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Assessing Coping Costs of 'Unreliable' Public Tap-Water Supply in Residential Typologies of Gurugram (India)

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ABSTRACT

This paper attempts to understand the households' coping/monetary costs associated with 'unreliable' public tap-water supply (quality and quantity) in various residential typologies identified in Gurugram. The study is based on the primary survey done through the technique of purposive or non-random sampling of 270 households in residential areas of Gurugram from 2014 to 2016. The study found that the residents or the water consumers of the Haryana Urban Development Authority supplied piped-water in Gurugram, in light of intermittent and unreliable piped-water supply, are consistently in practice of devising multiple domestic household methods/sources to meet their day-to-day domestic water needs. The study indicates that the domestic arrangements of water procurement have appreciably higher monetary costs than what the water consumers would have been paying for making the official supplied water reliable in form of monthly water bills. The results of the study suggest certain policy solutions so as to make public tap-water supply reliable in Gurugram.

Keywords: Coping cost, groundwater sustainability, residential typologies, water rates and tariffs, urban governance, urban planning

Water, a scarce resource, is pre-requisite for socio-economic prosperity of any society and the nation at large. Clean, adequate and reliable water supply to residents is an essential component of the basic civic infrastructure of urban settlement *(Economic Survey of Delhi 2012-2013).* It is generally maintained that 'water, though a scarce resource, is a necessary good (if not economic good), infact a basic human need, which should ideally be provided by the State (government) at subsidized rates to the water consumers, in order to attain maximum economic efficiency and social welfare in distribution (Roach *et al.* 2015). Traditionally, in urban India, the State public utilities/parastatal agencies have been assigned the responsibility of delivering domestic water, qualitatively fit, and quantitatively desirable to the residents through piped-water networks.

Quite often, the civic authorities find it increasingly difficult to manage water supply distribution on account of resource constraints, both in terms of water as a scarce resource (availability of water for distribution) on one hand, and financial constraint in the operation and maintenance of the water utility in question on the other hand. Besides these, existing poor infrastructure and non-revenue water loss are prominent reasons for ineffective water supply. These inherent bottlenecks in the operation and management of water utility can be labelled as the fundamental as well as universal reasons for inefficiency in water service delivery.

Specifically, public authorities in developing countries face ever increasing challenges in improving access to potable water in today's era of globalization (Rudra 2011). McKenzie *et al.* (2009) opined that 'a large number of households in cities in developing world do not have access to one of the most basic of human needs – a safe and reliable supply of drinking water.' McKenzie *et al.* (2009) further maintained that 'State's intermittent water supply, with predominantly low tap water pressure, and unpredictable service impose additional coping costs for the unreliability on households.' It is therefore, a general interest in academic research in areas of residential water governance, to look at the impact of inefficient State's water utility in relation to the alternative strategies of procuring domestic water by the households.

PROBLEM BACKGROUND

The Haryana Urban Development Authority (HUDA) is the nodal agency of the government of Haryana engaged in water delivery to the residents of Gurugram. One should, however, remember that HUDA is not an exclusive water utility or water board; rather it is a State-sponsored city development agency of Gurugram with water delivery to the residents as one of its various assumed roles.

Following the evidences from various secondary sources, the author has found that one of the problems seems to be the under-provisioning of residential piped-water by the HUDA, in face of rapid urbanization, population out-growth and increasing expansion towards its periphery areas of Gurugram. In situations when there is inadequate piped-water supply by the formal agencies, the problem that explicitly reaches out to the author, first and foremost, lies in the institutional incapacity of the State, which then voluntarily gives incentives, and in a way, passive authority to the informal water suppliers.

The development of private water markets is inevitable if the residents find unreliable piped-water supply by the State agencies. This practice would gradually become a pervasive trend as the residents have to depend inadvertently upon the informal or the privately managed domestic water supplies. Therefore, it becomes pertinent to execute an empirical study of water management methods of households in residential areas of Gurugram when there is a case of deficit water supply by the State agencies. Therefore, the research problems in hand is to understand the determinants of residential water demand of the residents of Gurugram, thus, knowing the households' coping strategies and responses on the subject under study.

DATA BASE AND METHODOLOGY

Identifying Water Beneficiaries of HUDA Piped/Tap-Water Supply

The study is centred on water supply and distribution of HUDA piped-water to residents in different areas of Gurugram. It is therefore, utmost important to identify the beneficiaries of HUDA piped-water, and thus also to identify the areas being served by HUDA piped-water network system. The selection of areas is based on the fact that HUDA supplies domestic water through piped networks in the Old Gurugram areas, and in the New Gurugram areas where much of the city's growth and expansion have been taking place over the years, either by the HUDA, or otherwise by private developers, and where the instances of water shortages occur more frequently.

More precisely, major residential typologies – namely, HUDA Sector colonies, MCG administered areas *(Old Gurugram and Urban villages)*, and Private elite colonies (New Gurugram) areas, that is, southeast of National Highway (NH)-8, and migrant colonies are taken into consideration while studying the impact of water shortages upon the residents. The analysis would enable one to look at how different segment of residents in respective residential areas are managing water or coping up with water shortages.

Primary Survey Methodology: Data and Survey Design

An attempt had been made to obtain primary data from the residents of Gurugram for a set of parameters through framing 'structured questionnaire-based-interviews' of residents by the author. The questionnaire was characteristically divided into two parts. The first part was about households (HHs) socio-economic and demographic profile. The other part was precisely about the HH water amenities and water-use behaviour. The set of broad parameters for empirical analysis were:

(a) Information on residents' current source/ access to water.

(b) *Average* consumption of water per HH daily.

(c) HH monthly income.

(d) HH *average* monthly water bill for consumption of water *(both on metered and un-metered connections)* from HUDA.

(e) HH *average* monthly expenditure on all other sources of household water demand.

(f) HH coping strategies for the deficit water from HUDA, if any.

(g) HH domestic water purification technologies.

(h) Residents' awareness of water scarcity in Gurugram.

(i) Residents' attitude and perception against the 'State agencies' in public water provisioning.

The field survey had been designed to include samples from four different sets of distinct and visible residential areas in Gurugram, namely, *(i)* the private builders' colonies like DLF City Phases, *(ii)* HUDA residential sectors, *(iii)* urban villages, and *(iv)* the private un-regularised/migrants colonies. The selected private builder's colonies for the purpose of carrying out field surveys were – *(a)* DLF City Phase I, *(b)* DLF City Phase II, and *(c)* DLF City Phase III. Evident from the secondary sources, there are cases of severe water scarcity right from Old Gurugram areas to New Gurugram areas, adjoining Delhi. Apart from these, a few HUDA residential Sectors like 4, 23 and 104, had been selected for the field study. Urban villages like *Dhanwapur* and *Nathupur,* both under the jurisdiction of Municipal Corporation of Gurgaon (MCG) were also chosen for primary survey as part of the case study.

Sample Size and HH Sampling

In the present study, purposive or selective or judgmental or non-random sampling technique has been used. To put in other words, the empirical study is qualitative research oriented study as *'qualitative data are often textual observations or categorical that portray attitudes, perceptions or intentions of affected communities.'*[1] 'Purposive sampling, though, is not statistically representative of the entire population, could provide arguments for the deeper understanding of the impact of amenities shortages upon communities and generalisable for the entire population' (Palys 2008). 'This method is usually used to choose no more than 30 units from each area of selection' (Elder 2009).

In the present study, purposive sampling technique had been used primarily for two reasons, *(i)* the population listing of private colonies like DLF Phases and un-regularized migrant colonies was not available to the author at the time of field study, which restricts the author to carry out probability sampling, *(ii)* there is ample prior knowledge and information with the author of water shortages in various residential areas of Gurgaon being served by HUDA water supply. On a prior judgmental basis, the author felt that even if the population listing was not available, the study of water in various residential areas was important to understand how different segments of population perceive HUDA water supply.

For the purpose of sampling, the author had considered respondents from all the chosen areas for the study as one universe – as water demanders of HUDA piped water. Broadly, residents from four heterogeneous classes of residential communities had been identified as water demanders for the purpose of extracting primary data. That is, for the purpose of sample collection, *first,* residents living in private builder's posh colonies, like DLF blocks/colonies, were classified as homogenous community, *second,* residents of urban villages like *Dhanwapur* and *Nathupur* had been classified as one community, *third*, residents of privately developed un-regularized areas mostly by migrants, like *Surat Nagar* Part II as one community, and *finally,* the HUDA Sector colonies as one community.

On an experimental basis in the primary survey, the total number of HH surveyed was 270 in all from the areas chosen for the study. Equal number of samples, that is, *n=30,* has been collected from each one of these areas chosen. Many HHs, especially in the posh-DLF Phases were found reluctant in sharing information with the author, and refused outrightly to give responses. After repeated visits and delayed appointments, some residents in these elite colonies were able to cooperate.

Most of the residents in posh private builders' colonies advised the author to meet private civic maintenance bodies meant for water and waste management in these colonies. The private security

[1] WFP, *Emergency Food Security Assessments, Technical Guidance Sheet No.8*, Introduction to qualitative data and methods for collection and analysis in food security assessments. February 2009. p.2.

agencies functioning in the various blocks of DLF Phases and the Resident Welfare Associations (RWAs) coordinated with the author by convincing the residents to seek appointments. It was indeed difficult to convince residents about the usefulness of such studies. In areas like urban villages and private un-regularised colonies, the author himself filled-up the questionnaire on behalf of the residents after having personal interactions, interview sessions, focused group discussions with the respondents and on-site observation.

(i) The area-wise distribution of the respondents is given in Table 1 as follows:

Table 1: Area-Wise Distribution of Total Samples

Sl. No.	Areas Surveyed	Community	No. of HHs
1	Various Blocks of Posh-DLF City Phases I, II and III	**A**	30×3=90
2	HUDA Sectors 4, 23 and 104	**B**	30×3=90
3	Urban Villages *(Dhanwapur* and *Nathupur)*	**C**	30×2=60
4	*Surat Nagar* Part II (Un-regularised)	**D**	30
	Total		270

(Field Survey 2014-15, 16)

(ii) Data on monthly HH income has been depicted in Table 2. Income of HHs is specifically categorized into four class-sizes or income-brackets as provided in the questionnaire, calculated and tabulated as follows.

Table 2: Monthly Income of the Sampled HHs

Sl. No.	HH Income (in ₹)	No. of HHs Community-wise				Total HHs
		A	B	C	D	
1	0 - 50 000	5	19	23	30	77
2	50 000 - 100 000	15	39	37	0	91
3	100 000 - 150 000	40	22	0	0	62
4	150 000 - 200 000	30	10	0	0	40
	Total HHs	90	90	60	30	270

(Source: Calculation using data from the field survey)

It is evident from Table 2 that community A has the highest monthly income in the highest two income class sizes. Community B has a moderate income distribution relative to different income classes, followed by Community C, and finally Community D has the least monthly income. However, 'it is maintained that expenditure on domestic water is a very small proportion of the HH total budget'… also, 'how much the maximum expenditure can a HH bear on domestic water, say monthly, will typically depends upon the maximum willingness-to-pay for water'(Osei-Asare 2004). Another way of looking at the homogeneity in classification of a particular community of residents is based on their HH's monthly income in terms of various income brackets – a *proxy variable* for standard of living, on the assumption that HHs having higher income would have higher propensity to spend on necessities like water. Accordingly, one way of classifying various communities in the present study could be based on HHs incomes.

THE PRIMARY SURVEY

(i) Based on the results of the primary survey, a summary of community-wise source(s) of domestic water has been presented in Table 3 and 4 below.

Table 3: Community-wise Sources of Domestic Water

Sl. No.	Sources	Community			
		A	B	C	D
1	HUDA	yes	yes	yes*	no
2	Groundwater	yes	yes	yes	yes
3	Private tanker	yes	yes	yes	yes
4	Packaged drinking water bottles	yes	yes	yes	no

*(Source: Calculation using data from the field survey); *Non-uniformity in HUDA piped connections to all the HHs surveyed.*

Table 4: Domestic Water Source

(%) of Sampled HHs

Sl. No.	Sources	HHs
1	Within residence HUDA tap water supply *(metered + unmetered connections)* (inclusive of all areas)	52
2	Groundwater through bore-wells (inclusive of all areas)	28
3	Private water tankers (inclusive of all areas)	12
4	Packaged drinking water bottles from open market (inclusive of all areas)	8
	Total	**100**

(Source: Calculation using data from the field survey)

It should be noted at this point that the primary survey characteristically distinguishes between the perennial source and the occasional source (s) of HH water. For instance, in principle and in practice, HUDA water supply has been taken as the perennial source of residential water in Gurgaon, while others are subsidiary sources, only demanded in deficit of HUDA water.

It is clear from Table 4 that a significant proportion of total HHs surveyed have access to HUDA piped water supply, except the community D. Interestingly, most depend heavily on other mentioned sources as well. This corresponds to the fact that the State's supply of water is inadequate or unreliable. Therefore, at times, the HUDA water supply is not satisfactory, the private water supply complements with the public water supply. Also, groundwater contributes 28 per cent of water supply according to the primary survey within the sampled communities. It should be noted that though groundwater is fast dwindling, it contributes an appreciable percentage of the total water supply to various communities. In addition, 20 per cent of residents also access water from secondary sources like private water tankers and packaged drinking water purchased from markets (combined).

(ii) It becomes important to evaluate the *average* monthly water bills of the communities on HUDA tap-water supply. It is noted that Community A pays water bills to HUDA *via* private block maintenance bodies, and therefore pays a certain proportion of their water bills as maintenance charges to private civic bodies. It is worthwhile to mention here that Community A does not have clarity on how much water bill they actually pay to HUDA. From the primary data collected, it has been calculated for all communities which are as follows.

Table 5: Average Monthly Water Bill of HUDA Water[2], Community-wise (in ₹)

Agency	Community			
	A	B	C	D
HUDA	700	158.5 or 52	154.62 or 52	n. r.

(Source: Calculation using data from the field survey); ***Notes:*** *n. r. stands for not reporting HHs. For Communities B and C, both the volumetric rates, and the flat rate, currently exist.*

From Table 5, one finds that relative to the incomes of the HHs, monthly expenses on HUDA water are negligible. Community B revealed that they pay water bills on monthly basis to HUDA. Not all the residents in community C have metered connections, and hence the estimate given for HUDA water bills in Table 5 is exclusive of the residents of *Nathupur* and *Dhanwapur*. Infact, the water bills stand '0' for *Dhanwapur* residents and a proportion of the *Nathupur* residents. For community D, water bill is '0'.

(iii) Next, an attempt has been made in the primary survey to estimate the *average* expenditure of the communities on supplementary sources of domestic water sources.

Table 6: Average Monthly Expenditure of Communities on Other Water Sources[3]

Sl. No.	Secondary Source	Community's Expenditure (in ₹)			
		A	B	C	D
1	Private water tanker	1200	750	1000	0
2	Packaged drinking water bottles	800	500	700	0
3	Groundwater	0	0	0	0
	Total	**2000**	**1250**	**1700**	**0**

(Source: Calculation using data from the field survey)

Table 6 shows that HHs expenditure on other sources is an average of expenditures inclusive of summer and winter months. In Community C, especially the residents of *Nathupur* village demand these categories of water given the fact that HUDA water is not sufficient in the area for drinking and other uses. Moreover, Community C residents, especially of *Nathupur* demand and pay for private tanker water on shared basis. Interestingly, no community pays anything for the consumption of groundwater, which contributes about 28 per cent of total water supply to all communities. Groundwater, which is also the source of private tanker water and packaged/bottled water supplies, has no State-regulated price and comes as a monopoly price to water consumers. Residents in relevant areas reveal

[2]Existing ₹ 1.25 per Kilolitre on metered connection, and a flat rate of ₹ 52 on unmetered supply (since 2001), likely to be increased to ₹ 3.25 per Kilolitre, in order to bridge the gap between cost of producing potable water and revenue receipts of HUDA (Jha, *Times of India,* City/Gurgaon, 18.1.2016).

[3]Here, packaged/bottled drinking water has been taken as a 20-litre volume standard, number of units of which HH purchases from open market. It was found in the primary survey that a volume of 20-litre bottle costs ₹150. In case of Community D, water tankers are provided by the local politicians to residents free of cost (primary survey).

that in summer months their average expenditure on tanker water and bottled water goes up manifold for increased frequency of such sources of water demand.

RESULTS AND DISCUSSION

(i) Scope for Coping Costs

The scope for coping costs of the communities is explicit from Tables 5 and 6. The coping costs of the communities with respect to deficit HUDA water can be understood in the first place as spatial unequal access to HUDA piped-water in the sampled areas of Gurgaon. *Additionally, coping costs, here, has been defined as the difference between what the residents would like to pay to HUDA in terms of their average expenditures incurred on the source(s) of domestic water other than the HUDA piped water supply, and the amount of water bills currently being paid to HUDA, monthly, ideally to make HUDA tap-water reliable.*

In other words, coping costs are simply the costs that are incurred by the residents to make domestic water improved and reliable regardless of the source. Yet, in other words, coping costs signify the averting behaviour of the respondents towards the risk involved in unreliability of piped water from HUDA. In this direction, the author further found that instead of asking each respondent's 'willingness-to-pay' for improved HUDA water, this could be a loose criterion in establishing a sound reasoning for any kind of justification on water tariff rationalization. At the best, the coping costs in monetary terms could be one way of revisiting the water tariff structure for any kind of tariff rationalization.

(ii) Water Reliability Index of HUDA Piped/ Tap-Water Supply

A 'water reliability index' of HUDA piped-water supply has been constructed in order to understand residents' perceptions on reliability of HUDA's water supply. Here, 'reliability' includes availability and sufficiency of HUDA piped water, frequency, and flow of tap water supply daily.

Here, 'N' stands for *Nathupur* village and 'D' stands for *Dhanwapur* village, n. a. stands for not applicable.

Table 7 is self-explanatory. It shows the significant proportion of HHs, inclusive of all the communities that believe that the HUDA piped water supply is unreliable. It justifies that HHs would like to pay more for improving HUDA water supply.

Table 7: Water Reliability Index of HUDA Water, Community-wise

(%) of HHs

Reliability Scale	Communities			
	A	B	C	D
5	0	0	0(N, D)	n. a.
4	49	33	12(N), 84(D)	n. a.
3	37	39	66(N), 10(D)	n. a.
2	0	15	22(N), 1(D)	n. a.
1	14	13	0(N), 5(D)	n. a.
Total	**100**	**100**	**100**	**n. a.**

(Source: Calculation using data from the field survey); ***Notes:*** *Water Reliability Index in the Scale of 1 to 5; 5-Highly reliable, 4-Reliable, 3-Unreliable, 2-Higly unreliable, 1-Can't say.*

This justification is imbibed in their coping costs structure, which is the manifold amount they are currently paying in the form of water bills to HUDA. In case of Community C, those who are not currently resorting to HUDA piped water, especially in the *Nathupur* area, have shown willingness to get connected with HUDA pipelines, as they have no groundwater option left *(primary survey)*. For community D, of course, this kind of justification is not permissible, as it is not so far connected to HUDA piped network.

(iii) Visualizing Water-Rent Economy in Case of Community A

An interesting theory, which directly follows from the field survey of the residents of Community A, which is the posh (elite) private colonies, is that they pay an amount which is higher than the water bills of HUDA on monthly basis. *This amount the residents are paying can be understood in terms of coping costs of making water reliable and affordable.* In other words, the HUDA water 'unreliability' has been 'rented out' to the private civic authority in these colonies. This is evident from the primary data that 49 percent of all the respondents of Community A, feel that HUDA water is reliable. However, the *average* amount of ₹ 700, which is greater than what they would be paying, for instance, ₹ 160 or so on volumetric prices, had there been individual metering.

The 'water-rent' *vis-à-vis* private supplier of HUDA (public) water has been collected by private bodies. It is an interesting case; because the author wasn't clear about how much the private agencies pay back to HUDA. Nevertheless, the residents keep paying more for regular water supply. This kind of theory has moreover nothing to do with spatial inequity in water distribution of HUDA water, because these areas have strong foundation of private civic monitoring agencies. Therefore, the case study of water in case of Community A is characteristically different from the other communities as visible from the primary survey.

POLICY SOLUTIONS

From the above results and discussions, it is evident that the different residential typologies in Gurugram are managing their domestic water demand through various mechanisms. It is also evident that HUDA piped-water supply is non-uniform and has some elements of spatial inequity in distribution. It comes out to the author that lack of infrastructure for piped-water supply could be one of the major supply bottlenecks in efficient, reliable, and effective residential water delivery. The public water supply deficiency thus, culminates into rising coping costs for the water consumers of the HUDA water. The author would like to put forth certain policy solutions to mitigate or atleast to reduce the on-going residential water scarcity *vis-à-vis* coping costs of residents in Gurugram, which are as follows:

The Supply Side Policy

The supply side policy would include a few recommendations in order to make HUDA piped-water supply reliable and improved. *First,* Gurugram needs a centralized public water utility/board such as Delhi Jal Board (DJB) in adjoining Delhi or Municipal water boards in cases of NOIDA and Faridabad and so on. A centralized water utility could enhance the performance in water delivery, in terms of a single monitoring authority for all purposes, namely, water collection, treatment and storage, operation and maintenance, water distribution and tariff collection from residents. This could reduce the transactions costs unnecessarily involved in water supply through multiple civic agencies and thus, minimize the civic mess which currently exists in Gurugram.

Second, the governance in Gurugram needs to boost investment in water infrastructure. Gurugram, if considered 'Singapore of India', then, it also needs to follow what Singapore did in terms of securing water for its citizens. In other words, the government must show willingness on its part to invest in Water Research and Development (R&D), water innovations, search for newer or potential sources of water, and absorbing newest technologies for minimizing water loss both during capture and transportation, and also at the distribution levels.

And, *third,* a city like Gurugram, which is fast urbanizing and expanding, needs a concrete planning in civic amenities. Ad-hoc planning measures would only make the urban life of citizens miserable, even if there is enough 'willingness-to-pay' for public water. The urban planning methodology should encompass opinion of all the stakeholders in urban governance – primarily, the State and the civil society, water engineers, geographers, economists and so on. This needs a further coordination of the residents and the civic agencies for an integrated urban water management programmes. Eventually, a concrete and envisioned planning would reduce inter-residential water conflicts.

The Demand Side Policy

The demand side policy could be much more comprehensive. To begin with, *first,* the need is to universalize water metering in all the residential typologies. To argue such policy, the author advocates that since water is scarce in Gurugram, water metering on consumption enhances uniform water demand and minimizes water loss at the consumer end. Metering water consumers would then lead economists to understand the quantity of water demanded by the consumers over the period of time; which could lead in turn, in determining correct water tariffs chargeable to the consumers. Ultimately, the criterion of economic efficiency and social welfare could be attainable for different segments of citizens from the fact that residents' 'willingness-to-pay' is revealed implicitly in their coping costs for any kind of tariff alterations.

Second, re-visiting the coping costs of the residents of Gurugram, it yields one way of tackling water shortage problems in relation to Gurugram, specifically in terms of raising infrastructure. The manifold amount of coping costs relative to what residents are currently paying for water bills to HUDA (not all the residents) is a linear function of water supply unreliability. In a functional form, the coping costs can be given as follows.

Coping costs of residents of Gurugram = f (Unreliability of HUDA tap water). This means, more the unreliability, higher the coping costs to be borne by the residents. Therefore, coping costs correlate with unreliability of HUDA water. Now as a policy intervention, the government should understand that the coping costs are entirely borne by the residents themselves for securing domestic water regardless the source of it. This can be used as a demand side policy instrument in the following way.

If one looks at the HUDA water bills corresponding to the coping costs of the communities A, B, and C, currently in practice, it is a minimal fraction (Table 5 and 6), except the case of community D, for which it stands zero. The author has accordingly, to make arguments sound, taken coping amounts of various communities as the amount the residents would like to pay as the maximum reservation price for HUDA water, monthly, in case it becomes reliable.

However, this coping amount cannot be the lower bound for determining any water pricing policy. The water pricing policy, in case the State decides to improve the water supply, would then depend on differential water pricing method based on social, economic and demographic characteristics of the population. As a pricing policy, the HUDA can decide an initial reservation price for the anticipated consumption, precisely using the increasing block-rate pricing method. The author has tried to devise rather a hypothetical domestic water tariff policy for the community A, in Gurugram as follows:

Community A, which is paying an appreciable amount for HUDA water through the private agencies, the State can devise a tariff structure as follows. This exercise is apparent because, the author realizes that community A is paying a huge amount and is still uncertain in accessing HUDA supplied tap-water.

Coping costs 'savings' on domestic water of the community A = {Coping costs of the community A *minus* User charges paid to HUDA currently + (the Volumetric consumption of HUDA water on metered connections @ 225 lpcd[4] + 50% of water bills as sewage maintenance charges to private bodies)} = Water tariff on HUDA water consumption, monthly.

For example, for community A, savings of the residents monthly = {₹ 2000 – ₹ 700 = ₹ 1 300. Now, ₹ 1300 *can also be understood as the base price/fixed cost to be paid monthly by the water consumers.* For instance, from the data obtained from the primary survey, ideally and on standard, community A would like to consume at the institutional quantity of 225 lpcd. With the existing volumetric rate of ₹ 1.25 per Kilolitre, theoretically the following tariff structure can be possible.

Now, 225 *lpcd* × 30 *days* = 6750 *litres per month. Since* 1 *Kilolitre* = 1000 *litres, therefore, it implies,* 6750 *litres* = 6.75 *Kilolitre* × ₹ 1.25 = ₹ 8.4 + ₹ 1300 = ₹ 1308.4, *water user charges, monthly. Adding* 50% *of* ₹ 1308.4 *as sewage maintenace charges, this will be* ₹ 654.2. *Therefore, the total water bills for the residents of community A will be* ₹ 1308.4 + ₹ 654.2 = ₹ 1962.6, *monthly.*

Interestingly, the amount of ₹ 1962.6 is equivalent to the amount community A has been incurring currently as coping costs on monthly basis. In order to make such tariff pragmatic, the State has to relook at the governance of water delivery in the elite colonies (community A), and try to minimise the involvement of private intermediaries in water supply. For rest of the communities such as B and C, the block-rate pricing is advisable on metered connections, instead of both the flat rates and the block rate currently. For community D, unless it is regularised, there is no meaning to cover residents under such tariff justification.

Taking the coping costs as a demand management instrument, HUDA can rationalize its current tariff structure to raise the finance of new infrastructure for better water delivery (at the best HUDA can do presently). However, to an economist, it is favourable to design a differential (based on income) and acceptable water pricing taking into consideration the poorer section of the society.

[4]Litres per capita daily (lpcd).

This could be worked out by engaging economists to draw a framework in which all the aspects (primarily, the social and economic impact) of water pricing can be assessed at the institutional level. The author believes that rationalizing tariffs rate through better metering and coverage will result in better infrastructure with larger coverage of water beneficiaries under HUDA piped supply network, and in turn, it will definitely increase the potentiality for better access to HUDA supplied tap-water.

Next, the 'cost savings of the HUDA' in terms of reducing the non-revenue water loss of the total volume of water supplied could be explained. To make the water supply system better, the pre-requisite is to minimize the non-revenue loss of the State. Metering would enable the State in the detection of illegal tapping of water. 'The State through the impact of metering would enable it to find out how much of water is lost in theft, thereby able to detect illegal connections and regularize them, using volumetric pricing method' (Kumar 2014).

CONCLUSION

The assessment of the coping costs of residents in various residential typologies in Gurugram in face of public or tap-water supply unreliability, leads to significant conclusions from the study. It has been found that the residents demand for HUDA tap-water, is not a linear function of the water bills they pay for consumption, rather it is a function of a series of alternative domestic water procurement sources and also infrastructure deficiency. The author strongly advocates that the public water authorities of Gurugram must acknowledge the fact that the magnitude of coping amount is a multiple of official and current water tariff rates, and can re-design a re-structured water tariff rates to raise infrastructure and make public water supply reliable. In totality, the supply side bottlenecks of the State agencies explicitly correlate with the poor status of water supply infrastructure in Gurugram relative to the rate of urbanization and expansion, which is the source of coping strategies and hence coping costs of the residents.

More significantly, the groundwater sustainability in Gurugram is vital for the over-all development sustainability of the city. The study clearly shows how groundwater in Gurugram has become the 'lender of the last resort' in situations of unreliable tap-water supply for all the communities' demand for household water. In nutshell, the coping costs of the residents of Gurugram can be taken as policy tool to encompass all policy decisions pertaining to urban water governance so that Gurugram can be truly recognized as the 'global city of India'.

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REFERENCES

Cowan, Thomas 2015. Fragmented Citizenships in Gurgaon. *Economic and Political Weekly*, **XLIX**(27): 29-31.

CSE-Anon Report 2011. 71-City Water-Excreta Survey, Indo-Gangetic Plains Gurgaon. New Delhi: Centre for Science and Environment.

CSE Report 2012. Green Building. New Delhi: Centre for Science and Environment.

Economic Survey of Delhi 2012-13. Government of National Capital Territory of Delhi.

Elder, Sara 2009. ILO School-to-Work Transition Survey: A Methodological Guide, Module 3, Sampling Methodology. Geneva: International Labour Organization.

Gupta, Rajeev 2012. Real Estate in Gurgaon – Opportunity and Challenges, *International Journal of Management and Business Studies*, **2**: 4.

Kait, Kuldip Singh 2013. Water and Sanitation Situation in Urban Villages of Municipal Corporations of Gurgaon – India: A Geographical Analysis, *Indian Cartographer*, **XXXIII**.

Kumar, M. Dinesh 2014. Thirsty Cities: How Indian Cities Can Meet Their Water Needs. New Delhi: Oxford University Press.

McKenzie, David and Isha Ray 2009. Urban Water Supply in India – Status, Reform Options and Possible Lessons, *Water Policy*, **11**: 442-460.

Osei-Asare, Yaw 2004. Household Water Security and Water Demand in the Volta Basin of Ghana. Germany: Peter Lang.

Palys, T. 2008. Purposive Sampling in L. M. Given. (eds.), The Sage Encyclopedia of Qualitative Research Methods. (Vol.2). Los Angeles: Sage.

Prakash, A. Sreoshi Singh and Vishal Narain 2011. Changing Waterscapes in the Periphery: Understanding Peri-Urban Water Security in Urbanising India. India Infrastructure Report (IIR) 2011: Water – Policy and Performance for Sustainable Development. New Delhi: Oxford University Press.

Rich, Nathan 2014. Globally Integrated/Locally Fractured: The Extraordinary Development in Gurgaon, India in Peggy Deamer. (eds.), Architecture and Capitalism: 1845 to the Present. New York: Routledge.

Singh, Varsha and Vinita Yadav 2012. Role of Floor Space Index in City Sprawl – Case Study of Gurgaon, *Indian Journal of Regional Science*, **XXXXIV**(2).

Singh, A. 2013. Private Provision of Public Utilities: The Solution to India's Urban Problems – An Introduction. Centre for Civil Society (CCS) Working Paper No. 229. Research Wintership Programme 2013. Accessed online from the website http://www.ccs.in, on 12.1.2015.