

博士論文（要約）

**Evaluation of Stakeholders' Relative Positions  
Regarding their Opinions about Water Issues in Dhaka,  
Bangladesh**

(バングラデッシュのダッカにおける水問題への意識に基づくステ  
ークホルダーの相対的位置関係の評価)

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## **ABSTRACT**

Rapid growth of population, increasing water demand, inadequate water supply, severe water pollution, gradual ground water depletion are some of the common as well as major issues in water arena of the developing countries. Bangladesh, a developing country of south Asia, is also facing immense difficulties to meet the increasing water demands of the growing population within inadequate water supply facilities managed by limited financial budget. Due to rapid and unplanned urban sprawling, especially in Dhaka city, existing water supply infrastructure cannot provide piped water access to most of the urban dwellers. And, the rural people have to manage water supply from ground water through tube well, or from ponds, rivers and other water bodies. Almost all wastewaters from households (residential, commercial etc.) and industries are discharged untreated to the surface water bodies around Dhaka city, which causes serious water pollution and makes the water unable to be used for any purpose, even not able to be treated to get water supply. As a result, huge amount of ground water is withdrawn. The paved surfaces of the city area prevent ground water recharge. Thus, ground water level is declining at an alarming rate. Besides, climate variabilities in the forms of flood, drought etc cause difficulties to the water users, especially to agriculture. Therefore, changes in demographics, land use patterns, economy and climatic patterns impose to devise more proactive and resilient water management policies and to implement the plans properly. And, in this total process of water issue identification, solution formulation, project planning, resource mobilization, impact assessment and field execution - all key stakeholders, having direct and indirect interest and influence, should be consulted and engaged literally, to make the management decision really operational and sustainable. Slightly deviating from conventional stakeholder participation practices, this study focused on stakeholders' participation in gathering perceptions/opinions about their 'relative positions' within water sectors regarding major water issues. The homogeneities and variations in - stakeholders' opinions about sectoral contributions to water issues; their water spending and saving attitudes; concerns about water quality and pollution; and their solution preferences were evaluated. Besides, the study was aimed to identify the probable perception gaps/conflicts among water users and water-use observers (water researchers, planners and scholars). Again, whether the stakeholders' water use attitudes and concerns influenced their opinions about their own contribution to water issues, were also evaluated. Then, the probable pathways to grasp the stakeholders' opinions and preferences for the target group of water planners and experts were formulated in the study.

To get the representation of the key stakeholders regarding the selected water issues in the study area - social, economical, water use, water pollution, water institutional and water expertise perspectives were considered in the study. The selected key stakeholders from urban and rural residential people, commercial institutions, agriculture, industries, water organizations (including water research, planning and management) and scholars (university professors) were asked to give their opinions/perceptions about the major water users' (urban and rural house dwellers, commercial institutions, industries and agriculture) relative contribution and importance to selected water issues in the study area of Dhaka, Savar and Keraniganj through questionnaire survey. During the questionnaire survey, 328 respondents were asked to make comparative choices on five water use sectors (mentioned above) arranged in pairs, regarding five water issue questions about one sector - causing more water shortage, more important for earning money, suffering more damage due to water shortage, causing more pollution and causing more water loss during use than other sectors. The responses were measured following Satty's comparison scale from equal to strongly more. The pair-wise comparison matrices based on comparison scale scores were used to calculate comparative contribution factors (CCF) for each water use sector on the scale of 0 to 1.

To evaluate the variations in residential respondents' opinions, they were categorized into five groups using Cluster analysis. The clusters showed variations in their opinions about the sectoral relative contributions to water issues of the study area. Some clusters thought industries causing more water shortage, more pollution, but at the same time industries seemed to be more important for earning money to them. Some others thought urban house dwellers more responsible for causing water shortage in the area. In some cases, demographic composition influenced their opinions, such as cluster with larger rural respondents gave their choices more inclined to rural or agricultural contribution. Respondents from commercial places, agriculture and industries also presented significant variations in their opinions. For the cases of water organizations and scholars, even if the respondents were from the same organizations or same field of specialization, they showed significantly different opinions/perception about the water sectors' relative contribution to water issues. In addition to statistical comparison, the variations in the relative positions of the stakeholder groups about the water issues were analyzed through Social Network Analysis (SNA). SNA can be a useful method to visualize the stakeholder's perceptions about each other. However, the limitation of SNA was also revealed that variations inside the same sector cannot be expressed in detail.

The respondents were asked about five water use attitude questions to identify their water spending tendency, water saving attitude; concern about water quality during use, water pollution and ground water depletion issue, on an attitude scale ranging from 'I have no idea' to 'I strongly think so'. The respondents, gave the answers for water spending and saving questions in the same way, were excluded and the attitude scores for the remaining 236 respondents were used for factor analysis to identify two factors – 'water use and saving attitude' and 'water issue concern'. Then the stakeholders were plotted along 'water use and saving' attitude and 'water issue concern' using their respective factor scores. Some stakeholders were found to have both positive water attitude and concern, while some got negative scores in both factors and other got positive and negative scores. Scholars were mostly found to show negative factor scores for water attitude and concerns of the water users, though a number of water users showed positive attitudes and concerns. One residential cluster showing positive water spending and saving attitudes, thought that residential people were not as much responsible as industries for causing water shortage and water loss during use. They thought their contribution in causing water shortage and water loss were lower, which might be influenced by their positive attitudes.

During the second questionnaire survey, 80 out of 328 respondents (surveyed before) were asked to explain the reasons of their sectoral choices for water issue questions in the first questionnaire survey. They explained the reasoning and also showed their preferences about solution options to resolve critical water issues. Variations in reasoning and solution preferences were likely to come out with respect to their previous diverse opinions about sectoral contributions. Here, the solution preferences were specific to the sectors causing the issues. The respondents from two specific residential clusters, who showed positive water attitudes and concern, thought urban house dwellers more responsible for causing water shortage and water loss in the study area during the first survey. During the second survey, most of them, from those clusters, identified water loss and high consumption by urban people as the major reasons of their contribution to water shortage, whereas they evaluated lack of awareness as the principal reason of causing water loss during use by urban house dwellers. Though they thought themselves positive about water attitudes and aware of these facts, but they perceived urban house dwellers causing more water loss as a sector than other sectors. To solve water shortage by urban households, they preferred reducing water loss as the major solution option, while they chose increasing awareness to reduce water loss. Other stakeholders showed variations in identifying sector specific solution preferences. Some organizational respondents and scholars preferred more stringent solution, like increasing water bill, provision of intermittent supply etc to resolve water issues (water

loss) caused by the water sectors. Finally, to grasp the stakeholders' opinions and preferences by the target group of water planners and experts, sector-wise probable flow-charts were formulated.

This study aimed to arrange public participation and revealed water stakeholders' opinions as well as preference of solution options for water issue related to water quantity as well as quality. The relative positions of the water sectors were evaluated by comparative contribution factors based on stakeholders' opinions and the variations were addressed. Also, the variations of opinions, attitudes and preferences within each stakeholder group were evaluated. The tendency of water users' opinions was found quite different from water researcher, planners and scholars, which indicated perception gaps/conflicting views among water users and water-use observers. During analyzing the influence of water use attitudes and concerns of water users on their opinions about their respective contribution to water issues, some were found to have their opinions influenced by their positive attitudes and concern, while others showed their opinions not influenced by their water attitudes and concern. The SNA results and the decision flow-charts formulated in this study may facilitate better understanding about stakeholders' opinions and preferences to the water researchers, planners and experts, which may further enhance effective and sustainable water management and planning.