GERMAN - MONGOLIAN INSTITUTE FOR RESOURCES AND TECHNOLOGY

The present work was submitted to the Faculty of Engineering

Perspective of reusing glass bottles: experience of some selected countries and behavior of end-users in Mongolia

Bachelor Thesis

by

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Ulaanbaatar 05/16/2022

Statutory Declaration

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I hereby affirm in lieu of an oath that I provided the submitted bachelor thesis

Reusing glass bottles in Mongolia as seen from the perspective of end-users

I did not use any sources other than those stated. In case that the work is additionally submitted on a data medium, I declare that the written and the electronic form are completely identical. The work was not submitted in the same or similar form to any examination authority.

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Abstract

In this paper, the living condition of Mongolian cities has faced air, waste, and water pollution due to human-induced activities as well as, economics. From the statistics, Mongolia imported 33 million USD number of glass-made products from other countries. Thus, this research aims to decrease the price of imported glass-made packages by reusing and recycling them in the country. For this purpose, this thesis work is structured with finding out the attitude of reusing and collecting the beverage packages, also finding out alternative packages to replace glass bottles. The method to determine the current problem, effective ways are researching existing as well as efficient systems of other countries and conducting consumers' behavior surveys. Baltic states' deposit return method and Namibian solid waste managements are suitable methods that may assist Mongolians to adopt waste management systems from other developing countries.

Acknowledgement

First and foremost, I want to express my gratitude to the entire research project team at the German-Mongolian Institute for Resources and Technology for their unwavering support over the months.

In addition, I'd like to express my gratitude to Prof.Dr. Enkhzaya Chuluunbaatar and Mrs. Nasanbayar Batsaikhan, my thesis supervisors, for their advice and wisdom throughout my research.

Finally, I am grateful to my family, friends, and fellow students for their support and encouragement during my bachelor's degree.

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List of Abbreviations

APU	Absolute, Pure and Unique
SRMCC	Secondary Raw Material Collection Center
MBC	Mongolian Beverage Corporation
CEO	Chief Executive Officer
USAD	Užstato Sistemos Administratorius
UB	Ulaanbaatar
DRS	Deposit Return System
RVM	Reverse Vending Machine
LLC	Limited Liability Company
IT	Information Technology
LSC	Landscaping Service Company

1. Introduction

With the development of industrialization various waste materials were formed, we have to pay attention to the waste materials that will influence our future in at least two ways: it is polluting our nature and affects the product price.

Additionally, in Mongolia, we have been faced with some urgent problems during the Covid-19 pandemic - a shortage of glass bottles for the reason of border closure between Mongolia and China. We have been using imported glass bottles like paper cups and the amount of money we allocate to buy glass bottles is high up to the present time. According to the Mongolian database website 1212.mn and also news website gogo.mn [2], in Mongolia, there are 118 million glass-made products yearly and Mongolian beverage manufacturers pay at least 33 Mio USD yearly to buy glass bottles from China.

We do not have any recycling and sterilization system to re-use those glass bottles meaning that we “buy” waste for at least 33 Mio USD.

Because of that, this thesis aims at finding out consumers’ perspectives on returning glass bottles in order to develop suggestions for glass bottles' reverse logistics. For this purpose, it will answer the following questions:

1. What is the current behavior of end users/consumers towards returning glass bottles? How can we influence the behavior of consumers to return the used glass bottles? (Such as supermarkets, wholesalers, and collecting places)

2. Is there any alternative packaging for glass bottles from the perspective of end consumers? If and to what extent would end consumers accept any alternative packaging other than glass bottles? If and how can an alternative packaging be introduced in Mongolia?

In order to answer these questions, this thesis:

- Provides an overview of glass packaging in Mongolia

- Designs and conducts a consumers’ survey which will among others look at:

    - The current state of knowledge of consumers about glass packaging

    - The present situation of glass bottles

    - How often and how much do they use glass packaging

- What kind of incentives do they need when they return their used empty glass bottles?
- Are there any issues to return the glass bottles to secondary raw material collection centers, supermarkets, and wholesalers?
- Any other suggestions about returning their empty glass bottles to

  easily

- Analyze the survey results and suggest a way to return used glass bottles
- Conclude and recommend further research

1.1. Methodology

As far as the survey is concerned, this work applies a mixed method to collect the consumers about their perspectives on reusing glass bottles. Mixed-method means a mix of qualitative and quantitative methods. Quantitative research methodology gathering numerical data to realize how much of them wants this kind of change and it requires a short time to gather. Most importantly qualitative methodology creates data about their behavior, opinion, and experience but it requires much more time to collect their thoughts. This thesis indicates to consumers what they want and their thoughts, ideas about returning the bottles for the purpose of reusing the glass bottles, and also how many of them want and support this ongoing project. The method of collecting the survey is questionnaires, interviews, and also using focused group discussion to collect what they really want. Also, this thesis work mostly uses qualitative methods, for the reason that researching consumers' behavior and their thoughts about packaging wastes.

In addition, due to the responses of the survey participants tend to avoid answering some questions about their usage of alcohol, using the concept map methodology is to know the truth of their intentions. During the questionnaire, interviews, and also focused group discussion they prevent telling their true feelings which means they lie and hide. This methodology’s purpose is to know what they really thought and committed. All those methods are going to process what kind of perspectives they have based on how to develop the glass bottles’ reverse logistics, and what kind of strategy to implement. This thesis work research is based on qualitative and quantitative methodology.

Survey method will be based on paper questionnaire and interview questionnaire. In order to, collect important data to arise or set a system to utilizing Mongolian condition related to the behavior of the end-users.

2. State of the art

2.1. History and origins of reusing glass bottles

Compared to plastic bottles, the glass bottle is more durable, long-lasting, and corrosion resistant, moreover, glass bottles utilizing time is incomparable to plastic bottles. Safety of glass containers are made from non-toxic raw materials such as silica, sand, soda ash, limestone, and recycled glass, additionally, the chemical interaction rate of producing glass bottles is almost zero and it is the only packaging material that has been certified “Generally Regarded As Safe” by Food and Drug Administration.

Figure 1. Glass production process

Ages ago, in the 1800s glass bottles were quite expensive, the reason that they were handmade. There was a common phenomenon for people to return their glass containers after they used them. In the 1920s the soda industry offered approximately 2 cents for consumers’ returned glass bottles and it was the origin of the modern deposit system. During the beginning of World War 2, there were material shortages hence, this scarcity was huge support for these programs grew even further.

Most of the packaging collection systems were collected with an integrated trash container that is usually displayed at waste dumpsites or collection points in different public areas. In this collection system, consumers have participated with the system mainly on a voluntary basis, they throw collect packages to collection points, or integrated bins themselves. The success rate of this

depends on consumers' environmental awareness, volunteer work, and local governments ordering companies to do volunteer work related to social responsibility.

2.2. Current Situation in Mongolia

Mongolia has 1.564 million square kilometers of area and 3.278 million people. The capital city of Mongolia is Ulaanbaatar which has 1.615 million people who live there. This statistic shows that half the population of Mongolians live in their capital city and waste pollution is one of the biggest problems in this city.

During the COVID-19 situation in 2020, the border closure of neighbors affected beverage industries. Because of the pandemic, Mongolian beverage industries faced a lack of glass bottles. Glass-made products, packages such as glass bottles, windows, and souvenirs are all imported from China, Russia, and France, and also costs 33 million US dollars yearly.

Recycling and reusing beverage packages are hard to collect, the reason why is that inhabitants do not dispose of their waste in separate bins and most of the wastes are disposed into landfills of Ulaanbaatar named “Narangiin enger”, “Tsagaan Davaa", “Moringiin Davaa”. Also, there is no sustainable collection system for beverage packages from end consumers. However, beverage producers such as APU (Absolute, Pure and Unique), Gem international, Arvain Undes beverage, Ulemj organic, and Gazar shim, which produce products packaged with glass containers collect their products packages and reuse them by themselves for their own method.

2.2.1. APU returnable glass bottles

APU (Absolute, Pure, and Unique) is one of the monopoly beverages companies in Mongolia.

APU imports new glass bottles from China, Russia, and France. According to the pandemic, APU focused on collecting their glass bottles and creating habits for consumers.

The main goal is to set a habit to return glass bottles to supermarkets for consumers. There are three channels of distribution which are “Ulaanbaatar on” channels including bars, karaoke, and restaurants, “Ulaanbaatar off” channels are supermarkets, and retail shops, and “Region” channels mean who buy from APU and sell the product to their province or countryside. APU organizes a campaign named “Let’s revive glass bottles” from February to March 2021. This project aims to collect 2 million glass bottles but they collected a million glass bottles for 132 million MNT which is the return rate of glass bottles is 48 percent.

Their collection system uses a delivery man to buy the returnable glass bottles from supermarkets, stores, and Secondary Raw Material Collection Center (SRMCC). In October 2021 returnable glass bottle prices were 60 MNT per beer bottle, 80 MNT per Vodka bottle, and 500

MNT for a vodka bottle named Eden. According to the campaign named “Let’s revive glass bottles” the collection rate of returnable glass bottles they have decided to increase the price of bottles to motivate consumers and retailers to activate them. On the 17th of November, the price increased to 100 MNT per beer bottle, 200 MNT per vodka bottle, and 400 MNT per Eden bottle.

Figure 2. Current consumer price

The beverage company does not collect all beverage packages, most of the acceptable glass bottles are vodkas and beers. They are named Borgio beer, Sengur beer, Seruun beer, Niislel beer, Tiger beer, Kaltenberg beer, Altangobi beer, Kharaa vodka, and Yrool vodka, Taiga vodka, Arkhi X vodka, Arkhi silver vodka, Arkhi copper vodka, Eden vodka, etc.

Figure 3. Second raw materials collection center

One delivery team has 3 people, two of them are loaders, one of them drives their delivery car, and the other one is to do accounting and money transfer which means APU buys their glass bottles from retailers and secondary raw material collection centers. The company hires 15 people with 6 trucks to collect glass bottle packages from SRMCC, briquette places, and individuals.

The truck capacity has 170 plastic crates which transport 3400 glass bottles. Also, one secondary raw material collection center mostly filled the truck with glass bottles which means one SRMCC has enough potential to give 3400 glass bottles in one cycle. But in collecting glass bottles three different supermarkets and retailers fill the truck. The reason why Mongolian most supermarkets and stores do not have enough space to accumulate huge amounts of glass bottles.

Figure 4. APU's collection site at Bayan Gol district

The collection of returnable glass bottles system uses not only delivery men. Another way is using a collection center from APU and it is only available in the Bayan Gol District of Ulaanbaatar the capital city of Mongolia which has the smallest area and a high quantity of population.

Before the collected reusable glass bottles were warehoused in 4 locations.

- MBC warehouse located at Amgalan, Bayanzurkh district
- “Logistic” fully automated warehouse located the nearby Gobi, Khan-Uul district
- Khan-Uul delivery warehouse at APU main building.
- APU-2 warehouse where receives dirty bottles at APU main building

The collected glass bottles were sent to “DEPOD” which sorted the received glass bottles and was owned by “Eco-evolution” LLC. Sorted beverage bottles go to the sterilization department in APU company located in 19th khoroolol, Khan-Uul district. The glass bottles are carefully observed and sent to a sterilization machine. “DEPOD” is not only a sterilization company but also a Mongolian Beverage Corporation (MBC) fully automated sterilization machine for beer bottles located in Bayanzurkh district in Ulaanbaatar and “Tumenzeerd” company who sterilizes recyclable glass bottles located in Selenge province, Dzuunkharaa soum. “Tumenzeerd” company collects reusable glass bottles named Kharaa from Ulaanbaatar and the region's SRMCC, and transport them to Dzuunkharaa, Selenge province.

2.2.2. “Ulemj organic” returnable glass bottles

“Ulemj organic” Co. Ltd is a dairy company established in 2011 and one year later, the company began to reuse its glass bottles. There are overall 36 retail shops that organize to collect glass bottles at the cashier in Ulaanbaatar city. Collection retail points are Nomin (16 chains), Efes (5 chains), Gachuurt (10 chains), Good price (3 chains), Saruul market, and Bosa.

About the APU company, their consumer price is not dependent on the glass bottle size but “Ulemj organic” is different; their consumer price of glass bottles is related to the size of the bottle. Consumer prices are 100, 200, and 400 MNT regarding glass bottle sizes. Of all of the bottles 60 percent were returned and 30 to 40 percent are qualified to be reused. The standard of quality inspection must be no scratch, have a lid, and no other liquids.

Transportation of “Ulemj organic” glass bottles activity takes place twice a month, related to the number of returnable, then collected on their own to their production building. The sterilization process begins with washing glass bottles manually with soap and water. After the washing process, the company has an automated machine to wash again and sterilize.

Figure 5. Ulemj Organic's collection process and products

2.2.3. ‘Gazar shim” LLC

In 1999, "Gazar shim" was founded. By that time, the CEO had collected 10,000 bottles from the garbage in order to launch a company that makes pickled veggies and salads. He also paid 20, 30 MNT for glasses from rubbish pickers. He sold 20,000 pickled vegetables and salads, which encouraged him to keep going. He gathered 100,000 bottles from garbage throughout the winter because it was a seasonal business during the summer and autumn. Purchasing veggies from farmers in the countryside, such as cucumbers from Darkhan city. The procedure of collecting bottles lasted 5-6 years. Consumers sell used glass to secondary raw material collecting centers for 20 MNT, which the corporation resells for 50 MNT. Even though imported glasses are more expensive than used glass, Gazar shim favored them because of the extra procedures involved in collecting dirty-smelling glass, locating the proper sizes, evaluating cracks, breaks, scratches, washing dried product residues, fungus, and sanitizing them. For example, a 500 ml glass comes in three different shapes, imported from Vietnam, and Germany. One person has been in charge of collecting, washing, and delivering glasses to the company. For roughly 40, 50 million MNT, the company erected a little washing house for him three or four years ago. There are 4,5 persons washing glasses there. In terms of money, import glass costs roughly 400 MNT, whereas sterilized glass costs around 250 MNT.

Figure 6. Gazar shim products

The company currently employs 170-180 people and uses 10% of old glasses out of total glasses; this percentage will be enhanced. Because Mongolia has numerous pickled vegetable glass users, including individuals, small workshops, Vidan, and Bagro companies, collecting glasses at a low cost is competitive. At the same price as UB city, the company delivers to the countryside (province center) and collects used glasses in sacks. However, the company's glasses can be used again at home. When compared to APU products, the usage sequence of "Gazar shim" items is low. The company does not reuse caps, but if the customer provides one, it will suffice to keep the edge screw from breaking. Customers and consumers were suggested to be given crates on condition. They must pay if they do not return the cartons within a particular time frame. If they have crates, they will collect them and bring them to retailers because they will not make a lot of noise. If a system for collecting all sorts of glass is created, the company will join the system. It does not necessitate government policy. Producers and consumers must benefit from the system. It is inefficient to give things as a bonus to those who bring glasses. Giving money is the most effective method. In any case, the corporation will not pay more for used glass than it would for imported glass.

2.2.4. “New Glass” LLC

"New Glass" LLC, founded in 2018, is a glass recycling company. At the end of June 2021, we began collecting and storing stages in order to produce foam glass insulation out of granulated glass. When people call them, they will come to a location with their own truck and pick it up for free. Except for windshield and screen glass, people are given glasses even if they are shattered. They offer reusable glasses to relevant companies if they collect them. In August 2021, the company agreed to receive one-way bottle, unqualified, and non-reusable glasses from APU.

2.3. Current Challenge

During the Soviet occupation, Russians set our base of settled citizenship and infrastructure of our cities. Moreover, production was developed systematically, well-structured, and influenced citizens' behavior as well as attitude to take care of the environment but after the socialism, this settled behavior began to be lost little by little. Currently, Mongolia is faced with a huge problem with all kinds of pollution, one of them is waste pollution, and also economically we did not use our natural resources efficiently. One of them is glass bottle production and there were not any producers except “New Glass” LLC which is founded lately and has not covered a wide range yet.

Secondly, Mongolia has a waste packaging law related to this thesis work. Such as,

- Article 5: Right to own waste.
- Article 10: Rights and responsibilities of citizens, business entities, and organizations regarding waste.
- Article 14: Cleaning, collection, and transportation of ordinary waste.

According to article 10, citizens, business entities and organizations will be in charge of managing waste. Which follows, separate ordinary waste in accordance with the procedure set forth in Article 9.1.3 of this law; have a garbage bin that meets the requirements set forth in Article 15 of this law; business entities and organizations shall conclude waste transportation service contracts with citizens, business entities, and organizations authorized to collect and transport waste; Dispose of waste in designated bins and dumps or transfer to a waste collection authority.

Those articles were well structured and it shows that Mongolia has poor law enforcement. Thus, this indicates the need for improved oversight and enforcement.

Then, beverage companies did not cooperate to reduce, reuse, and recycle their beverage packages, so companies should develop sustainable collection systems based on the consumers.

Finally, citizens of Mongolia lack knowledge about reusing and recycling their ordinary wastes which means the system should pay attention to end-user behavior and attitude. For that reason, parents, and educational institutions should focus on how to teach and install in consciousness their younger generation. Also, the relationship, as well as information flow between consumers and producers, is relatively low.

2.4. The existing system in Baltic states

There is a system named DRS currently working in Baltic states to aim to increase the collection rate of waste packages. Due to this, environmental, air, and soil pollution were decreased in addition, influencing countries' economies. But this traditional system's collection rate was relatively low. Because of this statistic, Baltic states adjust the deposit return system.

Before implementing the DRS, system there is government participation, which is responsible for setting waste management, package act, or law to pressure the industry to deal with social responsibility. The creation of the waste management and packaging act aims for producers and retailers to be in charge of the collection of such packages. Because this system considers retailers as polluters, they help and participate in the collection of empty beverage packages.

A deposit return system (DRS) is a system that motivates consumers with monetary incentives and its stakeholders are producers, importers, retailers, and consumers. In addition, recyclers and logistics companies are playing the main role in this system. It is a buy and sells system responsible for the beverage industry and also importers. The beverage products are on a labeled shelf which means product price plus beverage container price, it sells per product, if you choose two or more products, consumers will pay all products price plus all containers price.

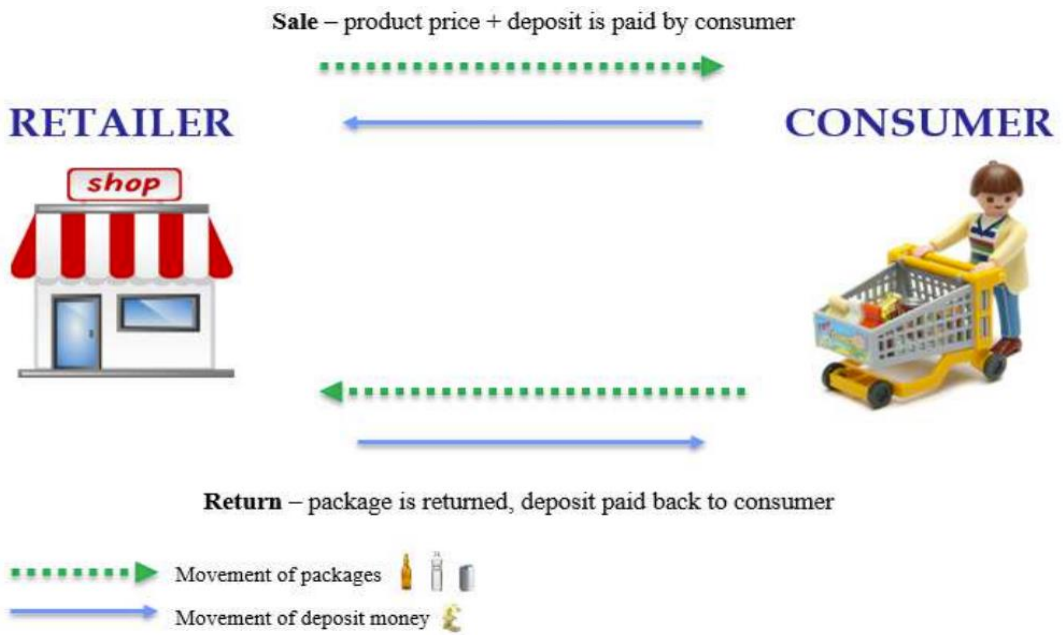

Figure 7. Movement of deposit money and packages

Consumers after purchased beverage products have been consumed, consumers collect their empty packages depending on their available home space, when they get back to the grocery store, they take them to shops or near collection points then return packages prices to grocery

stores' loyalty cards or check. Most of the collection points are near to the stores. When returned money is collected, they could use their deposit to buy or price deducted from purchased products, which means they get their deposited money back. There is an automated collection machine named reverse vending machine (RVM) and it is installed near the retail shop, in the retail shop, or retail shop building.

The producers, importers, and retailers are responsible for the formation of the central DRS organization, investments, system creation, its packages handling center, and package collection infrastructure. DRS has to be as efficient as possible to use minimum cost for the industries and maximum collection rate for retailers.

The money movement logic of the deposit return system starts with producers paying deposit money per package to the central DRS. At the same time, producers put their products to market price with product price plus package price, which means they are not bear the cost of the deposit money. The retailer puts the product on the shelves with the product's price plus the package prices and consumers purchase products. When consumers get back to the market with empty beverage packages to return, then they get their deposit money back. Retailers get the deposit money back from the central DRS organization according to the agreed contract and get a handling fee per package from the central DRS organization. As you can see from the figure below, the money bearer is the central organization.

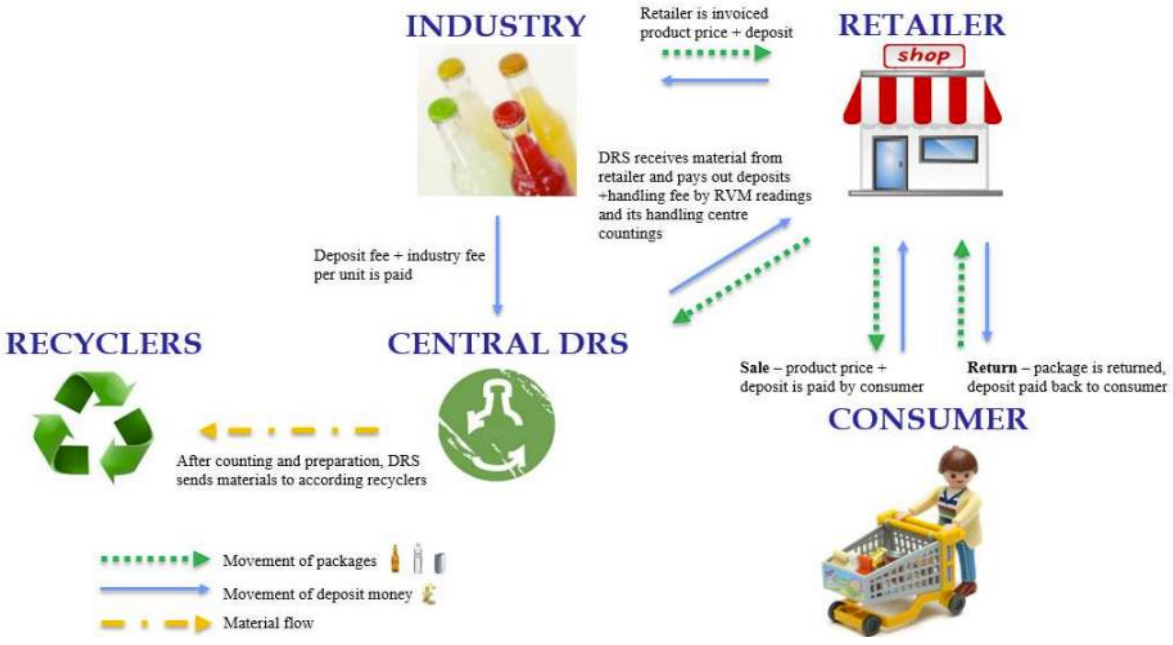

Figure 8. DRS flow chart

However, each country uses a different DRS system and implementation but the principle of DRS is the same around the world. There is an organization named Central DRS for each country and depending on the country they do different roles in packaging reverse logistics and the share of owners of the Central DRS organizations are different. The usage of DRS is different depending on the country's culture and people's attitude towards it. The stakeholders of DRS are industry, retailer, recycler, central DRS also, and consumers. The cooperation of these stakeholders is going to build highly effective results and reverse logistics.

All of the manually and automatically (using the reverse vending machine) collected packages are sent to the central DRS organization handling center for counting, sorting, and preparation for recycling to the recyclers.

2.4.1. Deposit Return System in Estonia

Estonia is one of the Baltic countries and has a 45.338 km square long coastline and a 1.331 million population. It was one of the Soviet occupation countries. There was a problem similar to Mongolia which is waste management to reduce the waste pollution of the country. There is a system that works efficiently in Estonia at the moment.

2.4.1.1. Legislative background and stakeholders

Implementation and creation of a deposit return system in Estonia have several factors to monitor and be successful for the system. In 1994 Estonia create a waste packaging act, a market-driven take back system was hard to control, and monitor the 60 percent recovery target was difficult to monitor and was not reach the consumers who live in rural areas, meaning the system was not cover the countryside, or in remote areas of the city and towns were not able to give empty beverage packages.

In 2004 becoming a member of the EU, the Estonian new Waste Act and Packaging Act was created and its activities in 2005. Consumers of Estonia have a lower focus on environmental-oriented behavior, but there was an experience from Soviet occupation times returning their empty glass bottles and getting paid like a modern deposit system. Also, it affects the modern Deposit Return System's success.

Estonian DRS consists of the Central DRS Organization, Producers, Importers, Retailers Association, and Consumers. Central DRS Organization is named Eesti Pandipakend OÜ, the ownership of the organization is divided equally into 4 parts.

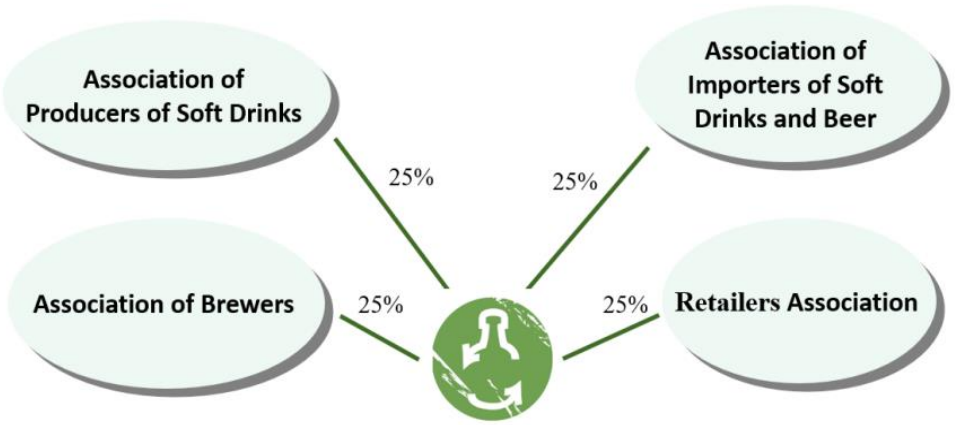

Figure 9. Stakeholders of Estonian central DRS organization

These are the Association of Producers of Soft Drinks, Association of importers of Soft Drinks and Beers, Association of brewers, and Retailers Association. The industries and retailers were invested in the creation of the Central Organization and its package handling center in Estonia. Central DRS organizations' key characteristics are producer responsibility organization, non-profit principle, enforced by a packaging excise tax threat, and controlled at least once per year by the ministry's subordinate unit. Estonian central organization is non-profitable, if profit might be made sometimes, it will not go to the owners, but the profit of the organization invested into system development and stability.

About the packaging act of Estonia is fully exempt from excise duty if:

- ✓ at least 60 per cent of PET and Glass is recovered as of 1 January 2005
- ✓ at least 63 per cent of PET and Glass is recovered as of 1 January 2006
- ✓ at least 65 per cent of PET and Glass is recovered as of 1 January 2007
- ✓ at least 70 per cent of PET and Glass is recovered as of 1 January 2008
- ✓ at least 75 per cent of PET and Glass is recovered as of 1 January 2009
- ✓ at least 85 per cent of PET and Glass is recovered as of 1 January 2012

Figure 10. Tax credit of PET and Glass

2.4.1.2. System coverage, the deposit value

The producers or industrial associations are invested in the formation of a central DRS organization, and retailers are invested in packaging collection infrastructure. The beverage producers are respectable for investment and creation of the central deposit return systems organization and there is no alternative participation needed.

The Government of Estonia sees retailers as polluters which means they are responsible for the collection of packaging waste. There should be some regulation in the Packaging Act as follows:

- If the retailer's trading building size is less than 20 square meters and it is located in a densely populated area, they are not allowed to return the packaging.
- If the size of the trading area is equal to or greater than 200 square meters, they should organize the packaging collection in their trading area or building.
- If the size of the sales premises of a retailer is less than 200 square meters, sellers may organize the package collection outside the trading building or their place. In densely populated areas with less than 500 residents per square kilometer, there should be one or more collection points allowed.

When a consumer gets their empty beverage packages back to the allowed retail shop, according to the system they take their packages and give a deposit.

There is another way to collect the empty beverage packages using the Reverse Vending Machine (RVM), which collects them automatically.

RVM is an automated kiosk machine that collects empty packages and gives consumers deposits, a reason that is convenient for consumers, a small amount of investment also, and low running costs depending on the shops. RVM is installed in stores, somewhere in shops buildings, and also in parking areas. The RVM owners can be flexible such as owners of shops, staff of shops, and also cleaning and security services, and they can lease and buy them.

Figure 11. Reverse vending machine

Implementing collection waste packages shops are able to receive during their trading time. Estonia collected 80% of all volume of deposit packages compacted in retail shops and in 2018 6% of is the manual collection, the rest of 94% of glass bottles are collected in Reverse Vending machines (RVM).

Currently, there are 340 producers and importers clients with over 10000 various products registered in the central DRS organization. Estonian central DRS is responsible for sorting and categorizing the collected packaging waste and sending it to the recycling and reusing organizations. The deposit amount is defined by law and in 2015 single deposit value is not able to be lower than 0.10 EUR for all materials.

Collection infrastructure is not only the responsibility of retailers, another way is the traditional way that collects municipality from household wastes.

2.4.2. Lithuania, deposit return model

Lithuania has a 65300 km square meter area and a 2,795 million population. In 2013 before using the Deposit Return System, the rate of returning packages was lower than 60 percent which has 53.8% packaging waste collection. After years in 2016, a single-use beverage container deposit-refund system was introduced. The deposit system allows only refillable glass containers used for beer, alcoholic beverages, soft drinks, mineral water, and juice.

2.4.2.1. Legislative background and stakeholders

In 2013, Lithuania implemented the Deposit Return System in refillable glass bottles and in 2016 they introduced single-use beverage containers on DRS. Until then, the deposit was applied only

to refillable glass containers used for beer, alcoholic beverages, soft drinks, mineral water, and juice.

This system is administered by the non-profit organization Užstato Sistemos Administratorius (USAD) which plays a role in the Central organization and manages the deposit system as indicated in the Law on Packaging and Packaging Waste. USAD is created, invested, and managed by the Lithuanian Brewers Association, the Association of Lithuanian Trade Enterprises, and the Lithuanian Natural Mineral Water Manufacturers' Association. Packaging and packaging waste management law obliges the reuse of the reusable packaging to manufacturers and importers. Additionally, USAD is monitored by the Ministry of Environment and has to report organizational, financial, and public information plans of the organization.

Give an explanation of the organization is responsible for managing the system, managing to integrate data of collected packaging materials, reporting, logistics, and sales of the collected materials. A company should spend at least 1 percent of its annual income to educate stakeholders and consumers. The main sources of income are 50 percent of producer fees, 30 percent of raw materials sales, and unredeemed deposits taking up the rest of the percent. Also, there are stakeholders such as retailers, consumers, and Reverse Vending Machine (RVM) providers who are separate from the central organization but work together.

2.4.2.2. System coverage, the deposit value

The retailer's duty is to collect all outgoing packages from consumers and organize the collection of reusable packaging waste and give deposit money to consumers at their trading area, or in its near area and it is not allowed to exceed 150 meters away from the trading point, whether they have sold this beverage or not. Collection systems have some requirements for shops that are not smaller than 300 meters square in one-way packaging and 90 meters square for refillable wastes. If the area of the shop does not exceed 60 square meters are free from collecting waste packages but they can join on a voluntary basis.

Refund of the packages is on flexible terms such as cash, goods, services, or to make donations for customers who give back beverage containers. Also, the handling fee system is the same as the Estonian retailers' handling fee system.

There is an additional stakeholder for the collection system that uses reverse vending machines. RVM, made by an information technology company, provides retailers with those machines and is compensated per collected package fee paid to RVM suppliers named Tomra.

DRS systems deposit money is paid by producers and refillable deposit money retailers bear and later pay to retailers when containers are returned. Retailers handling fees amount is negotiated

between producers and retailers, then paid by the producer to the retailer with deposit money per package. Registration of refillable products is counted when the product enters the market.

Of all the collected packages 89 percent of them are collected by RVM collection points. The deposit return system aims to ensure that 90 percent of beverage packaging would be recycled by 2025 but at the same time, they achieved 74 percent in 2016. In 2017, the purpose of the collection rate of 2025 is already exceeded.

2.4.3. A Latvian packaging waste management system

Latvia has become popular in the recycling industry in the Baltic states. There are 2 large recycling companies Nordic Plast recycling polyethylene, and PET Baltija recycling polyethylene terephthalate, which mostly recycles plastics.

2.4.3.1. Legal framework and stakeholders

Latvian legal framework, driven by European Union legislation. The main laws that are related to waste management are waste management law, pollution law, natural resource tax law, and environmental protection law. All of these laws are directed to prevent, decrease waste generation and recycle the state waste management plan. State waste management plan aims to clean technologies, eco-design labeling of the product, environmental management system, education, information, and increase the rate of collection.

The central authority of waste management is supervised and monitored by the Ministry of Environmental Protection and Regional Development which controls compliance with legal requirements, technical issues, and permissions for waste management activities, but those works are divided into government departments. Most of the wastes go to the landfills and Latvia's total of 13 landfills are located in waste management regions. As mentioned above, landfills are controlled by the region's municipality.

Also, the private sector is involved in municipal waste management and they serve more than 50 percent of the population, the rest of the population is served by municipally-owned waste management companies.

2.4.3.2. Collection infrastructure and information flow

Latvia utilized a separate collection of waste in 2015 for metal, plastic, paper, and glass. But the investment and development of separate collections worked between 2007 and 2013 for sorting facilities. Collections are organized as the door to door or collection points using deposits. There are more than 3200 collection points and 80 facilities where the public can dispose of household waste.

Separated wastes are going to be separated a second time by quality, which means the recycling company sorts sufficient quality material to recycle and lower quality materials are directed to landfills.

Data on the waste generation and movement are collected, monitored, and reported by The Latvian Environment, Geology, and Meteorology Center from waste managers. Reporting of collected data reported to the Eurostat in accordance with EU Regulation on environmental accounting.

2.4.3.3. Deposit-refund system for reusable packaging

Deposit-refund system was introduced in 2004 for reusable beverage packages. When a system works successfully in glass bottles and plastic crates for bottles, the state waste management plan decides it is mandatory and plans to extend it to other types of packaging materials such as plastic and metal beverage packaging. But there are producers that are on the opposite side of the system. However, the deposit-refund system would also be expected to improve the quality of the collected packages, sorting, and separate collection system. Latvia investigated countries that utilized the deposit-refund system for more than ten years such as Estonia [1].

2.5 Solid waste management in Tsumeb, Namibia

Tsumeb is the largest town in the Oshikoto area of northern Namibia, with a population of 15,000 people. Tsumeb is recognized as Namibia's "portal to the north." It's the settlement closest to Etosha National Park. Tsumeb served as Oshikoto's regional capital until 2008 when Omuthiya was designated as a town and the new capital. Tsumeb has its own electoral constituency, with a population of 44,113 people.

Compared to the other countries' waste management systems Namibia utilizes a completely different method. The collection method of Tsumeb which is the largest town in Namibia is simple they do not require consumers and are based on the municipality for the responsible town. The stakeholders divided into three groups.

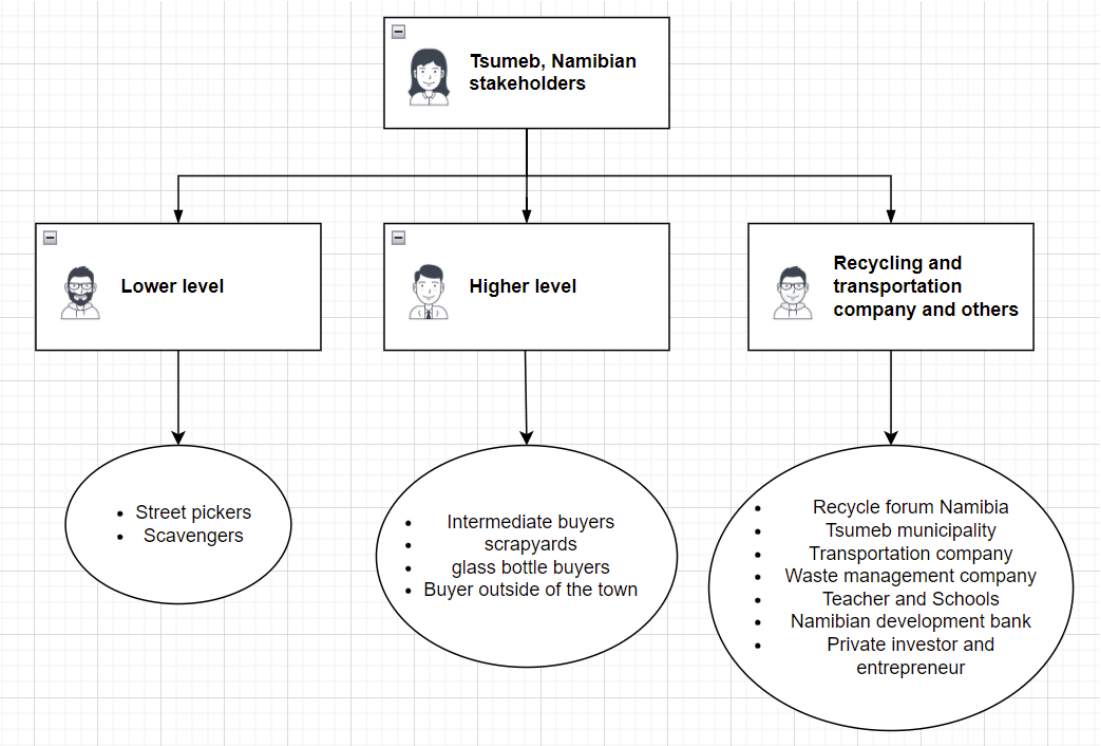

Figure 12. Stakeholders' hierarchy

A lower level of stakeholders is generally not very organized, have low education, street pickers and scavenger do not own any transportation vehicle and recycling is for them a means to own a bit of money to survive. They are vulnerable to the price of recyclable, too bad working environment, and also the limit to be legal when working on a dumpsite.

Higher levels of stakeholders are local authorities, a Namibian waste management company named Enviro-fill that operates in town with its own compactor truck, and Tsumeb waste management company named Eclipse Investment that cleans the outskirts area with a municipal truck.

Figure 13. Map of Tsumeb, Namibia

The system is mainly based on cleaning and collection of solid waste of the town is divided into following different areas and jobs. Refuse removal job collects wastes from town household refusal removal, outskirt named Nomtsoub household refuse removal, and business refuses removal. Street sweeping job cleaning and collecting trash from Nomtsoub area and push-cart and bag remove from the open area.

Accumulated wastes go to the sorting station which samples and sorts the collected trash. After the separation process, recyclable materials send to the recycling company, rest of the wastes directly dumped to the landfill.

3. Survey analysis

The APU company invested in a chess tournament and the survey was conducted during the chess competition on the 29th of January. The survey aims to study glass bottle use and consumer behavior, thoughts, and preferences regarding the collection as well as reuse of glass bottles. The survey was conducted in two methods which are quantitative and qualitative, a questionnaire in which participants choose their own answers called a quantitative survey, and another one is a qualitative survey, an interview way to communicate with consumers and understand what they really thought about glass packages and the collection of glass bottles. According to the participants, the survey was divided into two groups, a paper questionnaire, and an interview questionnaire. The reason why is to avoid misunderstanding questions and being too lazy to answer the questions the interview questionnaire added.

3.1. Quantitative survey

The survey questionnaire has a total of 25 questions and is separated into closed-end questions and open-end questions. A total of 248 participants of the survey are chess tournament competitors, parents of players, organizers, and observers of the competition. As seen from the survey the compilation rate of open-end questions is the low response.

- **Socio-demographic information**

The age group of the survey participants is relatively similar, which shows the trend for all ages. Moreover, most of them are male and a small percentage of females, therefore analyzing the influence of gender as well as age group compared to the behavior of reusing glass bottles.

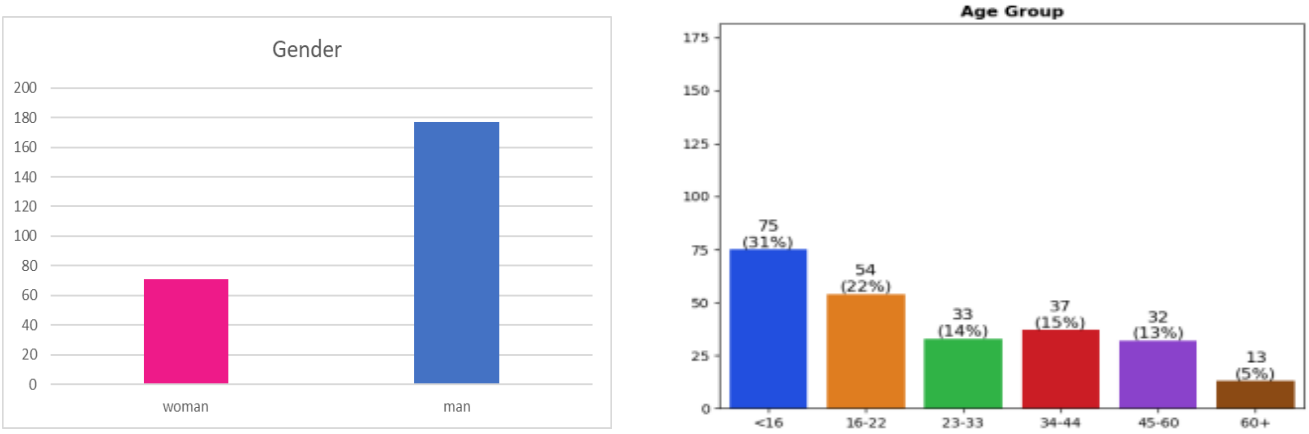

Figure 14. Use of glass bottles and its buying source

- **Use of glass bottles**

As you can see in the chart below, 25% percent of the participants use glass-bottled vodka and beer. On the other hand, the respondents tend to avoid saying their use of beers and vodkas as well as its related information even if it is asked indirectly.

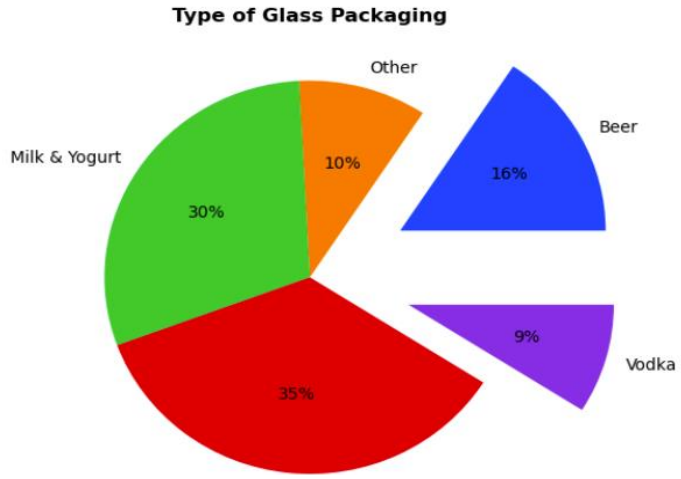

Figure 15. Type of glass packaging

The source of the glass-made beverage products is shown below, statistics indicate that the main buying source is supermarkets, the rest of which are wholesales and neighborhood stores. Also, regarding their age and gender, most of them buy glass packaged beverages in supermarkets. The comparison, as well as influential factors between the source of buying and age group, shows no difference. Not only age groups but also gender does not produce significant results.

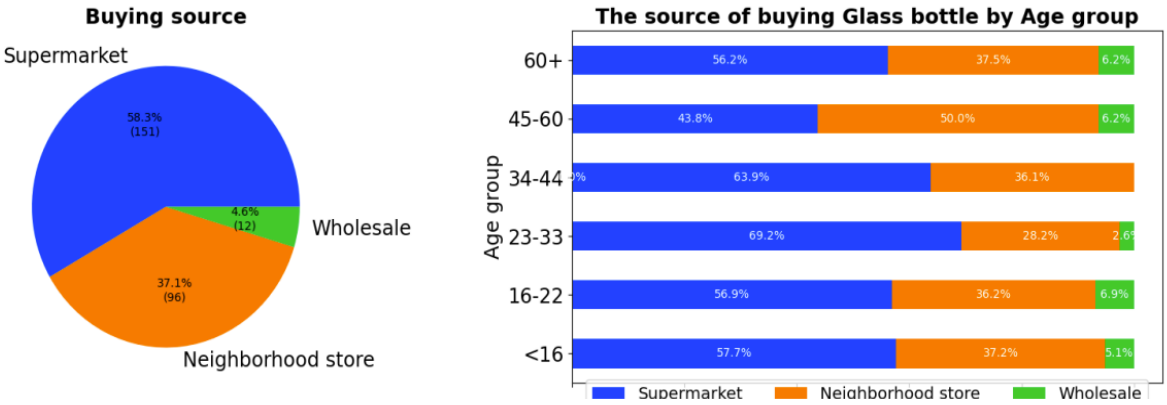

Figure 16. Source of buying compared to age groups

- **Dispose of types**

Most of the respondents stated have directly trashed (64%) the glass bottles in the bin and a small number of people put beverage packages to put separate bin (19.8%), bring to the collection center (8.3%), also gives to those who need it and use themselves (7.9%). The gender survey shows no difference but in the age group, there is a small difference, and participants mostly had beverage packages trashed at once. People who are 16 to 33 years and older than 60 years are more likely to dispose of their glass bottles in separated bins. Except older people who are beyond 60 years are not bringing glass bottles to the collection center.

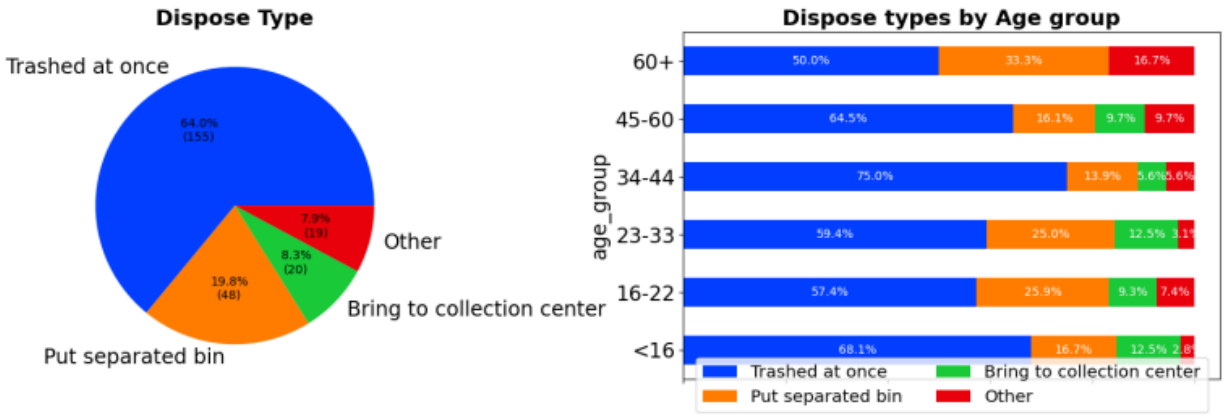

Figure 17. Dispose types by age groups

- **Information on glass bottle recycling and reusing**

Information on glass bottle recycling and reusing, respondents got knowledge of reusing or recycling a glass bottle from social media (38.3%), official websites (6.6%), individuals (8.6%), and other sources (6.2%). According to statistics if age increases following information spread trends decreases.

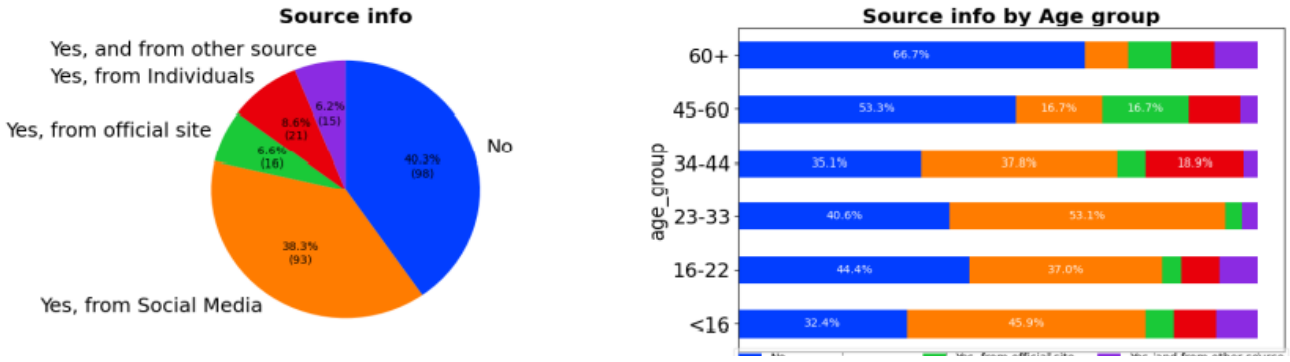

Figure 18. Sources info by age groups

Consideration bringing bottles

Cause to bring beverage packages participants responded mainly to support the project (42.4%), to bring good old habits (16.9%), to save the environment (10.6%), to follow instructions (3.8%), and the rest of the percentage other causes. A huge percentage of responses are to support the ongoing project.

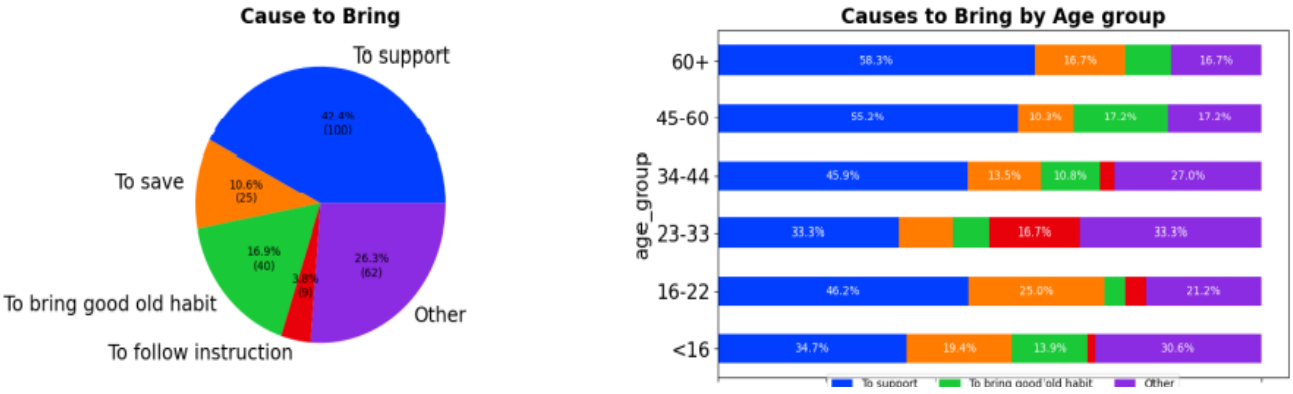

Figure 19. Causes to bring age groups

- **Collection method in order to bring glass bottles**

Participants answered about how to collect the glass bottles in order to bring them. They mainly chose from household (38%), neighborhood, or friends (37%).

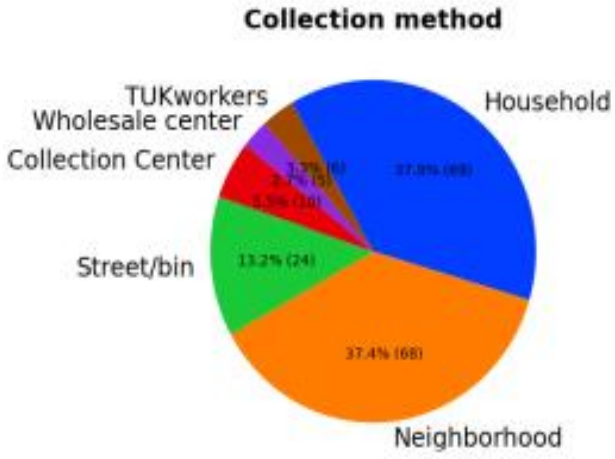

Figure 20. Collection methods

- **Motivation to return empty bottles**

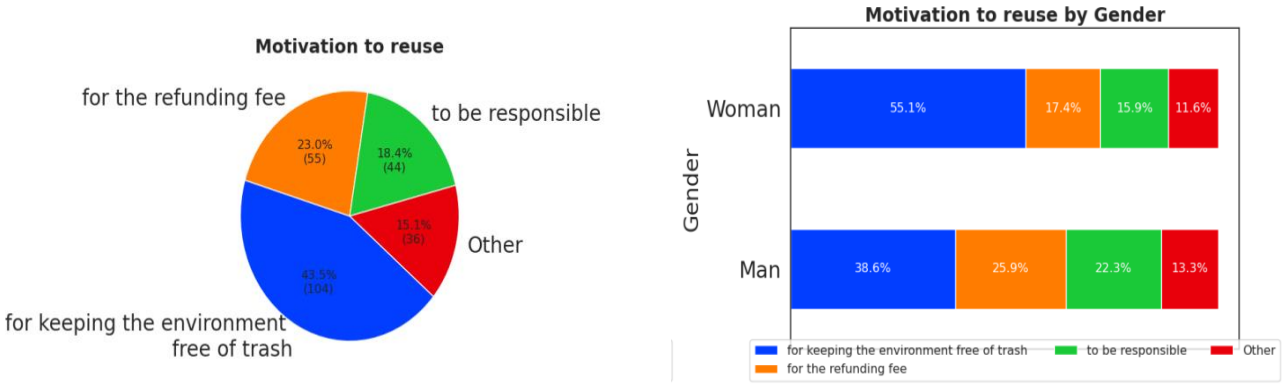

Figure 21. Motivation to reuse by gender

As well as the motivation to reuse beverage packages, 44 percent of participants responded that they are motivated to have a trash-free environment followed by a refunding fee (23%). In gender comparison, women tend to be trash-free for keeping the environment and attach more weight to it. Women are more likely than men to free-trash for keeping the environment to motivate them.

- **Responsibility for collecting empty bottles**

Responsibility of collection of empty bottles, consumers selected those consumers and producer including bottles and importers have to be responsible for collection of empty bottles. Group age between 23-44 saw the most responsibility as producers, retailers and LSC worker's duty.

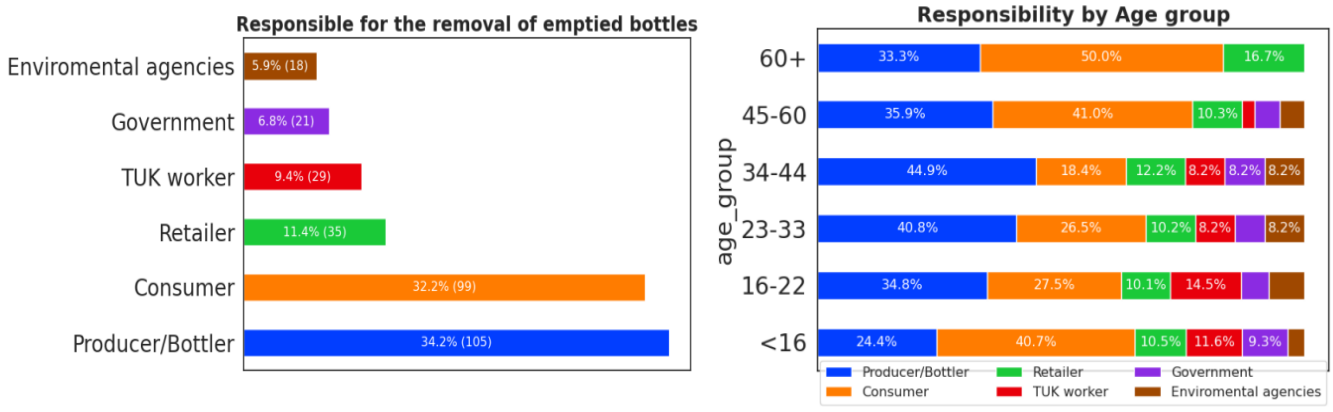

Figure 22. Responsibility by age group

- **Convenient bottle collecting method**

The selected convenient bottle collecting method is returned to retail shops (40.3%) and this is valid for all categories of respondents.

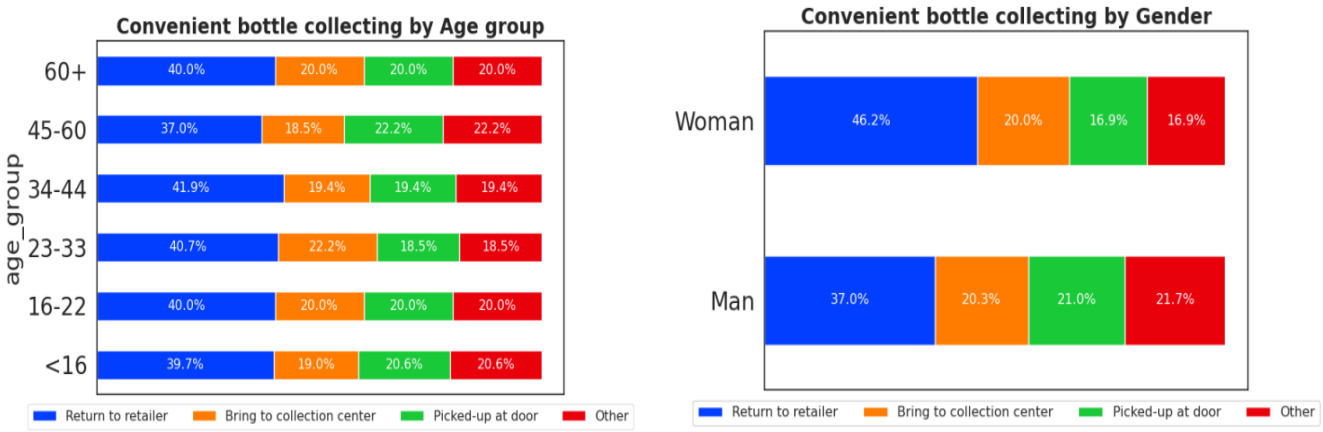

Figure 23. Convenient bottles collecting by gender

- **Refund amount**

A refunding amount of 200 MNT per bottle is generally “OK” for the majority of respondents. The minority of respondents said refunding 200 MNT per bottle was too less, too much, and eventually not even necessary. In addition, a refund of 200 MNT is an acceptable price for end-users. The survey considered the amount per bottle that activates the most of the UB citizens to start collecting, the majority of respondents thought that 300-400 MNT is enough to motivate consumers.

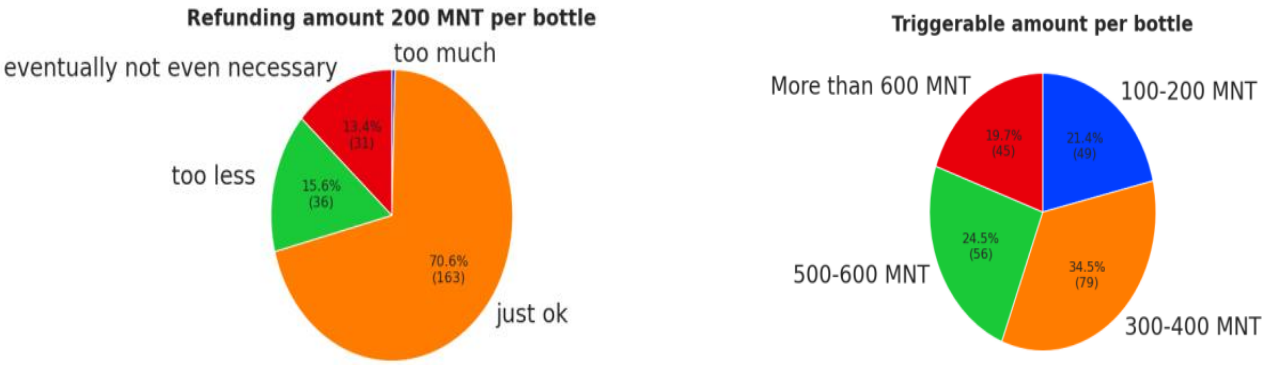

Figure 24. (a) Refunding amount 200MNT per bottle (b) Triggerable amount per bottle

- **Acceptable distance to carry empty bottles**

The following diagram depicts an allowable distance for carrying empty bottles to the designated return location. People are accustomed to a range of up to 600 meters. If their economic level is low, they may be able to accept a greater distance.

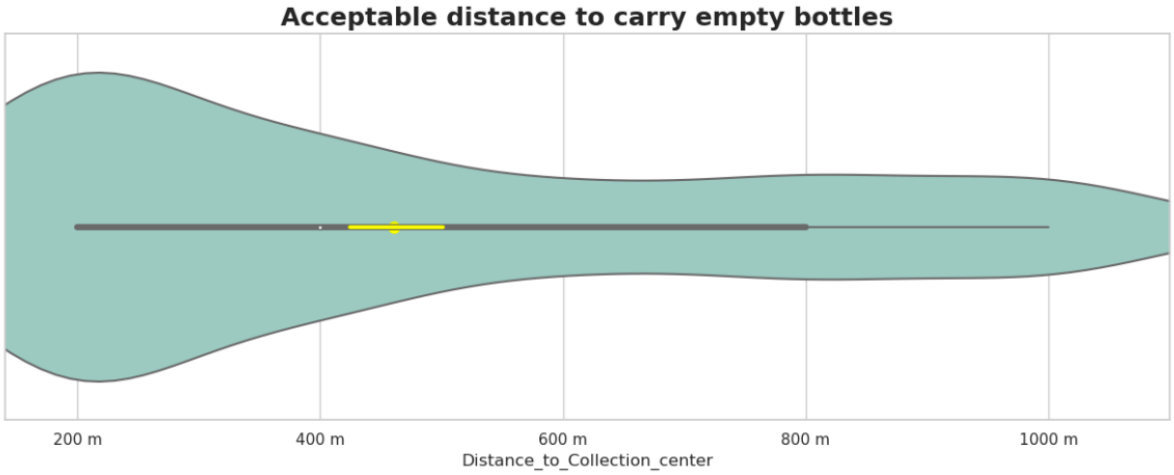

Figure 25. Distance to collection center

3.2. Qualitative survey

According to the respondents' quality, most of them avoided answering the open-ended questions, and also, participants tended to avoid or did not understand the ordering question. Thus, this interview questionnaire helps to take exact and inner thoughts of response to open-ended questions. This survey consists of 18 questions classified into 14 open-ended questions, 3 close-ended, and 1 ordering question.

In total, we have 37 interviews with participants, organizers, and family members of the participants. According to the lack of time, participants in interviews decreased to the targeted numbers. The interview mostly includes all categories of people, who have their own thoughts.

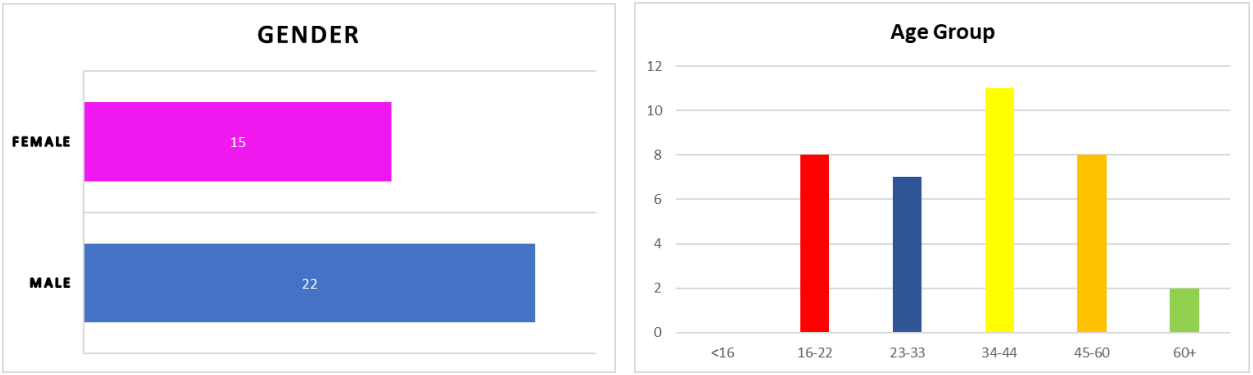

Figure 26. Socio-demographic information

Most of the respondents (37%) state that they use glass packaged vegetables and also alcoholic beverages including beer and vodka (41%). These interview questions are more effective than previous paper questionnaires about the consumption of consumers.

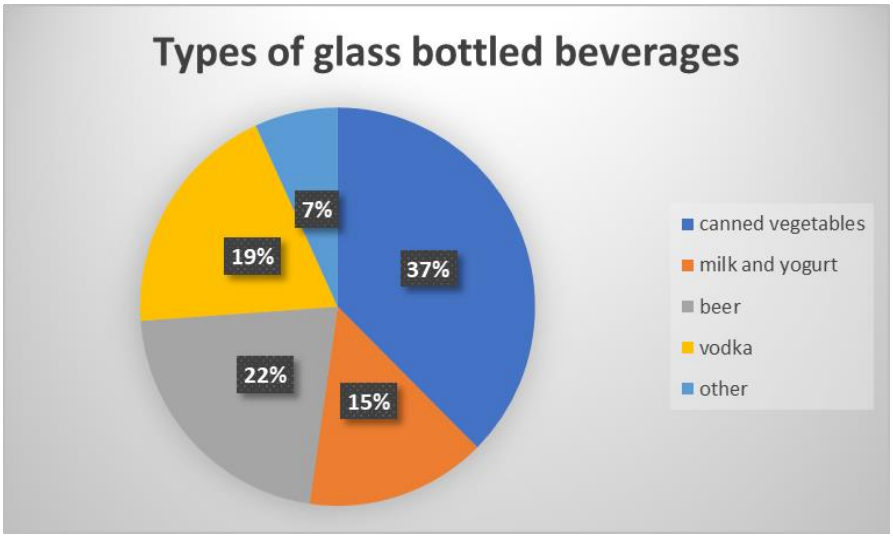

Figure 27. Types of glass bottled beverages

- **A location where Mongolians usually consume alcoholic beverages**

The comparison between the influential factors within the organization of buying glass packaged alcohol is shown below. The majority of the participants consume alcohol in bars, restaurants, pubs, karaoke, etc.

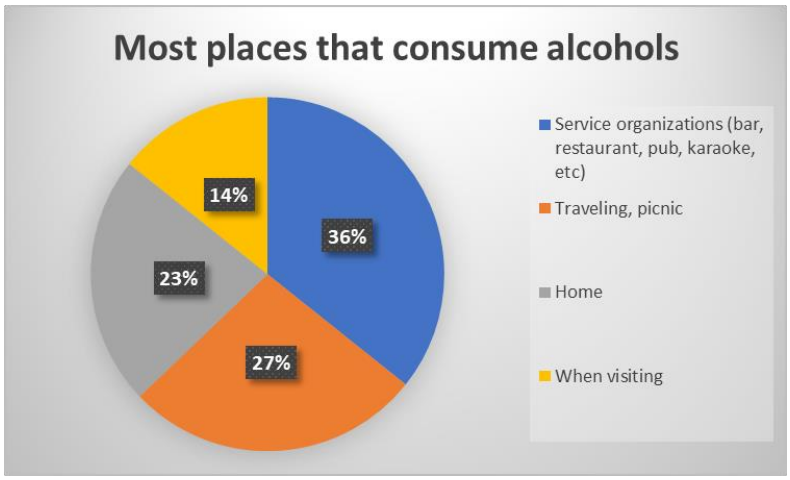

Figure 28. Most places that consume alcohols

- **Purpose to use alcohol**

The comparison between the reasons for using alcohol is shown in the figure. The respondents mostly purchase alcohol when they are going to celebrate and psychotherapy.

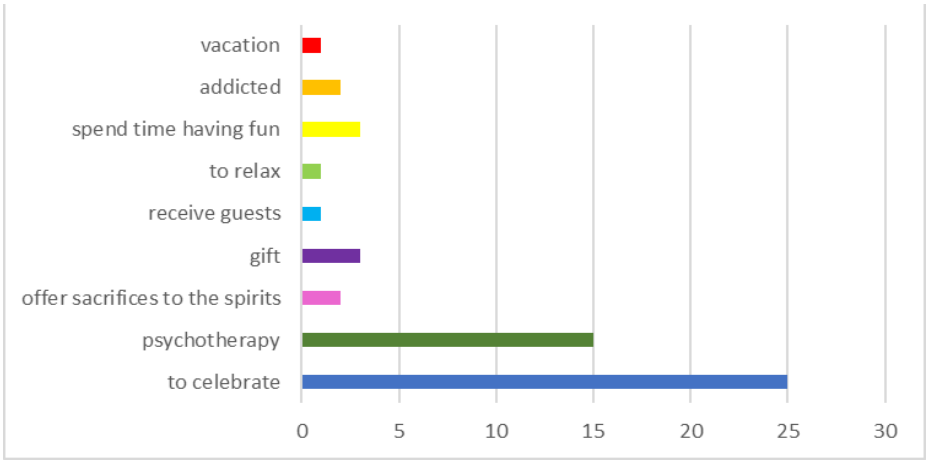

Figure 29. Alcohol usage reasons

- **Dispose of types**

The interview participants were asked to select their ways to dispose of glass-bottles packaging. Respondents' responses were trashed at once (67%) when they consumed it reaffirmed previous paper survey results.

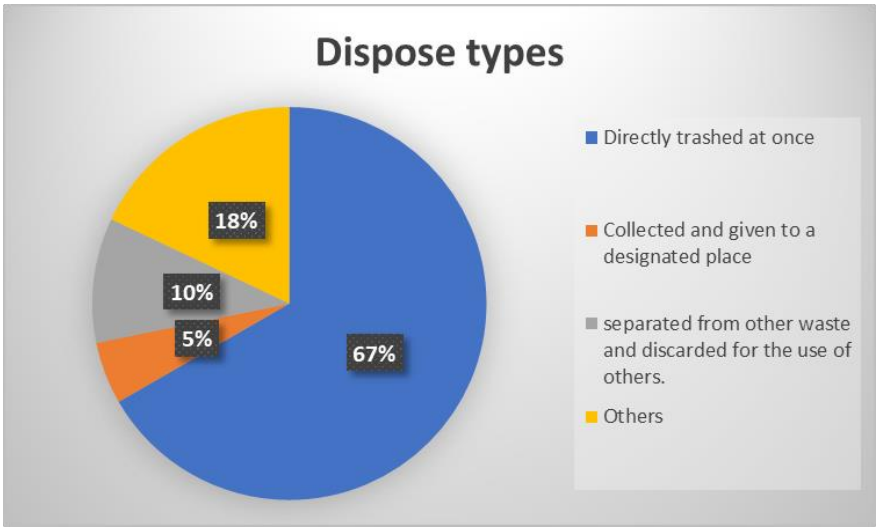

Figure 30. Dispose types

- **The consumer who has the experience to reuse glass bottles**

According to the, When, where, and how many bottles did you last order or give to someone else? The overall experience rate is (29%), which shows current situation participation is inactive. The tendency to pay attention to the environment is relatively low. According to the age group younger than 30 years, people do not care about the environment.

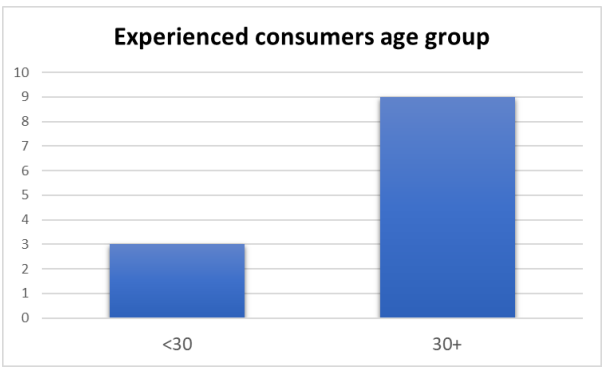

Figure 31. (a) Attitude of bottle reusage (b) experienced consumers age groups

- **Participation in reusing glass bottles ongoing project**

Most of the respondents (97%) stated that they will participate in the current project which is reusing glass bottles. Interview participants' requirements that they said “YES” are available collection center’s location and near to them. Additionally, to recover the behavior of giving back empty bottles during the Soviet occupation.

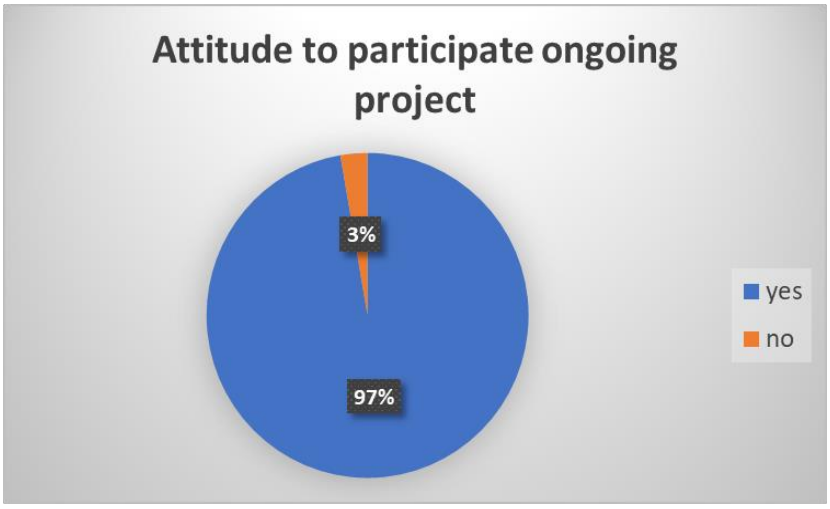

Figure 32. Attitude to participate ongoing project

- **The reason that we need to collect used glass bottles**

When it comes to the reason for reusing glass bottles, 47% of the respondents answered that they should not pollute the environment following 45% said Mongolians do not produce glass bottles ourselves.

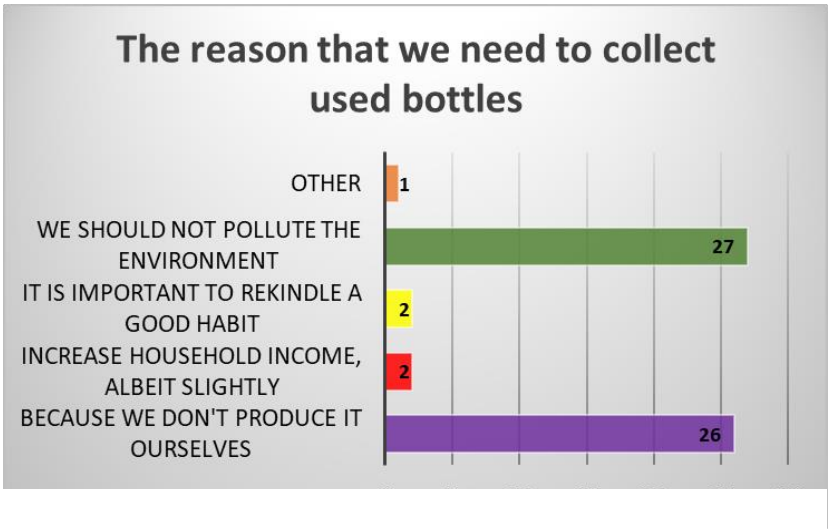

Figure 33. Used bottle collection reasons

- **Additional packaging solution**

Getting feedback from interview participants about the best new solution to replace glass packages. Total answers do not have a slight difference but most of the consumers had no idea (55%) which means glass bottle quality is not comparable to other packaging materials. The rest of the respondents have an idea (45%). For instance, environmentally friendly and also alternative packaging hygienic quality requirements should be met.

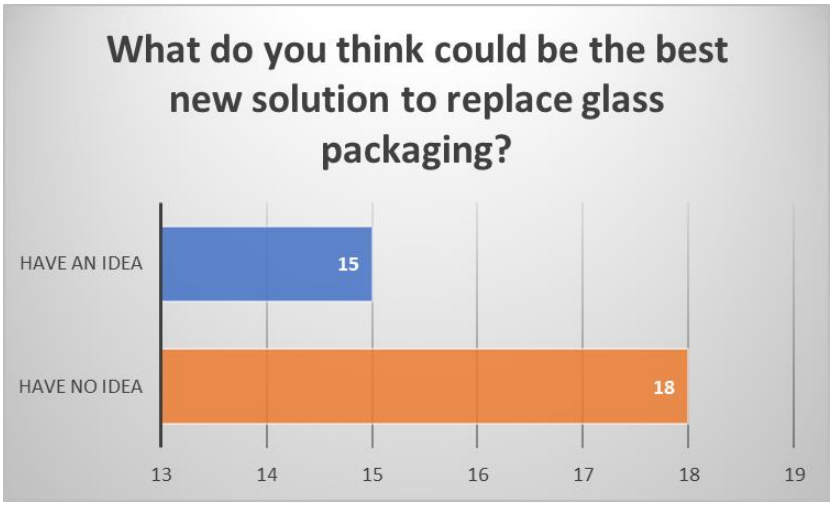

Figure 34. Alternative solutions of replace glass packaging

- **Consumers possibility to use the system when there is a comprehensive glass waste collection system**

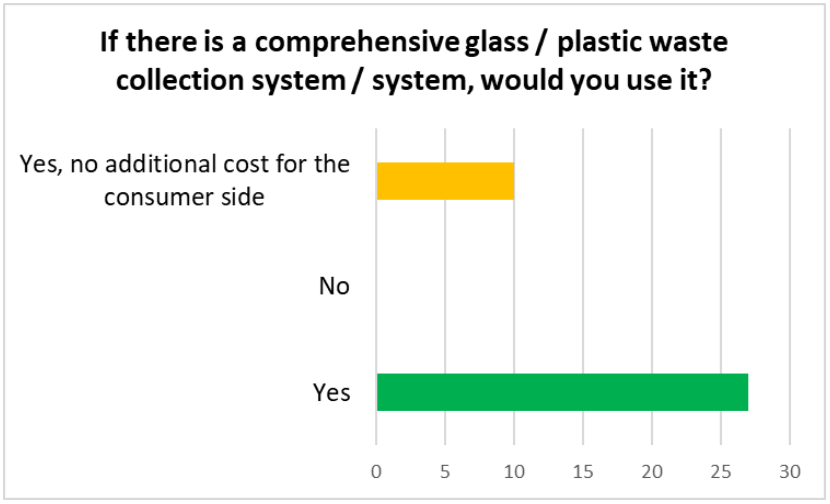

Figure 35. Alternative solutions of reusages

- **The system should meet the following requirements as requested by the consumers and what kind of bonuses?**

According to the previous survey result most of the participants tended to avoid ordering questionnaires. Using an interview method is more convenient to collect responses for the survey. To conclude the responses of the questions, the system must meet the following requirements, ranked by most important to irrelevant. As you can see in the figure, systems' environment should be clean as possible and provide location information efficient.

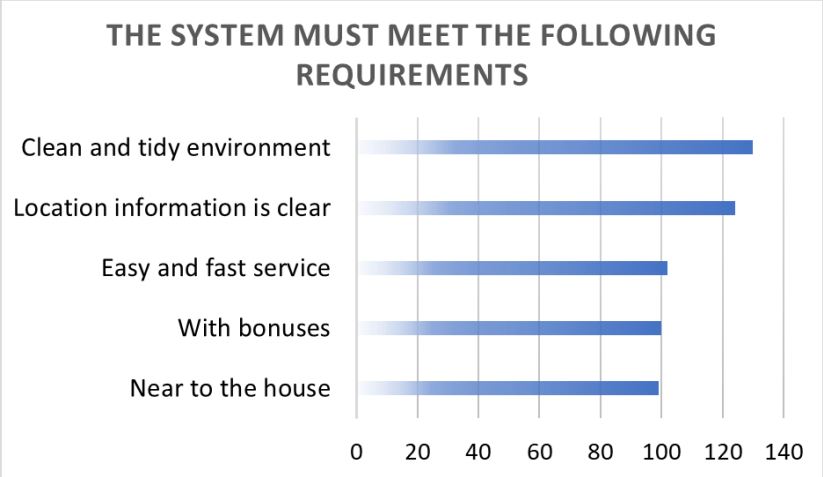

Figure 36. Requirements of the system

The requirement with bonuses is not relevant to the consumers, but if there would be a system developed, possible types of bonuses would be accepted. The requirement with bonuses is not relevant to the consumers, but if there would be a system developed, the following chart will show the acceptable types of bonuses.

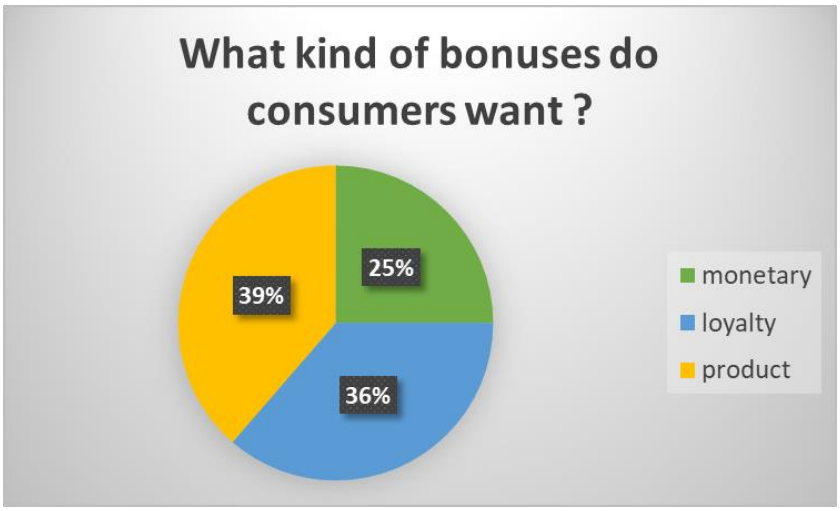

Figure 37. Consumer wanted bonuses

4. Results of survey

To conclude all the survey results, most of the respondents buy beverages from supermarkets and neighborhood stores. In a paper questionnaire, participants tend to avoid talking about their consumption of alcohol packaged in glass bottles. Mongolians are ashamed to tell strangers about alcohol consumption the reason that an interview questionnaire was conducted between the chess tournament participants, parents, and organizers. According to the interview, participants mostly use beer and vodka and answered when, and where consumers use alcohol.

Consumers after using the products, beverage packages are directly trashed at once and a few people are put in a separate bin. This statistic indicates that end-users should need more information about reusing and recycling glass bottles and responses to information on glass bottle recycling and reuse. The majority of respondents answered had not got information about the current reusing and recycling project that APU implementing named “Let’s revive glass bottles”.

In the interview survey and paper questionnaire, most of the respondents have a good attitude to reusing the glass bottles due to, the responses of consideration bringing bottles, responsibility for the removal of emptied bottles, participation in ongoing project, and the reason that consumers need to collect used bottles.

Respondents answered 100% approved shown Figure 32, consumers possibility, activity to use the system when there is a comprehensive glass waste collection. Therefore, consumers ranked a system requirement important to not important following, clean and tidy environment, location information is clear, easy and fast service, with bonuses, and near to the house.

According to the system requirements, bonuses divided into 3 types, monetary incentives, loyalty, and product. Most of the participants answered products when consumers give used glass packages. If the bonus were monetary incentives, end-users admire 300 MNT to 400 MNT refund amount per bottle.

5. Discussion

5.1. Main lessons learned from an existing system

From the beginning of this thesis work, I thought that Mongolia has a huge number of problems with packaging waste but after researching more deeper the problems were defined one by one. Important lessons learned from an existing system in Mongolia, within the framework of social responsibility beverage companies utilizing projects and voluntary based works.

Observing and researching the existing system in Baltic states, it is more suitable to convert Mongolian current situation because of the ratio between population and area of the country and these countries were in soviet occupation. Baltic states use monetary incentives to motivate end-users to collect empty beverage bottles. Also, the most influenced factor is an attitude to love and protect the environment.

Additionally, producers and importers join one central organization to implement and activate the collection system. This cooperative improves the collection rate and easy to utilize the system for the consumer side. The system should be provided clear information, and enough supply which is technical equipment (Reverse Vending Machine), near to consumers' houses, and most the retailers implement the collection system.

Finally, legally the government provides suitable waste management acts for both producers and retailers.

5.2. Opportunities to convert DRS into Mongolia

As mentioned in the Literature review section, there are two types of collection systems, the DRS method, and solid waste management of Tsumeb, Namibia. Focusing on the future of the waste management DRS system is a more sustainable and flexible method for utilizing the Mongolian situation. Because, the DRS system is a win-win process that consumers, retailers, and producers are mutually beneficial.

To compare with Baltic states to Mongolia. The identical situations are most of the countries that use deposit refunding system are developing countries and both were soviet occupation. Mongolian beverage companies already collect their glass bottles from consumers using money incentives or other alternative bonuses. Explaining easily producers of beverages are buy their empty glass packages from the end-users. In the industrialization and IT sector, Mongolia is relatively developed, and producing RVM is not a big problem.

Mongolia's diplomatic involvement with many countries is likely to provide more funding, for instance, Germany, and European Union countries. EU countries have rich experience to implementing DRS systems in their member countries. Also, cooperate with those countries, the system will be more realistic and high-quality when installed.

Finally, development of transportation systems, converting DRS into Mongolia has huge push to implement the collection system.

6. Conclusion and Recommendation

To conclude this thesis work, the current behavior of the consumers with 97 percent tended to contribute to and support a system when converted to sustainable waste management by reusing and recycling glass bottles. Based on the survey result, most of the respondents were concerned about environment than for the funding fee. Furthermore, the reason to bring empty glass bottles to the chess tournament, to supporting the ongoing project which is reusing and collection of glass bottles rather than to follow the requirements for participating in a tournament. Consequently, when the comprehensive glass collection system should meet the following ordered requirements that are clean and tidy environment, location information clearly defined, fast and easy service, with bonuses, and near to the house for end-user perspective. According to the clean and tidy environment requirement, nowadays people pay attention to their living environment. The convenient bottle collection method is return to retailers analyzed from the survey.

However, consumers should be motivated to return the used glass bottles. The result of the survey consumers wants to take the shortest route is 450 meters and possible distance to carry empty bottles minimum 400 meters, maximum 800 meters. About the influence the behavior of consumers to return the used glass packages should be the bonuses. Consumers wants the product bonuses when they return used glass bottles. From the DRS system based on the monetary incentives for end-users. Due to the monetary bonuses, survey results of respondents show triggerable amount per bottle is 300 MNT to 400 MNT.

Finally, end-users have resentful attitude to replace the glass packaging. Nevertheless, some of survey participants have an alternative packaging solution. If the solution has environmentally free and harmful for health, consumers mainly happy to assist the packaging.

6.1. Further Recommendation

African country Namibian solid waste collection system possible to implement current situation of Mongolia because the system is more suitable for developing countries. The result of the survey about disposes type of consumers mainly trashed at once follows throw their packages to the separated bins.

The Namibian system is based on collecting the solid waste from the households, and street bins when the LSC workers clean the city or town. To converting solid waste management of Tsumeb, Namibia stakeholders and system implementation takes short-term. Due to that, stakeholders are already formed in Mongolia, such as municipality, scavengers, street pickers, local cleaning team which is LSC workers and the system requires low amount of fund.

7.References

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