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Assessing Household Willingness to Pay for Quality Sanitation Services in Urban Areas of Pakistan

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ABSTRACT

Addressing the problem of rapid deterioration of environment in urban areas has not produced the desired results in developing countries. This paper is an attempt to asses household willingness to pay (WTP) for Quality Sanitation Services (QSS) like sewage disposal, solid waste management and clearance of municipal drains in Peshawar city. For assessing WTP, Contingent Valuation Method (CVM) and Bid-wise Binary Logic Model were applied to a sample size of six hundred (600). Result analysis shows that 92.8 percent of household were not satisfied with existing situation of sanitation services and want improvement in the services. Policy variables: household income, education, occupation, size and ownership of the respondents, were used as regresses. Among the policy variable, household income, education and occupation were statistically significant for the first three bids in the model. This study further elaborated that 452 respondents were in odd of 1st bid and were willing to pay Rupees 220 per month for QSS. This paper recommended that CVM was an appropriate tool for estimating WTP for QSS. The application of CVM and Logit Model to find WTP will not only collect more revenues for the public utility companies but will also make service delivery more efficient and sustainable.
Note: Data analyzed in this paper is extracted from my own doctoral dissertation.

Keywords: *Willingness to Pay, Logit Model, Contingent Valuation Survey Method, Quality Sanitation Services*

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INTRODUCTION

Sanitation is a procedure used for safe and secure disposal of human excreta and communal waste to ensure public health safety (Van Minh et al., 2013). It is a basic human need and municipal authorities were legally bound to provide affordable sanitation services to the community without any discrimination (Hutton, 2012). In developed countries, every household is required by law to dispose-off their sewage into the sewer line provided by the authorities concerned. However, in developing countries, lack of information regarding household affordability and non-availability of assessment data about willingness to pay (WTP) by the marginalized people were not addressed at planning level (Whittington et al., 1991). Such information were essential in formulating economically viable and environmentally sustainable policies (Bender et al., 1980).

Globally, the provision of water and sanitation services were not up-to the optimum level as 2.6 billion individuals live without improved sanitation services (Montgomery and Elimelech, 2007). However, provision of improved sanitation services neither requires a huge amount of money nor scientific breakthrough or technological advancement (Bartram et al., 2005). The dismal situation of sanitation services is mainly attributed to lack of public participation, to unrealistic policy formulation and to ineffective implementation of sound policies (Nawab and Nyborg, 2009). Due to lack of public participation in policy formulation, the community members usually question, and even resist, the implementation of centralized experts' formulated policies (Mara, 2003).

In developing countries, policies were formulated, massive funds allocated, but still these policies do not deliver the desired results because of the socio-cultural values and economic considerations of the people (Nawab and Nyborg, 2009). Beside this, unplanned urbanization, indiscriminate discharge of untreated waste and lack of appropriate remedial action further ignite the daunting situation (Kalbermatten et al., 1999). Regrettably, both public and private sectors, were giving meagre attention to improved sanitation services; which is causing environmental and health problems (Khan et al., 2007)).

In Pakistan, there is a wide gap between peoples' needs and policies of government for sanitation services (Nawab and Nyborg, 2009). Pakistan social living measurement survey shows that 73 percent of households have the facility of flush toilet and 13 percent households have no toilet facility at all (Government of Pakistan, 2015). The inadequate water supply and sanitation were causing major environmental degradation and health problems in the country (Ahmad and Sattar, 2010). Further, total expenditure on water supply, sanitation and hygiene was Rs.112 billion per year (Government of Pakistan, 2009).

In Peshawar city, residents suffer from the lack of sustainable sanitation service delivery, especially, in slums and informal

settlements. Due to inappropriate solid waste management, the drains get chocked. Further, sewerage pipe network were either not provided or totally dysfunctional, resultantly, sewage is directly discharged into rivers, irrigation canals, perennial nullah or agricultural land, which pose severe environmental and public health hazards.

This paper presents an assessment of household WTP for quality sanitation Services through application of contingent valuation method (CVM) in Peshawar city, and highlight the importance of WTP for sustainable environmental planning. There is little literature available on WTP for quality sanitation services (QSS) which is attributed to the difficulty in measuring objectively the different aspects of the urban environment. Understanding of household WTP for QSS (e.g., as in Peshawar) can provide important inputs for sustainable municipal planning. The research focus of this paper was as under:

- To assess the current state of sanitation services in Peshawar city
- To assess the main determinants of household WTP for QSS.

I. Literature Review

In developing countries, majority of household have lack of improved sanitation services (Mara et al., 2010). The municipalities cannot afford to provide municipal services on subsidized rates. Thus, municipal services in developing countries depend on household financial contributions, which in turn depends on WTP for QSS (Russell et al., 1995).

A series of studies in developing countries have been conducted to estimate household WTP for improvement of these services e.g. in Nigeria (Arimah) 1996; Ghana (Whittington et al., 1993); Vietnam (Van Minh et al., 2013); Peru (Morris and Thi Le, 2012) and Uganda (Francis, 2014).

Various methods have been used for WTP like Hedonic Housing Price Approach and Averting Behavior. CVM has been used for data collection and for assessment of household WTP for improved safe sanitation services by most of the researchers and practitioners (Cumming et al., 1986a; Mitchell and Carson, 1989). Variables: socio-economic characteristics, satisfaction regarding the existing sanitation services, distance from the improved source and the environmental condition of the study area; were the main determinates. Findings reveal that gender and economic status of the respondent, type of current toilet, satisfaction with existing toilet, and knowledge of health effects of poor sanitation were statically significant for WTP (Van Minh et al., 2013).

Literature further showed that, most of the household of the developing countries were off track to meet the millennium development goals (MDGs) and sustainable development goals for improved sanitation services (World health organization, 2015). Majority of household were not satisfied with existing sanitation services and wanted its improvement (Montgomery and Elimelech, 2007).

In Pakistan, numerous studies like Altaf et al., (1992); khan and Javed (2007; Noor et al., (2010); Khan et al., (2010); Ahmad and Sattar (2010); Haq et al., (2007); khan (2014); Parveen (2015) and Rauf et al., (2015), had estimated household WTP for improvement in water and sanitation services and have used various methods used for assessment of WTP as required by the nature and objective of the studies.

Similarly, different determinants have been used to investigate household WTP for improvement in sanitation services and advocate that, "household demand" for improved water and sanitation services is much more complex and need expertise in design of questionnaire and data collection. In this regard, this study was vital in reorienting planners and policy makers from expert driven approach to demand driven approach for QSS.

II. DATA AND METHODOLOGY

i. Study Area and Sampling

Peshawar, capital city of Khyber-Pakhtunkhwa, is a dynamic and fast growing city. It is the 8th populous city of Pakistan having important historical, political, economic and military role. Administratively, district Peshawar comprised of 92 (45 urban and 47 rural) union councils. Geographically, District Peshawar lies between 33° 44′ and 34° 15 East and 71° 22′ and 71° 42′ North, and borders District Nowshera in the East, Charsada in the North, Mohmand Agency and Khyber Agency in the North-West and Frontier Region of Kohat in the South. Demographically, the total population was 2,019,000 persons out of which 982816 persons (48.69%) live in urban area. The population growth rate was 3.56% and household size was 8 persons (Government of Pakistan, 1998). The study was limited to all the 45 Urban union councils of District Peshawar.

Primary data was collected from households through questionnaires using simple random sampling method-a method which is more representative of the sampled group as compared to non-random sampling techniques (Gravetter and Forzano, 2011). With the help of sample calculator, the sample size was estimated using the formula:

$$SS = \frac{Z^2 * (p) * (1 - p)}{C^2}$$

Where:

SS= Sample size

p = Percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

Z = Z value (e.g. 1.96 for 95% confidence level)

C = Confidence interval, expressed as decimal (e.g., 0.04 = ±4)

The population of urban Peshawar was projected 1,694,936 persons for the year 2017 and the sample size, thus, calculated was 600 households. The sample size was allocated to 45 urban union councils through proportional allocation method.

ii. Survey Design and Data Collection

Data analyzed in this paper is extracted from the doctoral dissertation, entitled " An Analysis Of Households' Demand For Improved Water And Sanitation Services Towards Better Planning In Peshawar, Khyber Pakhtunkhwa" of the corresponding author of this paper (Muhammad, 2017)

CVM was applied to investigate the WTP of households, through a user-pay approach for QSS in urban Peshawar. The survey was conducted through a well-designed questionnaire and data collected from the main income earner of household. The precise nature of QSS, offered through hypothetical market, were properly defined in the survey questionnaire. Households were offered to choose fee through various bids for QSS. Five (05) ranged Bids were floated to households for assessing WTP, for finding the significance of policy variables through various statistical estimates and for estimating consumer surplus through demand curves.

The household responses and their maximum WTP against each bid were recorded. The responses were recorded in dichotomous (DC) choice "Yes" or "No". In addition, socio-demographic informations were obtained from each respondent. The DC format was applied for mitigation of biased strategic response.

III. Analytical Procedure

Statistical Package for Social Scientists (SPSS) software were used for data analysis. The socio-economic characteristics and existing state of sanitation services were assessed through descriptive statistics. For assessing household WTP for improvement in the environment, literature suggested various models, namely, Linear Probability Model (LPM), Logit Model, Probit Model and Tobit Model (Hanemann, 1984). This study quantified the households WTP for non-market goods and services, so logit model was found more relevant.

- **Econometric Specification of Model**

For estimating household WTP for QSS, bid-wise Binary Linear Logit Regression Models were used. The depended variable was constructed in dichotomous format, i.e. taking the value "1" if the household was willing to pay for QSS and "0" otherwise. The model was used for similar studies by Whittington et al., (1993); Raje et al., (2002); Van Minh et al., (2013) and, being algebraically simpler than other models, it has an advantage over other discrete choice models (Linear Probability mode, Tobit Model and Probit model). Thus, Binary Linear Logit Regression Model estimated the probability of odds in an event and was given by:

$$\text{Probibility (event)} = \frac{1}{e^{-Z}}$$

Where Z is the combination of variables X_1, X_2, ..., Xn

$$\text{Probibility (event)} = \frac{1}{e^{-(\beta 0+\beta iXi)}}$$

The probability equation can be transformed to determine the log odds in favor of the event as:

ln (probability of event/1-probibilty of event) =Z.

In model the model used in this study:

$Z= \beta_0 + \beta_1 Ih + \beta_2 Edu + \beta_3 HHs + \beta_4 HO + \beta_5 HOcp_+ U_i$

Where,

Ih = Total Income of Household in PKR/month.

Edu=Number of years in education of the main earning member of the household.

HHs= Household Size in number.

HO=Household occupation.

HOcp=Housing occupancy of household

The detail descriptions of these variables are given in Table-3.

IV. RESULTS AND DISCUSSION

i. Existing State of Sanitation Services in Urban Peshawar

The inhabitants of urban Peshawar were faced with major problems like lack of land use planning, unplanned urbanization and over utilization of municipal sanitation services. The lack of proper planning and lack of public participation in public planning were central the deteriorating situation of sanitation services. Beside this, multi-institutional arrangements lead to duplication of initiatives and wastage of resources, below-par operation and maintenance of existing infrastructure, and inadequate staffing-all these hindered the capability of municipalities to ensure sustainable basic service delivery.

For provision of QSS, the government of Khyber Pakhtunkhwa (GoKP) has established Water and Sanitation Services Peshawar (WSSP), an independent utility company. Table-1 showed that WSSP provided water and sanitation services to 93.0 percent of urban population while the remaining 7.0 percent was served by Cantonment Board. The company replaced the previous multi institutional arrangements by one corporate entity and took, in hand, various projects for improving the overall planning and service delivery in the city.

From public health perspective, sanitation facilities like safe and secure toilet facilities are basic human needs. Analysis showed that 97.0 percent of household had improved toilet facilities (flush, VIP latrine/pit latrine with slab, pit latrine without slab) while the remaining 3.0 percent had unimproved facilities (Public latrine/Hanging latrine, field/bushes) or no facilities at all

Table 1. Household Responses on the Existing Sanitation Services in Urban Peshawar

Sanitation services provider in Urban Peshawar		
	Frequency	Percentage
Water and Sanitation Service Company (WSSP)	558	93.0
Cantonment board	42	7.0
Total	600	
Responses of HHs access to Toilet Facility		
Yes	582	97.0
No.	18	3.0
Total	600	
Source of Toilet Facility		
Flush	415	69.2
VIP latrine/pit latrine with slab	152	25.3
Pit latrine without slab	15	2.5
Public latrine/Hanging latrine	8	1.3
No facility/Bush/field	10	1.7
Total	600	100.0
Toilet Connection to the Sewerage line		
Yes	75	12.5
No.	525	87.5
Total	600	100.0
Surrounding Environmental Condition of Households		
Pathetic and unhygienic	481	80.2
Fair and satisfactory	105	17.5
Good and hygienic	14	2.3
Total	600	100.0
Satisfaction Regarding the Existing Sanitation Services		
No	557	92.8
Yes	43	7.2
Total	600	100.0
WTP for Improvement in Sanitation Service		
No.	43	7.2
Yes	557	92.8
Total	600	100.0

In urban Peshawar, most of households had lack of public sewer line facilities and sewage was discharged directly in rivers, irrigation canals, khawars or agricultural land. It was shown in table-1 that only 12.5 % household had and 87.5% had no/dysfunctional public sewer line facilities. It was ascertained from the data in table-1 that 80.2% of the households were not satisfied with the existing sanitation service and were willing to pay for QSS in the area.

i. Household WTP Potential for QSS

In developing countries, Households WTP for QSS was an important social and behavioral process with implications on public health, for sanitation policy and planning, and for public utility company for improvement of sanitation services. Literature suggested that, planners and policy makers in developing countries had a lack of understanding of WTP for quality sanitation services (Arimah,1996; Whittington *et al*., 1993; Meeks, 2012; Van Minh *et al*.,2013; Thanh *et al*., 2014. However, safe, secure and hygienic sanitation services was the right of every citizen (Hutton, 2012).

Research suggested that improved sanitation services increase income generation of the households, reduce poverty and was a pre-requisite for sustainable development (Howard and Bartram, 2005; Van Koppen *et al*., 2006). There was a sizeable WTP for QSS in developing countries (Adenike and Titus, 2009; Whittington, 2010).

However, in Peshawar, usually the benificiaries are no consented and traditionally the charges are set by thumb rules. The household demand determinants for improved environmental sanitation services and charges applied for these services have not been carefully investigated and

analyzed. The lack of policy guidelines from the government in this context has further increased the miseries of an ordinary citizen besides causing health and environment problems

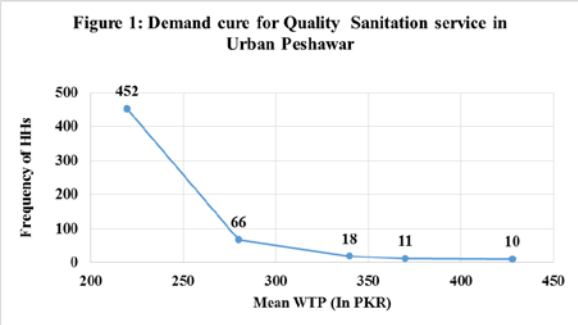
Table 2. Various bids for WTP for Quality Sanitation Services in Urban Peshawar.

Bid No	Range of bid (In PKR)	Frequency of Responses out of 557 respondents in odd of each bid value.	Percent	Mean WTP
1	200-250	452	81.1	220
2	251-300	66	11.8	280
3	301-350	18	3.23	340
4	351-400	11	1.97	370
5	401-451	10	1.79	428
	Total	557	100	

Table-2 gave us a broad picture of household WTP for QSS including sewage disposal, solid waste management and clearance of sanitary drains. In urban Peshawar, sanitation services were free or nominal cost in some area to the community. Keeping in view the quality and suitability of the services, household responses were recorded through ranged bids as given in Table 2. It was clear that most of households i.e. 81.1% were odd in favor of bid No-1. As the bid value increased from Bid No to Bid No-5, the frequency of WTP of respondents decreased as such follows the law of demand for normal goods and services.

ii. Average Demand Curve for Quality Sanitation Services

The demand curve for QSS was derived from WTP information. Y-axis showed households average WTP while bids values were plotted on X-axis (Figure-1). Demand curve was derived based on intersection of bids value to corresponding Frequency of households' WTP. Every point on the demand curve showed household WTP for the bid offered. The demand curve showed that as the bid value increases, the households' WTP decreases.



In Peshawar,the existing Sanitation charge have more elaboratie system. In Hyatabad, the conservancy charges varies from PKR (100 to 350) per month while sewerage charges varies from PKR 50 to 195 per month depending upon the size of the plots. In University Town Peshawar, the conservancy charges are PKR 170 and sewerage charges are PKR 90 per month on flate rate. The Cantonment Board (CB) area have its own arrangments. With the exception of the PDA and CB jurisdiction, in the whole WSSP jurisdiction the conservancy charges are PKR 100 and sewerage charges are 50 per month on flate rate.

However,these charges were implented by the service provider with out proper involvement of households, their desired quality of services and willingness to pay for the services. In the absence of baseline survy, the existing services are falling short of the demand and desires of the majority of households and thus charges applied againts these services are just like compulsory tax. This study actually covers this gap and investigate HHs WTP for the offered quality of sanitation services. Table-2 showed that highest number of persons were odd in favor of Bid No-1(200-250) and average WTP for QSS were PKR 220/month which is higher than the existing charges.

The financial benefits of QSS were the sum of extra revenue generated by WSS company from consumer's surplus and from mitigation of dead weight losses. Collection of consumer surplus for QSS in urban Peshawar would mitigate dead weight loss as well as will generate revenue to WSS company for sustainable services. The findings of this study could serve as a useful tool for sanitation policy makers, planners, and practitioners of WSS for providing QSS, revenue collection and as a spring board for further studies.

iii. Bid wise WTP for QSS

- **Variables Description**

The results of descriptive statistics were presented in Table-3. Household Income, education, occupation, housing occupancy, and household size were main dependent variables for WTP.

Table 3. Definition and Summary Statistics of Variables

Variable	Description of the variable	Mean	Std. Deviation
Ih	Income of household.	167991.01	164020.649
Edu	Education of household. (0= Illiterate, 1=Middle, 2=Secondary, 3=Higher Secondary, 4=Bachlor, 5= Master, 6=Higher level)	1.1983	3.699
HHs	Total members of household.	6.412	3.699
HO	Household status of employment. (1= Un Employed, 2= Govt. Emplyed,3= Private employed,4=own business)	2.462	1.089
HOcp	Household Housing occupancy status. (1=Own, 0= Otherwise)	0.797	0.403
WTP	Willingness to pay (Dichotomous, 1=Yes, 0=No)	0.930	0.258

Moreover, mean WTP of the sampled household was also derived in the analysis. The income of the household was estimated from the household monthly expenditure.

i. Determinants of Households' WTP for Quality Sanitation Services

Household WTP for QSS have direct, indirect or associated benefits, such as mitigating diseases, enhancing social status and improving hygienic condition (Hussen, 2012). Table-4 represented bid-wise logit analysis of the variables that determined households' WTP for QSS in urban Peshawar. The selected variables, given in Table-3, were used in econometric model, three variables, Ih, Edu, Ho, significantly influenced household WTP for QSS.

The estimate of the parameter of variable 'Ih' was significant as well as positive in all three bids at (P<0.01) which implied that rich people were willing to pay more than poor. Similar findings were also reported in studies (Whittington *et al*., 1993, Fujita *et al*., 2005).

Further, variable 'Edu' was also statistically significant and positive in all three bids at (P<0.01) which showed that the WTP for QSS increased with the level of education. These findings were in agreement with previous studies reported in (Fujita *et al*., 2005; Jenkins and Scott, 2007; Seraj, 2008; Adenike and Titus, 2009).

Table 4. Results of Logistic Regression Model for QSS in Urban Peshawar

Independent variable	Dependent Variable: Willing to Pay for QSS at different Bids (Dichotomous)		
	PKR (200-250)	PKR (251-300)	PKR (301-350)
Income of the Household	2.521*** (0.375)	2.747*** (0.330)	12.45*** (5.045)
Education of the Respondent	2.083*** (0.287)	0.351*** (0.148)	2.561*** (1.010)
Household Size	-0.100* (0.054)	0.028 (0.53)	0.494 (0.451)
Household Occupation	.675*** (0.170)	-0.275* (0.187)	-0.266 (0.875)
Household Occupancy	-0.575 (0.521)	0.079 (0.026)	0.963 (1.767)
Constant	-29.252*** (4.221)	-35.615*** (4.198)	-161.313*** (66.701)
Diagnostics	No of observation, N =452 Pseudo R^2=0.698 χ^2=322.285	No of observation, N =66 Pseudo R^2=0.462 χ^2=135.799	No of observation, N =18 Pseudo R^2=0.872 χ^2=62.075

- Standard Error values are given in parenthesis.
- *** significant at 1percent
- **significant at 5 percent
- * significant at 10 percent

Source: Author's own calculation from field data.

The variable 'Ho' was found significant for initial two bids at (P<0.01) and (P<0.05). This phenomenon implied that WTP for QSS was dependent on employment hierarchy of the respondents.

The variable HHs size had a significant and negative effect which indicated that as the household size increased, WTP for QSS decreased. To sum up, majority of households in the study area were willing to pay for QSS. Further, WTP amount were strongly influenced by the economic status, education and awareness of health hygiene of households.

iv. CONCLUSION

It was ascertained that majority of the households were willing to pay for QSS and CVM was found an effective tool for assessing WTP and subsequently for framing public policy for QSS. CVM can be applied, successfully, to household survey through a well-designed questionnaire for data and information collection. Further, it was concluded, using Logit Model, that the key determinants of the household WTP for QSS were income, education and household occupation. Income, education and occupation of household were statistically significant for all three bids while household size was significant with negative sign on WTP.

This paper recommends that practitioners of public utility company can use the CVM for measuring households WTP to bridge the gap between the customers and policy makers. Assessing WTP will not only increase the revenue of the public utility company but also make the services more sustainable. Beside this study will also a become a spring board for future research studies.

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