

## **Changing Policy Paradigm of Drinking Water Service Delivery: An Empirical Investigation in the context of Bihar, India**

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### **Abstract**

The present study critically analyses the policy framework of supply of drinking water in Bihar and attempts to explore scope of the new policy paradigm, which advocates for treating drinking water as economic good and supply it based on demand and cost recovery principle. The present paper uses the technique of Contingent Valuation Method to assess the Willingness to Pay for piped drinking water in rural Bihar and uses logistic regression analysis to identify factors influence willingness to pay for drinking water, critical to the new policy paradigm. The study found a large section of people are ready to share capital cost, monthly user charges and agreed to take part in management to ensure regular supply of improved drinking water. Education, income and community status, existence of contamination, perceived improved quality of piped water play significant role in determining willingness to pay for piped drinking water. The possibility of sharing project cost as well paying monthly charges and involving in managing the water supply project appeared to be an effective service delivery model in the context of rural Bihar. The findings indicates for adoption of more pragmatic approach and governance reform in supply of drinking water in rural areas, hitherto supplied by only public sector/enterprises.

**Keywords:** Bihar, Contingent Valuation, Drinking Water Policy, Willingness to Pay

### **Introduction**

Safe and clean supply of drinking water has been recognized as important human right. The United Nation in its resolution adopted by the General Assembly on 28<sup>th</sup> July, 2010 has acknowledged the importance of equitable access to safe and clean drinking water and sanitation as an integral component of the realization of all human rights (United Nation, 2010). This proposal has left us with two questions, how to make the water available and accessible to the people and who is going to pay for it? However, in the same resolution, there is hint of state's responsibility to promote safe drinking water. Drinking water, though has characteristics of private good, however, in the developing world the drinking water mainly supplied in form of basic service by the state mostly free and through public institutions. However, searching of solution of these questions paves avenue for development discourse which is purely economic. In this context the public institution plays a critical role. Public institutions, as argued by Lal (2010) is not static, the new policy paradigm of drinking water supply advocates for an economic solution. As water is a scarce natural resource, increasingly there are arguments to treat drinking water as an economic good and to be supplied based on demand and impose user charges to ensure its efficient utilization. The Dublin Statement in 1992 advocated recognizing drinking water as an economic

good and also argued for participatory management of water services (International Conference on Water and Environment, 1992). In India, there have been changes in the policy paradigm of drinking water supply since 1990s. In India, the Eighth Five Year Plan (1992-97) advocated for treating water as a commodity to be supplied based on effective demand and cost recovery principle and managed by private local organizations. The rightward shift of the approach from supply driven to demand driven to make the system more sustainable through cost recovery and efficient through involving beneficiary in the decision making and management.

Though, drinking water is argued to be treated as economic good, however, determining the price of drinking water, a non-market good possess challenge. Of late, the assessment of price of water, a non-market commodity, has received attention of many policy makers. In this context, the Contingent Valuation Method has emerged as a method to determine 'Willingness to Pay' for a good, particularly a non-marketed good. The present paper is an attempt to explore the possibility of user charges for service of piped drinking water in the context of rural Bihar with the help of people's response on 'willingness to pay' for piped drinking water service based on the 'Contingent Valuation Method'. The present study attempts to explore the issue of contingent valuation method in determining willingness to pay for safe drinking water and identify determinants of willingness to pay in the context of rural Bihar with the help of primary survey conducted in four districts in the State.

The penetration of piped drinking water is lowest in Bihar. Only 3.07% households get tap water from treated source and the situation of rural Bihar is worse, as only 1.5% gets treated tap water which is lowest in the country (Government of India, 2011). To upscale the present service requires increasing the investment on drinking water many folds. So the question of who is going to pay for it becomes critical. The draft Bihar Water Policy (Government of Bihar, 2010) argued for community participation in management as well imposition of user charges for drinking water supply. The present study attempts to explore feasibility of the policy decision of imposing user charges with the question of how far the rural people are ready to pay for improved drinking water and share the investment on piped drinking water. Any positive answer can also create avenue for involvement of market forces in service delivery.

### **Policy Context**

Rural drinking water supply is a State subject, included in the Eleventh Schedule of the Indian Constitution, a subject that may be entrusted to local governments by the States. The Sector Reform Project in 1999 and the Swajaldhara programme in 2002, initiated by the Government of India, advocated inclusion of community in water supply services, not only through sharing capital cost and user charges, but also sharing of responsibility of operation and maintenance of the supply schemes/projects. Subsequently, the Tenth Five Year Plan (2002-07) and the National Water Policy 2002 also argued for imposition and collection of water charges to 'cover at least the operation and maintenance charges of providing the service initially and a part of the capital costs' (Government of India, 2002). The National Water Policy 2002 also suggested that the water user rates should be linked directly to the quality of service provided and the subsidy on water rates to the poor and disadvantaged sections of the society should be well targeted and transparent. The National Water Policy, 2012 (Government of India, 2012) also reiterates this view.

The Public Health Engineering Department (PHED), Government of Bihar, is the principal agency in providing supply of drinking water in Bihar. The department has drafted State Water Policy in the year 2010 (Government of Bihar, 2010). This Draft Policy advocates for a shift towards community-level empowerment and responsibility for water and sanitation management. The Draft State Water Policy advocates for shifting service norms for coverage from habitation to household level through pipe water

system, and also advocates for moving from supply based to demand based water management. It also suggests initiation of rational water pricing and imposition and collection of user charges for sustainable operation and management of drinking water services. The draft policy aims for Public Private Partnership in development and management of water systems. It advocates creation of adequate space for participatory management by engaging people as well as Panchayati Raj Institutions (PRI), institution of self-government at rural areas, in the delivery chain and constituting Village Water and Sanitation Committees (VWSCs) to ensure community participation. Provision for adequate capacity building support to VWSC/community groups/PRI to help them undertake the required responsibilities also incorporated. The community is expected to be involved from planning, implementation, monitoring and managing services. The draft policy propose that after installation of schemes the management be transferred to PRI/community groups/VWSC for effective and sustainable management and empower the VWSC to collect user charges to ensure sustainable delivery.

Given this draft policy as background the present study attempts to assess to what extent the rural population in Bihar is ready to adopt change in supply provision especially the most critical/ sensitive part of the change in paradigm in service delivery pattern, that is, water pricing. The study explores the issue of willingness to pay for drinking water through Contingent Valuation Method and explores the underlying determinants for willingness to pay through a primary survey of rural households in four sample districts.

### **Concept, Research Design and Database**

#### *Non-Market Valuation Method: Willingness To Pay and Contingent Valuation*

Of late, the process of valuing non-market goods has attracted attention of the policy makers. The economic valuation becomes important because a section of the services are provided to people in form of common good with limited scope of excludability. Though the supply of drinking water cannot be considered as pure public good as it has components of 'rivalry' and 'excludability', this does not rule out the market operation in providing service of piped drinking water. However, as there is absence of market operation for providing drinking water to rural Bihar, there is no observed price to reveal how much a household should pay to receive uninterrupted supply of improved piped drinking water. Economists have developed several techniques to measure the value of non-market goods and services, in consistent with market goods. These techniques are basically of two types. One type is based upon observed behaviour or through 'revealed preference' towards some marketed goods in connection to the non-marketed good of interest. The other approach, based on stated preference and feedback, collected through surveys, towards some non-marketed goods or services (Freeman, 1993). This stated preference approach is termed as 'contingent valuation method'.

The Contingent Valuation Method (CVM), based on the theory of economic utility and welfare. The technique enquires the individual directly to reveal their preference in terms of willingness to pay (WTP). WTP is argued to be a better technique if the consumer currently does not have the good or service for which the survey is being carried out (Carson, Contingent Valuation: A User's Guide, 2000). The concept of WTP is based on the theory of Hicksian Consumer surplus measures. The CVM uses survey research technique to elicit people's preferences in the form of WTP monetary amounts (Carson & Mitchell, 1993). Carson & Mitchell (1993) have depicted that in its standard form the CVM survey describes a detail hypothetical market in which a specified good may be purchased and asked respondents how much of their current household income they would be willing to give up in exchange for a specified increase in the level of the public good. This implies that the respondent is asked about the compensating surplus (CS) from a change in the good in question, which can be represented as

$$CS = [e(p_0, q^*, q_0, U_0)] - [e(p_0, q^*, q_1, U_0)]$$

Or equivalently  $CS = Y_0 - Y_1$

where 'e' is the expenditure function,  $p_0$  is the vector of prices for marketed goods,  $q^*$  is the vector of marketed goods, which remain fixed.  $q_0$  and  $q_1$  are the initial and subsequent level of non-marketed goods being valued respectively.  $Y_0$  and  $Y_1$  are the initial and subsequent level of disposable income associated with each of the two expenditure functions, respectively.  $U_0$  is the initial utility level. This exercise, as argued, tries to trace out the Hicksian compensated demand curve (Carson & Mitchell, 1993).

The CVM has emerged as one of the most familiar method for being applied to deal with the compensating and equivalent measures of welfare changes. The CVM technique has been considered as unique technique among other benefit measure technique because of its ability to measure non-use benefits, since it can elicit values from both users and non-users of a given amenity. The CV survey, as mentioned by Khai (2015), mainly aims to get an accurate estimate of benefits (sometimes cost) of a change in the level of allocation of some public good. He pointed out the varieties of approaches in practice for valuing contingent market

- (i) Using an open-ended question in which the respondent is simply asked to claim his/her WTP.
- (ii) Using the questions in sequential bids in which respondents are asked whether or not they would pay some specified sum (the question is then repeated using higher or lower amount, depending on the initial response)
- (iii) Using a dichotomous choice question in which the respondents is asked only whether or not they would pay for any service (The sum is varied across respondents).

The present study has followed Carson (2000) as mentioned above and explored the WTP through the dichotomous choice question where the respondents have been asked whether they are willing to pay for piped drinking water or not.

#### *People's Participation in Service Delivery: Review of the Concept*

The new policy paradigm of drinking water throughout the world talks about people's participation in operation and maintenance and paying water prices to ensure sustainable supply. This participatory method of governance received utmost importance in many kinds of service deliveries since last few decades. Dreze and Sen (1995) and Webster (1992) ascertain that the poor functioning of the local public services in India relates to the centralized and non-participatory nature of their management. With the help of the data from 121 rural water supply projects from 49 countries of Asia, Africa and Latin America, Isham, Narayan, & Pritchett (1995) showed a positive impact of participation in project performance. Hoddinott et al., (1999), in their study in South Africa, also found a direct positive impact of participation on efficacy of public works projects and targeting of the beneficiaries. Paying and contributing for services is considered as higher form of participation. White (1996) has termed it as 'instrumental participation' where people contribute inputs. The involvement of citizen through contributing and producing public goods and services of consequence to them termed as co-production (Ostrom, 1996; Brandsen & Pestoff, 2008). The study considers 'willingness to pay' as a higher form of participation and attempts to identify underlying factors of a household's willingness to pay for piped drinking water.

#### *Database*

For this study the four districts of Bihar, viz. Nalanda, Begusarai, Purnia and West Champaran have been selected as sample districts. One district each has been selected from the four regions of Public Health Engineering Department, the main department responsible for providing drinking water in the state

through hand pump, tube well, pipe water etc. Moreover, the sampled districts represent various agro-climatic zones in the state and consist of population of different communities. Representation of various problems of water contamination has been taken into account while sampling the districts. There are three main problems of water contamination that affect drinking water quality, viz. Arsenic, Fluoride and Iron. Out of four sample districts, three districts suffer from these problems viz. Begusarai (Iron & Arsenic), Nalanda (Fluoride), and Purnea (Iron). West Champaran was selected to have detailed insight of working of water supply schemes in forest and tribal areas. From each district 4-5 blocks have been selected based on (a) presence of contamination problem in drinking water; (b) presence of backward/minority community population; (d) distance from the district headquarters. From each block 1-2 Gram Panchayats (Institute of self-government/rural local body at grass root level) selected for household survey. Overall 20 Gram Panchayats were selected for the study and in each Gram Panchayat 20-25 household randomly selected for sample survey. A total 458 household have been sampled for the study. The household level data collected in month of January 2013 through structured questionnaire. The questionnaire covered broad aspects of socio-economic, demographic and village level characteristics as well as subjective notions of motivation of taking part in the decision making process and willingness of the households to get engaged in drinking water supply and willingness to pay for the same.

#### *Research Design*

The study attempted to explore the issue from qualitative and quantitative point of view. For quantitative analysis data were collected from sample households and for qualitative analysis, the issue of willingness to pay was discussed in a focus group discussion with community members in different neighbourhood in every Gram panchayat.

To explore the concept of willingness to pay and the underlying household characteristics for this works as as a motivation for this study. The CVM uses to elicit a households willingness to pay for piped drinking water. It is argued that, willingness to pay depends upon several factors ranging from social capital (Polyzou, Jones, Evangelinos, & Halvadakis, 2011), to trust on delivery institution (Kim, 2005). Literature suggest that education (Almond & Verba, 1989; Helliwell & Putnam, 2007), economic status (Weinberger & Jutting, 2001; Nisha, 2006), social status in community structure (Alesina & La Ferrara, 2000; Ghatak & Ghatak, 2002) have positive impact of household in involvement in community affairs. Several variables have been identified to have influence on 'willingness to pay' of a household for piped drinking water. These variables have been brought under five distinct categories, namely education, economic status, social status, service delivery status and participation.

The current study considered mode years of schooling as determinant of education of the household. For economic status of the household the study considers monthly income of the household. Caste status, specifically whether the household belong to any marginalized community or not, has been considered as determinant of social status. To assess current delivery standard three variables have been considered, namely dysfunction of current source, distance of the current source from household and perceived quality of drinking water. To assess dysfunction it is assessed that how many times the current source got defunct in last six months. For distance it was assessed that whether the current source is within 50 meters or more than that. To assess quality of drinking water, the perceived quality of the water by the user, whether it is good or not is considered. Following White (1996), who termed it as 'Instrumental Participation', the concept of willingness to pay has been conceptualized as higher form of participation; and the study attempted to assess level of participation from two points, namely whether the households have been consulted for drinking water delivery or not and whether the

household ever contributed for drinking water service or not. The method of operationalization of variables considered in the model and their summary statistics presented in table 1 and 2 respectively.

**Table 1: Method of Operationalization of the Determinants of Willingness to Pay**

| Determinants                         | Variables considered  | Symbol Used | Method of operationalization   |
|--------------------------------------|---|-------------|--|
| Education                            | Years of schooling  | Edu         | Mode years of schooling of the household   |
| Economic Status                      | Household income  | Inc         | Monthly income of the household  |
| Social Status in Community Structure | Caste or community of the household<br>(Dummy variable)                               | Caste       | Whether the household belongs to SC or ST community.<br>Caste=1, if household belong to SC, ST, OBC, EBC<br>Caste=0, otherwise |
| Service Delivery Status              | Dysfunction of Current source of water  | Dysf        | No. of time the current source got defunct in last six months  |
|                                      | Distance of Current Source<br>(Dummy variable)  | Dist        | Dist=1, if source is within 50 meters<br>Dist=0, otherwise   |
|                                      | Perceived Quality of Drinking Water<br>(Dummy variable)                               | Qual        | Qaul=1, if perceived quality is good<br>Qual=0, otherwise  |
| Participation                        | Household contributed for drinking water supply<br>(Dummy variable)                   | Cont        | Cont=1, if the household contributed<br>Cont=0, otherwise  |
|                                      | Household consulted for supply of drinking water in last one year<br>(Dummy variable) | Conslt      | Conslt=1, the household consulted<br>Conslt=0, otherwise   |

**Table 2: Summary Statistics**

| Variable                | Mean   | Std. Dev. | Min | Max   |
|-------------------------|--|-----------|-----|-------|
| Mode Years of Schooling | 7.8  | 4.5       | 0   | 19    |
| Monthly Income          | 5899.4   | 4484.3    | 600 | 50000 |
| Dysfunction             | 1.5  | 1.7       | 0   | 10    |
| Caste                   | Proportion of sample household belong to backward social status: 39.7% |           |     |       |
| Distance                | Proportion of household have water source within 50 meters: 74%        |           |     |       |
| Quality                 | Proportion of sample household perceive water quality is good: 65%     |           |     |       |
| Contribution            | Proportion of Household contributed for drinking water service: 43.2%  |           |     |       |
| Consulted               | Proportion of Household consulted for drinking water service: 7%       |           |     |       |



To identify factors those influence a household's decision of willingness to pay the following logistic regression model is specified

$$WTP_i = \alpha + \beta_1 Edu_i + \beta_2 Inc + \beta_3 dysf_i + \gamma_1 Caste_i + \gamma_2 Dist_i + \gamma_3 Qual_i + \gamma_4 Cont_i + \gamma_5 Conslt_i + \epsilon_i \dots\dots\dots(1)$$

Here,  $WTP_i=1$ , when a respondent household is willing to pay for improved drinking water and  $WP_i=0$ , when the household do not want to pay. The model predicts logit of dependent variable from explanatory variable. The dependent variable predicts logit, which is natural logarithm of odds ratio, and odds ratio is probabilities (p) of WTP happening (i.e. a household willing to pay) to probabilities (1-p) of WTP not happening (i.e. a household not willing to pay).

**Results and Discussion**

During the focus group discussions it was revealed that people actually contribute to repair the local hand pumps for uninterrupted supply of drinking water. The discussions also reveal people's willingness to participate in the operation and management of drinking water supply. During the focus group discussions the issue of payment for pipe water system was discussed and analyzed and it was found that a large section of people were ready to pay for pipe water service and for household connection. It was also found that people are even ready to share a part of capital cost of implementation of drinking water project and also to pay monthly user charges. The range of payment they agreed varies from Rs.50 to Rs. 2000 for sharing capital cost and for monthly charges they are ready to pay on an average Rs. 25 per household per month.

The result of logistic regression (Table3) indicates that income, education and community status have significant and positive impact on willingness to pay for piped water. However, one of the interesting result is that, member of backward caste are more likely to pay for piped drinking water service. Frequent dysfunction of current water sources also found to influence people to become willing to pay for piped drinking water for improved service. Though the contribution of household not found to have significant impact on willingness to pay, another interesting result is significant impact of consultation with a negative sign. The reason might be that a very small proportion of people are actually being consulted for decision making on drinking water service. In the present study, it was found that only 7% of the sample households have been consulted in last one year. The result indicates some important aspects. First, better off households in terms of income and education attainment are more likely to pay for piped drinking water.

The awareness level of better off households might drive the households to opt for better and improved drinking water option which may be useful for them to reduce time and medicinal costs. Secondly, there is a willingness to pay among marginalized communities. This result may be the indicator of awareness among these marginalized section related to drinking water and its quality. The present result paves ways for two avenues. The first one of management of service delivery system along with community termed as co-production (Ostrom, 1996; Brandsen & Pestoff, 2008), which argues for participation of citizen with service delivery organization through contributing and producing public goods and services. The second one is more pragmatic in nature, which argues about possibilities of reform and participation of private sector in water service delivery against water charges. However, sound political and water supply governance have been identified as necessary conditions to unfold and reap benefits of private sector participation, as there are risk of failing policy due to adverse governance factors (Krause , 2007).

**Table 3: Regression Results: Determinants of Willingness to Pay**

| Independent Variable  | Regression method:<br>Maximum Likelihood<br>Coefficient and Standard Error |
|---|--|
| Years of schooling  | .1532835 (.0370362)*   |
| Household income  | .0001773 (.0000566)*   |
| Caste or community of the household                               | 1.186865 (.3509919)*   |
| Dysfunction of Current source of water                            | .5444639 (.1459834)*   |
| Distance of Current Source  | -.2637671 (.3572315)   |
| Perceived Quality of Drinking Water                               | -.516174 (.3726904)  |
| Contributed for drinking water supply                             | -.4469469 (.3645736)   |
| Household consulted for supply of drinking water in last one year | -1.587784 (.5576738)*  |
| Constant  | -.0404921 (.6969657)   |
| No of Observations: 458   | Wald Chi2(9) =75.52*<br>Pseudo R <sup>2</sup> =0.2399                      |

Note: 1. Robust standard errors given in parentheses

2. \* represent levels of significance at 1% .

### Conclusion

In last couple of decades there has been advocacy for change in the public service delivery mechanism. The new paradigm talks about demand based supply and more participatory approach. In India, there have been changes in the policy paradigm of drinking water supply since 1990s. It advocates for treating water as a commodity to be supplied based on effective demand and cost recovery principle and imposition of water tariff. The present study is an attempt to assess policy preparedness and community preparedness for this new regime of service delivery through exploring the concept of willingness to pay for piped water supply in the context of rural Bihar. It is revealed that people want to have pipe water in their households and are willing to share capital cost and ready to pay monthly user charges for it if uninterrupted supply of drinking water is provided. The identification of determinants of willingness to pay reveals that though households with more education and income are more willing to pay for piped drinking water, however, the marginalized community members also found willing to pay for drinking water.

The frequent dysfunction of current water source might have influenced them to think about alternative sources. It has also found that people are not only willing to pay, they are also ready to be involved in operation and maintenance of drinking water service. This opens up the avenue for a distinct kind of participatory management mechanism often termed as 'co-production', which consists of citizen involvement or participation (rather than bureaucratic responsiveness) in the delivery of services. On the other hand the result also unfold possibility of involvement of private sector in the service delivery, hitherto being supplied through public agencies only. This calls for well thought about reform in political and water supply governance. Making people aware of the process and outcome, building capacity of the community are basic prerequisites for successful for community involvement. Whereas, policy formulation and changing institutional set up for alternative service delivery pattern are challenges in terms of institutional arrangements for effective implementation. The present study found that the community is eager to accept the new set of service delivery pattern. However, making people aware and building their capacity is necessary for its success. Regarding institutional set up, though there is a shift in paradigm advocated in the new Drinking Water Policy. In the context of Bihar, the institutional



set up needs more attention. The policy still in the draft form, which needs revise and finalisation of state water policy in line of national water policy and adopts it as guiding principle. Also, huge capacity building at all stages of political and governmental set ups who are responsible for implementation is required to bring about a change in mind-set to strengthen the possibilities alternative delivery models of delegation of responsibility to the grass root level.

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Acknowledgement: An earlier version of this paper was presented at the Second International Conference on Applied Economics and Business, organized by Shri Mata Vaishno Devi University and The Indian Econometric Society, held during 28<sup>th</sup>-29<sup>th</sup> July, 2016

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