WILLINGNESS TO PAY FOR IMPROVE WATER SUPPLY USING STRUCTURAL EQUATION MODEL: A CASE STUDY OF DHOKE SYEDAN

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CERTIFICATE

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Dedicated to

My Beloved Family

And my Husband Syed Farhan Raza

Whose Lovable attitude and Sincere Passion always compels me to do something new and innovative!

ABSTRACT

The scarcity of water resources and the extreme use of water can put a burden on the quality of water. This problem is becoming serious issue in Pakistan, where water pollution is common in most parts of the country. In urban areas where the population rate is increasing day by day, issues related to water are also rising. This study is based on primary data collected from the urban area of Rawalpindi that is Dhoke Syedan (Rawalpindi). The people of Dhoke Syedan, facing a shortage of water. The main objective of this analysis is to find out which significant determinants are willing to pay for clean drinking water. The list of partial determinants includes age, employment, income, household size, household ownership, gender, and availability of water. Among these awareness and perception are used as latent variables. Nine variables are used to calculate the indirect outcomes of variables using SEM. The structural equation method is an extension leading to a general linear model that allows researchers to analyze a series of regression equations separately.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

WTP	Willingness To Pay
WTA	Willingness To Accept
CVM	Contingent Valuation
SEM	Structural Equation Model
HH	Household
Edu	Education
HH	Household
WHO	World Health Organization
GOP	Government Of Punjab
PKR	Pakistani Rupees
CBA	Cost Benefit Analysis
PDHS	Pakistan Demographic Household Survey
GDP	Gross Domestic Product
DDA	Demand Driven Approach
DMA	Demand Side Management Approach
IRDC	International Development Research Centre
JSDF	Japan Social Development Fund
MOE	Ministry Of Environment
NGO	Non-Government Organizations
FDG	Focus Group Discussion
PBS	Pakistan Bureau Statistics
PSP	Private Sector Participation
MR	Media Role
GHQ	General Head Quarter

CHAPTER 1

INTRODUCTION

1.1. Introduction

Safe drinking water is a basic human need. Casgrove and Rijsberman (2000) compared population growth with water availability by almost three times the population over the last ten decades, with demand for water used for human purposes growing by six times. Because people do not have adequate access to clean drinking water, three million people die each year from waterborne diseases (WHO 2007). According to the world water development (WWD) report (2019) Global water demand is expected to continue increasing at a similar rate until 2050, accounting for an increase of 20 to 30% above the current level of water use, mainly due to rising demand in the industrial and domestic sectors. Demean *et al* (2003) compared developing nations with developed nations and emphasized that developing nations are more impacted by poor sanitation and unhygienic water supply.

Pakistan is a developing country and similar to other developing countries, with water security and safety becoming a threat to Pakistan (Majeed and Piracha, 2011). In such a situation, water is scarce and unable to satisfy the need of people. Pani (2011) has reportedly the groundwater is over-exploited as thousands new wells are installed every year.

In the most populous province (Punjab) of Pakistan, there are no specific policies to govern the use of groundwater and aquifer quality and property rights for groundwater (Government of Punjab 2007).

Water and sanitation are some of the key aspects of sustainable society. Research shows that 80 % of diseases in children in developing countries are caused by polluted water Pani (2011). It has been found that 30% of diseases and 40% of deaths in Pakistan are caused by poor water systems (Haydar *et al*, 2009).

According to PDHS (2018) Diarrhea is the second leading cause of morbidity in the Pakistan, survey shows that 22 percent of deaths in children are because of diarrhea. There are a number of waterborne diseases, including diarrhea. Hepatitis is the second leading disease due only to the use of contaminated water, according to report every 10^{th} Pakistanis effected with hepatitis (Pani, 2011). According to the Ministry of the Environment (2015), this situation imposes a significant economic burden on production. An estimated 112 billion has been wasted due to inadequate water supply.

There are many factors that promote willingness to pay for clean drinking water, according to the World Bank report (1992), many of the water projects that have been initiated in developing countries have failed due to lack of knowledge about the health. Brisco et al, (1990) willingness to pay is not completely depend upon the income it's depend upon the existing water service provided by the government. Sattar and Ahmed (2007), analyzed that willingness to pay in developing is lower than developed one the major cause of this behavior is lack of awareness toward the contamination of water and also waterborne diseases.

According to Zeeshan (2015), Water quality and health of human being has very important and strong connection. Polluted water is the factor which causes infectious diseases which are of significant concern in developing countries where such diseases are increasing rapidly. With going the age of industrialization the chemical aspect of water

quality have become a great cause of concern as toxic chemicals in industrial wastage gives high risk to the heath.

Failure to scheming suitable valuing policy for water facilities in the past has caused in under-investment, poor preservation, sluggish growth in spreading attention, and depletion of water resources. Consequently, approximation of the WTP will be beneficial for policy makers in making well-organized investment choices as well as in scheming rating policies for maintainable organization and establishment of water services that will recover the well-being of the humanity.

1.2. Problem statement

This study examines the willingness to pay of people for clean drinking water. Being a developing country Pakistan has not enough resources to cope up with this environmental issue. Access to clean drinking water is the basic right of every human being.

Dhoke Syedan is the congested area of Rawalpindi. The government should provide everyone safe drinking water. The main problem is that we are less aware with water problems and we have a little access to safe drinking water. Unfortunately in Pakistan there is lack of knowledge about this, a research conducted by USAID in 28 districts indicates that 70% of the selected households said that odorless and colorless water is not safe for drinking, this causes very bad effects as in shape of diseases (Ministry of Environment, 2015). Concern over the growing environmental degradation, pollution and lack of safe drinking water availability in Dhoke Syedan.

Awareness is not only cause to willingness to pay but there are many other factors like awareness about waterborne diseases and also awareness about the existing quality of water. People in this area are not aware about the quality of water.

This study examines the determinants of willingness to pay that encourage the people to get better services by provider and also examine the behavior of people toward this emerging issue and solve the issue by using simple method to collect data and find out the people perception of existing service and how much willing to pay if provide better service by any private organization.

1.3. Objectives of the study

The main objectives of the study is determines the factor that influence people willingness to pay for improve drinking water quality using Structural Equation Model (SEM).

1.4. Motivation of the study

Mustafa *et al,* (2008) conduct a survey in Abbottabad to improve the quality of water. The area chosen to improve the quality of water is the urban area of Rawalpindi. This study is an initiative to address the gap in services provided by the government to people. Ahmed and Sattar (2007) analyzed the willingness to pay in Hyderabad. Parveen *et al.* (2016) estimated willingness to pay in the town of Nowshera. In all studies, a logit model was used to estimate results and a contingent valuation method to collect data from the respondent and to give value non-market goods. In this research, structural equation modeling will be used to calculate influences on variables to check willingness to pay. This method is a mixture of factor analysis and multiple regression analysis and is used to evaluate the dynamic relationship between variables and latent constructs. Latent variables are used in this model of knowledge and perception. There are many approaches used to calculate the results, but the reason to do this work is to interpret the results using a structural equation model and to quantify indirect variables. Latent variables used to illustrate the complex relationship between a numbers of variables and to demonstrate the simple relationship between the variables and the underlying variable.

1.5. Significance of the study

Concern about the increasing environmental degradation, pollution and lack of safe drinking water availability is cause to rise many issues. Increased water quality can be accomplished by increased water supply. Determinants of willingness to pay for improving water supply therefore need to be establish.

It is very difficult for the government to meet the demands of people with limited financial resources to improve water quality. This study could motivate people if the government does not have the financial resources they need to work together on this issue. There will be some variables that will assess the willingness to pay for clean drinking water.

This research will define significant determinants of willingness to pay for better water quality in Dhoke Syedan and support them to focus on specific problems instead of relying on the government.

The study will help the government to understand the problem of people at home, to test the quality of the water if it is not fulfilled, and to increase the quality of the water for future generations.

1.6. Organization of the study

This thesis comprises of total five chapters, here the outline of the discussion in each Chapter are given below as:-

Chapter 1 have discussed introduction, objectives of the study and significance of the Study. In chapter 2 literature review about willingness to pay for safe drinking water will be discuss. In chapter 3 methodological and theoretical framework will discussed. Chapter 4 will discussed the results and discussion. Chapter 5 will discuss about the conclusion and policy recommendation.

CHAPTER 2

LITERATURE REVIEW

Willingness to pay for clean drinking water is one of basic hazard to avoid the health relates issues. Drinking water is basic need of human life. In the literature alot of studies related to water and value the non-market goods by using different method one of them is CVM to check the household willingness to pay. The quality of water which is used by the households for drinking is very important aspect to check this quality is reliable or not. WHO (2013), to improve the quality of water not only improve the public life style it's also impose viable impact on the socio economic development.

Kwak *et al.* (2013), have finalized their work on the tap water quality is Pusan which is the second largest city of Korea and using the variable income, age, gender, HH size to check the willingness to pay . Parveen *et al.* (2016), have originate the study in Peshawar, taking the sample of 150 and check the WTP of people. According to them income and education is highly significant toward WTP.

Otsetswe (2001) studied the constraints for private water link in Kenya that are determinants of WTP. The income and employment are the main determinants of this analysis. Educated people are more willing to pay than less educated people.

Nam *et al.* (2004), done study on the demand of households for improve quality of drinking water in Ho Chi Minh City, Vietnam. The findings of this study households are more willing to pay for improve water quality that is higher than the existing water bills. Gender shows significant results with willingness to pay.

According to Clasen and Haller (2008), it is expensive to provide piped water services to home in rural areas because of their demographic characteristics areas of rural sides are very vast it is difficult to maintain water service. There are a lot of technologies are used to estimate the water relate issues and access to water in rural areas.

Different studies show the different conclusion of same water related issues. In urban areas where the population rate is increasing day by day the water relates issues are also growing at the same level. The government support is very important to cope up with water relate issues. According to Mustafa *et al.* (2008), the current water system is not reliable in Abbottabad and household are also not satisfied with the present supply of water. Usman *et al.* (2017), the result shows that income is highly and positively significant to WTP.

Ahmed and Sattar (2007), conclude that print media plays important role to aware the people. Briand *et al.* (2010), show that people who concern with environmental issues are significantly positive toward WTP. According to Parveen *et al* (2016), more health cost cause more WTP for clean drinking water. Null (2012), young people are more at risk by drinking unsafe water.

Faiza *et al.* (2010), the demand for clean drinking water is higher if income is higher. According to Asim and Lohano(2013) increase the price of water government should subsidize poor's. Alam (2014), Informal water market plays important role in fulfilling the demands of poor household. According to Honglin *et al.* (2010), water pricing is important but to check the willingness to pay of people first observed that it is acceptable or not.

According to Doria *et al* (2009) there are many approaches used in past studies to evaluate determinations of willingness to pay for water quality enhancement, but few studies used the structural equation model to analyze their outcomes.

Kline (2015) used SEM to improve existing water quality information and reveals the methodology that can be used to figure out the relationship between different variables at the same time. Structural equation system used to evaluate the inconsistency between the matrixes of covariance and also to research fitted matrix of covariance defining the relationship between variables based on this model (Hu, 1999).

SEM is a powerful technique in statistical model because it also account error in the model, which is impossible in tradition approach of regression (Kline, 2015). In addition, Kline (2015) explores that the structural equation model also helps researchers to easily identify indirect impacts on the path diagram of variables.

Chenini *et al* (2009) evaluated the value of the groundwater using the structural equation model and investigated that many variables are used simultaneously in SEM to determine the relationship between the independent variables. Doria et al (2009), investigate the water quality using SEM in which show the mixed method to analyzed the quality of water and also identify the risk related to tap drinking water. Shuaibu (2017), estimated variables using structural equation model on self-supply water system in urban areas using AMOS results are interpreted there are three variables(income, education and ownership) that shows the significant relationship with WTP but gender and duration of time not show any significant impact on willingness to pay.

Jonas *et al* (2017), analyzed the understanding of water quality using the structural equation method, explaining the relationship between particular variables and specifying various factors to interpret the system differently and also identifying health risks using the same water quality in different areas of the United States. Hosseini *et al* (2017), analyzed the effects of drought using SEM, this study shows the farmers ' problem when the extra water damages their crop and also highlights the effects using the different variables.

Doria *et al* (2005), analyze the value of tap water using a model of structure equation and clarify people's awareness of water quality and identification of people between past and present tap water systems which cause health-related issues to rise. In addition, describes the problems of the industrial countries which cause damage to the quality of the tap water but are now under control due to heavy efforts.

Literature review shows that almost in all studies CVM is used to estimate the willingness to pay this method values the non-market goods. Being a developing country Pakistan facing a lot of water related issues especially in urban areas where the availability of water is not up to the mark and creating problems for human beings. The problem of safe drinking water not only in developing country to some extent this issue also find in highly developed country.

Not only in developing countries, this issue also finds the issue of safe drinking water to some degree in developed countries. A critical part of the research study, Stevens (2002) use correct methodology choice in the structural equation system. Structural equation Modelling structural equation (SEM) is the multiple used to test the model's reliability.

Every statistical methodology has some characteristics that govern the applicability to a particular problem. To select the most suitable attitude to the data, consider the technique and its characteristics is important. Logit model used traditionally to measure variables, but many other methods are used to calculate the same variables differently. This Study conducted on water related issues using the structural equation method in see the direct impact of variables on willingness to pay.

CHAPTER 3

DATA AND METHODOLOGY

3.1. Introduction

This section provides the detail on data collection and methodological framework. First of all, theoretical framework of willingness to pay for clean drinking water. How much household responds to the environmental problem in their residential area and values non-market goods. Section 3.2 below, explains the theoretical framework using the indirect demand method and examine the status of water services offered to households, as well as the willingness to pay for clean drinking water. In section 3.3, the econometric model is described using the structural equation model. Section 3.4 focuses on route analysis and confirmatory factor analysis. Section 3.5 discusses the indirect effect of the Sobel test on mediators. Section 3.6 explains the size of the sample and the description of the data.

3.2. Theoretical Framework

Deaton (1980) examined that demand functions are not only dependent on income and education, but that there are many other factors involved in this process, including socioeconomic characteristics. Demographic features, the level of education and the occupation. In the cross-section results, clearly analyzed that all consumers pay the same prices so that there is no price discrimination in this system, so conclude that different prices from different consumers are negligible in this process if the region changes then the quality of the water and the position can be reasonable (Sattar 2007).

According to Engel curve, the revenue-consumption curves are distorted when the spending increases, people move to luxury tends and rises, and the basic necessities are decreasing.

Assume that rich households spend more of their budgets on drinking water purification systems than poor households (Sattar 2007). Thurstone 1927 explained the theoretical framework of the process of conditional valuation in which the random utility function was studied. Find the function of household utility subject to budgetary constraints and the indirect role of household utility as follows:

$$V = v\,(p, q, y) \tag{1}$$

p: Price of market commodities

q: Status of tap water services per hour acquired by the household(availability of water)

y: Household income

The price of household transformation in monetary terms is characterized by the Hicksian variable, the countervailing variation C, which satisfies the following:

$$V\,(p, q_o\,, y - C) = V\,(p, q_1\;\; y) \tag{2}$$

As the change in q from q_0 to q_1 is an improvement in tap water infrastructure and raises the household utility rate, C would be optimistic. In this case, C tests the ability of the household to pay (WTP):

$$V\,(p, q_1, y - WTP) = V\,(p, q_0, y) \tag{3}$$

WTP is the maximum amount of money that the household must charge in return for enhancing tap water facilities from q_0 to q_1 . WTP Solving Equation (3) provides the WTP function:

$$WTP = (p, y, q_0, q_1) \quad (4)$$

The above equation indicates that

WTP= depends on the prices of the market commodities p,

Household income= y,

Existing status of tap water services hourly acquired by the household (availability of water) = q_0,

Improved status of tap water services = q_1

After analysis, the willingness to pay for any goods and services also depends on socio-economic characteristics such as age, education, household size, household ownership, sex, perception, In view of the willingness to pay, evaluation of these determinants is accompanied by an econometric model.

$$WTP = (\beta_0 + \beta_1 hh_{size} + \beta_2 hh_{incom} + \beta_3 age + \beta_4 edu + \beta_5 gender + \beta_6 Avail - water + \beta_7 HHown + \beta_8 Perception + \beta_9 Awarenss + U_i)$$

In equation (5), perception and memory are latent unobserved variables and researchers used to refer the effects of these variables to the model. Latent variables usually explain the complex relationship between a numbers of variables and demonstrate the simple relationship between the variables and the underlying variable.

3.3. Econometric model

The structural equation method is an extension leading to a general linear model that allows researchers to analyze a series of regression equations separately. SEM can easily test the traditional model, but has also been accredited to verify the complex model and the complex relationship between variables, e.g. the confirmatory factor analysis (CFA).

3.4. Structural Equation Model CFA, path analysis

According to Bayrn (2009), most researchers of behavioral science want to examine variables that are not directly observable, and then the idea of latent variables or causes helps to explain the terms of unobserved variables.

At the beginning of the development of SEM, starting with Spearman's work (1904, 1927) Spearman (1904) investigated the construction of model building using SEM, the main focus of this theory is on factor system after many researchers have found latent variables in the light of true score theory (Gulliksen 1950).

Path analysis of the structural equation system, primarily developed in (1921, 1960) by Wright, which analyzes the path diagram.Wright (1960) expanded the technique to evaluate the model association that is observable when beginning a non-recursive model (where two variables are motivated to trigger each other and error terms are not correlated) this model has already been explained in the econometric model.

SEM is commonly used in behavioral economics to combine factor analysis with route diagram (Hox, 1999). Hox (1999) identified the confirmatory factor analysis in which the double-headed arrow shows the association between the two arrows of the factor

indicating the loading of the factor that cannot presume that latent factors are entirely highlighting practical variations, because each measurement parameter is correlated with an error term that is not measurable. With this definition, the route diagram of willingness to pay for improvement of water quality along determinants is shown in Figure 3.1.2.

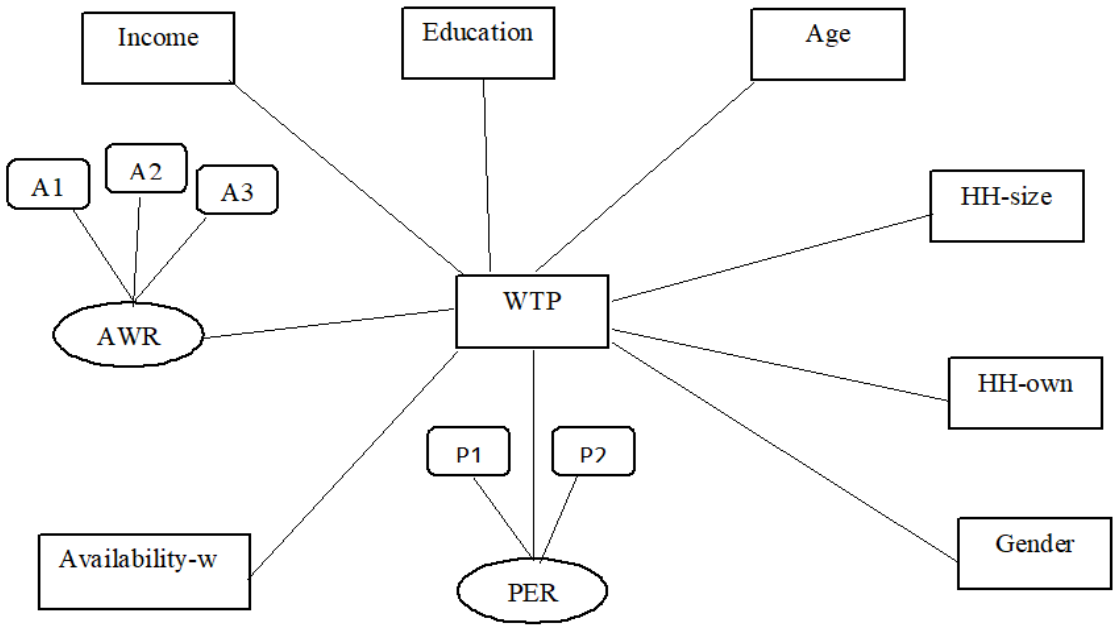

Figure 3.1.2 Structural equation model path diagram

In path diagram income, age, education, HH size, OwnHH, gender availability of water, are considered observed variables through these variables show direct impact on willingness to pay. There are two variables that are unobserved including awareness and perception. In awareness two questions will used to show the results A1 and A2. In perception same two questions to interpret results.

A1 focuses primarily on group discussion which raises awareness of the impact of water-related issues on safety, and A2 examined poor water quality is not an environmental degradation problem. P1 underlying people's perception of water-related issues in which

people give their perception of the initiate water quality improvement program in the city. In addition, the expectation that the new program will provide better water quality through the involvement of the private sector.

In this model the mediating variables where education put impact on awareness that is direct to willingness to pay for clean drinking water. Mediation indirect effect hypotheses suggest the means through an interpreter variable education (X) applies its outcome on variable WTP (Y).

In modest Mediation model, containing only one proposed mediator, X is hypothetically put influence Y through the intervening variable awareness (A) (Hayes, 2009; MacKinnon *et al*., 2007) Willingness to pay for clean drinking water for instance, education (X) might be hypothesized to put its effect on Willingness to pay (Y) through the intervening variable awareness (A). In terms of this suggested progressive organization of variables, education is assumed to influence on WTP, which, in turn, affects awareness Perera (2011). Partial mediation is described the effect of X on Y remains significant after partial zing out the impact of the intervening variable (A) (Baron and Kenny, 1986)

This is the hypothesized relationship between the variable where one variable affects other in response it affect the third variable (education → awareness → willingness to pay). In binary logistic model the direct relationship between the variables which called the manifest in which direct impact of variables. The latent variables are those variables which show the indirect relationship also called it factor analysis. Direct relationship shows in the equation below

$$WTP = (\beta_0 + \beta_1 hh_{size} + \beta_2 hh_{incom} + \beta_3 age + \beta_4 edu + \beta_5 gender + \beta_6 Availwater + \beta_7 HHown + \beta_8 Perception + \beta_9 Awarenss + \text{Ui}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Above equation indicates willingness to pay is an age, income, education based variables and all other variables are determinants of willingness to pay. Describe the latent variables in order to see the results.

As awareness is the unobserved variable which is observed by two variables including focus group discussion and environmental concerns.

$$AW = \beta_{10} + \beta_{11} A1 + \beta_{12} A2 + \beta_{13} A3 + U \qquad (2)$$

A1= *f* (Awareness) , A2= *f* (Awareness)

A3 = *f* (awareness)

A1=Focus group discussion and community discussion bring more awareness regarding the Effect of water related issues on health

A2 = Poor water quality is not problem of environmental degradation.

A3= Does media plays important role to aware the people?

$$PR = \beta_{20} + \beta_{21} P1 + \beta_{22} P2 + U \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

P1= *f* (perception) , P2= *f* (perception)

P1= Do you consider that safe drinking water program initiate in your area.

P2= Filtration plant should be provided to people free to people by PSP.

Households with very positive environmental and water conservation attitudes consumed significantly less water in total and this construct mainly affect the willingness to pay for clean drinking water. It's important to change public perception on the water quality that will be beneficial to relevant the government agencies, regulators, planners, utility providers and other relevant parties in private sector, for the future development.

In path analysis once education is directly related to willingness to pay and indirect related to willingness to pay via awareness.

$$Edu = \beta_{21} + \beta_{22} Awareness + U \quad (4)$$

Wang *et al* (2018) conduct a survey in china where analyzed the public awareness of drinking water safely. Results shows that people who are more educated are more aware about the clean drinking water as compare to less educated people.

3.5. Sobel Test

Sobel test is proposed by Sobel in 1982 in which explained the relationship between dependent and independent variables that is postulated to an indirect effect due to the effect of third variable. In this model X (education) is the independent variables and Y (WTP) is dependent variable A (awareness) is the mediator. So the independent variable X is related to mediator and also directly related to dependent variable, so call it simple mediation. It shows that how education put causal effect on awareness holding all other variables constant and also indirect effect on variable Y.

Dependent variable Y is the willing to pay and the independent variable X is the education of the people. Mediator variable is the awareness. The main objective of this test to observe the relationship between willingness to pay and education and its impact on

awareness. There is a positive relationship between education, awareness and willingness to pay.

Here education → awareness, awareness → willingness to pay, education → awareness → WTP. So results show that when the people are educated more willing to pay as compared to uneducated people. After that awareness cause more willing to pay, these three variables are partially mediators. So find results through this equation:

$$Z\text{-Value} = a*b/\text{S-Deviation}\ (b^2*s_a^2 + a^2*s_b^2)$$

3.6. Data description and sample size

This study is based on the primary data, collected from urban area of Rawalpindi (Dhoke Syedan). The study was based on primary data, which is collected from households. The main objective of this study is to estimate the people willing to pay if provided them clean drinking water and also find out the determinants that cause willing to pay. Dhoke Syedan is near to GHQ (General Head Quarters) of military forces. After some data collection knows the responses of people which are very clear. People in this area are suffer with shortage of water and suffer from unhealthy water quality. Some people are not clearly knowing the side effects of this water. But after surveying mostly people clarify that they use ground water for drinking another people use mineral water which is very expensive to buy.

According to dawn news (2018) the many areas of Rawalpindi are badly face the shortage of water. According to the residence of Dhoke Syedan the availability of water tanks is not appreciable because in some area water tanks are easily available and in other areas water tanks are expensive and not easy to get on time.

The random sampling used to collect the data. The sample size which is selected for the survey is direct method by using Pakistan Bureau Statistics (PBS). The population size of Rawalpindi in 1998 is 1,927,612 and in 2017 is 3,258,547. Simple random sampling uses the 225 sample size by using sample calculator holding 95% confidence interval. Questionnaire is available in annex.

CHAPTER 4

RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the descriptive analysis from the data and also present trend of data. Descriptive statistics shows the behavior of people toward any problem; here highlight the water related problems. Section 4.2 explains the qualitative assessment of public willingness to pay in which see the maximum and minimum value which taken from the survey. Section 4.3 explains the quantitative assessment of public willingness to pay via SEM. Section 4.4 explains the model fit indicators. Section 4.5 explains the Sobel test results.

4.2. Qualitative assessment of public willingness to pay

This section briefly explains the descriptive statistics of variables which used in this study are age, education, income, household ownership, household size and gender. The whole sample size is 225 household. The descriptive statistics are provided in table 4.1.

The age of respondents, minimum age of respondent are 19 and the maximum age level is 65. There are 49% of male respondent and 51 % of female respondent. The study level of people described in a group form 16% people are done minimum education and the 8% of people who are completed higher education. There are 62% people in this area who have their own houses and 37% people who do not have their own house. The minimum household size is 3 and the maximum household size is 9. The highest income in this area is 60000 and lowest is 20000. There is open handed question to check the willingness to

pay of people. Also make bids but we take willingness to pay in continuous form according to the requirement of structural equation modeling.

Table 4.1: Summary Descriptive for the Variables

Variable Name	Distribution	Total (Years)
Age	Minimum	19
	Maximum	65
Gender	Male	109
	Female	116
Education in a HH	Matric	38
	Intermediate	79
	Graduate	620
	Masters	44
	MPhil	02
HH ownership	Own house	140
	Rented house	85
HH size	Minimum	03
	Maximum	09
Income	Minimum	20000PKR
	Maximum	60000PKR
WTP	Minimum	0PKR
	Average	250PKR
	Maximum	1000PKR

The questionnaire is organized conferring to the Likert Scale in order to quantify the strength of the respondent's view on the household perception on clean drinking water that matters. The respondents are provided with numerous declaration choices such as strongly disagree, disagree, neutral, agree, and strongly agree. By likert's method, behavior of person is restrained by joining their responses through all items. Then in order to access the general attitude of respondents to clean drinking water services. Answers to questions will be shown on a 0 to 4 point Likert Scale. Does media play important role to aware the people? Results shows that there are 49% people who are agree and only 5% people who are natural.

In Table 4.2, the results for Does focus group discussion (FGD) play important role to aware the people? show that there is high percentage of respondents 31% who are strongly agree focus group discussion has important role to aware people.

Results for Poor water quality is not problem of environmental degradation? People who are strongly agree to this are comprised of 33%. The results for does Filtration plant should be provided to people free to people by PSP? There are 36 percent respondents who are agree which is high percentage. People are agree to this there should be provision of filtration plants by PSP (private sector participation). If there is an organized clean drinking water program in my area? The respondent shows their reviews that there are 39 percent respondents who are strongly agree that there should be organized a program in area.

Table 4.2: Respondents Awareness and Perception on clean drinking water

Item		Frequency analysis			
		(D)	**(N)**	**(SA)**	**(A)**
		1	**2**	**3**	**4**
1. Focus group discussion and community discussion bring more awareness regarding the effect of water related issues.	**NR**	45	53	56	71
	PR	**20%**	**23%**	**24%**	**31%**
2. Does media play important role to aware the people?	**NR**	0	12	105	108
	PR	**0%**	**5%**	**46%**	**49%**
3. Poor water quality is not problem of environmental degradation.	**NR**	21	62	66	76
	PR	**9%**	**27%**	**23%**	**33%**
4. Filtration plant should be provided to people free to people by PSP	**NR**	0	72	81	72
	PR	**0%**	**32%**	**36%**	**32%**
5. There is an organized clean drinking water program in my area	**NR**	4	58	74	89
	PR	**1%**	**25%**	**32%**	**39%**

(NR): Number of Respondents (PR): Percentage of Respondents (D): Disagree (N): Neutral

(A): Agree (SA): Strongly Agree,

4.3. Quantitative assessment of public willingness to pay

This section briefly explains the results of Structural equation model. The results show that some variables are highly significant towards willingness to pay while on the other hand results are totally insignificant.

Table 4.3 briefly explains the results of variables. Income is significant, as income increases willingness to pay of respondent's increases. If income is increases by one standardize unit willingness to pay increases by 0.03 standardize unit holding other variables constant. The similar results are found in Mustafa *et al* (2007) conduct a survey in district Abbottabad. Education put the statistically significant impact on variables so education is highly significant toward willingness to pay results show that if standardize unit of education increase by one standardize unit willingness to pay increase by 0.033 standardized unit. Similar results are found in Ahmed (2007) conduct survey in Hyderabad.

Household ownership statistically significant result shows that the people who have their own houses are more willing to pay as compare to those people who do not have their own house. This is because they are not permanent residential in that area. It might affect their WTP.

Age is not significant. As age will increase adults exhibit extra concern about their health problems instead to improve water quality so age put no significant impact on willingness to pay.

Gender is insignificant results shows male and females are similar concern show toward this issue.

Household size is insignificant towards willing to pay result suggests respondents with a large family size are less willingness to pay for improve water quality. The large family size has more concerned towards basic needs.

Availability of water is statistically negatively significant with willingness to pay. If availability of water decreases by one standardize unit willing to increase by 0.020 standardize unit holding other variables constant. Perception is significant toward willing to pay. Awareness is significantly related to willingness to pay if standardized unit of awareness increase by one standardize unit willingness to pay increase by 0.550 standardize unit holding all other variables constant. When awareness increases, people will show more concerns about the healthy water quality

The standardized unit of perception increases by one standardize unit the willing to pay Increase by 0.0321 standardize units holding other variables constant.

Education → awareness → WTP show the mediating Full mediation is when the complete relationship between the independent and dependent variables is through the mediator variable. Results show that if standardized education and awareness increase by one standardize unit willingness to pay increase by 0.061 units holding other variables constant.

Table 4.3 structural Equation Model result for clean drinking water

Dhoke Syedan

Loadings of latent variables		
Awareness	Coefficient	P-value
A1	0.994	0.001
A2	0.996	0.001
A3	0.993	0.001
Perception		
P1	0.996	0.001
P2	0.997	0.001

Direct impact of variables			
Variables	Coefficient	s-deviation	P-Value
Income → WTP	0.320	0.052	0.001
Age→WTP	-0.003	0.098	0.090
Edu→ WTP	0.322	0.055	0.003
HH-own→WTP	0.135	0.037	0.004
HH-size→WTP	0.001	0.050	0.988
Gender→WTP	-0.025	0.037	0.490
Availability-W→WTP	-0.020	0.042	0.034
Perception→WTP	0.321	0.038	0.005

Indirect impact of variables			
Edu→awareness	0.079	0.035	0.004
Awareness→WTP	0.550	0.040	0.001
Edu→awareness→WTP	0.061	0.057	0.002

Edu (education), HH own (household ownership)

4.4. Model Fit

Normed fit the first measure proposed in structural equation model by bentler and Bonnet (1980). The value of NFI closer to one but if it's more than 0.9 then it is acceptable NFI>0.90. Lohmoller (1989) provide detail information on the NFI and about model fit indicators. This study find out the model fit through NFI. The NFI of this model is 0.94 which is greater than 0.90 and less than one (0.94>0.90<1). So the model show significant indication.

4.5. Sobel Test Result

T-Statistics	Std-error	P-value
2.22	0.019	0.02

The Sobel test result shows that p-value below the 0.05 the mediation effects between educations; awareness and willingness to pay are significant.

CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATION

5.1. Introduction

This chapter generally concentration on the main conclusions that are gained taken in to account WTP. The dependent variable which is used to understand the outcomes are income, education, household size, age, gender, household ownership awareness and perception. A model used to show different results. Structural equation model used to check the significance and insignificance of variables.

5.2. Conclusion

Structural equation model used to estimates the results of independent variables. Income is significant result shows that when income increases willingness to pay also increases. People move the better quality of services provided by any private organization.

Education is significant people who are more educated are more willing to pay as compare to those people who are illiterate. Ownership of household is significant. According to the survey people who have their own houses are more concern about drinking water quality because they are more concern about the health of children's. Awareness is the significant. People who are aware from the waterborne diseases and health issue are ready to willingness to pay. In this model the mediating variables where education put impact on awareness and awareness is direct to willingness to pay.

With the help of structural equation modelling indirect impact on the variables. Awareness and perception are the latent variables through these variables direct and indirect results of variables.

5.3. Policy Recommendation

The area, which is selected for research, is the urban area of Rawalpindi (Dhoke Syedan).Our study reveals that there is positive relationship between income education with willingness to pay so these observations show that, if the study area more develop or less develop education and income can put significant impact on willingness to pay. So need to educate the people by giving them awareness about the consequences of contaminated water. Awareness may bring more willingness to pay.

If they become aware of the use of unsafe drinking water through a focus group conversation, they will be able to minimize expenditure on diseases caused by the use of unsafe water.

Additionally, perception about the clean drinking water is significant toward willingness to pay. Government should also play their role and provide funds to private organization. For this purpose, government should allocate the budget for drinking water resources

Existing water services are not reliable for the people of Dhoke Syedan. Therefore, it is also responsibility of people to play important role through community participation. People needs focus group discussion to sort out their problems.

According to the results, awareness is significant. People who are aware are more willing to pay. Government should initiate such kind of programs in which people come to know the importance of safe drinking water.

REFERENCES

Communities. Dhaka, Bangladesh: World Bank Water and Sanitation Program South Asia .Akram, A., & Olmstead,the Value of Household Water Service Quality in Lahore, Pakistan. Environmental and Resource Economics, 49(2), 173-198.

Arouna, A., & Dabbert, S. (2012). Estimating Rural Households' Willingness to Pay forWater Supply Improvements: A Benin Case Study Using a Semi-Nonparametric Bivariate Probit Approach. Water International, 37(3), 293-304.

Behailu, S., Kume, A., & Desalegn, B. (2012). Household is Willingness to Pay for Improved Water Service: A Case Study in Shebedino District, Southern Ethiopia Water and Environment Journal, vol 26(3), pp 429-434.

Bagherzadeh, A. (2012). Determining tourism value of National Park of Urmia Lake in Iran by family production function. UTMS Journal of Economics vol 3 (2): pp 119–127.

Bateman, I. J., Langford, I. H., Jones, A. P. & Kerr, G. N. (2001). Bound and path effects in double and triple bounded dichotomous choice contingent valuation. Resource and Energy Economics, vol 23 (3): pp 191-213.

Fujita, Y., Fujii, A., Furukawa, S., & Ogawa, T. (2005). Estimation of Willingness-toPay (WTP) for Water and Sanitation Services through Contingent Valuation Method (CVM) ─ A Case Study in Iquitos City, the Republic of Peru─. JBICI review, 59-87.

Genius, M., Hatzaki, E., Kouromichelaki, E., Kouvakis, G., Nikiforaki, S., & Tsagarakis, K. (2008). Evaluating consumers' willingness to pay for improved potable water quality and quantity. Water Resources Management, vol 22(12), pp 1825-1834

Government of Punjab. (2007). Punjab urban water and sanitation system. Hanemann, W. M. (1989). Welfare evaluations in contingent valuation experiments with discrete response data: reply. American Journal of Agricultural Economics, vol 71 (4):pp 1057-1061

Hensher, D., Shore, N., & Train, K. (2005). Households' Willingness to Pay for Water Service Attributes. Environmental and Resource Economics,vol 32(4),pp 509-531

Haq, M., Mustafa, U., & Ahmad, I. (2007). Household's Willingness to Pay for Safe Drinking Water:
A Case Study of Abbottabad District. The Pakistan Development Review (46: 4 Part II (Winter 2007)), 1137-1153.

Haydar, S., Arshad, M., & Aziz, J. (2009). Evaluation of Drinking Water Quality in Urban Areas of Pakistan: A Case Study of Southern Lahore. Pakistan Journal of Engineering and Applied Sciences vol 5, pp 16-23

Imandoust, S., & Gadam, S. (2007). Are People Willing to Pay for River Water Quality, Contingent Valuation? International Journal of Environmental Science and Technology, vol 4(3), pp 401-408.

Khan, F. J., & Javed, Y. (2007). Delivering Access to Safe Drinking Water and Adequate Sanitation in Pakistan.. [Working Paper]. Pakistan Instiute of Development Economics, Working Paper, 2007-30.

Majumdar, C., & Gupta, G. (2009). Willingness to Pay and Municipal Water Pricing in Transition: A Case Study. Journal of Integrative Environmental Sciences, vol 6(4), pp 247-260.

Mbata, J. N. (2006). Estimating Household Willingness to Pay for Water Services in a Rural Economy: The Case of Kanye in Southern Botswana. Development Southern Africa, vol 23(1), pp 29-43.

National Institute of Urban Affairs. (2005). Status of Water Supply, Sanitation and Solid Waste Management in Urban Areas (pp. 78): Central Public Health and Environmental Engineering Organization (CPHEEO)

Olajuyigbe, A., & Fasakin, J. (2010). Citizens' Willingness to Pay for Improved Sustainable Water Supply in a Medium-Sized City in South Western Nigeria. Current Research Journal of Social Sciences, vol 2(2),pp 41-50.

Roy, J., Chattopadhyay, S., Mukherjee, S., Kanjilal, M., Samajpati, S., & Roy, S. (2004). An Economic Analysis of Demand for Water Quality: Case of Kolkata. Economic and Political Weekly, vol 39(2),pp 186-192

Sattar, A., Ahmad, E., & Pant, K. P. (2007). Willingness to Pay for the Quality of Drinking Water. The Pakistan Development Review, vol 46(4), pp767-777

Zhang, W. (2011). Measuring the Value of Water Quality Improvements in Lake Tai, China. Journal of Zhejiang University Science A (Applied Physics & Engineering),vol 12(9), pp 710-719

Henser, D., N. Shore; and K. Train (2005). Households' Willingness to Pay for Water Service Attribute, Environmental and Resource Economics,vol 32 (4),pp 509531.

Jordan, J.L., and A.H. Elnagheeb (1993). Willingness to Pay for Improvements in Drinking Water Quality, Water Resource and Reserve., vol 29 (2), pp 237-245

Sattar, A. and E. Ahmad (2007). Willingness to Pay for the Quality of Drinking Water, The Pakistan Development Revie, 46(4) Part II (winter), 767-777.

Um, Mi-Jung, Seung-Jun Kwak and Tai-Yoo Kim (2002). Estimating Willingness to Pay for Improved Drinking Water Quality Using Averting Behavior Method with Perception Measure, Environmental and Resource Economics, 21(3), 285-300

Akter, S. (2008). Determinants of Willingness to Pay for Arsenic Safe DrinkingWater: a Case Study in Bangladesh, Asian Journal of Water, Environment and Pollution, 5 (3), 85-91.

Abdalla, C. W., B. A. Roach, and D. J. Epp (1992) Valuing Environmental Quality Changes Using Averting Expenditures: An Application to the Ground— Water Contamination. Land Economics vol 68: pp 163–69.

Abrahams, N. A, Bryan J. Hubbell, and Jeffery L. Jordan (2000) Joint Production and Averting Expenditure Measures of Willingness to Pay: Do Water Expenditures Really Measure Avoidance Costs? American Journal of Agricultural Economics 82: pp 427–37.

Altaf, M. A., Haroon Jamal, and Dale Whittington (1992) Willingness to pay for Water in Rural Punjab, Pakistan. UNDP–World Bank, Water and Sanitation Programme. Washington, DC, World Bank. (Water and Sanitation Report No. 4.)

Bergstrom, John C., Kevin J. Boyle, Charles A. Job, and Mary Jo Kealy (1996) Assessing the Economic Benefits of Groundwater for Environmental Policy Decisions. Water Resources Bulletin 32, 279–291.

Bresnahan, Brain, Mark Dickie, and Shelby Gerking (1997) Averting Behaviour and Urban Air Pollution. Land Economics 73(3), 340–357.

Canter, L.W., Nelson, D.I. and Everett, J.W. (1992). Public perception of waterquality risks - influencing factors and enhancement opportunities. J. Environ. Systems, 22, 163–187.

Comrie, D., Evans, S., Gale, R. and Kitney, P. (2002). Taste and odour in drinking water: perception versus reality vol 29(3), pp 20–26.

Griffin, R.J. and Dunwoody, S. (2000). The relation of communication to risk judgment and preventive behaviour related to lead in tap water. Health Communication, 12(1), 81–107.

Jardine, C.G., Gibson, N. and Hrudey, S.E. (1999). Detection of odour and health risk perception of drinking water. Water, Science andTechnology. 40(6), 91–98.

Malt, B.C. (1994). Water is not H2O. Cognitive. Psychology. 27, 41–70.

Muthe ´n, B. and Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of nonnormal Likert variables. British journal of Mathematics. Statistics. Psychology.Vol 38, pp 171–189.

O'Donnell, M., Platt, C. and Aston, R. (2000). Effect of a boil water notice on behaviour in the management of a water contamination incident. Communication disese and Public Health care vol 3, pp 56–59.

The performance of ML, GLS and WLS estimation in structural equation modeling under conditions of misspecification and nonmorality. Structural Equation Model, vol 7, pp 557–595.

Alwin D. F., Hauser R. M. (1975), the Decomposition of Effects in Path Analysis. American Sociological Review. Vol 40, PP 37–47.

Baron R. M., Kenny D. A. (1986), the moderator-mediator distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology vol 51, pp 1173–1182.

Bollen K. A. (1987), Total, direct and indirect effects in structural equation models. Sociological Methodology vol 17, pp 37-69.

Brown R. L. (1997), Assessing specific mediational effects in complex theoretical models. Structural Equation Modeling vol 4,pp 142-156.

Edwards J. R., Lambert L.S. (2007), Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. Psychological Methods vol 12, pp 1-22.

Holmbeck G. N. (1997), toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. Journal of Consulting and Clinical Psychology vol 65, pp 599-610.

Judd C. M., Kenny D. A. (1981), Process Analysis: Estimating mediation in treatment evaluations. Evaluation Review vol 5(5), pp 602–619.

MacKinnon D. P., Krull J. L., Lockwood C. M. (2000), Equivalence of the mediation, confounding and suppression effect. Prevention Science vol 1(4), pp 173181.

MacKinnon D. P., Lockwood C. M., Hoffman J. M., West S. G., Sheets V. (2002), a comparison of methods to test mediation and other intervening variable effects. Psychological Methods. Vol 7(1), pp 83-104.

ANNEX

Survey Questionnaire

SECTION I. Household Details

1. **Name of the respondent:**

……

2. **Are you the head of the household**? Yes/No
3. **Name of the head of the house hold:**

…….

4. **Total members of the Household** ……; Male……..; Female…….... Children

   (6-14)…… Kids (1- 5 years).....; Infants (<1 year).....

5. **Education of the HH head……** : Highest education among the members of the HH……..

1. Illiterate; 1. Primary; 2. Middle; 3. Matric; 4. FA/FSc; 5. BA/BSc/BCS; 6. MA/MSc; 7. Above

6. **What is the age of respondent……..**
7. **Gender…….**
8. **Total number of HH who are employed……..**
9. **Employment status of Head of Household Head**

1 Unemployed 2. Street Vendor/Small Informal Business

3 Government Employee 4. Own Business

5 Private Employee 6. Other

10. **Average Monthly Household Income**

1…

11. **Do you think that media has raised your awareness about water quality and water borne diseases.**

Yes 1 No 0 *(if yes cont. to Q.11)*

12. **What type of mass media component was more effective in generating your awareness?**

a. Radio 2. Television 3. Newspaper 4. Social media

II. Demographic characteristics

12. What type of house they lived in?

1. Paved 2. Semi- paved

13. What is source of energy?

1. Coal burning 2. Natural gas 3. Wood fire

14. Do you have electricity?

1. Yes 2. No

15. House ownership

1. Own house 2. Rented

Section III: Current Water Supply Usage

16. Do you use a water line?

1. Yes 2. No

17. What is your household's main source of Drinking Water?

1. Piped water from RWSB line
2. Water Tankers
3. Shared Public tap in neighborhood
4. Boring Well
5. Other (Please Specify):

18. Do you use any other sources of water for drinking water?

1. Piped water from RWSB line
2. Water Tankers
3. Shared Public tap in neighborhood
4. Boring Well
5. Other (Please Specify):

If respondent answered RWSB, go to Q 23.

19. What is your average monthly water bill?

_____

20. How many hours of water supply do you get weekly (Availability of water)? (Please enter a number)

_____

Section IIII: WTP

Are you willing to pay?

1. Yes
0. No **If Yes,**

21. How much you willing to pay **Rs…?**

Respondents' opinion and perception on water supply system

Item	Frequency Analyse				
	(SD)	(D)	(N)	(A)	SA)
	0	1	2	3	4
1. There is an organized clean drinking water program in my area					
2. Filtration plant should be provided to people free to people by PSP					
3. Focus group discussion and community discussion bring more awareness regarding the effect of water related issues.					
4. Poor water quality is not problem of environmental degradation.					
5. Does media play important role to aware the people?					

ANNEX II

Author/ years	Title	Variables	Methodology	Results	Conclusion
Usman Mustafa *et al* march, 2008	**Household's willingness to pay for safe drinking water: A case study of Abbottabad district**	**U= u(z,q) Z= water quality Q= composite goods Exp function E(p,q,u) P= price U= utility**	**Use CVM method to estimate the non-market goods.**	**The people who live in urban areas more WTP than rural areas the people who have their own water sources (Well, boring) not WTP.**	**The current water system is not reliable in Abbottabad and HH are also not satisfied with the present supply of water.**
Faraz Usmani *Et al* January, 4th 2017	**What are households willing to pay for improved water access? Results from a meta-analysis**	**WTP Age Income Water connection Private WC Urban area HH size Gender**	**Use meta-regression model to estimate the results of variables.**	**The result shows that income is highly and positively significant to WTP.**	**We can conclude that HH's are Sensitive to income.**
Eatzaz Ahmed And Abdul Sattar (Winter) 2007	**Willingness to Pay for the Quality of Drinking Water**	**WTP Education Gender Occupation HH wealth HH size**	**Logit probit model is used to estimate the results**	**The results shows that female are highly WTP than male.**	**We conclude that print media plays important role to aware the people.**
Anne Briand *Et al* 5th July, 2010	**What are Households Willing to Pay for Better Tap Water Quality? A Cross-Country Valuation Study**	**WTP HH characteristics Education Income Age Gender Composition**	**Tobit model used to estimate the pooled data cross countries.**	**The results show that people who concern with env issue are significantly positive.**	**Italy, Korea and Mexico these countries are dissatisfied with the supply of water.**
Shazia Parveen *Et al* 2016	**Estimating Willingness to Pay for Drinking Water Quality in Nowshera Pakistan: A Domestic Study for Public Health**	**WTP Impact on health Education Income Gender Hh size Filter cost Awareness**	**CVM method and OLS used to estimate the results.**	**The results shows more health cost cause more WTP for clean drinking water.**	**Education is very important to aware the people and it's positively related to WTP.**
Moffat B. *et al* 2008	**Household willingness to pay for improve water quality and reliability of supply in CHOBE WARD, MAUN**	**WTP Income Age gender Water quality Health risks Education**	**CVM method used to estimate the results.**	**The results show that the age affects more WTP to water quality.**	**Largest families are not WTP for water quality.**

Robert J. Johnston and Paul J. Thomassin February, 2010	**Willingness to Pay for Water Quality Improvements in the United States and Canada: Considering Possibilities for International Meta-Analysis and Benefit Transfer**	**WTP Age Protest bid Income Gender Water quality**	**Meta-analysis and benefit transfer use to estimate the results**	**Results show that Canadian WTP is less than U.S WTP.**	**Difference between the two country undefined current analysis is not satisfactory.**
Céline Nauges 23rd February, 2012	**The willingness to pay for access to piped water: a hedonic analysis of house prices in Southwest Sri Lanka**	**WTP HH size Market value structural char Neighbor char Access to water source.**	**Log- linear model use to estimate the results. Simple OLS model also used.**	**Result shows that 5 to 7% households are WTP from their monthly expenditure**	**Households that network is out of range are not WTP than those who are with in range.**
Faiza Iqbal *et al* 2010	**Estimating willingness to pay for improvements in drinking water quality: evidence from Peshawar, Northern Pakistan**	**WTP Education Hh size Income Awareness water borne diseases**	**CVM method used to elicit WTP results.**	**Results shows that all household get water from piped and use boring water for drinking.**	**The demand of safe drinking water higher if income is higher.**
Sidrat Asim and Heman D. Lohano L. VenkatachAlam 11th June, 2014	**Households' Willingness to Pay for Improved Tap Water Services in Karachi, Pakistan Informal water markets and willingness to pay for water: a case study of the urban poor in Chennai City, India**	**Max utility V= (p, q, y) P= price Q= status of tap water Y= household income WTP Sources of water Number of households Income Household expenditure.**	**CVM method to estimate average WTP and Logit probit used to estimate the results. CVM method used Logit model used to estimate the results.**	**Result shows demand for any commodity depends upon income Results show that 52% reported the timing of water supply which is inconvenient.**	**Study shows if increase the price of water government should subsidize poor's. Informal water market play important role in fulfilling poor household.**
Clair Null 2012	**Willingness to pay for cleaner water in less developed countries: systematic review of experimental evidence**	**WTP Water quality Price Population Availability of water**	**CVM method use to collect data and Logit probit use to estimate the results**	**Result shows that price is directly affecting the consumer.**	**Young people are more at risk by drinking unsafe water.**
So-Yoon Kwak 25th September, 2013	**Measuring the Willingness to Pay for Tap Water Quality Improvements: Results of a Contingent Valuation Survey in Pusan**	**WTP Gender Age Education Income**	**Logit probit method used to estimate the results.**	**Results show that income is highly significant to WTP.**	**In Korea supply of water is at low price because local government operated all the system.**

Honglin LI *Et al* 2010	**Water pricing with household surveys: A study of acceptability and willingness to pay in Chongqing, China**	**WTP Income current water supply Age Education**	**Linear regression model used to estimate the results**	**Results show that high water pricing low the demand of water.**	**As a conclusion we can say that water pricing is important but see it is acceptable or not**
William F. Va squeza *Et al* 2009	**Willingness to pay for safe drinking water: Evidence from Parral, Mexico**	**WTP Age Protest bid Income Gender Water quality**	**Logit probit model used to estimate the results.**	**The results show that education is significant to WTP.**	**Current water system is quite good and better than before.**
Zelalem Lema Moti and Fekadu Beyene November, 2012	**Willingness to Pay for Improved Rural Water Supply in Goro-Gutu District of Eastern Ethiopia: An Application of Contingent Valuation**	**WTP Income current water supply Age Education**	**Logit probit model use to estimate the results.**	**The results show that water supply is the biggest issue and closely related to education.**	**We can conclude that need more improvement in water system.**
Shimelis Kebede And Lamessa Tariku December,2016	**Households' Willingness to Pay for Improved Water Supply: Application of the Contingent Valuation Method; Evidence from Jigjiga Town, Ethiopia**	**utility function for water U= U(W, Y, X) W= Water service Yi= income Xi= individual characteristics income of the Hh, Hh size,**	**CVM method to estimate the WTP.**	**Result shows that age is negatively related to WTP. Gender results are totally insignificant.**	**Analysis shows that existing water tariff rate is very high**
Hina Aslam *et al* 14th April, 2018	**Willingness to Pay for Improved Water Services in Mining Regions of Developing Economies: Case Study of a Coal Mining Project in Thar Coalfield, Pakistan**	**WTP Income current water supply Age Education**	**CVM method to estimate the WTP. Multiple linear regression models.**	**Results show that education is one of the basic which is positively related to WTP.**	**As a conclusion we can say that awareness among the people is really matters.**
Kamshat Tussupova *Et al* 19th June, 2015	**Investigation willingness to pay to improve water supply service: application of contingent valuation method**	**WTP Income current water supply Age Education**	**CVM method use to estimate the results.**	**Results show that more than 90% people are WTP for clean water supply.**	**We can say that price is very important aspect to understand the consumer WTP.**