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Towards a circular economy: a case study of an educational entity on economic approach to waste management

Bachelor Thesis

by

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

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Place, Date	Signature

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Abstract

This thesis explores the relationship between the circular economy and consumer behavior through an in-depth analysis of consumer attitudes, motivations, and decision-making processes. The circular economy presents a paradigm shift in waste management and resource utilization, aiming to create a regenerative and sustainable system. Understanding consumer behavior within this context is crucial for effectively implementing circular economy principles.

In order to collect data from a diverse sample of consumers, the research uses a mixed-methods approach that combines quantitative surveys and qualitative interviews. The study investigates various factors that influence consumer behavior, including awareness, knowledge, values, social norms, and perceived benefits and barriers to adopting circular practices. Demographic variables such as age, income, and education level are also considered to assess their influence on consumer behavior.

The findings highlight the significance of consumer education and engagement programs in promoting the adoption of circular economy practices. Effective communication strategies, tailored to different target groups, are identified as essential tools for encouraging sustainable waste management behaviors. Additionally, the study reveals the importance of creating enabling environments that facilitate the transition towards circularity, such as improving waste infrastructure, implementing supportive policies, and fostering collaborations among stakeholders.

The thesis contributes to the existing body of knowledge by providing insights into the intersection of consumer behavior and the circular economy. It offers practical recommendations for policymakers, businesses, and organizations seeking to design consumer-centric strategies and interventions that promote sustainable waste management practices. This study ultimately aims to promote a deeper comprehension of how consumer behavior can support the effective adoption of a circular economy model, resulting in a more sustainable and resource-efficient future.

Outline

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1. Introduction

One of the most urgent environmental issues facing us today is waste management, which has an impact on both the environment and human health and wellbeing. The ecosystem's various nutrient cycles, including carbon, nitrogen, and others, balance the earth's life support system (1). However, anthropogenic activities put these ecosystem cycles under constant stress. As natural resources are depleted and pollution and climate change are exacerbated by the current linear economy model, which involves extracting, using, and discarding resources, it is not sustainable over the long term. By 2050, the predicted global demand for resources from an ecosystem perspective will have doubled, placing severe strain on natural resources (2).

The world is turning into a garbage dump because of unsustainable production and consumption habits. In addition, the issue has been intensified by the accelerated rate of population expansion, as well as by fast urbanization and rising living standards. Resource scarcity and high consumption rates pressure ecosystems, which demand more environmentally friendly and sustainable methods. Municipal solid waste (MSW) is produced by aggressive industrialization, household, institutional, and commercial activities, rapid urbanization, high consumption rates among the general population, and a high standard of living (3). The multidisciplinary issue of MSW management interconnects sustainability's social, environmental, and economic pillars. A closed-loop economy must be established after disconnecting from the current linear economy model to address such interdisciplinary problems effectively. This change will accelerate achieving the objectives of the Sustainable Development Goals (SDGs). The typical "take, make, use, and dispose of" strategy centered on a linear economy will not hold up over time. To prevent going over the earth's biophysical limit, switching from the current linear economy-based practices to sustainable ones (4). As a result, there has been a growing interest in a circular economy, where resources are used for as long as possible, waste is minimized, and materials are recycled or repurposed.

One of the key factors in the success of a circular economy is the behavior of customers. Customers play a crucial role in waste management by deciding what products to buy, how to use them, and how to dispose of them. Therefore, understanding customer behavior toward sustainable waste management practices is essential for transitioning to a circular economy.

This thesis aims to study customer behavior towards sustainable waste management practices and their impact on adopting a circular economy approach. The research questions will focus on customers' current waste management practices, the factors that motivate them to engage in sustainable waste management practices, and the

potential barriers that prevent them from adopting a circular economy approach to waste management. Additionally, the thesis will explore the role of economic incentives, social norms, and customer education in shaping customer behavior toward sustainable waste management practices.

The research presented in this thesis will help to better understand consumer attitudes toward circular economies and sustainable waste management practices. The results of this study will have implications for companies and decision-makers who want to advance sustainable waste management procedures and make the transition to a circular economy. Businesses and policymakers can develop effective strategies to promote the adoption of a circular economy approach to waste management by understanding the factors that affect customer behavior toward sustainable waste management practices. These strategies include providing more information about the environmental and health benefits of sustainable waste management practices, providing financial incentives for customers who engage in sustainable waste management practices, and creating a culture that rewards customers for using sustainable waste management practices.

1.1. Background of the study

The capital of Mongolia, Ulaanbaatar (UB), is one of the cities dealing with previously unheard-of effects of a rapid increase in population, a booming economy, and a lack of adequate regulations. Ulaanbaatar City, which has a population of 4,704 km2, is home to about half of Mongolia's population of about 3,400,000 people. Variations in consumption have increased the amount of waste that is thrown away, and issues with solid waste management (SWM) have gotten worse as a result of a 1.6% increase in population and the shift to a market economy. A significant portion of this population lives in "ger districts," which are unofficial settlements lacking in basic amenities. One of the most urgent problems affecting public health, the environment, and resource efficiency is the city's municipal solid waste management (MSWM), which is facing serious difficulties. MSWM is a complex system that complies with the definition of a "system of systems," which combines the assets and skills of a number of specialized systems or subsystems to produce a more complex metasystem that offers more functionality and performance than the combination of its component systems. It suggests that the system's overall functionality and performance are significantly more dependent on how different aspects of MSW are interconnected. Socio-economic, environmental, financial, and institutional factors must be taken into consideration in MSWM analysis since integrated approaches are a viable tool for tackling the current

waste management issue in developing nations. To successfully manage waste and its negative effects, it is also necessary to address the issue of data availability and reliability. The goal of this study is to use "Customer behavior analysis" as an analysis tool to assess the current situation of MSWM in Ulaanbaatar, Mongolia. A city's SWM system's effectiveness can also be used as a stand-in for good governance and the municipality's approach to addressing issues related to urbanization and the environment. Following are the research questions that will be covered in the remaining sections of this paper:

1. What are the current waste management practices of customers and what motivates them to engage in sustainable waste management practices?
2. How do demographic factors such as age, income, and education level influence customer behavior towards sustainable waste management practices?
3. How can customer education and engagement programs be designed to encourage the adoption of a circular economy approach to waste management?
4. What are some potential challenges and limitations to adopting a circular economy approach to waste management?

1.2. Introduction to waste management

The issue of managing solid waste affects different parts of the world on varying scales. The amount of effort made by various nations to contain the solid waste issue determines the size of the problem. Solid waste is not as serious an issue in industrialized nations as in underdeveloped nations. The difference can be explained by the fact that the pace of solid waste generation in developing nations does not correspond with the ability to manage it effectively. The population is letting the authorities or administrative units handle a load of solid garbage they produce. Waste management is the responsibility of urban authorities, such as cities, in the majority of developing nations. In Mongolia, since indiscriminate waste dumping is so common, instead of sorting waste for recycling and composting, the authorities responsible for cleaning up cities, towns, and residential areas find it faster and more efficient to collect the rubbish and transport it to a landfill.

Getting more people involved, directly or through education, is crucial to managing solid waste sustainably. This study uses the ideas of the circular economy to identify sustainable programs and tools for educational participation in sustainable solid waste management. A well-planned design preserves the value of materials throughout the life cycle of a product, which is critical to the circular economic theory.

1.3. Introduction to the Circular Economy

The principles of the circular economy emphasize reducing, recycling, and reuse of resources and goods. Increasing resource productivity and decoupling economic growth from resource use and environmental effect are the goals of such an economic model. A restorative industrial economy is referred to as having a "Circular Economy" if its material cycles are divided into two categories: the biological cycle, in which processes ensure that the components return to the biosphere without having any negative effects, and the technical cycle, in which the components are used extremely effectively and do not enter the biosphere.

One method of economic growth that has great efficiency and low emissions is the circular economy. Some academics have compared the circular economy to the linear economy, which is typically connected to the industrialisation process but has significant emissions and high consumption. In order to protect the environment while the economy is developing to gradually achieve high efficiency, a low-cost economy where pollutant emissions are reduced, and a high recycling rate, the circular economy reflects the sustainable development strategy.

2. State of the art

The concepts of waste management, sustainability, and circular economy are arranged in a way that makes sense from a circular perspective and builds upon one another.

First and foremost, waste management should put a strong emphasis on sustainability. Sustainable waste management aims to reduce the harmful effects of waste on the environment and promote resource efficiency.

The next step is to adopt circular economy principles. The circular economy is an economic system that aims to keep resources in use for as long as possible by promoting material reuse, repair, and recycling. Waste can be turned into a resource and have its value increased by applying the circular economy's principles.

The waste that cannot be avoided or recycled should finally be managed by applying waste management practices. The process of managing waste includes waste collection, transportation, processing, recycling, and disposal. The goal of waste management is to handle garbage safely and effectively while minimizing the amount of waste delivered to landfills and incinerators.

In general, implementing effective waste management procedures comes after prioritizing sustainability, adopting circular economy principles, and managing waste sustainably. By encouraging resource efficiency, reducing the environmental harm caused by waste, and encouraging the efficient use of resources, this technique can help sustainable development.

2.1. Sustainability

The idea of sustainability is to satisfy current needs without compromising the capacity of future generations to satisfy their own needs. It acknowledges the interdependence of these three sustainability pillars and is based on environmental, social, and economic sustainability principles.

The sustainability movement has its roots in the 1960s and 1970s, when worries about resource depletion and environmental damage first gained popular attention. Silent Spring by Rachel Carson, which was published in 1962, helped the general public to better appreciate the negative impact that human activities like industrialization and agriculture have on the environment.

The 1972 Stockholm United Nations Conference on the Human Environment was a crucial turning point in the history of sustainability. Leaders from around the world gathered at the conference to talk about pressing environmental issues like deforestation, air and water pollution, and the depletion of natural resources. The discussion led to establishing the United Nations Environment Programme (UNEP) and adopting the Stockholm Declaration, which encouraged international cooperation to address environmental problems.
The concept of sustainable development was introduced in the 1980s, with the publication of the Brundtland Report by the World Commission on Environment and Development in 1987. The report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The report emphasized the importance of economic growth, social development, and environmental protection, and it called for a new approach to development that recognized the interdependence of these three factors.

In the 1990s, sustainability became a more prominent issue on the global agenda, with the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The conference resulted in the adoption of the Rio Declaration on Environment and Development, which outlined 27 principles for sustainable development, and the Agenda 21 action plan, which called for global action to promote sustainable development.

The importance of sustainability in business and industry has grown significantly since the 1990s. Companies have recognized the importance of sustainable practices in reducing environmental impact, improving social outcomes, and promoting economic growth. Developing sustainability standards and certifications, such as the ISO 14001 environmental management standard and the LEED green building certification, has helped promote sustainable practices in the industry.
The concept of sustainability has also become more integrated into government policy and planning. Sustainable development has become a top priority in urban planning, transportation, and other policy areas, and it has been addressed in numerous governments' strategies and plans for sustainable development.

Due to the worsening effects of climate change and biodiversity loss in recent years, it has become even more urgent to address sustainability concerns. The adoption of the

United Nations Sustainable Development Goals in 2015 has helped to focus global attention on the need for sustainable development, and many companies and governments have committed to achieving these goals.

In conclusion, sustainability has a rich and complex history that has evolved over several decades. People are starting to understand how crucial it is to meet the requirements of the present without sacrificing the capacity of future generations to meet their own needs, which has made it a subject of growing relevance in global policy, industry, and society. The challenges facing sustainability are significant, but with global cooperation and commitment, it is possible to create a more sustainable future for all.

2.2. Waste Management

The act of gathering, moving, processing, recycling, or discarding waste is referred to as waste management. Effective waste management is crucial for promoting sustainable development and protecting the environment. The waste management process can vary depending on several factors, such as the type of waste, its source, and the available resources. Waste management methods also differ between developed and developing nations, urban and rural areas, and producers in the residential and industrial sectors.

Identifying the kind, amount, and characteristics of the trash produced is the first stage in waste management. This information is essential for creating effective waste management strategies. It is also crucial to consider future waste generation trends and potential changes in waste characteristics. Waste reduction and minimization are key components of effective waste management. This entails locating the sources of trash and putting policies into place to stop waste production there. This can include initiatives such as waste segregation, composting, and recycling.

Proper disposal of waste is also critical for effective waste management. Waste disposal options include landfilling, incineration, and recycling. Landfilling is the most common method of waste disposal globally, but it has significant environmental impacts, such as groundwater contamination and the emission of greenhouse gases. Incineration is a different way to dispose of trash, although it has negative environmental effects such air pollution. Recycling is an crucial element of sustainable waste management.

Waste management is the "collection, transportation, processing, recycling, or disposal of waste materials." It is acknowledged that waste management methods vary between developed and developing nations, between urban and rural areas, and between producers in the residential and industrial sectors. However, the methods used for waste management can vary significantly depending on several factors, such as the level of development of the region, the nature of waste, the source of waste, and the available resources. For effective waste management, it is crucial to understand the types, quantities, and characteristics of waste produced and consider future waste generation trends.
Efficient waste management strategies involve identifying the source of waste, reducing and minimizing waste generation, and ensuring proper disposal options. Recycling is a crucial part of sustainable waste management since it lessens the quantity of trash that must be disposed of in landfills or incinerators. Effective waste management practices can help to maximize the use of limited raw materials and minimize energy consumption, which is essential for promoting sustainable development.

When waste was predominantly disposed of by burning or burying in ancient civilizations, the history of waste management began. In ancient Rome, garbage was collected and transported to landfill sites outside the city walls. During the Middle Ages, waste disposal was less organized, and waste was often thrown into the streets, creating significant health hazards. Large amounts of waste were produced in metropolitan centers as a result of the Industrial Revolution's urbanization throughout the 19th century, which presented considerable waste management difficulties.(5)

The first municipal waste collection service in the United States was established in New York City in the 1880s. In the early 20th century, waste incineration became a popular method of waste disposal, but it was later recognized as a significant source of air pollution. The first garbage trucks were developed in the 1920s with the invention of the automobile, which improved the efficiency of waste collection.

Modern waste management strategies, such as recycling and composting, were developed in the 1960s and 1970s as a result of environmental concerns. The environmental effects of trash were highlighted by the inaugural Earth Day in 1970, and the US Environmental Protection Agency (EPA) was established in 1972 to control methods of waste disposal.

The emphasis on waste management moved in the 1980s and 1990s to minimizing waste generation and encouraging sustainable waste management techniques. To promote waste reduction and recycling, the 3Rs concept—reduce, reuse, and recycle—was established. Extended producer responsibility (EPR) initiatives, which were first implemented in the 1990s, held producers accountable for all aspects of the product's lifespan, including waste management.

Today, waste management is a critical issue globally, and efforts are underway to promote sustainable waste management practices, reduce waste generation, and promote recycling and reuse of waste materials. New technologies are being developed to make waste management more efficient and environmentally friendly, such as waste-to-energy and advanced recycling techniques.

2.2.1. Household participation in waste management

In order to encourage sustainable practices and lower the amount of waste produced, household participation in waste management is crucial. Waste management is a collective duty that includes participation from all interested parties, including households. Here are some ways households can participate in waste management:

Reduce, Reuse, Recycle: Reduce, reuse, and recycle are the three R's of waste management, and they are essential for home garbage management. The first step in efficient waste management is reducing the quantity of garbage produced by reducing the use of disposable products like plastic bottles, bags, and silverware. Households can opt for reusable items such as shopping bags, water bottles, and lunch boxes to minimize the amount of waste they produce.

Reusing items is another way households can participate in waste management. Items such as jars and containers can be repurposed and reused for storage or as decorative items, rather than throwing them away. This reduces the amount of waste that ends up in landfills, which can take years to decompose.

Recycling is another important aspect of waste management that households can participate in. Recycling helps the environment by reducing the quantity of waste dumped in landfills. Households can participate in recycling by separating recyclable materials such as paper, plastic, glass, and metal from non-recyclable waste such as

food waste and hazardous materials. Recycling can be done through curbside collection, drop-off points, or recycling centers.

Composting: Composting is another way households can participate in waste management. Composting is the process of turning organic waste, such as grass clippings, leaves, and food leftovers, into nutrient-rich soil. By installing a compost bin in their backyard or, if one is offered in their community, utilizing a composting service, households can compost their food and yard waste. Composting creates nutrient-rich soil for gardening in addition to lowering the quantity of garbage sent to landfills.

Segregating waste: Proper segregation of waste is critical for effective waste management. Households should separate recyclable materials such as paper, plastic, glass, and metal from non-recyclable waste such as food waste and hazardous materials. This makes it easier for waste management services to process and recycle the materials. Households should also segregate hazardous waste such as batteries, electronics, and chemicals, and dispose of them at designated collection points.

Proper disposal: Proper disposal of waste is another important aspect of waste management. Households should dispose of their waste properly by following the guidelines set by their local waste management authorities. This includes disposing of hazardous waste at designated collection points and not in regular garbage cans. Additionally, since doing so can harm the environment and pose health risks, homes shouldn't discard rubbish in public areas.

Educating family members: Education is key in promoting sustainable waste management practices.Families can be taught the value of composting, recycling, and trash reduction by households. This can be done through regular discussions, signage, and educational materials. Households can also involve children in waste management activities, such as composting and recycling, to teach them the importance of sustainable practices.

2.2.2. Sustainable waste management

Sustainable waste management is defined as the controlled handling of waste materials from the point of generation through processes for recovery and disposal. In order to protect environmental quality, human health, and the preservation of natural resources, it involves the control of solid waste generation, storage, collection,

transportation, processing, and disposal. As part of a conservation strategy, emphasis is placed on waste management practices that are environmentally friendly, such as reducing, recycling, and reusing both biodegradable and non-biodegradable waste. According to Lansink, the most preferred option in waste management is to prevent waste so that there is little waste to be disposed of, while the least preferred option is to permit a large amount of waste to be disposed of. The first R, "reduce," refers to waste prevention and reduction. It's important to keep waste production to a minimum. The prudent use of resources in manufacturing is stressed by waste reduction. The second R, "reuse," refers to the future and secondary applications of waste products, either whole or partially. Trade in used goods, such as clothing, electronics, cars, furniture, and other goods, is an example of how waste can be reused. Reuse is accomplished by sorting at the source as opposed to the disposal site and by carefully following processes for inspecting, cleaning, refurbishing, and repairing complete items or spare parts. The third R, "recycle," is reliant on waste products, which cannot be directly reused but can be processed into new products or raw materials. For instance, recycled paper is used to make cards, envelopes, and files. Additionally, pyrolysis—a method that involves burning waste in the absence of oxygen to produce gasses, liquids, and solid compounds—recovers energy through recycling. The "3Rs" relate to other global environmental challenges as well as achieving sustainable solid waste management. Reduced emissions of greenhouse gases, specifically those that could contribute to sustainable development, as well as methane (CH_4), biogenic carbon dioxide (CO_2), non-methane volatile organic compounds (NMVOCs), nitrous oxide (N_2O), nitrogen oxide (NOx), and carbon monoxide (CO) from landfills are among these challenges.

2.2.3. The economic efficiency of waste management

Waste management is a crucial aspect of modern society, as the amount of waste generated by human activities continues to grow. The economic efficiency of waste management refers to how well resources are used to manage waste, taking into account the costs and benefits of different waste management strategies.

There are several key factors that affect the economic efficiency of waste management. The kind of waste being managed is one of the most crucial factors. Different waste kinds necessitate various techniques for disposal or recycling, and some may cost more to manage than others. For example, hazardous waste requires

special handling and disposal methods that can be more costly than managing non-hazardous waste.

Another important factor is the scale of waste management operations.Because they can take advantage of economies of scale, large-scale waste management facilities like landfills and incinerators may be more effective than smaller ones. The cost-effectiveness of various scales of operation will rely on factors including the volume of trash being managed and the local regulatory environment. However, larger facilities might also have greater initial capital expenditures.

The regulatory environment is another important consideration when evaluating the economic efficiency of waste management. Regulations may impose costs on waste management operations, such as fees for obtaining permits or complying with environmental standards. However, regulations can also provide incentives for waste reduction or recycling, which can help to offset some of the costs of waste management.

In addition to these factors, technological advances can play a significant role in improving the economic efficiency of waste management. For example, new recycling technologies can make it possible to recover more materials from waste streams, reducing the need for disposal and creating new revenue streams. Similarly, advances in waste-to-energy technologies can make it possible to generate electricity from waste, providing a source of renewable energy while reducing the volume of waste that needs to be disposed of.

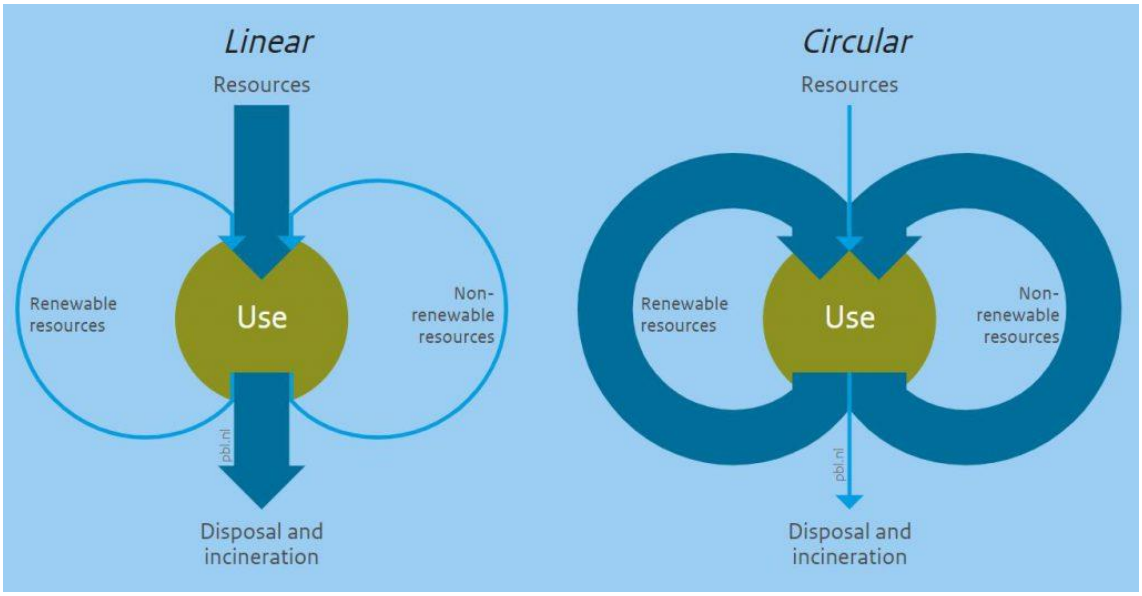
Overall, waste management's economic efficiency is a complicated topic that is influenced by a range of variables, such as the type of waste being managed, the size of operations, the regulatory environment, and technology advancements. Although there isn't a single waste management strategy that works for everyone, there are several tactics that can increase the economic effectiveness of waste management, from cutting waste at the source to investing in new recycling and waste-to-energy technology. One can develop a more effective and sustainable system for handling the garbage produced by contemporary civilization by carefully weighing these possibilities and making wise investments in waste management infrastructure.

2.3. Circular economy

The circular economy is a new way of creating value, and ultimately prosperity. It aims to more efficiently use resources by reusing them rather than simply utilizing them once through prolonging product lifespan through better design and servicing, transferring waste from the end of the supply chain to the beginning, and other tactics. In contrast, products in a circular economy are made to be robust, recyclable, and reused, while raw materials for new products are sourced from those used in older ones. Everything is reused, remade, recycled back into raw materials, used as a source of energy, recycled, or in extreme situations, disposed away.
Governments are promoting and, in some circumstances, mandating the adoption of circular economy practices and concepts, which would improve resource efficiency and reduce waste. The Sustainable Development Goals are a set of interconnected goals that were approved by United Nations Member States in 2015.

2.3.1. The circular economy differs from the linear economy

The circulatory system and the linear system are different in terms of how value is created or retained. Traditionally, a linear economy follows a step-by-step "take-make-dispose" strategy. This implies that raw materials are gathered, transformed into usable products, and then discarded as waste. Value is created in this economic system by creating and selling as many items as feasible.



The 3R method—reduce, reuse, and recycle—is used in a circular economy. Minimizing or reducing the use of resources. The amount of product and component reuse is increasing. And last but not least, high standards are followed when reusing (recycling) raw materials. Utilizing products with more users, such as shared cars, can

achieve this. Additionally, products can be transformed into services. For instance, Spotify sells listening licenses rather than CDs. By concentrating on value preservation in this system, value is created.

2.4. Mongolian situation

In particular, Ulaanbaatar, the capital city of Mongolia, struggles with waste management. The lack of adequate waste collection and disposal infrastructure is one of the major issues.Only approximately 60% of Ulaanbaatar's waste is collected and properly disposed of, according to a World Bank research. The remaining 40% is regularly burned or buried in unauthorized landfills, which pollutes the air. The correct management of waste is a critical environmental issue that needs to be addressed. Improper waste management can pose severe environmental problems such as pollution, soil contamination, and water pollution. Mongolia is a country that has experienced significant development in recent years with the expansion of mining activities and urbanization. However, these developments have resulted in an increase in waste generation, which has led to an increase in environmental issues. Therefore, this study aims to examine the current situation of waste management in Mongolia.

Mongolia is one of the least densely populated countries globally, with a population of approximately three million people. However, the country's population is concentrated in urban areas, with the majority living in the capital city of Ulaanbaatar. Agriculture, mining, and tourism make up the bulk of the nation's economy. Since 2010, Mongolia's economy has grown significantly, with an average annual growth rate of 7.5% from 2010 to 2019.

Waste Generation

In Mongolia, trash output has increased as a result of the country's rapid urbanization and economic growth. In 2018, homes and business operations produced the majority of Mongolia's 1.4 million tons of rubbish, according to a report by the Ministry of Environment and Tourism. The report also indicates that waste generation is expected to increase by 10 percent annually.

Waste Management Practices

Waste management practices in Mongolia are inadequate, and the country faces several challenges in managing waste. The lack of infrastructure, inadequate funding,

and limited public awareness are some of the challenges that hinder effective waste management in Mongolia.

Landfills

Landfills are the most common waste management practice in Mongolia. However, the country lacks adequate landfill sites, and the existing ones are poorly managed. The landfills lack proper lining, which leads to groundwater contamination. Additionally, the landfills are poorly designed, which results in the emission of greenhouse gases such as methane.

Recycling

Recycling is a crucial waste management practice that helps reduce waste generation and conserve natural resources. However, recycling is not widely practiced in Mongolia due to the lack of infrastructure and public awareness.

Incineration

Incineration is an effective waste management practice that helps reduce waste volume and generates energy. However, incineration is not widely practiced in Mongolia due to the lack of infrastructure and the high cost of implementation.

2.4.1. Mongolia goes circular

With a number of efforts targeted at lowering waste and boosting sustainability, Mongolia has made tremendous progress toward creating a circular economy.

One example is the Green Passport program, launched by the Mongolian government in 2019.The program offers a certification system for goods and services that comply with specified environmental requirements in an effort to encourage businesses and customers to embrace more sustainable practices.

Another initiative is the development of a national waste management strategy, which aims to improve waste collection and disposal infrastructure, as well as promote recycling and composting. The strategy includes measures such as expanding the coverage of waste collection services, improving waste segregation practices, and establishing new recycling facilities.

Mongolia has also implemented policies to encourage the use of renewable energy sources, such as wind and solar power, which can help reduce the country's reliance on fossil fuels and promote a more sustainable energy system.

In conclusion, Mongolia's transition to a circular economy is a significant step toward attaining sustainable growth and minimizing the nation's environmental impact. By promoting sustainable practices and reducing waste, Mongolia is taking a proactive approach to protecting the environment and promoting long-term economic growth.

2.4.2. Mongolian imports of glass bottles, jars, etc.,

Due to the rising demand for alcoholic and non-alcoholic beverages, glass bottle imports to Mongolia have been rising over time. Mongolia has a rich tradition of brewing alcoholic beverages like vodka, beer, and wine. The demand for these beverages has been increasing, which has led to a rise in the import of glass bottles. Non-alcoholic beverages like soft drinks, juices, and mineral water are also packaged in glass bottles, which has contributed to the increase in glass bottle imports.

Another factor that has affected the import of glass bottles in Mongolia is the lack of local production. Mongolia does not have a significant glass bottle manufacturing industry, which makes it necessary to import from other countries. The cost of importing glass bottles from other countries is high, which has resulted in an increase in the prices of bottled beverages in Mongolia.

By enforcing import taxes and regulations, the Mongolian government has also had a big impact on the import of glass bottles. Due to these taxes and rules, it is now more challenging for importers to bring in glass bottles from other nations. This has also contributed to the increase in the cost of bottled beverages in Mongolia.

The import of glass bottles in Mongolia has been increasing over the years due to the growing demand for alcoholic and non-alcoholic beverages. The lack of local production and government regulations have also played a significant role in the import of glass bottles. A fuller understanding of import trends and their effects on Mongolia's economy may be possible with additional research in this field.

2.4.3 Ensure sustainable consumption and production patterns in Mongolia

NGDP Strategic Objective 1 is fully in line with SDG 12 and focuses on promoting sustainable consumption and production patterns, promoting effective use of natural resources, low greenhouse gas emissions, and decreased waste. The industrial sectors in Mongolia generate a sizable amount of waste, such as sawdust, coal, coal ash, and construction debris, all of which cause environmental pollution that is detrimental to the quality of the air, water, and soil, supporting SDG 12.4. Saving and conserving cultures do not exist within organizations if business entities do not practice them, which demonstrates the poor norm in wasting water, electricity, and heating energy. To combat the seasonal scarcity of water, pasture, and livestock products, Mongolia's traditional pastoral economy, which is mainly reliant on agriculture, does, however, have rigorous customary norms for resource conservation. A lack of environmental awareness, a low value placed on resources like water, and lax enforcement of environmental monitoring, on the other hand, have led to modern urban Mongolians developing more opulent behaviors. For instance, studies carried out in 2016 revealed that food remnants made up one-third of municipal waste.

As a result, the government approved the National Programme on Reduction of Air and Environmental Pollution, which will strengthen the application of the "polluter pays principles" and promote responsible consumption. Additionally, the 2006-approved and 2014-revised National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants has objectives to promote proper handling and use of chemicals imported into the nation. The most important thing is to stop POPs from being released into the environment, preventing harmful effects on human health.

The Solid Waste Management Improvement Programme for 2014–2022, which establishes a number of waste management targets, is another tool for promoting responsible consumption. It calls for a 12 percent reuse and recycling target to be met by 2022, up from the 4.4 percent achieved in 2013. The Programme also mandates that by 2022, there will be 40 waste disposal facilities that comply with sanitary landfill standards, up from 3 in 2013. On the other hand, Mongolia has not adopted the standards for sustainability reports (SDG12.6.1). While the Business Council of Mongolia claims that some mining companies have begun reporting in this area, the National Chamber of Commerce and Industry reports that very few businesses publish sustainability reports.

2.5. Customer behavioral analysis

With the aim of reducing waste and maximizing resource utilization, items and materials are designed to be reused, mended, and recycled in a circular economy. Understanding customer behavior is essential to the success of a circular economy, as it can help businesses to design products and services that meet customer needs while also promoting sustainable practices.

In a circular economy, taking into account the three stages of a product's life cycle—production, consumption, and disposal—is one method of doing customer behavioral analysis. By examining customer behavior at each of these stages, businesses can identify opportunities to promote circular practices and design products that are more sustainable.

At the production stage, customer behavior can be analyzed through the lens of product design. By understanding customer needs and preferences, businesses can design products that are more durable, repairable, and recyclable. For example, a company that produces smartphones could design a device with replaceable batteries and screens, which would make it easier for customers to repair their devices and extend their lifespan. By designing products that are more circular, businesses can reduce waste and promote sustainable practices.

At the consumption stage, customer behavior can be analyzed through the lens of product use. By understanding how customers use products and the factors that influence their behavior, businesses can identify opportunities to promote circular practices. For example, a company that produces clothing could promote the use of rental or second-hand clothing, which would reduce waste and promote circularity. Businesses may assist reduce waste and enhance resource efficiency by fostering sustainable consumption habits.

At the disposal stage, customer behavior can be analyzed through the lens of waste management. By understanding how customers dispose of products and the factors that influence their behavior, businesses can identify opportunities to promote circular practices. For example, a company that produces electronics could offer a take-back program, where customers can return their devices for recycling. Businesses may minimize waste and encourage resource efficiency by supporting circular waste management techniques.

By reducing the imports of goods, customer behavior in Mongolia can support local businesses, create jobs, and reduce the reliance on imported goods. This may contribute to Mongolia developing a more robust, sustainable, and wealthy economy.

3. Data and methods

3.1. Previous study on consumer behavior

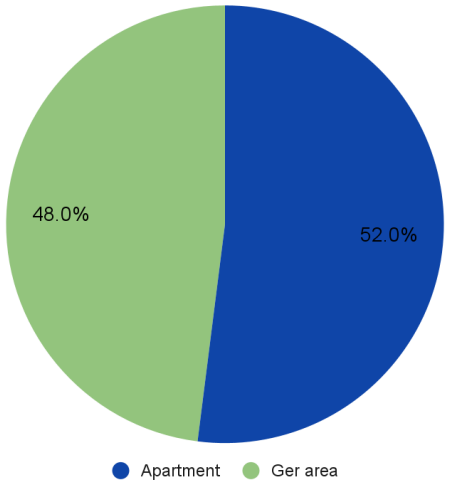
The structure of the collection and analysis of crucial data for the goal of the research is known as the research design. The study of Mongolian Marketing Consulting Group (MMCG) LLC, prepared for GMIT, is designed to use the theory of planned behavior method of study. In this study 403 interviewees from ages 12-65 (median 34.2) in quantitative research, and 35 interviewees from ages 16-50 in qualitative research were participated regardless of their sex, monthly average income, residential area, housing type, employment statement, etc., It therefore draws on the social psychology model that explains human behavior in terms of the influence of attitudes, beliefs, intentions, and perceived behavioral control, as proposed by Icek Ajzen in the late 1980s.

3.1.1 Research and its methods

The International ISO 20252:2015 standard for research, marketing, public opinion, and sociology has been adopted as a national standard, and this standard has been followed throughout the study.

Participants in the aforementioned study were split between 52% women and 48% men, with an average age of 34.2. Their educational backgrounds revealed that 5% of participants had a master's degree or higher, 33% had bachelor's degrees, 49% had high school diplomas, and 14% were still in high school. As a result, their average monthly household income was roughly 1,961,600 MNT.

Chart 1: Participants residential area

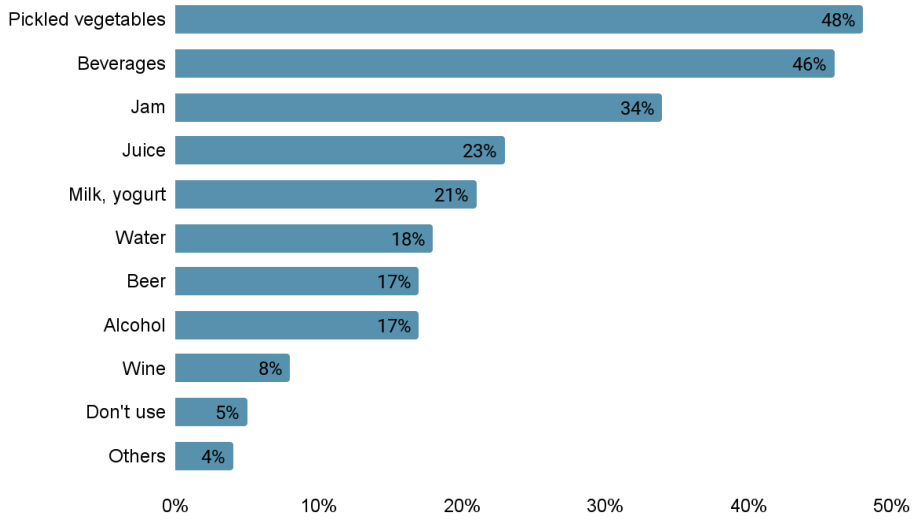


3.1.2. Consumption of glass-packaged products

Products

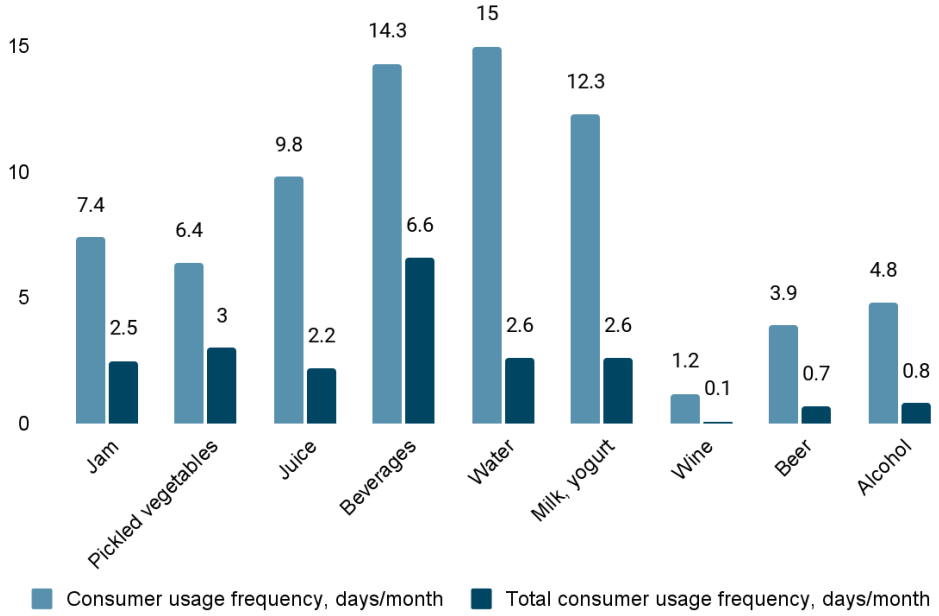
The study's participants primarily used pickled vegetables (48%), beverages (46%), jam (34%), juice (23%), milk and yogurt (21%), water (18%), beer (17%), alcohol (17%), wine and whiskey (8%) and other products (4%), while 55 of them claimed not to use glass packaging products at all.

Chart 2: Consuming of glass packaged products by product



Frequency of consume

Chart 3: Consuming frequency of glass packaging products by product



3.1.3. Advantages and disadvantages of glass packaging products

Public perception of the advantages of glass packaging products:

- 34% - Opportunity to reuse
- 19% - No chemicals, less harmful
- 17% - Eco, environmentally friendly.

Public perception of the disadvantages of glass packaging products:

- 72% - Fragile and prone to cracking
- 19% - Bulky and heavy
- 17% - Difficult to transport and store

3.1.4. Segmentation

- Apathetics - A segment with little knowledge and a negative attitude
- Genuine Greens - A segment that has a positive attitude toward recycling, is aware of its consequences, and acts in an environmentally conscious manner
- Followers - Similar to Genuine Greens segment or a segment that is informed but less active and does not consider sorting and recycling is convenient
- Indolents - A segment that is aware of environmental issues and has a very positive attitude towards recycling, but less interested in taking action, believes that the government and other sectors will take action.

Differentiation of segments

Table 1: Differentation of segments

	Overall	Genuine Greens	Followers	Apathetic	Indolent
Awareness of consequences	86%	95%	91%	68%	91%
Attitude towards recycling	86%	95%	90%	66%	93%
Stakeholders involvement	83%	95%	88%	69%	81%
Reuse and Donate	74%	94%	71%	59%	71%
Convenience	71%	89%	68%	49%	77%
Moral norm	67%	86%	71%	46%	66%
Social norm	62%	85%	65%	45%	52%
Perceived behavioral control	59%	76%	48%	46%	66%
Stereotype	49%	49%	47%	54%	46%
Resell	40%	66%	31%	29%	33%

Factors explained:

- Awareness of consequences - Understanding the importance of recycling
- Convenience, Intention - The feeling of convenience and the intention to recycle the glass
- Subjective norm - Expect others to take away to reuse of glass
- Reuse, Donate - Dispose of bottles in separate bins, donate and reuse attitude
- Moral norm - The attitude that it is wrong to not reuse glasses
- Perceived behavioral control - Aspects of where the glass is ordered and how it is used in factories
- Attitude towards recycling - An attitude that consider recycling as a useful and good thing
- Resell - Approaches to take away glasses to manufacturers and distributors

3.1.5. Regression analysis

Linear Regression : Resell Behavior

Resell=0.512 Perceived behavioral control + 0.424 Education level + 0.148 Age group + 0.158 Economic benefits - 0.109 Household average monthly income

The R2=0.314 of the above linear regression means that the model explains 31.4% of the change in resell behavior. According to the ANOVA test, Sig.000 or the whole model is statistically significant.

Linear Regression : Reuse/Donate behavior

Reuse/Donate = 0.252 Convenience intention + 0.120 Subjective norm + 0.133 Encourage others to keep the environment clean + 0.006 Knowledge of waste reuse + 0.216 Stakeholders involvement + 0.127 Perceived behavioral control + 0.096 Moral norm

The above linear regression R2=0.446 indicates that the model explains 44.6% of behavioral changes. According to the results of ANOVA test, Sig.000 or the whole model is statistically significant.

3.1.6. Overall Results

1. **Glass packaged products**

34% said that the main advantage of products with glass packaging is that people can reuse them. On the contrary, 72% answered that it is harmful because it is fragile and easily cracked.

As for the use of products with glass packaging, products with large rims such as pickled vegetables and fruit jam are used for normal consumption mostly, so it is necessary to recycle the glass bottles not throwing them.

2. **Recycling behavior**

- Citizens should encourage others to keep the environment clean, and manufacturers should take back and reuse glass packaging.
- There is relatively little emphasis on economic benefits and benefits.
- Ulaanbaatar citizens' reuse behavior was segmented into 4 different segments. The Genuine Greener segment accounts for 45% of the market, the Followers segment accounts for 35% of the market, the Indolent segment accounts for 8% of the market, and the Apathetic segment accounts for 11% of the market. The key distinction between the segments is that they behave differently depending on how much they are aware of recycling.
- In order to strengthen the attitude of citizens to handing-in bottles, it is better to educate them about recycling and its benefits and inspire them, rather than make material interests.
- The element indicates that educating individuals about the value of saving and establishing it as a social norm is more crucial.
- Citizens believe that the active participation of individuals and private organizations in glass reuse is the most important.

- Currently, the convenience of sorting and handing-in bottles is not good enough, which is the biggest problem.

3. Readiness assesment

- Citizens have issues returning their bottles because they don't know where the bottles are picked up, because they are awkward to carry and transport, and because ordering is problematic for a number of different reasons.
- Citizens rated their knowledge about glass recycling, recycling and sorting as 50% on average. It shows that the level of knowledge of citizens in this area is low, and there is a need to provide information.
- In terms of waste reuse behavior segment, Genuine green has been ranked with over 94% drop rate.
- Here's a look at the differences in segmentation, or which approach is offered to which segment: In Genuine Green, it is necessary to provide the opportunity to pick up the waste glass from home, to make the automatic machine that collects glass more efficient, and to keep the glass drop-off point close to the home. For Followers, 1st, it is necessary to keep the automatic machine that collects bottles in good condition, 2nd, the waste bottles should be collected from home, and 3rd, the amount of discarded bottles should be used for good use. For the Apathetic segment, ways to increase the reusability of bottles were rated close to the Followers group. The Indolent group was more likely than the other groups to support sorting their bottles if they had a landfill where they could be sorted.
- 59% of respondents who were asked how long it would take to return the glass said they would be willing to do so if it took 10 minutes. Therefore, it is necessary to keep track of the hours and locations where people can purchase bottles along the roads in order to increase the returning of the bottles.
- If 350T is deemed a low price for glass, 500T is the best option. The ideal price range for glass is between 350T and 650T. The survey participants say that it is the price. The price of glass has to be raised, according to 50% of study participants, who feel that it is now too low.
- 52 percent of participants want details on sorting, recycling, and returning glass. As can be seen, social media can be used to educate young people between the ages of 12 and 30, TV advertisements can educate people over the age of 51, and a combination of social and TV advertisements can educate people between the ages of 31 and 50.

Reuse behavior

In clarifying the importance of the following aspects related to reuse behavior, encouraging others to keep the environment clean, the manufacturer taking back and reusing it, and if the waste is created in nature, it is fined by the law on pollution.

- 92% - Encourage others to keep the environment clean
- 90% - The manufacturer probable takes back the glass bottles and reuses it
- 90% - If waste is dumped into the environment, it will be fined by the Violation Law
- 86% - Recycled bottles may be cleaned and reused
- 83% - Being environmentally friendly or using energy efficiently
- 78% - Help others by donating their unused reusable waste
- 77% - To be environmentally productive /earn money/
- 73% - Enjoy discounts and incentives

Awareness of consequences: 82% of participants agree that they can make a positive difference to their community by handing in, donating, or disposing of their waste glass bottles when they pick it up, and 80%agree that reusing glass bottles is a way to reduce landfill waste.

Convenience/Intention : 68% of participants think that there is enough time to sort waste glass, while 50% think that there is enough time to recycle it. 61% say they will regularly reue their bottles.

Subjective norm : 53% of participants say that their colleagues and friends believe that they will reuse the bottles of products. 44% of participants believe that their community groups and 40% of the media are interested in reusing glass bottles.

Moral norm: 57% of the participants say that they can not throw away glass bottles.

Stakeholders Involvements : 82% of Ulaanbaatar citizens believe that the participation of private organizations is the most important for glass bottles recycling. On the other hand, 73% believe thatthe government’s role is important, and 72% believe that recycling glass bottles is our responsibility to society.

Attitude : 80% of the participants have positive attitudes towards reusing glass bottles.

Stereotype : 18-34% of citizens agree with attitudes such as only homeless people collect and hand-in bottles, they don’t carry bottles to the pick-up points because the

environment is dirty, and they are worried and ashamed of other people, which shows that this is not a widespread concept.

Reuse/Donate : When asked if there is enough time to sift glass garbage, 63% of respondents replied yes, while 50% said no.

Perceived behavioral control : Only 1 in 5 people, or 23% of participants know about recycling glass waste in factories.

Resell : 27% resell their glass waste to earn money in return.

Research on customer behavior related to waste management practices has revealed several significant findings. Firstly, it has been found that customers are generally aware of the importance of waste management practices and their impact on the environment. The study found that 84% of respondents knew the importance of waste management practices. This suggests that customers understand the issue well and are willing to take action to address it.

Secondly, research has shown that customers are willing to engage in waste management practices. It was found that 80% of respondents were willing to separate their waste for recycling. This suggests that customers are willing to make changes to their behavior to address the issue of waste management.

Thirdly, research has shown that the level of engagement in waste management practices varies depending on factors such as age, gender, and education level. In a study found that no matter of their age, residential area, or housing type, consumers were likely to engage in waste management practices.

Finally, research has shown that the effectiveness of waste management practices is dependent on factors such as the availability of recycling facilities and the ease of use of waste management systems. It was found that the availability of recycling facilities was a key factor in determining the effectiveness of waste management practices. This suggests that improving the availability of recycling facilities may be an effective strategy for promoting waste management practices.

3.2. How consumer behavior analysis impacts

Understanding the economic factors that affect consumers' decisions and behaviors regarding circular practices is the main goal of an economic approach to consumer behavior tests in the circular economy. This strategy considers the financial benefits,

costs, and incentives that influence consumer decisions in the context of the circular economy. Several crucial factors are listed below:

Price and cost considerations: Economic factors play a significant role in consumer behavior. Consumers assess the price and cost implications of engaging in circular practices, such as purchasing recycled or second-hand products, repairing items instead of replacing them, or participating in recycling programs. Consumer behavior tests can evaluate consumers' sensitivity to price changes, their willingness to pay for sustainable and circular products, and their perceptions of the cost-effectiveness of circular behaviors.

Economic incentives and rewards: Consumer behavior tests can explore the effectiveness of economic incentives and rewards in encouraging circular behaviors. For example, providing financial incentives or discounts for recycling, offering trade-in programs for used products, or implementing deposit-refund schemes for reusable packaging can influence consumers' decisions and motivate them to participate in circular practices.

Consumer preferences and value proposition: Economic factors are intertwined with consumer preferences and the perceived value proposition of circular products and services. Consumer behavior tests can examine consumers' preferences for eco-friendly and sustainable products, their willingness to trade-off price for circular attributes, and their perceptions of the value derived from circular consumption, such as reduced environmental impact or long-term cost savings.

Market dynamics and competition: Understanding market dynamics and competitive forces is crucial in the circular economy. Consumer behavior tests can assess consumers' awareness and perceptions of circular products and services, their trust in circular business models, and their preferences for circular offerings compared to conventional alternatives. This helps businesses identify market opportunities, differentiate their circular offerings, and adapt their strategies to meet consumer demands.

Behavioral economics principles: Applying insights from behavioral economics can enhance the understanding of consumer behavior in the circular economy. Concepts such as default options, social norms, loss aversion, and framing can influence consumer decision-making and facilitate the adoption of circular practices. Consumer

behavior tests can incorporate these behavioral economic principles to design interventions and nudges that encourage circular behaviors.

By integrating economic considerations into consumer behavior tests, businesses, policymakers, and organizations can gain a deeper understanding of the economic drivers of consumer choices in the circular economy. This knowledge can inform the design of effective strategies, policies, and incentives that align with consumers' economic incentives and motivations, ultimately promoting the transition to a more circular and sustainable economy.

3.3. Municipal solid waste management of Ulaanbaatar according to consumer behavior

"On average, 2 trillion liquid food containers are produced annually in the world. Where do they go, though? This topic was one of the most talked about during the 2019 World Economic Forum. It is estimated that only 24 percent of these are reused. The impact of each packaging on the environment is different. Of these, glass bottles are 100 percent recyclable, showing how much of a resource we're putting into the ground as waste.

Table 2: Import of glass bottles (2013-2022)

Year	Import quantity	Import cost (thousand USD)
2013	92,387,231	22,918.57
2014	95,716,500	24,331.9
2015	85,503,209	23,971.09
2016	96,015,627	26,970.49
2017	98,228,779	28,337.62
2018	118,282,779	33,528.19
2019	111,522,308	33,912.48
2020	107,200,125	26,159.47
2021	98,398,046	22,912.26

2022	151,150,209	43,635.43

As shown in the table 2, Mongolian import of glass bottles are increasing year by year, as population grows. Some companies that produce glass bottled products in mongolia, such as APU, Gazar shim etc, intended to collect their glass waste bottles but results are not shown to their web site or other sources.

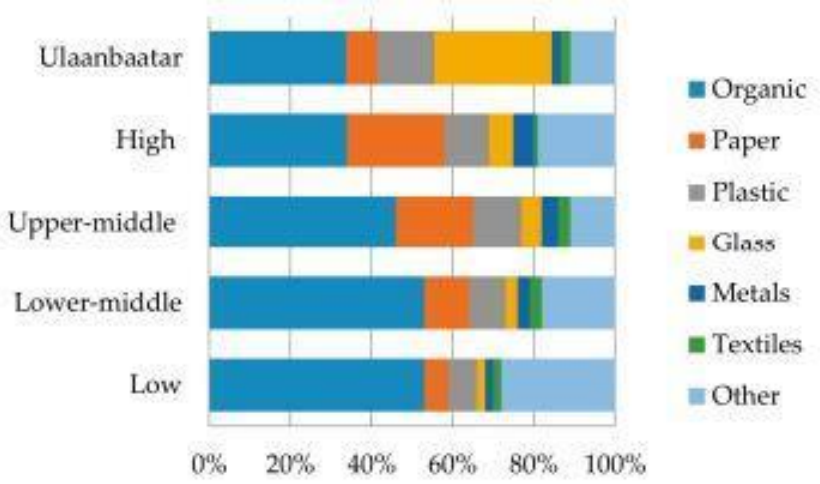
Currently, 12-13 percent of total waste is recycled in this age. Last year, 1.2 million tons of waste went to the centralized landfill from Ulaanbaatar. Waste that goes to a centralized landfill is sorted by the people working there and given to recycling plants. Considering the composition of waste, 60-70 percent of waste can be turned into money. (50) According to MMCG's earlier research, 80% of the population is willing to help manage waste by using sorting glasses, but waste composition is managed in a way that is inferior to other nations. Our current practice is to bury waste in centralized landfills. Reducing the amount of waste buried in the environment is a major goal we are working toward. To reduce this, waste should be reduced. If individuals, businesses, and organizations uphold their legal duties and implement a system of sorting and separating waste, 20 to 30 tons of every 100 tons of trash headed for the centralized landfill will be sorted and sent to the recycling facility. This implies a reduction of 20–30% in the amount of waste buried in the environment (50).

969.1 thousand tonnes of garbage were recorded at the three dump sites in 2015, with respective percentages of 47%, 36.8%, and 16.2%. MSW waste makes up 53.9% of the total waste that weighbridges register, including waste from homes (including apartments and gers), streets, and public areas. The city of UB generates 1.12 kg of MSW per person per day (408.82 kg per person per year). Since recyclables are removed during the steps leading up to disposal, this number should be regarded as the absolute minimum. UB qualifies as a "higher waste generating" city because its waste generation rate is higher than the national average of 1 kg per person per day.

Despite the fact that Mongolia is regarded as a lower-middle-income nation, the JICA (48) study found that the composition of UB's household waste was comparable to that of nations of all income levels (Figure 5). For instance, the organic fraction in UB is only about 33.7%, which is comparable to that of high-income nations. Metals (2.1%) and paper (7.7%) consumption were comparable to that of low-income nations. Comparing the waste composition of all other high income countries, the percentage of plastic

waste (14%) was in the higher range. Glass and bottles made up 29% of the total, which was significantly more than the other materials. This might be explained by how frequently goods packaged in glass jars and bottles are used, but more research is needed to be sure. Of the total amount of waste, recyclables such as paper, plastic, metal, bottles, and glass accounted for about half (52.8%).

Chart-4: Waste composition comparison of Ulaanbaatar with averages of various income level countries (data for household waste composition study 2010–2011)(48)



Given that Mongolia is a lower-middle-income country and that the household waste it produces is comparable to that of all other countries, as you can see from the chart above, waste management is an important issue for Mongolia.

A recycling rate estimate was made based on JICA studies' (48) identification of recycling activities at each of the three stages of discharge, collection, and disposal. Calculation:

- Recycling percentage at discharge: 9.3% of garbage from ger areas (18 g/day out of 192 g/day, ash removed) and 9.4% of waste from flats (26.5 g/day out of 294 g/day) were extracted and transported to the recyclables' market, according to JICA's waste generation study. Ash and general waste from the ger area were distributed in a 69% to 31% ratio, respectively.
- Recycling percentage at collection: Waste collection workers separated 1.3% of commercial and residential waste, and 2% of ger area waste (ash excluded) into the recyclables stream.
- Recycling amount at disposal: 1.15 percent of waste entering the landfill was removed by waste pickers and sold on the market for recyclables (1.3% in the winter and 1% in the summer).

3.4. Economy and Finance

At the beginning of the 1990s, the Mongolian economy changed from a planned to a market economy, and a comprehensive economic reform program was launched. This program included privatizing state-run companies, attracting foreign investment, and altering the tax and banking systems. Following this pattern, all of the districts in the study area—with the exception of Nalaikh District (Duureg)—were privatized, including the district cleansing corporation (TUK), which was responsible for cleaning operations. Although the GDP fell at the beginning of the shift to a market economy system, it has since turned positive, and growth has continued. The manufacturing sector accounts for 34% of the GRDP in Ulaanbaatar City, making it the industry with the highest percentage. In addition, the growth rate between 2000 and 2003 was 25%, the second largest behind the 45% growth rate seen by the education sector. To encourage equity in the transfer of financial resources between urban and rural areas, the Mongolian government is pushing a financial redistribution strategy. So, even though Ulaanbaatar local generated 26.6 billion MNT in local taxes in 2004, the federal government only received 13.5 million MNT. Additionally, there is no budgetary support from the federal government for SWM operations in Ulaanbaatar City.

4. Results

The amount of waste produced was 408.8 kg per capita per year, which is 1.12 kg per capita per day (the minimum amount). This places the city in the category of "higher waste generating" because the amount of waste created exceeds the daily threshold of 1 kilogram per person. This means that the topic of waste minimization needs to be carefully considered in addition to recycling garbage. In terms of waste composition, the other four cities had the lowest percentages of organic waste when compared to the national averages, which can be attributed to high-income nations. Paper and metal content was within the normal range, while plastic content was above average. But compared to other cities' averages, there were significantly more bottles and pieces of glass. Roughly half of the total amount of waste was made up of recyclables, which included paper, plastic, metal, bottles, and glass. This can be explained by the fact that there are fewer seasonal fresh fruits and vegetables available in UB because of its climate, leading to a high proportion of imported consumer goods and products, as well as their packaging. Research on waste flow as well as a thorough and current study of waste composition require more effort. The most crucial factors in MSWM planning are the basic information on waste generation and waste composition, which also has a special role in informing the stakeholders. As a result, it's critical to give this kind of

research priority. The university has outperformed low- and lower-income nations in terms of institutional features, public health, and environmental control, according to the benchmark indicator findings for UB, and it has also satisfied the criteria for updating its waste management system. To complete the transition, however, there are still a few significant steps to take. The best-performing metrics, (1.1) Waste collection coverage and (1.2) Controlled treatment and disposal, are in line with JICA and Asia Foundation projects that have been aimed at enhancing SWM. There is still room for improvement, as evidenced by the "quality" indicators for Environmental control and Public health. Setting a collection frequency in ger regions of at least twice a month will enable the delivery of high-quality services to remote places. In terms of inclusivity, there has been some improvement for Provider Inclusivity in the formal SWM sector, but there is still work to be done for inclusivity in the unofficial sector. Consumers are also an essential component of the system, and initiatives aimed at altering behavior and increasing awareness should be carried out in a systematic way.

4.1. Analysis of the relationship between customer behavior and an economic approach to waste management

Utilizing pricing incentives is one economical waste management strategy. Customers are encouraged to limit the quantity of waste they produce by raising the cost of waste disposal. Although this strategy has been effective in many contexts, it is crucial to make sure that low-income neighborhoods are not disproportionately impacted. A "pay-as-you-throw" system, for instance, is one where clients are taxed in accordance with the amount of rubbish they produce. In certain places, this strategy has proved effective in lowering waste and raising recycling rates.

Another approach to waste management is the use of education and outreach programs. It is feasible to alter behavior and reduce waste by teaching customers about the value of trash reduction and recycling. This strategy can work, but it necessitates a major time and resource commitment. For example, some companies have implemented waste reduction programs that include employee training and education campaigns to raise awareness about waste reduction and recycling.

A third approach to waste management is the use of technology. By implementing new waste management technologies, it is possible to reduce waste and improve recycling rates. However, these technologies can be expensive and may not be accessible to all communities. For instance, to improve waste collection and lower the quantity of waste

that ends up in landfills, some towns have installed automated waste collecting systems that make use of sensors and other technologies.

1. **Awareness of waste and environmental issues - Overall, the findings point to a high level of environmental awareness.** People in UB would be more interested in environmental issues because pollution issues like air pollution would only get worse for a while. Due to insufficient waste collection services, there were a number of issues in the Ger area, including strewn waste and illegal dumping on major streets and in public areas. The findings indicate that residents of the Ger area were more aware than those of the Apartment area of the issues brought on by poor solid waste management.
2. **Discharge and collection of garbage in the apartment area -** Despite the subpar collection service, the majority of the waste was regularly collected in the residential area. Apartments in UB have caretakers who are in charge of keeping the communal areas clean and making sure their own apartments are secure. These keepers are crucial to the management of solid waste, and residents don't need to focus much on collection work. As a result could not accurately depict the actual circumstances surrounding the discharge and collection of waste due to the respondents' lack of familiarity.It is possible to compare the findings of the follow-up interview survey with apartment managers to identify the actual problems and conditions that need to be fixed.
3. **Discharge and collection of garbage in the Ger area -** The majority of respondents in the Ger area were dissatisfied with the collection service due to the infrequent service. The Ger region has an acute need for a waste collection service, but many residents did not regularly use the service. They thus unlawfully disposed of a significant amount of their waste in an open area, severely degrading the ecosystem in the Ger region.
4. **Recycling -** The amount of recyclables in UB is not very high. There aren't many intermediate buyers, and regular people aren't aware of where they can sell recyclables because there aren't many final consumers of recyclables in UB. Two of the most common recyclables in UB are glass and plastic bottles.

4.2. Question 1: What are the current waste management practices of customers and what motivates them to engage in sustainable waste management practices?

As of my last knowledge, the current waste management practices of customers in Mongolia may include the following:

1. Landfill disposal: A significant portion of waste in Mongolia is still disposed of in landfills. This is the most common waste management practice among individuals and businesses.
2. Informal waste collection and scavenging: In some areas, informal waste collectors and scavengers collect recyclable materials, including glass, from waste bins and sell them to recycling businesses.
3. Limited recycling infrastructure: Recycling facilities in Mongolia are still limited, particularly for certain types of waste. This can hinder recycling practices among customers.
4. Limited awareness and education: The level of awareness about proper waste management practices, including recycling, can vary among customers. Lack of education and awareness may contribute to suboptimal waste management practices.

Motivations for customers to engage in sustainable waste management practices in Mongolia can include:

1. Environmental consciousness: Some individuals in Mongolia are motivated by their concern for the environment. They may engage in sustainable waste management practices as a way to reduce pollution, conserve resources, and protect natural ecosystems.
2. Economic incentives: In some cases, customers may be motivated by economic incentives. For example, informal waste collectors and scavengers may engage in waste management practices to earn income by selling recyclable materials.
3. Government initiatives and regulations: Government policies and regulations can play a significant role in motivating customers to adopt sustainable waste management practices. Incentives such as recycling programs, waste separation requirements, and financial incentives for recycling can encourage individuals and businesses to participate.
4. Social responsibility and community pressure: Customers may feel a sense of social responsibility and community pressure to engage in sustainable waste management practices. This can be influenced by the attitudes and behaviors of peers, community groups, and social norms.
5. Education and awareness campaigns: Awareness campaigns, educational programs, and information dissemination about the benefits of sustainable waste management practices can motivate customers to adopt such practices. Providing information about the environmental impact of waste and the importance of recycling can help raise awareness and change behaviors.

It's crucial to keep in mind that attitudes about and behaviors related to waste management can change over time, and there might have been changes since my previous update. I suggest consulting regional waste management organizations, environmental organizations, or local research studies for the most precise and up-to-date details on trash management practices and reasons in Mongolia.

4.3. Question 2:How do demographic factors such as age, income, and education level influence customer behavior towards sustainable waste management practices?

Demographic factors such as age, income, and education level can influence customer behavior towards sustainable waste management practices in Mongolia in the following ways:

1. Age:

- Younger generations: Younger people tend to be more aware of sustainability issues and more environmentally sensitive. Compared to older age groups, they may be more inclined to actively participate in sustainable waste management techniques, such as recycling.
- Older generations: Older individuals may be less familiar with sustainable waste management practices and have ingrained habits regarding waste disposal. However, this can vary among individuals, and some older individuals may also adopt sustainable practices if they are educated about their benefits.

2. Income:

- Higher income: Customers with higher income levels may have greater access to resources and infrastructure that enable sustainable waste management practices. They may be more likely to afford recycling services or invest in waste separation equipment.
- Lower income: Customers with lower income levels may face financial constraints that limit their ability to engage in sustainable waste management practices. Lack of access to recycling facilities or limited awareness about sustainable practices can also be barriers for this group.

3. Education level:

- Higher education: Individuals with higher education levels are generally more aware of environmental issues and have a better understanding of sustainable waste management practices. They may be more inclined to adopt and actively engage in recycling and other sustainable practices.
- Lower education: Customers with lower education levels may have limited knowledge and awareness of sustainable waste management practices. Lack of education can result in less engagement in recycling and other environmentally friendly behaviors. However, targeted education and awareness campaigns can help bridge this knowledge gap.

It's important to note that these relationships are generalizations and can vary among individuals. Other factors such as personal values, attitudes, and cultural influences can also play a role in shaping customer behavior towards sustainable waste management practices. Understanding the specific dynamics and preferences within different demographic groups in Mongolia can help tailor interventions and communication strategies to effectively promote sustainable waste management practices.

4.4. Question 3:How can customer education and engagement programs be designed to encourage the adoption of a circular economy approach to waste management?

The following approaches can be used in the design of consumer education and engagement initiatives to promote the adoption of a circular economy approach to waste management in Mongolia:

1. Raise awareness: Run focused awareness efforts to inform clients of the idea and advantages of a circular economy, stressing the significance of waste reduction, reuse, and recycling. To reach a large audience, use a variety of platforms including social media, television, community events, and seminars.

2. Provide information and guidance: Offer clear and accessible information about waste management practices, including recycling guidelines, proper waste sorting techniques, and the locations of recycling facilities. Provide step-by-step instructions on how customers can participate in recycling programs and the positive impact of their actions.

3. Tailor messaging: Recognize Mongolia's varied demographics and cultural characteristics and adapt your messaging to speak to each group. Use relatable language, visuals, and examples to make the information engaging and relevant to individuals from various backgrounds.

4. Collaborate with local communities: Engage community organizations, schools, and local leaders to support and promote sustainable waste management practices. Foster partnerships with community groups and involve them in waste reduction and recycling initiatives, such as organizing cleanup events or implementing community recycling programs.

5. Incentives and rewards: Offer incentives or rewards programs to motivate customers to participate in recycling and waste reduction efforts. This could include discounts on products or services, loyalty programs, or special promotions for customers who actively engage in circular economy practices.

6. Education in schools: Integrate waste management and circular economy education into school curricula. Inform pupils about the value of trash reduction, recycling, and the adoption of sustainable behaviors. Encourage them to apply this knowledge in their homes and get their families involved in eco-friendly waste management practices.

7. Partnerships with businesses: Collaborate with businesses and industries to promote sustainable practices in their operations and supply chains. Encourage businesses to adopt recycling programs, reduce packaging waste, and explore innovative solutions for reusing or repurposing materials.

8. Provide infrastructure and resources: Invest in the development of recycling infrastructure, such as recycling centers and collection points, to make it convenient for customers to participate in recycling programs. Ensure that resources, such as recycling bins and educational materials, are easily accessible in public spaces, residential areas, and workplaces.

9. Continuous evaluation and improvement: Regularly assess the effectiveness of customer education and engagement programs through surveys, feedback, and data analysis. Use the insights gained to refine and improve the programs, addressing any barriers or challenges that customers may face in adopting circular economy practices.

By implementing these strategies, customer education and engagement programs can effectively promote the adoption of a circular economy approach to waste management in Mongolia, fostering a culture of sustainability and responsible waste disposal.

4.5. Question 4:What are some potential challenges and limitations to adopting a circular economy approach to waste management?

In Mongolia, implementing a circular economy approach to waste management may run into a number of obstacles. Some potential ones include:

1. Lack of awareness and understanding: Limited awareness and understanding of the concept of circular economy and its benefits may hinder its adoption. Educating the public about the principles and advantages of a circular economy can be a significant challenge.

2. Infrastructure limitations: Insufficient recycling and waste management infrastructure can pose a barrier to implementing circular economy practices. To facilitate the effective recycling and reuse of materials, insufficient collecting methods, recycling facilities, and suitable technologies may need to be built or enhanced.

3. Financial constraints: Investing in the necessary infrastructure and technologies for a circular economy can require significant financial resources. Securing funding for such initiatives, especially in resource-constrained environments, may be challenging.

4. Behavior and mindset change: Shifting consumer behavior and attitudes towards waste disposal and recycling practices can be difficult. Overcoming ingrained habits and promoting behavior change to embrace recycling and waste reduction requires targeted education, engagement, and long-term efforts.

5. Limited cooperation and collaboration: Achieving a circular economy requires collaboration among various stakeholders, including government agencies, businesses, communities, and individuals. Building partnerships and fostering cooperation among

these diverse entities can be challenging, particularly when there are competing priorities or lack of alignment.

6. Informal waste sector: Informal waste collection and recycling practices, which are prevalent in Mongolia, can create challenges in integrating them into formal circular economy systems. Coordinating and formalizing these informal practices while ensuring fair working conditions and environmental standards can be complex.

7. Cultural and social factors: Cultural norms and social attitudes towards waste management can influence the adoption of circular economy practices. Addressing cultural perceptions, social norms, and traditional practices related to waste disposal and recycling may require tailored strategies and community engagement.

8. Geographic challenges: Mongolia's vast and sparsely populated areas pose logistical challenges for establishing efficient waste collection and recycling systems. Addressing the geographical aspects and ensuring access to recycling facilities and services across different regions can be demanding.

9. Regulatory and policy frameworks: Establishing supportive policies, regulations, and incentives that encourage and enable the transition to a circular economy is crucial. Ensuring the existence of clear and consistent regulations, as well as mechanisms for enforcement, can be a challenge that requires active government involvement.

Addressing these challenges and limitations requires a holistic approach involving government support, public-private partnerships, stakeholder engagement, and continuous efforts to raise awareness and build the necessary infrastructure. Overcoming these obstacles can pave the way for the successful adoption of a circular economy approach to waste management in Mongolia.

5. Discussion

An innovative approach to waste management called the circular economy has substantial potential economic and environmental advantages. A circular economy can minimize waste, recycle or repurpose materials, keep resources in use for as long as possible, and limit resource depletion, greenhouse gas emissions, and other environmental effects related to trash disposal. Additionally, a circular economy can create economic opportunities and value by reducing dependence on finite resources, creating new jobs, and promoting innovation and technological development.

These benefits can be quantified through a variety of methods, including life cycle assessments, cost-benefit analyses, and economic modeling. For instance, life cycle assessments can quantify the environmental impacts of a product throughout its entire

life cycle, from extraction of raw materials to disposal. Cost-benefit assessments are able to weigh the advantages and disadvantages of various waste management strategies, particularly those linked to a circular economy approach. The economic effects of a circular economy, such as employment creation, cost savings, and greater economic activity, can be estimated by economic modeling.

Overall, the potential benefits of a circular economy approach to waste management are significant and wide-ranging, and can be quantified through a variety of methods. By understanding and quantifying these benefits, businesses and policymakers can design effective strategies and policies that promote sustainable waste management practices and the transition towards a circular economy.

5.1. Identification of the limitations and future research directions

This study's limitations include its use of a small sample size and emphasis on a single geographic region. Future study may be able to overcome these restrictions by using a larger and more varied sample, which includes people from other areas and demographic groupings. Furthermore, to supplement reported data, future study should use more objective measurements of waste management behavior, such as waste audits..

Future studies can also examine how technology can support the development of circular economies and sustainable waste management methods. For instance, the use of smart waste management systems could provide customers with real-time information about their waste generation and disposal, which could help them make more informed decisions. Additionally, the adoption of blockchain technology can make the waste management supply chain transparent and traceable, which might encourage companies to use the circular economy.

Another area of future research could be the role of cultural values and beliefs in shaping customer behavior towards sustainable waste management practices. Previous research has shown that cultural factors can play an important role in shaping environmental attitudes and behaviors. Therefore, future research could explore how cultural values and beliefs influence customer behavior towards sustainable waste management practices, and how these factors can be leveraged to promote the adoption of a circular economy approach to waste management.

5.2. Waste management policies

In accordance with the Mongolian Law on Waste Management (2012), which addresses the needs for solid waste management, a municipal "Regulation on Funding of Waste Management and Transportation Operations and Consolidation of Waste Management Service Fee" was passed in 2015. The aforementioned law, however, was not adequate to control the complex problems brought on by various waste-related aspects. After being returned to the Parliament once in 2016, the process of enacting the new law formulation started in January 2017. There are numerous national plans and strategies for sustainable and green development. The State Great Khural approved the concepts for Mongolian Sustainable Development 2030 on February 19. On June 13, 2014, the Green Development Policy was approved. This policy includes goals to reduce landfill waste by 40% and increase recycling rates to 40%. These objectives should have a clear path to fulfillment, but they should also be attainable and realistic. These objectives are typically set on the basis of insufficient research, information, and data. There are guidelines for local governments to follow when putting the laws and strategies into practice, but the current methods of addressing issues related to MSW are not comprehensive enough. The baseline studies for all the targets are insufficient and usually do not adequately reflect reality, which makes it more challenging to achieve these objectives. The Ministry of Environment, Green Development, and Tourism is the national organization in responsibility of formulating policies; however, they are not in charge of organizing the implementation procedure. The rules must be followed, according to the local government. Extended producer responsibility (EPR) and product stewardship (PS) implementation has not been attempted. The introduction of an additional import tax on goods that cannot be recycled is one way that this issue has been addressed. However, this issue is no longer being discussed. As a form of corporate social responsibility (CSR), the informal sector, on the other hand, hopes to provide waste pickers with employment opportunities through their participation in the "Eco-Park." These facts result in a 46% score for the qualitative indicator.

6. Conclusion & Recommendations

In developed and developing nations, SWM is currently in very different states. These differences can be attributed to a number of factors. The problem of waste is more complex in developing nations due to their current socioeconomic and cultural characteristics, lack of financial resources, ability of municipal and local administrations, and attitudes of the general people. By considering all current complexities, systems perspective can help construct the situation in developing nations.

The most pressing issue that needs to be addressed among the difficulties that UB and other developing nations face is a lack of data and improper data collection. Further advancement depends on accurate and current data, which calls for better data collection and reporting. These include waste generation, waste composition (from households and other sources ending up in landfills), other properties (like moisture, density, and calorific value of waste), and waste flow, which takes into account recycling at various stages carried out by the unofficial recycling industry. The results demonstrate that a sizeable part of rubbish is recyclable; most of it is gathered by unpaid waste pickers in the informal sector, whose services are rarely recognized. Utilizing all recyclable materials and expanding on current recycling activities in the informal sector can significantly boost UB's ability to become resource-efficient and lessen the negative consequences of waste on the environment and human health.

The public must be led by clear and practical instructions in order to change behavior and raise awareness in order to meet the targets set for sustainable and green development goals. When people are not aware of the implications of their actions, they are less driven and more reluctant to take part in any new policies and initiatives. Therefore, providing educational programs to the public that accurately reflect the current state of waste (i.e., the actual makeup of a household's waste and its effects) can assist in bringing about a change in behavior. Nevertheless, in order to advance waste management modernization, participation from all stakeholders is necessary.

Our study significantly improved the body of knowledge about UB by identifying its most important assets and areas for development. A material flow diagram (MFD) is included with the benchmark indicators for "Wasteaware". However, the MFD was built using the information available due to uncertainties in waste flow and a lack of data on recycling aspects. Future research should focus on overcoming these constraints.

6.1. Recommendations for waste management practices and policies in circular economy context

Cooperation with government, private and non-government organizations to increase use of glass waste

- In the legal framework, the manufacturing company needs legal regulations to increase the recall of packaging waste

- Non-governmental organizations operating in the direction of waste recycling should provide citizens with information on this aspect and make them aware
- For manufacturing organizations, take the lead in recalling and increasing the reuse of packaging waste, and call on citizens and other business organizations.
- To establish a memorandum of understanding for collaboration between the government, business community, and non-governmental organizations regarding the recycling and reuse of used glass
- To increase the quantity of people returning and returning bottles, to make ordering bottles easier, and to extend the number of locations where bottles can be collected, cooperation is required.
- Provide opportunities for waste sorting in cooperation with Condominium Associations and district organizations.

Creating opportunities for the recycling of waste bottle locally disposed of

- Introducing an efficient logistics system for bringing waste glass from the local area. Organizing transport vehicles going to local distribution to ensure that they do not arrive empty on one side
- Organize the collection of waste glass in cooperation with secondary raw material collection points, middlemen and local authorities. For provinces with developed domestic tourism, there is a lot of waste of glass packaging products, and it seems that we need to cooperate with holiday camps.

Working with Genuine Green segment to encourage sitizens to sort and recycle glass waste

- We see a chance to expand the number of recycled bottles by enabling the reuse of our glass in this area, which accounts for 45% of the market, which is a good outcome.
- Genuine green segment accounts for 6% of people who would have ordered their bottles, and 32% believe that they will regularly dispose of their bottles in the future.

Based on the findings of the study, the following recommendations can be made for waste management practices and policies in a circular economy context:

1. Increase customer awareness and education:Effective consumer education and engagement initiatives that highlight the advantages of sustainable waste management techniques and circular economy ideas should be developed by businesses and policymakers. This could include providing information on

waste reduction, recycling, and repurposing, as well as the environmental and economic benefits of a circular economy.

2. Develop economic incentives: Economic incentives can be effective in encouraging customers to adopt sustainable waste management practices and a circular economy approach. For example, businesses could offer discounts or rebates for products that are designed for circularity, such as those made from recycled or repurposed materials.
3. Promote social norms: Social norms play an important role in shaping customer behavior towards sustainable waste management practices. Policymakers and businesses can promote social norms that encourage sustainable waste management practices, such as recycling and repurposing.
4. Invest in technology: Technology can play a key role in promoting sustainable waste management practices and the transition towards a circular economy. Businesses and policymakers should invest in smart waste management systems that provide customers with real-time information about their waste generation and disposal, as well as blockchain technology that provides transparency and traceability in the waste management supply chain.
5. Address convenience and cost barriers: Adoption of sustainable waste management techniques and a circular economy strategy is hampered by convenience and cost. To overcome these barriers, businesses and policymakers should design products and services that are convenient and affordable, as well as provide economic incentives and disincentives that encourage sustainable waste management practices.

In summary, adopting a circular economy approach to waste management requires a concerted effort from businesses, policymakers, and customers. By implementing the recommendations above, we can promote sustainable waste management practices and transition towards a more circular economy that minimizes waste, reduces resource depletion, and maximizes the value of materials.

6.2. Final remarks

Reusing and recycling materials as part of a circular economy offers the potential to lessen waste and advance sustainable practices. Reusing glass bottles is one method of achieving this.

The usage of bottled beverages has increased recently in Mongolia, which has resulted in a large rise in glass trash. Reusing glass bottles can be a long-term fix for this issue. Glass bottles are resilient and can be recycled after several uses. This can encourage environmentally friendly behaviors in Mongolia and greatly lower the amount of garbage produced by bottled beverages. Additionally, the reuse of glass bottles can create new business opportunities and promote local industries.

A study by the Ellen MacArthur Foundation found that the adoption of a circular economy can have significant economic benefits. The study found that a circular economy can create new jobs, reduce resource dependency, and promote economic growth. In Mongolia, the reuse of glass bottles can create new jobs in the recycling and manufacturing industries, leading to economic growth and development.
Furthermore, a study by Geissdoerfer found that the adoption of a circular economy can have significant environmental benefits. The study found that a circular economy can reduce greenhouse gas emissions, promote sustainable resource management, and reduce waste. Reusing glass bottles in Mongolia can help to cut down on plastic waste and encourage environmentally friendly waste disposal methods, creating a cleaner and safer environment.
In conclusion, the reuse of glass bottles in Mongolia can have significant economic and environmental benefits. It can create new business opportunities, promote local industries, and reduce waste. A circular economy can promote sustainable behaviors and a cleaner environment while also fostering economic growth and development. Therefore, it is important for Mongolia to consider the reuse of glass bottles as a sustainable solution to the growing problem of waste.

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