Pre-valuation of Deposit Refund Scheme for proper disposal of plastic bottles: A case study of Islamabad

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CERTIFICATE

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Abstract

This study is to assess the possibility of implementing deposit refund schemes for the proper disposal of plastic bottles in Islamabad, Pakistan. As we know that Pakistan is a developing country and the formal sector of waste management is not involved in the recycling activities. And, most of the plastic bottles are incinerated or dumped to the landfills outside main cities. So, to facilitate the recycling of these bottles, the proposed integration of waste scavengers/pickers in the informal waste collection with the deposit refund schemes can pay dividends on both environmental front and income generation for the waste pickers. The information regarding the consumers socio-economic, their awareness regarding the harmful impacts of plastic bottles, their use and disposal behavior and their willingness to pay/accept an amount of refundable money for plastic bottles, is collected through well-structured questionnaire in the major residential area of Islamabad. The information from waste pickers of their average income from plastic bottles and to whom they usually sell these bottles, is collected through field surveys and face-to-face interview. In order to explore the relation between consumers willingness to accept/pay, qualitative regression model is employed. The empirical results of this study shows that most of the consumers are well aware of the negative impacts of the plastic bottles and is willing to accept/pay an amount of money: Rs. 4.5 for half liter and Rs. 6.5 for one liter bottles, Similarly, they are willing to pay Rs. 3 for half liter and Rs. 6 for one liter bottles. Which when treated in relation with waste pickers income from per kg (Kilogram) plastic bottles amounts to Rs. 104 instead of average Rs. 30 per kg. Hence, the government need to intervene by devising a framework for the integration of waste pickers into the formal waste collection and implement the policy of deposit refund schemes for the proper disposal of plastic bottles through a chain of plastic bottle manufactures and retailers.

Keywords: Deposit refund scheme, recycling, waste scavengers, PET plastic bottles, willingness to pay/accept.

Chapter-1

1. Introduction

In large metropolitan areas of developing countries, the solid waste issue became a challenging task that is responsible for rapid deterioration of the environmental quality (Moh et al., 2014). Disposal or discarding of solid waste has remained a problem from the start of human history. However, with the increase in awareness about environmental impacts of these growing waste stream in quantity and their poor management has gain more significance over the past years (Masood et al., 2013). Scheinberg et al. (2010) estimated that globally, the generation of solid waste by 2025 will be 2.4 to 5.9 billions tonnes annually. It has been estimated that currently every minute one million plastic bottles are bought around the world and it has been predicted that by 2021 this consumption would increase up to 20 percent (Laville et al., 2017).

Developing countries in Asia have limited infrastructure and facilities for collection and treatment of the MSW (Municipal Solid Waste), hence these wastes are collected without proper segregation and treated in uncontrolled ways. In these developing countries the waste mostly end up being incinerated or dumped. The rate of collection in urban cities of developing countries lies between 50% to 80% of generated waste and all the waste finds its way into open dumping (Wilson et al, 2006).

In formal sector of MSW management, the waste is properly treated as disposal in landfill or it is properly incinerated aiming reduction of waste volume and recovery of the energy content. Whereas the collection of plastic waste occur in informal ways outside the MSW stream, which undergoes separation and purification that are relatively clean and could be recycled (Siddique et al, 2008).

It has been estimated that upto 10 percent of the MSW is composed of plastic waste of which PET bottles (Mineral water and soft drinks bottles etc) compose a considerable share in major cities of Pakistan (UNEP report on waste mgt: in Pakistan, 2016). While in urban areas Polyethylene contributes the major portion in plastic waste stream that is followed by PET (Siddique et al, 2008) (de Mello et al, 2009).

In Asian developing countries, the increased volume of MSW has made the municipal cooperation’s unable to properly handle these wastes, which goes into uncollected waste stream

found spread in public areas and alongside road leading to increased pollution, causes damage of land and possess adverse impact on human health (khajuria et al, 2009).

For instance, in South Africa the recyclable fraction of the MSW is collected and separated by informal sector and vends them to buy-back facilities or centers which are operated by individual entrepreneurs or municipalities , the recyclable waste is then transported and sell to formal recycling corporations. Whereas formal collection setup is also present, particularly drop off containers, drop-off centers, and curbside collection in most of the municipalities. There are limited operational material recycling facilities (MRFs) in the state (e.g. in Cape Town) and a small fraction of the municipal solid waste is recycled through this way (friedrich et al, 2013).

Recycling amounts in the formal systems are usually very low due to less coordination between the municipal authorities and stakeholders in the informal sector, the buying and selling of these wastes through informal channel has made the recycling system dominated and operated mostly by the informal sector (Fei et al, 2016). The other major reason for low recycling in the developing world is the lower allocation of budget, which leaves municipalities with little or no resources for formal recycling (Masood et al., 2013). The 'informal waste management system' (IWMS) means the unregistered and unregulated involvement of people in collection of waste, its disposal and recycling (oguntoyinbo et al, 2012). The informal sector involved in recycling accounts for 20-50 % in Pakistan (Ezeah et al, 2013).

Although, the exploitation and downgrading of the waste pickers in the informal sector is a major issue. Which is posed by other classes of society, middlemen in waste collection hierarchy and the law enforcing agencies leads to lower income opportunities for these already downtrodden section of the society, making it imperative for government to devise public policy involving scavengers cooperatives (Medina, 2000) (Oguntoyinbo et al., 2012). However, (sembiring et al., 2010) argues that policy makers are generally averted to the idea of integrating the informal sector into the formal sector, which is another challenging scenario for the individuals in the informal sector.

In a study carried out by (hayami et al., 2006) in Bangladesh to assess the conditions of waste pickers in informal sectors finds that these people are exploited by the municipal authorities and police on entry to the waste dumps, bribe money, respectively. In case of waste dealers, waste pickers are less prone to exploitation if there is enough market competition for waste.

There is no credible data present at the moment regarding PET bottles waste (Soft-drink bottles) for Pakistan, however total solid waste generation per year is around 48 million tons, which has been increasing by an account of 2 percent annually (Project Procurement International, Pakistan, 2018). Mostly, MSW is either dumped, burned, or buried in empty available lots.

The rate at which waste is generating, especially plastic waste, is simply unsustainable (World bank group, 2016). As it causes various environmental impacts including land degradation, which is related with the mining of the non-renewable and renewable resources, generation of green house gases (GHGs), energy consumption, air and water pollution (Verghese,2007), causing threats to the health and well-being of the general public and population.

According to a report, Government of Pakistan (GOP, 2019) estimated daily generation of solid waste i.e 87,000 tons per day, generally from main metropolitan cities. Karachi being the largest city of Pakistan generates over 13,000 tons of MSW per day. All the major cities in the country face huge challenges related to the management of municipal waste. Administrative problems, absence of urban and town planning, insufficient waste management tools, and little awareness of public contributes to the said problem. Also, there are no legislations regarding recycling and recyclables in Pakistan, therefore formal sector is not truly involved in recycling (Batool et al, 2008).

In developing countries, incineration is not a feasible option for disposal of waste as a part of management strategy due its high capital cost, installation cost and maintenance cost; in addition, the high content of moisture in MSW also contributes to the non-feasibility of incineration in the near future (khajuria et al, 2009). According to a study by ‘thanh et al, (2010) in Vietnam, currently the post-consumer PET bottles are treated collectively as part of MSW, where no rewards in shape of incentives or penalties for recycling have been developed, similarly; Islamabad, the capital and the urban cities of Pakistan are no exception.

The situation in developing countries like Pakistan, India, South Africa are worse regarding the recycling. For instance, in South Africa disposal to landfill is the cheapest (in financial terms) and most common strategy, however by comparing the external costs of disposal to landfill, and the external benefits associated with recycling leads to the fact that the former option is more expensive in terms of overall social cost (Nahman et al, 2010). Motivating consumers towards

sustainable and environment friendly behavior such as, less use of energy and more recycling contributes to the protection and sustainability of environment (Stevens, 2010).

For the proper disposal of plastic waste refillables and recyclables beverage containers, many developed countries i.e. Germany, Denmark, Austria etc, have introduced deposit-refund systems which is basically a combination of a subsidy and a tax. The refund will be paid to the consumer of packaging and container materials when he or she returns back the waste packaging material to the retailer, which is an authorized and certified reuse or recycling point. The refund will be given to consumer, who may have paid for product an extra price or deposited amount at the time of purchasing product (Pearse et al, 1993).

Deposit-Refund Schemes

A deposit refund system involves the consumers to deposit an extra amount at the time of purchase of product, which will be refunded to the consumer on returning back the reusable part of the product (Kulshreshtha et al, 2001). A mutual recycling subsidy and output tax, as referred as deposit–refund, encourages the consumer by providing incentives for recycling and also discourages illegal dumping of waste by paying extra tax on purchasing commodities (Calcott et al, 2005). Those consumers are awarded in deposit-refund schemes who brought back or return the reusable packaging material to the manufacturers by refunding the charged amount that was deposited at the time of purchasing products that may possess potential to cause pollution in the environment, the deposit-refund scheme hence encourages the reuse and recycling of potentially harmfum materials (oosterhuis et al, 2014).

The producers along with the retailers manages the network of deposit refund. The consumer bring back their reusable packages and materials to the retailers and get refund of their deposited amount from retailers. The allocation of space by the retailers for the empty and returned packages and acting as an intermediary, the producers pay a handling fee to the retailers. Whereas the producers aims to reduce their net cost by ensuring the legal requirements of recycling rate (Özdemir et al, 2015).

Alternative uses of recycled PET bottles

New plastic can be manufactured from the recovered plastic present in MSW, it can also be used for energy recovery, for example the plastic recovered from waste is mostly used in making of other plastic materials. In South Africa, the market uses for plastic recyclate in 2009 were: for

plastic film (30%), injection moulding (25%), pipes (12%), fibers tapes and filaments (11%), toll (8%) and 8% for other uses including replacement of timber (wood composites and plywood 0.7%) and 1% for profile, barricades and fencing poles (friedrich, 2013).

Polymer concrete of good quality can be made from unsaturated polyester resin founded in recycled PET (Frigione, 2010). Post-consumed plastic bottles on thermo-mechanical recycling specifically the bottles made of polyethylene terephthalate (PET), can be used for engineering applications as composite materials (Avila et al, 2003).

According to Siddique et al (2008), by chemical modification method of recycling, PET bottles could be modified chemically for production of unsaturated, boat hulls, automobile exterior panels and thermoset polyester which is used specifically in bathtubs.

It is the most significant raw ingredients used in fabricated fibers (Siddique et al, 2008). I addition it can also be used for food packaging film and microwave food trays (Sinha et al, 2008).

1.1 A background to the study

This study is to propose the possibility of deposit-refund system for plastic bottles in Pakistan, under the umbrella of Extended Producer Responsibility (EPR), in which the manufacturers of the plastic bottles are regulated through the economic instruments to support the deposit-refund schemes. In this system the EOL (end-of-life) product is returned back for environmentally friendly disposal or recycling (Gupt et al, 2015). In Asia countries, the concept of EPR is progressively increasing. Up till now, the system has been applied to a number of waste types, such as electronics and electrical equipment waste (e-waste), packaging waste and end-of-life vehicles in South Korea, Japan and Taiwan; Japan in 1997 imposed the Container and Packaging Recycling Law (kojima et al, 2009).

Extended Producer Responsibility

Organization of Economic Cooperation and Development (OECD) defines extended producer responsibility (EPR) as an “environmental policy approach in which a producer’s responsibility for a product is extended to the postconsumer stage of a product’s life cycle” (Jacobs et al, 2011). EPR has been a significant model in endorsing the 3Rs (reduce, reuse, and recycle) in economically developed states. According to this approach, the physical and financial

responsibilities for the collection of outdated items have been retained on the producers (kojima et al, 2009). The EPR approach guarantee the take back of products by the producers or manufacturers particularly when reuse and remanufacturing options for the obsolete products are available, and then the manufacturers are responsible to pay in deposit-refund scheme and in curbside collection of reverse logistic (Nkwachukwu et al, 2010).

The most recognized EPR system is the Duales System Deutschland (DSD) (or Green Dot system) packaging waste that was initially applied in 1990s in Germany and later on applied to all over the Europe (Buclet et al, 2002). DSD was basically the idea of establishing a private, organized and well-structured system which can ensure the collection of primary packaging from consumers that will go through a material-specific reprocessing and recycling through the service providers consumers (Pires at al, 2011).

Since 1990, several countries have legislated regulations centered on the Extended Producer Responsibility (EPR) approach to handle the environmental impacts originating from end-of-life consumer items. One of the initial and most established among these regulations was related to packaging materials, the producers using packaging materials for their sale was made responsible for end-of-life handling and treatment of these obsolete products. Regarding packaging material, the most recognized regulation is the “EU Directive on Packaging and Packaging Waste (94/62/EC and 2004/12/EC)”. According to the Directive the Member States are require to guarantee to set up the collections systems in order to meet the targets of collection and recycling established in the Directive (i.e. 60% for glass, 50% for metals, 22.5% for plastics by weight) (Özdemir et al, 2015).

Therefore, to facilitate and empower the individual waste pickers/scavengers [Lowest in the waste hierarchy of informal sector], who are being exploited by the middlemen at depots i.e waste pickers sell plastics as low as Rs. 35/kg- (Answered!! Jannat gull, a waste picker in an interview). Low incomes of the scavengers can be justified by the low rates paid by intermediaries (medina, 2000). For livelihood in developing countries, thousands of people in cities rely on collecting recyclable materials from waste streams, and it is estimated that in Latin America and Asian cities, up to 2% of the overall population live on by scavenging (sasaki et al, 2013). Scavengers contributes to society in a valuable way by converting useless waste into raw

products and resources for other products, over and above they contributes in cleaning the city (hayami et al, 2006).

So, on one end the consumer would be bound to return the bottles to get the refundable amount. If, the case is not so and the consumer decided to forgo the refundable money then the scavengers may be able to get the refundable amount on the deposit of bottle to the store, that has been collected by him from the municipal waste, community dumps or households.

Consumers behavior regarding the plastic bottles use, disposal, and their willingness to pay a certain amount of money per container or their relative willingness to accept, which would be refunded on the deposit of container after the use. Keeping in view the problems regarding waste management of these containers, in 1971 traditional kind of deposit-refund scheme was established in America through 'first bottle bill' (walls et al, 2011), the modification to the system is the German Pfand system. As end customers, containers are deposited to the super markets or retailers after use, and specific amount of money per container is refunded to the customers, when they return the bottles. However, these policy tools influence consumers only if the economic incentive is strong enough to come in their decision-making manners (Stevens, 2010).

In Pakistan, according to waste management overview of the country commercial guide (2019), responsible bodies for the waste collection in the major cities are either municipal or local government. The solid waste in the major cities amounts to 60-70 percent and the primary collection of this waste is done through handcarts or donkey pull carts. Which, is in turn, collected secondarily by tractor trollies, open trucks for further transportation. Some of the municipalities tends to hire street sweepers and sanitary workers for making the collection system more efficient, in terms of collection from dustbins and small heaps, and storing them at depots of formal and informal sector. Only, Karachi and Lahore have sanitary landfill sites, while other cities are planning to build proper landfills, still dumping off their waste outside the city.

1.2 Research Objectives

As we have discussed earlier that the formal sector in Pakistan is either limited or non-existent. So, the current study focus on the assessment of informal sector and to intercalate it into the strata of formal waste collection to generate higher incomes for the waste scavengers, which are

usually the exploited section of society and at the lowest level of waste hierarchy. Moreover, this study tends to assess the consumer behavior and awareness regarding the plastic bottles and their willingness to pay/accept in the deposit refund setup; along with the amount of money they are willing to pay or accept.

1. To assess the waste collection and disposal in the informal sector.
2. To assess the consumer behavior and awareness regarding plastic soft-drink bottles use and disposal.
3. To evaluate the consumers willingness to pay or willingness to accept per plastic container in a hypothetical market of deposit-refund system.

1.3 Research questions

1. Do the waste scavenging peasants are exploited in the informal waste sector hierarchy specifically regarding the plastic bottles?
2. How does the consumption attitudes and behavior pattern leads to plastic bottles waste generation?
3. Are the consumers willing to pay/accept a refundable amount on plastic bottles purchase/return and on average how much amount of money they would be willing to pay or accept per plastic bottle?

1.4 Significance of the study

1. In most developing countries the already disadvantaged waste pickers/scavengers are most often being exploited by the ‘middlemen’ (Medina et al, 2000), so this study would help in the assessment of informal waste sector.
2. This study aims at finding the attitudes and consumption patterns in the household consumers, which may help in regulating the plastic bottles waste.
3. Moreover, the study would prove helpful in setting a specific amount of money on the return/purchase of plastic bottles, which could then be incorporated into future policy implementation regarding PET plastic bottles.

1.5 Plan of the study

This study is divided into Introduction, Review of literature, Data collection, Methodology, Results and discussion, Conclusions. It is as following;

Chapter-1 deals with the introduction and background of the deposit refund schemes, waste collection, disposal and recycling of the plastic containers. The chapter-2 covers the review of literature of deposit refund schemes, waste pickers/scavengers in informal sector, comparative literature on recycling and other disposal methods. The subsequent chapter (3) deals with data collection in which the details about study area, data collection procedure and sampling technique is discussed. The chapter of methodology (4) includes; data analysis and qualitative regression model for the interpretation of the collected data. Chapter-4 also deals with the results and discussion from the descriptive and statistical analysis of the data. While, chapter-5 covers the conclusion and recommendation.

Chapter-2

2. Literature Review

This chapter consist of three sections, which cover the thematic review of deposit refund schemes, waste scavenging in the informal waste hierarchy and recycling of the plastic bottles.

2.1 Deposit-refund

Deposit-refund policy is capable of controlling pollution effectively in more or less the similar way as a Pigovian tax [tax or duty on the market activity that causes undesirable externalities], but more effectively because it avoid the midnight dumping, monitoring and enforcement problems (walls et al, 2011). Deposit-refund is an integrated way to exploit the channels of reduction of waste by reducing consumption and encouraging recycling of items (acuff et al, 2013). Deposit-refund schemes (DRS) includes depositing an extra payment at the purchasing time of a product that possess potential for causing pollution (e.g. cans and bottles), the extra payment then would be refunded once the consumer returns the product or its remaining residues to the retailer, seller or recognized and established collection point. These type of schemes can encourages and incentivize proper management of waste i.e. collection and recycling of waste (Mcllgrom et al, 2011).

Several studies indicates that alternative schemes and options to the deposit-refund are not effective, because neither a recycling subsidy nor a tax on virgin material can make the objective to achieve social optimum; which can be effectively achieved by the deposit refund system (walls et al, 2011). Production of materials from recycled waste products have usually reduced quantity of emissions than production from the raw inputs or raw materials, hence the reduced quantity of emissions has given more emphasis for increase in the rate of recycling wastes (acuff et al, 2013).

However, existence of informal recovery or recycling in most of the developing nations provides a profitable alternative to the downstream stake-holders i.e. retailers, which stop them from satisfying their requirement defined in the EPR policy (Extended producer responsibility). So, care should be taken and contribution of retailers must be limited to physical treatment of the

waste products (Gupt et al, 2015). With added strict regulations, the availability and accessibility of recycling sites tend to increase, improve the easiness and reduce the time cost of waste recycling (Viscusi et al, 2011).

Deposit-refund systems in developed countries

The recycling of domestic recyclable waste in most developed nations is managed directly by the government unit as a part of MSW management (Formal sector), mainly some developed states have implemented complete EPR policy and proper system in order to protect environment (Fei et al, 2016). For example, through EPR (extended producer responsibility) in Japan has got great success and in 1982, a law that is labelled as Returnable Container Legislation (or ‘‘Bottle Bills’’) was enacted throughout the state in United States (thanh et al, 2010). International experience shows that DRS can attain significantly high return rates and thus they ensure lead to a decrease in litter (Oosterhuis et al, 2014).

The law levied a refundable deposit fee on the entire soft drink and beer containers that would be repaid to the consumer once they return the recyclable containers (walls et al, 2011). Plastic waste recycling reduces the demand of raw materials for the primary production of items made of plastics, which on the other hand would have been required for primary production. Green Dot system is an application of EPR, that have to be extended as an essential part of up-to-date solid waste management systems, meanwhile it may offer a possible way to make best use of resources utilization and promotes the sustainability (pires et al, 2011).

The existence of first and large-scale EPR program came in Germany through the ‘Green dot system’ or ‘Ordinance on avoidance of packaging waste’. Which has resulted in substantial reduction in waste generation i.e. annually 3% reduction occurred in packaging from 1991 to 1997, which was increasing at the rate of 2 % to 4% annually before the enactment of this law (Gupt et al, 2015).

Denmark executed one of the oldest Deposit-refund system ‘Dansk Retursystem’ mainly for mineral water bottles and beverage bottles, similarly in Netherlands and Switzerland PET bottles are collected through Deposit-refund system (Bing et al, 2012).

(bevington, 2008) reported that only six European countries have an obligatory deposit in force on non-refillable containers of different drinks: the countries includes Denmark, Finland, Estonia, Germany, Sweden and Norway. Whereas in Canada, each of the ten provinces is

directly responsible for environmental policy, that is similar to the United States. However, the attempts have been made in Canada to co-ordinate the policies related to waste and environment among the provinces, which is not practiced in the US. In Canada the formal co-operation occurs through the "Canadian Council of Ministers of the Environment" (CCME). In 1990, a National Packaging Protocol was signed with the consumer and environmental organizations and with the industry under the umbrellas of the CCME.

2.2 Problems encountered by Scavenger/Waste pickers in informal sector of recycling

Scavengers' pickup and recover materials from waste in public areas or along roadside and vend it for recycling and reuse, they also picks up various items for their personal use. These people are commonly known as 'rag pickers' 'scavengers' or 'waste pickers' in English-speaking regions (medina, 2000). These are like many informal self-employed workers who extends their goods and services to the capitalist production in recycling sector, but are usually exploited because of the middlemen or sub-contractors, who hire them or buy their waste at lower prices in absence of any regulatory protection in the developing countries (Agarwala, 2016). The sustainable waste management provides a source of employment for those who are involved in this business to maintain their livelihoods, thus social equity is promoted by Scavenging by providing means of income (rockson et al, 2013).

(UN-habitat, 2010) states that informal waste collection and recycling is mostly carried out by, disadvantaged, poor, marginalized and vulnerable social groups (e.g. Rural migrants, Gypsies, disabled, the illiterate, elderly and religious minorities) who a lot opt to scavenging for existence. People are involved in collecting and sorting waste informally even after knowing health risks associated with the business, it is due to the financial benefits this informal sector offers that are relieving unemployment (oguntoyinbo et al, 2012). However, the reluctance of government in many developing countries pertaining to the informal waste collection and disposal in the informal sector is a common policy, which reflects attitude of governments towards these activities (Navarrete-Hernandez et al., 2018).

Study reports often says that human scavengers are mostly the vulnerable and disadvantaged individuals of the population (medina, 2000). Mostly, activities of informal sector are hardly supported, generally ignored, and occasionally discouraged by governments (sembiring et al,

2010). In developing states, approximately 2% of the total population rely on waste picking for daily existence (ezeah et al, 2013).

A key problem towards the integration of the FWMS (formal waste management system) with the IWMS (informal waste management system) is social and public acceptance of IWCs (informal waste collectors) activities, the activities of IWC's is viewed as public nuisance, shameful and a social problem in major cities that have to be banned (oguntoyinbo et al,2012).

In developing countries, the waste is collected by informal waste pickers from commercial and residential areas, dumping sites, transfer points or transfer stations, storage containers, landfill sites and available plots (Scheinberg et al., 2010). Thus, it provides a direct financial assistance for waste pickers and it helps the municipalities who are left with lesser quantity of waste to tackle with as informal sector removes some part of the waste from the formal system (masood et al., 2013).

In general, the main materials recovered from wastes are plastics, bottles, ferrous and non-ferrous metals, rubber materials and papers. Availability of a market for these materials determines the quality and quantity of recovered wastes (Agunwamba et al, 2003).

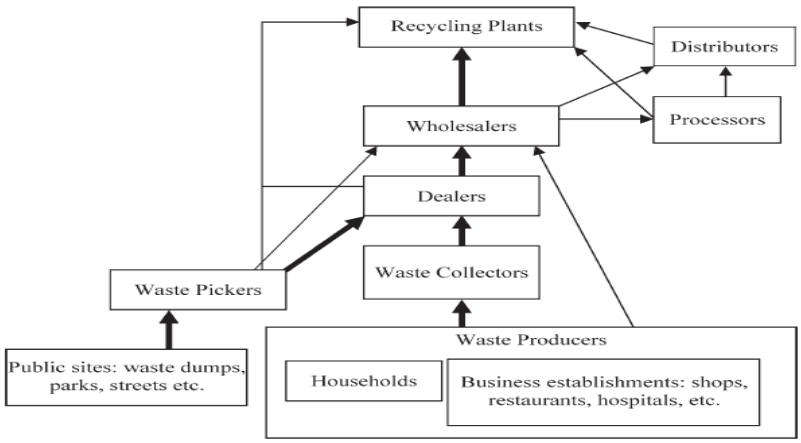


Figure 1. Marketing channels of recyclable waste in informal sector; Source: hayami (2006)

Figure 2: The position of informal waste pickers in the waste hierarchy

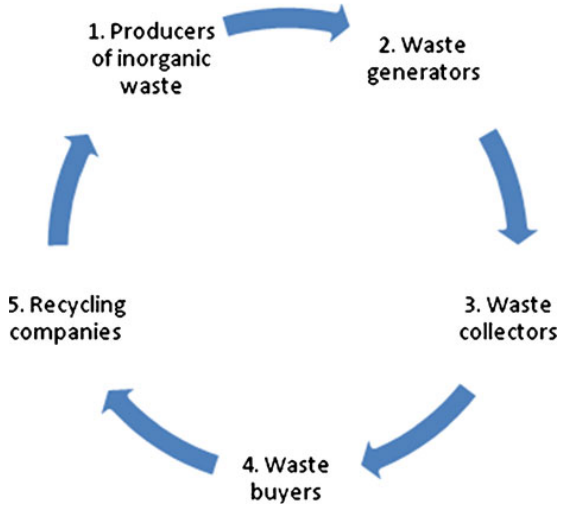
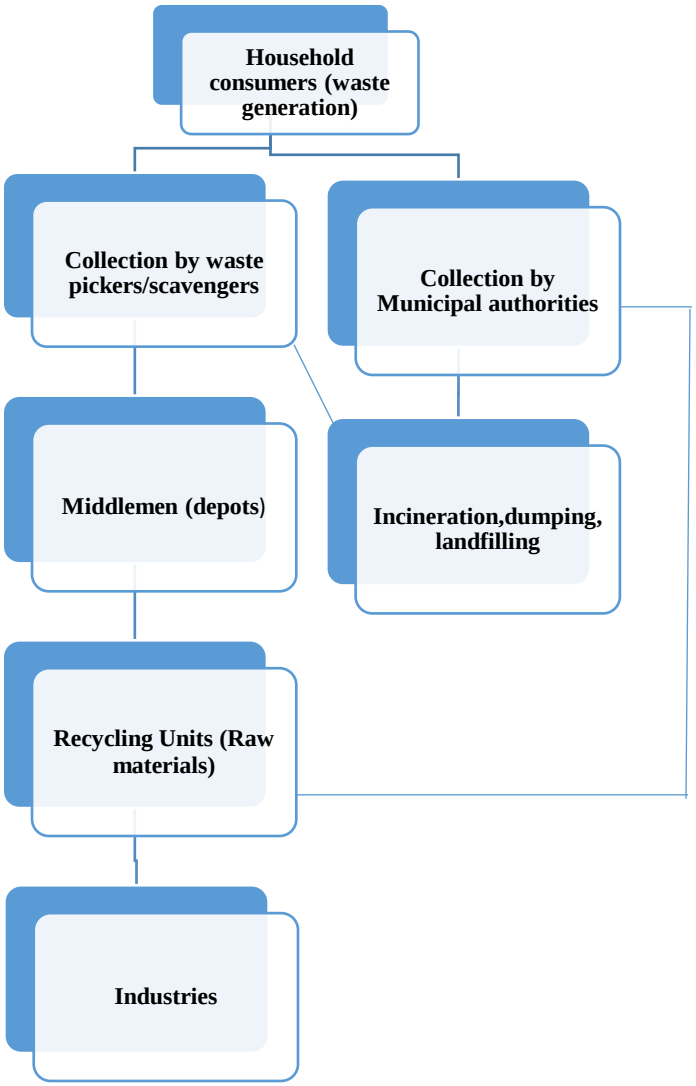


Figure 3: the waste cycle. Source: Schenck (2011)

Figure 4. Source: (DAWN NEWSPAPER)

Figure 5. Waste picker (Source: Author)

Typical flow chart of Informal sector:



2.3 Recycling

Recycling saves valuable landfill and dumping sites, and also helps in the mitigation of air pollution by prohibiting the burning/incineration of solid waste. The improvement and increase in activities of waste recycling decreases the demand for purchasing raw materials for primary production. Hence it helps in saving the resources, reserves and foreign exchange, in addition it decreases the cost for the end-of-life disposal of the products and residues, it also creates opportunity for jobs and helps the households with low-income by producing comparatively cheaper products (Banga, 2011).

In developing world, like Malaysia and South Africa have introduced specific legislation regarding the recycling of solid waste. moh et al (2014) states that in 2006, Malaysia launched the Waste Minimization Master Plan (WM-MP) in realization of minimizing the consumption of the natural resources and aims to minimize the reduction of environmental burden in the society, where the activities for waste minimization are established and suitably embedded in the performance of private, public and government sector.

By adopting WM-MP the master plan for 3Rs was prepared and Solid Waste Management Act (SWM Act) was formulated in 2007. The act included the promotion for minimizing the waste through activities of 3Rs policy, which defined recycling as collection and separation of solid waste for the production of primary products.

Similarly in South Africa according to friedrich et al (2013), it is necessary to mention the the regulatory pressure put by the Waste Act i.e. Act 59 of 2008. According to the Act the state is responsible to ‘‘set in place uniform procedures that seek reduction in the generation of waste quantity and, where waste is generated, to make sure that the waste is reused, recycled in an environmental friendly way prior to being carefully treated and disposed of’’ (RSA – Waste Act, Act 59 of2008). It specifies that all levels of governmental administration i.e. local, provincial and central have responsibilities, as the same as for waste holders and producers of waste.

The informal recycling rates attained by China, India, Pakistan and Philippines ranges from 20% to 50%, whereas it ranges up to 80% in Egypt (Wilson et al, 2009). Therefore, ineffective management and disposal of MSW in developing countries eventually causes environmental degradation (Khajuria et al, 2009).

It has been estimated that the feedstock used for plastics consumed about 4% of non-renewable resources, oil and gas production, and an additional 3-4 % is consumed providing energy for their manufacture (Hopewell et al, 2009). According to Pacific Institute, in USA, the production of every single ton of PET bottles produces about 3 tons of carbon dioxide (CO2). Thus Bottling water in 2006 produced over 2.5 million tons of carbon dioxide (Pacific Institute).

These observation shows that our present-day usage of plastics is not based on sustainability (Hopewell et al, 2009). Some organizations and large companies have started to change their behaviors and practices concerning plastic usage, such as UNILEVER has somehow assured that

by 2025, practically all of its plastic container and packaging will be recyclable, reusable or compostable in a commercially sustainable manner (Macarthur, 2017).

Recycling saves a considerable amount of raw materials for plastic products that would have been essential for primary production of plastic items (Subramanian et al,2000). However, every successful recycling program need to be designed in a way that should increase the awareness and knowledge of society regarding environment, direct its attitudes and behavior concerning recycling (Banga et al, 2013). For example, after the 1992's Rio declaration, environmental issues such as recycling have been made the part of school curriculum in Botswana (Bolaane et al, 2006).

Coca-Cola being the world largest drinking and beverage company has made noteworthy efforts in calculating and decreasing its carbon footprint i.e. in developing countries like India, Coca-Cola has been associated with intermediary recyclers for handling and recycling of waste PET bottles (Ghoush et al, 2015).

Recycling is one of the most significant actions currently available to decrease the externalities associated with the dumping and landfilling of recyclable waste i.e., Plastic bottles (Hopewell, 2009). The general reason of consensus for recycling among professionals and researchers is that, Recycling on one hand reduces the total amount of waste and on the other hand helps in conserving the natural resources (Bolanne et al, 2006).

According to (bing et al, 2012) around 30MJ of energy [which is same to the energy content of around 1 Liter fuel] can be saved by manufacturing of 1 kg flakes from recycled PET as a substitute for virgin or raw PET.

Debate about the plastic bottles is prevalent, although when taken the carrying capacity ratios [Plastics has the highest i.e. 34 ounces juice in 1 ounce plastic, while 1.9, 6.9, 21.8 for glass, paper and aluminum, respectively] of different packaging materials, Plastics win the debate. In addition to above, by the use of plastic packaging, the manufacturers and primary producers of products save sufficient energy every year to power a town with one million households for approximately three and a half year in United States alone (Subramanian et al, 2000).

The deposit refund system in the developed world is discussed to grasp the general idea of this system, its working and whether and how it can be implemented in the developing world. In

addition to the deposit refund scheme, issues encountered by the waste scavengers in the informal sector is discussed for the assessment of ways in which this section of society can be incorporated into the formal waste sector to implement the waste policies regarding the plastic bottles and also to generate opportunities for the waste collectors. To answer the query regarding plastic bottles recycling, is basic theme of recycling section which highlight the benefits of recycling plastic bottles over other disposal methods.

Chapter-3

3. Methodology

This section covers the Study Area, Data collection procedure and Sampling technique and Methodology.

3.1 Study area

Islamabad is the capital city of Pakistan, and is federally administered as part of the Islamabad Capital Territory. Built as a planned city in the 1960s to replace Karachi as Pakistan's capital, Islamabad is noted for its high standards of living, safety, and abundant greenery. Its total area is round about 906 square kilometers.

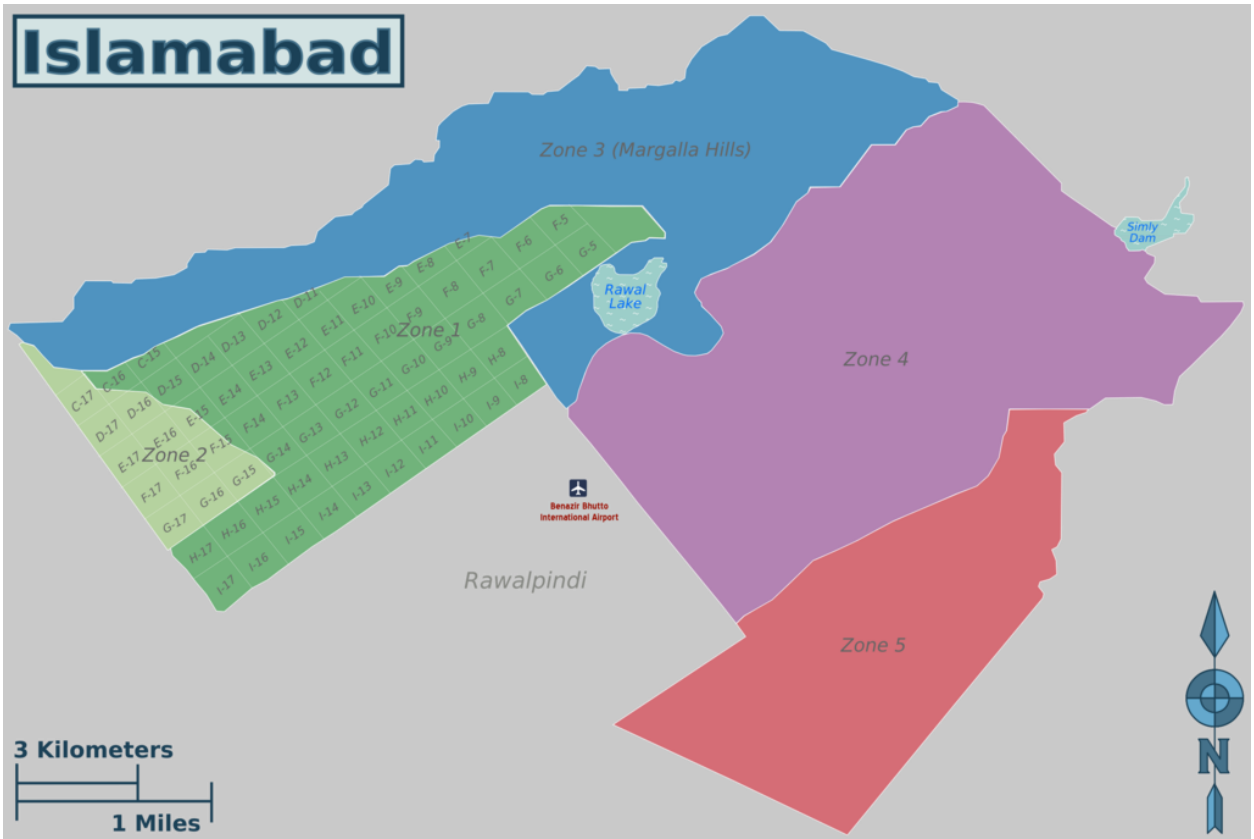


Figure 6. Map of Islamabad capital territory along with zonation

Population

With a population of 1,014,825 as per the 2017 Census, Islamabad is the 9th largest city in Pakistan. Islamabad city is divided into five major zones: Zone I, Zone II, Zone III, Zone IV, & Zone V. Zone IV is the largest in area while Zone I is the largest developed residential area.

Zone 1 is divided into sector's, each residential sector is identified by a letter of the alphabet and a number and covers an area of approximately 2 km × 2 km. So, the questionnaire survey focus on zone I because of its residential nature. Urban population was 209180 according to the population census (2017).

Altitude and Latitude

Lying at altitudes ranging from 457 to 610 meters. With the map reference of Northern latitudes 33^{o} 49' and longitudes 72^{o} 24' east of Greenwich. The territory is bounded by Punjab on the south, west and east and by Khyber Pakhtunkhwa on the north.

3.2 Data collection procedure and sampling technique

To achieve objective 1: information regarding waste picking and informal sector is evaluated through key informant interviews, field visits and secondary data from the previous studies.

To achieve objective 2 and 3: Questionnaire base primary data is collected in different localities of Islamabad (mainly Zone 1).

Simple random sampling technique is adopted as has been applied in the previous household related studies, as one such study done by (Islam, MD Tasbirul., 2016) in Bangladesh to assess the public awareness, knowledge and attitude and their willingness to pay for electronic waste management. In zone 1, which comprise the urban population in different sectors to collect the primary data as our concern is with the household consumers. A questionnaire-based survey is conducted in the study area for assessing the consumer awareness, attitudes and behavior, and their willingness to pay or willingness to accept certain amount of money on the return of containers. A limited random survey is conducted with a sample size of 400 questionnaire among the available respondents belonging to different age groups, educational background, profession and income levels. Survey is conducted through face to face interview method to gather information that are sufficient, meaningful and comprehensive for further analysis. An initial pilot survey has been conducted with a small sample of 20 respondents to verify that all the questions were easily understandable, and to check multiple options in closed questions to guide

the questionnaire development. On the basis of responses and comments from the pilot survey the final questionnaire was designed.

3.3 Empirical framework

According to the 2017 census the urban population of Islamabad was 209180, so the sample size for the questionnaire survey of households is 400. Questionnaire is divided into four section. Section 1 covers the socio demographic variables, Section 2 focuses on the awareness of consumers regarding plastic bottles waste, their negative externalities on the environment and the recycling of plastic bottles. Section 3 deals with the consumers attitude and behavior regarding the plastic bottles use, reuse and recycling.

Section 4 of the questionnaire is assigned to assess the consumers' willingness to pay (WTP) in absence of any deposit refund scheme and their willingness to accept (WTA) a refundable amount of money from the market suppliers/manufacturers. The reason for assessing the WTP of consumers alongside WTA is to find, whether they are interested to pay certain amount of money per container. So, would they be willing to pay given that no such program i.e., an offer of refund on container deposit from the market suppliers is available.

Market Suppliers consent for such scheme and data regarding waste picking and informal sector is to be evaluated through key informant interviews mainly waste pickers from the zone-1 of Islamabad and as many as possible (30-40), field visits and secondary data from the previous studies.

Descriptive analysis of the consumer's socioeconomic variables, awareness, attitude and consumption pattern and further statistical analysis for the consumer's willingness to pay/accept has been done through STATA/SPSS by applying qualitative regression model.

Model 1: $WTP = \beta_0 + \beta_1 Inc_i + \beta_2 Edu_i + \beta_3 Age_i + \beta_4 Awr + \beta_5 Nb_i + \beta_6 Reuse_i + Age^2 + \varepsilon$

Model 2: $WTA = \beta_0 + \beta_1 Inc_i + \beta_2 Edu_i + \beta_3 Age_i + \beta_4 Awr + \beta_4 Nb_i + \beta_5 Reuse_i + Age^2 + \varepsilon$

Variable specification:

Variable code	Variable Explanation	Expected sign
WTP	Willingness to pay a refundable amount of money to the retailers by the consumers (0= No, 1= Yes)	
Inc	Monthly income of the household in PKR.	**+ve**
Edu	Education of the respondents (In years of schooling)	**+ve**
Age	Age of the respondents (In years)	**-ve**
Awr	Awareness regarding plastic bottles, their waste, and recycling (Index of ignorance: which is actually the composite variable applied in social sciences, to tap the collected effect of more than one variable, regarding the plastic bottles in the present case. This index is computed by summing up all the variables in 0=No, and 1=Yes form, then dividing them by 4, as of four number of variables. And each of the variables in the row (individual respondent) is divided by the number of respondent saying 'No', so to get the Ignorance index by finally dividing and multiplying with 4 and 100, respectively. The value we get for each respondent ranges between 0 and 4. '0' shows lowest awareness or higher ignorance and highest awareness or lower ignorance, respectively, as we move towards '4'.	**+ve**
Nb	Number of bottle consumers uses on a weekly basis	**+ve**
Reuse	Reusing of the plastic bottles (0= No, 1= Yes)	±
WTA	Willingness to accept of the consumers a certain amount of money per container, paid by manufacturers to the retailers for incentivizing the return of plastic containers for making the recycling rate efficient. (0= No, 1= Yes)	
ε	Denotes the error term in the linear model	±

3.4 Data Analysis

For the study of consumer's socioeconomic characteristic, awareness, behavior and their WTP/WTA; the data collected is processed and statistical analysis is conducted using the software SPSS. Descriptive analysis is performed for the responses of consumer to each question and interpreted, as either a bar graph or pie chart. The analysis is performed to examine the correlation of socioeconomic characteristics of respondents with the awareness regarding the general plastic waste and PET bottles waste.

A logistic regression model is developed to explore the influencing factors on the willingness to pay /accept of the consumers to pay or accept an amount of money on the purchase or return of plastic containers to the retailers. Regression analysis is a statistical method that allow to examine the relationship among variables of interest.

This study employs logistic regression to assess the relation among the socioeconomic variables of the respondents (independent variable) to their willingness to pay/accept (dependent variable) for the proper recycling of plastics bottles. Respondents are first asked for their willingness to pay for the plastic bottles they purchase, an extra amount, which will be refunded on the return of the container to the retailers. Respondents are then asked about their willingness to accept, an amount of money [an assumed scheme by the producers], which they can retrieve on the return of container to the retailers on any collection point.

The option provided are in the form of 'Yes' and 'No' for binary variables in '0' and '1' form. Here, respondents selected their willingness to pay and accept in two alternatives; '1' for willing to pay/accept for plastic bottles; '0' for not willing to pay/accept for plastic bottles. When the dependent variable is in 0-1 form, the researchers can choose between probit regression and logistic regression.

In this study, the author is using binary logistic regression model for the evaluation of effects of different independent variables upon the willingness to pay and willingness to accept of the consumers; which are in this case dependent variable. In a study conducted by (Song et al., 2012) in macau to assess the attitude and behavior of the residents regarding their willingness to pay for e-waste recycling and uses age, education and income level showing significant impacts upon their willingness to pay in the logistic regression analysis. In a study carried out by (Genius, Margarita et al., 2008) tends to find out the willingness to pay of the consumers for the quantity

and quality of portable water, in which the author of the study also used the number of bottles to assess the its impact upon the consumers willingness to pay. Sumukwo et al., (2012) includes the reuse of household solid waste materials as a disposal method in their study regarding the economic valuation.

Chapter-4

4. Results and Discussion

This chapter will covers the results and discussion.

4.1 Behavior of Plastic Bottle Consumers

4.1.1 Socioeconomic characteristics of the respondents

The survey for this study is conducted in the month of August and September of 2019. The survey is conducted from respondents through questionnaires in the different residential sectors of Islamabad including G, H, I,sectors, margalla town and Bhara kahu area. The survey asks questions about the knowledge and awareness, Consumer behavior and their willingness to pay/accept an amount of money on the returning of plastic bottles. Approximately, 78 percent of the respondents are males and 22 percent are females.

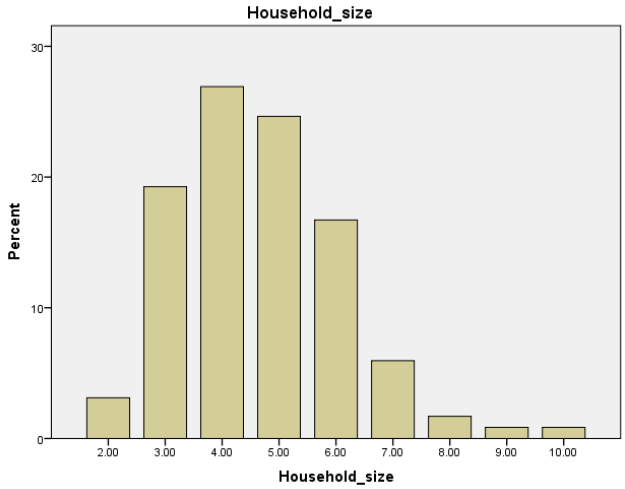


Figure 7. Household sizes of the consumers

Education of the respondents are recorded in the 'years of schooling' i.e. 12, 14, 16, 18 years and above 18 are attributed to higher levels of doctorate or post-doctorate studies. The income level ranges in between Rs. 23000 upto Rs. 150000.

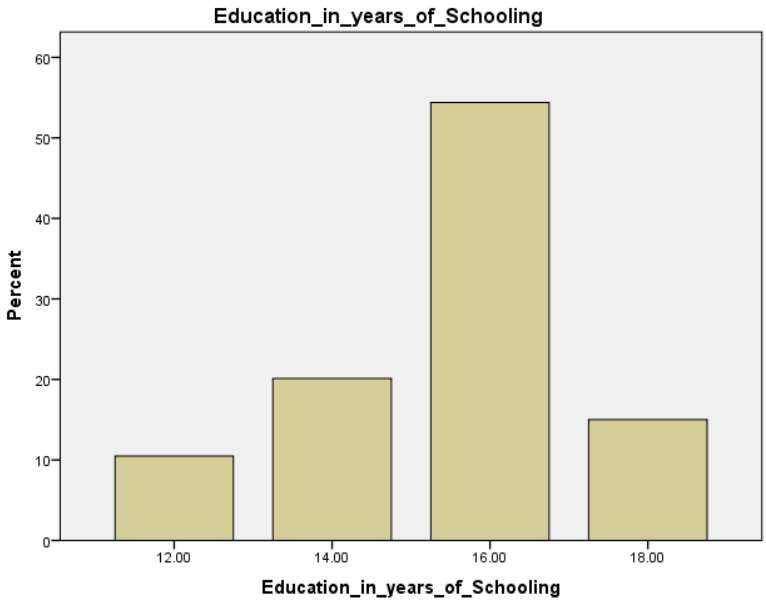


Figure 8. Education of the consumers in years of schooling

In this study, most of the respondent are government servants, Self-employed and people belonging to the private organizations, as shown in the bar chart below.

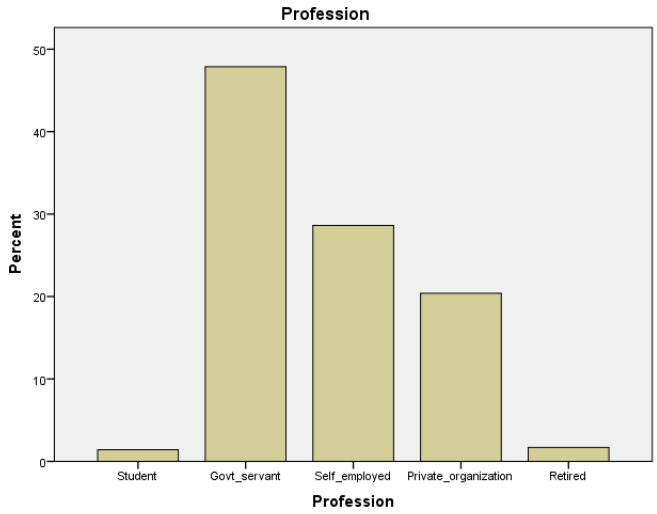


Figure 9. Profession of the respondents in percentage

Moreover, the study area included for the consumer behavior and data regarding the waste pickers is collected in the various residential sectors and towns of Islamabad. Half of the data is collected from the G-sector as the residents are not so reluctant to fill the questionnaire. 11% of the data is collected from the f-sector, 11% from the bara kau area, 8% from the margalla town

and 17% is collected from the I-sector. The socioeconomic characteristics of the respondents are correlated with the willingness to pay/accept for the proper disposal of plastic bottles via deposit-refund schemes using software SPSS.

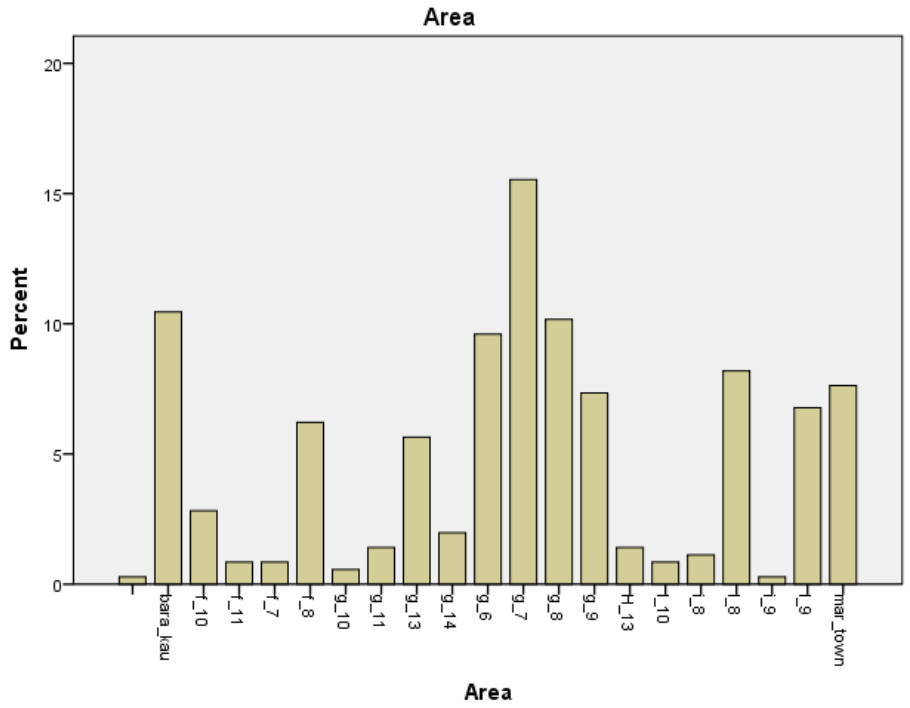


Figure 10. Area wise distribution of the number of respondents with their monthly income

4.1.2 Public Knowledge and awareness about impacts of plastic bottles

The second section of the questionnaire is about the knowledge of respondents related to the awareness in regards of the harmful impacts of general plastic waste and specifically the plastic bottles. The survey results shows that almost 98% of the respondents are familiar with the general plastic waste. Whereas, almost 78 % of the respondents are aware of the plastic bottles waste and their negative impacts on the environment. Only 16% of the respondents are not aware that PET bottles can be recycled, while the other 84% of the respondents are aware of the fact that PET bottles can be recycled. 70% of the respondents are aware of the fact that more than half of the plastic bottles are not recycled, and are either incinerated or being dumped into the landfills. In one such study on plastic bags in Botswana by (Madigele et al., 2017) proposes that governments should devise such policy measures that tends to kindle in public more

environmental friendly disposal of the waste end of life products. The finding of this study points to the fact that most of the people living in urban areas are aware of the negative impacts of plastic containers; and of plastic generally, and are willing to pay and a fraction of population is not willing to pay a refundable amount of money on plastic containers. So, if the government take initiative to either legislate a deposit refund system by the manufacturers or construct its own recycling facilities can achieve certain level of efficiency if pursued both in letter and spirit.

4.1.3 Consumers use and disposal scenario of the plastic bottles

The third part of the questionnaire investigates the consumer behavior regarding the number of the plastic bottles they are using per week, occasions of the plastic bottles purchase, their priority product choice, and their disposal patterns. 21 percent of the respondents are using only one bottle per week, 31 percent using two bottles per week, 20 percent are using three bottles per week, 14 percent of the respondents are using four bottles per week and almost 10 percent are using five bottles per week.

Overall, 46 percent of the respondents are not specific about the occasions on which they are purchasing the plastic bottles, 15 percent of the respondents are buying the plastic bottles while doing shopping, 3 percent while during exercise and 36 percent of the respondents are purchasing and using the plastic bottles on the occasion of family get together. Almost 70 percent of the participants in this questionnaire survey are reusing the plastic bottles, while the remaining 30 percent are not at all reusing (See Fig. Appendix 2: Figure 12). And, 43 percent of the respondents are disposing the plastic bottles by throwing them into the roadside litter, 53 percent are first reusing and then finally throwing them away and only 4 percent of the respondents are selling the plastic bottles to the waste buyers. On the enquiry of the consumers' priority product choice among the plastic, glass, or aluminum containers: 63 percent opts for the plastic bottles, 27 percent for the glass and 9% for the aluminum containers. In an open-end question for the suggestions of consumers, many suggests that the awareness of consumers and stringent laws and regulation by the government (See fig. 16, Appendix 2). Monetary incentive and motivation is different from intentions and plays a significant role in regulating the consumers' behavior and attitude (Ertz, Myriam et al., 2017). The green discernment does not always shows that the consumers' have an environmental friendly behavior, though it certainly give an indication that consumers generally think as environmental friendly (Roozen et al., 1998).

4.1.4 Willingness to pay/accept of the consumers for plastic bottles

In the fourth section of the questionnaire which Consumers are asked for their willingness in paying/receiving certain amount of refundable money to the market suppliers of plastic bottles, if there is a deposit-refund scheme in practice. And, also the amount of money per half Lit bottle or below, or per one Lit bottle or above. Consumers who are willing to pay (WTP) extra money per plastic container [A refundable amount of money on the return of container] are 75 percent, who are mostly from the category of government servant, self-employed individuals and private organizations. Among these individuals, most of them are willing to pay Rs. 2, 3 or 5 for 0.5 litre bottles and Rs. 4, 5 or 10 for one liter bottles (See Fig. in Appendix 2). Which accounts to the average amount of money; people are willing to pay, is approximately six rupees per one liter bottle and three rupees per half liter bottles if deposit refund system was in place.

And, the remaining 25 percent are not willing to pay an extra amount of refundable money per container. Although, the subsequent question, in the questionnaire indicate that 37 percent of the respondent deems it to be the plastic bottle manufacturers/producers or government responsibility to pay them an extra amount of money per container, if they are cooperating in returning the bottles to the retail stores. A study in Malaysia investigated the reasons for not paying an extra amount of money/fee for recycling where most of the participants mentioned that they can earn money by selling waste electronics equipment while others thought that it is the government responsibility for recycling and protecting environment (Afroz et al, 2012).

The finding of this study regarding the willingness to pay is substantiated by the study of (Dwivedy et al, 2013) and (Wang et al, 2011) that the lower willingness to pay for recycling is due to the lower income and economic conditions in developing countries as compared to the developed countries.

The subsequent series of questions in the questionnaire asks for the consumer willingness to accept (WTA) certain amount of money per container, if they return the container to the retailers/recycling/collection sites. Almost, 94 percent of the respondents are willing to accept and the remaining 5-6 percent are of the view that they have no time for returning the bottles. Among the respondents who are willing to accept, most of them are accepting for Rs. 5 and Rs. 8 for one liter containers, Rs. 2 and Rs. 5 for half liter containers (See fig… 22,23 Appendix 2).

On average, respondents are willing to accept six and a half rupees for one liter bottles and four and a half rupees for half liter bottles.

On question regarding suggestions that by whom this kind of deposit refund program can be implemented, 68 percent of the respondents are of the view that it should be implemented by the government and around 20 percent choose the manufacturer/producers of the plastic bottles to introduce the deposit refund scheme for ample recycling.

However, according to a study by (Nnorom, ohkawe et al, 2009) concludes that as the age increases, WTP decreases having an inverse proportion as young people are more environment friendly. As for as the willingness to accept an amount of money on the return of containers, almost all the respondents i.e. 331 are willing to accept the money, distributed equally among all the age groups depending upon the number of respondents from each group.

4.2 Waste pickers

In the various field surveys, while collecting the data for the consumer side of this study and waste chain of plastic bottles, 25 numbers of waste pickers are interviewed and are asked a specific number of questions I.e. Age, daily income from plastic waste, per kilogram (kg) price of plastic bottles, number of bottles per kg, and to whom the waste bottles are sold.

By analyzing the data through SPSS, minimum amount of Rupees 20/kg and maximum amount of 35/kg are paid to the waste pickers, and on average Rupees 30/kg are paid to them by the waste depots and recycling units. Daily average income of the waste pickers fluctuates between Rupees 150 and 300, having mean amount of Rs. 216. On an average, per kg number of 1.5 lit bottles is approximately 16.

Table 1. Frequency table of the waste pickers

	N	Minimum	Maximum	Mean	Std. Deviation
Daily income from plastics	25	150.00	300.00	216.0000	47.95832
Per kg price of plastic bottles	25	20.00	35.00	30.0800	4.93221
Nos: of bottles per kg	25	15.00	17.00	16.2800	.61373

Almost 72 percent of the waste pickers are selling their waste to the nearby waste depots, and 28 percent to a recycling unit. It can be deduced from the table below; that recycling units are paying fairly above than most of the middlemen at the waste depots, although less number of

waste pickers are inclined towards selling their waste to the recycling units because of the problem regarding access to the recycling units. Moreover, most of them do not own any kind of transports vehicles to sell their waste to the recycling units for fair price of money. A study by (Medina et al., 2008) suggests micro enterprises, public-private partnerships, and cooperatives as three models to organize the waste scavengers, which can possibly lead to higher levels of recycling and reduction in poverty.

Table 2: Frequency table of collection sites to whom the waste pickers sold their waste

Collection sites	Frequency	Percent
Waste depots	18	72
Recycling units	7	28
Total	25	100

On examining the per kilogram price of plastic bottles (in rupees) in the informal market of waste management; we tries to capture the price discrimination [if any] carries out by the middlemen at waste depots, municipality officials at dumping sites and harassment by police to pay them bribe (hayami et al., 2006). In the following Table-4, we examine this effect by cross tabulating the per kg price of plastic bottles with the market buyers of waste bottles, to whom waste pickers sell their waste.

Table 3: Cross-tabulation of per kg price of plastic bottles and to whom these bottles are sold

		To whom the waste bottles are sold		Total
		Waste depots	Recycling units (Manufacturers/Private owners)	
Per kg price of the plastic bottles	20	3	0	3
	25	2	0	2
	27	1	0	1
	30	6	4	10
	35	6	3	9
Total		18	7	25

By taking into account the per kg number of plastic bottle, so that we can build a scenario in which, if we take a product of the above assessed money for per liter and half liter of container. If, returned to the retailers by the waste pickers can provide them with one hundred and four rupees instead of the meagre thirty rupees which they are receiving by selling the plastic bottles weighing one kg to the middle-men or recycling units. In a study by (Navarrete et al., 2018) carried out in Santiago de Chile, shows that there is a positive relation between the sustainable performance of waste pickers and support of the government.

And, this kind of evaluation certainly needs some assumptions to be taken into account and provided for, which implies that the consumers, who are WTP/WTA certain amount of money, but often forgo the responsibility (WTP) and incentive (WTA) due to the human nature of procrastination, lack of time, interests and priorities etc.; simply disposing it off by throwing the plastic containers into the road side litter. The case in this study, which is excluding at present, any such policy instruments like deposit refund; the disposal attitude of the consumers is shown in the figure below.

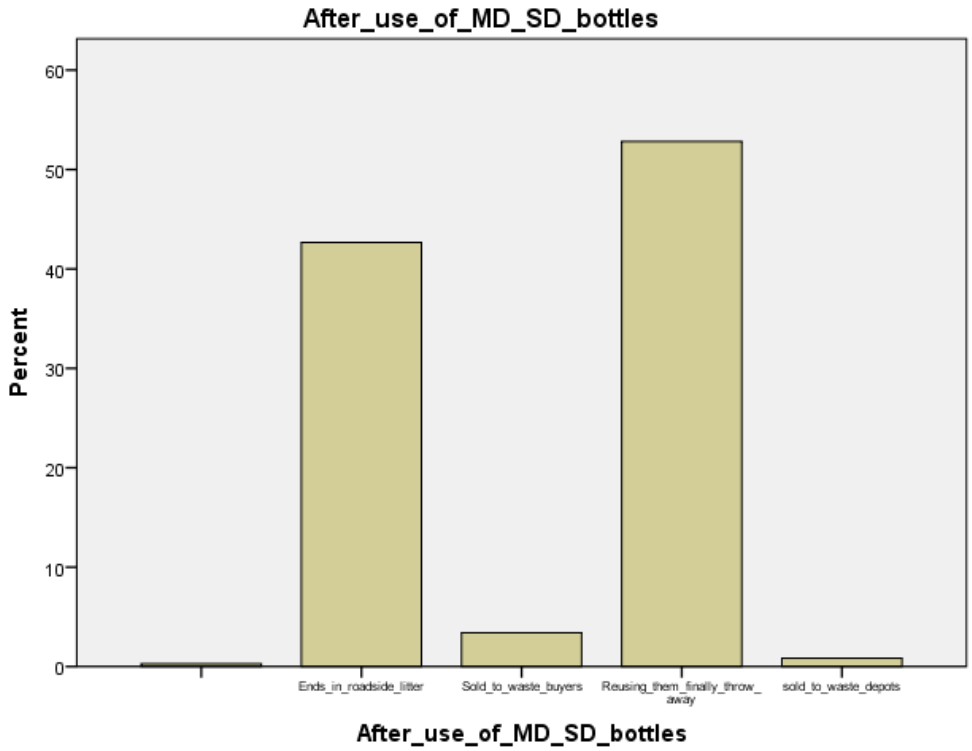


Figure 11. Disposal of the plastic bottles by the consumers in percent

4.3 Results from the Statistical Modelling and their Interpretation

Willingness to pay/accept of the consumers in a deposit refund system for plastic bottles

By applying the logistic regression model for the assessment of effect of different independent variables; both continuous and dichotomous variables, upon the consumers willingness to pay a certain amount of money in a deposit refund setup for plastic bottles. The results indicate that education and monthly income of the respondents have a significant influence upon the respondent's willingness to pay, which shows that with the increase in education level and monthly income of the respondents; likewise the probability of willingness to pay also increase. Other studies by (Genius, Margarita et al., 2008) and (Song et al., 2012) also concluded that education and income have significant impacts upon the willingness to pay. In a study by (Triguero et al., 2016) concludes that the acceptance of any waste management policies by the consumers/individual are necessary for the implementation of preventive and proactive

approaches to enhance the involvement and responsibility of all the stakeholders i.e. Institutions, firms and consumers, so to mold the individuals' behavior and attitude. In a study carried out by (Klaiman et al., 2016) concludes that in packaging, the WTP of the Consumers' is highest for plastic, followed by glass, carton and Aluminum packaging.

In our equation, the result for age on the basis of odd ratio shows that for every one unit; years in this case, increase in age as we move up in assessment, the odds of willingness to pay increases by 163 percent. But, to accurately measure the impact of age, the author of this study also included the age square, whose odds ratio is slightly lower than one, which indicates that the consumers' willingness to pay/accept tends to rise with the increasing age, but at slow rate after reaching certain age. Other studies for recycling (Nnorom, Ohkawe et al., 2009) shows that age is inversely related to the consumers' willingness to pay and younger people are more friendly towards the environment. This anomaly in age may arises due to the hypothetical condition of the money being refunded to the consumers on their return of bottles to the market retailers.

As far as education and monthly income are concerned, the odd ratios for these two continuous variables is also greater than one. Therefore, it indicates that, per unit change in education tends to increase the consumers' willingness to pay by approximately four times or 397 percent more likely. However, for each unit increase in monthly income do not have any apparent influence upon the willingness to pay as shows by the beta value (I.e. 0.00). In a study by (Ezebilo, E. E., 2013) to find the willingness to pay for residential waste management, it is concluded that income and education have a positive influence upon the willingness to pay.

The consumers' per week number of plastic bottles use tends to influence their willingness to pay by 140 percent. Which means that they are willing in paying a certain amount of money as their purchase of plastic bottles increases. By taking the index of ignorance in account, which is also a continuous variable and indicates that, over the digit one or unity (As elaborated in the variable explanation table above) in Exp(B) value, the consumers' willingness in paying tends to increase by 100 percent. Which means that as the consumers' awareness level get higher, they get more likely in willing to pay. The variable of plastic bottle reusing is dichotomous having an odd ratio less than one, which indicates that it is 75 percent less likely that the people who are reusing the bottles are willing to pay.

Table 4. Impact of different variables upon consumers' willingness to pay

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.493	.241	4.169	1	.041	1.637
Education	1.380	.196	49.389	1	.000	3.977
Monthly Income	.000	.000	18.650	1	.000	1.000
Number of PET bottles per week	.384	.202	3.623	1	.057	1.468
Reusing of plastic bottles	-.287	.486	.348	1	.555	.751
Age Square	-.006	.003	3.598	1	.058	.994
Index for Ignorance	1.396	.336	17.257	1	.000	1.002

As far as willingness to accept is concerned, age, education and monthly income of the consumers; which are continuous variable indicates that with every one unit increase in age tends to increase the willingness to accept by two times or 202 percent. Also, the age when interpreted in connection with age square, indicates that this increase in willingness to accept is rising with increasing age but slow down after certain age. Every one unit increase in education tends to increase the willingness to accept a certain amount of money by 120 percent. Consumers income have no such impact upon their willingness to accept an amount of money. The per unit change in the number of PET bottles purchase by the consumers' per week tends to decrease the willingness to accept by 68 percent, however, its value is not significant.

Table 5: Impacts of different variables upon Consumers willingness to accept

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.706	.237	8.888	1	.003	2.025
Education	.235	.235	1.000	1	.317	1.265
Monthly Income	.000	.000	.934	1	.334	1.000
Number of PET bottles	-.372	.241	2.384	1	.123	.689
Age square	-.009	.003	9.726	1	.002	.991
Index of Ignorance	.011	.975	.000	1	.991	1.011
Reusing of plastic bottles	-.893	.710	1.581	1	.209	.410

The dichotomous variable of reusing plastic bottles by the consumers ; indicates that it is 41 percent less likely that the consumers' who are reusing the plastic bottles are also willing to accept [See tables, Appendix 1].

This study attempted to assess an amount of money per one liter and half liter and that whether the consumers' would be willing to pay an extra amount of refundable money. In this study it turns out to be, their willingness for such system is highly dependent upon the income and awareness of the consumers. So, it can be implemented only on a small scale in the major cities given that there are strict regulations on both the producer and consumer side by the government. However, unlike the developed countries, where the consumers have better economic conditions and high environmental awareness: In Pakistan, to implement deposit refund schemes the government must have to shift the burden on the producers side and bounds them to provide monetary incentive by providing the retailers with the money to pay the consumers', whenever they return the container for recycling.

As it is difficult to develop proper collection system and implementing the formal recycling infrastructure to contain the ever increasing plastic containers' demand and waste generated thenceforth.so, to lessen the environmental impact the government can also include the down trodden waste scavengers and collectors in the informal sector by offering high dividends for the waste plastic containers.

4.4 Market suppliers' consent

The qualitative response from the market suppliers or retailers on the sideline of our survey, tells us that while provided with the monetary incentives either from the manufacturers of the plastic bottles or from the government for the collection and storing of plastic bottles, they show general agreement for supporting such deposit refund scheme. In addition their consent is also dependent upon the space at their stores for storing the plastic bottles.

Chapter-5

This chapter will cover the conclusion and recommendation.

5. Conclusion and Recommendations

On the assessment of waste collection and disposal by informal sector, from the existing literature shows that the formal sector of waste management is not actually involved in the recycling of plastic bottles in case of Pakistan. The major contributor to the plastic bottles recycling is informal sector and the bottling enterprises. Municipal waste collection bodies are either dumping or incinerating the waste. So, there is a need of efficient incentive system which would encourage the informal sector to recycle on large scale, the end of life products. Because, it is clear that recycling process indirectly benefits the environment by recovering the valuable material from the waste bottles and also it contributes towards the lessening of environmental costs, that are associated with the extraction of virgin materials for the manufacturing of new bottles.

Waste scavengers and collectors are being paid nominally for their plastic bottle waste either by middle-men at depots or recycling units. Keeping in view the per kilogram price of empty plastic bottles provided the deposit refund scheme, amounts to Rs. 104/kg; which in absence of any such scheme is currently amounting to Rs. 30/kg on average. The fluctuation in amount of money paid to the waste pickers at the waste collection points and depots by the middlemen shows the price discrimination for one kg plastic bottles waste. So, the government can regularize the waste scavengers into formal waste collection and incentivize them by setting a fix monetary value for plastic bottles.

Therefore, developing an efficient and effective incentive system for informal sector, and the utilization of informal sector for collection of end of life product i.e., can prove environment friendly and in addition have economic benefits, which are necessary as in case of Pakistan. If recycling companies, local government bodies and NGOs starts considering the waste scavengers in waste management chain, they can considerably contribute to the society, by benefiting their selves and the general public too.

Consumers' attitude regarding the plastic bottles disposal is dismal in a sense that more than 40 percent are simply throwing the used bottles into the roadside litter and the remaining

respondents were, however, reusing the plastic containers, finally throw it away at community dumps. According to the qualitative logistic regression model employed in this study shows, Education, reuse of plastic bottles, number of plastic bottles purchased per week and age have significant impact upon the consumers willingness to pay. Although, age square shows negative relation with the willingness to pay of consumers' for plastic containers in hypothetical deposit refund setup.

As per the results of this study, 'if' deposit refund scheme for plastic bottles was in place, more than 80 percent of the consumers', are willing to accept an amount of refundable money, have higher incomes and education. In absence of any deposit refund scheme, the willingness to pay of the consumers has almost similar trend as that of willingness to accept. And, also as the age square shows inverse relation with the willingness to pay which shows that the young people are more generally concerned about the environmental impacts of plastic waste. So, if the deposit refund system is implemented by the government, it would lead to efficient collection and recycling of the plastic bottles.

This study also tends to evaluate the average amount of money, which the consumer are willing to pay/accept for one liter and half liter plastic bottles. The consumers' willingness to pay average amount of money assessed for one liter empty plastic bottle is 6 rupees, and 3 rupees for half liter bottle. And, the average amount of money consumers' are accepting has been assessed: Rs. 6.5 for one liter and Rs. 4.5 for half liter plastic bottles. Therefore, it is highly recommended that government should implement such schemes, which, on one hand will effectively control the pollution relating to plastic bottles and on the other hand more income generation opportunities for the waste pickers.

This study also proposes further research for designing an efficient and effective framework through which deposit refund system can be implemented, taking in account all the stakeholders I.e., Consumers, Manufacturers/producers, retailers, waste scavengers, municipalities, independent recycling units etc.

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Appendix 1

Tables

Glossary

Terms	***Acronym/Meaning***
DRS	Deposit refund schemes/system
EPA	Environmental protection agency
EPR	Extended producers responsibility
IWMS	Informal waste management system
Kerbside collection	A service provided to households, typically in urban and sub-urbans areas, of collecting and disposing of household waste and recyclables.
MSW	Municipal solid waste
PET	Polyethylene terephthalate (Raw material used to produce plastic bottles)
Pigovian tax	A tax on any market activity that generates negative externalities
WTA	Willingness to accept
WTP	Willingness to pay

Table 5: waste pickers regarding plastic bottles collection and sale in informal setup

Waste pickers or waste scavengers	Average age	Average daily income from plastics	Average No: of plastic botlles in one kg	Average Per kilogram price of plastic bottles (Rs)	To whom the waste is sold
25 N	36	216	16.3	30	Waste depots= 72%(18 N)
					Recycling units=28%(7 N)

Table: Willingness to pay as a dependent variable

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.493	.241	4.169	1	.041	1.637
Education	1.380	.196	49.389	1	.000	3.977
Monthly Income	.000	.000	18.650	1	.000	1.000
Number of PET bottles per week	.384	.202	3.623	1	.057	1.468
Reusing of plastic bottles	-.287	.486	.348	1	.555	.751
Age Square	-.006	.003	3.598	1	.058	.994
Index of Ignorance	1.396	.336	17.257	1	.000	1.002

Table: Willingness to accept as a dependent variable

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.706	.237	8.888	1	.003	2.025
Education	.235	.235	1.000	1	.317	1.265
Monthly Income	.000	.000	.934	1	.334	1.000
Number of PET bottles	-.372	.241	2.384	1	.123	.689
Age square	-.009	.003	9.726	1	.002	.991
Index of Ignorance	.011	.975	.000	1	.991	1.011
Reusing of plastic bottles	-.893	.710	1.581	1	.209	.410

Appendix 2

Figures:

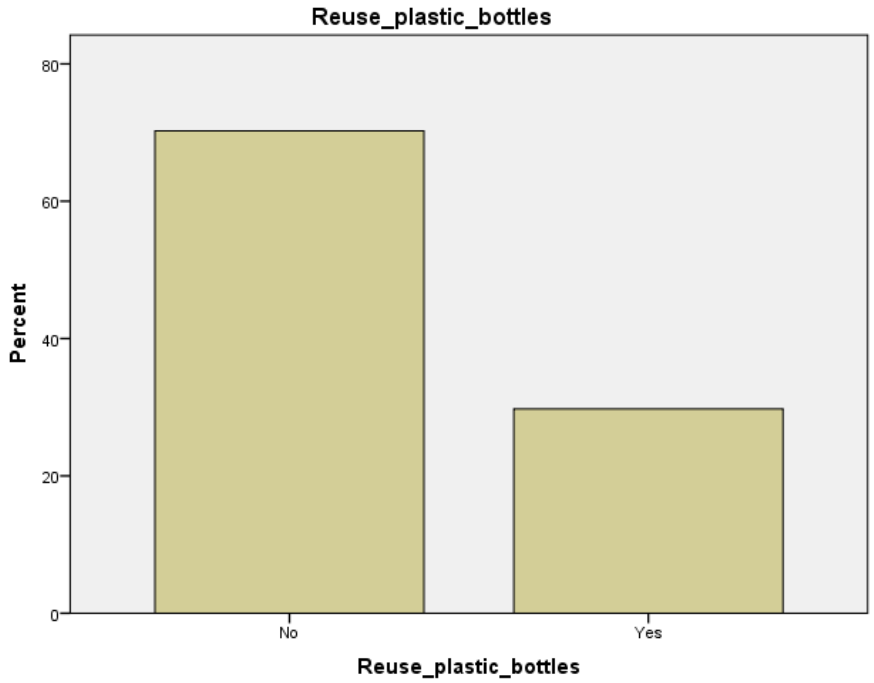

Figure 12: Percentage of the respondents reusing the plastic bottles

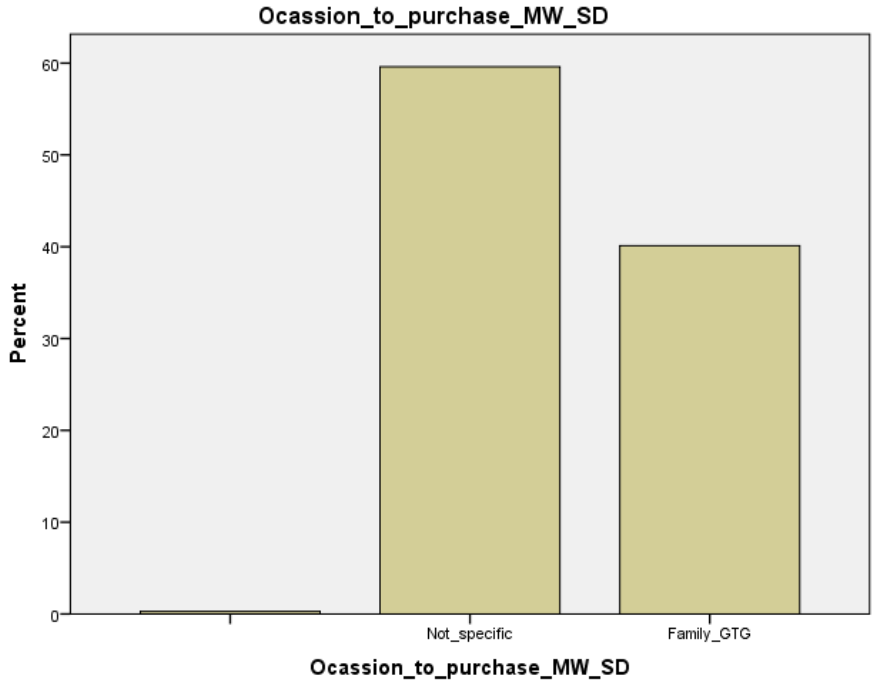

Figure 13: Different occasions on which respondents are purchasing plastic bottles

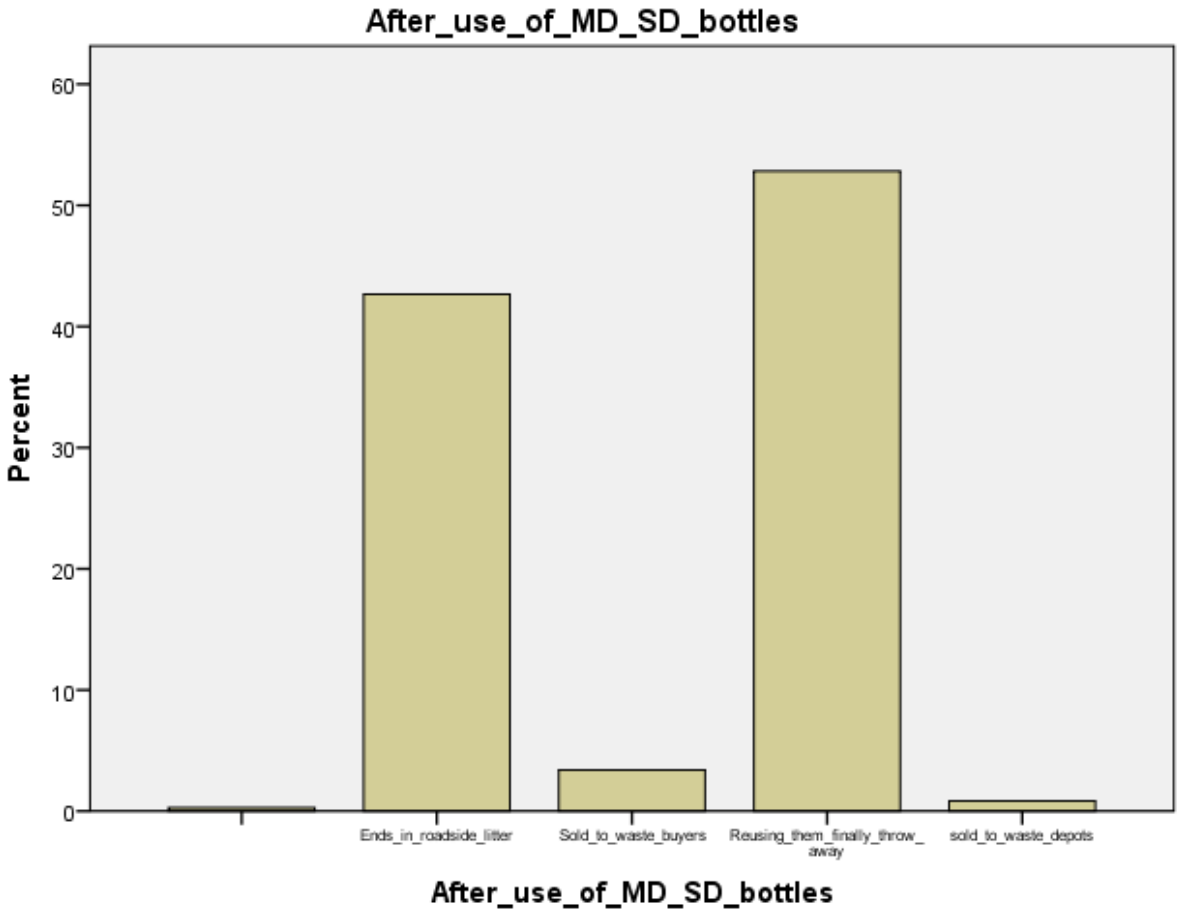

Figure 14: Various disposal patterns of the consumers

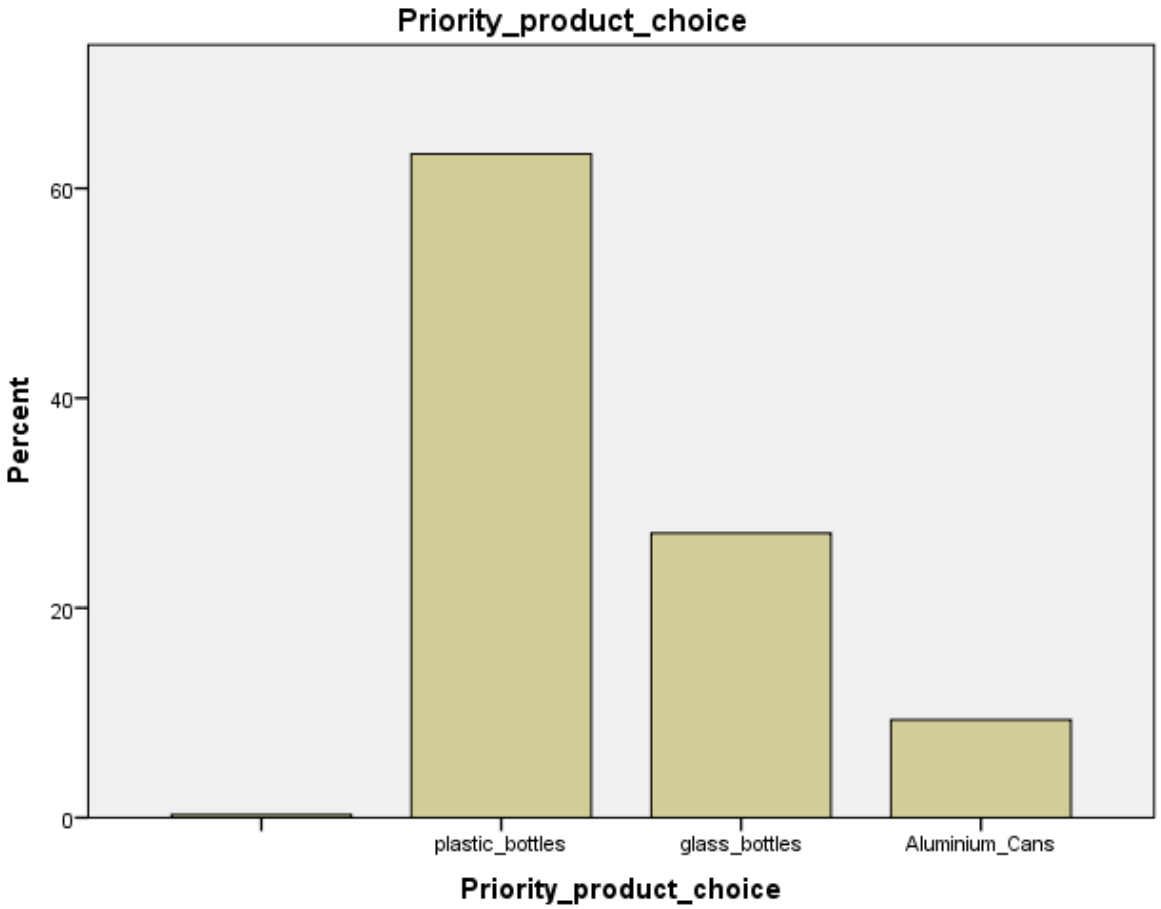

Figure 15: Priority product choice of the consumers in water and soft-drink packaging

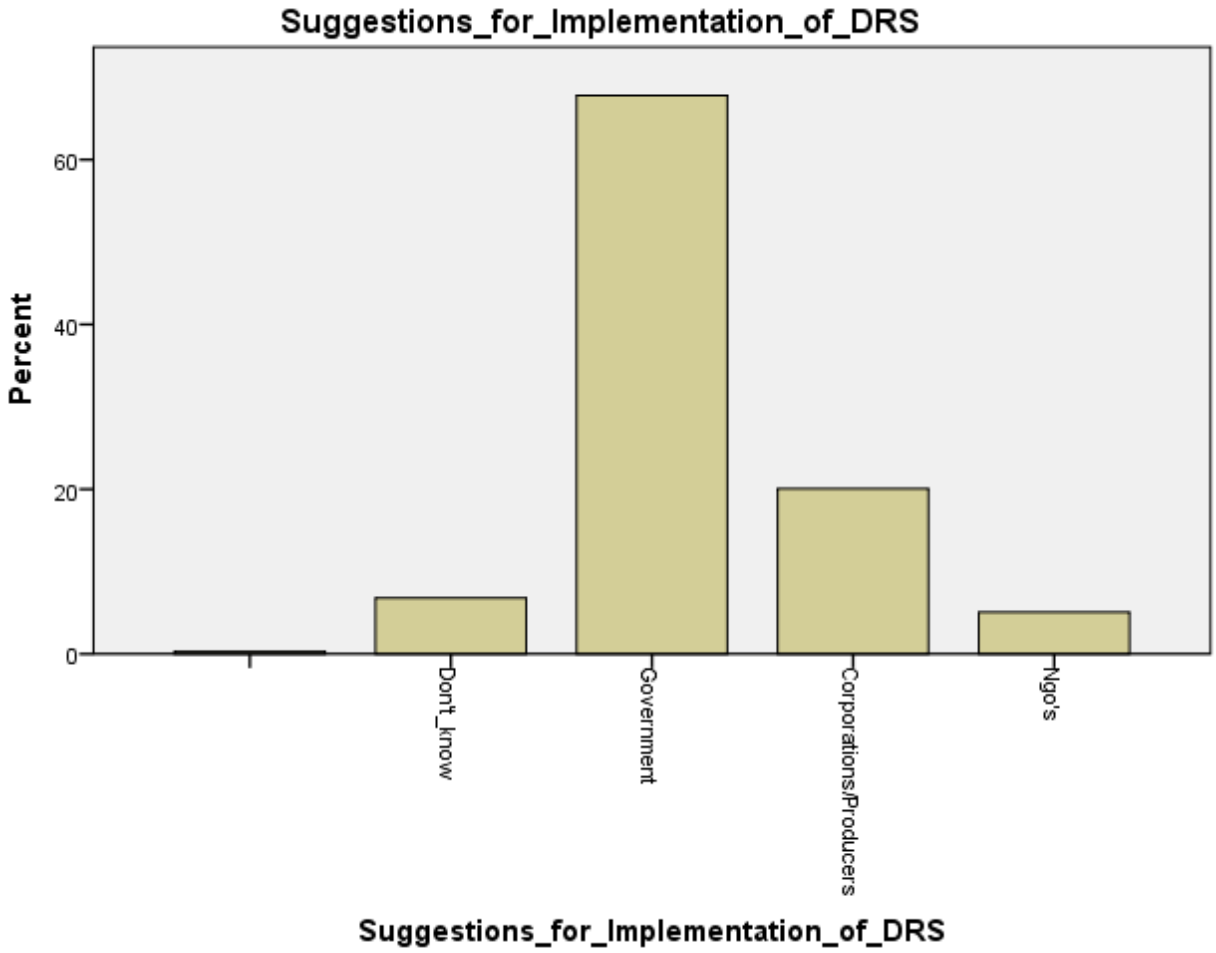

Figure 16: Consumer suggestions for the implementation of deposit refund schemes

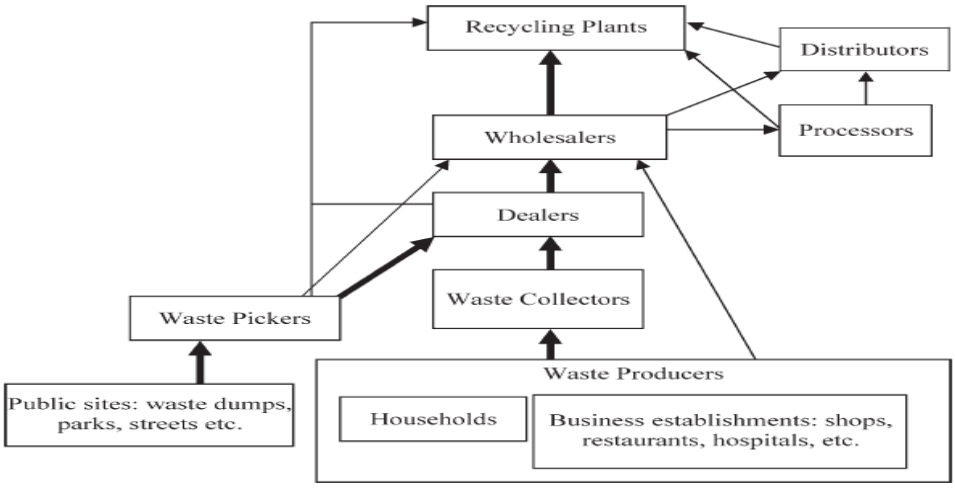

Figure 17: Flow diagram of the waste generation, collection and selling in the informal setup

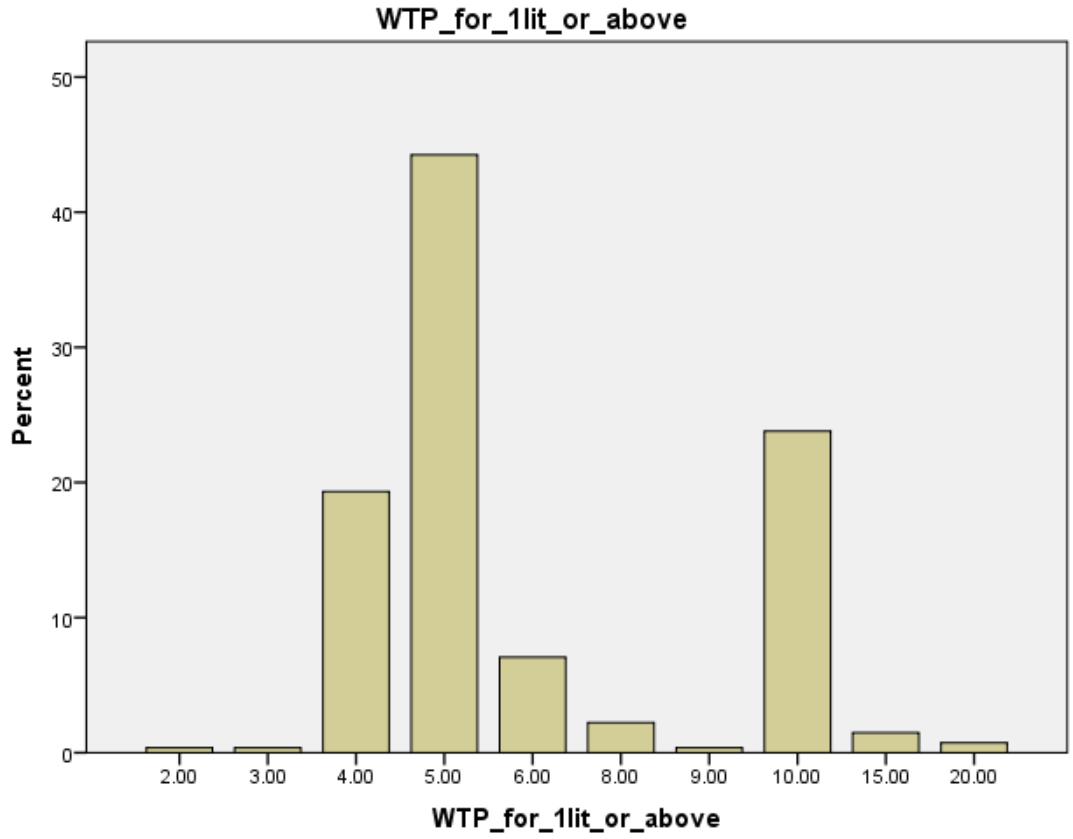

Figure 18: Respondents WTP for one Liter bottles (In rupees)

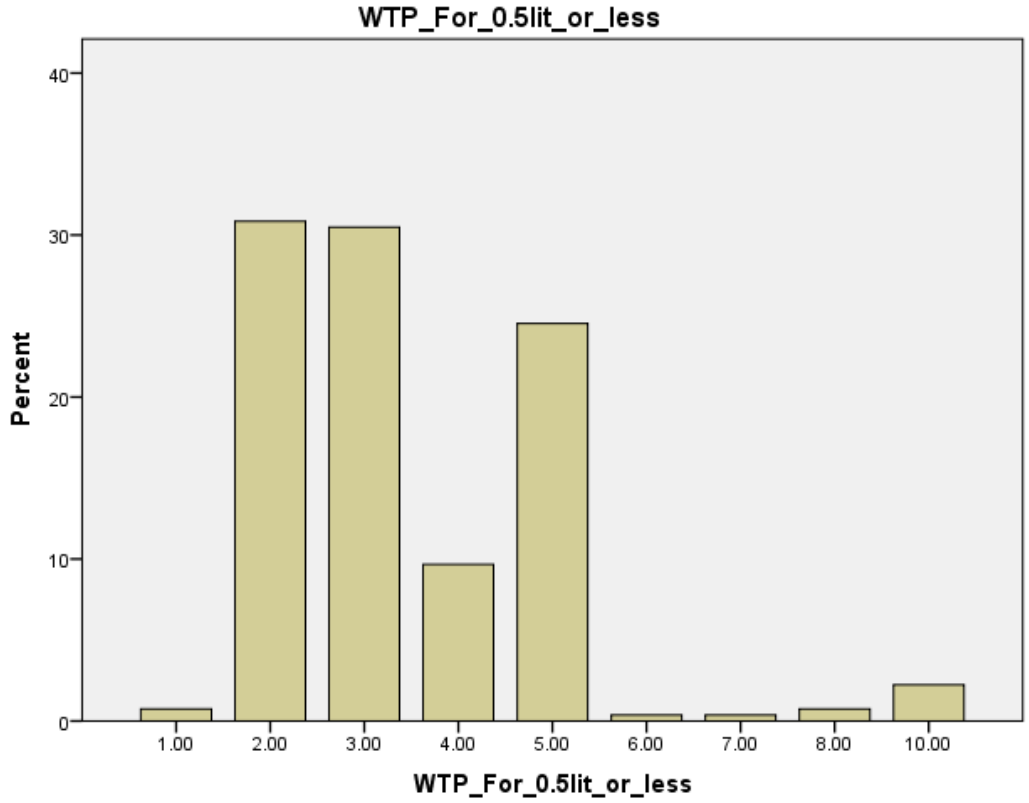

Figure 19: Respondents WTP for 0.5 Lit. bottles (In rupees)

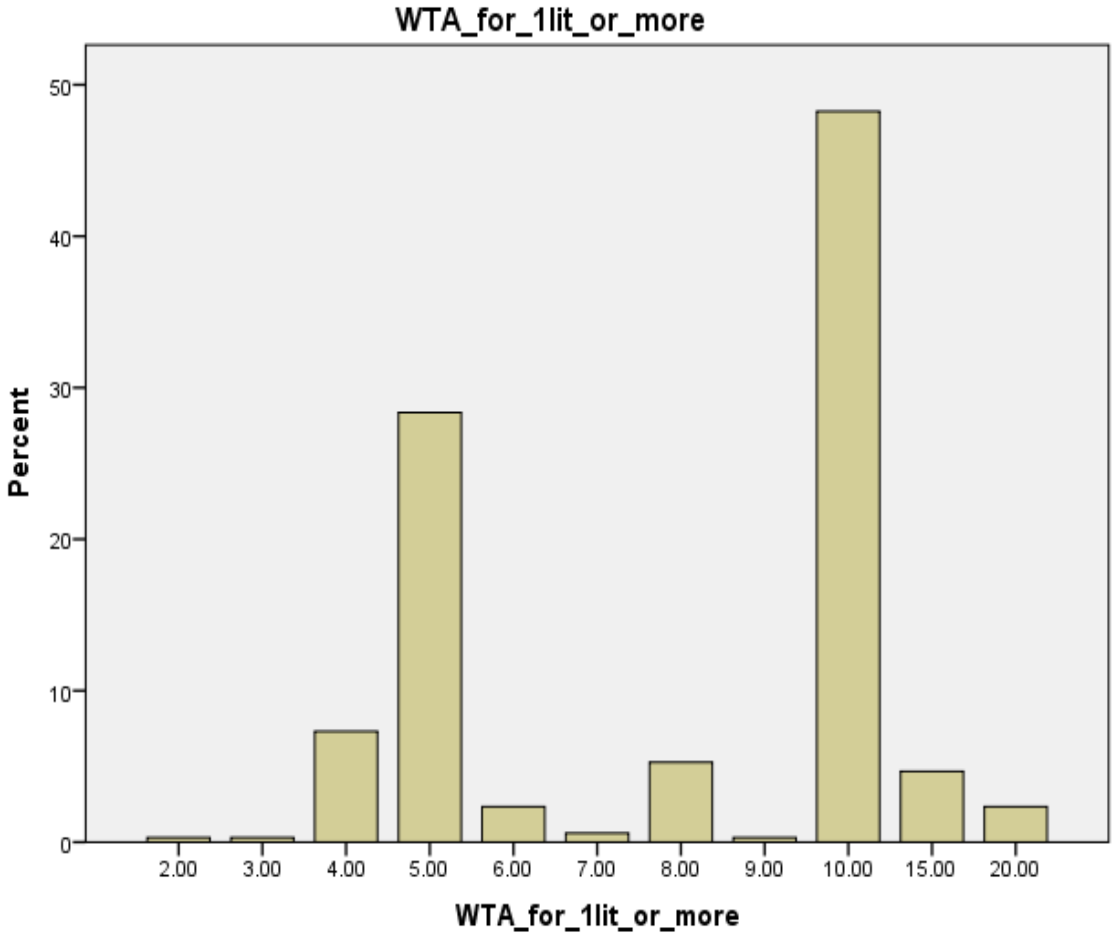

Figure 20: Respondents WTA for one Liter bottles (In rupees)

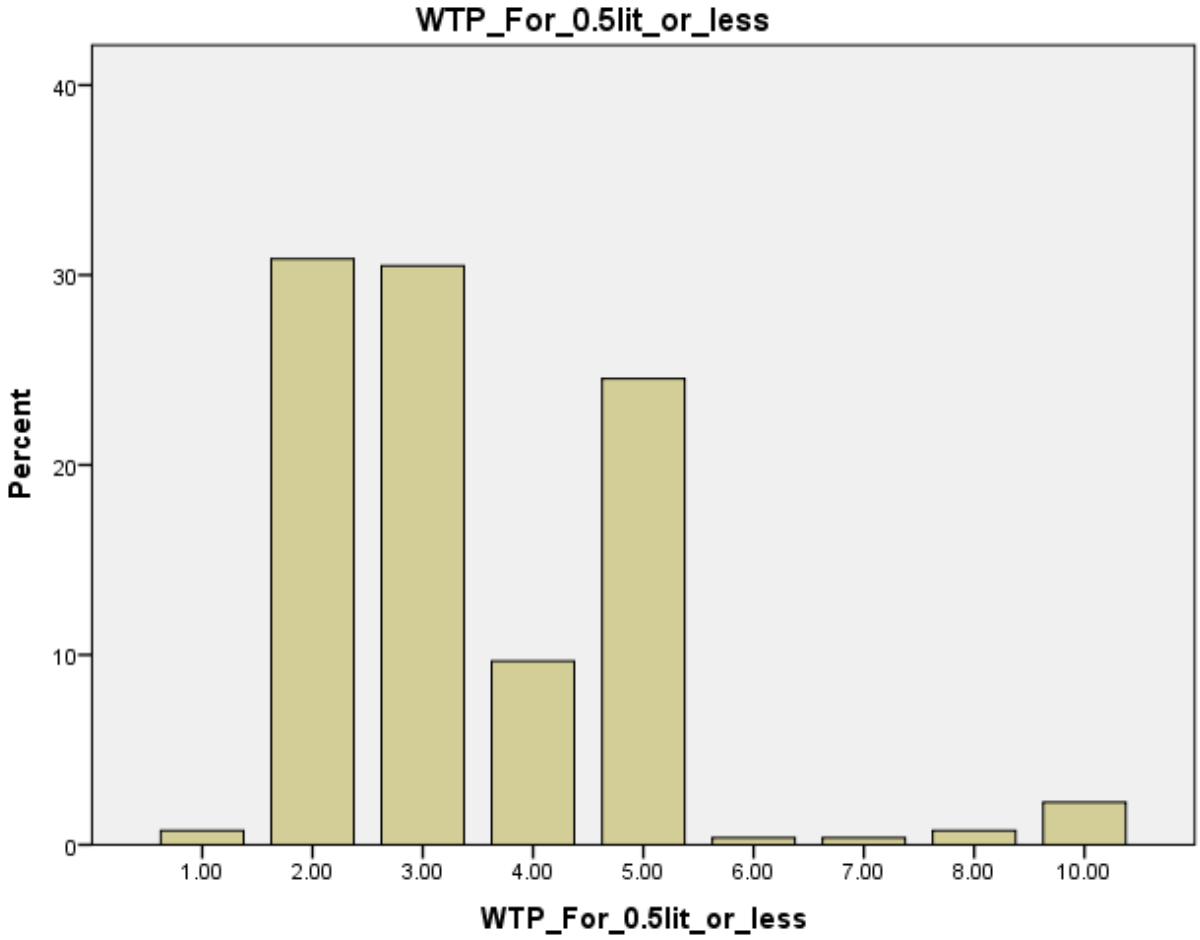

Figure 21: Respondents WTA for half liter plastic bottles (In rupees)

Appendix 3

Questionnaire

QUESTIONNAIRE

Acknowledgement: I am a student of M.Phil. Environmental Economics at PIDE, Islamabad. I am doing my research on '**Pre-valuation of Deposit Refund Scheme for proper disposal of plastic bottles: A case study of Islamabad**'. All the data and information to be collected will be treated confidentially and it will not be revealed to any individual or organization. Your cooperation in this survey by providing accurate information is highly appreciated and duly acknowledged.

Regards : Tabish Ayaz

Email: tabishayaz1994@gmail.com

Demographic Section

Name: _____ Area: _____

Gender: _____ Household Size: _____

Age (In years): _____

Education (years of schooling): _____

Profession/Occupation: mark any one out of the following categories.

	Disable
	Student
	Govt. Servant
	Self-employed
	Retired
	Others (Please Specify)

Income/month (Rs): _____

Awareness Section

1. Do you know about the general plastic waste ?
   ☐ Yes ☐ No

2. Do you know about PET bottles (Mineral water and soft-drink bottles) waste?
   ☐ Yes ☐ No

3. Do you know that PET bottles (Mineral water and soft-drink bottles) waste have negative impacts on environment ?
   ☐ Yes ☐ No

4. Do you know that PET bottles can be recycled ?
   ☐ Yes ☐ No

5. Do you know that more than half of the PET bottles are not recycled, and is end as a part of municipal solid waste in landfills, open dumping or
   burning?
   ☐ Yes ☐ No

6. Are you aware of the harmful impacts of plastics on health and environment ?
   ☐ Yes ☐ No

7. If 'Yes' then which type ?
   ……...
   …….

Consumers use of bottles and disposal scenario

8. How much do you purchase the mineral water and soft drink bottles in a week?
   ☐ 1-2 ☐ 2-3 ☐ 3-4 ☐ 4-5 ☐ above 5

9. On what occasions do you purchase the MW and SD bottles more frequently?
   ☐ Not specific
   ☐ Shopping
   ☐ Exercise/playing

☐ Family/friends GTG

☐ if any other (please specify)

……

10. Do you reuse plastic bottles ?

☐ Yes

☐ No

11. After using the MW and SD bottles, what do you do with the bottles?

☐ Throwing them into the roadside litter

☐ Storing it at home and selling it later to waste buyers.

☐ Reusing them and finally selling them to waste buyers

☐ Bringing bottles to small community waste-buying depots

☐ If any other 'Please Specify'

……..

12. What is your priority product choice among the following MW and SD bottles ?

☐ Plastic bottles

☐ Glass bottles

☐ Aluminium cans

13. How do you think we can influence people to recycle?

Please state _____

_____

Willingness to pay/accept (WTP/WTA) Section

[Through various research, it has been found that in developing countries, due to lack of infrastructure and legislation, more than half of the PET bottles share their fate at

landfills, open dumping or burning, which in turn poses serious threat to the environment. Current study is to propose a hypothetical market model in which Consumers are asked for their willingness in paying/receiving certain amount of refundable money to the market suppliers of plastic bottles.]

14. Would you be willing to pay certain amount of money to plastic bottles supplier in the market?

☐ Yes ☐ No

15. If 'Yes' then how much you can afford to pay an extra amount of refundable money per container?

Rupees	Container capacity
	0.5 lit or less
	1 lit or more

16. If 'No'

What are the reasons?

☐ Don't Know

☐ No time for returning the container to the retailer

☐ Government responsibility

☐ Manufacturers/suppliers responsibility

☐ 'others' (Specify please)

☐ No

17. Would you be willing to accept money on the return of container to the store?

☐ Yes ☐ No

18. If 'Yes' then how much amount you are willing to accept on the return of container to the supplier?

Rupees	Container capacity
	0.5 lit or less
	1 lit or more

19. if 'No' What are the reasons? _____

_____

20. What are your suggestions that by whom this kind of deposit refund programme be implemented by?

- ☐ Don't know
- ☐ Government
- ☐ Corporations/producers
- ☐ Non-governmental organizations (NGO's)
- ☐ others (please specify)

Thank you for your time and participation in this survey.