercial water tankers	-0.213	Very weak correlation
	Suction pump	0.95	Strong correlation
Reliability of Supply	Valvemen	0.744	Average correlation
	KWSB/WSD staff	0.853	Average correlation
	Commercial water tankers	-0.697	Very weak correlation

Legend for Remarks	
0.9 & above	Strong
0.5 – 0.899	Average
0.0 – 0.499	Weak
Below 0.0	Very weak

Research questions (section 3.4 and figure 3.2) and their translation into variables (figure 3.3) as well as the hypothesis (section 3.3) lay down the argument for the usage of alternative modes of supply. The correlations based on the findings and analysis clearly confirm this aspect. The following discussion shall elaborate on the various related aspects.

Table-8.40 outlines the findings of correlation of inter-related variables in this cross case analysis. Piped supply had a very strong dependence on the working of suction pumps. Besides piped supply was also found as the arrangement through which optimum quantities of water could be supplied to consumers. The correlation reflected this fact to a sizable extent. Daily supply was very strongly facilitated by piped supply.

Legal status of tenure was very vital in the smooth functioning of piped supply. Piped supply arrangement also displayed strong relations with reliability as it was found to be very effective through piped supply modes. Perception of adequacy, daily and alternate day supply and legal status of supply were important links in this study.

Correlations show that adequacy of supply is greatly dependent upon the valvemen who determines the lower stream of supply at the street/household level. KWSB/WSD staff who are assigned different functions are also important for arranging such a service that could be perceived as adequate in nature. Supply from a reliable mode was found to generate adequate supply. It has become obvious that alternative arrangements such as through boreholes or commercial water tankers could not generate adequate supply for the body of consumers they normally cover (Figure 8.14).

Figure-8.14
What Do Correlations Tell?

Piped water supply is strongly affected by suction pump. It however proves to be the most reliable arrangement to deliver adequate quantities of supply to the consumers. The working frequencies of supply for piped arrangement are daily and alternate day. The legality of settlement and supply arrangement directly affect the performance of piped supply arrangement.

Among the existing alternative arrangements, commercial water tankers and boreholes proved to be inadequate according to consumer needs. However wherever a piped network existed, favours from valvemen and KWSB/WSD staff acted as an effective alternative to obtain water through piped infrastructure. Valvemen's performance also ensured reliability of supply. Consumers who accessed water from a legally valid arrangement considered it as an essential public good. Such consumers had adequate measure of supply through a daily frequency. They seldom received water through lesser frequencies.

Disconnection of service was influenced by the valvemen and KWSB/WSD staff. Commercial water tankers were not found to directly affect piped supply arrangement. However disconnection of service created a premise to obtain water from any kind of available or accessible alternative arrangement.

In the absence of supply from piped sources, boreholes and commercial water tankers were used as an alternative supply arrangement. Water tankers were not a reliable alternative of supply.

It was found that alternative day supply frequency was not necessarily a guarantee for appropriate quantities of supply. Similarly it was found that while domestic filter installation improved the quality of water, not many consumers were aware about it. Boreholes produced a very poor quality of water supply.

In reference to alternative arrangements, valvemen and suction pumps ensured rapid availability of supply. While commercial tankers were an alternative, their availability was found neither rapid nor sufficiently reliable.

Such consumers who spent resources to purchase water service on a cash basis considered water as a saleable commodity. Thus users of boreholes and commercial tankers showed a strong relationship.

Consumers who considered water as a public good normally acquired the service from a legally valid arrangement, as the correlation and regression showed. Daily and alternate day supply were the two frequencies at which the water was generally supplied. Where it declined to once or twice a week supply, the legality of the supply became doubtful. Consumers had a strong perception that status of supply had to be legally valid to generate adequacy.

Disconnection of supply service was strongly influenced by valvemen and KWSB/WSD staff. This meant that at the lower leg of the water supply dynamics, the staff members belonging to the system can play a very vital role. This aspect was not governed by commercial water tanker operators.

Consumers who experienced an absence of supply had to resort to alternative arrangements. Boreholes and vending supply from commercial water tankers had a strong relationship in such situations.

Whereas piped water supply had a strong correlation with alternate day supply frequency, it did not ensure enough quantities of supply. Thus quantities of supply had a very weak correlation with this frequency. This made a premise for accessing alternative arrangements.

In relation to quality, it was observed that quality of supply had a link with filter installation. However, due to little awareness about its usage and cost, few consumers would use it. Water from boreholes obviously generated poor quality output.

In sum, it is obvious that the guiding hypothesis is sufficiently proven. The consumers have been found to obtain water supply through alternative arrangements (Tables 8.25, 8.26, 8.27, 8.28 and 8.34). While several of these means exist and function, some of them do not have any recognition in the formal system (Table 8.17, Figure 8.1 and also Annexure-13).

9. CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH

9.1 Revisiting Research Premise, Hypothesis and Questions

Water supply service is accessed by the urban consumers in a variety of arrangements that are developed by several types of conventional and unconventional providers. The study of these arrangements in varius contexts, as done in Chapter-2, revealed several common demominators that led to a premise for this research. Components of this premise include the existence of water as a saleable commodity without any formal recognition of this fact; greater price paid by urban poor than other income groups; vending operations found to be more expensive than piped supply; limited formal relationship beteen public and private sectors in the domain of water supply and piped connections as the legally recognized arrangements for water supply in urban areas. Literature was found on the water supply through utilities and related aspects. Literature was also found on water vending in smaller cities and peri-urban areas. However a knowledge gap was found about the alternative arrangements through which water is accessed by urban consumers on a routine basis. This dissertation is an attempt to address this knowledge gap.

The research into this gap was guided by a hypothesis that stated that consumers obtain water through many modes which depend upon alternative arrangements not integrated in the formal procedures. Exploration into the urban water supply domain was structured around the fundamental research question as to why consumers resort to alternative supply arrangements. Relevant background for appropriate exploration was developed through several sub-questions. Perceived status of water supply; modes; factors affecting supply; frequency; machinery and equipment; staff and personnel as well as characteristics of available alternative arrangements constituted the sub-questions. A research design was prepared that incorporated the premise, guiding hypothesis and research questions, as elaborated in sections 3.2, 3.3, 3.4 and 3.5. Three case studies were undertaken in the city of Karachi to generate the data to test the hypothesis and explore the research questions

(Chapters 4-6). Research findings and analysis of this data is presented in chapters 7 and 8.

9.2 Reference to the Literature

The literature review in Chapter-2 has generated the theoretical premise and arguments explored in the course of this dissertation. Bodies of relevant literature have demonstrated the existence and subscription of alternative water supply arrangements. Research questions, that were formulated in section 3.4, have been generally addressed by the literature. Below is a summarised account of the literature's response to the research questions:

- **Perceived Status of Water Supply**

In the discussion on water supply in relation to public and private sector (section 2.2.3), reference is made to consider access to essential quantities of water as a basic human right. While many international conventions and debates have stressed on this matter, the practices show that water is sold as a tradable commodity in many contexts and situations. Urban poor, who normally desire to access basic quantities of water, can only obtain it through expensive vending options.

- **Modes and Arrangements**

Water supply service is accessed through multiple modes especially in those areas where piped supply service is not available or disconnected for some reasons. These modes are often utilized through arrangements according to mutual satisfaction of consumers and providers as discussed in section 2.3.2. Water vending arrangements draw from sources of various kinds; stand pipes (posts) and kiosks primarily for low income communities; *aquateros* who supply through ground water sources; independent providers who developed independent links to sources of supply and water re-selling enterprises of different scales and nature of operations have been evidenced in the literature.

- **Factors Affecting Supply**

  Many factors affected supply. Several of them are discussed in section 2.5.2. Literature showed that such alternative arrangements were successful that adopted a market based approach. Recognition of alternative arrangements was a crucial factor. Where recognized, the alternative arrangements were able to sustain and scale up their operations. In many contexts, small scale operators were found to be consumer driven with an ability to adapt to changing conditions. Contractual arrangements between utilities and alternative service providers was also a key factor affecting supply. In many low income communities and other contexts human relationships from the ranks of consumers and providers affected the service delivery.

- **Frequency, Machinery and Equipment**

  Examples discussed in the literature showed that the independent providers aimed to provide service according to the desirable frequency and need of the consumers. The *'aquateros'* in Paraguay are an example where they invested in the infrastructure including machinery and equipment to facilitate service (section 2.3.2). Instances where desirable frequency was not ascertained showed that the consumers were dissatisfied with the service. Example of Kiberia kiosks in Nairobi is an example cited in the literature.

- **Staff and Personnel**

  Water supply service was found to be affected by human relationships. Alternative arrangements were often managed by communities. Utilities also engaged into working relationships with independent providers and communities for mutual interest (section 2.5.2). An interesting finding was the fact that in several alternative arrangements, menfolk were dominant primarily due to extensive physical labour involved in the exercise.

- **Characteristics of Alternative Arrangements**

  The literature has provided several characteristics of alternative arrangements which are mentioned in sections 2.2.2, 2.3.2, 2.4.2 and 2.5.2. Flexibility to accommodate consumer's need; capacity to generate options; innovation to derive unconventional arrangements; adjusting to conditions of monopoly and competition and generating useful institutional arrangements such as public private partnerships are key characteristics highlighted in the literature.

9.3 Findings and Analysis from Case Studies

Section 3.3 had described the guiding hypothesis that argued that consumers in urban areas obtained water through many modes which depended upon alternative supply arrangements not integrated in formal procedures. The fundamental research question that emerged from this hypothesis was that why consumers resort to alternative arrangements (Section 3.4). The research design, case studies and their analysis have addressed these issues leading to conclusions which are discussed in this sub-head.

The consumers have been found to obtain water supply through a variety of arrangements as mentioned in the findings and analysis (Chapters 4-8). The case studies have demonstrated that in planned areas, consumers obtained water supply through a piped mode which largely functioned with the help of a suction pump. The other alternatives that were commonly resorted by consumers included commercial water tankers and boreholes. In unplanned areas, the supply was facilitated to a limited extent by piped water supply with suction pumps and augmented through boreholes, commercial water tankers, vending supply through donkey carts and/or manual water carriers as well as boreholes. In remote areas, where piped water service did not exist, people relied upon the *awami* tanks. Localities serviced by bulk consumers obtained water supply through a limited piped supply service and combination of other modes including commercial tankers, boreholes and tankers supplied by the bulk consumer itself.

Consumers accessed water supply through arrangements mutually worked out with various set of stakeholders as outlined in Chapters 7 and 8. This aspect refers to the relationship with valvemen, staff members of KWSB/WSD and water vendors. For instance, the logical framework in section 3.5 described that one of the reasons to approach alternative modes was the disconnection of service. The correlations in Tables 8.24 and 8.25 showed that the disconnection of service possessed a strong correlation with valvemen and KWSB/WSD staff. Interestingly, the correlation and regression analysis between commercial tankers and disconnection of service was negative. This proved that in the instance of disconnection, consumers had a choice to select any alternative arrangement – not necessarily commercial tankers. Since the role of these stakeholders affects water supply (Figure 8.40), the performance of the arrangement depends upon the relationship of the consumers with these stakeholders.

Consumers often accessed water supply through arrangements which were not part of formal procedures. Chapter-6 described the case study of awami tanks which was worked out locally to serve the local consumers. Logical framework (section 3.5) laid down the argument that many alternative arrangements could not be integrated due to lack of institutional provision. Correlations between legal status of supply and settlements and piped supply – being the standard institutional mode – had a strong relationship (Tables 8.8, 8.9 and 8.40). Other modes such as *awami* tanks have been in usage for a sizable period of time (Table 6.1). However they have not been integrated as an established mode neither by the utility [section 6.3.5(d) and (e)] nor by the consumers (Table 6.5). While this practice worked for several years, it was not made a part of the KWSB/WSD system.

The response to the research question as to why alternative supply arrangements are resorted has been provided in the case study description and analysis (chapters 4-8). In following up of the logical framework (section 3.5), it was found that piped water supply and adequacy had a strong correlation. However piped supply was largely dependent on suction pumps (Table 8.40). The regression analysis in Figure 8.2 also predict that dependence on suction pumps shall continue as a trend, given the prevailing circumstances. This meant that even within a conventional mode of supply, there was an alternative arrangement which was essentially catalytical for its routine functioning. Inadequate supply, less reliable supply arrangements, less quantity and poor quality were the key reasons that led the consumers choose an alternative arrangement. Absence of supply and disconnection of service were also important reasons. While the consumers attempted to use several supply arrangements, the piped supply was perceived as the most desirable mode to access water.

The findings and analysis established the argument that water supply service was facilitated in more than one ways. The service adjusted itself between the desires of consumers and the capacity of service delivery by the providers. The logical framework in section 3.5 had outlined the possibility of existence of several alternative arrangements for water supply. Research showed that various categories of consumers resorted to different arrangements according to their choices and available modes. In low income unplanned areas such as Orangi, *awami* tanks were considered as a useful alternative (Table 6.2) with an ultimate aspiration to acquire piped water service (Table 6.3). In this pursuit, it acquired many unconventional forms which were not laid down in the prevailing procedures of the utility/municipal administration. For instance, in the event of disconnection of service, supply from boreholes was opted by consumers (Table 8.40).

With the exception of suction pumps individually or collectively installed on the piped network and the boreholes, the other modes have been atleast partly recognized by the utility. The reason for non-recognition of boreholes is obviously due to its poor quality and unfitness for human consumption. The KWSB/WSD staff and other stakeholders gave a very clear view on this option (Annexure 13). Suction pumps were perceived as quasi-criminal activities however tolerated due to the inability of the utility to extend service to its bonafide consumers. Suction pumps were an open secret. It was also clear that they could not be integrated in the formal system (Focused group meeting with KWSB/WSD staff – Anexure-13).

Possibilities of integration of different alternatives were variable. The alternative arrangements where legal, administrative and financial barriers did not arise, had the possibilities for integration. In this respect, the supply of water through commercial water tankers, KWSB/WSD tankers and awami tanks have the possibility. The chances of boreholes and suction pump getting legalized were very remote. This was due to the reasons that both of these arrangements were illegal and administratively unviable. They were only applied temporarily till such time that the level of service improved to an extent where their need did not remain any longer.

9.4 Contribution to Knowledge

This dissertation has attempted to make contributions to the existing body of knowledge pertinent to the gap identified in the literature review in chapter-2. It is mentioned below:

The dissertation has created a framework to study the water supply service in a typical urban setting from the standpoint of consumer – provider relationship. Internationally, there may be several urban contexts where this framework of study and analysis can be applied. As evident from the literature review, there are many urban contexts around the world where alternative arrangements exist. By applying the research approach used in this dissertation, the nature and characteristics of various arrangements of water supply can be studied after appropriate modifications. Previously, the urban water supply was traditionally approached through utility based interpretations where the emphasis was on the coverage and characteristics of service. The study has also highlighted the roles and performance of various categories of stakeholders who are vital in this context.

The study has clearly indicated the existence of built-in alternatives within the context of a piped supply system. Suction pumps and augmentation of water supply through boreholes and tankers provide sufficient proof that even those communities that are serviced by conventional supply have to resort to certain alternatives to obtain the desired level of service.

The study has laid down a framework to study the standing alternative arrangements for their possibility of integration in the formal procedure. In this reference, the study provides the consumer acceptance or otherwise as a useful variable in conjunction to administrative and legal premise of an alternative arrangement.

The study has highlighted the existence of several arrangements with a quasi-legal status that are frequently subscribed by the consumers. The interesting point is that some arrangements that are devised by the utility/municipal administration do not have any legal or administrative cover. Example of *awami* tank provides an evidence.

The study outlines the various pre-conditions that lead to the creation and sustenance of an alternative arrangement or otherwise. This aspect is vital to examine the performance of a piped system to a level where after it is supplemented with an alternative arrangement.

9.5 Directions for Further Research

Several possibilities of further research have evolved from this dissertation. Study into the financial affairs of water supply with a focus on the willingness to pay for supply services; institutional arrangements needed to manage water supply in a changing context; implications in urban areas; prospects of water vending; water consumption pattern across different income brackets; issues related to retail distribution of water in different areas are some valid options for this head.

Research around application of awami tanks may be undertaken. The perception that it is a temporary arrangement must be closely examined and finally dealt according to research findings. Many issues identified in this dissertation related to alternative means require proper sustainable solutions. They include the reliance of piped supply on individual suction, mode of operation of different types of vending, management of frequencies of water supply in different localities, social acceptance of otherwise adhoc solutions such as awami tanks and the perceived status of supply/settlement versus the settlement.

The role of elected representatives needs to be studied in the overall management of water supply affairs. This need arises due to the fact that the consumers found practically no role of elected representatives despite the fact that water is an essential necessity of life.

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ANNEXURE-01

Interviewer: ______________________________ **Code: 'D'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
Users/Households (Residents of Single Unit Housing)

A- BASIC INFORMATION

1. Name: ______________________________
2. Address: ______________________________
3. Profession/occupation: ______________________________
4. No. of household members residing in the house: ______________________
5. Owner/tenant: ______________________________
6. Date: ______________________

B- WATER SUPPLY

7. In your opinion, is water supply a **public good** or an **economic good**?
8. Give a few reasons for your answer?
9. Mode of water supply to the house
   (i) Piped supply _______ (ii) Boring hole _______
   (iii) KWSB tanker _______ (iv) Commercial water tanker _______
   (v) Bhishti (manual water carrier) _______
   (vi) Any other (please specify) ______________________

10. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    (i) Piped water supply __________
    (ii) Water tanker service __________
    (iii) Any other from of water vending ______________________
    (iv) Combination of any two or more ______________________
    (v) Others ______________________

11. What factors govern the water supply service to a consumer (choose more than one)
    (i) Legal status of house/settlement ______________________
    (ii) Legal status of water supply service ______________________
    (iii) Reliability ______________________
    (iv) Water quantity ______________________
    (v) Water quality ______________________
    (vi) Availability/access ______________________
    (vii) Others (please specify) ______________________

12. Frequency of supply
    (i) 24 hours _______ (ii) Daily _______
    (iii) Every alternate day _______ (iv) Twice a week _______
    (v) Once a week _______ (vi) Less than once a week _____
    (vii) Other (please specify) ______________________

13. Adequacy of supply
   (i) Adequate for daily use requirement ______
   (ii) Not adequate for daily use requirement ______

14. Details of apparatus/machinery related to water supply
   (i) Water pumping motor (to pump water to the overhead tank) ________
   (ii) Sution pump (pump used to suck water from external pipes) ________
   (iii) Overhead tank ____________ (iv) Underground tank ________
   (v) Filter ____________ (vi) Valving system ________
   (vii) Others (please specify) ____________________________________

15. What factors lead to the acquisition of an alternative service of water supply?
   (i) Non availability of piped water ______________________________
   (ii) Breakdown in service ______________________________________
   (iii) Inadequate quantity of water _______________________________
   (iv) Inappropriate water quality ________________________________
   (v) Others (please specify) ____________________________________

16. How a choice for alternative supply arrangement is made?
   (i) Quick availability
   (ii) Suitable quantity (to match with the household's storage capacity)
   (iii) Suitable rates of supply
   (iv) Acceptable quality
   (v) Others (please specify) ____________________________________

17. Personnel related to water supply
   (i) Plumber ______ (ii) Valveman ______
   (iii) Watchman (at the lane or sub neighbourhood level) ______
   (iv) KWSB Staff ______
   (v) Elected representatives (coucnillors/Nazim/Naib Nazim, etc.) ________
   (vi) Others (please specify) ____________________________________

C- EXPENDITURE ON WATER SUPPLY

18. Is water bill received (i) Yes ______ (ii) No ______
19. Is water bill paid (i) Yes ______ (ii) No ______
20. If not paid then the reason ______________________________________
21. Are any informal payments released to any personnel/agency for facilitating water supply? (i) Yes ______ (ii) No ______
22. If yes then to whom ______________ amount Rs. ____________ per week.
23. Do you purchase water tankers. (i) Yes ______ (ii) No ______
24. If yes then how many per week ____________.
25. Amount paid per tanker Rs. ____________.
26. Do you purchase drinking water/canned/bottled water for regular use.
   (i) Yes ______ (ii) No ______

27. If yes then at what price ____________ per week or month.

28. Remarks about the performance of (i) KWSB (ii) Nazim/Councillors in respect of water supply.

(i) Advisory role ________ (ii) Executive role ________

(iii) Attempting the complaints ________

(iv) Attending the complaints and solving them ________

(v) Forwarding complaints to concerned agency ________

(vi) Any other role ____

D- PROBLEMS AND SUGGESTIONS RELATED TO WATER SUPPLY

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ANNEXURE-02

Interviewer: ______________________________ **Code: 'I'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
Users/Households (Residents of Apartments)

A- BASIC INFORMATION

1. Name: ______________________________
2. Address: ______________________________
3. Profession/occupation: ______________________________
4. No. of household members residing in the apartment: ______________
5. Owner/tenant: ______________________________
6. Date: ______________

B- WATER SUPPLY

7. In your opinion, is water supply a **public good** or an **economic good**? ________
8. Give a few reasons for your answer? ______________________________
9. Mode of water supply to the flat
   (i) Piped supply _______ (ii) Boring hole* _______
   (iii) KWSB tanker** _______ (iv) Commercial water tanker** ______
   (v) Bhishti (manual water carrier) _______
   (vi) Any other (please specify) ______________________________

10. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    (i) Piped water supply _________
    (ii) Water tanker service __________
    (iii) Any other from of water vending ______________________________
    (iv) Combination of any two or more ______________________________
    (v) Others ______________________________

11. What factors govern the water supply service to a consumer (choose more than one)
    (i) Legal status of house/settlement ______________________________
    (ii) Legal status of water supply service ______________________________
    (iii) Reliability ______________________________
    (iv) Water quantity ______________________________
    (v) Water quality ______________________________
    (vi) Availability/access ______________________________
    (vii) Others (please specify) ______________________________

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* Borehole in the apartment complex.
** Tanker supply to the apartments.

12. Frequency of supply
(i) 24 hours _______ (ii) Daily _______
(iii) Every alternate day _______ (iv) Twice a week _______
(v) Once a week _______ (vi) Less than once a week _____
(vii) Others (please specify) _______________________________________

13. Adequacy of supply
(i) Adequate for daily use requirement _______
(ii) Not adequate for daily use requirement _______

14. Details of apparatus/machinery related to water supply
(i) Water pumping motor (to pump water to the overhead tank) _________
(ii) Suction pump (pump used to suck water from external pipes) _________
(iii) Overhead tank ______________ (iv) Underground tank ________
(iv) Filter ______________ (vi) Valving system _________
(vii) Storage tanks within the apartments __________________
(vii) Others (please specify) _______________________________________

15. What factors lead to the acquisition of an alternative service of water supply?
(i) Non availability of piped water __________________________________
(ii) Breakdown in service ____
(iii) Inadequate quantity of water ____________________________________
(iv) Inappropriate water quality ______________________________________
(v) Others (please specify) ____

16. How a choice for alternative supply arrangement is made?
(i) Quick availability
(ii) Suitable quantity (to match with the household's storage capacity)
(iii) Suitable rates of supply
(iv) Acceptable quality
(v) Others (please specify) ____

17. Personnel related to water supply
(i) Plumber _______ (ii) Valveman _______
(iii) Watchman (of the apartments) _______
(iv) KWSB Staff _______
(v) Elected representatives (coucnillors/Nazim/Naib Nazim, etc.) ________
(vi) Others (please specify) ____

C- EXPENDITURE ON WATER SUPPLY

18. Is water bill received (i) Yes _______ (ii) No _______
19. Is water bill paid (i) Yes _______ (ii) No _______
20. If not paid then the reason ____
21. Are any informal payments released to any personnel/agency by the apartment management for facilitating water supply? (i) Yes _______ (ii) No _____
22. If yes then to whom ___________________ amount Rs. _____________ per week.
23. Do the apartment management purchase water tankers.
(i) Yes _______ (ii) No _______
24. If yes then how many per week _____________.

25. Amount paid per tanker Rs. ____________.

26. Do you purchase drinking water/canned/bottled water for regular use.
    (i) Yes ______ (ii) No ______

27. If yes then at what price ____________ per week or month.

28. Remarks about the performance of (i) KWSB (ii) Nazim/Councillors in respect of water supply (iii) Apartment management

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D- PROBLEMS AND SUGGESTIONS RELATED TO WATER SUPPLY

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ANNEXURE-03

Interviewer: ______________________________ **Code: 'F'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
(NGOs/CBOs)

A- BASIC INFORMATION

1. Name of the Organisation ____
2. Address and telephone number ____________________________________
3. Nature of activities undertaken ___________________________________
   (i) Advocacy _____ (ii) Project implementation _____
   (iii) Technical guidance _____ (iv) Lobbying _____
   (v) Any other (please specify) ______________________________
4. Office bearers/staff (President and Secretary General .....) ________________
5. Brochure or leaflet of the Organisation or any other available material ________
6. Date: ________________________

B- WATER SUPPLY

7. In your opinion, is water supply a **public good** or an **economic good**? _____
8. Give a few reasons for your answer? ______________________________
9. Supply of water to the area
   (i) Adequate and satisfactory _____ (ii) Barely satisfactory _____
   (iii) Not satisfactory ____________

10. If the supply is not satisfactory or barely satisfactory, what are the reasons for it.
    (i) Overall shortage _____ (ii) Leakage from lines _____
    (iii) Water thefts _____ (iv) Illegal connections _____
    (v) More households connected than available supply of water ___________
    (vi) Uneven distribution frequency ____________
    (vii) Others (please specify) _________________________________

11. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    (i) Piped water supply _________
    (ii) Water tanker service __________
    (iii) Any other from of water vending ___________________________
    (iv) Combination of any two or more ___________________________
    (v) Others (please specify) _______________________________

12. What factors govern the water supply service to a consumer (choose more than one)
    (i) Legal status of house/settlement ___________________________
    (ii) Legal status of water supply service _________________________
    (iii) Reliability ____
    (iv) Water quantity _______________________________________
    (v) Water quality ____
    (vi) Availability/access ____________________________________
    (vii) Others (please specify) _______________________________

13. What factors lead to the acquisition of an alternative service of water supply?
   (i) Non availability of piped water ______________________________
   (ii) Breakdown in service ______________________________
   (iii) Inadequate quantity of water ______________________________
   (iv) Inappropriate water quality ______________________________
   (v) Others (please specify) ______________________________

14. How a choice for alternative supply arrangement is made?
   (i) Quick availability (ii) Acceptable quality
   (ii) Suitable quantity (to match with the household's storage capacity)
   (iii) Suitable rates of supply (iv) Others (please specify) ____

15. In your view, is the KWSB (now Water and Sanitation Department, CDGK) discharging its duties?
   (i) Yes ___________ (ii) No ___________
   (iii) If 'yes' then how ___________ (iv) If 'no' then why _____

16. In your view, what is the status of alternate sources of water supply (please tick)

	Very good	Good	Satisfactory	Poor	Does not exist
(i) KWSB tanker service					
(ii) Commercial tanker service					
(iii) Donkey carts					
(iv) Drinking water vendors					
(v) Others (specify)					

17. As an NGO/CBO, what role do you have in the water supply affairs of the area
____

18. Are you satisfied with your role (i) Yes _____ (ii) No _____

C- PROBLEMS RELATED TO WATER SUPPLY

19. (i) Problems related to KWSB ______________________________
   (ii) Problems related to the role of elected representatives ______________
   (iii) Problems related to commercial water suppliers ________________

20. Suggestions for improvement
____
____

ANNEXURE-04

Interviewer: ______________________________ **Code: 'G'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
(Maintenance/Management Association of Apartment Blocks) (Checklist Only)

A- BASIC INFORMATION

1. Name of the Association: ______________________________
2. Office bearers: (i) President _______ (ii) Secretary ______
   (iii) Any other member ______________________________
3. Elected _______ Appointed _______ Others (please specify) ___________
4. Total no. of apartments ________ (i) Occupied _____ (ii) Vacant ______
5. Square feet area of each apartment ______________________________
6. No. of bed rooms _______________
7. No. of bath rooms _______
8. No. of underground tanks in the complex _______________
9. Capacity of underground tank/s _______________ gallons

B- WATER SUPPLY MANAGEMENT

10. In your opinion, is water supply a **public good** or an **economic good**? _______
11. Give a few reasons for your answer? ______________________________
12. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    (i) Piped water supply __________
    (ii) Water tanker service ___________
    (iii) Any other from of water vending ______________________________
    (iv) Combination of any two or more ______________________________
    (v) Others (please specify) ______________________________

13. What factors govern the water supply service to a consumer (choose more than one)
    (i) Legal status of house/settlement ______________________________
    (ii) Legal status of water supply service ______________________________
    (iii) Reliability ______________________________
    (iv) Water quantity ______________________________
    (v) Water quality ______________________________
    (vi) Availability/access ______________________________
    (vii) Others (please specify) ______________________________

14. What factors lead to the acquisition of an alternative service of water supply?
    (i) Non availability of piped water ______________________________
    (ii) Breakdown in service ______________________________
    (iii) Inadequate quantity of water ______________________________
    (iv) Inappropriate water quality ______________________________
    (v) Others (please specify) ______________________________

15. How a choice for alternative supply arrangement is made?
    (i) Quick availability
    (ii) Suitable quantity (to match with the household's storage capacity)
    (iii) Suitable rates of supply
    (iv) Acceptable quality
    (v) Others (please specify) ________________________

16. Location/placement of overhead tanks ________________________
17. How many water pumping motors are installed ______________
18. Is a suction pump installed ______________
19. If yes then what is its power ________________________
20. Does suction pump helps in acquiring water supply ______________________
21. Can you get any water without using a pump ________________________
22. How frequently is the maintenance of water supply equipment done?
    (i) Weekly ______________ (ii) Fortnightly ______________
    (ii) Others (please specify) ________________________

23. Do you receive separate electricity bill for the water supply and suction motors?
    (i) Yes ______________ (ii) No ______________

24. If yes then what is the amount ________________________
25. What is the per apartment cost paid by each household ____________________

D- PROBLEMS RELATED TO WATER SUPPLY

26. Problems
    (i) Poor quality ___________ (ii) Irregular frequency _______
    (iii) Low quality ___________ (iv) High water bill _______
    (v) Maintenance of water related infrastructure _______
    (vi) Expensive options of alternate supply (tankers) ____________________
    (vii) Any other (please specify) ________________________

27. Suggestions
    ____
    ____

ANNEXURE-05

Interviewer: ______________________________ **Code:** 'E'

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
(Elected Representatives in Local Bodies) (Checklist Only)

A- BASIC INFORMATION

1. Name: ______________________________
2. Address of the office: ______________________________
3. Designation: ______________________________
4. Population size of constituency (union council or town council) ____________
5. Date: __________________

B- WATER SUPPLY

6. In your opinion, is water supply a **public good** or an **economic good**?
7. Give a few reasons for your answer?
8. Supply of water to the area
   (i) As per need ______________ (ii) Barely satisfactory _______
   (iii) Not satisfactory __________________

9. If barely satisfactory OR not satisfactory, what are the reasons?
   (i) Overall shortage in supply ______ (ii) Leakage from lines ______
   (iii) Water thefts ______ (iv) Illegal connections ______
   (v) More households connected than supply of water ______
   (vi) Uneven distribution frequency ______ (vii) Others (please specify) ____

10. What choices a consumer possesses to subscribe to any type of water supply arrangement?
   (i) Piped water supply _________
   (ii) Water tanker service __________
   (iii) Any other from of water vending ______________________
   (iv) Combination of any two or more ______________________
   (v) Others (please specify) ______________________________

11. What factors govern the water supply service to a consumer (choose more than one)
   (i) Legal status of house/settlement ______________________
   (ii) Legal status of water supply service ____________________
   (iii) Reliability ______________________________
   (iv) Water quantity ______________________________
   (v) Water quality ______________________________
   (vi) Availability/access ______________________________
   (vii) Others (please specify) ______________________________

12. What are the commonly existing problems of water supply in the area? ________
(i) Water shortage in the overall respect ______________
(ii) Water quality is poor ________________ (iii) Leakages _______
(iv) Theft ______________ (v) Non payment of bill _______
(v) Non payment of bills ______ (vi) Unplanned development _______
(vii) Others (please specify) ______________________________________

13. What are the key responsibilities of union/town councils and elected representatives with respect to water supply?
____

14. Is the union/town council able to discharge all its duties towards water supply?
(i) Yes ___________ (ii) No ___________

15. If the answer of 14 is No. then what are the reasons?
(i) Shortage of funds __________
(ii) Absence/shortage of maintenance staff __________
(iii) Shortage of water __________
(iv) Absence of clear relationship with KWSB __________
(v) Absence of prior experience in managing water supply __________
(vi) People do not approach for their problems in water supply __________
(vii) Others (please specify) ______________________________________

16. What factors lead to the acquisition of an alternative service of water supply?
(i) Non availability of piped water ________________________________
(ii) Breakdown in service ______________________________________
(iii) Inadequate quantity of water __________________________________
(iv) Inappropriate water quality ___________________________________
(v) Others (please specify) ______________________________________

17. How a choice for alternative supply arrangement is made?
(i) Quick availability
(ii) Suitable quantity (to match with the household's storage capacity)
(iii) Suitable rates of supply
(iv) Acceptable quality
(v) Others (please specify) ______________________________________

18. In your view, is the KWSB (now Water and Sanitation Department) discharging its duties?
(i) Yes _______ (ii) No _______
(ii) If yes, then why? ____

19. In your view, what is the status of alternate sources of water supply (please tick).

	Very good	Good	Satisfactory	Poor	Does not exist
(i) KWSB tanker service					
(ii) Commercial tanker service					
(iii) Donkey carts					
(iv) Drinking water vendors					
(v) Others (specify)					

C- PROBLEMS AND SUGGESTIONS

20. Problems related to the performance of elected representatives ____________
    - (i) No legal power _______ (ii) No administrative control _____
    - (iii) No executive authority _________ (iv) No funds __________
    - (v) Others (please specify) ______________________________

21. Suggestions to overcome the problems as well as water supply situation
    ____
    ____
    ____

ANNEXURE-06

Interviewer: ______________________________ **Code:** _____________

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF PLANNED SETTLEMENTS
KWSB Staff

A- BASIC INFORMATION

1. Name: _________________________ Designation _________________
2. Address: ____
4. Date: ________________________

B- WATER SUPPLY

5. Supply of water to the area
   (i) As per need of the area ____ (ii) Barely satisfactory in the area ____
   (iii) Not satisfactory ___________

6. If the answer of 5(ii) and 5(iii) is YES, then what are the reasons for it?
   ____
   ____

7. What are the commonly existing problems of water supply in the area?
   ____
   ____

8. Do the people lodge complaints to water board in case of any emergency or problem?
   ____
   ____

9. Do the people pay KWSB bills? Yes __________ No ___________
10. If 'no' then why? ____
   ____

11. Does the KWSB run a tanker service in case of emergency/water shortage?
   Yes_________ No ___________
12. If yes then at what rate? _______________________________________
13. Do the area residents purchase water from commercial tankers? Yes ___ No ____
14. If yes then why? ____
   ____

C- PROBLEMS RELATED TO WATER SUPPLY

15. Problems
   (i) Water shortage in the overall respect ______________
   (ii) Water quality is poor _______________ (iii) Leakages ________
   (iv) Theft _____________ (v) Non payment of bill ______
   (v) Non payment of bills __________ (vi) Unplanned development ______
   (vii) Others (please specify) ______________________________________

16. Suggestions
   ____
   ____
   ____

ANNEXURE-07

Interviewer: ______________________________ **Code: 'A'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF UNPLANNED SETTLEMENTS
Users/Households (Residents of Apartments)

A- BASIC INFORMATION

1. Name: ____________________
2. Address: ____________________
3. Profession/occupation: ____________________
4. No. of household members residing in the apartment: ____________
5. Owner/tenant: ____________________
6. Date: ______________

B- WATER SUPPLY

7. In your opinion, is water supply a **public good** or an **economic good**? ______
8. Give a few reasons for your answer? ____________________
9. Mode of water supply to the flat
   (i) Piped supply ______ (ii) Boring hole* ______
   (iii) KWSB tanker** ______ (iv) Commercial water tanker** _____
   (v) Bhishti (manual water carrier) ____ (vi) Any other (please specify)

10. What choices a consumer possesses to subscribe to any type of water supply arrangement?
   (i) Piped water supply _________
   (ii) Water tanker service _________
   (iii) Any other from of water vending ______________
   (iv) Combination of any two or more ______________
   (v) Others (please specify) ______________

11. What factors govern the water supply service to a consumer (choose more than one)
   (i) Legal status of house/settlement ______________
   (ii) Legal status of water supply service ______________
   (iii) Reliability ______________
   (iv) Water quantity ______________
   (v) Water quality ______________
   (vi) Availability/access ______________
   (vii) Others (please specify) ______________

12. Frequency of supply
   (i) 24 hours ______ (ii) Daily ______
   (iii) Every alternate day ______ (iv) Twice a week ______
   (v) Once a week ______ (vi) Less than once a week ______
   (vii) Others (please specify) ______________

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* Borehole in the apartment complex.
** Tanker supply to the apartments.

13. Adequacy of supply
  (i) Adequate for daily use requirement ____________
  (ii) Not adequate for daily use requirement ____________

14. Details of apparatus/machinery related to water supply
  (i) Water pumping motor (to pump water to the overhead tank) ________
  (ii) Suction pump (pump used to suck water from external pipes) ______
  (iii) Overhead tank ____________ (iv) Underground tank ______
  (v) Filter ____________ (vi) Valving system _______
  (vii) Storage tanks within the apartments ________________
  (vii) Others (please specify) ______________________________

15. What factors lead to the acquisition of an alternative service of water supply?
  (i) Non availability of piped water ________________________
  (ii) Breakdown in service ______________________________
  (iii) Inadequate quantity of water ________________________
  (iv) Inappropriate water quality ________________________
  (v) Others (please specify) ________________________

16. How a choice for alternative supply arrangement is made?
  (i) Quick availability
  (ii) Suitable quantity (to match with the household's storage capacity)
  (iii) Suitable rates of supply
  (iv) Acceptable quality
  (v) Others (please specify) ________________________

17. Personnel related to water supply
  (i) Plumber _______ (ii) Valveman _______
  (iii) Watchman (of the apartments) ______ (iv) KWSB Staff ____
  (v) Elected representatives (coucnillors/Nazim/Naib Nazim, etc.) ______
  (vi) Maintenance and management union of the Apartments __________
  (vii) Others (please specify) ________________________

18. Role of personnel related to water supply
  (i) Advisory role __________ (ii) Executive role ________
  (iii) Attending the complaints __________
  (iv) Attending the complaints and solving them __________
  (v) Forwarding complaints to concerned agency __________
  (vi) Any other role ______________________________

C- EXPENDITURE ON WATER SUPPLY

18. Is water bill received. (i) Yes ______ (ii) No ______
19. Is water bill paid. (i) Yes ______ (ii) No ______
20. If not paid then the reason
  (i) Too expensive __________
  (ii) Not obliged to pay as does not receive service __________
  (iii) No compulsion to pay __________
  (iv) Others (please specify) ________________________

21. Are any informal payments released to any personnel/agency by the apartment management for facilitating water supply?
(i) Yes ______ (ii) No ______

22. If yes then to whom ________________ amount Rs. ___________ per week.
23. Do the apartment management purchase water tankers.
(i) Yes ______ (ii) No ______

24. If yes then how many per week ___________.
25. In case of shortage, what is the measure adopted:
(i) Purchase commercial tankers ________ (ii) KWSB tankers ____
(iii) Obtain from any nearby apartment ___________
(iv) Individual apartment owners arrange it through their own means (buckets, drums, cans filled from neighbours and relations for drinking purposes) ______________

26. Amount paid per tanker Rs. ______________________.
27. Do you purchase drinking water/canned/bottled water for regular use.
(i) Yes ______ (ii) No ______

28. If yes then at what price ____________ per week or month.

29. Remarks about the performance of (i) KWSB (ii) Nazim/Councillors in respect of water supply (iii) Apartment management _________________

D- PROBLEMS RELATED TO WATER SUPPLY

30. Problems
(i) Poor quality __________ (ii) Irregular frequency ________
(iii) Low quality __________ (iv) High water bill ___________
(v) Maintenance of water related infrastructure ___________________
(vi) Expensive options of alternate supply (tankers) _________________
(vii) Any other (please specify) ______________________________

31. Suggestions
____
____
____

ANNEXURE-08

Interviewer: ______________________________ **Code:** 'H'

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF UNPLANNED SETTLEMENTS
Users/Households (Residents of Single Unit Housing)

A- BASIC INFORMATION

1. Name: ______________________________
2. Address: ______________________________
3. Profession/occupation: ______________________________
4. No. of household members residing in the house: ______________
5. Owner/tenant: ______________________________
6. Date: ______________________

B- WATER SUPPLY

7. In your opinion, is water supply a **public good** or an **economic good**? _____
8. Give a few reasons for your answer? ______________________
9. Mode of water supply to the house
   (i) Piped supply _______ (ii) Boring hole _______
   (iii) KWSB tanker ______ (iv) Commercial water tanker _______
   (v) Bhishti (manual water carrier) _______
   (vi) Any other (please specify) ______________________
10. What choices a consumer possesses to subscribe to any type of water supply arrangement?
   (i) Piped water supply _________
   (ii) Water tanker service __________
   (iii) Any other from of water vending ______________________
   (iv) Combination of any two or more ______________________
   (v) Others (please specify) ______________________

11. What factors govern the water supply service to a consumer (choose more than one)
   (i) Legal status of house/settlement ______________________
   (ii) Legal status of water supply service ______________________
   (iii) Reliability ______________________
   (iv) Water quantity ______________________
   (v) Water quality ______________________
   (vi) Availability/access ______________________
   (vii) Others (please specify) ______________________

12. Frequency of supply
   (i) 24 hours _______ (ii) Daily _______
   (iii) Every alternate day _______ (iv) Twice a week _______
   (v) Once a week _______ (vi) Less than once a week _____
   (vii) Others (please specify) ______________________

13. Adequacy of supply
   (i) Adequate for daily use requirement _______
   (ii) Not adequate for daily use requirement _______

14. Details of apparatus/machinery related to water supply
   (i) Water pumping motor (to pump water to the overhead tank) __________
   (ii) Suction pump (pump used to suck water from external pipes) __________
   (iii) Overhead tank _____________ (iv) Underground tank ________
   (v) Filter _____________ (vi) Valving system __________
   (vii) Others (please specify) ______________________________________

15. What factors lead to the acquisition of an alternative service of water supply?
   (i) Non availability of piped water ______________________________
   (ii) Breakdown in service ____________________________________
   (iii) Inadequate quantity of water _______________________________
   (iv) Inappropriate water quality ________________________________
   (v) Others (please specify)____________________________________

16. How a choice for alternative supply arrangement is made?
   (i) Quick availability
   (ii) Suitable quantity (to match with the household's storage capacity)
   (iii) Suitable rates of supply
   (iv) Acceptable quality
   (v) Others (please specify) ______________________________________

17. Personnel related to water supply
   (i) Plumber ______ (ii) Valveman ______
   (iii) Watchman (at the lane or *katchi abadis* level) ______
   (iv) KWSB Staff ______
   (v) Elected representatives (coucnillors/Nazim/Naib Nazim, etc.) _________
   (vi) Others (please specify) ______________________________________

C- EXPENDITURE ON WATER SUPPLY

18. Is water bill received (i) Yes ______ (ii) No ______
19. Is water bill paid (i) Yes ______ (ii) No ______
20. If not paid then the reason ____
21. Are any informal payments released to any personnel/agency for facilitating water supply? (i) Yes ______ (ii) No ______
22. If yes then to whom __________________ amount Rs. __________ per week.
23. Do you purchase water tankers. (i) Yes ______ (ii) No ______
24. If yes then how many per week ____________.
25. Amount paid per tanker Rs. _____________.
26. Do you purchase drinking water/canned/bottled water for regular use.
   (i) Yes ______ (ii) No ______

27. If yes then at what price _____________ per week or month.
28. Remarks about the performance of (i) KWSB (ii) Nazim/Councillors in respect of water supply.

____

D- PROBLEMS AND SUGGESTIONS RELATED TO WATER SUPPLY

____

____

ANNEXURE-09

Interviewer: ______________________________ **Code: 'B'**

CASE STUDY-01: GENERAL WATER SUPPLY
SURVEY OF UNPLANNED SETTLEMENTS
KWSB Staff (Checklist only)

A- BASIC INFORMATION

1. Name: ________________________________
   Designation ____________________
2. Address: ____
4. Date: ________________________

B- WATER SUPPLY

5. In your opinion, is water supply a **public good** or an **economic good**?
6. Give a few reasons for your answer?
7. Supply of water to the area
   (i) As per need of the area ________
   (ii) Barely satisfactory in the area ________
   (iii) Not satisfactory __________

8. If the answer of 7(ii) or 7(iii) is YES, then what are the reasons for it? ________
9. What are the commonly existing problems of water supply in the area? ________
   (i) Poor quality _____ (ii) Irregular frequency _____
   (iii) Low quality _____ (iv) High water bill ______
   (v) Maintenance of water related infrastructure _____
   (vi) Expensive options of alternate supply (tankers) _____
   (vii) Any other (please specify) _____

10. Do the people lodge complaints to water board in case of any emergency or problem?
    ____
11. Do the people pay KWSB bills? Yes __________ No ___________
12. If 'no' then why? ____
13. Does the KWSB run a tanker service in case of emergency/water shortage?
    Yes___ No ____

14. If yes then at what rate? ____
15. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    (i) Piped water supply __________
    (ii) Water tanker service __________
    (iii) Any other from of water vending ____________________________
    (iv) Combination of any two or more ______________________________
    (v) Others (please specify) ______________________________________

C- PROBLEMS RELATED TO WATER SUPPLY

16. What factors govern the water supply service to a consumer (choose more than one)
    - (i) Legal status of house/settlement ______________________
    - (ii) Legal status of water supply service ______________________
    - (iii) Reliability ______________________
    - (iv) Water quantity ______________________
    - (v) Water quality ______________________
    - (vi) Availability/access ______________________
    - (vii) Others (please specify) ______________________

17. Problems
    - (i) Water shortage in the overall respect _____
    - (ii) Water quality is poor _____
    - (iii) Leakages _____
    - (iv) Theft _____
    - (v) Non payment of bills _____
    - (vi) Unplanned development _____
    - (vii) Others (please specify) _____

18. What factors lead to the acquisition of an alternative service of water supply?
    - (i) Non availability of piped water ______________________
    - (ii) Breakdown in service ______________________
    - (iii) Inadequate quantity of water ______________________
    - (iv) Inappropriate water quality ______________________
    - (v) Others (please specify)______________________

19. How a choice for alternative supply arrangement is made?
    - (i) Quick availability
    - (ii) Suitable quantity (to match with the household's storage capacity)
    - (iii) Suitable rates of supply
    - (iv) Acceptable quality
    - (v) Others (please specify)

    ____

20. Suggestions

    ____

    ____

ANNEXURE-10

Interviewer: **Code: 'M'**

BULK WATER SUPPLY STUDY
CASE STUDY NO. 2
KWSB Staff Related to Bulk Water Supply (Checklist Only)

A- BASIC INFORMATION

1. Name of the staff member:
2. Designation:
3. Organisation/Agency
4. Date of interview
5. In your opinion, is water supply a **public good** or an **economic good?**
6. Give a few reasons for your answer?
7. What is your process of obtaining and distribution of bulk water supply system?
8. Is KWSB fulfilling your existing needs of bulk water supply satisfactorily? Yes, No, If no why.
9. Who are your existing clientele consumers of this bulk water supply system? Give list if available?
10. How much is the requirement of water as per your existing clientele consumers?
11. Who are the potential future clientele of this system?
12. In your opinion how efficiently the bulk water supply department of KWSB is operating? Are there any problems?

B- WATER SUPPLY

13. What is the level of administrative link with bulk consumers?
14. Operation and maintenance issues?
15. Billing and recovery issues?
16. What choices a consumer possesses to subscribe to any type of water supply arrangement?
    - (i) Piped water supply
    - (ii) Water tanker service
    - (iii) Any other from of water vending
    - (iv) Combination of any two or more
    - (v) Others (please specify)

17. What factors govern the water supply service to a consumer (choose more than one)
    - (i) Legal status of house/settlement
    - (ii) Legal status of water supply service
    - (iii) Reliability
    - (iv) Water quantity
    - (v) Water quality
    - (vi) Availability/access
    - (vii) Others (please specify)

18. What factors lead to the acquisition of an alternative service of water supply?
    (i) Non availability of piped water
    (ii) Breakdown in service
    (iii) Inadequate quantity of water
    (iv) Inappropriate water quality
    (v) Others (please specify)

19. How a choice for alternative supply arrangement is made?
    (i) Quick availability
    (ii) Suitable quantity (to match with the household's storage capacity)
    (iii) Suitable rates of supply
    (iv) Acceptable quality
    (v) Others (please specify)

C- SUGGESTIONS/RECOMMENDATIONS FOR THE OVERALL IMPROVEMENT

ANNEXURE-11

BULK WATER SUPPLY STUDY
CASE STUDY NO. 2
Staff of the Organisation/Agency Receiving Bulk Water Supply (Checklist Only)

A- BASIC INFORMATION

1. Name of the staff member: ______________________
2. Designation: ______________________
3. Organisation/Agency ______________________
4. Date of interview ______________________

B- WATER SUPPLY

5. When bulk water connection was obtained ______________________
6. Type of bulk connection ______________________
7. Main conditions of the bulk connection ______________________
8. Total bulk water obtained per day ______________________
9. No. of retail connections granted by the said organisation/agency ____________
10. Description of water supply from bulk to retail consumers ____________
11. Description of problems faced in the working of the bulk supply cycle
    (a) Problems faced by the consumers ______________________
    (b) Problems faced by the organisation ______________________

C- FINANCIAL DETAILS

12. Rate at which water is obtained from KWSB ______________________
13. Rate at which water is supplied to retail consumers
    (a) Domestic __________ (b) Commercial __________ (c) Industrial ____

14. How rates with KWSB are determined ______________________
15. How rates for retail consumers are determined ______________________
16. Are bills of KWSB regularly paid by the organisation ______________________
17. Are recoveries from the retail consumers satisfactory? ______________________
18. If not, then what is the reason? ______________________
19. Does your organisation arranges for a tanker service for consumers
    (a) Yes ____________ (b) No ____________

20. If yes, then give details ______________________
    ____
21. Does your organisation also purchase water through commercial tankers?
    (a) Yes ____________ (b) No ____________

22. If yes, then please give details ______________________
    ____

D- SUGGESTIONS/RECOMMENDATIONS FOR THE OVERALL IMPROVEMENT

____
____

ANNEXURE-12

Interviewer: ______________________________ **Code: 'C'**

BULK WATER SUPPLY STUDY
CASE STUDY NO. 2
Retail Beneficiaries of Bulk Water Supply

A- BASIC INFORMATION

1. Name: ____
2. Address: ____
3. House type:
   (a) Single unit _____ (b) Double unit _____
   (c) Apartment _____ (d) Others (please specify) ____________

4. Organisation/agency through which water connection/supply is provided ____
5. Date of interview: ____________________

B- WATER SUPPLY

6. In your opinion, is water supply a **public good** or an **economic good**?
7. Give a few reasons for your answer?
8. Mode/s of water supply to the house
   (a) Piped supply ______
   (b) Boring hole ______
   (c) Tanker arranged by the agency/organization ______
   (d) Commercial water tanker ______
   (e) Manual water carrier (Bhishtee) _______
   (f) Any other source (please specify) _________________________

9. What choices a consumer possesses to subscribe to any type of water supply arrangement?
   (i) Piped water supply _________
   (ii) Water tanker service __________
   (iii) Any other form of water vending ____________________
   (iv) Combination of any two or more ____________________
   (v) Others (please specify) ___________________________

10. What factors govern the water supply service to a consumer (choose more than one)
   (i) Legal status of house/settlement ____________________
   (ii) Legal status of water supply service __________________
   (iii) Reliability ________________________________
   (iv) Water quantity ______________________________
   (v) Water quality _______________________________
   (vi) Availability/access ____________________________
   (vii) Others (please specify) __________________________

11. Frequency of supply from the piped connection
   (a) 24 hours _______ (b) Daily _______
   (c) Every alternate day _______ (d) Twice a week _______
   (e) Once a week _______ (f) Less than once a week _______
   (g) Others (please specify) _______________________________________

12. Adequacy of supply
   (a) Supply is adequate for domestic requirements _______________
   (b) Supply is not adequate for domestic requirements _______________

13. If the supply is not adequate, then the reason is:
   (a) Piped supply is less than required ______________________
   (b) Tankers load of water from the organization/agency are less than required ___________
   (c) Leakage or pilferage _______________
   (d) Any other reason (please specify) ______________________________

14. Details of apparatus/machinery related to water supply:
   (a) Water pumping motor (to pump water from underground to overhead tank) _______________
   (b) Suction pump (pump used to suck water from external lines) ________
   (c) Underground tank _________ (d) Overhead tank _________
   (e) Filter ____________________ (f) Valving system ________
   (g) Others (please specify) _______________________________________

15. What factors lead to the acquisition of an alternative service of water supply?
   (a) Non availability of piped water ________________________________
   (b) Breakdown in service ____
   (c) Inadequate quantity of water ___________________________________
   (d) Inappropriate water quality ____________________________________
   (e) Others (please specify) _______________________________________

16. How a choice for alternative supply arrangement is made?
   (a) Quick availability
   (b) Suitable quantity (to match with the household's storage capacity)
   (c) Suitable rates of supply
   (d) Acceptable quality
   (e) Others (please specify) _______________________________________

17. While apparatus/machinery/infrastructure is provided/installed by the agency/organisation

   ____

18. What are the personnel related to water supply operations/maintenance?

   ____

C- **EXPENDITURE ON WATER SUPPLY**

19. Amount spent per month/year on water supply
    - (a) Water bill (annual/monthly) ______________
    - (b) Tankers (monthly by the agency) ______________
    - (c) Tankers (commercial monthly) ______________
    - (d) Any other (please specify) ____________________________________

20. Is water bill paid? (a) Regularly __________ (b) Not regularly _______
21. If not paid then the reason ____
22. Are any informal payments released to any personnel/agency for facilitating water supply? (a) Yes ______________ (b) No ______________
23. If yes then to whom ____
24. Do you purchase drinking water/cannel/bottled water for normal use?
    - (a) Yes ______________ (b) No ______________

25. If yes then how much ____
26. Do the elected representatives (nazim, councilors) have any role in water supply arrangements?

    ____
27. If yes, then what type of role? _____________________________________
    - (i) Advisory role ___________
    - (ii) Executive role ___________
    - (iii) Attending the complaints ___________
    - (iv) Attending the complaints and solving them ___________
    - (v) Forwarding complaints to concerned agency ___________
    - (vi) Any other role ____

D- **PROBLEMS AND SUGGESTIONS RELATED TO WATER SUPPLY**

____

____

ANNEXURE-13: TRANSCRIPTS

1. FOCUSED GROUP WITH KWSB SUPPLY STAFF IN ORANGI TOWN (September, 2003)

- On the basis of rights water is an essential commodity. Hence it has to be accessible to all the human beings.
- The service has a cost which needs to be borne out by those who benefit from this service. When we see the pipelines laid and the contracts awarded by our institution, this aspect becomes all the more evident.
- It shall be useful if water tax is affordable by all the users and has a large clientele to pay back. From some of our experiences in the field, we found that people using water are honest and willing to pay for it.
- Supply in squatter settlements is adversely affected by water thefts and leakages in the main system of supply. This is a well thought out and organized crime. It happens in those locations where water lines with continuous supply are passing through.
- People obtain water from a wide variety of sources. However the water supplied from a KWSB source is better in terms of quality compared to other sources. People, who use boreholes and water from illegal hydrants are mostly affected by different types of diseases.
- If leakages and thefts are completely stopped, water supply shall become adequate for all existing consumers. Law enforcement agencies, police and rangers will have to cooperate with KWSB.
- The use of suction pumps is found almost every where in the network. In some tail end locations, suction pumps actually accelerate the legal supply since KWSB pumping is weak.
- People resort to water supply arrangements on the basis of quick availability of the service. People cannot wait, water must be readily available.
- The valve operator sometimes connive with area influentials to change the supply plans.
- There is no possibility of suction pumps or boreholes to be legalized. They are considered as absolutely illegal entities.

2. KWSB/WSD STAFF DEPUTED IN PLANNED AREAS (September, 2003)

- Water supply is essentially a service with a cost factor. If this factor is not properly accounted for, the service shall fail to deliver.
- Although water is supplied through a singular format in residential areas by KWSB, due to scarcity and other reasons, people resort to different modes of water supply.
- Arrangements for alternative sources of supply are largely flexible. However in planned settlements the reliance usually remains on tankers. These tankers sometimes obtain water from illegal hydrants also.
- In planned areas, water connection is essentially provided to households. However the availability of adequate quantities depend upon the source and leakages in the system. If leakages are several or the thefts exist, water is lost on the way. It has been found that the people are also responsible for the leakages, thefts and similar line defects. Even when they observe a damage or any other kind of defect, they do not report the matter.
- Places which are connected with KWSB normally receive water on a regular frequency. Technical faults and breakdowns are the only ruptures experienced in this reference.
- People create problems due to their own doings. At times they install very heavy suction pumps which suck water creating trouble for other people in the area. It is not that the poor steal water. The rich are included in this organized activity without the fear of being caught (due to their clout). People also build oversized water tanks to store more than required quantity of water.
- Valvemen is a crucial person. At times he violates his job description to provide water to a few households.
- The valvemen, KWSB repair staff and local area councilors are vital in the distribution process of water.
- Water tankers happen to be the most common mode of water supply when scarcity or breakdown appears.
- In Karachi, boreholes have a very limited application as the sub-soil water is brackish and often not fit for human consumption.
- People perceive water charges as 'tax' which is a wrong conception. It is a utility charge levied against consumption.
- Planned areas are supplied with connection much more easily than unplanned areas. Due to their procedural validity, they atleast get a water connection as a sign of hope to receive water at some point in time.

3. FOCUSED GROUP MEETING WITH ELECTED REPRESENTATIVES (October, 2003)

- Water should be considered as an essential commodity with no profit motivation.

- Elected representatives have no direct link with water supply. The KWSB staff and top management does not wish to be a subordinate of elected representatives, mainly local bodies. They have their own objectives to fulfil, mainly for personal gains.

- If some role is given to elected representatives, the situation shall improve, as they will be able to better understand the problems.

- At present frequency of water supply in some planed areas is very poor. For instance, in Gulistan-e-Jauhar – despite being a planned settlement – very few households benefit.

- People report to us several ruptures in supply, excess billing and poor quality. We ask them contact concerned KWSB staff. We do not have administrative powers to exercise any control on the day to day working of KWSB.

- Thefts and suction pumps are two major negative elements in this respect. It is a dilemma that while some people complain about poor supply, they themselves are responsible for part of the causes for these problems. They should cooperate with one another without causing mutual harm by denying people the rights to access normal water supply (that is free from suction pumps/devices).

- Alternative sources are inevitable for people to survive. There is however no proper check to regulate the supply from alternate sources.

- In majority of the cases, tanker supply makes the most common alternate.

4. WATER VENDORS (DONKEY CART OPERATORS) (September and October, 2003)

- We supply water to a wide variety of clientele – shop keepers, residents, bus stop/bus depots and small workshop owners.

- Sources of water are multiple – donkey cart owners in Gulshan-e-Iqbal (Block-4A) obtain water from the broken water mains; others obtain it from boreholes and illegal hydrants. Water from broken mains fetches better price compared to the supply from boreholes.

- For us, water is a saleable commodity. We have to pay a flat rate of Rs. 50-70/= per trip to the source owner. We then supply this water to our clientele for a rate of Rs. 100-120 depending upon the season as well as demand.

- We have seen people obtain water from various sources, especially in low income groups. However people prefer to obtain water from multiple sources in order to be secure against irregularity or scarcity of supply from any source. Most of our clients are such residents/shop owners who are connected to some sort of piped supply. However they receive very limited quantity of supply as a whole.

- When there is scarcity of water, the overall supply is affected.

- In localities where piped supply is available, people are found to benefit from it only after the usage of suction pumps.

- People are bound to rely on alternative sources. For many years we have been observing that piped supply is more or less of the same quality/status. It is not improving sizably as a service option.

- People choose alternative sources according to their requirement, storage capacity, access and affordability.

- People in remote low income areas do not benefit from the piped water supply. Thus they are reluctant to pay the water bills.

5. FOCUSED GROUP MEETING WITH WATER VENDORS (TANKER OPERATORS) (October, 2003)

- Tankers provide the most useful service to a very wide section of urban population in Karachi. This population stretches from residential to industrial consumers.

- Obviously water is a saleable commodity. We have to pay for the water loads that we eventually sell in the market.

- Piped water supply is restricted to only a few residential locations in Karachi. Even in posh localities like DHA, people rely on water vending through tankers.

- We obtain water from designated hydrants. Our system is regulated by contracts that ensure that water is not sold at exorbitant prices.

- The Rangers control the city hydrants. City Government is critical of our performance due to the reason that water tankers destroy city roads due to heavy loads.

- A large number of houses and other premises that obtain water from us also use suction pumps for their piped connections. However they do not openly discuss about their existence since they are illegal in nature.

- Water vending cannot be removed as an alternative. It is the sole means of supply for a very large number of city residents. Newly developed areas, old town areas where water supply, lines are broken down, tail-end katchi abadis and areas where water is in short supply shall continue to be our clients.

- Water vending is not a recognized trade. We are only allowed to operate as petty contractors. We are harassed both by the city government/police as well as the Rangers themselves.

- When people receive a good service, they are likely to pay also. Nobody obtains water free of cost in Karachi from tankers. Just like food, clothing, shelter or even security services for which one has to financially contribute, water also possess a price.

6. FOCUSED GROUP MEETING WITH 06 REPRESENTATIVES OF PRESS/MEDIA COVERING WATER SUPPLY ISSUES IN KARACHI (November, 2003)

- Peak season of summer in Karachi is a time when chronic water supply problems are found in various city locations.

- During press coverage, the most common problems observed include absence of water supply through the pipes, leakage, thefts, monopoly by water tanker operators, mixing of potable water with underground sewerage and inability of KWSB staff to redress the complains of the consumers.

- Water is sold openly. When the shortage of supply occurs, the vendors exploit the consumers by raising the rates and creating artificial shortage.

- No city area is totally free from tanker supply. The volume and frequency may however change.

- Control of KWSB is very weak. Thefts and leakages are seldom attended. Valvemen tamper the supply by taking bribes.

- Old areas like Lyari have acute shortages.

- People are bound to depend on alternatives to piped supply in order to survive.

- People wish to improve their condition of supply, however, they have no means or control over the affairs.

- Alternative sources are easily accessible, whosever tries to approach them. They also bargain for rates acceptable.

- Far-flung squatters are distant from the mains, hence receive very little piped supply.

- Water is facilitated greatly by the local/small scale enterprises, they are normally found abundant in Karachi.

- For a sustainable urban water supply system, the vendors must be trained and strengthened. It can be housed in idle property with the help of communities.

- Alternatives need recognition whether in local supply or other options; the planning and management of the vending must be undertaken institutionally. Otherwise the monopoly of tankers shall never be checked.

7. FOCUSED GROUP MEETING WITH THE APARTMENTS MAINTENANCE ASSOCIATIONS IN PLANNED AREAS

- Participants included Nazish Heaven Action Committee, Block-11, Gulshan-e-Iqbal; Ibrahim Galaxy Action Committee, Block16, Gulshan-e-Iqbal; Salman Plaza Owners Welfare Associations, Mir Karam Ali Talpur Road, Saddar; Abdullah Terrace Owners and Residents Association, Block-16, Gulistan-e-Jauhar and Safari Heights Welfare Association, Block-15, Gulistan-e-Jauhar, Karachi (Five Sessions were held in the months of September and October 2003).

  Below is a brief of the apartment projects covered:

Name	Apartments			Area of Each Apartment in sq. ft.	No. of Bathrooms	Underground Tanks	
	Total	Vacant	Occupied			No.	Capacity in Gallons
Nazish Heaven	100	27	73	1125	3	2	10,000 each
Ibrahim Galaxy	120	44	76	950	2	2	6000 each
Salman Plaza	18	--	18	1250	3	1	3000
Abdullah Terrace	240	60	180	1250	3	2	50,000 (total)
Safari Heights	100	10	90	1250	3	1	20,000

- Water is an essential public use good. It must not be sold as a tradable commodity in the market. Payment of water tax is an essential aspect which public minded citizens undertake without fail.

- For alternate supply, tanker service is used. In Saddar, manual water carrier is also asked to provide the service.

- Legal status of water supply as well as the settlements and reliable connection to the source are factors that are vital in determining the status of water supply. It has been observed in such apartment projects where legal procedures of acquiring ownership were not completed, serious discrepancies were found in operations of water supply.

- Several reasons give rise to a need for alternative sources of water supply. Disconnection of service, supply of less quantities of water and supply of poor quality water makes it necessary for acquiring alternative sources of supply.

- Alternate is chosen by considering several factors. Ready availability and appropriate quantities are the two main features found to be viable for consideration. When the water supply is disrupted, the pressure of residents rises and the apartments union has to respond at the earliest without wasting time.

- Water cannot be obtained without suction effect of the installed pump. Thus the apartment dwellers invariably have to resort to alternative sources of supply. Most apartment complexes keep external infrastructure intact for facilities.

- Apartment owners separately charge the residents for providing water through suction effects.

- Apartments must be allocated sufficient quota of water and higher diameter connection to facilitate the smooth flow. Duration of supply must be increased to facilitate appropriate time for each resident in this reference.

- Peak summers are difficult times to obtain tankers as the number of complaints are far greater than the capacity of the agency to provide.

8. FOCUSED GROUP MEETING WITH VALVEMEN IN TWO PLANNED LOCALITIES (02 RESPONDENTS) (August, 2003)

- Our job is to open the values of the distribution lines according to the schedule and instruction of Engineer concerned.

- We report to the pumping station. As soon as the pumping in the main lines is begun, we reach our designated points and open the valves. We close them after 05 hours.

- Usually the timetable is followed. However upon receiving extraordinary instructions from our officers, we open the valves other than the normal conduct.

- We do not have the authority to change the timetable. There is a lot of propaganda against us that we are part of the network which corrupts the supply. It is not correct.

- The problem is that when in a locality water is acquired in more than one households, people steal it by installing suction pumps. It is also obvious that considerable water gets wasted due to leakages and seepages occurring in the systems.

- We do not have any ulterior motive because we are not directly concerned with the supply.

- Water lines are old and leaking in many parts of the city. It causes shortage on its own. May be the higher ranking officers need to be approached to learn about the corruption issues.

- At present, the supply of water in such areas is temporarily halted where the water lines are leaking.

9. FOCUSED GROUP MEETING WITH INFORMAL DEVELOPERS (04 IN NUMBER)
(August, 2003)

- We have helped the poor in developing their settlements and houses. This process continues in almost all the areas.

- Water was initially provided, through water tankers arranged by us, from borehole hydrants. Later the settlements received some development input and water lines were laid. However water supply was not received for a very long period of time.

- Water supply through pipe is still not predictable. Many older areas such as Orangi Town receive water for only 1-2 hours per week. They have to purchase it through tankers and donkey cart suppliers.

- New settlements are in even worse situation. They have to entirely rely on water tankers since lines are not laid.

- Situation is not likely to improve. The pumping process is very weak. Hardly any water reaches remote areas.

- The KWSB officials are also helpless. When major projects are not sanctioned, they seldom get any opportunity to improve the system.

- People also tamper with the system. They destroy the sequence by installing powerful suction pumps. In places where the electricity connection is not available, people resort to diesel motors to run these pumps.

10. FOCUSED GROUP MEETING WITH AREA RESIDENTS, MUNICIPAL COUNCILLORS, NAIB NAZIMS (DEPUTY MAYORS) OF LOCALITIES AND MANAGEMENT STAFF OF AWAMI TANKS IN GHAZIABAD, ORANGI TOWN, KARACHI JULY 2002

- Water supply project do not serve low income localities like Orangi.
- They also failed to cater to even the most essential water needs of the residents.
- It has been found that a great deal of water is stolen on the way. Some people have made water a profitable business such as tanker operators.
- Due to the creation of awami tanks, people have benefited.
- However many of them do not have proper management.
- There is little water supplied to awami tanks. Since nobody is responsible or ready to take responsibility.
- In our area we have 20 lanes and 22 councillors. What are the responsibilities of these councilors. In area, such as Christian Colony, water is being managed very well through awami tanks.
- At present, the water supply issues are being shared by KWSB, Rangers and to some extent Nazims/councilors. Crises of water supply is basically an outcome of the poor performance of KWSB. In order to make the management process effective, the system should be handed over to one agency. Awami tanks are not a permanent solution, however, they are providing a useful service in the present crises.
- The system of supply should be such that the area should receive full quota of the supply. Areas such as Bismillah Nagar where water pipelines are not available should be supplied water through awami tanks. In the present system, people are deriving full benefit from the Ranger's supply. UC-6 Orangi Town is one of the tail-end settlements. Pipeline should be laid down to properly supply water without problem. This line should be connected to a larger water supply line to ensure proper running of the system. For making solution this happen, proper documentation and survey must be done. A principle that may be tried is that the government lay down the main lines through its means and the remaining work may be done by the people through their own expenses and management.
- (Another participant from a political party contributed in the discussion at this stage). He was of the view that the system of awami tanks should be closed because it is likely to benefit the tanker operators. At present a tanker load of water costs Rs. 150. It is obtained after a great deal of hassle after spending hours requesting the tanker operators to pour the water at stipulated points.

Besides this hassle, its availability is a blessing for the residents. Our political organization was very keen to resolve the problems of water supply. Funds were also allocated to the area but, as alleged, they were embezzled by the high-ups. We, the area residents, demand the re-allocation of these funds for investment in the area). (A question was posed as to what are the water requirements of the areas of Orangi such as Gulshan-e-Zia in Sector-11½). (If piped water is supplied for 3-4 hours daily without rupture, our requirements can be met. Water pumping pressure is a major issue which does not allow water to reach the far-flung areas. Awami tanks can only serve the needs of people who have communal files. After 1993, the area residents of Gulshan-e-Zia, Ghaziabad, Sadiqabad and Mansoor Nagar used to obtain water from Sakran (a saline tube-well source). This water was supplied through water tankers at variable rates such as Rs. 200-350. This water was extremely saline and difficult to consume. One can also observe the cattle drinking water from the same source.

- KWSB has a disappointing performance. KWSB is of the view that further water cannot be provided in the far flung areas. Thus they are not willing to work on those schemes. It has not even connected the lines which were supposed to be connected to the main lines.

- Another political activist/councillor cited his view point. In order to make water available, large storage tanks should be constructed in different areas and people should be provided with water through the lines. Because where the matter of physically transporting an entity arises, the possibility of bungling also comes into picture. It is a hassle to go to the offices of Rangers and waste countless hours to obtain a tanker load of water. The movement of heavy tankers has destroyed the road surface to a great extent. In smaller lanes, the tankers cannot enter. Thus the core issue remains that KWSB does not provide us water. Whatever water we acquire is basically done through purchase. One cannot rely on the supply from Rangers. If in all 3-4 tanker loads are supplied, they are not adequate for this whole area. If one does not reach there on time, one does not get it either. Often water is supplied through pipelines it gets mixed up with sewerage. Rangers must supply water to the area according to a plan of supply irrespective of the representations made by people. This will reduce misappropriation of water to a great extent. Nazim (mayor) is not to be relied upon. He keeps sitting in his office. Councilors have to follow up all the issues. Whether, water, sewerage, law and order and others, in all cases councilors run after the issue taking initiative to resolve the issues.

- It is a hassle for womenfolk to lift the canister loads of water, from the awami tanks to their houses, in situations where there is no young male member in the household. Sometimes, donkey cart, or handcart are also used but in very rare circumstances. At this stage, the councilors of Pakistan People's Party and Jamaat-e-Islami also contributed. Gulshan-e-Zia is reported to contain a population of about 150,000 people. Water supply has been in dismal conditions. People have to fend for their own needs. However people with political and social colour succeed in obtaining water. In some areas of Orangi Town the supply is optimum while in the others the supply is scarce and not up to the mark at all. When the World Bank funded project was initiated, people were very satisfied as they anticipated that their genuine problem would be resolved. But it did not happen. The community residents even agreed to participate in the operation and maintenance of the system, but no follow up action was taken.

ANNEXURE-14

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

I- Area Residents

1. Name of the interviewee: ____________________
2. Date of interview: ____________________
3. Address: ____________________

   ____

4. Amount of water acquired from awami tank at a time: ____________________
5. Since when you are using water from awami tanks: ____________________
6. Why are you using water from awami tanks: ____________________

   ____

7. Views on the performance of the awami tanks with respect to following:
   (a) Frequency of supply: ____________________
   (b) Quantity of water made available at a time: ____________________
   (c) Hours (night and day time delivery): ____________________
   (d) Management of awami tanks: ____________________
   (e) Money/financial contribution for water purchase: ____________________
   (f) Operation and maintenance of the tanks: ____________________

8. Role of Rangers in the water supply: ____________________

   ____

9. Role of KWSB in the overall respect of water supply: ____________________

   ____

10. Role of Nazims/Naib Nazims/new local administration: ____________________

    ____

11. Specific problems related to the operation of awami tanks: ____________________

    ____

    ____

12. Suggestions for the improvement in the performance of awami tanks:

    ____

    ____

    ____

13. Are awami tanks a permanent solution for water: ____________________

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

II- KWSB Staff

1. Name of interviewee: ______________________________
2. Address: ______________________________
____

3. Designation/office: ______________________________
4. Date of interview: ______________________________
5. Background understanding about the construction and operation of awami tanks:
____
____

6. Role of KWSB in the construction, operation and management of awami tanks
____
____

7. Views on the performance of the awami tanks with respect to following:
   (a) Frequency of supply: ______________________________
   (b) Quantity of water made available at a time: ______________________________
   (c) Hours (night and day time delivery): ______________________________
   (d) Management of awami tanks: ______________________________
   (g) Money/financial contribution for water purchase: ______________________________
   (h) Operation and maintenance of the tanks: ______________________________

8. Role of Rangers in the water supply: ______________________________
____

9. Role of Nazims/Naib Nazims: ______________________________
10. Specific problems related to the operation of awami tanks: ______________________________
____

11. Suggestions for the improvement in the performance of awami tanks:
____
____
____

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

III- Pakistan Rangers

1. Name of staff: ______________________________
2. Address: ______________________________

____

3. Date of interview: ______________
4. Association with the supply to awami tanks – brief background: ______________

____

____

5. Views on the problems of water supply in Orangi: ______________

____

____

6. Views on the performance of the awami tanks with respect to the following:
   - (a) Frequency of supply: ______________
   - (b) Quantity of water made available at a time: ______________
   - (c) Hours (night and day time delivery): ______________
   - (d) Management of awami tanks: ______________
   - (h) Money/financial contribution for water purchase: ______________
   - (i) Operation and maintenance of the tanks: ______________

7. Role of KWSB in the overall respect of water supply

____

____

8. Role of Rangers in the supply to awami tanks: ______________

____

9. Suggestions for improvement in the performance of awami tanks:

____

____

____

10. Are awami tanks a permanent solution: ______________

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

IV- Local Organisations

1. Name of the interviewee: ______________________________
2. Date of interview: ______________________________
3. Address: ______________________________

____

4. Amount of water acquired from awami tank at a time: ______________________________
5. Since when you are using water from awami tanks: ______________________________
6. Why are you using water from awami tanks: ______________________________

____

7. Views on the performance of the awami tanks with respect to following:
   - (a) Frequency of supply: ______________________________
   - (b) Quantity of water made available at a time: ______________________________
   - (c) Hours (night and day time delivery): ______________________________
   - (d) Management of awami tanks: ______________________________
   - (j) Money/financial contribution for water purchase: ______________________________
   - (k) Operation and maintenance of the tanks: ______________________________

8. Role of Rangers in the water supply: ______________________________

____

9. Role of KWSB in the overall respect of water supply: ______________________________

____

10. Role of Nazims/Naib Nazims/new local administration: ______________________________

____

11. Specific problems related to the operation of awami tanks: ______________________________

____

____

12. Suggestions for the improvement in the performance of awami tanks:

____

____

____

13. Are awami tanks a permanent solution for water: ______________________________

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

V- Political/Religious Parties

1. Name of staff: ____________________
2. Address: ____________________

____

3. Date of interview: ____________________
4. Association with the supply to awami tanks – brief background: ____________________

____

____

5. Views on the problems of water supply in Orangi: ____________________

____

____

6. Views on the performance of awami tanks with respect to the following:
   (a) Frequency of supply: ____________________
   (b) Quantity of water made available at a time: ____________________
   (c) Hours (night and day time delivery): ____________________
   (d) Management of awami tanks: ____________________
   (l) Money/financial contribution for water purchase: ____________________
   (m) Operation and maintenance of the tanks: ____________________

7. Role of KWSB in the overall respect of water supply

____

____

8. Role of Rangers in the supply to awami tanks: ____________________

____

9. Suggestions for improvement in the performance of awami tanks:

____

____

____

10. Are awami tanks a permanent solution: ____________________

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

VI- Tanker Operators from KWSB Hydrants

1. Name of interviewee: ______________________
2. Address/location: ______________________
____

3. Date of interview: ______________
4. Background understanding about the construction and operation of awami tanks:
____
____

5. What rate do you get per trip to supply water to awami tanks? ______________
6 (a). Do you supply to awami tanks only? ______________
(b). How much water quantity per trip is supplied to awami tanks? ______________
(c). Do you supply to awami tanks during day or night? Give reasons for either case.
____
(d). Do you observe the management of awami tanks as very organized or not organized.
____
(e). Do the residents/awami tanks managers pay you directly any amount? ______________
(f). Do the residents directly buy water from you for their own use or for awami tanks?
____
(g). What is the commercial price per trip of your supply? ______________
(h). Do you only supply sweet water from KWSB hydrants? ______________

7. Role of Rangers in the water supply: ______________________
____

8. Role of Nazims/Naib Nazims: ______________________
9. Specific problems related to the operation of tanker supply to awami tanks:
____
____

10. Suggestions for the improvement in the performance of awami tanks:
____
____
____

STAKEHOLDER'S PERCEPTION ON AWAMI TANKS

VII- Tanker Operators from other Hydrants

1. Name of staff: ______________________
2. Address: ______________________

____

3. Date of interview: ______________________
4. Details of the source from where you obtain water ______________________

____

____

5. Views on the quality of water obtained by you ______________________

____

____

6. Description of operation

(a). Do you supply directly to households? ______________________

(b). How frequently one household calls a tanker for its homes? ______________________

(c). What is the approximate size of the underground tanks in the households you supply.

____

(d). For what purpose this water can be used? ______________________

(e). Do you also fill water from KWSB hydrants? ______________________

(f). Why do you fill water from other hydrants? ______________________

7. Role of KWSB in the overall respect of water supply

____

____

8. Do you deal with Rangers in any capacity ______________________
9. What are your specific problems? ______________________

____

____

10. Suggestions for improvement in the performance of awami tanks:

____

____

____

VIII- Awami Tanks in Orangi Town - Updating the Facts as per Current Status (Residents, Managers of Awami Tanks and Community Leaders)

1. Name of the Interviewee ______________________________
2. Date of Interview ______________________________
3. Address ______________________________

____

4. Current status of water supply

4.1 Has water supply improved during the past year

____
____
____

4.2 If yes, then through which mode?
(a) Through pipe lines __________ (b) Through tankers __________
(c) Through awami tanks __________ (d) Others (please specify) __________

4.3 If, no then what is the status of current water supply?

____
____

4.4 What are the major problems faced in your area regarding water supply?

(a) Overall shortage __________
(b) Water is not available at all __________
(c) High price of water __________
(d) Low quantity __________
(e) Poor quality (which is not drinkable) __________
(f) Poor performance of awami tanks __________
(g) Fatigue/labour to manually carry water from awami tanks __________
(h) Inconvenient timings of supply (late night) __________
(i) Any other reason (please specify) ______________________________

5. What is the present physical condition of the awami tank/s in your area.
(a) Very good ______ (b) Satisfactory ______ (c) Poor/ill maintained ______

6. If the answer of 5 is (c) then please give reasons.

____
____
____

7. Are you satisfied with the overall performance of the awami tanks?

____
____
____

8. Problems related to awami tanks

____

____

____

9. Is there a need to upgrade the awami tanks (for example, in capacity and size).

____

____

10. Can awami tanks be considered as a permanent solution of water supply ____________

11. Is there a possibility to expand the awami tanks for the benefit of lower income settlements ______________

12. If the answer of 11 is yes, then how can the awami tanks be expanded in the other locations?

    (a) Through self help ____________________
    (b) Through the help of Rangers ____________________
    (c) Through the help of Nazims/Naib Nazims ____________________