Water Governance for the Urban Poor in Bangladesh – A Model of Two Pillars with Six Dimensions

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ABSTRACT

In the growing number of large and mega-cities in the developing world, an adequate supply of potable water to the urban poor living in informal settlements is a serious problem, with important health, economic and social implications. Based on a review of literature and extensive field work, this paper evaluates the two pillars and six dimensions that limit the accessibility of potable water supply to the urban poor in developing countries. The Pillars are constituted of central actors and complementary actors; and the six dimensions are factors stratified as technical, biophysical, political, institutional, economic and social. The study identified the principles, criteria, indicators and verifiers of each factor within informal settlements in Dhaka, Bangladesh. Aggregated values of the indicators from Weighted Average (WA) and Average Ordered Weighted Average (Av-OWA) operators were used in an overall performance evaluation. It is proposed that planners and managers could make more informed decisions as a result of the model of ‘Two pillars with Six Dimensions’ to improve the present water supply situation in informal urban settlements.

1.0. INTRODUCTION

In almost every developing country, the gap between the demand for and the supply of water to low-income communities is continuously widening. For example, 80% of high-income residents in the developing countries have piped water supply, while only 18% of the low-income residents (including those people sharing tap water supply with neighbours) have that access (World Bank

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So the formal system\textsuperscript{3} of urban water supply fails to reach the poor, who subsequently rely on informal water supply systems\textsuperscript{4}. Inadequate public provision of urban water has been a major problem in the cities of many developing countries, especially for the urban poor (World Bank 2000b). The problem is not always one of resource availability; a number of the large and mega-cities of developing countries have enough fresh water to serve all the people but in practice water is not made available to everyone, especially to the poor (Kirby 2004). The provision of water is unevenly distributed and skewed in favour of high-income communities, and access is systematically biased against the poor (UN-HABITAT 2003b).

For example a survey of water vending in 16 developing cities demonstrated that the unit cost of water sold by the vendors is, on average, 12 times higher than that of piped water (World Bank 2000). Furthermore, Solo (1999) and UNCHS (1996) found that 30% of the people of Jakarta depend solely on water vendors, and pay up to fifty times more than that paid by households served by the municipal water company. Recent statistics show that the urban poor of developing countries can pay vendors up to 200 times the formal price for potable water (UN-HABITAT 2003a). In the case of Dhaka, Bangladesh the people who dwell in informal settlements pay at least ten times the price of formal water supply (Gallagher 1997). On the other hand, public water providers in most-mega cities in developing countries are losing up to 50% of their water because of leaks and theft (MalIntosh and Yniguez 1997). There are some physical problem such as water scarcity and water pollution in some cities in developing countries (People and the Planet 2004), but this problem does not only apply to the poor. Moreover, the cost bearing capacity of the poor is not the major problem of urban water supply (UN-HABITAT 2003b). Yet access to adequate water supplies by the poor in large and mega-cities is a major problem in developing countries.

This paper evaluates the ‘two pillars and six dimensions’ that limit the accessibility of potable water supply to the urban poor in developing countries with a case study examination of Dhaka, Bangladesh. It is argued that six factors (or dimensions i.e. technical, biophysical, political, institutional, economic and social) are necessary to evaluate the performance of urban water supply systems in order to improve the situation in any town or community; and two main type of

\textsuperscript{3} Formal water supply system means piped water supply system which is formally operated by the public or private sector or NGO;

\textsuperscript{4} Informal water supply system includes hand pump, dug-well, pond, river, lake, swampy land and rain water. It also includes vendors’ water and illegal draw off water.
actors (i.e., central and complementary pillars) govern the formal and informal urban water system based on the particular performance of the existing system. Factor and dimension in this paper, are used interchangeably; actor and pillar, are used to describe governance entities.

Section Two provides an analytical framework for exploring the actors and factors of urban water supply (UWS) accessibility to the poor through a brief literature review on urban governance, urban water supply systems and approaches in developing countries. Section Three describes a brief of the methodology which includes the methods of data collection and analysis. Section Four describes the case study in brief and Section Five analyses the application of the actors and factors (pillars and dimensions) framework on UWS in the informal settlement in Dhaka city. Section Six concludes the findings of the study along with lessons learned from the case study with some future directions.

2.0. LITERATURE REVIEW

This literature review discusses succinctly the concept of urban governance and the institutional frameworks and key principles governing urban water systems which are seminal to understanding the conceptualisation of the ‘Two Pillars and Six Dimensions model’ that informs the assessment of urban water supply systems.

Urban governance: The concept of ‘urban governance’ emerged in the 1990s (Pugh 1997). This is a concept of interaction between the government and civil society (i.e., community) and involves mechanisms to determine how power, rights and responsibilities are distributed and expressed among the stakeholders (Buehler 2003). Urban governance can be defined within the processes of urban direction-setting and implementation that incorporates the roles and responsibilities of government (the state), the private sector (the market), and civil society (the community), as well as the partnerships and conflicts amongst them (Minnery 2004). Decentralisation, liberalisation, rapid urban population growth and the changing urban economy direct the governance concept in urban management (Fine 1999). Urban governance is a process that is embedded in a myriad of economic, social, political and historical factors pertaining to the exchanges between the government and civil society (Pierre 1999). It can be usefully described as a process of dynamic urban management. It includes an enabling role for the government,
privatisation and people's participation (UNCHS 2001). It helps individuals and organisations (public and private) to plan and manage their basic services (see Figure 1).

**Institutional Framework of UWS**: Rules and organizational arrangements characterise the institutional framework for urban water supply management. These include laws and regulations on the one hand, and actors (Pillars) such as water users, national or local government agencies and the private sector, on the other hand (Figure 2).

Water users were labelled as a third category of actor under traditional water supply systems but more frequently they are now recognized as the primary stakeholders and increasingly interact officially with supply entities (Asad et al. 1999). Institutional norms are directly related to water policy. Success of the water policy depends on legislation and the operational mechanisms of the water providers. Hence, water policy, water law and water administration, all are inter-related aspects of "water institutions".

**Principles of UWS**: The following internationally recognised principles help frame institutional best practices for potable water supply and can be incorporated into designing and managing urban water supply system to the poor (Akbar, 2005):
(i) Water availability and quality should be maintained for potable water supply;
(ii) Political commitment should have a role in water supply to the urban poor;
(iii) Institutional rules and regulations should be maintained and enhanced for accessibility of water supply to the urban poor;
(iv) Water supply should be managed as an economic good;
(v) Water supply should be managed as a social good; and
(vi) Water supply should be operated and maintained with appropriate technical knowledge and tools and standards.

**Dimensions of UWS:** Understanding complex systems such as urban water supply systems has been aided by partitioning the system into identifiable dimensions. For example, Abbot (1996) identified four dimensions of basic urban services delivery that are applicable for designing and managing potable water supply: political, economic, institutional and technical, other studies such as World Bank (2004), UN-HABITAT (2003a), ADB (2002), Basu and Main (2001) mention the biophysical and social dimensions of water supply but ignore the political dimension. However, none of the existing approaches to UWS in developing countries clearly mention all dimensions together.

This study groups the dimensions of UWS to the poor into six categories in order to analyse the problems that persist in developing countries, for the purpose of gaining some guidelines for future improvement. Here each category is referred to as a 'factor'. Every factor contains indicators that can show the performance of UWS systems available to the urban poor in developing countries. These indicators are developed mainly from the principles and criteria of each dimension. At least one verifier describes each indicator in order to collect the information at the local level.

The six factors; technical, biophysical, political, institutional, economic and social constitute an holistic framework which references best practice principles and in which meaningful indicators can logically reside.

The key technical indicators of an urban water supply system are planning and design standards, the reliability, hygienic water supply and use, and water conservation. These are presented in
The key biophysical indicators of urban water supply system are water availability, physical accessibility, water quality and physical sustainability of the source (Table 1). Political commitment, political leaders’ participation, supportive policy and policy implementation are the political indicators of accessibility of UWS in developing countries (Table 1). Laws and regulations for relevant users’ involvement and multi-providers’ involvement (e.g., private sector), a legal framework for pilfering and corruption control, and securing property rights, organisational capacity, accountability and transparency are the main institutional indicators of UWS in developing countries (Table 1).

The indicators of economic factors for UWS in developing countries are capital investment, operation and maintenance costs, ability and willingness to pay (Table 1). Community participation and capacity, social equity and responsibility in water supply systems and women’s participation in water supply management are the main social indicators of urban water supply system (Table 1).

Within large and mega-cities in the developing world a significantly high percentage of habitants classified as urban poor are not effectively served with adequate potable water supply because no approach or plan integrates all relevant factors of urban water supply systems. Integration of all the factors in any water supply system could manage and improve the water supply situation for the urban poor living primarily in informal settlements in these cities. The indicators are collectively able to measure the quantitative or qualitative condition of UWS systems at city or community level based on direct responses from poor communities. The indicators are also able to give direction to the future improvement of UWS systems through the construction of the ‘Two Pillars with Six Dimensions’ model.

3.0. METHODOLOGY

The indicators used in this case study were examined in the informal settlements of Dhaka, Bangladesh and along with literature and secondary data on urban water supply systems collected from international and national sources form the primary data of the research. The methodology involved the use of questionnaire surveys, field observation, informal and formal discussion with the key stakeholders (informants) concerned with the water supply of Dhaka city. National
(Bangladesh) case study data sources included Dhaka Water Supply and Sewerage Authority (DWASA), the Centre for Urban Studies (CUS), Bangladesh Bureau of Statistics (BBS), Dhaka City Corporation (DCC), the Capital Development Authority (RAJUK), the Department of Public Health and Engineering (DPHE), the Local Government Engineering Department (LGED), the Urban Development Directorate (UDD), the National Housing Authority (NHA) and NGOs. Also international literature and data were collected from the World Wide Web (www) sites of International Agencies and within Bangladesh.

Data collection methods involved participatory rapid appraisal (PRA) to finalise the household questionnaire survey. The selection of the informal settlements for the household survey was through two-stage proportional random sampling. The study surveyed 540 households from 86 informal settlements of 16 sub-districts of Dhaka City. Questions were asked of the head of the household or of the family member nominated by the head of the household. Some inquiries, such as cleanliness of water, water fetching distance, and water pressure involved observation by the interviewers themselves.

The main data analysis method involves indicator aggregation. Data from the questionnaire survey were input into STATISTICA 6.0 software and these were transferred to MS Excel. Indicator values were aggregated by two methods: composite index (CI) and ordered weighted average (OWA). OWA method is developed as a more general aggregation.

To understanding how the methods of aggregation differ, it is necessary to know how the data is structured and the method of data manipulation. Responses from the participants against each indicator have been standardised by the “fuzzyfication” procedure and appropriate weighting applied. The weights of all the indicators have been calculated by the analytical hierarchy process (AHP). Standardised values of the indicators are multiplied by the weights in order to get the weighted values, and then the weighted values are summed in order to get a single aggregate value.

The weighted average technique is the most widely used technique of composite index (Nijkamp et al., 1990). This technique can be used where the indicators have different weights in terms of importance in assessing performance.
The simplest formula of this technique is:

$$U = y_1 x_1 + y_2 x_2 + \cdots + y_n x_n$$

Where $x_n$ is the $n$th indicator, and $y_n$ its corresponding weight. This is a linear aggregation method.

The ordered weighted average (OWA) is primarily concerned with the problem of aggregating multi criteria to form an overall decision function. This is a comparatively new but flexible system of aggregation. It allows the users to decide on the types of aggregation depending on the purpose of their decision making (Yager 2004). The construction phases and the formulae of different types of OWA operators are detailed in Akbar (2005). For the purpose of this research the basic formula of OWA is given as:

$$F = w_1 b_1 + w_2 b_2 + \cdots + w_n b_n$$

Here $b_1, b_2, \cdots, b_n$ are the positional values of the indicators and $w_1, w_2, \cdots, w_n$ are the weights of those positional values. Positional values of the indicators are arranged in descending order, and thus this is a non-linear aggregation.

4.0. CASE STUDY: DHAKA BANGLADESH

The research uses a case-study approach focusing on Dhaka, Bangladesh. The relevance of this location can be easily illustrated. Bangladesh is one of the poorest countries in the world. More than 49.8% people live under the absolute poverty line as measured by the Asian Development Bank (ADB 2004). The urbanisation level is not high (only 18% in 1992 and 25% in 2000) but the average annual growth rate has been more than 6% over the last 30 years (World Bank 2000a). Even by standards in most developing countries the performance of urban service delivery (USD) in Bangladesh is unsatisfactory. Only 26.2% of urban households have access to tap water, while another 54.1% have access to hand pumps. The remaining 19.7% depend on water sources of uncertain quality. Flush toilets serve only 11.3% of the households; another 29.6% are served by sanitary latrines, while as many as 59.9% have no sanitary facilities (Islam 1996).

Dhaka is the capital, and primate city, of Bangladesh and now has a population of over 10 million, equal to about 34% of the total urban population (BBS 2001). Seventy percent of the population within Dhaka live under the absolute poverty level, generally in severely overcrowded housing with few or no basic urban services (Enayetullah 2002). There were about 1125 locations
classified as slums and squatter settlements in Dhaka City in 1980s (CUS 1988) and 2100 to 3007 slums and squatter settlements in the late 1990s (BBS 1999) indicating a significant increase in informal\(^5\) urban settlements.

Dhaka’s\(^6\) situation is a little better than that of other urban areas of Bangladesh, but is still in a precarious condition. The poor (70% of the total population of Dhaka) own or use only 20% of the land. Sixty percent of people in this poor group own no land and so use the land as tenants or as illegal occupiers (GOB 1996b). Twenty to 30% of Dhaka’s population is currently served by a sewerage system (DWASA 2001). Of the rest, about 25% use inside septic tanks, 15% have pit latrines and 5% bucket latrines. The remaining 35% to 40% of the urban population use unsanitary systems, consisting typically of *kutch* (open, or only made with bamboo) latrines (GOB 1996a). The City Corporation removes and cleans the refuse every night from high-class residential areas, but rarely removes or cleans in poorer areas. So, urban service accessibility by the poor is a major problem in Dhaka.

Sixty five per cent of Dhaka’s population has access to a piped water supply (supplied by the government-led authority, the Dhaka Water Supply and Sewerage Authority) and the remaining 35% use hand pumps and unspecified sources of water (DWASA 2000). Only 20% of the poor have access to a tap water supply, but 100% of the upper-class and 70% of the middle-class people have such access. In addition, every household in the wealthier part of Dhaka (e.g., Wari Residential Area) has an average of 18 hours water supply per day with one or more connections (Akbar 1994). But in slum or poor areas at least 100 households share one connection such as a stand-pipe or water point (Gallagher 1997). Potable water supply to the poor of Dhaka has the worst coverage of all urban services within the city. This seriously affects the health, economy and environment of the poor. For example, the infant mortality rate is 9.7 per thousand in urban non-slum areas and 152 to 180 per thousand in urban slums and squatter settlements (CUS 1997). Diarrhoea, cholera, fever and jaundice are very common water borne diseases in these areas.

\(^5\) Slum and squatter settlements can be referred to as informal urban settlements inhabited by poor

\(^6\) Also known as Dhaka City
Dhaka (Figure 3) has been selected as a case study for inquiry into the factors influencing urban water supply inaccessibility by the poor because the problems are readily apparent. The study area encompasses the Dhaka Metropolitan Area (DMA) and Narayanganj Municipality. Dhaka Metropolitan Area, consists of 15 sub-districts (old), is mostly administered by Dhaka City Corporation (DCC), the local government for Dhaka. Both Dhaka Metropolitan Area and Narayanganj Municipality are the jurisdictional area of Dhaka Water Supply and Sewerage Authority, a parastatal body of the central government, supplying water to the urban residents (DWASA 2001). In this study they are together considered as 16 sub-districts under the name of Dhaka. All existing operational, maintenance and performance studies aggregate these areas.

Some characteristics of Dhaka are unique and some are similar to other large and mega-cities of developing countries in terms of UWS to the poor. Surface and ground water is easily available in and around Dhaka (except the southern and central part of Dhaka, where ground water is depleted during the dry season). This is similar to some large and mega-cities of developing countries such as Calcutta and Delhi, but is dissimilar to others, such Guadalajara in Mexico or Beijing in China (IIED 2003). Most of the political, institutional, economic and technical aspects of urban water supply in Dhaka are very similar to cities such as Calcutta, Delhi, Bombay, Bangkok, Jakarta, Manila, Karachi, Mexico City, São Paulo, Buenos Aires, Rio de Janeiro and Lagos. Therefore the case study of Dhaka will provide a good overall picture of UWS to the poor residing in informal urban settlements in developing countries and may provide guidelines for improving the situation in many other mega-cities.

5.0 APPLICATION OF THE ACTORS AND FACTORS OF UWS IN DHAKA

Application of the actors and factors of the urban water system in Dhaka to the research model involved firstly, indicator aggregation by composite index and OWA operators for the factors, and secondly, extensive stakeholder assessments for both factors and actors.

Two evaluation scenarios were determined to evaluate the performance of UWS to the informal settlements in Dhaka based on the two methods of indicator aggregation described earlier. These are: Weighted Average (WA) and Average Ordered Weighted Average (Av-OWA).
In further explanation of aggregation method the values of WA and AV-OWA operator vary on a scale between 1(one) and 0(zero). Here 1(one) means 100% or the ideal condition of the indicators existed, and 0(zero) means the indicators revealed no performance. WA and AV-OWA operator’s values can be interpreted using three main methods. Firstly, the values (i.e., mainly the highest, lowest and average values) will be interpreted by comparing them with the ideal condition. This will indicate the absolute performance of UWS to the informal urban settlements. Secondly, the value of each sub-district will be interpreted by how well the UWS condition is compared to the mean (average) value, i.e., identifying the position of the sub-districts by counting the number of standard deviations from the mean (NSM) (Figure 4). These NSM values are shown in the maps to indicate the spatial distribution of the performance of UWS over the sub-districts in Dhaka. This will indicate the relative performance of UWS to the informal urban settlements. Thirdly, the values of each factor have been shown by graphs and maps to illustrate the important factors in UWS accessibility to the informal urban settlements. Thus, the interpretations of the factors’ values underpin the supporting analysis for the scenarios which identify the critical factors of UWS accessibility to the informal urban settlements. Moreover, the critical factors, which are mostly responsible for the good or poor UWS performance in a particular sub-district, is analysed in relation to the stakeholder consultations and the field observation.

\textit{(INSERT FIGURE 4 HERE)}

\textbf{Scenario one - weighted average (WA):} Under the weighted average method, the values of all indicators of UWS accessibility to the poor in Dhaka are aggregated arithmetically. Prior to such aggregation, all indicators’ values were multiplied by their respective importance weight. This is a linear arithmetic aggregation, which is known as weighted average. According to this method, the planners and the water providers do not have any other choice in selecting critical parameters for the performance evaluation, therefore their specific localised knowledge may not be fully utilised.

In this scenario two distinctive informal urban settlements within Dhaka were examined, areas characterised as slums and squatter settlements. The informal urban settlements of Motijheel and

\footnote{AV-OWA produces a risk-neutral, intermediate solution. This operation allows for full trade-off between indicators, so that poor indicator scores can be compensated for by higher score of another indicator.}
Kotwali respectively have the highest and lowest performance of UWS system amongst the slums analysed; and the squatter settlements of Kotwali and Narayanganj respectively have the highest and lowest performance of UWS system (Table 2). Kotwali has both types of UWS supply condition (i.e., good and poor), so these conditions were characterised by the types of settlements. However, on average, the gap between the highest and lowest performance is about 32%. The average performance of UWS to the informal urban settlements is 25.6% and 30% respectively of the ideal condition of UWS system. The ‘ideal condition of UWS’ means a 100% performance standard of the indicators of UWS. By the NSM method of identifying the performance, the best performance of UWS is found in the slums of Motijheel and also in the squatter settlements of Kotwali (Maps 2 and 4 of Figure 5). In both cases, the political factor is significantly responsible for best or worst performance. For illustration, the performance of institutional and social factors in the slums of Ramna is better than those of Motijheel, and the other factors have almost similar values for both sub-districts, but the higher performance of the political factor provided for a 15% better condition of UWS in Motijheel than in Ramna. So the politicians (actors) of Motijheel would appear to be more active than in Ramna in helping the urban poor obtain a potable water supply.

Scenario two - average ordered weighted average (OWA): The average OWA operator uses equal positional values to aggregate the indicators. This operator reveals a full trade-off among the indicators. This is an arithmetic aggregation. Under this operator, the highest value of the slums and the squatter settlements is 0.505 and 0.482 respectively, and the lowest value of these settlements is 0.304 and 0.287 respectively (Table 2). Comparing these values with the ideal value, the best condition of UWS prevails in the slums of Ramna and in the squatter settlements of Kotwali (i.e., about 50% of the ideal condition of UWS); on the other hand, a poor condition of UWS prevails in the slums of Kotwali and in the squatter settlements of Uttara (about 30% of the ideal condition). Mean values of both types of settlement is about 41% of the ideal condition. This demonstrates that below average performance of UWS exists in most informal urban settlements. Here, the gap between the highest and lowest values is 20%.

(INSERT TABLE 2 HERE)
(INSERT FIGURE 5 HERE)
(INSERT FIGURE 6 HERE)
By NSM counting, slums of three sub-districts (Cantonment, Ramna and Motijheel) have an above average condition of UWS, one sub-district (Kotwali) has poor UWS condition, two sub-districts (Uttara and Narayanganj) have below average condition of UWS and the remaining 10 sub-districts have average UWS condition (Map 2 of Figure 6). In the case of squatter settlements, three sub-districts (Ramna, Kotwali and Sutrapur), one sub-district (Dhanmondi) and one sub-district (Uttara) have above average, below average and poor UWS condition respectively and the remaining eleven sub-districts have an average UWS condition (Map 16 of Figure 6.11). This relative technique of finding the UWS condition indicates that most sub-districts have a below average to average condition of UWS to the informal urban settlements.

6.0 STAKEHOLDER ASSESSMENT

The three main factors influencing UWS accessibility to the informal urban settlements drawn from the extensive stakeholder assessments in order of importance were political factors, institutional factors, economic factors and social factors.

The majority of the stakeholders pointed out that the political factor is the most important in UWS accessibility to the informal urban settlements. For instance, about 90% of the informal urban settlement dwellers claimed that some politicians gave commitments during the national or local election campaigns but they did nothing after the election. Despite politicians’ vague commitment or no commitment, stakeholders generally pointed out that lack of supportive policy for the poor and also weaknesses in policy implementation are the main political reasons for UWS inaccessibility to the informal urban settlements.

The second most important factor of UWS to informal urban settlements is the institutional factor. First, because of lack of regulation of multiple providers’ involvement in UWS, private providers may not invest money in formal water supply development in this sector. Most stakeholders blame the Ministry concerned and the DWASA for such lack of regulation, because under the single public provider system, some DWASA’s employees are reportedly earning a large amount of money, through bribery or by some other form of improper activity. For example, about 75% of the informal urban settlement dwellers said that they paid bribes to the DWASA staff, and their claim was further supported by 90% of the stakeholders. On the other hand, the informal urban settlement dwellers and the stakeholders claim that DWASA is not accountable to their
customers and is not at all transparent. Some NGOs are working as mediators in provision of water supply to the informal urban settlements; and both the informal urban settlement dwellers and the stakeholders have supported the NGOs organisational efficiency, accountability and transparency.

The third factor responsible is the economic factor. Over half of the informal urban settlement dwellers do not have the ability to pay the capital costs. A consensus of stakeholders believed that DWASA, DCC or the NGOs do not have the ability to fully manage the capital cost; but a small percentage of them thought these organisations have some ability to manage the capital cost. On the other hand, although about one-third of the informal urban settlement dwellers either do not pay or do not need to pay any user charge, the majority of the stakeholders claimed that the informal urban settlement dwellers have the ability and willingness to pay some user charges.

The fourth responsible factor is the social factor. About half of the informal urban settlement dwellers did not participate in demanding operational and maintenance services of the existing system. Political interference did not allow the urban poor to unite in stating their needs to the politicians or to the water providers. On the other hand, most stakeholders and the informal urban settlement dwellers indicated that social values and attitudes towards the informal urban settlement dwellers is a barrier to water supply development in the informal urban settlements. Moreover, wealthier Dhaka residents and formal Dhaka institutions did not accept any significant responsibility for the development of UWS to the informal urban settlements. Women are mostly responsible for the household management of water supply within Dhaka, but women are not given any priority in the operation and maintenance of the formal water supply system. Most stakeholders had a similar view on this issue. Biophysical and technical factors are also responsible in the provision of UWS to the poor, but they appear to only have a small effect based on this analysis.

In addition to the above summary of the individual factors of UWS accessibility to the informal urban settlements, weighted average (known as composite index), ordered weighted average (OWA) operators and weighted OWA have been used to aggregate the values of all indicators of the factors of UWS accessibility to the informal urban settlements. All types of aggregation show that the average water supply performance to the informal urban settlements in Dhaka is about 36% of the ideal condition of UWS systems. The above analyses of the factors of UWS
accessibility also reveal that biophysical and technical factors are not the main factors of limiting the water supply to the dwellers. The critical factors are political, institutional, economic and social.

Therefore, it can be specifically concluded that people living in the informal urban settlements of Dhaka are neglected in terms of formal potable water supply. Throughout this study it is evident that there is almost no problem with water availability at the local sources, no existing problem with the willingness and within limits ability to pay, and even a social mediator has emerged to overcome the problem of property rights. What are lacking, however, are political willingness and an institutional framework to ensure reliable water supply to the informal urban settlements. The existing biophysical and technical indicators of UWS to the informal urban settlements and subsequently to the poor can be easily improved if the political and institutional indicators are reflective of an UWS that is functioning properly.

7.0 THE PILLAR-DIMENSION MODEL

The relationship between the actors and factors constitutes the 'Two Pillars and Six Dimension' model. The mechanism of the model starts with the actors i.e., pillars and allows for examination of the inter relations between the pillars and the factors i.e., dimensions. In this case study the actors relevant to water supply provision to the informal urban settlements were grouped into two categories (two pillars): central actors and complementary actors. Central actors refer to dwellers of slums and squatter settlements within informal urban settlements in Dhaka including the community based organisations (CBOs) and community leaders; and complementary actors refer to international agencies and donors, non-governmental organizations (NGOs), civil societies, national and local government/politicians, and the private sector.

Beyond the academic exercise of constructing an explanatory model of UWS within informal urban settlements the research has a community development objective of aiding the establishment of a practical framing mechanism for the improvement of conditions for the poorer residents in large and mega cities in developing countries. The most important task therefore, of the 'Two Pillars and Six Dimension' model in the case study area of Dhaka, is to aid the

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Comment [LG1]: Not mentioned earlier
Comment [LG2]: Stands for

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A mediator is anyone (e.g., NGO) works between the slums dwellers and water supply operators to negotiate the supply system.
formation of a community water supply group (CWSG) and to keep this group free from inappropriate political interference. It is envisaged that the CWSG would be reflective of the constituent group who are most affected by discriminatory UWS supply policies and practices and yet still be able to give leadership and strength within the urban governance framework. Within the case study area this is problematic as many questions have been raised about how this group would be formed and who would initiate it. National and/or local government would not appear to be a sufficiently benevolent actor to form such a group. International agencies, NGOs and civil societies can help the informal urban settlement dwellers to form community groups. Preferably, civil societies (e.g., professional groups, media, technocrats and social organisations) and NGOs would come to the fore to accomplish such a task. The processes of social mobilisation take time but it is not impossible to do in the existing socio-political environment. International donor agencies can make provision for community mobilisation as part of loan or grant disbursement.

The question arises as to who would, in practice, be involved in the capital investment. It is envisaged that it would be primarily international donors, NGOs and CBOs, as already exist to some extent. After completion of a few small-scale water supply systems at community level, NGOs and CBOs can offer the development to the private sector as entrepreneurs or loan providers. However, after a certain period, private investment will come spontaneously. Private investors may even start investment from now if the NGOs and CBOs unveil the prospects of the investment in this sector properly and help them to be involved with DWASA and DCC. Private providers must have trade licences with technical and engineering tools and techniques. CBO must be linked with the management of the small-scale water supply system as a member of the governing body and as an employee.

The 'Two Pillars and Six Dimension' model is applicable to other metropolitan cities of Bangladesh such as Chittagong, Rajshahi and Khulna, where a large proportion of the urban population live in the informal urban settlements. It could be used in other large and mega-cities where there is water availability but where the urban poor do not have access to potable water. Even where there is water scarcity, it could work as a sharing mechanism for the existing water resources between the public providers, the private providers, the NGOs and CBOs in order to best use the available resources. Moreover, it can be said that the model successfully articulates the components of strategic planning and the components of urban governance (i.e., community,
market and state), which is theoretically and practically adaptable to the rapid changes in the mega-cities of developing countries.

8.0 CONCLUSIONS

The above analytical framework of exploring the water supply problem to the informal urban settlement dwellers in developing countries and the model that is briefly discussed is presented as part of the solution of the problem based on internationally recognised principles of potable water supply, and the seminal lessons from the case study. The model is able to provide both a framework and evidence (data) based decision making for an adequate potable water supply to assist the informal urban settlement dwellers and thus improve the health and economic condition of the urban poor.

At present, institutional and political factors are the main barriers to implementing this model, but it is certainly possible to overcome these barriers through the mobilisation of communities by the international agencies, national and local NGOs, and the civil societies strengthened by the evidence gathered by this research. The model sees a strong role for private sector investors. The model is applicable to those cities where there is little or no problem with water availability but the poor do not have access to potable water supply (such as Calcutta in India). The model does not claim to be a complete solution for the existing problem, but it will significantly reduce the existing potable water supply problem in the informal urban settlements of Dhaka. The model revitalises the urban poor into gradually becoming more knowledgeable, empowered and socially responsible people. This would be one of the important outcomes of this model. Finally, the model will act as a vision of urban basic service delivery to the urban poor by the urban poor.

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REFERENCES


Effect

Figure 1: Relationship between urban management approaches and UWS

Urban Management
  Administrative
  Managerial
  Governance

Nature and characteristics of UWS
  Public providers develop and manage urban water
  Public providers managing water supply by including private contractors
  Public and private sectors, and community involvement in water supply development and management

Figure 2: Institutional framework for urban water supply (based on Asad et al. 1999)

Institutional norms: Laws and regulations and administration

Acting entities: National and local governments, public and private sectors, CBOs and NGOs (main task: development, operation and maintenance of UWS)

Water users: individual household, factories, industries, environment, public and private offices
Figure 3: Map of the study area (Dhaka Metropolitan Area and Narayanganj Municipality)

Source: Asaduzzaman and Rob 1997

Figure 4: Categorical scale for the interpretation of WA and OWA values using mean and standard deviation (sd) [Adapted from Gunewardena 2000]
Map 1: Average OWA values of the slums organised by sub-districts

Map 2: Urban water supply condition in the slums

Figure 5: Maps showing the performance of UWS to the SSS in Dhaka City: by WA values and NSM

Map 3: WA values of the squatter settlements organised by sub-districts

Map 4: Urban water supply condition in the squatter settlements

Figure 6: Maps showing the performance of UWS to the SSS in Dhaka City: by AV-OWA values and NSM

Map 1: Average OWA values of the slums organised by sub-districts

Map 2: Urban water supply condition in the slums

Map 3: Average OWA values of the squatter settlements organised by sub-districts

Map 4: Urban water supply condition in the squatter settlement

NSM of OWA values

1.1 - 2.0 (Above average)

-1.0 - 1.0 (Average)

-2.0 - -1.1 (Below average)

-2.1 (Poor)

NSM of WA values

2.1 - 2.5 (Excellent)

1.1 - 2.0 (Above average)

-1.0 - 1.0 (Average)

-1.9 - -1.1 (Below average)

-2.1 (Poor)
<table>
<thead>
<tr>
<th>Principle</th>
<th>Criteria</th>
<th>Indicators</th>
<th>Verifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical dimension</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Water supply shall be operated and maintained with appropriate technical knowledge and tools | Technically proficient | 1. Planning and design standards are practicable. | 1. Nature and magnitude of planners’ and/or providers’ consultation with community for local area project planning and system design.  
2. Nature and extent of current practices (such as exiting systems, purposes and duration of water use).  
3. User friendliness with the existing operation and maintenance system.  
4. Nature of time and method flexibility in user payment system. |
| 2. Water supply is Reliable. | | 5. Magnitude of community satisfaction with present water pressure.  
6. Duration of water supply per day.  
7. Technical performance of the system (at community or household level). |
| Efficiently used | 3. Hygienic water supply and use, and water conservation are maintained. | 8. Extent of hygienic water use by the community.  
10. Extent of water loss directly from the system (at household and/or community level).  
11. Number and percentage of households that see or hear hygienic water use and water conservation promotion programs. |
| **Biophysical dimension** | | | |
| Water availability and quality shall be maintained for potable water supply | 1. Physically feasible | 1. Various sources of water are available | 1. Nature and extent of water availability in and near the settlement.  
| 2. Potable water is physically accessible | | 3. Amount of per capita water consumption.  
4. Distance between the home and the source of water.  
5. Queuing time to collect water. |
| 2. Environmentally sustainable | 3. Water quality has acceptable potability to maintain human health | 6. Perception about the cleanliness of water.  
7. Incidence of water related disease (e.g., diarrhoea). |
| 4. No damage to water sources is maintained | | 8. Signs of damage to the source; |
| **Political dimension** | | | |
| Political commitment to roles in water supply to the urban poor | Political participation | 1. Political commitments are given to the urban poor for potable | 1. Nature and extent of political commitment during the election campaign;  
2. Magnitude of the implementation of political commitment. |
<p>| | | 2. Political leaders participate in water supply development. | 3. Nature and frequency of the meetings among the political leaders, poor community and the water providers. |</p>
<table>
<thead>
<tr>
<th>Institutional dimension</th>
<th>Politically sanctioned</th>
<th>3. Policy is supportive to water supply to the urban poor.</th>
<th>4. Magnitude of the politicians’ involvement (on behalf of the poor community) in policy/plan preparation workshop or meeting.</th>
<th>5. Extent of pro-poor water supply strategies in the policy documents.</th>
<th>6. Extent of policy reflection in local area development plans and/or projects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional rules and regulations shall be maintained and enhanced for accessibility of water supply to the urban poor</td>
<td>Institutionally recognized</td>
<td>1. Community and multi-providers involvement in water supply development (in formal and informal settlement) is ensured by the government rules and regulation.</td>
<td>1. Nature of the norms and rules of water providers for community participation.</td>
<td>2. Nature and magnitude of private sector, NGOs and/or CBOs involvement in water supply development.</td>
<td>3. Nature and effectiveness of government initiatives to address the property rights issue in providing water supply to squatter settlements.</td>
</tr>
<tr>
<td>Institutionally efficient</td>
<td>2. Legal action is practised by the water providers.</td>
<td>4. Nature and extent of illegal connections and organisational corruption.</td>
<td>5. Number and percentage of illegal users and corrupted staff penalized.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic dimension</td>
<td>Financially capable</td>
<td>1. Government, providers and the community have capacity to manage capital cost.</td>
<td>1. Amount of government and/or providers budget/grants for water supply development.</td>
<td>2. Amount of upfront development fees from the community.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economically viable</td>
<td>2. System covers at least operation and maintenance costs.</td>
<td>3. Balance between user charges and operation and maintenance costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The poor have ability to pay.</td>
<td>4. Number and percentage of hard core poor in a community.</td>
<td>5. Affordability to the people of user charges and/or capital costs.</td>
<td></td>
</tr>
</tbody>
</table>
4. The poor have willingness to pay.

6. Willingness of the people to pay user charges and/or capital costs.

Social dimension

Water supply shall be managed as social good

1. Community participation and capacity are ensured.
2. Extent of people’s participation in operation and maintenance of the water supply system at community level.
3. Intensity of community awareness about water pilfering.

Socially capable

1. Magnitude of community demands to the stakeholders of water supply development.

Socially equitable

2. Water is treated as social good.

3. Women’s participation is ensured in water supply operation and maintenance.

4. Nature and magnitude of community satisfaction with the present water supply condition.
5. Amount of government subsidy to the poor community.
6. Extent of social help to the poor for potable water supply.
7. Proportion of women staff in the operation and maintenance of water supply.
8. Extent of men’s and women’s contribution to household water management.

Source: Akbar, 2005

### Table 2: Performance of UWS to the SSS in Dhaka City: by AV-OWA values and NSM

<table>
<thead>
<tr>
<th>Sub-district</th>
<th>Slums</th>
<th>Squatter settlements</th>
<th>Slums</th>
<th>Squatter settlements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>NSM</td>
<td>Value</td>
<td>NSM</td>
</tr>
<tr>
<td>Cantonment</td>
<td>0.287</td>
<td>0.6</td>
<td>0.217</td>
<td>-0.8</td>
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<tr>
<td>Demra</td>
<td>0.244</td>
<td>-0.2</td>
<td>0.361</td>
<td>0.6</td>
</tr>
<tr>
<td>Dhanmondi</td>
<td>0.312</td>
<td>1.0</td>
<td>0.290</td>
<td>-0.1</td>
</tr>
<tr>
<td>Gulshan</td>
<td>0.214</td>
<td>-0.8</td>
<td>0.303</td>
<td>0.0</td>
</tr>
<tr>
<td>Kotwali</td>
<td>0.153</td>
<td>-1.9</td>
<td>0.580</td>
<td>2.8</td>
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<tr>
<td>Lalbagh</td>
<td>0.218</td>
<td>-0.7</td>
<td>0.417</td>
<td>1.2</td>
</tr>
<tr>
<td>Mirpur</td>
<td>0.257</td>
<td>0.0</td>
<td>0.287</td>
<td>-0.1</td>
</tr>
<tr>
<td>Mohammadpur</td>
<td>0.275</td>
<td>0.3</td>
<td>0.200</td>
<td>-1.0</td>
</tr>
<tr>
<td>Motijheel</td>
<td>0.394</td>
<td>2.5</td>
<td>0.352</td>
<td>0.5</td>
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<tr>
<td>Narayanganj</td>
<td>0.261</td>
<td>-0.1</td>
<td>0.184</td>
<td>-1.2</td>
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<tr>
<td>Pallabi</td>
<td>0.201</td>
<td>-1.0</td>
<td>0.294</td>
<td>-0.1</td>
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<tr>
<td>Ramna</td>
<td>0.253</td>
<td>-0.1</td>
<td>0.212</td>
<td>-0.9</td>
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<tr>
<td>Sabujbagh</td>
<td>0.200</td>
<td>-1.0</td>
<td>0.238</td>
<td>-0.6</td>
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<td>Satrapur</td>
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<td>0.2</td>
<td>0.245</td>
<td>-0.6</td>
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<tr>
<td>Tejgoan</td>
<td>0.301</td>
<td>0.8</td>
<td>0.348</td>
<td>0.5</td>
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<tr>
<td>Uttara</td>
<td>0.258</td>
<td>0.0</td>
<td>0.269</td>
<td>-0.3</td>
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<tr>
<td>Mean</td>
<td>0.256</td>
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<td>0.300</td>
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<tr>
<td>Standard deviation</td>
<td>0.055</td>
<td></td>
<td>0.099</td>
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