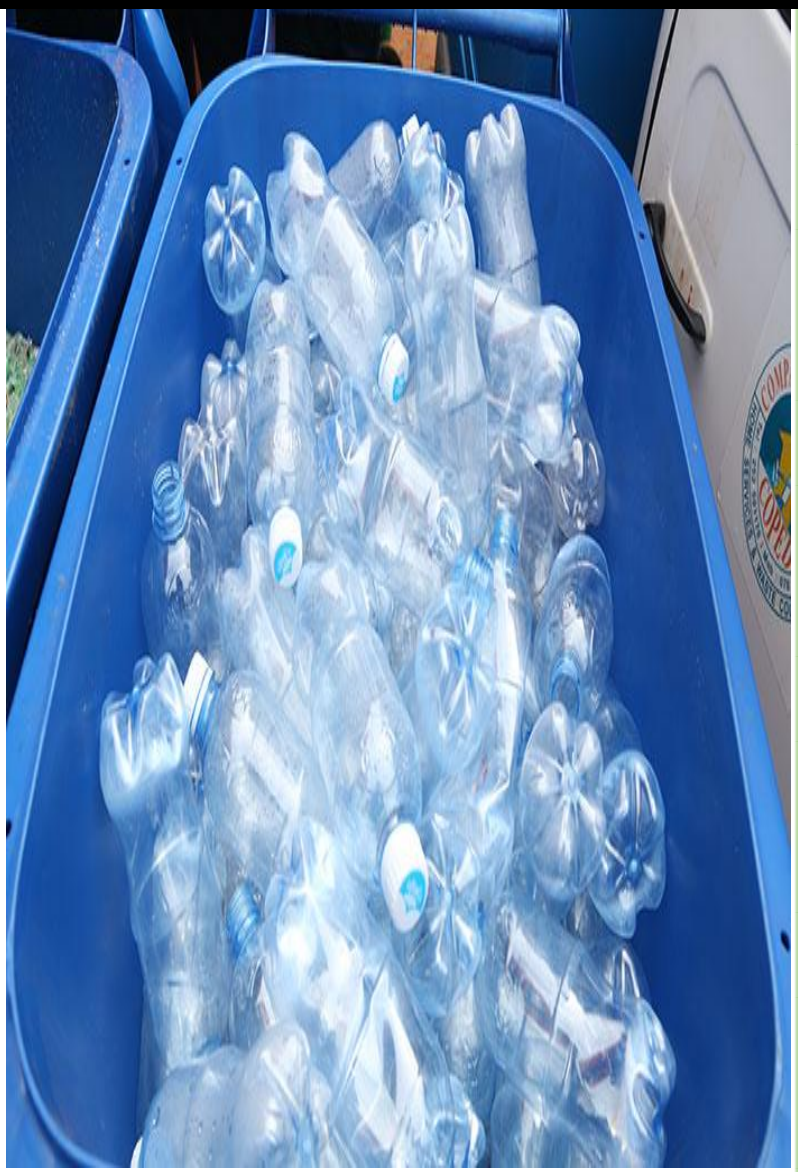
2019/2020

CONSUMER-PERCEPTION ON REDUCTION OF SINGLE USE PLASTIC BOTTLES CONSUMPTION AND ITS ALTERNATIVES IN RWANDA



Sifa, Noella

WAGENINGEN UNIVERSITY AND RESEARCH

2019/2020

A Msc thesis

CONSUMER-PERCEPTION ON REDUCTION OF SINGLE USE PLASTIC BOTTLES CONSUMPTION AND ITS ALTERNATIVES IN RWANDA

Sifa, Noella

891225761010

noella.sifa@wur.nl; sifnoella@gmail.com

Date of submission:

Thesis code: ENR-80436

Supervisor: Dr Silke Gabbert (Associate professor)

Examiners: 1. Dr Silke Gabbert

2. Dr Hans-Peter Weikard

Wageningen University and Research

Environmental Economics and Natural Resources Group

Master of Environmental Sciences

Abstract

Single-use plastic bottles (SUPBs) consumption are significant sources of plastic environmental pollution. Yet understanding consumers' perception about the reduction (SUPBs) consumption and introduction of its alternatives are substantial drivers for policy interventions being successful. Our study is aimed at generating information regarding consumers' perception of SUPBs reduction and introduction of its alternatives. The findings show that consumers perceive the reduction of SUPs consumption as essential to mitigate environmental pollution of SUPBs. Yet, the prevention of consumption through legislative and non-legislative strategies such as recycling, ban and awareness is crucial. To facilitate consumers to move towards a shift away of SUPBs consumption will require various intervention supports and facilities such as the provision of more sustainable alternatives at an affordable price, raising awareness of consumers, provision of recycling facilities and economic incentives.

Keywords

Single-use plastic bottles, consumption, consumers, consumer perception, negative environmental impacts.

Table of Contents

List of figures

List of tables

CHAPTER 1: INTRODUCTION

1.1. Background

Plastic packaging such as, for example, plastic bags, plastic bottles and other kinds of plastics are widely used in our daily activities all over the World (Orset, Barret, & Lemaire, 2017). However, at the end of their lifecycle, plastic generates an essential amount of waste. One of the most commonly used plastic ingredients is polyethene terephthalate (PET) (Orset et al., 2017). This kind of ingredient makes plastic very strong and durable chemically; thermally stable. It has low gas permeability; it can be processed smoothly and is convenient to carry. All these properties make PET more preferred by consumers in packing food and beverage (Orset et al., 2017). Worldwide, The total production of PET-based bottles was estimated 389billion of bottles in 2010, 46% of which was used for water packaging (Orset et al., 2017). Yet, PET stability causes them to be highly resistant to environmental degradation. The degrading of one PET bottle in the environment can take up to 500 years. Due to its resistance, plastic results in many environmental challenges for both marine and terrestrial (Lange & Wyser, 2003).

Plastic products such as plastic bags, plastic bottles, plastic for construction produce certain social benefits. The benefits of plastics related to health such in medicine, safety, energy-saving and material conservation, reduction of food waste by plastic packaging, creation of construction material that perform better than other substances (Andrady & Neal, 2009). Yet, although the plastic bottle has societal benefits, it causes also environmental and human risks. According to (Derraik, 2002), most of all marine debris is plastic, and most of them are made from PET-based. Plastic waste causes a direct threat to wildlife such death of an animal who ingest plastic, affect animal development growth due to inhibition of body activity. For example, a study done off the coast of North Carolina on 1033 birds, showed that 55% of birds recorded has plastic particles in their guts (Moser & Lee, 1992). The study has done by Swan (2008), showing that the chemical used to produce plastics has body burden in the human population, including reproductive abnormalities, disrupt the androgen-signalling pathway in males.

In Rwanda, there is no accurate data on the amount of single-use plastic bottles (SUPs) waste generated in the country. However, one of the companies that collect solid waste in Rwanda estimated that out of 400 tonnes of solid waste collected daily, more than 5% is plastic bottles (Kabona, 2018). Thus, the volume of garbage has increased from 300tonnes in 2016 to more than

400 tonnes in 2018 daily. However, the capacity for recycling all plastic waste is limited; therefore, this exposes the population to health risks and environmental degradation (Sabiiti, 2018). The general director of REMA, Coletha Ruhamya argued that the most important is not about the amount plastics produced but avoiding the increase of that quantity due to their negative impact on the environment is crucial (Tasamba, 2019).

To minimise the impact of plastic pollution caused by single-use plastics consumption, Rwanda has started to ban single-use plastics (Froidbise, 2015). In 2008, the country altogether banned single-use shopping bags. Today it is prohibited to manufacture, import, use or sell the single-use plastic bags except in the military and medical sectors (REMA, 2009).

Furthermore, the Rwandan started a move to ban other single-use plastics that have not banned in 2008. For instance, on January 28th 2019, the Rwandan cabinet approved the first draft law to ban the other single-use plastics among other such as single-use plastic bottles (SUPBs), straws, soft drink bottles and most of the food packaging plastic materials (Kwibuka, 2019). The government initiated the campaign for reducing SUPBs. As a result, today, SUPBs are no longer used in governmental institutions' offices (Kwibuka, 2019). On 12td June;2019; the Rwandan parliament explained the issues about the proposed ban of single-use plastic such as SUPBs, single-use plastic cups and coffee stirrers, during their plenary session, the government discussed options how to implement the policy (Irabizi, 2019). The industries that rely on plastics have called on the government to promote sustainable alternative products to ensure effective implementation (Mugisha, 2019).

1.2. Problem statement

Although Rwanda has adopted a ban on single-use plastic bags, and the implementation of this policy seems to be successful, as mentioned above. There are different challenges to expand this ban on the SUPBs; First, the capacity of recycling industries in Rwanda for SUPBs is limited. Secondly, the recycling rate is slow compare to the production rate of plastic bottles. Third, the availability of alternative is another challenge (Sabiiti, 2018). Coletha Ruhamya, the director-general of Rwanda Environment Management Authority (REMA) argued that the country has mainly been dealing with single-use plastic bags. But other single-use plastics such as water bottles, cups, coffee stirrers, and most plastics used for food packaging are equally problematic or even worse compared single-use plastic bags (Tasamba, 2019). In her speech, she argued that

some single-use plastic items have an alternative on the market. Besides, she asked, “What is required is to go back to our abandoned original practices as they are environmentally friendly. It is time to pay the cost to the environment” she said (Tasamba, 2019). The government called on the industries to produce sustainable alternatives to single-use plastics items to keep environmentally safe. Also, the government encourage consumers to change their behaviour from unsustainable consumption to sustainable consumption. “I encourage everyone to join us to beat plastic pollution! Disposable plastic like bottles, cups, straws, cutlery and plates are hazardous for the environment. Sustainable alternatives exist” Dr Vincent Biruta, The minister of environment, said (Sabiiti, 2018).

To reduce SUPBs consumption, Rwanda has started to move from single-use plastic bottles to sustainable alternatives, started from government institutions, as mentioned in the previous section. The government aimed to expand this policy to all consumers of SUPBs. However, it is still unclear whether there this has the potential to become expanded from governmental institutions to all consumers of SUPBs. Thus, the consumers’ perception of the reduction of SUPBs and the introduction of its alternatives is not known. Understanding the perception of consumers on reduction and introduction of alternatives can help policymakers to develop suitable tools for implementation of this ban policy, and this can make policy to be more effective.

According to Madara, Namango, and Wetaka (2016), connecting consumer’s perception with governmental policies can be an influential factor for a strategy to be successful. The studies that have been conducted in Rwanda and have addressed single-use plastic bags policy (Danielsson, 2017; Froidbise, 2015); None of these studies addressed consumer’s perception of single-use plastics consumption. Also, several similar studies on consumer’s perception on single-use plastics have been studies but treated mostly populations living in developed countries and just a few of them in developing nations(Blundell, 1988; Cherrier, 2006; Heidbreder, Bablok, Drews, & Menzel, 2019; Lopez Murcia Martin, 2015; Madara et al., 2016). So far, however, no consumer’s perceptions on banning SUPBs consumption in Rwanda have been explored.

Understanding the current discourse on SUPBs reduction and the introduction of its alternatives can enhance effective decision making among the relevant stakeholders. Since it will provide information on what consumer are willing to do, what factor that will stimulate them to act

sustainably. Thus, it will help the decision maker to develop adequate tools to implement this policy in the coming years.

1.3. Objective and significance of the study

The aim of the study is to generate information about consumer's perceptions on single plastic bottles reduction and introduction of alternatives by assessing their current situation regarding the use of SUPBs and its alternatives, identifying possible options for SUPBs, assessing how consumer perceive the reduction of SUPBs consumption and introduction of alternatives and the feasibility of replacing SUPBs by alternatives, identifying the factors that can stimulate effective switch from single-use plastic bottles to alternatives.

The outcome of this research can be useful for Government, non-governmental organizations as well as private companies and individuals. They want to develop adequate strategies to reduce the environmental impact of plastic bottles consumption in Rwanda. Besides, since the single-use plastic bottles ban is the crucial agenda of the Rwandan Government and a topical issue among the populace because of several discourses surrounding its implementation in the coming years. Understanding the current discourse on single-use plastic bottles and its alternatives will enhance effective decision making among the relevant stakeholders.

1.4. Main Research question

How do Rwandan consumers perceive the use of single-use plastic bottles in comparison to possible alternatives?

Sub-questions

1. What is the current situation regarding the use of SUPBs in Rwanda?
2. What are possible alternatives to single-use plastic bottles such as soft drink and water bottles?
3. How does the civil population in Rwanda perceive a planned reduction of single-use plastic bottles consumption and the introduction of more sustainable alternatives?
4. Based on the views of consumers, can we identify factors that can stimulate an effective switch from single-use plastic bottles to possible alternatives?

CHAPTER 2: LITERATURE REVIEW

This chapter will review some of existing literature on the history of single plastic use plastic bottles, the impact of single-use plastics, discuss the measures that have been used by different countries, exploring the current situation regarding single-use plastics in Rwanda. It also provides literature on perceptions of plastic ban and pollution.

2.1. Plastic bottle

Plastic bottles like other kinds of plastic are multipurpose since they can be used in different ways, and they are used everywhere in our society (Lithner, Larsson, & Dave, 2011). The plastic bottle is a bottle produced from high-density plastic and they are commonly used to store liquid such soft drink, water, cooking oil, medicine, shampoo, ink and other liquid (Birkby, 2014). The plastic bottle was introduced in the 19th century and was used to replace the existing materials such as ivory, rubber and shellac. The plastic bottles were used commercially since 1947, but the price was relatively high until the 1950s when high-density polyethene used to manufacture plastic bottles (Bellis, 2019). In the 21st century, the spread of plastic has increased dramatically to a significant amount of commodities sold today, including plastic beverage bottles(Leigh, 2011). The plastic bottles quickly become more popular with chemical industries and consumers because of their lightweight nature and their low cost of production and low cost for consumers compare to glass bottles or other kinds of bottles (Golovinova, 2014). In 2010, the estimation of plastic bottles production was 389 billion of PET globally, yet,46% of them was for water packaging. Besides, this kind of plastic is highly resistant and leads to environmental degradation since it can remain in environmental around 500years (Fornabaios, Poto, Fornabaio, & Sordo, 2019). Plastic waste can harm the wildlife physically or chemically, either because the animal ingests them or because they have potential toxic materials (Chelsea M. Rochman et al., 2013).

Plastic is constituted with many units of monomers that are bonded together to form long chains; this long chain is chemically passive and unreacted. Yet, the other harmful ingredients can be contained in plastic. Based on the classification made by the United Nations 'Globally Harmonized System of classification and labelling, the chemical components of plastic, more than 50% of plastic are hazardous (Lithner et al., 2011). The chemical that used to manufacture plastic items is from crude oils which is a non-renewable resource. This non-renewable resource is not only used during the production process but also transportation and use of plastic products (Lithner et al., 2011).

Some research was assessing, for example, the transfer of additives in polyvinylchloride (PVC) from medical supplies to humans shown that these chemicals from the plastic can be transferred through the blood and accumulate in the body (Mettang et al., 1996). The monomers that use for making plastic seem to be gentle. However, these materials contents may be still more toxic by picking up other pollutants (Mettang et al., 1996). For instance, pesticides and organic contaminants such as polychlorinated biphenyl were found in plastic waste at a harmful concentration a hundred times those found in sediments and one million times those found in water (Truelove, Yeung, Carrico, Gillis, & Raimi, 2016). Besides, chemicals considered as priority pollutant chemical that is regulated by governmental agencies due to the level of their toxicity and persistency in organism and food chain. These chemical pollutants have a diverse effect such as cell division disruption, slow reproduction (Truelove et al., 2016).

Moreover, some study found that about 78% of priority pollutants listed by EPA and 61% by the European Union found in plastic debris. The toxins are found in either ingredient of plastics or in the other pollutants that absorbed from the environment (Chelsea M Rochman et al., 2013). The research shows that contaminants that contain in plastic can enter in the body of animal after they ingest debris and cause malfunction of an animal. For example, seabirds that have eaten plastic waste, have polychlorinated biphenyls in their body at high concentration of 300% than those birds that have not consumed plastics (Teuten et al., 2009).

2.2. Impact of plastic pollution

The researchers have evidenced the harmful effect of plastics that are existing in the environment. Plastic pollution is a persistent-global environmental threat. The study has shown that there is plastic debris from North poles to the Equator, this explains how the plastic can be spread into the environment from one source or many sources (Thompson et al., 2004).

There are plenty of priority pollutants that can harm our health contain in plastics. Some of them are; Bisphenol A(BPA), Phthalates and Brominated Flame Retardants. It has been shown that BPA is in plastic bottles, while the remains additives were found in pipes, televisions and more apparatus. The reason behind using BPA in plastic manufacturing is that it makes it hard and clear the plastic. However, the use of these additives bring risk to human health as well as animal, since BPA function as endocrine disruptors and more specifically, it affects the body

development stage and causes other diseases such as Diabetes and Obesity (Comăniță, Hlihor, Ghinea, & Gavrilescu, 2016).

The single-use plastic processing emits the toxic emissions gas called *Dioxins* and *furans*, which are very persistent organic pollutants in the environment. Therefore, this contributes to air pollution from open-air burning of plastic or waste stream (Beychok, 1987). The human health impact of Dioxins and furans include cancer since these chemicals act as "endocrine disruptors", and results in malfunctioning of body development and other living organisms. Yet, this malfunction may pass from mother to child through the womb and breastfeeding milk and these pollutants it mostly stored in body-fat-tissue, which can lead to the damage of nervous and immune system (Ritch, Brennan, & MacLeod, 2009).

The socio-economic impact of plastic bottles also is associated with direct-damage caused by littering of single-use plastics. There are adverse effects of plastic bottles, such as block drain and waterways, thus resulting in the damage of infrastructure and properties. The destruction of infrastructure and properties is due to flooding since the plastic bottles block the water pathways. Being the threat to tourism is associate to loss of biodiversity and change the environmental features (L. C. Smith, 2009). Further, the production of plastic bottles influences resource depletion. Plastic bottles are made of non-renewable resource such as petroleum which can be depleted. Also, plastic bottles production emit toxic gas during its production, which has a detrimental impact on the life of our planet (Muthu, Li, Hu, & Mok, 2009). Yet, modern society in both developed and developing nations are dominated by throwaway habit; in this case, the industry produces short lifetime goods to continue producing. As results, the non-renewable resource, which is crude oil, is under depletion. Also, the production of SUPBs does not only use crude oil, during production but also transportation, storage and final disposal of plastic bottles (Hawkins, 2009).

Littering of SUPBs on beaches or other recreation sites can also cause a socio-economic problem due to unpleasing aesthetics of beaches or recreation places. In Australia, during clean-up, on land, and on coasts shown that plastic bottles were in top three letterings (Willis, Hardesty, Vince, & Wilcox, 2019). e. g the clean-up in 2017 and 2018 on International coastal clean-up, plastic bottles were the third and second littered items respectively (Clean-up, 2017; conservancy, 2019). In Rwanda, there is no accurate statistical information of SUPBs. Still, collecting waste companies have shown that SUPBs are among the top plastic waste collected

(Kabona, 2018). A study by (Sheavly & Register, 2007) demonstrated that the littering of plastic floating in water or coastal areas could discourage tourists from visiting those areas. As consequences, the local people who rely on tourism and recreation can suffer due to the decrease of visitors who are discouraged by the littering of plastics in water or other recreation sites.

Plastic bottle pollution can arise many challenges to wildlife animal as well as human life since many types of plastics can take many years to decay (Pereira, 2019). Fish and wildlife get plastic in their body due to ingestion of plastic by confusing with food. As a result, the toxic that contain in plastic can make fish or wildlife to get sick, end up to death. This toxics from plastic has entered the food chain and become a threat to human life (Pereira, 2019). Plastic pollution can affect humans by eating sick fish or another animal who ingested plastic that contains some toxics (Pereira, 2019). The study on assessing the impacts of potentially toxic chemicals derived from plastics, such as bisphenol has been conducted. This study found that when plastic is broken down, it releases harmful poisonous substances that can be entered into the ocean or remain in open environmental. As a result, this toxic enter into the food chain, which causes fish, wildlife as well as human get sick and can end to death.

2.3. Existing measures to reduce single-use plastic consumption

Different regulatory approaches have been used by governments to reduce single-use plastic consumption in developed and developing countries. The following examples are the approaches that have been used by states to reduce SUPBs. However, no study has conducted in African countries on SUPBs; most of the studies mainly focused on single-use plastics in general.

A study done in the United States by Viscusi, Huber, and Bell (2012) on Analysis of option approaches to increase recycling of plastic water bottles, by using two economics mechanisms which are financial incentives and infrastructures. The study found that financial incentives which are refund system and infrastructure, which is to put collecting point closed to the consumer both were identified as a factor to enhance the degree of recycling. The researcher found that the high-income groups had a high degree of recycling but were not interested in the refund system in place; they were motivated by time and available cost. However, the low-income people were motivated by the refund system in place, since they find that deposing plastic bottles can increase income source. The author that the effect of combining policies provided best recycling outcome compare single policy (Viscusi et al., 2012).

Another study in the United States on the efficacy of a bottled water ban in reducing plastic waste has to be done. The outcome in universities, cities and town were not all the same. The studies have shown that ban of those bottled water led to reduction of SUPBs consumption. In, contrast, other the research has been demonstrated that the prohibition of bottled water has led to increasing consumption of sugar-sweetened beverages which increase the weight of plastic bottle again (D'Altrui, 2017). The researcher found that the best option would be bottled water tax not only for bottled water but all other plastic beverages, therefore this will reduce single-use plastic bottle consumption. Furthermore, the researchers conclude that the best option is to eliminate the production of PETs (D'Altrui, 2017)

A study by Willis et al. (2019) in Australia on the effectiveness of filtered water refill station to reduce single-use plastic bottled water consumption shown that the policy has been successful. An Australian government implemented this policy by putting filtered water refill station along the Brisbane River, Queensland, Australia. The researchers found that plastic bottle littering was reduced after the policy of putting filtered water refill station was implemented. The researcher identified the factors that can help to reach the maximum outcome of this policy. For example, put filtered water refill stations were the consumers were usual to dispose of plastic bottles, increase awareness of consumers on the location of filtered water station was also the factor in reducing single-use plastic bottle consumptions.

Furthermore, education has been found as an essential factor to reduce single-use bottled water consumption (Willis et al., 2019). This strategy became popular in U.K, North America, South-East Asian. However, in Africa, the filtered water refill station is still an infant in African countries. This project is working in only a few countries (South Africa with operations in Botswana, Namibia and Swaziland). South-Africa this strategy has been used with so-called I-drop water company, the project aims at supplying pure drinkable water to reduce single-use plastic bottles(I-DROP, 2015).

Further, reuse single-use plastic bottles were identified as a strategy to reduce environmental degradation. A study by Patel, Shah, and Patel (2016) shown that SUPBs can be used as material for the construction of a house by fill in sand or clay in a bottle, and it works as bricks. This technology has a good impact in some countries such as Serbia, Uganda, Kenya, India, Eco-art Exhibition hall in Taiwan (Haque, 2019; Pati, Homma, & Iki, 2016; Sojobi, Nwobodo, & Aladegboye, 2016). The author summarised the importance of SUPBs as material for

construction in three: saving energy consumption for the region and reduce littering of SUPBs, mitigate climate change by reduce CO2 during the production of cement, reduce the cost of production(Patel et al., 2016).

Another study done by Convery, McDonnell, and Ferreira (2007) in Ireland on the impact of imposing taxes of 15 Euro cent on plastic shopping bags has shown that shopping plastic bags consumption has been decreased about 90% and the cost of monitoring was low. The authors argued that product taxes had resulted in the littering reduction and other adverse environmental effects of shopping plastic bags consumption. The researchers concluded that plastic bag levy has been successful and this can give insights for different plans of a similar proposal (Convery et al., 2007)

Other studies have been done in a developing country (Botswana and South Africa) on the impact of plastic bag policy. The survey in Botswana aimed to assess the effect of charging fees on plastic bags. The analysis showed that charging fees on the plastic bag has resulted in a decrease in demand for plastic bags for short-term, even in long-term (Dikgang & Visser, 2012). This study is similar to the one that has done in South Africa in the short term. The consumption of plastic bags has decreased in the first three months since the policy has been implemented (Hasson, Leiman, & Visser, 2007). However, Dikgang, Leiman, and Visser (2012) who looked at the impact this policy in long-terms patterns, shown that the declining in consumption was only for the short term because after that the consumption of plastic bags increased as usual (Dikgang et al., 2012). The author argued that the failure of South Africa was due to the relatively low initial set price, which made consumers continue consuming, although there was some charge. In contrast, Botswana set the initial price high that makes this legislation to be successful, but the rate was constant, which led to the partial success of this legislation (Dikgang & Visser, 2012). In contrast to other developing countries did, Rwanda has chosen different approaches to reduce single-use plastics consumption, which is restrict ban shopping plastic bags (Danielsson, 2017).

Rwanda is still rebuilt from economic and destruction of genocide against Tutsi in 1994. As part of the recovering plan, the Government of Rwanda also decided to put emphasize on environmental protection, one of the series of reforms is plastics (Kardish, 2014). Rwanda is one

developing countries that have managed to introduce an ecological policy regarding single-usee plastics that even some high-income countries are not even close to reaching (Danielsson, 2017). Rwanda has started to ban single-use shopping bags since 2008. Today it is prohibited to manufacture, import, use or sell the single-use plastic bags expect military and medical sectors (Froidbise, 2015). The government of Rwanda has used different instruments in the implementation process. The economic approach in the form of fines, providing alternatives to single-use a plastic bag. Besides, information campaigns, especially on the free day; which occur every 4th week of the month (Danielsson, 2017). Rwanda plastic ban seems to have been effective in many aspects, partially making Rwanda one of the cleanest countries in Africa, although it may harsh in some side. (Kardish, 2014).The study on how Rwanda implemented single-use plastic bag ban shown that the Country applied tools that suited for the country even though the approach seemed to be repressive, but as with other policies, there are negative and positive effects (Danielsson, 2017). The author argued that the country has been prosperous in achieving the aim to reduce single-use plastic bags, and in the long run, is believed to be beneficial for all Rwandan.

2.4. Perceptions of single-use plastics consumption reduction and its impacts

Although there does not exist enough literature on perception on single-use plastic bottles ban, there are some few studies regarding knowledge on other SUPBs reduction have been studied.

A study has been conducted in Indonesia Khoironi, Anggoro, and Sudarno (2019) on community behaviour and SUPBs consumption. It was aimed to mitigate SUPBs by studying, the relationship between culture and community behaviour regarding single-use plastic bottle consumption. The study showed that 80% consumer at least one SUPBs, with the 20% consumed at least four SUPBs by day, for 88% participants, only 10% separate SUP in the waste bin. The result showed that community understanding of plastic bottle negative impacts well not the same to all individuals. The author concluded that to reduce SUPBs consumption, and there is a need to change community behaviour by for example, by switching from highly-consumption of SUPBs to reusable bottle and also introduction of single-use plastic bottle consumption tax (Khoironi et al., 2019).

An experimental test of pro-environmental spillover has been conducted in the US. The study aimed to assess environmental identity, guilt, environmental worry as well as assess support for a pro-environmental campus green fund among democrat, republic and independent. The result showed that although democrat recycled their SUPBs, they had low environmental identities and were less supportive of the campus green fund than republic and independent people. The researcher found that feel guilt did not connect to recycle a plastic bottle or global warming worry; it was associated to increase support for the green fund (Truelove et al., 2016)

A study has been conducted in Island on determining the Island resident's perception of marine plastic debris and their support for plastic and paper bag legislation (Pereira, 2019). The study has shown that the residents classify plastic pollution as a serious threat to the marine environment, human health and Island Economy. The results have shown that the residents were very supportive of banning plastic bags. The supportive behaviour identified through pro-environmental practice such, as carrying reusable bags to shops, recycling, and denying buying single-use plastic bags and single-use plastic water bottles. The researcher concludes that to reduce the increase inputs of plastics to oceans; consumers need to switch from single-use plastics to reusable and more sustainable alternatives. The policies must ban the materials in the first place to achieve the reduction of SUPBs pollution (Pereira, 2019).

Another study that has been conducted in South Africa on single-use plastic bags usage: perception, practices and intervention strategies (O'Brien & Thondhlana, 2019). This study found that consumers in South Africa consumers plastic bags due to convenience, easy availability and affordability. The consumers were highly agreed that plastic bag like other single-use plastics is a problem to the environment in terms of over-purchasing and disposal of those bags (O'Brien & Thondhlana, 2019). Further, the researcher evidenced that consumers are highly consuming plastic bags despite their high level of education, this means having high-level of education, does not mean to be conscious about environmental concern (O'Brien & Thondhlana, 2019). Another study that has been conducted in Ethiopia has shown that the lack of alternative and low cost of plastic bags are the main drivers of increasing consumption. People believe that plastic consumption has environmental impacts, this study also revealed that receiving well organised solid collection service and willingness to pay for those services were positively related to increase utilisation of plastic bags. A research suggests that responsible body needs to educate

community in order to change their consumption behaviour, also enhance waste collection service and promote degradable plastic bags (Negussie & Mustefa, 2017).

In Mangalore, a similar study was conducted to investigate the perception of people about the ban on plastic bags (Rao, 2014). This study shows that many participants 88.9% know that single-use plastics are significant environmental pollution which resulting in a health hazard to human beings, fishes, as well as domestic and worldwide animals. This study revealed good things about single-use plastic bags such as, waterproof, convenient, can be used for several purposes. However, the respondents also revealed bad thing of single-use plastic bags such as creating pollution, difficult to decompose, creating a human health hazard, the threat to animals. The study shows that respondents were supporting ban enforcement of single-use plastic bags with 73% who were supportive of ban and 27% who were not favouring plastic bag ban enforcement, as respondents accepted result ban on single-use plastic bag. The researchers suggested that it is crucial to reduce the number of plastic bags used in the first place, with some initiatives aimed at consumers and improving plastic bags collection and recycling facilities. Yet, Researcher found that environmental awareness is essential to support the element of other initiatives that can be used to reduce the usage of plastics (Rao, 2014).

2.5. The current situation regarding SUPBs and other single-use plastic items in Rwanda

Rwanda now is the first country in East Africa and the second country in Africa to ban all single-use plastics if the law of banning single-use plastic items can be implemented. The ban will affect all single-use plastic items that have not been affected by the law in 2008. The 2008 law was to prohibit selling, importing and manufacturing single-use plastic bags only (REMA, 2009). The 2019 rule aimed to check unnecessary production and consumption, such as single plastic items that were not affected by the 2008 law (Africa, 2019). The ban will include all single-use plastic bags and other single-use plastic items such as plastic container, bottles, wrappers, straws, folders, plastic cutlery and balloons (Africa, 2019).

The ban of single-use plastic items divided into three categories: The first category was the ban of single-use carrying bags that has banned since 2008. Type two include single-use plastics such as disposal folks, spoons, plates and all that. Category three will consist of other single-use

plastic in which some of them do not yet have alternatives on the market till now. This category includes water bottles, soft drink bottles, beer bottles and other bottles (Tashobya, 2018). Some single-use plastic bottles that have not yet have alternatives will be gradually discouraged until their replacements will be established by producers (Tashobya, 2018).

The minister of environment, Dr Vincent Biruta, said that the producers who used to manufacture single-use plastics had been sufficiently informed on time and they have an accurate understanding of the environmental issue. Some industries have started to search for the possible alternatives that are not yet available in the market place (Africa, 2019). Once this ban is passed into law, the people who will fail to follow the law will have penalties or the producer can even have the revocation of trade licences(Africa, 2019). The minister of environmental said that also though there is not entirely alternatives. The ministry has already started talking to some local factories that have begun the process of shifting to manufacture materials made of papers, bamboo among others and the government is ready to support them to produce these alternatives in sustainable ways (Sabiiti, 2019). Despite, the incentives of the government to help factories to provide viable options, there are some fines to people who will fail to follow the law. The law suggested that at least Rwf 50,000 which is approximately 50euro, be charged by local government official onto people who will dump in a public place and will be asked to remove the waste and repair the damage made. This law also suggests that Rwf 5 million fine by local government onto producers, retailers and importers who will not stop to manufacture, import or selling single-use plastic items (Sabiiti, 2019). The ministry of environment encourages people, especially manufacturers, to think of the ways to produce sustainable alternatives. But for meanwhile, there are no full alternatives on markets, and the law proposed addition tariffs on the importation of single-use plastic items in beverage industries such as water bottles, soft drinks (Sabiiti, 2019).

CHAPTER 3: METHODOLOGY

3.1. Geographical description

Rwanda is in the centre of Africa; the small country Rwanda is situated over 3 000ft (914m) above the sea level. The latitude and longitude of Rwanda are 2^0 00’ S and 30^0 00’(Review, 2019). The central and western part of the country is dominated by a portion of the Albertine lift mountains that give way to forests, savannahs, plains and swamps as you move to eastward

(Worldatlas, 2018). The country is bordered, on the Democratic Republic of the Congo to west, Tanzania to the East, Burundi to the South and Uganda to the North (Rwanda, 2017).

In this thesis, the research focuses on Rwanda as a case study. Rwanda is among the developing countries that have already started to reduce environmental problems caused by SUPBs consumption (Mushonga et al., 2015); one example is the ban of single-use plastic bags in 2008 (REMA, 2009). Besides, after the genocide against the Tutsi population, Rwanda has taken extensive effort to recover economically without compromising the needs for future generations (Froidbise, 2015). Moreover, banning SUPBs is on the agenda of the Rwandan government (Sabiiti, 2018).

3.2. Data source

3.2.1. Literature review on plastic use in African countries and no- countries

To gain insight into the current situation regarding the use of SUPBs in Rwanda, information was retrieved from the scientific literature, the government reports and newspapers articles. Furthermore, the available secondary data will be collected on the environmental impact of single-use plastics Worldwide. Existing country measures to reduce single-use plastic bottle consumptions in African developing countries as well as in developed nations, e.g. by screening books, journals articles, government reports and newspaper articles.

3.2.2. Framework for qualitative data analysis

Primary data on possible alternatives to SUPBs and peoples' perceptions regarding the ban and the replacement of SUPBs by other options will be collected through face-to-face interviews.

The data collection will take place in Kigali, the capital city of Rwanda. Kigali city was chosen because it is the largest city in Rwanda with many processing industries, many activities and many consumers of single-use plastics. Moreover, Kigali city has a high population density compared to other Rwandan cities with 1 132 686 inhabitants (nisr, 2012). Third, more than half of the World population now live in cities, and the study predicted that in 2050, more than 70% would live in cities (Loewe & Rippin, 2015). Primary data will be collected using the following tools:

1. Semi-structured interviews
2. Key Informants Experts interviews

The two approaches were selected because they are complementary regarding the type of information revealed, and the type of participants involved. The semi-structure interviews will generate a better understanding of people's' opinion on options for SUPBs reduction and the introduction of more sustainable alternatives. The key informant interviews will provide in-dept-information regarding existing regulations and measures to reduce SUPBs consumption.

3.2.2.1. Semi-structured interview

According to R. Kumar (2019), a semi-structured interview is the approach of research used most often in social sciences. The semi-structured interview can be used in household research, community members, companies; It helps the interviewer to get the answer to questions and the reason behind the answers, it also allows freedom of participants to express their point of view on issues discussed (Keller, 2019). The semi-structured interview is used to describe people's point of views and cultures with customs, habits and differences and get information from experts about the research field (Jenner, Flick, von Kardoff, & Steinke, 2004). This method has been used in many studies related to plastic pollution (E. Smith, 2019); (Ballantine, Ozanne, & Bayfield, 2019); (Sung, 2010). The vital advantage of the semi-structured interview is to make unknown information to be known, where the interviewees are seen as experts by their own experience (O'Keeffe, Buytaert, Mijic, Brozović, & Sinha, 2016), It allows the researcher to his/her personal subjective views and opinions, since social science, creativity, invention can't be possible without subjectivity (Diefenbach, 2009)

However, this approach has some limitations, e.g. models, formulas and diagrams indicate in a structured is simply not the case in Semi-structure approach. A semi-structured interview is less objective compare to a formal interview (Zojceska, 2018). Another drawback is that Semi-structured interview is time-consuming, labour intensive and require the interviewer to have experiences compare structured interview.

Semi-structured interviews consist of a set of open-ended questions which produce focused, qualitative and textual data. A researcher develops the questions, but the answers can be extended at the choice of the interviewee and interviewer (O'Keeffe et al., 2016). Using semi-structured interviews will help to understand better consumers 'opinions; and views regarding reducing SUPBs and introduction of sustainable alternatives. What people think can be most appropriate options regarding SUPBs reduction. The interview will be conducted in the local

language “Kinyarwanda” because it is a language of participants. The transcripts of participants will be translated into English and will be presented in the appendix of the thesis report.

3.2.2.2. Key informant expert interviews

A key informant interview is an in-depth qualitative interview with people who have expert knowledge of a particular topic (K. Kumar, 1989). The purpose of the key informant interview is to collect information from a wide range of people include community leaders, professional or residents who have first-hand knowledge about SUPBs. For the thesis research, the key informants will be the employees of REMA (Rwanda Environment Management Authority), an environmental officer at the district level and the local (village) leaders called “Imidugudu” in local language “Kinyarwanda” who knows more about the community.

REMA is a national board that facilitates the coordination and implementation of national environmental policies; therefore, employees have detailed information about possible alternatives to SUPBs. Environmental officers at district level work hand in hand with REMA were selected because they work hand in hand with REMA. The local leaders (village leaders) were chosen because they have a lot of insight into the on-going process in the respective villages

After collecting the information on the current situation regarding, (i)the use of SUPBs, (ii) consumers’ perception regarding a reduction of SUPBs and (iii) introduction of the alternatives and possible alternatives; the participants will be asked their opinion on what could be the factors that can influence the effective switch from SUPBs to more sustainable alternatives.

3.3. Sampling strategy

Semi-structured interviews do not aim to address a representative sample of the population; Rather, they aim to provide detailed information and reliable qualitative data from interviewees (O'Keeffe et al., 2016). Purposive and convenient sampling techniques will be used to produce more acceptable results. Purposive sampling involves selecting participants from a population who likely have the most information on the characteristic of research (Guarte & Barrios, 2006). For this research, those are experts such as the employees of REMA, Village leaders and environmental officers. Convenient sampling is non- random sampling where the participants are selected because of their convenient accessibility at a given time slot; this technique can use. At the same time, the researcher can observe habits, opinions, and viewpoints in a possible

manner(Bhat, 2019). In this study, convenience technique will be used to select consumers of SUPBs.

As noted by Diefenbach (2009), there is no general rule to define the number of interviewees. Instead, it is up to the research's decision. Interviewing different people on the same issue can improve the quality of results. For this research, thirty (30) participants will be interviewed in total. This number can, however, change, depending on the information provided by the participants.

Twenty-five (25) consumers will be selected from the UBUMANZI village of Kigali city using convenient sampling. Five of informant's participants (REMA employees, Environmental officer, Local leaders) will be selected using a purposive sampling technique. I choose this technique because I will interview participants who will be willing to participate in my research. Three other participants (REMA employee, Environmental officer and Local leader of UBUMANZI village) will be selected using the purposive technique. I choose this technique because these three participants are more likely to have rich information regarding single-use plastic bottles.

Interview design

To conduct semi-structured interviews, The interviewer developed an interview guide. As discussed by O'Keeffe et al. (2016), designing an interview guide help to collect relevant information in which the interview can be shaped by interviewee's understanding and interest of the researcher. Yet, the content of the topic can be presented as questions that the interviewer can ask interviewees. These questions help the conversation between interviewer and interviewee to progress flexibly. To better understand consumers' opinions and views regarding the ban on SUPBs, its alternatives and what consumers found most relevant regarding SUPBs reductions, the interview guide is organised as follows:

1. Reasons for consuming SUPBs
2. Consumers awareness about environmental impacts of SUPBs
3. Consumers' knowledge of possible alternatives (soft drink and water bottles)
4. Consumers 'opinions about a reduction of SUPBs and the introduction of possible alternatives
5. Factors that can support an effective switch from SUPBs to sustainable alternatives

As explained by Newcomer, Hatry, and Wholey (2015) in a semi-structured interview, the interviewer asks closed-end questions and open-ended questions which can be extended to encourage the interviewee to provide further information around the topic. The questions in a semi-structured interview often followed by why and how questions. Before conducting interviews, I will first test the interview questions with three people to check if the questions are understandable to give relevant information that I am looking for. It helps to identify the ambiguities and difficulties to discard or modify them, and It also helps the interviewer to adjust taken to complete the interview, to check whether the time is reasonable (Dikko, 2016). The participants 'responses will be recorder and transcribed afterwards.

2.4.Data processing and analyses: Thematic analysis

Once data collection is completed, all interviews transcripts will be uploaded to a qualitative data analysis software MAXQDA (Consult, 2019) to enable a systematic analysis of collected data. Thematic analysis methods will be used to analyse the collected data (Caudfield, 2019). This method is usually used to sets of notes or texts, such as interview transcripts and allows to find out people's opinions, views, experience and values from qualitative data. Thematic methods are useful to explain and interpret the perceptions and experiences of people in a qualitative manner (Maguire & Delahunt, 2017). The aim of this method is not only to summarise the information gathered but also to identify core themes that participants point to in their responses. To analyse qualitative data using the thematic method, Clarke and Braun (2013) identified six steps to analyse data using the thematic approach:

1. Familiarization: This is the first step that an interview needs to take into consideration before doing any further. It involves to read and re-read the transcripts to be familiar with data sets.
2. Coding: This stage involves organising data in meaningful and systematic ways. In this case, the researcher highlights the segment of text which has something interested in research questions
3. Generating themes: After coding, the interviewer can search theme, as explained by (Braun & Clarke, 2006). There is no fixed rule about what can make a theme at this stage, and the research can organise codes into broad themes that seem to say something relevant about specified topics.

4. Reviewing themes: At this stage, a researcher reviews the themes to see if they do make sense, support themes, fit the theme and to identify the subthemes.
5. Defining and naming themes: This is the final stage of making themes, it involves identifying what each theme says, the relationships between themes, how subtheme relate to the main theme
6. Writing up: at the end of this process, the researcher writes the report.

However, another portion of data from direct questions such as age, level of education, gender will be analysed using descriptive statistical analyses.

After collecting data from interviews, I will read and re-read transcripts notes from interviews, by using MAXQDA software, I will highlight the segment of texts of data that is relevant to research questions by using a different colour. This help keeps addressing to study questions (Clarke & Braun, 2013). Coding help the researcher with a formal system to organise the information and documenting the additional information. It helps label key concepts by preserving the context in which the concepts occur.

After coding, the code will be organised into a theme that seems to give relevant information about research questions. Maguire and Delahunt (2017) defined themes as "a pattern that capture something significant or interesting about the data and research questions". Once examining the code, one or more than one can fit into one theme. After having themes, I will read the data that is associated with each theme and see whether the data support the theme. Thus, I will analyse whether the themes work in the context of the entire data set. Further, after formulating themes, I will review those them and gather all data that is more relevant to each theme. The following step will be to check if the themes are fitted in the entire data set. A portion of data from closed questions will be analysed using descriptive statistics. At the end of the analysis process, I will write the thesis rapport.

Some data will be quantitative, and this will use descriptive statistical analyses of some variables such as, assess the difference in perceptions-based on age, income, level of education and gender.

3.5. Ethical considerations

Better introduction of the research to participants is essential when a researcher wants to obtain information. The introduction involves to clearly explain what the research is aimed, how the information will be stored and used, and explain to respondent that there is no obligation to answer any question if they don't want to (Mottram, 2011). To get the respondents' trust, before starting the interview, I will introduce myself, and I will briefly explain the research I am doing and its purpose. The anonymity and confidentiality of participants' answers will be guaranteed. The anonymity is not only essential in creating good environmental where respondent feel they are free to provide information but also having useful information with the participants (Rabionet, 2011).

CHAPTER 4: RESULTS

In total, 30 interviews were conducted in Kigali city, distributed among three districts (Figure 1). To reach the main objective of this study, MAXQDA qualitative software was used. By using this software, different themes that were frequently mentioned by respondents were identified and based on frequency themes hierarchy was constructed. Thus, the content relates to each theme were highlighted.

Five main questions emerged regarding consumers perceptions on SUPBs consumption reduction and introduction of its alternatives including Reasons for consuming SUPBs (1), Consumers awareness about environmental impacts of SUPBs consumption (2), Consumers' awareness of possible options of SUPBs (3), Consumers 'perceptions about a reduction of SUPBs consumption and the introduction of possible alternatives (4). These factors can support an effective switch from SUPBs to more sustainable alternatives (5).

Figure 1: Three districts within Kigali City, Rwanda, where interviews were conducted.

4.1.Descriptive statistics of sample composition

In total, 30 participants were interviewed. Among all the respondents, 56.7% were male, and 43.3% were female (Table 1). Table 1 illustrates that the most significant number of responses were received from people in the age between 20-35 years. This group accounted for 60% of the respondents. 33.3% of the respondents in the sample were 36-45 years old, followed by people being 46-55 years old (3.3%) and those > 55 years old (3.3%). Regarding school education level, 63.3% of the respondents had a university education, 33.3% a secondary school level education, and 3.3% had no formal education. Further, table 1 illustrates the current occupation of interviewee participants. Many respondents (33.3%) had a self-employment business, followed by participants who work in a governmental institution (23.3%) and private sector with 20%, no employed with 16.7% and employed in research institution with 6.7%.

Table 1: Demographic profile of the participants

Variable	**n**	**%**
Gender		
Male	17	56.7
Female	13	43.3
Age		
20-35 years	18	60.0
36-45 years	10	33.3

46-55	1	3.3
>55 years	1	3.3
Education		
No formal education	1	3.3
Secondary school	10	33.3
University	19	63.3
Current occupation		
No employment	5	16.7
Self-employed business	10	33.3
Employed in the government institution	7	23.3
Employed in private sector	6	20.0
Employed in the research institution	2	6.7

4.2. Findings

4.2.1. Reasons for consuming SUP bottles.

Figure 1 shows the themes that were frequently mentioned by respondents on the reason why consumers use SUPBs. The figure illustrates those themes and how often respondents indicated these themes. The main themes that emerged from the reason why people consume SUP bottles are Convenience (1), reusability and price (2), health concern (3).

Table 2: Main themes associated with the reason for consuming SUPBs and the number of entries

Theme	**Frequency of respondents**
Convenience	23
Reusability and Price	18
Health concern	6

Figure 2: Themes associated with reasons for consuming SUPBs

4.2.1.1. Convenience

Participants mentioned convenience to be the main theme when being asked about the purpose of using SUPs. However, convenience was viewed by participants in different ways. Many participants highlighted that the utilization of SUPBs depends on whether participants are going to travel far from their homes or the working environment since it is easy to carry and to get everywhere.

"... I use single-use plastic bottles once I want to go to church or visit my family members because they live in other cities, so once I want to travel sometimes I feel thirsty, so when bus stops I go to supermarket or restaurants to buy water or jus, all these drinks are packaged in single-use plastic bottles". (Lay people interview\ Diolah: 4 - 4).

The responses from lay participants were like ones of experts who revealed that they use SUPBs while travelling far from home or during fieldwork. Yet, the expert told that they use SUPBs sometimes because they have reusable bottles, especially for water bottles:

"I use single-use plastic bottles some time because it is easy to carry, it is convenient while travelling, sometimes I buy water in the single-use plastic bottle once I forget to pack water in my reusable bottle, that means it is my second choice to drink water, and it doesn't take time to take back to the supermarket, you know if you buy water, Jus in plastic bottle and Fanta, you don't need to go back there" (Key informants\Mukashema: 5 - 5)

Convenience also was expressed in terms of time savings, where participants commented that it doesn't take time since they don't need to bring back their empty bottles to the supermarket or selling points. Besides, participants discussed that consuming to SUPs do not require extra time for cleaning since they are used only once. Thus, using SUPBs is less time consuming compared to other bottles like a glass bottle or reusable plastic bottles where you need to clean before other use:

"I use Single-use plastic bottles while working or travelling because of it easy to carry, and it is time-saving since I don't need to return the bottle to selling point" (Lay people interviews\ Mupenzi 1: 4 - 4)

"It is less time consuming because I don't need to clean the bottle since I use it once" (Lay people interviews\Calter 1: 4 - 4)

Convenience in terms of accessibility and availability was mentioned by lay participants who commented that they use SUPBs due to their availability on the market. Also, because they don't have another choice to purchase drinks in another kind of package, since buying drinks in SUPBs is only the option that they have. The answers from laypeople are like answers form experts who felt that SUPBs are more dominant on the market in beverage packaging industries and single-use plastic consumption habits dominate modern society. Figure 3 shows that SUPBs are available in supermarkets and a small shop.

"The reason for using single-use plastic bottles is that they are available on the market", (Lay people interviews\Ingabire: 4 - 4),

"*We use them because we as a modern society; single-use consumption habits dominate us. First, they are available in every selling shop, and it is difficult to avoid them"* (Key informants\Namenye: 5 – 5)

4.2.1.2. Reusability and price

Second usage theme was also highlighted by many participants who mentioned that they often buy drinks in SUPBs not only to for drinks but also for getting a bottle for free since they can use that bottle more than once:

"I buy water in single-use plastic bottles so that once I finish the water, I can use it to buy cooking oil if I don't have money to buy the whole bottle of cooking oil". (Lay people interviews\Ishimwe 1: 4 - 4).

Participants explained that SUPBs is essential to them in term of reducing food waste since they can keep the rest of the drink in that bottle. Besides, the responses from laypeople and experts about the price of SUPBs were similar. The participants argued that the price of drinks packaged in SUPB is different from those drinks packaged in other kinds of packages such as glass bottles or boxes. They mentioned that they get bottles for free which is different from another package where seller can charge you some money if they buy the same drinks in glass bottles:

"I can use it for another purpose like refill water, buy other liquid, for example, cooking oil. Also, single-use plastic bottles such empty bottle of water or jus, I can use them to put my home-made jus and keep it in the fridge" (Lay people interviews\David: 4 - 4).

"*if you buy drinks in those bottles, it means you have the free bottle, so it is cheap* (Lay people interviews\Murungi: 4 - 4).

"….. *that means the price of purchasing goods packaged in SUP bottle is different from purchasing goods packaged in another style of the package"* (Key informants\Namenye: 5 - 5).

4.2.1.3. Health concern

The health concern is a theme that was pointed out repeatedly by participants. Several participants talked about purified water and mineral water. Both experts and lay participants commented that they don't have tap purified water, because water treatment plant companies can't clean water at the level where tap water can be used as drinkable water. Yet, experts' participants commented that in developing countries, water packaged in SUPBs is essential because there are no other ways to have purified water unless they use bottled water:

"*I use SUP bottle in my home because I use purified water, And because I don't trust boiled water, so I choose to buy water in the shop so that I can get purified water"* (Lay people interviews\Giles 1: 4 - 4).

"... so, I buy water in plastic bottles because it is mineral water and purified". (Lay people interviews\Mupenzi 1: 4 - 4).

"..... we don't have tap purified water, so this push many people include me to consume water in SUP bottle because there are no other alternatives". (Key informants\Namenye: 5 - 5).
"I can say that we share some problem with other African countries which related to having pure water for drinking, that is why many times we use that single-use plastic bottle" (Key informants\Benefique: 5 - 5).

Also, participants highlighted the importance of SUPs to avoid infection with diseases. For instance, they mentioned that SUPBs could not keep some germs which can cause diseases because they use them once, which is different from the reusable bottle. They argued that reusable bottles could keep some bacteria which can cause diseases once it is not well cleaned after the first usage.

"...Also, I don't like reusable bottle because if you don't clean it well, it can keep some bacteria or germs which can result to diarrheal diseases, so the single-use plastic bottle is more preferable to me" (Lay people interviews\Mupenzi 1: 4 - 4).

Single use plastic bottles in Simba Supermarket in Kigali city

Single use plastic bottle in a small shop in Kigali city

Figure 3: Water and soft drinks in single-use plastic bottles in shops in Kigali, Rwanda

4.2.2. Perceived environmental consequences of SUPBs consumption.

One aim of the interview was to investigate if consumers are aware of the negative environmental impacts of SUPBs consumption. Figure 4 illustrates the themes and number of respondents per the theme.

Table 3: Main themes associated with adverse impacts of SUPBs consumption and number of entries.

No	Theme	Number of respondents
1	The decline of the beauty of nature	19
2	Agriculture and Livestock	17
3	Marine ecosystem	15
4	Human impact	14
5	Air pollution	12
6	Climate change	3

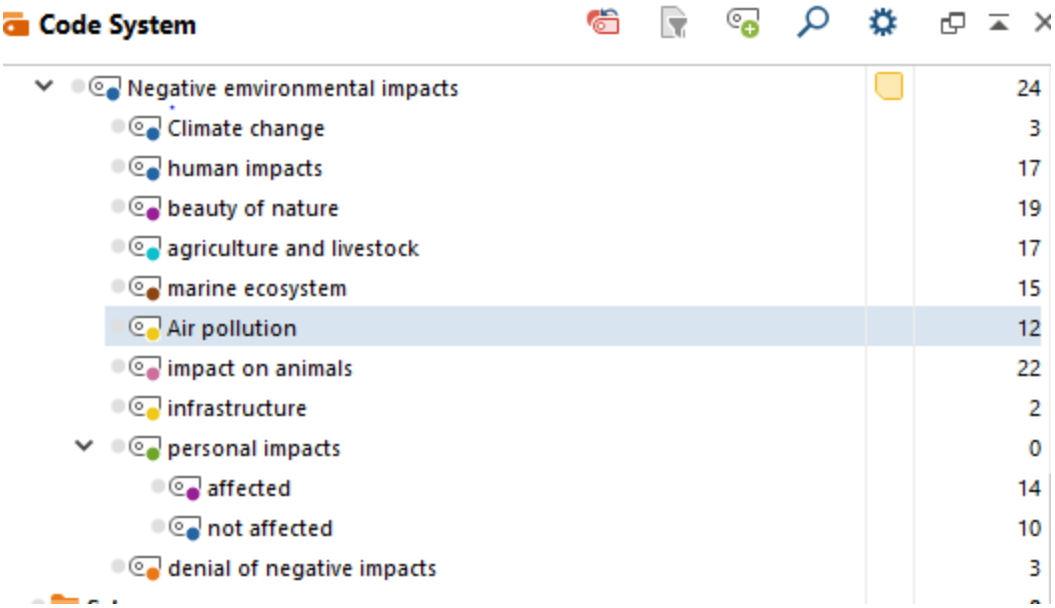


Figure 4: Themes identified from negatives environmental impacts of SUPBs

Many participants perceive SUPBs consumption as a significant challenge to the environment. However, few of them did not become aware that SUPBs consumption can have negative impacts on the environment. Based on their responses, the researcher categorised adverse effects into four: the beauty of nature, agriculture and animal impacts, Marine impacts and climate change and air pollution, as illustrated in Figure 4 above.

4.2.2.1. The decline of the beauty of nature

This theme was frequently mentioned by participants who felt that SUPBs consumption could result in visible pollution of nature due to littering of SUPBs, for example, along the roads, parks, beaches or other recreational sites. Also, participants argued that littering SUPBs can have impacts on tourism; plastic in nature can make an area less attractive for tourists who want to visit the place. Participants discussed that single-use plastic littering results in poor sanitation of the environment. Figure 5 shows the mixture of solid wastes include plastic bottles at Nduba Landfill, where all municipal wastes are disposed. Before trees occupied this place but now is held by a mix of solid waste.

"*The fact that single-use plastic bottles are not biodegradable, they result in littering, which causes poor sanitation in the environment as a result of their accumulation in mass".* (Lay people interviews\Muhawe: 6 - 6).

"It affects the beauty of nature, recreation sites like beaches or parks because undesirable to swim or to visit because no one likes the dirty place". (Lay people interviews\Chantal 1: 6 - 6).

The answers given by lay participants were like ones of expert's participants who commented that single-use plastic bottles littering affect the aesthetic of the nature such as beaches, parks and other recreational sites since it changes the feature of the landscape.

"….it is the dirtiness of environment when those SUP bottles are thrown everywhere in an open environment, this makes the place, for example, small parks, beaches and other recreation sites to look very bad", (Key informants\Umutabazi: 8 - 8).

Single use Plastic bottles during waste separation at Nduba landfill, Gasabo district, Rwanda	Mixture of waste at Nduba landfill site in Gasabo District, Rwanda

Figure 5: Mixture of waste at Nduba landfill site in Gasabo District, Rwanda.

4.2.2.2. Agriculture and livestock impacts

Negative agricultural impacts of SUPBs consumption were mentioned by many participants who argued that SUPBs could hamper plant growth due to forming a layer on top of the soil which prevents water from penetrating the soil (see Figure 6).

"..... it causes soil degradation because you know that it takes a long time for the plastic to decompose, so it stays in the soil, and the plant can't grow well. As a result, the soil productivity goes down" (Lay people interviews" \Ishimwe 1: 7 - 7).
"..... if there is no water penetration, it is hard to plant to absorb nutrient because water plays an important role in plant growth, so this is a challenging issue to agriculture in general". (Key informants\Umutabazi: 7 - 7).

Yet, participants argued that SUPBs in the soil could affect the activity of soil microorganisms which facilitate nutrients uptake by plants. They argued that organisms are not able to decompose SUPBs in a short time; that is why plastics can stay in the soil for long periods. Furthermore, participants mentioned that littering of SUPBs could cause soil degradation such as soil erosion; this is due to less infiltration of water into the soil because of plastic layers which result in water runoff.

"single-use plastic bottles once are in the soil; it affects soil microorganisms which help nutrients up taken by plant" (Lay people interviews\Vincent1: 6 - 6),
".... they can prevent the water infiltration into the soil which can cause water runoff, this can result in erosion". (Lay people interviews\Chantal 1: 6 - 6).

The answers from non-expert respondents were similar to those of experts, who argued that SUPBs littering like another kind of single-use plastic affect the agriculture sector since it stays in the soil for a long time. It is time-consuming to do land preparation for farmers to remove that plastic in soil, they commented that most of the Rwandan population live in agriculture and livestock. Therefore, single-use plastic is a big challenge to the agriculture sector.

"...more than 75% of Rwandan population live in agriculture and livestock, so if those plastics bottles or other single-use plastic items are in the soil, it hinders water penetration into the soil so that plant can benefits from water, as water facilitate plant uptake of nutrients, so this can result to slow plant growth". (Key informants\Namenye: 9 - 9).

"Another example is farmers in low land, when its rain, the runoff carries all plastic from upland to low land as result farmers get a lot of plastic bottles and other kinds of plastics in their farms. This takes time for farmers, to prepare the land to next season". (Key informants\Mukashema: 9 - 9).

Furthermore, lay participants mentioned the negative impacts on domestic animals as well as none domestic animals. Participants revealed the adverse effects of SUPBs on cow, goats, sheep, pigs, among others. They said that, once animal eats a plastic bottle, either small pieces or big can cause animals to get sick, which can result in the death of animals. Also, participants commented that SUPBs littering does affect not only domestic animals but also forest animals. They said that once the animal in the forest or parks eat plastic can cause them to get sick or die.

"….. *in rural areas, if the cow eats plastic bottles or other plastics by confusing them with food, particularly to grazing cows, goats and sheep; this can cause the animal to get sick or die if the animal is not able to digest those plastics".* (Lay people interviews\Byiringiro: 6 - 6).

"In our country, there is a policy that prohibited people from throwing things, especially in forests. But because people don't have the same understanding, some of us throw them in the forest while travelling to Nyungwe or Akagera forest, and this is too bad for animals who live in those forests". (Lay people interviews\Uwase: 7 - 7).

Also, experts' participants highlighted that it is evident for forest animals to have a high chance to eat SUPBs once it exists in the forest.

"….. so, can you imagine if I drink energy drinks in a single-use plastic bottle, and throw in Nyungwe forest, there is a high probability that some animal can eat that bottle, and can cause the animal to get sick or die". (Key informants\Benefique: 7 - 7).

Figure 6: Mixture of plastics in the soil at Nyabugongo riverbank, Kigali/Rwanda.

4.2.2.3. Impacts on marine ecosystems

Participants argued that when plastics enter water systems such as rivers, oceans and lakes, they can cause harm to marine animals such as fish, hippopotamus and other animals:

"...If the fish eat that plastic, especially big fish, can die because fish do not have a doctor". (Lay people interviews\Diolah: 6 - 6).

".... this can be invisible because we don't know how much fish died due to swallowing SUP bottle but, I know that many aquatic animals die because of plastics" (Key informants\Umutabazi: 10 - 10).

Yet, participants who argued that SUPBs littering could affect aquatic animals due to chemical compounds contain in bottles which can cause marine animals to get sick or die:

"...I think also that the chemical compound contains plastic bottle can affect fish because may fish cannot tolerate those chemicals in their body" (Lay people interviews\Ingabire: 6 - 6).

Another marine impact is pollution; for example, some participants said that due to many SUPBs and other plastics in water, can increase algae in water which create an undesirable condition for

aquatic animals. Figure 7 shows the plastic bottles floating in the Sebeya River that end up in Lake Kivu/Rwanda.

Figure 7: Marine single-use plastic bottles pollution in Rwanda.

4.2.2.4. Human impacts

Human impacts of SUPBs consumption was a theme that participants frequently pointed out. Several participants commented that SUPBs consumption could cause people to get sick due to the harmful gases that people can respirate once they are near to burning area:

"Another thing is that there are some people who use to burn those plastics, so when plastic is burnt, it emits CO2 and other gases which can affect people who inhale those gases, people can catch respiratory diseases" (Key informants\Namenye: 11 - 11).

Yet, participants argued that SUPBs littering could damage properties and infrastructures. Once SUPBs exist environment can be transported in waterways during the rainy season. Thus, they can block waterways, as results can cause water and sewage to overflow which destroy houses, roads and other infrastructures:

"As our country experiences heavy rain; If there are many plastic bottles or another kind of plastics, due to rain, it can transport those plastics in the waterway. Then when its block them, water can spread everywhere because ways are blocked due to plastics in it, as a result, can destroy a house, roads or other infrastructure" (Lay people interviews\PAUL 1: 7 - 7).

4.2.2.5. Air pollution

The participants also commented that once SUPBs are burned, they emit polluted gases into, which results in plastic air pollution. Therefore, air pollution can result in different problems:

"For me, I think SUPs consumption can cause air pollution, especially during recycling process because most of the plastic recycling emit CO2 and other gases which pollute our atmosphere" (Lay people interviews\Mupenzi 1: 9 - 9).

"Sometimes you see that the atmosphere is dark due to burning of plastics, which normally emit dark gases, so this makes the atmosphere to change its features" (Lay people interviews\Mukamana 1: 6 - 6).

4.2.2.6. Climate change

Also, the participants commented that SUPBs consumption could contribute to climate change due to the emission of greenhouse gases such as CO2, Methane gases and other gases which can be the source of Ozone layer destruction:

"Another thing is that there are some people who use to burn that plastic, so when plastic is burnt, it emits CO2 and methane gas and these gases once there are in the atmosphere, they can destroy the ozone layer that helps to protect as from high intensity of solar radiation. Therefore, this can contribute to climate change, such as global warming". (Lay people interviews\Ben: 6 - 6).

Furthermore, the experts argued that pollution is not only a result of SUP bottles consumption but can also occur during the production process.

"From production up to single consumption use plastic bottles, resulting in air pollution because you can't produce without polluting. Let look at the consumption side only. If people finish using SUP bottle then, dispose them in the waste bin or throw away, the process of recycling itself emit GHG, in addition to this some people the plastic in their home, it is not allowed. Still, some people do, so if there is burning of that plastic, of course, there is some gas, such as CO2, CH4

among others, so all this contribute to air pollution, this can lead to human sickness. In addition to this is that those emitted gases can affect the ozone layer that prevents high solar radiation, so this result to climate change such as global warming, sea-level rise. Some of these impacts we can't see them by our eye, but we feel it sometimes". (Key informants\Namenye: 11 - 11)

By asking participants if they had been affected by those negative impacts, many participants agreed that they had been changed; for example, in agriculture and livestock were frequently mentioned by participants. Also, participants argued that they had experienced low crop production due to plastic in their farms. Some participants also have been affected by the destruction of the beauty of nature, for example at recreation sites such as beaches, parks, among others:

"Yes, I remembered in 2010, my two cows died in Umutara, I asked the animal doctor, he said that they died due to many plastics in their stomach, that was the sad story of the single-use plastic either bottle, bags or another kind of single-use plastics". (Lay people interviews\Vincent1: 7 - 7).

"Yes, I have been affected by those impact because I have farms, cows. And I experience many plastics during land preparation, so I have been affected for sure". (Key informants\Umutabazi: 12 - 12).

4.2.3. Awareness of alternatives for SUPBs

One question in the questionnaire aimed to unravel whether the participants were aware of other options for SUPBs. Table 4 shows whether participants are aware of alternatives of SUPBs or not.

Table 4: Themes associated with awareness of alternatives of SUPBs.

No	Theme	Number of respondents
1	Aware of SUPBs alternatives	25
2	Not aware of SUPBs	5

alternatives

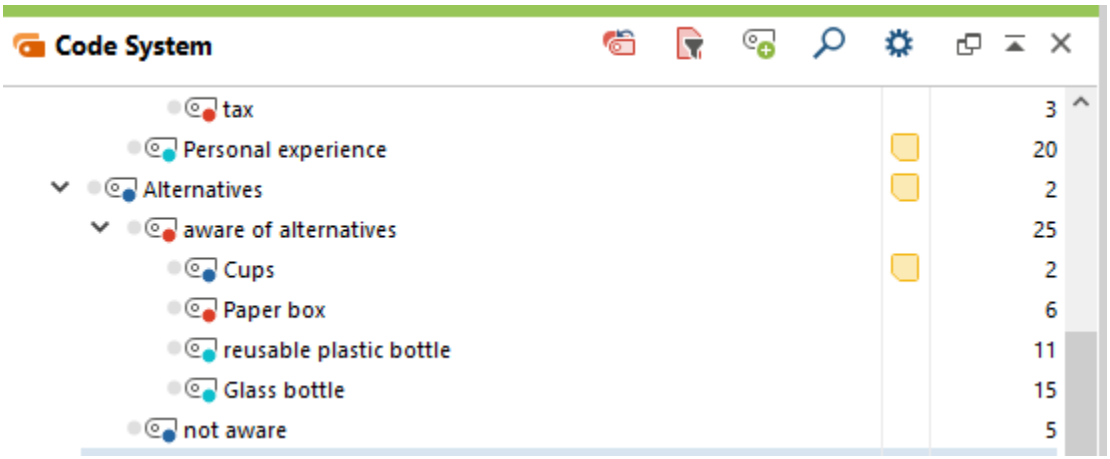


Figure 8: Themes identified from awareness of alternatives of SUPBs.

Figure 8 illustrates themes and subthemes about awareness of possible alternatives of SUPBs. Some participants agreed that they know some other options of SUPBs such as reusable bottles, big bottles, glass bottles, paper boxes, glass cups, reusable plastic cups, among others. Figure 9 shows different alternatives for SUPBs:

"Yes, But there are few on the market, for example for water, their reusable plastic bottle which you can keep it for a long time, there is also water dispenser which is the big bottle, it 15little or 20 little it depends on producers, this is alternative for a single-use plastic water bottle. There also is an alternative bottle for coco-cola, Fanta, which is glass bottles. These kinds of bottle, once you buy those drinks in a glass bottle, you make sure that you bring your or the supermarket ask you to leave money which you can take back once to bring back that bottle. We also have paper boxes which aluminium inside for especially milk and jus, but these are few on the market, and the good is if you buy milk or jus in those boxes, you don't need to return the box, you dispose of it in the trash, Is all I know about alternatives. Also, we have cups such as glass cups and reusable plastic cups that I normally use at home". (Lay people interviews\Donatha2: 10 - 10).

"Well, I can say that I am very aware of alternatives of SUP bottle, I have a reusable bottle on my table, …glass bottle package, reusable bottle for beers, for example, Skol industries has two

kinds of the bottle: glass bottle and single-use bottle, also, we have a water dispenser, a big bottle of fifteen little or more. We also have box package, for example, some manufacturing industries like INYANGE (soft drink industry) use box to pack jus or milk, we have glass cups, reusable plastic cups, etc. We are looking for other alternatives to reduce SUP bottle consumption; sooner, we will become free of SUP items". (Key informants\Namenye: 15 - 15).

Yet, some participants argued that there are only a few alternatives available on the market, and they are expensive compared with drinks packaged in single-use plastic bottles.

"I only know reusable bottle, but they are not commonly used by many, only children who usually go to school and maybe pregnant women, but ordinary people especially man does not use those alternatives, it is rare. (Lay people interviews\Mupenzi 1: 9 - 9).

"Although some alternatives are available, they are expensive, so I choose to buy small ones". (Lay people interviews\Chantal 1: 9 - 9).

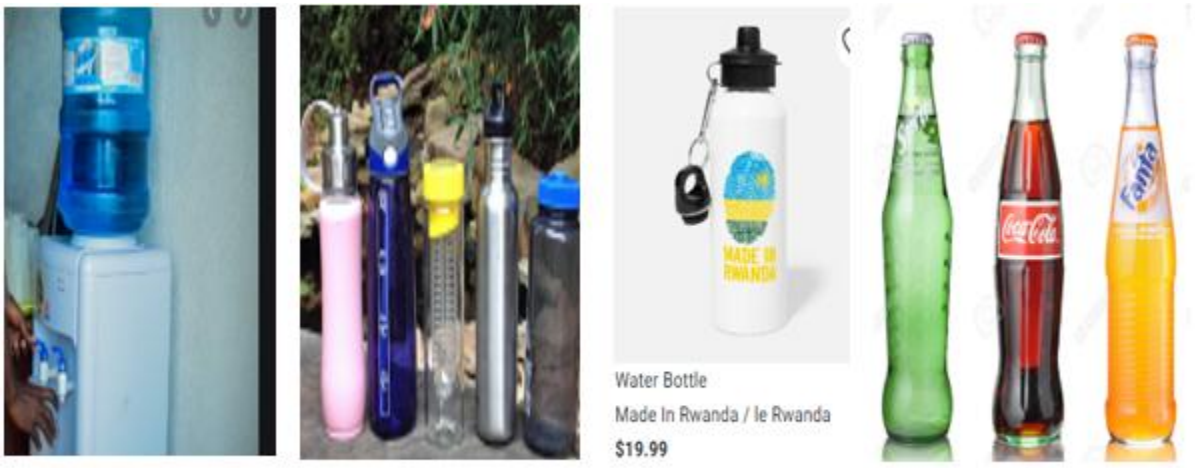


Figure 9: Possible alternatives of SUPBs in Rwanda

However, few participants said that they don't know any alternatives of SUPBs, they thought that maybe there are some alternatives, but they didn't know.

"No, I don't know any alternatives for single-use plastic bottle, maybe they are, but I don't know any" (Lay people interviews\Gisele: 10 – 10)

4.2.4. Perception of consumers about reductions of SUPBs consumption and the introduction of its alternatives

To understand the perception of consumers regarding a reduction of SUPBs and its alternatives, respondents were asked whether SUPBs can be reduced and how this reduction could be achieved. Figure 10 shows what options the participants thought could reduce SUPBs consumption. Many participants agreed that SUPBs consumption could be diminished, and they suggested some options which they thought would be adequate to reduce SUPBs consumption.

Table 5: Main themes associated with perceptions on the reduction of SUPBs and introduction of its alternatives and the number of entries

No	Theme	Number of respondents
1	Recycling	25
2	Ban	21
3	Raising awareness	7
4	Taxes	3

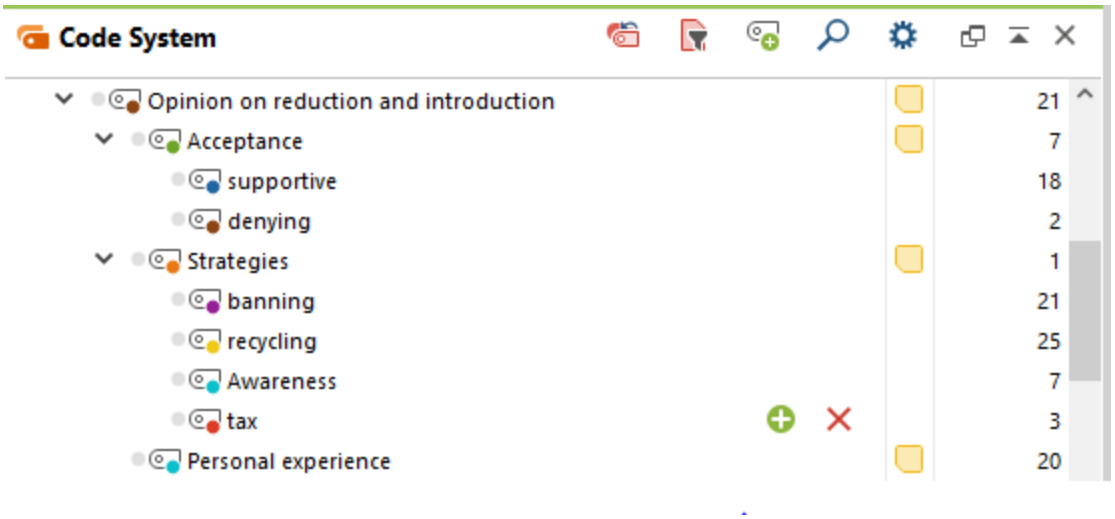


Figure 10: Themes associated with perceptions on the reduction of SUPBs and introduction of its alternatives.

4.2.4.1. Recycling

Recycling was a theme that was most frequently mentioned by participants. Respondents considered recycling an essential means for reducing the overall number of SUPBs produced and consumed. Furthermore, respondents argued that recycling would reduce plastic litter.

For me, the excellent option is to recycle those bottles. Rwanda, as a developing country, has to increase the recycling capacity to the reduction of single-use plastic bottle consumption. You see, right now, there is only one recycling plant in Bugesera district, all the landfill is not good, for example, Nduba landfill it is an open landfill where the waste collection companies dump their collected waste. So, this is a problem of poor management of waste, not consumption. (Lay people interviews\Gisele: 13 - 13).

However, participants commented that recycling in Rwanda is still in its infancy because recycling companies cannot recycle all SUPBs produced in a country. Therefore, they argued that increasing recycling capacity would be adequate to reduce SUPBs littering.

"in our country, we have a small recycling industry, and it doesn't have advanced technology to recycle those SUP bottle" (Lay people interviews\PAUL 1: 12 - 12)

Moreover, participants emphasized that recycling can be a useful intervention since Rwanda aims to become a middle-income country, and recycling will not bring any losses to the industry or consumers.

"our vision 2050 is to become a middle-income country, so based on that I think, recycling is a good strategy that can fit our country since neither consumers nor producers will experience loss" (Lay people interviews\Calter 1: 10 - 10)

The answers from lay participants were related to responses from experts' people, who said that recycling is one of intervention that they think, can reduce SUPBs pollution. As explained by one of expert, there is a system called producer extended responsibility system, which aimed to have zero litterings. The experts argued that to reach sustainable development; recycling is one of the strategies they want to apply to reduce SUPs littering. They commented that till now they don't have enough alternatives for all SUPBs, that is the reason why they felt that empowering recycling will reduce SUPBs pollution.

"This means that producer has to take responsibility of taking back the amount of bottle produced, for example, if the producer release 500 bottles of water, he is responsible for collecting back the same amount of empty bottle. We are dealing with producers to adopt this strategy. This will provide an advantage for industries because they can recycle easier. Become we want to adopt a circular economy; this will be a useful strategy" (Key informants\Namenye: 20 - 20).

They said that they want to involve different stakeholders such as industries, waste management companies, and recycling companies to look at what could enhance the recycling capacity.

"….. as I told you, that we don't have enough alternatives. So in case, we are waiting for those sustainable alternatives. We want to increase the recycling rate. Nowadays, we have small commercial recycling companies; Which there are not able to manage all country waste, so what we want is to collaborate with producers and recycling companies; so that we can empower the

recycling technology. We are thinking about this because we don't only consume what our country produces but we also do importation". (Key informants\Namenye: 21 - 21).

4.2.4.2. Ban

Banning of SUPBs distribution and provision of environmentally friendly materials was mentioned by many respondents who felt that ban would be an effective way to reduce SUPBs consumption. The answers were highlighted by participants who felt that the packaging industries could stop producing SUPBs and start providing sustainable alternatives.

".... I mean, replace the single-use plastic bottle, for example, jus, Fanta, Coca-Cola, yorgout and beverage bottle by other bottles that are maybe degradable, or organic bottle or boxes. I remember, once we banned single-use plastic bags, it was not understandable at start of implementation, but with time, we managed the situation, so ban consumption which will result from ban production is a good system to decrease consumption of single-use plastic bottle". (Lay people interviews\Byiringiro: 11 - 11)

"...I wonder what we used before single-use plastic bottle introduction? We used to use traditional thing made in trees such as (ikibindi, uruho, igicuma) or other renewable materials, so if we go back to our traditional root, if thing SUP bottle consumption will be reduced". (Lay people interviews\Diolah: 10 - 10).

Yet, participants felt that the ban on SUPBs consumption could not be effective without any policy enforcement, which prohibits the distribution of drinks in a single-use plastic bottle package. They argued that some producers do not care about the negative impacts of their production process, so they suggested the enforcement law to prohibit SUPBs distribution.

"I think, the government should enforce the policy of prohibition of SUP bottle, especially for industries packaging industries because many producers only look at their private benefits, not to social benefits". (Lay people interviews\Muhawe: 11 - 11)

However, other participants don't see complete as an excellent way to reduce SUPBs because they felt that ban would have considerable impacts to the economy of country especially for

small industries who won't be able to provide an environmentally friendly package. They argued that to avoid loss, the government should ban those SUPBs which have alternatives on the market right now but not ban those which do not have an alternative. They felt that those SUPBs which do not have alternatives right now should be gradually prohibited.

"……we live in the era of plastic; it is not possible to ban all plastic since we live in a world of plastic, but at least those plastic which has alternatives should be banned entirely (Lay people interviews\Uwase: 13 - 13).

The responses from laypeople were not different from those of experts, who said that the SUPBs which do not have alternatives on the market will be banned gradually since there are few alternatives now. There will be complete ban once those sustainable alternatives are available on the marketplace. They commented that the industries were given time to search for alternatives materials of SUPBs, they argued that the country could not rely only on recycling, because recycling reduces littering but not consumption or production.

"Although we have some alternative, there is some SUP bottle which does not have alternative till now, so in this case, we are encouraging packaging industries to look for the sustainable package, and the last meeting of the draft law in January 2019 concluded that the industries were given two years to produce the environmentally friendly package. Otherwise, the law of completely ban will be enforced". (Key informants\Umutabazi: 17 - 17).

"… For me, improving recycling is not enough to reduce single-use plastic bottle consumption, because recycling reduces littering but do not reduce production at all". (Key informants\Benefique: 15 - 15).

4.2.4.3. Raising awareness of the negative impacts of SUPBs consumption and existing alternatives

Raising awareness was also mentioned by a portion of participants who thought that educating people would be effective to reduce SUPBs consumption. As commented by participants, who believed that many people do not use the existing alternatives because they don't know the

negative impacts of SUPBs consumption. They argued that there are some alternatives on the market, but people prefer to continue using SUPBs because they don't know the consequences of their consumption behaviour.

Besides, raising awareness of the environmental impacts of single-use plastic bottles consumption and positive effects of consuming environmentally friendly products will be adequate to reduce SUP bottles usage:

"I think many people don't know that there are alternatives for SUP bottles, so I think if the companies or our leaders inform people importance of using those alternatives, would be better to reduce SUP bottles consumption" (Lay people interviews\Diolah: 10 - 10).

".... we need to have a good understanding of negative impacts of plastic because some people say that it market politic, other don't even know that it is a problematic issue, so if people have positive understanding, I think it is possible to reduce SUP bottle consumption" (Lay people interviews\Diolah: 10 - 10).

The experts commented that they already started to make people aware since there some consumers who began to move away from the utilization of SUPBs in their daily life from governmental institutions, hotels and big restaurants:

"First, we already started do the campaign of single-use plastic bottle consumption by encouraging people starting from a government institution, hotels and banks, so there are no rules, but people do because they understand the importance of reducing SUP bottle consumption. We are also aimed to continue educating people at all levels. So, raising awareness is the first strategy that we are using now". (Key informants\Namenye: 19 - 19)

4.2.4.4. Tax

Further, the fee was another theme that was mentioned by few participants, who felt that increasing consumption tax would discourage the consumer from purchasing drinks in SUPBs because most of the consumers prefer goods which have a low price. Also, participants thought

that polluter-pay strategy would discourage producer of SUPBs, which will have an impact on consumption as well.

"I think, increasing tax on commodity will change people's preference, because for people always prefer cheap products", (Key informants\Namenye: 22 - 22).

"…..*that I think as a person is polluter pay strategy, I don't know if you understand it but is a system where industry pay tax depends on how much it produces, this means if one industry ten tones bottle per year let say, will not pay the same tax as a small industry that produces one ton of bottles, so this strategy will discourage industries from producing much single-use plastic bottle, the industry will think about the alternatives".* (Key informants\Benefique: 18 - 18).

Although many participants agreed that SUPBs consumption could be reduced, some participants didn't agree to reduce SUPBs consumption, because they felt that single-use plastic bottles consumption doesn't have any adverse environmental impacts.

"….See for example water, before people were suffered from diarrhoea because of lack of pure water, but now we can get pure water plastic bottle, so if we stop using them, then there will be consequences like diseases from drinking tap water because tap water is not purified one. So, I don't prefer to reduce single-use plastic consumption; I think increasing consumption it is good to be healthy". (Lay people interviews\David: 11 - 11).

"…*I think, maybe it is the market strategy to change the package system, but I don't think in our country, SUP bottle consumption can result to the negative environmental problem"* (Lay people interviews\Murungi: 10 - 10).

4.2.5. Facilities and supports to move away from SUPBs consumption

Participants were asked what supports and facilities which they thought would be useful to shift from SUPBs consumption to more sustainable alternatives. The answers were varied among participants. Figure 11 illustrates the supports and facilities that consumers need to change from SUPBs to more sustainable alternatives.

Table 6: Main themes associated with Facilities and support to switch from SUPs to more sustainable alternatives and number of entries.

No	Theme	Number of respondents
1	Availability and affordability	23
2	Distribution of facilities	18
3	Collection points and recycling centres	11
4	Economic incentives	7
5	Educational programs	4

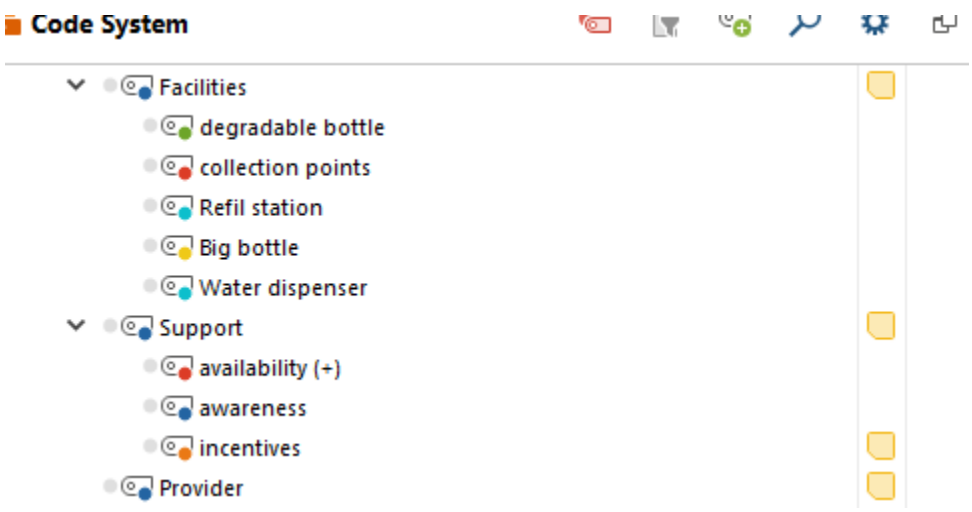


Figure 11: Themes associated with facilities and supports to switch

4.2.5.1. Availability and affordability of alternatives for SUPBs

The respondents felt that the availability of environmentally friendly materials would be a useful factor to shift from SUPBs to more sustainable consumption. They thought that providing those ecologically friendly materials such as reusable bottles, water dispensers and refill purified water tanks will encourage consumers to purchase in sustainable ways.

"I think having good alternatives for that plastic on the market. Because even if we are willing to buy drinks in that sustainable bottle or boxes, we can't buy them if they are not available in our shopping place". (Lay people interviews\Lilian 3: 15 - 15).

"... I will buy it in a single-use plastic bottle even though it is not what I prefer, so, make those sustainable bottles will influence people to buy them". (Lay people interviews\Mukamana 1: 17 - 17).

Yet respondents thought that providing environmentally friendly alternatives is not enough. They felt that provision of those alternatives at an affordable price would be an effective way to shift. Consumers argued that most of the environmentally friendly package is always expensive compared to regular packaging. Besides, suggested that the price of the environmental warm bottle should be at lower or at the same rate as SUPBs.

"Affordability means to fix the price that is comparable the price of SUP bottle, and this will help us to consume regularly because the price wouldn't change" (Lay people interviews\Ingabire: 15 - 15).
"We are dealing with producers to reduce the price of water dispenser so that every house at least in the city can have a water dispenser in their home" (Key informants\Namenye: 27 - 27)

4.2.5.2 Distribution of reusable bottles, water dispensers and refill purified water tanks

Furthermore, some participants felt that the distribution of some alternatives for free, especially for water bottles would facilitate consumers to reduce SUPBs consumption. For example, the distribution of reusable bottles and water dispensers and a big bottle for free will encourage consumers to reduce the usage of SUPBs.

".... they should start distributing bigger bottles as an alternative distribution from small bottles. And this can be done at an affordable price or for free because people are always the victim of any policy". (Lay people interviews\Habineza: 17 - 17)

Besides, respondents felt that once producers distribute reusable bottles. It is essential to provide also refill purified water stations, where they can refill the reusable bottles and pay money is low compare to money that they used to pay for SUPBs. They felt that this would be an effective way to switch from unsustainable consumption to sustainable consumption.

" ... I think, providing purified water tanks in a different location so that consumers can refill their reusable bottles without buying SUP bottled water, it is a cool idea I think because the industry will be benefiting as well as consumers" (Lay people interviews\Giles 1: 15 - 15).

The participants argued that they have the experience because they have milk tanks; they are no longer use SUPBs for milk. They can go to selling points with their reusable bottles and purchase milk without charging money for a bottle. They felt that if the industries could do the same thing for other drinks would be an excellent way to switch from SUPBs consumption to more sustainable consumption.

"..... for water is to provide a water refill station, let give you a small example of how this can be done. For example, we know that if you want milk from INYANGE industries, you can go with your bottle at selling point because they have the tank, where you can pay money, and they can give you milk in your own package/bottle. so, if they can do the same for water, would facilitate people to get water in an easy way and at low cost because the seller will not charge you the packaging fee as you bring your container". (Lay people interviews\Muhawe: 18 - 18).

4.2.5.3. Provision of Collection points and recycling centres for SUPBs

Given that participants felt that recycling could reduce single-use plastic bottles consumption, they commented that the provision of bottles collection points and recycling centres would be a helpful tool to recycle their SUPBs. Some participants argued that collection point should be selling points, streets or meeting points, where they can dispose of their empty bottles. They commented that right now they don't have plastic bottles collection point where they can dispose of their bottles. They said that they throw them or dispose of in trash bin where there is a mixture of wastes. Yet, participants felt that putting labelled bins at selling point or on roads and streets would help them to recycle their empty SUPBs.

"…As you can see, we don't have any collection points where we can dispose our bottles, I think industries can provide them, this can be trash on streets or roads, supermarket or retailer shop, so this will facilitate people to dispose of their plastic bottle more easily. And these bins must be labelled so that can inform consumers to know where to dispose of their single-use plastic bottle" (Lay people interviews\Calter 1: 13 - 13).

4.2.5.4. Economic incentives for recycling of SUPBs

The participants highlighted that financial incentives could motivate them to recycle their SUPBs. They felt that provision of economic incentives such as money. At the same time, the consumers bring back their empty plastic bottles to selling points would be an effective way to help consumers to recycle their empty bottles. Other felt that discount would be good motivation to facilitate consumers to recycle their bottles.

" *We give small incentives to people to recycle their bottle such as giving 100 frw for those who bring one kg of the plastic bottle, so if this can be applied at the national level, I think there will be a good impact"* (Key informants\Valens: 20 - 20).
"… discount for some commodities in shop, market or supermarket would be a good deal" (Key informants\Umutabazi: 22 - 23).

4.2.5.5. Education programs

Another portion of participants felt that changing consumers behaviour through education can help people to switch from SUPBs consumption to more sustainable alternatives. They thought that education campaigns around reducing SUPBs usage and promoting more sustainable alternatives are good ways to shift from unstainable consumption to sustainable consumption. Participants commented that many people don't know the negative impacts of their consumption behaviour; they argued that educating people will have ethical effects.

"…, educate people the negative impacts of single-use plastic bottle consumption because most of us don't know the impact of what we do, some people don't know that if you burn plastic, it results to air pollution, other people don't care about the environment, so education is key for a

shift from single-use plastic bottle to more sustainable alternatives" (Key informants\Umutabazi: 22 - 23).

Yet, other participants felt that educating consumers on how to recycle and the importance of recycling would be a good way to change consumers behaviours. Furthermore, the portion of participants, experts, agreed that campaigns have already started in in governmental institutions and big hotels, they felt that the attacks had ethical impacts, they said that they aimed to do many battles at the national level.

"As you know the governmental institutions, big hotels and some banks are no longer use the single-use plastic bottle in their officers, this has been done through campaigning only, and you can see good change, as you can see here", (Key informants\Umutabazi: 22 - 23).

By asking consumers who should provide those supports and facilities, majority of respondents felt that government and producers should provide those supports, they argued that government should educate people by using a different approach and enforce the law for those who will still use SUPBs illegally. They commented that producers are responsible for producing those sustainable alternatives at an affordable price.

"I think the government and industries are responsible for supporting and facilitating consumers to shift their consumption. The government can enforce laws and teach people, whereas industries are responsible for providing those alternatives at a low price". (Lay people interviews\Diolah: 13 - 13).

"... producer and government are responsible for facilitating and supporting people because consumers need to be taught by leaders, but also, they need available alternatives to be on the marketplace and affordable alternative package. So, producers are responsible provide a sustainable alternative but also at an affordable price". (Key informants\Namenye: 28 - 28).

Besides, felt that no only government and producers, but also the waste management companies should involve in reduction by educating people on how to do waste separation at home.

",…. I think waste management companies are responsible for teaching people how to separate waste" (Lay people interviews\Vincent1: 22 - 24).

CHAPTER 5. SUMMARY OF FINDINGS AND DISCUSSION

This study aimed to generate information about consumer's perceptions on single plastic bottles reduction and introduction of possible alternatives. The semi-structured interviews were conducted with different stakeholder groups (experts and laypeople) to reach the objective of the study. The participants (experts and laypeople) in Kigali city were asked questions. Beside each of which addressed a specific topic, Which is: reasons for consuming SUPBs; consumers' awareness about environmental impacts of SUPBs; Consumers' knowledge regarding possible alternatives, consumers 'perception regarding the scope for a reduction of SUPBs and the introduction of viable alternatives, and factors that can support a useful switch from SUPB consumption to sustainable alternatives). Participants could respond to the questions openly, i.e. they could add aspects or opinions that seemed relevant to them. The responses were analyzed, MAXQDA qualitative software. This study is the first addressing the issue of SUPBs use for Rwanda.

5.1.Summary of Findings

The section provides an overview of the main findings that the list is structured according to the five thematic blocks that were addressed in 5 main questions.

- The study shows that, while different reasons exist, most participants consume SUPBs because of convenience, for example, because they are an easy and less time-consuming means to carry fluids. Secondly, respondents prefer SUPBs to receive a free bottle for the second usage. Another reason is that SUPBs are widely available on markets, and they are cheap compared to other packaging system glass bottles, paper boxes systems. Some respondents also consume SUPBs due to expected health benefits because drinking regular tap water is not sufficiently clean would, therefore, induce a risk of disease.

- The study reveals that many respondents think that SUPB consumption causes adverse environmental impacts such as impacts on agriculture, environment, as well as human implications. However, few respondents indicated that they are not aware of adverse environmental impacts
- Most participants expressed awareness of some alternatives to SUPBs, while some respondents also explained not to be aware of any alternatives to SUPBs.
- Although most of the respondents felt that it is crucial to reduce SUPBs consumption, few respondents didn't think that reduction is essential. Most respondents perceive a lowering of SUPBs and the introduction of sustainable alternatives to be crucial tools to reduce plastic pollution in Rwanda. To achieve this goal, they suggest some interventions which can be provided by governmental institutions. Most respondents argued that recycling of SUPBs is a good option to reduce its impacts. There are also respondents expressing that banning SUPBs may be a good option to reduce SUPBs consumption. Also, some respondents felt that a reduction of SUPBs could be achieved Through increase tax and by educating consumers.
- Respondents explained that awareness in combination with the availability and affordability of alternatives, which followed by the provision of recycling facilities such as collection points and recycling centres with incentives to recycle their SUPBs are essential to shift from SUPBs to more sustainable alternatives.
- They also expressed that this should be a joint effort and responsibility of the civil population and the government, producers and waste management companies, as well as non-governmental organizations.

5.2. Discussion

Some consumers researchers have observed that to reduce unsustainable consumption, and it is essential to know why consumers have such consumption behaviours (O'Donnell & Rice, 2012). Our study found that consumers SUPBs because of its convenience, in term of time and easy to carry, availability of those plastic bottles on the market, having the bottle for free and being healthy especially for plastic bottled water.

Generally, the main results revealed from the study are in line with research findings in the scientific literature. For instance, (Ballantine et al., 2019) showed that consumers prefer SUPBs

because they are easier to carry during travel or at work. Availability also was found as the reason for consumption, which is like the study of Thøgersen (2000); Brécard, Hlaimi, Lucas, Perraudeau, and Salladarré (2009) who found that availability of products affects consumers to purchase environmentally friendly products. Yet, consumers not only aim to buy drinks in SUPBs but also to use empty bottles for other purposes. The literature reveals that bottles play an essential role to motivate consumers to make a purchasing choice (Opel, 1999).

Given that access to clean or purified water does not exist for the majority of populations in many developing countries, consumers were concerned about their health. The study in the UK found that consumers prefer to consume water in single-use plastic bottled water because they feel well and safe (Doria, 2006; Ferrier, 2001). Price was another reason to consume drinks in SUPBs instead of other bottles. Participants argued that drinks in SUPBs are cheaper than drinks in another package. Therefore price affects their preference. The literature revealed that price could be an influential factor to purchase environmentally friendly products (Khan & Larsson, 2012). In contrast, another study found that price is not a significant factor in consumer decision making, for those consumers who are concerned about the environment issues (Pérez-Ramírez, Almendarez-Hernández, Avilés-Polanco, & Beltrán-Morales, 2015).

This study revealed that participants are aware of the adverse environmental impacts of SUPBs consumption. However, other small portions of participants indicate that they don't know any ecological consequences regarding their consumption behaviour. Perception of adverse environmental impacts was varied among respondents. Many respondents felt that SUPBs littering could harm the agriculture soil and animal, marine living. The literature studies showed that shown that littering can be everywhere, such, in parks, beaches, open areas, streets, the city which can cause diverse impacts such as changing the feature of the environment (Cherrier, 2006). Marine results (Bartolotta & Hardy, 2018; Oberbeckmann, Osborn, & Duhaime, 2016), Agriculture and animals (Moharam & Maqtari, 2014). Our study found that some impacts are interrelated. The participants revealed that air pollution could result in other effects such as human health, climate change.

The fact that they SUPBs take many years to decompose can result in adverse environmental impacts. As discussed by Secretariat of the convention on biological diversity, plastics which remain the environment can cause wildlife and fish to get sick or die (Pereira, 2019). The study

revealed that SUPBs are littering affect the beauty of nature which similar to the research done by L. C. Smith (2009), which showed that single-use plastics littering change the feature of the environment. Besides, SUPBs littering can result in air pollution and climate change due to burning of those plastics. Literature reveals that the production and recycling processes of single-use plastics contribute to air pollution (Forbid, Ghogomu, Busch, & Frey, 2011). The air pollution contributes to human respiratory diseases (Muthu et al., 2009).

Our study found that majority of participants were aware of sustainable alternatives for SUPBs; only a small portion of them are not aware of those alternatives. However, they are not using them because they prefer SUPBs than those alternatives.

The findings have shown that perceptions of consumers on the reduction of SUPBs consumption and the introduction of its alternatives were varied. Majority of respondents perceive reduction and introduction of its alternatives as crucial, and they claimed that reduction SUPBs usage is essential, with some suggestions to achieve the reduction.

Many participants regard recycling as an excellent option to reduce the environmental pollution caused by SUPBs consumption. Participants felt that the impacts would be if consumers do not recycle their bottles, but there will be no consequences if SUPBs will be appropriately recycled. However, they argued that recycling companies of SUPBs in the country is a limiting factor that preventing them from recovering their SUPBs properly. Recent studies confirm that recycling can reduce SUPB pollution if there are recycling facilities and economic incentives (Viscusi et al., 2012; Willis et al., 2019). Other study revealed that recycling is a good option for end-of-life waste management of plastic products; it is beneficial economically and environmentally (Hopewell, Dvorak, & Kosior, 2009). In contrast, other literature argued that recycling wouldn't solve the problem of plastic pollution since recycling will not reduce the production of single-use plastic items (Wilkins, 2018).

Regulatory interventions such as a ban are one of the strategies applied by many countries to reduce consumption of single-use plastic items (Ornell & Finn, 2011; Rivers, Shenstone-Harris, & Young, 2017; Sharp, Høj, & Wheeler, 2010). Banning was also frequently discussed by participants who thought that complete ban and replacement of SUPBs by more sustainable alternatives would be more useful to reduce SUPBs consumption. They argued that the country

does not have enough capacity to recycle all single-use plastic items produced. Therefore, banning is a good option. Some literature revealed that participants also were supportive of the complete ban of single-use plastics consumption since consumers only consume the products that are available on the market (Rao, 2014; Wagner, 2017). However, other authors found that a complete ban was not sufficient to reduce single-use plastic bottle consumption (D'Altrui, 2017). The ban on single-use plastic shopping bags has been already implemented in Rwanda and has been a success story of the country (Froidbise, 2015). Therefore the lesson can be learned from the previous experience.

Although only a few respondents commented on Educating people as a good way to mitigate SUPBs consumption, this should be taken into account as some author concluded that lack of education programmes could lead to failure of policy implementation (McKenzie-Mohr, 2011). Yet, other author argued that sometimes educational programmes might not be able to address some constraints such as socio-costs related to the reduction of single-use plastics consumption (Ajzen, Joyce, Sheikh, & Cote, 2011).

Our study also looked at what do consumers need to shift from SUPBs consumption to more sustainable alternatives. The reveals that provision of other options such as reusable bottles, degradable bottle and refill purified water tanks, will help consumers to change their consumption behaviours. First, the provision of refill filtered water tanks in a different location in Kigali city and another part of the country will reduce the number of SUPBs used per day. The success of this can be evidenced by a study done by Willis et al. (2019) in the US on the impact of refill purified water tanks station, found that refill purified water station had a significant impact in the reduction of SUPBs consumption. In Rwanda, there is a refill milk station where consumers can bring their bottle to buy milk. If this can be applied for other drinks, such water and soft drinks can be an excellent way to get ride SUPB consumption.

Some respondents revealed that making those alternatives available. Also, the alternatives should be at a lower price or the same price as SUPB. As a result, it will be helpful for consumers to change their consumption behaviour. The results are consistent to the findings of another study from South-Africa, which showed that price of environmentally friendly products has the high potential influence to consumers to purchase eco-products (Khan & Larsson, 2012), which affect consumers to buy environmentally friendly products. In Rwanda, the availability of

environmentally friendly package is still a limiting factor. Yet, the price of some drinks packaged in an environmentally friendly way is high compare to products packaged in single-use plastic bottles as revealed by participants.

Participants also felt that providing recycling infrastructures such as collection point and recycling centres will help them to recycle their SUPBs more easily. Yet, participants need some incentives such as money or discount in shops to recover their bottle. Our findings are consistent to study that has been conducted in The US by Viscusi et al. (2012) on alternatives to increase recycling; this study revealed that provision of financial incentives could motivate consumers to change their behaviour. In Rwanda, there are no collection points for SUPBs to encourage consumers to recycle their single-use bottles.

Raising awareness was also chosen as one of option to encourage consumers to shift from SUPBs to more sustainable alternatives. Our findings show that some consumers are not aware of the environmental consequences of their consumption behaviour, and there are not aware of any alternatives of SUPBs. Little research suggested that raising awareness education programmes and campaigns can lead to the success of policy implementation (McKenzie-Mohr, 2011). Yet, experts revealed that they already started some campaigns from the high-level institution and big hotels and Restaurants, and they aimed to continue campaigning at the national level.

Although respondents did suggest financial incentives as one option to motivate consumers to recycle their SUPBs, Economic incentives are not currently being used by producers or retailers to encourage consumers to recycle their bottles. Few studies have investigated at the success of financial incentives to promote recycling and revealed that financial incentives could encourage the consumer to recycle their plastic bottles (Shaw & Maynard, 2008; Viscusi et al., 2012). However, other literature argued that incentives can work in the short term but can disappear in a long time. Therefore there is a need to combine strategies to encourage consumption behaviour change (Bartolotta & Hardy, 2018).

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

The study aimed at generating information regarding the perception of consumers about, the reduction of SUPBs consumption and the introduction of its alternatives in Rwanda. First, the study reveals that consumers use single-use plastic bottles due to their convenience, health, second usage and availability and low price. Although the consumers indicate different reasons

to use SUPBs, they recognize the negative environmental impacts of their consumption behaviour. Secondly, the participants feel that single-use plastic bottle consumption can affect agriculture, livestock, marine ecosystem, the beauty of nature, climate as well as human health. However, some participants are not aware of any environmental impacts.

Third, Consumers acknowledged some alternatives of single-use plastic bottles such as reusable plastic bottle, water dispenser, big bottles, paper box and glass bottles. Despite the awareness of these alternatives, consumers argued that those alternatives are not enough on the market.

Fourth, the study shows that participants perceive reduction of SUPBs consumption as essential and it could be achieved through recycling, banning of SUPBs distribution, education of consumers about negative impacts and positive site of sustainable alternatives, as well as increase tax.

Fifth, to move away from SUPBs consumption towards sustainable consumption patterns, using recycled plastic bottles or refillable bottles. Consumers require interventions such as the provision of alternatives materials at an affordable price, initiating education programs, improving recycling system and provision of economic incentives to change consumers behaviour. These multi-interventions will enable to reduce SUPBs pollution. Besides, these various approaches can occur at the same time, and they will help to more effective to mitigate SUPBs pollution in the long-term.

To address the impacts of SUPBs pollution caused by the consumption, consumers have to switch from SUPBs consumption to more sustainable alternatives. One way to achieve this is to use multi-faceted interventions to change consumers behavior. Here a key responsibility is on the side of governmental institutions. For example, recycling possibilities need to be created and financed by public donors.

The ban on SUPBs consumption needs with combinations of provisions of alternatives for SUPBs. For example, a public donor can provide a water refill station so that consumers can be able to use their reusable bottles instead of buying SUPBs every time. Provision of refill purified water station will reduce the number of SUPBs consumption. The experience of milk refill station can be adopted for other drinks. Also, a good lesson can be learned from other countries like in the UK, where refill purified water station has reduced SUPBs consumption. Distribution of those alternatives such as reusable plastic bottles, glass bottle or metal bottles in a

combination of their affordability will help people to reduce the demand of SUPBs. Raising awareness on the environmental impacts of SUPBs through campaigns, education programs would change consumer's attitudes.

This study has its limitations, and the interviewed population was not fully representative of Rwanda's demographic population. Besides, the study did not reflect the geographic diversity of the country since it was conducted in one city. Therefore, this might be difficult to generalize the results of our study to Rwandan 'whole population. Future studies could do a quantitative survey to extrapolate the results.

This study is the first one regarding perceptions of SUPBs consumption reductions in Rwanda. Therefore, more future studies on perception on SUPBs consumption could aim to study a more diverse group of respondents to consider more the demographic diversity of country's population and same study should be conducted in other developing countries.

To achieve, the effective switch from SUPBs to more sustainable alternatives, future research could search what could be possible instruments to provide alternatives for SUPBs to consumers at the national level. The study could explore the best tools that could be suitable for urban and rural population.

It is clear from the interviews that there is no quantification evidence in different towns of country that those policies will be adopted. Even though people have positive feelings of reducing SUPBs, it might not show that implementations of those policies will be successful, because perceptions might not reflect its real successes or failures. More studies into SUPBs reduction should be conducted to provide quantified information.

APPENDIXES

Appendix 1: Interview questions

Interview no:

- *The purpose of this interview is to generate information regarding single use plastic bottles and of introduction of more sustainable alternatives*
- *Your response will be anonymous and kept strictly confidential*
- *The results of this interview will be used in master's thesis submitted at Wageningen University and research, The Netherlands*

1. **Do you use single use plastic bottles in your daily life?** For what purpose and how (regularly or occasionally)? Ese *waba ukoresha amacupa ya plastic aya dukoresha rimwe tugata mubuzima bwawe bwa buri munsi? Ese ni iyihe mpamvu uyakoresha?*

2. **Can, in your opinion, single use plastic bottles cause negative environmental impacts?** If yes, what kind of negative impacts can in your opinion occur? Have you ever observed or been affected by those impacts? If yes, how? *Ese ku giti cyawe iyo urebye*

ubona amacupa ya palasitike ashobora kwangiza ibidukikije? Niba ari yego, nizihe ngaruka mbi waba uzi? Ese waba warigeze kugerwaho nizo ngaruka? Niba ari yego gute?

3. **Are you aware of any alternatives of single use plastic bottles**? If yes, Which? *Ese waba uzi andi macupa atangiza ibidukikije? Niba ari yego ni ayahe?*

4. **Could, in your opinion, the consumption of single use plastic bottles be reduced in your personal life/or work environment?** How could, in your opinion be achieved? Have you collected any experience with reducing single use plastic bottles in your life or work environment so far? *Mu bitekerereze yawe, urumva ikoreshwa ryamacuma ya palasitike ryagabanyuka haba kuri wowe ndetse naho waba ukorera? Nonese nigute ibi byagerwaho? Ese waba warigeze ugira igikorwa cyo kurwanya palasitike haba wowe ubwawe cg aho ukorera? Tubwire uko wabigenje?*

5. **What could, in your opinion, facilitate a broad shift from single use plastic bottles to more sustainable alternatives?** What kind of facilities and supports would be needed and whom should this support be provided? *Ese wowe urumva ariki gikenewe kugirango abantu bazabashe gukoresha amacupa atangiza ikirere? Mbwira icyafasha kikanashyigikira abaturage kugirango bazabashe gukoresha ayo macupa meza atangiza ibidukikije? Ese kugiti cyawe urumva arinde watanga ubwo bufasha?*

6. What is your gender (*Igitsina)?*

a) Male (*Gabo*) b) Female (gore)

7. What is your age? (Imyaka)

a) <20 b) 20-35 c) 36- 45 d) 46-55 e) >56

8. What education level do you have? (Amashuri ufite)

a) No formal education (ntabwo nize b) primary school(abanza) c) secondary school (ayisumbuye) d) university(kaminuza) e) other(andi)

9. What is your current occupation? (Ukora iki?)

a) No employment(ntakazi) b) Self-employed business(ndikorera) c) employment in a government institution(nkorera leta) d) employment in the private sector(Nkorera ikigo cyigenga) e) employment in research institution (Nkora mukigo cubushakashatsi).

Appendix 2: Codebook

CODEBOOK

Code Name	**Definition of the code**
Topic 1: Reasons for consuming single use plastic bottles	
1. Purpose	This code is describing the opinions from participants on why people use SUP bottles
2. Regularity	This code is describing the opinions from participants on how often they use SUP bottles (Regularly/occasionally)
Topic 2: 1. Consumers awareness about environmental impacts of single use plastics bottles	
3. Beauty of nature	This code is describing the negative impacts of using SUP bottles on open environment such as forests, beach, ...
4. Agriculture	This code represents the answers given on the negative impacts of using SUP on agriculture sector
5. Marine impact	This code represents the answers given on the negative impacts of using SUP on aquatic animals
6. Climate change	This code represents the responses given by participants on the negative impacts of using SUP on climate change
Topic 3: Consumers' knowledge of possible alternatives (soft drink and water bottles)	
7. Knowledge of alternatives	This code describes the answers given on awareness of alternatives on market nowadays
Topic 4: Consumers' opinions about a reduction of single use plastic bottle and the introduction of possible alternatives	
8. Acceptance	This code represents the opinions from participants on whether the reduction of SUP consumption is needed

9. Strategies	This code represents the opinions from participants on how to achieve the reduction of SUP usage
10. Personal experience	This code represents the answers given by participants on whether they participate in actions reducing usage SUP in the community
Topic 5: Factors that can support an effective switch from single use plastic bottles to sustainable alternatives	
11. Facilities	This code describes the answers given by participants on what facilities they need to shift from SUP to more sustainable alternatives
12. Support	This code describes the answers given by participants on what supports they need to shift from SUP to more sustainable alternatives
13. Provider	This code describes the answers given by participants on who can provide the support and facilities

References

Africa, C. (2019, 23/10/2019). Rwanda bans all single-use plastic *Africa*. Retrieved from https://www.theeastafrican.co.ke/news/ea/Rwanda-bans-all-single-use-plastics/4552908-5318814-akk8csz/index.html

Ajzen, I., Joyce, N., Sheikh, S., & Cote, N. G. (2011). Knowledge and the prediction of behavior: The role of information accuracy in the theory of planned behavior. *Basic and applied social psychology, 33*(2), 101-117.

Andrady, A. L., & Neal, M. A. (2009). Applications and societal benefits of plastics. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 1977-1984.

Ballantine, P. W., Ozanne, L. K., & Bayfield, R. (2019). Why Buy Free? Exploring Perceptions of Bottled Water Consumption and Its Environmental Consequences. *Sustainability, 11*(3), 757.

Bartolotta, J. F., & Hardy, S. D. (2018). Barriers and benefits to desired behaviors for single use plastic items in northeast Ohio's Lake Erie basin. *Marine pollution bulletin, 127*, 576-585.

Bellis, M. (2019, 2019). The troubled history of soda pop and carbonated bevereges. Retrieved from https://www.thoughtco.com/introduction-to-soda-pop-1992433

Beychok, M. R. (1987). A data base of dioxin and furan emissions from municipal refuse incinerators. *Atmospheric Environment (1967), 21*(1), 29-36.

Bhat, A. (2019). Convenience sampling: definition, methods and examples. Retrieved from https://www.questionpro.com/blog/convenience-sampling/

Birkby, D. (2014, may 16). PET bottle handle-N.A. success story. *Canadian Packaging*. Retrieved from https://www.canadianpackaging.com/general/pet-bottle-handle-n-success-story-136251/

Blundell, R. (1988). Consumer behaviour: theory and empirical evidence—a survey. *The economic journal, 98*(389), 16-65.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.

Brécard, D., Hlaimi, B., Lucas, S., Perraudeau, Y., & Salladarré, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecological economics, 69*(1), 115-125.

Caudfield, J. (2019). How to do thematic analysis. Retrieved from https://www.scribbr.com/methodology/thematic-analysis/

Cherrier, H. (2006). Consumer identity and moral obligations in non-plastic bag consumption: a dialectical perspective. *International Journal of Consumer Studies, 30*(5), 515-523.

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The psychologist, 26*(2), 120-123.

Clean-up. (2017). Rabish report. Retrieved from https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/

Comăniță, E.-D., Hlihor, R. M., Ghinea, C., & Gavrilescu, M. (2016). OCCURRENCE OF PLASTIC WASTE IN THE ENVIRONMENT: ECOLOGICAL AND HEALTH RISKS. *Environmental Engineering & Management Journal (EEMJ), 15*(3).

conservancy, O. (2019). Fighting for trash free seas. Retrieved from https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/

Consult, S. (2019). MAXQDA the art of data analysis.

Convery, F., McDonnell, S., & Ferreira, S. (2007). The most popular tax in Europe? Lessons from the Irish plastic bags levy. *Environmental and resource economics, 38*(1), 1-11.

D'Altrui, E. M. (2017). Bottle Water Bans: How can we curb the thirst for bottled water? *Elements, 13*(1).

Danielsson, M. (2017). The plastic bag ban in Rwanda: local procedures and successful outcomes. In.

Derraik, J. G. (2002). The pollution of the marine environment by plastic debris: a review. *Marine pollution bulletin, 44*(9), 842-852.

Diefenbach, T. (2009). Are case studies more than sophisticated storytelling?: Methodological problems of qualitative empirical research mainly based on semi-structured interviews. *Quality & Quantity, 43*(6), 875.

Dikgang, J., Leiman, A., & Visser, M. (2012). Elasticity of demand, price and time: lessons from South Africa's plastic-bag levy. *Applied Economics, 44*(26), 3339-3342.

Dikgang, J., & Visser, M. (2012). Behavioural response to plastic bag legislation in Botswana. *South African Journal of Economics, 80*(1), 123-133.

Dikko, M. (2016). Establishing construct validity and reliability: Pilot testing of a qualitative interview for research in Takaful (Islamic insurance). *The Qualitative Report, 21*(3), 521-528.

Doria, M. F. (2006). Bottled water versus tap water: understanding consumers' preferences. *Journal of water and health, 4*(2), 271-276.

Ferrier, C. (2001). Bottled water: understanding a social phenomenon. *AMBIO: A journal of the Human Environment, 30*(2), 118-119.

Forbid, G. T., Ghogomu, J. N., Busch, G., & Frey, R. (2011). Open waste burning in Cameroonian cities: an environmental impact analysis. *The Environmentalist, 31*(3), 254-262.

Fornabaios, L., Poto, M. P., Fornabaio, M., & Sordo, F. (2019). Law and Science Make a Common Effort to Enact a Zero Waste Strategy for Beverages. In *Processing and Sustainability of Beverages* (pp. 495-516): Elsevier.

Froidbise, A. (2015). Behind the scenes of the plastic bag ban in rwanda: Connections to culture, power and sustainability.

Golovinova, C. (2014, 2014). plastic vs. Glass-Why Plastic Containers are better. Retrieved from https://www.packagingoftheworld.com/2014/04/plastic-vs-glass-why-plastic-containers.html

Guarte, J. M., & Barrios, E. B. (2006). Estimation under purposive sampling. *Communications in Statistics-Simulation and Computation, 35*(2), 277-284.

Haque, M. S. (2019). Sustainable use of plastic brick from waste PET plastic bottle as building block in Rohingya refugee camp: a review. *Environmental Science and Pollution Research*, 1-21.

Hasson, R., Leiman, A., & Visser, M. (2007). THE ECONOMICS OF PLASTIC BAG LEGISLATION IN SOUTH AFRICA 1. *South African Journal of Economics, 75*(1), 66-83.

Hawkins, G. (2009). The politics of bottled water: assembling bottled water as brand, waste and oil. *Journal of Cultural Economy, 2*(1-2), 183-195.

Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. (2019). Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of the Total Environment*.

Hopewell, J., Dvorak, R., & Kosior, E. (2009). Plastics recycling: challenges and opportunities. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2115-2126.

I-DROP. (2015). Change start with simple idea. Retrieved from https://www.idropwater.com/

Irabizi, H. K. V. (2019). House passes bill to ban single-use plastics. *The New Times*. Retrieved from https://www.newtimes.co.rw/news/house-passes-bill-ban-single-use-plastics

Jenner, B., Flick, U., von Kardoff, E., & Steinke, I. (2004). *A companion to qualitative research*: Sage.

Kabona, E. (2018). Single use plastic bottle face ban. Retrieved from http://rwandatoday.africa/news/Single-use-plastic-bottles-face-ban/4383214-4638476-gk38nlz/index.html

Kardish, C. (2014). How Rwanda Became the World's Unlikely Leader in Plastic Bag Bans, Infrastructure and Environment. *Governing*. Retrieved from https://www.governing.com/topics/transportation-infrastructure/gov-rwanda-plastic-bag-ban.html

Keller, S. (2019). Semi-structured interviews. Retrieved from https://sswm.info/planning-and-programming/decision-making/gathering-ideas/semi-structured-interviews

Khan, M. A., & Larsson, S. (2012). A Study of Factors That Influence Green Purchase. In.

Khoironi, A., Anggoro, S., & Sudarno, S. (2019). *Community behavior and single-use plastic bottle consumption.* Paper presented at the IOP Conference Series: Earth and Environmental Science.

Kumar, K. (1989). *Conducting key informant interviews in developing countries*: Agency for International Development Washington DC.

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*: Sage Publications Limited.

Kwibuka, E. (2019). Rwanda moves closer to banning single use plastics. Retrieved from https://www.newtimes.co.rw/rwanda/rwanda-moves-closer-banning-single-use-plastics

Lange, J., & Wyser, Y. (2003). Recent innovations in barrier technologies for plastic packaging—a review. *Packaging Technology and Science: An International Journal, 16*(4), 149-158.

Leigh, E. (2011). The history of plastic bottles. Retrieved from https://recyclenation.com/2011/03/history-plastic-bottles-recycle/

Lithner, D., Larsson, Å., & Dave, G. (2011). Environmental and health hazard ranking and assessment of plastic polymers based on chemical composition. *Science of the Total Environment, 409*(18), 3309-3324.

Loewe, M., & Rippin, N. (2015). The Sustainable Development Goals of the Post-2015 Agenda: Comments on the OWG and SDSN Proposals. *Available at SSRN 2567302*.

Lopez Murcia Martin, J. (2015). Social perceptions of single-use plastic consumption of the Balinese population.

Madara, D. S., Namango, S. S., & Wetaka, C. (2016). Consumer-perception on polyethylene-shopping-bags.

Maguire, M., & Delahunt, B. (2017). Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *AISHE-J: The All Ireland Journal of Teaching and Learning in Higher Education, 9*(3).

McKenzie-Mohr, D. (2011). *Fostering sustainable behavior: An introduction to community-based social marketing*: New society publishers.

Mettang, T., Thomas, S., Kiefer, T., Fischer, F.-P., Kuhlmann, U., Wodarz, R., & Retternmeier, A. (1996). Uraemic pruritus and exposure to di (2-ethylhexyl) phthalate (DEHP) in haemodialysis patients. *Nephrology Dialysis Transplantation, 11*(12), 2439-2443.

Moharam, R., & Maqtari, M. A. A. (2014). The impact of plastic bags on the environment: A field survey of the City of Sana'a and the surrounding Areas, Yemen. *Int. J. Eng. Res. Rev, 2*(4), 61-69.

Moser, M. L., & Lee, D. S. (1992). A fourteen-year survey of plastic ingestion by western North Atlantic seabirds. *Colonial Waterbirds*, 83-94.

Mottram, A. (2011). 'They are marvellous with you whilst you are in but the aftercare is rubbish': a grounded theory study of patients' and their carers' experiences after discharge following day surgery. *Journal of clinical nursing, 20*(21-22), 3143-3151.

Mugisha, I. R. (2019, febuary2 2019). Rwanda adopt draft law to ban single use plastics. *The East African*. Retrieved from https://www.theeastafrican.co.ke/business/Rwanda-adopts-draft-law-to-ban-single-use-plastics/2560-4963084-70a2mdz/index.html

Mushonga, B., Habarugira, G., Musabyemungu, A., Udahemuka, J. C., Jaja, F. I., & Pepe, D. (2015). Investigations of foreign bodies in the fore-stomach of cattle at Ngoma Slaughterhouse, Rwanda. *Journal of the South African Veterinary Association, 86*(1), 1-6.

Muthu, S. S., Li, Y., Hu, J.-Y., & Mok, P.-Y. (2009). An exploratory comparative study on eco-impact of paper and plastic bags. *Journal of Fiber Bioengineering and Informatics, 1*(4), 307-320.

Negussie, B., & Mustefa, J. (2017). Community's perception of utilization and disposal of plastic bags in Eastern Ethiopia. *Pollution, 3*(1), 147-156.

Newcomer, K. E., Hatry, H. P., & Wholey, J. S. (2015). Conducting semi-structured interviews. *Handbook of practical program evaluation, 492*.

nisr. (2012). *Population size, structure and distribution*. Retrieved from

O'Brien, J., & Thondhlana, G. (2019). Plastic bag use in South Africa: Perceptions, practices and potential intervention strategies. *Waste management, 84*, 320-328.

O'Keeffe, J., Buytaert, W., Mijic, A., Brozović, N., & Sinha, R. (2016). The use of semi-structured interviews for the characterisation of farmer irrigation practices. *Hydrology and Earth System Sciences, 20*(5), 1911-1924.

O'Donnell, C., & Rice, R. E. (2012). A communication approach to campus bottled water campaigns. *Social Marketing Quarterly, 18*(4), 255-273.

Oberbeckmann, S., Osborn, A. M., & Duhaime, M. B. (2016). Microbes on a bottle: substrate, season and geography influence community composition of microbes colonizing marine plastic debris. *PLoS One, 11*(8).

Opel, A. (1999). Constructing purity: Bottled water and the commodification of nature. *The Journal of American Culture, 22*(4), 67.

Ornell, C., & Finn, S. (2011). *A Holistic Approach to Reducing Plastic Marine Debris in Coastal North Carolina.* Duke University,

Orset, C., Barret, N., & Lemaire, A. (2017). How consumers of plastic water bottles are responding to environmental policies? *Waste management, 61*, 13-27.

Patel, P. A., Shah, A., & Patel, H. (2016). Waste plastic bottles offering innovative building materials with sustainable application. *International Journal of Innovative and Emerging Research in Engineering, 3*(3), 38-45.

Pati, D. J., Homma, R., & Iki, K. (2016). Proposing the Use of Plastic Bottle Waste for Low-Cost Housing under Government Guidelines in India. *American Journal of Engineering Science and Technology Research, 4*(1), 1-10.

Pereira, S. (2019). PLASTIC PERCEPTIONS: SURVEYING PUBLIC OPINION OF PLASTIC POLLUTION IN RHODE ISLAND.

Pérez-Ramírez, M., Almendarez-Hernández, M., Avilés-Polanco, G., & Beltrán-Morales, L. (2015). Consumer acceptance of eco-labeled fish: A Mexican case study. *Sustainability, 7*(4), 4625-4642.

Rabionet, S. E. (2011). How I Learned to Design and Conduct Semi-Structured Interviews: An Ongoing and Continuous Journey. *Qualitative Report, 16*(2), 563-566.

Rao, T. J. (2014). Perception of People about Ban on Plastic Bags in Mangalore: An Empirical Study. *Anveshana, 4*(2), 110-136.

REMA. (2009). *'Law relating to the prohibition of manufacturing, importation, use and sale of polythene bags in Rwanda'*. Retrieved from http://www.rema.gov.rw/filAeadmin/templates/Documents/rema_doc/Laws%20and%20Regulat ions_Updated/Laws/Law%20related%20to%20the%20Prohibation%20of%20use%20and%20sale%20of%20Polythene%20bags%20in%20Rwanda.pd

Review, W. P. (2019). Where is Rwanda. Retrieved from http://worldpopulationreview.com/country-locations/where-is-rwanda/

Ritch, E., Brennan, C., & MacLeod, C. (2009). Plastic bag politics: modifying consumer behaviour for sustainable development. *International Journal of Consumer Studies, 33*(2), 168-174.

Rivers, N., Shenstone-Harris, S., & Young, N. (2017). Using nudges to reduce waste? The case of Toronto's plastic bag levy. *Journal of environmental management, 188*, 153-162.

Rochman, C. M., Browne, M. A., Halpern, B. S., Hentschel, B. T., Hoh, E., Karapanagioti, H. K., . . . Thompson, R. C. (2013). Classify plastic waste as hazardous. *Nature, 494*, 169. doi:10.1038/494169a

Rochman, C. M., Browne, M. A., Halpern, B. S., Hentschel, B. T., Hoh, E., Karapanagioti, H. K., . . . Thompson, R. C. (2013). Policy: Classify plastic waste as hazardous. *Nature, 494*(7436), 169.

Rwanda, R. o. (2017). Geography of Rwanda. Retrieved from http://gov.rw/home/geography/

Sabiiti, D. (2018). Rwanda Moves To Ban Use Of Plastic Water Bottles In Offices. Retrieved from https://ktpress.rw/2018/05/rwanda-moves-to-ban-use-of-plastic-water-bottles-in-offices/

Sabiiti, D. (2019). Rwanda Finds Alternative: What Plastics Do, Paper And Bamboo Will Do. *KT Press*. Retrieved from https://ktpress.rw/2019/10/rwanda-finds-alternative-what-plastics-do-paper-and-bamboo-will-do/

Sharp, A., Høj, S., & Wheeler, M. (2010). Proscription and its impact on anti-consumption behaviour and attitudes: the case of plastic bags. *Journal of Consumer Behaviour, 9*(6), 470-484.

Shaw, P., & Maynard, S. (2008). The potential of financial incentives to enhance householders' kerbside recycling behaviour. *Waste management, 28*(10), 1732-1741.

Sheavly, S., & Register, K. (2007). Marine debris & plastics: environmental concerns, sources, impacts and solutions. *Journal of Polymers and the Environment, 15*(4), 301-305.

Smith, E. (2019). A Pilot Qualitative Evaluation: Youth Perception on Plastic Straws Before and After Education Intervention.

Smith, L. C. (2009). *Paper Or Plastic?: The Economic Implications of Plastic Carrier Bag Legislation in the United States.* Colorado College.,

Sojobi, A. O., Nwobodo, S. E., & Aladegboye, O. J. (2016). Recycling of polyethylene terephthalate (PET) plastic bottle wastes in bituminous asphaltic concrete. *Cogent engineering, 3*(1), 1133480.

Sung, G. (2010). *Ban on Plastic Bags Usage-Is It a Right Move? An Emprical Study On Consumer Perception And Practice*. Retrieved from

Swan, S. H. (2008). Environmental phthalate exposure in relation to reproductive outcomes and other health endpoints in humans. *Environmental research, 108*(2), 177-184.

Tasamba, J. (2019, 12.07.2019). Rwanda's plastic dealers face uncertain future. *Africa*. Retrieved from https://www.aa.com.tr/en/africa/rwanda-s-plastic-dealers-face-uncertain-future/1529927

Tashobya, A. (2018, 23/09/2019). Law against single use plastics pending cabinet approval. *The new times*. Retrieved from https://www.newtimes.co.rw/news/law-against-single-use-plastics-pending-cabinet-approval

Teuten, E. L., Saquing, J. M., Knappe, D. R., Barlaz, M. A., Jonsson, S., Björn, A., . . . Yamashita, R. (2009). Transport and release of chemicals from plastics to the environment and to wildlife. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1526), 2027-2045.

Thøgersen, J. (2000). Psychological determinants of paying attention to eco-labels in purchase decisions: Model development and multinational validation. *Journal of consumer policy, 23*(3), 285-313.

Thompson, R. C., Olsen, Y., Mitchell, R. P., Davis, A., Rowland, S. J., John, A. W., . . . Russell, A. E. (2004). Lost at sea: where is all the plastic? *Science, 304*(5672), 838-838.

Truelove, H. B., Yeung, K. L., Carrico, A. R., Gillis, A. J., & Raimi, K. T. (2016). From plastic bottle recycling to policy support: an experimental test of pro-environmental spillover. *Journal of Environmental Psychology, 46*, 55-66.

Viscusi, W. K., Huber, J., & Bell, J. (2012). Alternative policies to increase recycling of plastic water bottles in the United States. *Review of Environmental Economics and Policy, 6*(2), 190-211.

Wagner, T. P. (2017). Reducing single-use plastic shopping bags in the USA. *Waste management, 70*, 3-12.

Wilkins, M. (2018, 6/july/2018). More Recycling Won't Solve Plastic Pollution. Retrieved from https://blogs.scientificamerican.com/observations/more-recycling-wont-solve-plastic-pollution/

Willis, K., Hardesty, B. D., Vince, J., & Wilcox, C. (2019). The success of water refill stations reducing single-use plastic bottle litter. *Sustainability, 11*(19), 5232.

Worldatlas. (2018). Where is Rwanda. Retrieved from https://www.worldatlas.com/af/rw/where-is-rwanda.html

Zojceska, A. (2018, 24/01/2018). Difference between structured,unstructured and semi-structured interview. Retrieved from https://www.talentlyft.com/en/blog/article/92/difference-between-structured-unstructured-and-semi-structured-job-interviews