Pre-Feasibility Study on Improved Waste Management

Table of Contents

List of Figures

List of Tables

Abbreviations

3Rs	Reduce, Reuse, Recycle
AFLOLU	Agriculture, Forestry and Other Land Use
BC	Black Carbon
BWB	Bhutan Waste Bank
CCAC	Climate and Clean Air Coalition
COPD	Chronic Obstructive Pulmonary Disease
DA	Dzongkhag Administration
DWM	Druk Waste Management
EPR	Extended Producer Responsibility
GBWM	Green Bhutan Waste Management
GHG	Greenhouse Gas
GLOFs	Glacial Lake Outburst Flood
GNH	Gross National Happiness
GWP	Global Warming Potential
HDPE	High Density Polyethylene
HFCs	Hydroflurocarbons
IA	Implementing Agencies
ICIMOD	International Centre for Integrated Mountain Development
IPCC	Inter-governmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IPPU	Industrial Processes and Product Use
ISWM	Integrated Solid Waste Management

KG	Kilogram
LDPE	Low Density Polyethylene
LULUCF	Land Use, Land Use Change and Forestry
MRF	Material Recovery Facility
MT	Metric Tonnes
NEC	National Environment Commission
NGO	Non-governmental Organization
NWIS	Nationl Waste Inventory Survey
PES	Payment for Environment Services
PET	Polythylene Terephthalate
PPP	Public-Private Partnership
RGoB	Royal Government of Bhutan
SAARC	South Asian Association for Regional Coorporation
SLCPS	Short-Lived Climate Pollutants
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
VOCs	Volatile Organic Compounds
WWF	World Wide Fund for Nature

1 Introduction

Bhutan is recognized as an environment friendly country with rich biodiversity and accredited by numerous international organizations for its conservation efforts. It is also enshrined in the constitution of Bhutan that 60% of forests shall be maintained for all times to come. It is imperative that the beauty and cleanliness of the country is maintained for the health, environmental, economic and tourism benefits. However, increased population growth, economic activities and unsustainable development processes have led to increased waste generation which are raising environmental and health concerns. In the present context, solid wastes and effluents are considered to be major environmental concerns in Bhutan in the face of weak institutional coordination, chronic under resourcing and rapid urbanization. This is aggravated by the ready availability of imported, non-biodegradable goods in the market and change in consumption patterns of the society.

While the consumption patterns and waste generation have increased over the years, the basic understanding, collection and management of waste has not changed in many parts of the country. A lot of people and municipalities still treat waste as a traditional problem and in un-engineered ways, while the quantity and quality of waste has changed in recent times (Allison, 2008). There are several key issues exacerbate the waste management crisis in Bhutan. First, improper disposal practices remain prevalent, with many areas relying on open dumping and inadequate collection services, leading to environmental pollution and health hazards. Additionally, there is a general lack of public awareness regarding sustainable waste management practices, which hinders community engagement and responsible disposal behaviors. Infrastructure deficiencies also pose significant challenges; the existing waste management infrastructure, including collection vehicles and processing facilities, is often inadequate to handle the volume and types of waste generated. Financial constraints further limit the implementation of innovative solutions such as recycling and composting facilities.

Over the years, waste management practices in the country have also progressed with involvement of the private sector and volunteers, especially for solid waste management. The Public Private Partnership (PPP) model promotes collaboration among various stakeholders—government agencies, private sector companies, Non-governmental Organization (NGOs), and local communities—creating a comprehensive approach to solid waste management that aligns with Bhutan's commitment to sustainable development. By engaging

private sector expertise and resources, Bhutan can implement innovative solutions tailored to local needs, such as recycling plants, composting initiatives, and waste-to-energy projects. These partnerships not only reduce landfill use but also contribute to economic growth by creating job opportunities within the community.

Moreover, the PPP model facilitates capacity building through training programs aimed at enhancing the skills of various stakeholders involved in waste management. This capacity-building effort is essential for improving operational efficiency and ensuring effective service delivery. Public awareness campaigns can also be implemented through partnerships with NGOs and private companies to raise awareness about sustainable practices, leading to better waste segregation at the source and increased community involvement.

In order to address the issue of waste, legislations and policies have been put in place which includes the following:

- Waste Prevention and Management (Amendment) Regulation, 2016
- Waste Prevention and Management Regulation, 2012
- National Integrated Solid Waste Management Strategy, 2014
- Waste Prevention and Management Act of Bhutan, 2009, National Environment Protection Act, 2007

Although legislations, acts, policies and rules seem to tb abundant, there are still gaps in actual implementation of these rules and regulations by the implementing agencies due to the limitation of resources and budget constraints.

To address these challenges comprehensively, the project will explore the potential for Public-Private Partnerships (PPPs) tailored to local contexts. This approach is crucial for enhancing stakeholder engagement, improving infrastructure, and fostering public awareness campaigns. By investigating feasible PPP models for waste management, the project aims to develop innovative solutions such as recycling initiatives, composting programs, and waste-to-energy projects. The overarching goal is to create a sustainable waste management system that not only addresses immediate issues but also contributes to long-term environmental sustainability and community well-being in Thimphu.

1.1 Background of the Project

The project aims to tackle several key challenges in waste management within Thimphu, including increasing waste generation driven by urbanization and population growth, improper disposal practices such as open dumping, and inadequate public awareness regarding sustainable waste management practices. The existing waste management infrastructure is often insufficient to handle the volume and types of waste produced, leading to operational inefficiencies and increased costs. Furthermore, financial constraints limit the implementation of innovative solutions like recycling and composting facilities. There is also notable capacity gaps among stakeholders involved in waste management, which necessitate targeted training and capacity-building efforts.

The overarching goal is to create a sustainable waste management system that not only addresses immediate issues but also contributes to long-term environmental sustainability and community well-being in Thimphu.

The specific objectives are as follows:

- **Assessment of Current Waste Management Practices:** Evaluate existing waste management systems in Thimphu and identify types and quantities of waste generated.
- **Exploration of Public-Private Partnerships (PPPs):** Assess the potential for managing waste through PPP models tailored to local contexts.

1.2 Acts, Rules and Regulations related to Waste Management in Bhutan

All the existing legal, regulatory, and organization framework for waste management (including the framework at the local, district and national levels were reviewed. The following sections present the features and purpose of each one of them.

1.2.1 Waste Prevention and Management Act, 2009

The Waste prevention and management Act, 2009 came into effect on 18th August 2009 and aims at preventing and reducing volumes of waste generation, and at promoting the reuse, recycle and management of waste in an environmentally sound manner. Waste includes solid, liquid, gaseous, hazardous and non-hazardous, organic or inorganic waste from all kinds of sources and also the materials being stored for recycling and the transportation, import and export of waste.

The purpose of this Act is to protect and sustain human health through protection of the environment by:

a) Reducing the generation of waste at source;
b) Promoting the segregation, reuse and recycling of wastes;
c) Disposal of waste in an environmentally sound manner; and
d) Effective functioning and coordination among implementing agencies.

The Act authorizes the National Environment Commission (NEC) as the regulatory authority for waste prevention and management. The NEC shall also be responsible for coordinating and overseeing the implementation of the Act.

The Act defines responsibilities of implementing agencies and of the public in managing different types of waste. It further provides for duties and responsibilities of implementing agencies and the different mechanisms used by them in managing waste including administrative, financial and research mechanisms. The Act further provides for funds to be financed by the Royal Government of Bhutan and details of offences and penalties to be imposed.

1.2.2 Waste Prevention and Management Regulation, 2012

"The Waste Prevention and Management Regulation, 2012" is a comprehensive regulation for the minimization and management of waste. It shall establish procedures to implement the

purpose of the Waste Prevention and Management Act, 2009; identify roles and areas of implementation of the Implementing Agencies for the purpose of establishing a sound waste management system including monitoring procedures at every organization level, through efficient collection, segregation, treatment, storage, transportation, reduction, reuse, recycling and safe disposal of solid, liquid and gaseous wastes; assign costs in proportion to the waste volume generated from the point source or by degree of their hazardousness by levying fees, charges and fines for non-compliance; and control and prohibit illegal dumping or release of waste into the environment.

National Environment Commission (NEC) is the apex monitoring body, which will coordinate and monitor the overall performance of Implementing Agencies (IA) designated to efficiently implement the provisions of this Regulation. The Royal Bhutan Police shall assist the IAs in achieving full compliance.

1.2.3 Waste Prevention and Management Amendment (Regulation) 2016

The amendment introduces a system of incentives for waste prevention and management on the principle that waste is an asset. It also encourages entrepreneurship in prevention, collection, segregation and recycling of waste.

With the experience in the implementation of Waste prevention and management Act, 2009 and the Regulations of 2012, a lot of amendment has been brought to this regulation.

1.2.4 National Environment Protection Act, 2007

This Act came into effect from 31st July 2007. It states that a person has the fundamental right to a safe and healthy environment with equal and corresponding duty to protect and promote the environmental wellbeing. The Act calls for the establishment of the National Environment Commission, which shall be an independent authority and the highest decision-making body on all matters relating to the environment and its management in Bhutan. Powers and functions of the Commission shall include: preventing environmental harm, including pollution, and protecting environmental quality; waste management; enforce and implement policies, plans, etc. For environmental protection; adopt regulations and rules including standards for environmental quality, emission limits and products; recommend declaring plant or animal species as endangered species and declare parts of the country to be national parks, wild life reserves,

protected forests, etc., establish regulatory controls over the import and use of genetically modified organisms; and designate ministries, organizations, agencies or committees to carry out its functions. The Commission further shall aim at reducing deforestation with clean energy and alternative technologies. The Act states that to promote environment-friendly technologies, codes of practice and eco-labelling, the government will provide financial incentives for environment protection and compliance. The Act also contains offences, penalties, and provisions of miscellaneous nature.

1.2.5 National Waste Management Strategy, 2019

The National Waste Management Strategy 2019, launched by Her Majesty the Gyaltsuen Jetsun Pema Wangchuck, outlines Bhutan's comprehensive approach to waste management, with a vision of achieving "Zero Waste Bhutan by 2030." This strategy emphasizes the prevention and minimization of waste generation, transitioning to a circular economy by reusing, recovering, and recycling materials.

It addresses the challenges of waste in urban areas, medical waste, e-waste, and wastewater, while highlighting barriers such as institutional inefficiencies, technical limitations, and financial constraints.

Key objectives include sustainable financing, capacity building, technological development, and behavioral change through education and awareness programs. The strategy integrates waste management with national and local planning frameworks, ensuring cross-sectoral coordination. It also introduces initiatives like waste banks, Extended Producer Responsibility (EPR), and the establishment of a National Waste Management Fund. Gender inclusivity, public participation, and environmental sustainability form the strategy's cornerstone, reflecting Bhutan’s Gross National Happiness principles. Monitoring and evaluation mechanisms are detailed to track progress, ensuring effective implementation and continual improvement.

2 Waste Management in Bhutan

Bhutan, a small Himalayan nation, had a population of approximately 789.9 thousand as of January 2024, reflecting a growth of 4,959 individuals (+0.6%) compared to the previous year. With a slightly uneven gender distribution, 52.8% of the population is male, while 47.2% is female. The country's population is spread across both urban and rural settings, with urban centers accounting for 44.6% of the population and rural areas making up the remaining 55.4%[1]. This demographic composition underscores Bhutan's strong connection to its rural and agrarian roots, even as urbanization gradually progresses. These trends provide important insights into the nation's evolving societal structure and highlight the unique challenges and opportunities in fostering sustainable development and waste management across both urban and rural landscapes.

Waste management, particularly in urban areas, has been a growing challenge for Bhutan due to increasing urbanization and population growth. Thimphu, Bhutan's capital and largest urban center, has experienced rapid development, accompanied by a significant rise in waste generation. Municipal waste management efforts in Thimphu began in 1994 with the establishment of a small office and the construction of a landfill at Memelakha. At the time, the landfill was designed to accommodate a capacity of 8 to 10 metric tonnes (MT) of waste daily, which was deemed sufficient for a population of approximately 15,000. However, with the city's rapid growth and a steady influx of people migrating from rural areas, the amount of waste generated in Thimphu has increased exponentially over the years.

Currently, Thimphu produces over 50 MT of waste every day, far exceeding the original capacity of the Memelakha landfill. This daily waste generation includes more than 30 MT of wet waste, such as organic materials, and approximately 20 MT of dry waste, including recyclables and other non-organic materials. Organic waste constitutes the largest share, making up about 59.2% of the total municipal waste in urban areas. The surge in waste generation has placed significant pressure on the city's waste management infrastructure, which is struggling to keep pace with the growing population and urban expansion. As of 2024, Thimphu's population has risen to

[1] https://datareportal.com/reports/digital-2024-bhutan

144,197, further compounding the waste management challenge (World Population Review, 2024)[2].

In Bhutan, the responsibility for waste management is divided between urban and rural areas. Urban waste is managed by municipal authorities, such as the Thimphu Thromde, which oversees collection, segregation, and disposal within city limits. In contrast, rural waste management falls under the jurisdiction of the Ministry of Health and the Dzongkhag (district) administrations. This division of responsibility underscores the need for a coordinated approach to tackle waste-related issues effectively across both urban and rural regions.

The situation in Thimphu reflects broader challenges faced by Bhutan as it navigates the pressures of urbanization and population growth. The outdated landfill infrastructure, limited recycling capacity, and increasing waste volumes highlight the urgent need for modernized waste management systems, including improved waste segregation, composting, recycling facilities, and public awareness campaigns. Without such interventions, the strain on Bhutan's waste management infrastructure is likely to worsen, posing risks to environmental sustainability and public health.

[2] https://worldpopulationreview.com/cities/bhutan/thimphu

2.1 Composition and Quantity of Waste in Bhutan

The National Waste Inventory Survey (NWIS), 2019 reveals that **Bhutan generates 172.16 MT of solid waste per day.** This significant volume underscores the pressing need for robust waste management strategies to safeguard the environment and public health.

Waste Sources	Total Weight	Percentages
Household	81500.50	47.34
Commercial Units	67299.70	39.09
Vegetable Markets	6168.50	3.58
Industries	5719.30	3.32
Institutes	5395.90	3.13
Government Offices	3097.19	1.83
Health Centres	2980.60	1.70
Total	172,161.09	100.00

Figure 1: Quantity of Waste Generated in Bhutan

In waste composition, nearly half of the total waste, or 46 percent, comprises of food waste. Plastic and paper wastes make up 33 percent of the total wastes. The remaining 21% comprises non-recyclable materials, requiring specialized handling and disposal solutions.

In terms of sectoral breakdown, Households are the primary contributors to Bhutan's waste, accounting for about half of the total, or roughly 81 metric tons daily. This household waste is predominantly composed of food waste (46%) and plastics and paper (33%). Urban households produce more waste per capita, at 0.7 kilograms per day, compared to 0.4 kilograms in rural areas. However, rural communities face considerable challenges, with only 15% having access to waste collection services, leaving 65% without such services. This disparity highlights the need for expanded waste collection services, particularly in rural areas.

Commercial establishments also play a significant role in waste generation, producing 67.3 metric tons daily. This waste is mainly comprised of food (35%), plastics (17.7%), and paper/cardboard (12.8%), with an average output of 5.03 kilograms per unit per day. Similar to

households, commercial waste is dominated by food and recyclable materials, emphasizing the potential for enhanced recycling and composting initiatives.

Educational institutions, such as schools and colleges, contribute 5.4 metric tons of waste daily, with food waste (38%), paper/cardboard (25%), and plastics (21%) being the main components. Industrial facilities generate 5.72 metric tons of waste daily, primarily consisting of paper/cardboard (40%), food waste (23%), and plastics (13.5%), excluding hazardous materials. Health centers produce 1.98 metric tons of general waste and an additional metric ton of medical waste daily, which requires specialized treatment and disposal. Vegetable vendors add 6.17 metric tons of waste daily, with food waste making up 70%, and smaller amounts of paper/cardboard (12.7%) and plastics (7%). These varied sources of waste necessitate tailored management strategies to address their unique generation patterns.

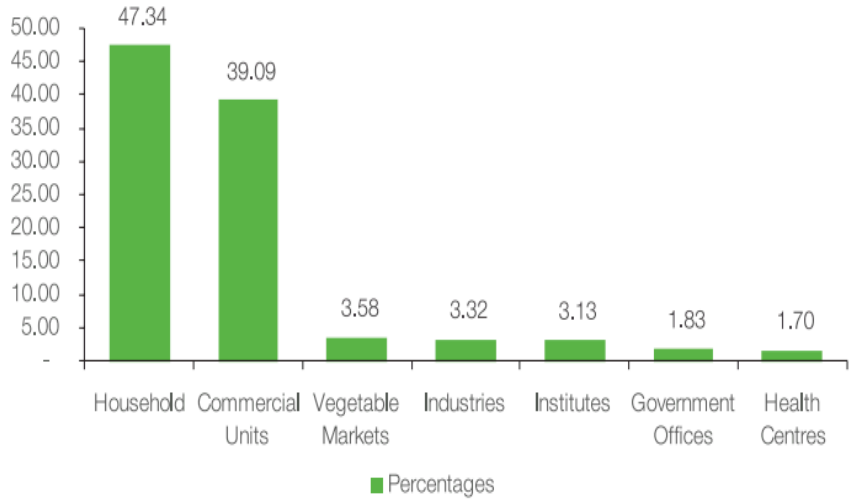


Figure 2: Proportion of Waste from Different Sectors

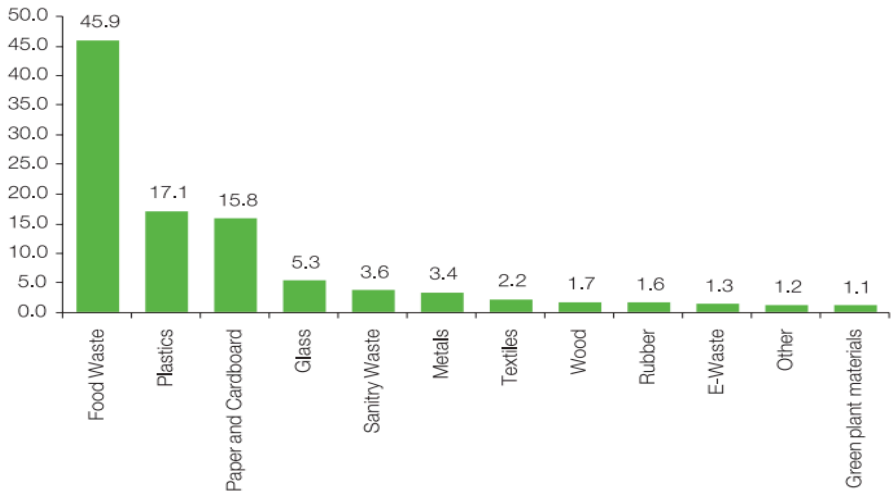


Figure 3: Composition of Waste

2.2 Issues of Waste Management in Bhutan

Waste management is an emerging challenge in Bhutan, driven by factors such as rapid urbanization, population growth, and changing consumption patterns. With waste generation steadily increasing, the country faces issues like inadequate infrastructure, improper disposal practices, and limited recycling and recovery efforts. Urban areas are particularly impacted, with rising municipal waste volumes and overburdened landfills. Additionally, rural regions struggle with limited access to waste collection services and persistent open dumping and burning. Addressing these issues is essential to protect Bhutan's environment, public health, and its commitment to sustainable development and Gross National Happiness.

Key Issues in Waste Management

- **Inadequate Infrastructure**
  - Limited capacity and infrastructure for waste segregation, recycling, and disposal hinder effective waste management.
  - More than 60% of households lack access to waste collection services, with only 15% of rural households having access compared to 75% of urban households.
- **Improper Disposal and Segregation Practices**
  - Illegal dumping and littering remain persistent issues. Despite some initiatives, waste segregation at the source remains a major issue. Only 88.5% of urban households and 78.4% of rural households segregate their waste, and the level of segregation varies widely.

- Improper disposal, including open burning and dumping in rural areas, is still prevalent, leading to significant environmental hazards, including leachate contamination of soil and water and air pollution.
- Many areas in Bhutan lack adequate waste segregation at the source, resulting in mixed waste being sent to landfills.
- Most wastes in rural areas are dumped in open fields or burnt, and landfills in urban areas are overflowing due to minimal waste treatment, recovery, and recycling practices.

- **Rapid Urbanization and Population Growth**
  - Urbanization and changing consumption patterns are driving higher levels of waste generation.
  - Increased rural-to-urban migration is leading to a sharp rise in municipal solid waste (MSW) generation.
  - Municipal waste in Bhutan averages 0.253 kg/capita/day, and this is expected to increase significantly as urbanization grows.
- **Plastic and Packaging Waste**: Single-use plastics and packaged goods contribute significantly to the waste burden despite Bhutan's long-standing ban on plastic bags.
- **Rising Waste Generation:** Bhutan generates about 172 metric tonnes (MT) of solid waste daily, with urban households contributing significantly (0.7 kg per person per day, compared to 0.4 kg in rural areas) . Rapid urbanization is expected to increase this volume, posing significant challenges.
- **Overburdened Landfills:** Landfills, such as Thimphu's Memelakha site, are nearing capacity. For example, Thimphu's waste disposal increased by 4,800 MT between 2019 and 2021.
- **Lack of Infrastructure and Public Engagement:**
  - Waste segregation and recycling facilities remain underdeveloped. Improper timing and placement of collection points lead to low utilization of collection services.
  - More than 60% of households lack access to waste collection services, particularly in rural areas where only 15% have access to such services.
  - The lack of modern waste management solutions in rural and sub-urban areas exacerbates the problem.
- **Environmental and Health Impacts:**

- Improper waste disposal leads to pollution, contamination of water sources, and risks to both wildlife and human health. This threatens Bhutan's environmental image and its commitment to Gross National Happiness.
- Open dumping and burning remain common practices in many regions.
- Open and unsanitary landfills can contaminate drinking water, cause infections, and transmit diseases. Debris dispersal pollutes ecosystems, and hazardous substances from electronic and industrial waste harm urban dwellers and the environment.

- **Community Challenges**
  - Awareness and engagement among residents vary. Many residents are knowledgeable about waste management but lack consistent practices.
  - Inadequate education on waste segregation and recycling.
- **Recycling and Recovery**
  - Limited recycling operations exist, such as PET bottle crushing and paper recycling.
  - Organic waste recovery through composting is underutilized despite its potential.
- **Limited Governmental and Institutional Support**
  - There is a lack of skilled personnel, financial resources, reliable data, and systematic approaches to integrated solid waste management.

3 Waste Management in Thimphu

Thimphu, the capital city of Bhutan, faces significant challenges in waste management due to its rapid urbanization and population growth. The Thimphu Thromde produces over 50 metric tonnes (MT) of waste daily, which includes more than 30 MT of wet waste and approximately 20 MT of dry waste. This substantial volume of waste necessitates an efficient and effective waste management system to mitigate environmental impacts and promote public health. To manage this waste, the city employs a fleet of around 30 waste collection trucks that transport the waste to the Memelakha Landfill each day. This landfill was initially designed to handle a much smaller volume of waste, and it has long since exceeded its capacity. As a result, the landfill is now facing numerous environmental and public health challenges, including overflow, leachate contamination, methane emissions, and air pollution from open burning practices.

3.1 Waste Composition and Quantity of Waste in Thimphu

The composition of waste generated in Thimphu underscores the importance of implementing robust waste segregation practices. Wet waste primarily consists of organic materials, while dry waste includes plastics, metals, paper, and other non-biodegradable items (Table 1). Effective segregation at the source is crucial for enhancing recycling efforts and reducing the burden on landfills. However, public awareness regarding proper waste segregation remains insufficient, leading to contamination of recyclable materials and improper disposal practices.

In response to these challenges, Thimphu Thromde has initiated several measures aimed at improving waste management. These include the establishment of drop-off centers for segregated waste disposal and the promotion of community engagement in recycling efforts. Additionally, the Bhutan Waste Bank initiative incentivizes residents to participate in proper waste disposal by offering monetary rewards for bringing recyclables to designated centers.

Despite these efforts, ongoing issues such as inadequate infrastructure, logistical challenges in waste collection, and limited funding for improvements continue to hinder effective waste management in Thimphu. Addressing these obstacles is essential for creating a sustainable waste management system that not only protects the environment but also enhances the quality of life for residents.

Table 1: Waste Composition and Quantity of Thimphu

Waste Category	Waste Composition	Quantity (kg/daily)	kg/Monthly	kg/Yearly
Food waste	59.20%	29,600	888,000	10,6560,00
Paper and Cardboard	15.10%	7550	226500	2,718,000
Plastics	9.30%	4650	139500	1674000
Glass	4.50%	2250	67500	810000
Sanitary Waste	5.70%	2850	85500	1026000
Metals	1.40%	700	21000	252000
Textiles	1.80%	900	27000	324000
Rubber	0.90%	450	13500	162000
E-waste	0.80%	400	12000	144000
Other	1.20%	600	18000	216000

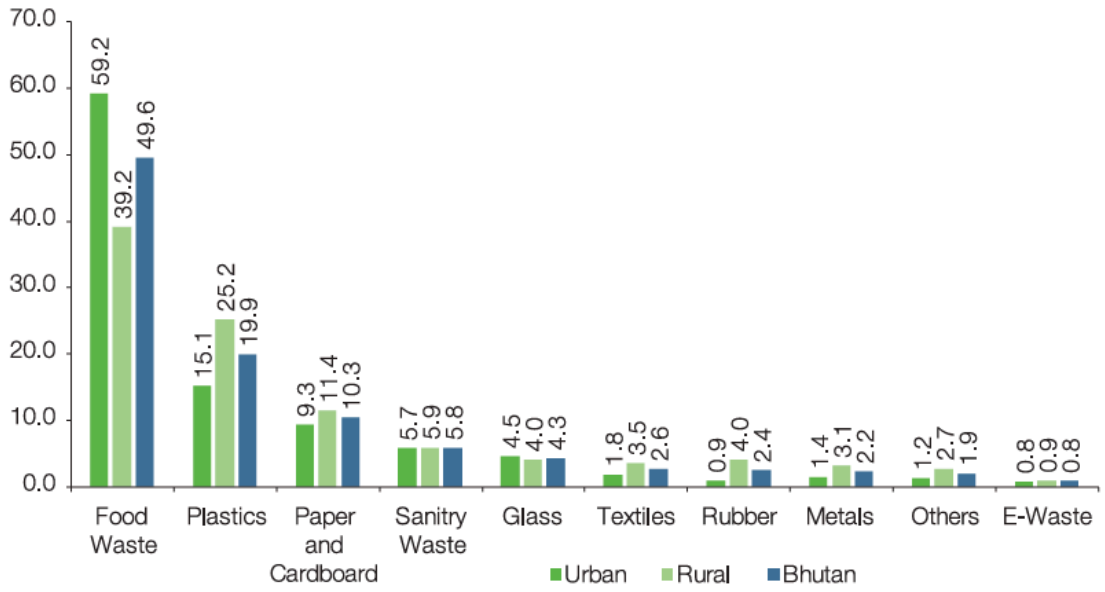


Figure 4: Composition of Household Waste in Percentage

3.2 Waste Collection System in Thimphu

Thimphu Thromde has three primary waste collection network that covers different zones: Greener Way serves the northern and core zones. Similarly, Green Bhutan Services operates in the southern zone. Waste collection is conducted according to established schedules to ensure

timely disposal[3]. Dry waste is collected 2 times a week, especially for the core zone wastes, which are collected 3 times a week. Furthermore, for the wet waste it is collected 2 times a week.

Figure 5: Waste Collection System

The northern zone encompasses areas such as Dechencholing, Taba, Langjophaka, Samtenling, Hejo, Jungzhina, Bebena, Zilukha, Kawangjangsa, and Tashichho Dzong. Greener Way provides waste collection services in this region under the organization of the Thimphu Thromde Environment Division.

The core zone includes Motithang, Changangkha, NPPF Colony, Changedaphu, Changzamtok, Changbangdu, the Hospital, and Royal Bhutan Police Camp areas, as well as Norzin Lam and Chang Lam. Greener Way also manages waste collection services in these areas.

In the southern zone of Thimphu, which covers Babesa Lam, Tshalu Lam, Bapi Lam, Babesa Community Police, Bhutan Kitchen, Babesa BOB Branch, Karma One Stop Shop up to Dr. Tobgay School Area, Green Bhutan Services is responsible for waste collection.

3.3 Waste Segregation Facilities in Thimphu

Waste segregation facilities in Thimphu are essential components of the city's waste management strategy, aimed at promoting sustainable practices and reducing the volume of waste sent to landfills. These facilities are designed to encourage residents to separate their waste into different

[3] http://thimphucity.bt/waste-collection-services

categories—organic, recyclable, and hazardous materials—thereby facilitating more effective recycling and composting processes.

The waste segregation facilities include a network of drop-off centers strategically located throughout Thimphu. These centers serve as convenient points for residents to dispose of their segregated waste, particularly for those who may not be able to align with regular waste collection schedules. Each drop-off center is equipped with separate compartments for various types of waste, allowing citizens to easily deposit their materials in the appropriate sections. Currently, there is one operational Material Recovery Facility (MRF) at Ngabirongchhu, South Thimphu, and one MRF at Taba of 40 TPD capacity which is under construction.

Figure 6: Material Recovery Facilities

3.3.1 Waste Drop-Off Centers

The drop-off centers established throughout Thimphu serve as temporary storage facilities where residents can deposit segregated waste into designated compartments for wet, dry, and hazardous materials. These centers offer a practical solution for individuals who may not be able to coordinate with scheduled waste collection services. When utilizing these drop-off centers, it is imperative that citizens properly segregate their waste before disposal. By adhering to these guidelines and utilizing the facilities effectively, residents can contribute significantly to improving the overall waste management system in Thimphu, ultimately leading to a more sustainable urban environment[4]. The 9 drop-off centers are located at the given locations below:

Table 2: Drop-off Center

North	**1.** Dangrina
	2. Pamtsho
	3. Bebena
Core	4. Motithang
	5. Changbangdu
	6. Changzamtok
South	7. Tshalu Maphay
	8. Changjalu
	9. Chubogang

[4] http://thimphucity.bt/waste-drop-centers

3.3.2 Bhutan Waste Bank

The Bhutan Waste Bank is an innovative initiative aimed at addressing the waste challenges faced by Thimphu by incentivizing waste collectors by a private firm called Greener Way Private Ltd. The concept is straightforward: individuals can drop off their solid waste at the nearest drop-off center and receive credits for the materials they bring, or they can open a savings account with the bank. The bank offers monetary rewards for various types of waste, providing Nu 100 for each kilogram of aluminum, Nu 25 for a kilogram of PET bottles, Nu 20 for a kilogram of plastic waste, Nu 10 for a kilogram of rubber waste, Nu 7 for a kilogram of paper and cardboard, Nu 3 for each beer bottle, and Nu 1 for other types of bottles[5].

This initiative redefines waste as a recoverable resource, fostering a behavioral change in the community regarding waste management. Additionally, the Bhutan Waste Bank aims to promote sustainable waste practices to mitigate plastic pollution in water bodies while also creating job opportunities for women and youth. By encouraging participation in this program, the initiative not only helps reduce the environmental impact of waste but also supports economic empowerment within the community.

[5] https://kuenselonline.com/greener-way-to-pioneer-circular-economy-with-waste-bank/

SL. No.	Category	Price Per Unit	Drop of Center
1.	Aluminum Can	Nu.1.5/PCS	All
2.	Aluminum Scrap	Nu.100/KG	All
3.	Any Glass Bottle	Nu.1/KG	All
4.	AWP	Nu.1/PCS	All
5.	Beer Bottle	Nu.2.5/PCS	All
6.	Brass/Pital	Nu.300/KG	Greener Way Head Office
7.	Copper/Tama (Mixed)	Nu.250/KG	Greener Way Head Office
8.	Copper/Tama (Pure)	Nu.450/KG	Greener Way Head Office
9.	Egg Tray	Nu.3/KG	All
10.	HDPE	Nu.20/KG	All
11.	Metal	Nu.26/KG	All
12.	Mineral Water Plastic	Nu.5/KG	All
13.	Mixed Plastic	Nu.1/KG	All
14.	Paper/Cardboard	Nu.7/KG	All
15.	Pet Bottles	Nu.25/KG	All
16.	Plastic Waste	Nu.20/KG	All
17.	Rubber Related	Nu.10/KG	All
18.	Steel	Nu.28/KG	All
19.	Tin	Nu.15/KG	All

Figure 7: Monetary Incentives

3.3.3 Issues Regarding the Waste Drop-Off Centers in Thimphu

The waste management system in Thimphu, Bhutan's capital, faces several challenges, particularly concerning the waste drop-off centers established to facilitate proper waste disposal and recycling. These centers are intended to provide residents with accessible options for disposing of various types of waste, including organic, recyclable, and hazardous materials. However, several issues have been identified that hinder the effectiveness of these facilities[6].

One of the primary challenges is insufficient public awareness and education regarding the proper use of waste drop-off centers. According to the chief environment officer of Thimphu Thromde, a significant issue is that many residents remain unaware of the importance of waste segregation. This lack of knowledge hampers effective management and recycling efforts, leading to contamination of recyclable materials and improper disposal practices that undermine the objectives of the waste management program.

Additionally, the infrastructure and capacity of the waste drop-off centers may not be adequate to handle the volume of waste generated by a growing urban population. As Thimphu continues to expand, the demand for effective waste management solutions increases. The existing centers

[6] http://www.bbs.bt/waste-drop-off-centre-to-be-upgraded/

may struggle to accommodate this demand, resulting in overflow and unsightly littering around the facilities.

Another significant issue is logistical challenges related to transportation and collection services. Timely collection of waste from these drop-off centers is crucial for maintaining cleanliness and preventing environmental hazards. Delays or inefficiencies in collection can lead to accumulated waste, attracting pests and posing health risks to the community.

Furthermore, there are concerns regarding funding and resource allocation for maintaining and improving waste management infrastructure. Without adequate financial support, it becomes difficult to enhance facilities, implement educational programs, or expand services to meet community needs effectively.

Lastly, environmental impacts associated with improper waste disposal practices remain a pressing concern. The accumulation of waste in inappropriate locations can lead to soil and water contamination, negatively affecting local ecosystems and public health[7].

In conclusion, while the establishment of waste drop-off centers in Thimphu represents a positive step toward improving waste management, addressing these challenges is essential for their success. Increased public awareness campaigns, improved infrastructure, efficient logistical operations, adequate funding, and a focus on environmental protection will be critical in overcoming these issues and achieving a sustainable waste management system in Bhutan's capital.

[7] https://www.bbs.bt/thimphu-thromde-to-establish-additional-waste-drop-off-centres-and-increase-waste-fees/

3.4 Memelakha Landfill: Environmental and Public Health Impacts

Municipal waste management was first initiated in Thimphu in 1994 with the establishment of a small office and a landfill site at Memelakha. Initially designed to manage 8 to 10 metric tons of waste when the population was around 15,000, the landfill has since been overwhelmed by rapid urbanization and a significant influx of people from rural areas. Consequently, it has long exceeded its lifespan, leading to several serious environmental and public health concerns.

3.4.1 Environmental Impact

1. **Landfill Overflow:** The Memelakha Landfill has exceeded its designed capacity for years, resulting in overflowing waste and uncontrolled dumping around the site. This situation creates unsightly conditions and poses serious environmental hazards as waste spills into surrounding areas[8].
2. **Leachate Contamination:** As waste decomposes within the landfill, it produces leachate—a toxic liquid that can seep into the ground and contaminate local groundwater and soil. This contamination poses significant risks to the environment, potentially affecting agricultural productivity and local ecosystems[9].
3. **Methane Emissions:** The landfill is a major source of methane emissions, a potent greenhouse gas that significantly contributes to climate change. The anaerobic

[8] https://www.bbs.bt/filled-up-memelakha-still-used-for-garbage-disposal/

[9] https://kuenselonline.com/managing-toxic-landfill-leachates-in-dumpsites-across-bhutan/

decomposition of organic waste generates methane which exacerbates global warming if not effectively captured or managed.

4. **Air Pollution:** Open burning of waste at the landfill is a common practice that releases harmful pollutants into the air. This contributes to air quality degradation and poses health risks to nearby communities due to exposure to toxic fumes and particulate matter.

3.4.2 Public Health Risks

1. **Disease Outbreaks:** The unsanitary conditions at the Memelakha Landfill create breeding grounds for disease-carrying pests such as rats and mosquitoes. These pests can transmit diseases to nearby populations, increasing the risk of outbreaks and public health emergencies[10].

2. **Respiratory Problems:** Residents living near the landfill are at risk of developing respiratory illnesses due to exposure to air pollution and hazardous chemicals released from decomposing waste. Prolonged exposure can lead to chronic health issues, particularly among vulnerable populations such as children and the elderly.

3. **Water Contamination:** The leachate produced by the landfill can infiltrate drinking water sources, posing serious health risks to communities reliant on groundwater for their water supply. Contaminated water can lead to gastrointestinal diseases and other health complications.

3.5 Waste Management Interventions in Thimphu

Waste management has become an increasingly pressing issue in Thimphu, Bhutan's capital, largely due to the rapid population growth and urbanization. As the volume of waste generated continues to rise, both residents and the government must implement effective waste management practices to foster sustainable and livable urban environments. To address these challenges, Thimphu Thromde has initiated several strategies aimed at reducing the amount of waste that ends up in landfills[11]. These initiatives include:

[10] https://thebhutanese.bt/precautionary-measures-needed-to-minimize-risk-at-memelakha-landfill/

[11] http://thimphucity.bt/services/municipal-solid-waste-management

1. **Construction of a Sanitary Landfill:** This facility is designed to manage waste in an environmentally safe manner, minimizing the negative impacts associated with traditional dumping practices.
2. **Encouragement of Waste Segregation and Composting:** Residents are urged to separate their waste into different categories, such as organic, recyclable, and non-recyclable materials. Composting organic waste not only reduces landfill contributions but also creates valuable fertilizer for gardens and farms.
3. **Use of Drop-Off Centers:** These centers provide convenient locations for residents to dispose of segregated waste at their convenience, especially for those who may not align with regular waste collection schedules.
4. **Increased Recycling and Reusing:** The Thromde promotes recycling initiatives to encourage residents to repurpose materials rather than discard them, thereby reducing overall waste generation.

While Thimphu Thromde is responsible for managing waste within the city, it has outsourced waste collection services to two private organizations operating in distinct zones. Greener Way operates in the northern and core zones, and Green Bhutan Services serves the southern zone. This division of labor aims to enhance efficiency and ensure all areas receive adequate waste management services. However, Thimphu Thromde cannot achieve effective waste management alone; public participation is equally essential. Citizens must take responsibility for the waste they generate and actively engage in the principles of the 3Rs (Reuse, Reduce, Recycle) to promote a cleaner and healthier environment in Thimphu[12].

4 Private Sector Involvement in Waste Management

Waste collection and management has been a municipal and government responsibility for a long time in Bhutan. As of 2024, ten private entities in Bhutan work on waste management. Private companies involved in waste management are as below;

[12] http://thimphucity.bt/services/municipal-solid-waste-management

[11] http://thimphucity.bt/services/municipal-solid-waste-management

1. Eco-Waste Solution
2. Green Bhutan Waste Management
3. Greener Way
4. Evergreen Bhutan
5. Green Waste
6. Druk Waste Management
7. The Green Road
8. Green Bhutan Services
9. SHE - Cycle
10. Clean and Green

4.1 Eco-Waste Solution firm

It is an innovative social organization with integrated approach on waste management operating in Punakha and Wangdue Dzongkhags. They follow the zero-waste strategy; reduce, reuse, recycle and recover hierarchy. The firm segregates waste at source and is able to recycle 20% of their wastes. Over the years, Eco-Waste Solution has been collecting waste from landfills, through municipality and scrap dealers. They have been getting support from Dzongkhag Administration in terms of land allocation, moral support and managing of waste wherever necessary. They have recently conducted a survey on the waste's generation composition of households for four seasons and quantified the waste depending on the household size and the pay scale of each household. Mr. Dhan Kumar the CEO of Eco-Waste Solution expressed the need for capacity building of the private waste management entities since they directly deal with wastes. Most often, they are not given opportunity to participate in such trainings and only the policy makers and government officials get the opportunity. He also expressed the hardships the private companies face in managing wastes due to lack of resources and budget.

Figure 8: **Community in Action:** Residents unite to tackle waste management challenges, collaborating with Eco Waste Solution to ensure proper segregation and transport of recyclables.

4.2 Green Bhutan Waste Management (GBWM)

Green Bhutan Waste Management was established in 2016 by Chogyal Lhamo to address the increasing waste management challenges in Bumthang, a region renowned for its cultural heritage and tourism appeal. The initiative was launched in response to the substantial waste generated, particularly due to the influx of tourists. The company efficiently collects waste from all four gewogs—Chokor, Chhumey, Tang, and Ura—reporting an impressive collection rate of approximately two truckloads of waste weekly.

A key aspect of Green Bhutan's operations is its emphasis on community engagement, encouraging residents to actively participate in waste segregation practices, which fosters a culture of cleanliness and environmental responsibility. Currently, the company employs five permanent staff members and six temporary workers, many of whom are graduates from Sherubtse College, thereby contributing to local employment.

Among its notable achievements, Chogyal Lhamo received the prestigious SAARC Woman Entrepreneur Award in March 2019, recognizing her significant contributions to entrepreneurship and sustainable practices in Bhutan. The company has plans to establish a recycling unit in Garpang and a composting facility for processing biodegradable waste, aimed at reducing landfill dependency and producing natural fertilizers for local farmers. Furthermore, Green

Bhutan collaborates closely with local authorities to enhance waste management strategies and has ambitions to expand its operations by taking over the entire municipal waste collection process in Bumthang. This comprehensive approach not only improves waste management efficiency but also reinforces the company's commitment to environmental sustainability within the community.

Figure 9: Empowering vulnerable women through home-based waste recycling skills for livelihood and waste management (March 8, 2023)

4.3 Greener Way

Greener Way is Bhutan's pioneering private integrated waste management company, founded on March 8, 2010, in Thimphu by Karma Yonten, who is often referred to as the "Trash Man." The company began as a simple scrap waste dealer and has since evolved into a comprehensive waste management service provider. In 2012, with support from Thimphu Thromde, Greener Way transitioned into a municipal waste collection company, marking a significant step in its development. Over the years, Greener Way has implemented various initiatives aimed at reducing reliance on landfills and promoting sustainable waste practices. In 2018, the company launched a material recovery facility as part of its waste flagship program, which enabled it to process recyclable materials more efficiently. This was followed by the production of eco-poles in 2019 and delineators in 2023, showcasing Greener Way's commitment to innovative recycling solutions.

A significant milestone for the company is the introduction of the Bhutan Waste Bank (BWB) project, launched on April 18, 2024, with funding support of USD 1.5 million from the World

Bank. The BWB initiative aims to incentivize residents to segregate their waste by offering cash rewards for recyclable materials. Residents can drop off their segregated waste at designated centers and receive payments based on the type and weight of the materials they bring. For example, individuals can earn Nu 25 per kilogram for Polyethylene Terephthalate (PET) plastics and Nu 20 for Low-Density Polyethylene (LDPE) plastics. This project not only addresses the pressing issue of plastic waste in Thimphu but also encourages behavioral change among residents regarding waste disposal.

Greener Way's efforts are aligned with Bhutan's broader goals of achieving zero-waste status by 2030 and reinforcing its commitment to carbon neutrality. The company has established partnerships with various stakeholders, including government agencies and non-profit organizations, to enhance its waste management initiatives. As of now, Greener Way provides waste collection services to approximately 50% of Thimphu city and has plans to expand its operations to other major towns in Bhutan.

Through its innovative approaches and community engagement strategies, Greener Way is playing a crucial role in promoting sustainable waste management practices in Bhutan while fostering a circular economy that values recyclables as recoverable resources.

Figure 10: Greener Way's Transfer Station and Waste Segregation facility is first of its kind in Bhutan and quite impressive

4.4 Evergreen Bhutan

It is a firm established at Doksum, a small town of Trashiyangtse Dzongkhag. They rightly entitle themselves as a Resources Management company, rather than a waste management company as they believe "*Something which is generally called as waste has its new value in recycling markets, so there is nothing called waste in our world."* Currently, they work on waste in two different ways;

a. Buy recyclable materials from local people, who segregate their waste at source, such as plastic pet bottles, HDPE plastics (jar, broken toys, juice container, etc.), cardboards, papers and beer bottles. Those who segregate waste at source are always one-step ahead than those who do not care. Their means of segregating waste helps them earn extra income. Segregation of wastes are mostly done by farmers in the villages and by old people in the towns who do not have an income source. They buy recyclable wastes from Yangtse town, schools and from villages under eight Gewogs of Trashiyangtse.
b. Evergreen Bhutan also started waste collection service in Doksum town. The Dzongkhag Administration and Municipal Office outsourced the waste collection service to Evergreen Bhutan. Dzongkhag Administration pays Nu 7,500/- as service charge to Evergreen Bhutan for collecting waste from Doksum town and then to dispose of in the landfill. Evergreen Bhutan, segregates waste in the process and recovers about 40% to 50% from total collection made each week. There is one collection trip in a week in Doksum (four times a month).

   The waste from Dokum is taken to the landfill, staffs then segregate and recover every recyclable material available and then dispose the unwanted wastes. The recovered materials are then taken to the recovery center and further segregations are done to categorize materials into different types. Different recyclables materials possess different market rates where some such as recovered copper wire earn about Nu 380/- per KG. Different recyclable materials are kept in store until the materials reach to expected mass and then transported in India for recycling, earning income in return.

Figure 11: Founder of Evergreen Bhutan – A private waste entity organizing a cleaning and awareness campaign

4.5 Green Waste Company in Gelephu

Gelephu Gewog, with a population of approximately 5,000 residents, is currently facing significant waste management challenges, generating around 8.8 tons of waste daily. This situation is further complicated by the existing landfill at Bhur, located 11 kilometers from Gelephu town, which has a designed capacity of only 3 tons per day. Given the current waste generation rates, this landfill is expected to reach its capacity sooner than anticipated, raising urgent concerns regarding effective waste management in the area.

In response to these challenges, the Sarpang district administration introduced a garbage collection vehicle in June 2023 to enhance waste collection services within Gelephu Gewog. This vehicle is scheduled to collect waste every Thursday, encouraging residents to bring their refuse to designated collection points. The initiative aims to reduce the volume of waste dumped in open areas while improving overall sanitation in the community. Feedback from residents has been positive, with many expressing optimisms that this new service will facilitate proper waste disposal and contribute to a cleaner environment.

To further address waste management issues, local authorities are developing plans for improved waste segregation and composting initiatives, particularly focusing on the effective management of organic waste. However, there remains a pressing need for enhanced infrastructure to support

these efforts adequately. Ongoing discussions are centered around establishing an integrated landfill site in Gakiling Gewog, approximately 21 kilometers from Gelephu town. This proposed site would incorporate facilities for waste segregation, recycling, and composting, which are essential components of sustainable waste management.

Despite these positive developments, significant challenges persist. Improper disposal practices continue to be prevalent due to inadequate facilities, with some residents resorting to dumping waste in open areas or burning it, thereby contributing to pollution and environmental degradation. Additionally, there is a critical need for public education campaigns aimed at promoting proper waste disposal habits among residents, particularly concerning organic waste management. Effectively addressing these issues will be vital for enhancing sanitation and environmental conditions in Gelephu Gewog in the future.

Figure 12: Gelephu Gewog Residents Set to Benefit from New Garbage Collection Vehicle, Addressing Growing Waste Issues and Promoting Cleanliness in the Community

4.6 Druk Waste Management

Druk Waste Management (DWM) is a private enterprise in the waste management landscape of Paro, Bhutan, founded by Ugyen Dorji in 2010. Recognizing the urgent need for effective waste disposal solutions in the region, Ugyen Dorji established DWM with a vision to create a cleaner and more sustainable environment for local communities. The initiative arose from the growing

challenges of waste management in Paro, particularly as urbanization and population growth increased the volume of waste generated.

DWM's mission is to provide comprehensive waste management services that not only focus on collection but also promote environmental sustainability and public health. The organization offers regular waste collection services to both residential and commercial establishments, ensuring that waste is disposed of properly and efficiently. DWM operates a fleet of vehicles that navigate various neighborhoods, collecting waste on a scheduled basis to minimize littering and illegal dumping. In addition to collection services, DWM places a strong emphasis on community education and engagement. The organization conducts awareness campaigns to inform residents about the importance of responsible waste disposal, recycling, and composting. By fostering a culture of environmental stewardship, DWM aims to empower residents to take an active role in managing their waste and reducing their environmental footprint.

Collaboration is a cornerstone of DWM's approach, as it works closely with local government authorities, including the Dzongkhag administration and gewog offices, to align its efforts with broader municipal waste management strategies. This partnership is essential for addressing the complexities of waste management in Paro, where varying levels of infrastructure and resources can impact service delivery. Despite its successes, DWM faces several challenges. One significant issue is the fluctuating volume of waste generated by commercial establishments, which can strain resources and complicate collection schedules. Additionally, there are ongoing community perceptions regarding waste management workers that can affect morale and service effectiveness. DWM actively works to address these challenges through training programs for its staff and by enhancing communication with the community.

Figure 13: Druk Waste Management commitment to maintaining Dongkola's beauty through weekly cleanups

4.7 The Green Road

Green Road was established in 2014 with the aim of utilizing waste plastic in the construction of durable and environmentally friendly roads. The initiative focuses on recycling plastic waste to create a sustainable solution for road construction, thereby addressing both waste management issues and infrastructure needs in Bhutan. Under Rikesh Gurung's leadership, Green Road has successfully paved approximately 130 kilometers of roads using over 700 metric tonnes of recycled plastic, significantly contributing to environmental conservation efforts in the country.

Key Initiatives and Achievements

- **Plastic Waste Utilization:** Green Road has successfully implemented a method of blacktopping roads using plastic waste, significantly contributing to waste reduction

efforts. The organization collaborates with schools in Thimphu to collect plastic waste, purchasing eco-bricks made from tightly packed plastic bottles for Nu 10 per kilogram. This initiative not only helps manage plastic waste but also engages the community, particularly students, in environmental stewardship.

- Road Construction: Since its inception, Green Road has paved roads in over four districts of Bhutan, utilizing more than 520 metric tonnes of plastic waste to construct approximately 80 kilometers of roads. This approach has proven effective in enhancing road durability while recycling non-recyclable plastics. Notably, the company has paved significant routes, including the road leading to the Buddha Dordenma statue in Thimphu.
- Health and Safety Improvements: Initially, the team collected plastic waste from landfills, which posed health risks to workers. Recognizing these dangers, Green Road shifted its strategy to combat plastic waste at its source by collaborating with local schools and communities. This proactive approach allows for safer collection practices while fostering community involvement.

- Environmental Impact: The project aims to reduce reliance on imported bitumen by up to 40% and decrease the volume of plastic waste sent to landfills by 30-40%. By integrating used plastic bottles and other waste plastics into road construction, Green Road contributes to a circular economy while addressing Bhutan's growing plastic pollution problem.

Figure 14: Bhutan’s first plastic road, built by Green Road in 2015, is a 150-meter stretch using 555 kg of waste plastics. Completed on October 5th, this durable road has required no repairs, showcasing a sustainable solution to plastic waste and innovative construction.

4.8 Green Bhutan Services

Green Bhutan Services was established in 2017 and operates primarily in the southern zone of Thimphu, providing essential waste management services to the local community. As a key waste collection service provider for Thimphu Thromde, the company plays a crucial role in effectively managing municipal solid waste, ensuring that the area remains clean and environmentally sustainable. The company focuses on several initiatives aimed at promoting sustainable waste management practices. One of its primary efforts is encouraging residents to segregate waste at the source. This practice is vital for effective recycling and composting, significantly reducing the amount of waste sent to landfills. To further support this initiative, Green Bhutan Services organizes community workshops that educate residents about composting techniques and sustainable waste management practices, fostering a culture of environmental responsibility within the community.

In addition to its educational initiatives, Green Bhutan Services collaborates closely with local government authorities to enhance municipal solid waste management systems. This partnership ensures efficient service delivery and raises community awareness regarding responsible waste disposal practices. The company also engages in public awareness campaigns designed to inform residents about proper waste disposal methods and the importance of recycling, contributing to a cleaner urban environment. Green Bhutan Services provides comprehensive waste collection services, including both dry and wet waste, according to a revised schedule that facilitates efficient disposal. The company prioritizes customer support by offering a dedicated hotline, allowing residents to easily report issues or request services.

Figure 15: Team of Green Bhutan Services and their commitment to efficient waste management ensures a healthier environment for all.

4.9 SHE – Cycle

The SHE-Cycle initiative in Bhutan is a transformative program aimed at empowering women through sustainable waste management and recycling practices. Supported by the Bhutan Trust Fund for Environmental Conservation, SHE-Cycle focuses on training women to become effective waste recyclers, equipping them with essential skills and knowledge to manage waste within their communities, specifically Chukha, Samtse, and Sarpang. This initiative addresses critical environmental challenges while promoting gender equality and economic empowerment. By actively involving women in waste management, SHE-Cycle fosters community responsibility and enhances awareness of the environmental impacts of waste. Participants are educated on the significance of recycling, sustainable practices, and the broader implications of waste management for public health and environmental conservation. SHE-Cycle has successfully implemented various strategies to engage women in recycling activities, creating a

supportive network that encourages collaboration and innovation. The initiative not only contributes to improved waste management in Bhutan but also uplifts women's roles in society, showcasing their capacity to drive change in their communities.

Figure 16: Women-Led Initiatives for Sustainable Waste Management supported by BTFEC on 15 May, 2024

4.10 Clean and Green

Clean and Green is a waste management company founded by Dawa Penjor in July 2023, aimed at addressing the waste disposal challenges faced by rural communities in Paro, Bhutan. The initiative was born out of Dawa's personal experiences with inadequate waste collection services in his village, prompting him to take action after his requests for municipal support were declined. The company operates two trucks that service eight gewogs, focusing on areas with

road connectivity. Clean and Green collects waste weekly from these villages and transports it to the landfill in Shaba Gewog. The pricing model for Clean and Green is designed to be affordable for residents, with households paying Nu 100 per month and shopkeepers Nu 150. This fee structure has been positively received, as it alleviates the burden of waste storage and disposal for many residents who previously resorted to burning or dumping waste in forests. Dawa Penjor has noted a significant change in community behavior, with reduced littering and improved cleanliness observed since the company's inception. In addition to regular waste collection, Clean and Green plans to expand its services by purchasing recyclable and reusable materials from villagers, further promoting sustainability and responsible waste management practices. The company has received support from local authorities, including permissions from the District Office and gewog offices, which underscores its legitimacy and importance within the community. Overall, Clean and Green represents a proactive approach to waste management in rural Paro, significantly enhancing environmental conditions and community engagement in sustainable practices.

Figure 17: Empowering Change: Clean and Green is Leading the Charge in Sustainable Waste Management in Paro, Helping Villagers Transition from Dumping to Responsible Disposal

4.11 Issues and Challenges Faced by The Private Entities Working in The Waste Sector

- Financial burden on waste management companies is a key challenge. There are substantial investments for private entrepreneurs to set up a waste management and Service Company, the work is also very hard and dirty and the income is not guaranteed, nor massive. Many have taken land on lease and bank loans. The private waste managing companies were set up because of their interest and enthusiasm in managing waste, to conserve and protect the environment as an answer to the social call and not for profit. However, financial sustainability of the entities is at big stake and a huge challenge.
- Another major concern is public responses and cooperation in Waste Management. People do not seem concerned about the values of the environment when they are busy in their daily schedule. If there is some delay in waste collection from concerned authorities, people start illegal dumping in bushes, riverbanks, streams and almost everywhere.
- Most of the equipment and machineries imported and given to the private companies before are obsolete and very expensive to repair which is putting a financial constraint to their company's budget and on the service reliability.
- There are also human resources constraints such as technical skilled workers in terms of collection systems, GIS experts and planners.
- The contract period of 5 years with the Thromde for waste management is very short as no proper investments can be made and the recovery period for huge investments is very less.
- There is also difficulty in managing time uniformity during waste collection because some residents do not bring their waste on time to dump.
- Lack of cooperation from public in terms of waste segregation at source is also an issue where there is separate dry and wet waste collection system.
- There are enough acts, rules and regulation but implementation and enforcement of these rules, acts and policies are not proper.
- Landfills are not properly managed and sanitary.
- Lack of cooperation between different organizations, which have the same type of work such as street cleaning. Waste management responsibility is shared by private waste

management entity and the Thromde, hence joint efforts need to be taken for proper monitoring and management of wastes.

- Due to inadequate facilities, some residents resort to dumping waste in open areas or burning it, which contributes to pollution and environmental degradation
- There is a pressing need for public education campaigns to promote proper waste disposal habits among residents, particularly regarding organic waste management.

5 Waste and Climate Change

Bhutan faces significant challenges in managing solid waste and wastewater, particularly due to rapid urbanization. The inadequate management of waste leads to environmental issues, including the release of methane from landfills, which is a potent greenhouse gas. These gasses are main cause of climate change. Bhutan's efforts to remain carbon neutral are challenged by increasing emissions from the waste sector.

Potential Impacts of Waste and Climate Change in Bhutan

1) **Resource Depletion and Energy Consumption:** Waste that is not recycled or reused can lead to the extraction and processing of new raw materials, which often involves energy consumption and additional greenhouse gas emissions.
2) **Water Pollution:** Leachate from landfills can contaminate water sources, affecting both human health and ecosystems. This can also impact the country's pristine water resources, which are crucial for hydroelectric power and biodiversity.
3) **Soil Degradation:** Improper waste disposal can lead to soil pollution, affecting agricultural productivity and ecosystem health
4) **Climate-Related Disasters:** Bhutan's waste management infrastructure is vulnerable to climate-related disasters such as floods and landslides, which can disrupt waste management services and exacerbate environmental and health issues.
5) **Threats to Tourism and Cultural Heritage:** Waste accumulation can tarnish Bhutan’s image as a sustainable and environmentally conscious destination. Tourism, a significant contributor to Bhutan’s economy, could be impacted, reducing funds available for climate change mitigation efforts.
6) **Impact on Bhutan’s Renewable Energy Goals:** Bhutan relies heavily on hydropower for energy, which is vulnerable to climate impacts such as glacial retreat and changing precipitation patterns. Poor waste management can exacerbate these issues by polluting water sources and affecting hydropower infrastructure.

5.1 Short Lived Climate Pollutant (SLCPS)

Short-lived climate pollutants (SLCPs) are a group of climate-forcing agents that have a relatively short atmospheric lifetime compared to long-lived greenhouse gases such as carbon

dioxide (CO2). SLCPs typically remain in the atmosphere for days to a few decades, which means their impact on global warming is immediate and significant.

The primary SLCPs include:

1. **Black Carbon (BC):**
   - **Source:** Produced from incomplete combustion of fossil fuels, biomass, and biofuels.
   - **Impact:** Black carbon contributes to warming by absorbing sunlight and converting it to heat. It also settles on snow and ice, reducing their reflectivity (albedo) and accelerating melting[13].
   - **Atmospheric Lifetime:** Approximately days to weeks.
2. **Methane (CH4):**
   - **Source:** Emitted during the production and transport of coal, oil, and natural gas; from livestock and other agricultural practices; and by the decay of organic waste in landfills.
   - **Impact:** Methane has a global warming potential (GWP) more than 25 times greater than CO2 over a 100-year period, and over 80 times greater over a 20-year period[14].
   - **Atmospheric Lifetime:** About 12 years.
3. **Tropospheric Ozone (O3):**
   - **Source:** Not emitted directly but formed through chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight.
   - **Impact:** Ozone is a powerful greenhouse gas that contributes to warming and has detrimental effects on human health and vegetation[15].
   - **Atmospheric Lifetime:** A few days to weeks.
4. **Hydrofluorocarbons (HFCs):**
   - **Source:** Synthetic compounds used primarily in refrigeration, air conditioning, and aerosol propellants.
   - **Impact:** HFCs can have a GWP thousands of times greater than CO2, although they are present in much smaller quantities.

---

[13] https://www.c2es.org/content/short-lived-climate-pollutants/

[14] https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/short-lived-climate-pollutants.html

[15] https://aida-americas.org/en/combating-short-lived-climate-pollutants-slcps

- **Atmospheric Lifetime:** Ranges from several years to decades depending on the specific compound.

5.1.1 Impacts of Short-Lived Climate Pollutants (SLCPs) in Bhutan

Short-lived climate pollutants (SLCPs) have significant impacts on Bhutan's environment, public health, and socio-economic conditions. The following points outline the key effects of SLCPs in Bhutan based on recent assessments and studies.

5.1.1.1 Health Impacts[16]

- **Respiratory and Cardiovascular Diseases:** SLCPs, particularly black carbon and particulate matter, contribute to air pollution that exacerbates respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD). In Bhutan, household air pollution from burning solid fuels is a major concern, leading to increased morbidity and mortality from respiratory infections and cardiovascular diseases.
- **Vulnerable Populations:** Children are particularly susceptible to the harmful effects of SLCPs. Exposure to air pollution can hinder their development, leading to long-term health issues such as reduced lung function and cognitive impairments. The UNICEF report highlights that environmental hazard, including air pollution from SLCPs, pose severe risks to children's health and well-being in Bhutan.
- **Increased Disease Burden:** The rise in SLCP emissions is linked to an increase in vector-borne diseases due to changing climate conditions. Warmer temperatures can expand the range of vectors like mosquitoes, increasing the incidence of diseases such as malaria and dengue fever.

5.1.1.2 Environmental Impacts[17]

- **Climate Change Acceleration:** SLCPs contribute significantly to global warming, which affects Bhutan's climate stability. The country is experiencing more frequent extreme weather events, including heavy monsoon rains and glacial lake outburst floods (GLOFs), which threaten infrastructure and livelihoods[18].

---

[16] https://unfccc.int/sites/default/files/resource/LTS%20Report_final%20print_copy.pdf

[17] https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15874-WB_Bhutan%20Country%20Profile-WEB.pdf

[18] https://www.adaptation-undp.org/explore/asia-and-pacific/bhutan

- **Glacial Melting:** Bhutan's glaciers are retreating due to rising temperatures exacerbated by SLCPs. This not only contributes to immediate flooding risks but also affects long-term water availability for agriculture and hydropower generation, which are critical for the country's economy.
- **Biodiversity Loss:** Changes in temperature and precipitation patterns can disrupt ecosystems, leading to loss of biodiversity. Species that are sensitive to climate changes may face extinction or migration pressures.

5.1.1.3 Socio-Economic Impacts[19]

- **Agricultural Productivity**: Air pollution from SLCPs can reduce agricultural yields by damaging crops through increased ozone levels. This poses a threat to food security in Bhutan, where agriculture is a primary livelihood for many communities.
- **Economic Costs:** The health impacts associated with SLCP exposure led to increased healthcare costs and reduced workforce productivity. This economic burden can hinder Bhutan's development goals, especially as the country seeks to balance economic growth with environmental sustainability.
- **Infrastructure Strain:** The increase in extreme weather events linked to climate change impacts infrastructure resilience. Roads and transportation networks are often damaged by heavy rainfall and landslides, which can disrupt economic activities and access to essential services.
- **Tourism Impact:** Bhutan's economy relies on tourism, which can be adversely affected by environmental degradation linked to climate change. Poor air quality and extreme weather conditions may deter tourists.

5.1.2 SLCP Monitoring in Bhutan

Bhutan is actively monitoring short-lived climate pollutants (SLCPs) such as black carbon, methane, and ozone to mitigate their impacts on climate and air quality. The country has established permanent air monitoring observatories in collaboration with the International Centre for Integrated Mountain Development (ICIMOD) to track SLCP emissions in the Himalayan region. Additionally, Bhutan is involved with the Climate and Clean Air Coalition (CCAC), which supports the integration of SLCP monitoring into national climate strategies. In 2023,

[19] http://www.bhutanwatch.org/climate-change-impact-in-bhutan/

Bhutan drafted a National Biodiversity Monitoring Protocol that incorporates SLCP monitoring as part of its environmental management efforts[20]. The country also collaborates with international organizations like UNESCO and WWF for technical support in environmental projects. Furthermore, Bhutan employs emission quantification tools to manage municipal waste and assess the reduction potential of various initiatives related to greenhouse gases and SLCPs.

5.2 GHG Emission Quantification and Trend

The main sources and sinks of greenhouse gas (GHG) emissions and removals have been divided into the four sectors, Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), and Waste following the Inter-governmental Panel on Climate Change (IPCC) 2006 Guidelines. Total GHG emissions in Bhutan in 2015 was 3814.09 Gg CO2 equivalent (CO2 e) excluding removals by forest, which represented a 120.75% increase from the 1994 level of 1727.74 Gg CO2 e and a 0.92% increase from the 2000 level of 3779.27 Gg CO2 e. The carbon sequestration capacity of Bhutan in 2015 was 9386.59 Gg CO2 e, which showed an increase of 2.47% and 4.57% from the year 2000 and 1994. Net GHG emissions in 2015 was -5572.50 Gg CO2 e, which represented a decrease of 23.11% from 1994 levels and an increase of 3.55% from 2000 levels. In general, emissions and removal from all sectors increased in 2015 compared to the base year, as shown in Figure below which shows the percentage contribution of each of the GHG inventory sectors for 1994, 2000 and 2015 (inventory year of INC, SNC & TNC), respectively.

[20] https://www.bbs.bt/115894/

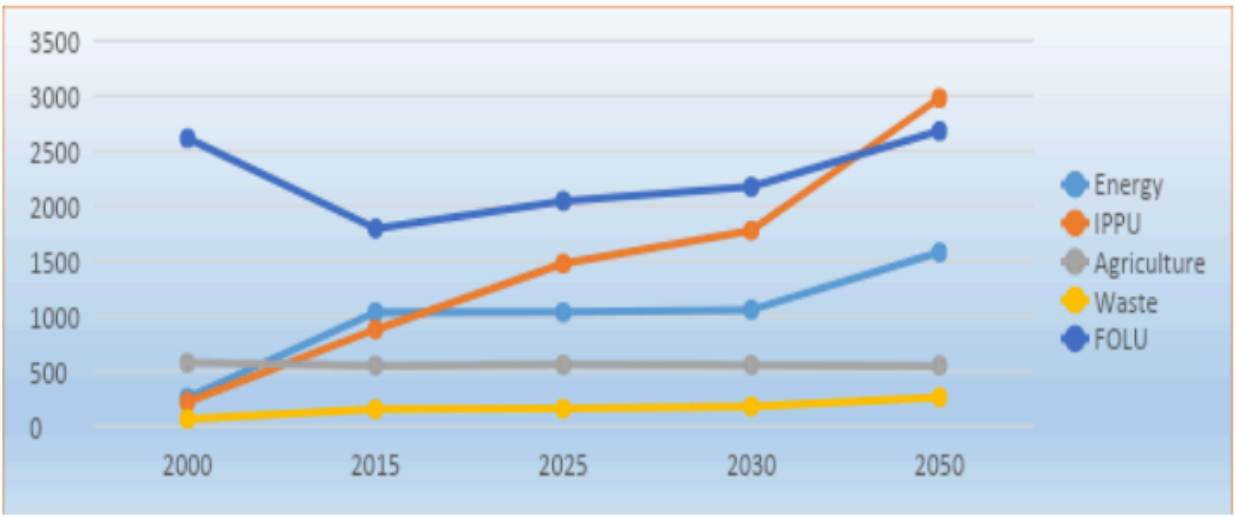


Figure 18: GHG Emissions Projections to 2050 (Based on TNC Data)

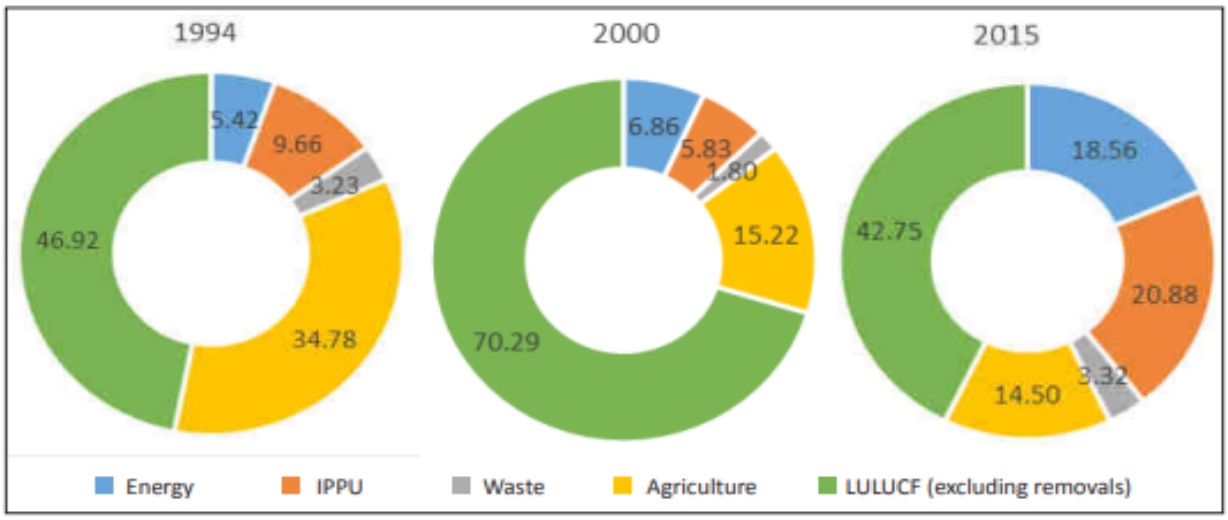


Figure 19: Figure Sectorial percentage contribution of GHG emissions excluding removals by forest

As shown in second Figure, the waste sector's contribution to net national emission has remained more or less constant from 1994 through 2015. However, in terms of absolute figure of Gg CO2 e, the emission from this sector has more than doubled. Percentage contribution of energy and IPPU sectors increased while the contribution of the LULUCF has been fluctuating based on the sector's level of activities. Emission from agriculture sector has been decreasing gradually over the same period. This pattern indicates that emissions associated with development and industrialization increased over time while the emissions associated with subsistence agriculture and livestock remained relatively stable.

GHG emissions from the waste sector was 126.50 GgCO2e in 2015 and represented 3.317 % of total national GHG emissions which was an increase of 127% from 1994 and 86% from 2000 levels. Following the increase in the trend of GHG emissions in the Waste category which also follows the rapid rate of urbanization and increase in the waste generation rates, projections for this category for 2030 are 179 GgCO2e in 2030 and 263 GgCO2e in 2050. The GHG from the waste sector is also projected to grow in the coming years as shown in the figure below:

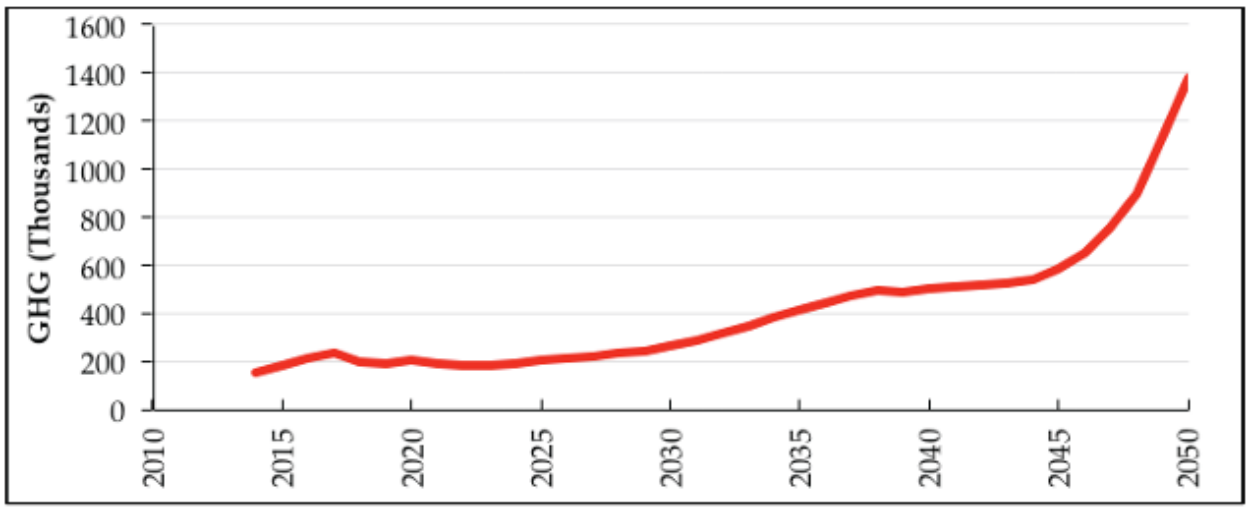


Figure 20: Projected emissions from waste sector in Bhutan

5.3 Waste and Climate Change Adaptation and Mitigation

Addressing climate change and waste management are critical priorities for Bhutan as the country strives for sustainable development and environmental resilience. Mitigation and adaptation strategies play a central role in reducing greenhouse gas emissions, minimizing waste-related environmental hazards, and preparing for climate impacts. Efforts focus on implementing climate-smart agriculture, improving waste management infrastructure, and fostering education and awareness about sustainable practices. Innovative approaches, such as waste-to-energy technologies, biogas generation, and the circular economy, are being promoted alongside strengthening policies, public-private partnerships, and community engagement. These strategies aim to align Bhutan's waste management practices with its commitment to Gross National Happiness while ensuring a robust response to the growing challenges of climate change.

Mitigation	Adaptation
Climate-Smart Agriculture Support climate-smart agriculture initiatives that promote practices reducing greenhouse gas emissions from agricultural activities.	**Climate-Resilient Waste Management Infrastructure** ● Develop waste management infrastructure that is resilient to extreme weather events such as floods and landslides, which are becoming more frequent due to climate change. ● Developing sanitary landfills with proper lining, leachate management, and compaction to prevent waste-related pollution.
Education and Awareness Enhance public awareness and education programs on climate change impacts and the importance of mitigation and adaptation measures. Encourage community participation in climate change mitigation and adaptation efforts.	**Policy and Regulatory Strengthening:** Strengthen policies and regulations to ensure compliance with sustainable waste management practices. The Waste Prevention and Management Regulation, 2012, and the National Waste Management Strategy 2019 provide a strong foundation for this.
Proper Waste Disposal Implement effective waste disposal systems, including segregation of organic and inorganic waste, to reduce methane production and leachate contamination.	**Private Sector Involvement:** Encourage private sector participation in waste management through incentives such as tax exemptions, license fee exemptions, and other benefits. This can help in providing efficient waste collection, recycling, and disposal services.
Recycling and Composting Promote recycling and composting programs to reduce the amount of waste sent to landfills. This can include community-based initiatives and educational programs to encourage sustainable waste management practices.	**Community Engagement and Education** Engage local communities in waste management through education and awareness programs, emphasizing the importance of proper waste disposal and its impact on climate change.

Waste-to-Energy Explore waste-to-energy technologies as a way to convert waste into energy, reducing the reliance on fossil fuels and lowering greenhouse gas emissions	**Use of Technology** Utilize advanced technologies like waste tracking software, IoT sensors, and smart waste bins to optimize waste collection and management, reducing the environmental impact of waste.
Reduction of Single-Use Plastics Implement policies to reduce the use of single-use plastics, which contribute significantly to waste and environmental pollution.	**Sustainable Tourism Practices** Implement sustainable waste management practices in tourist areas to manage the increasing waste generated by tourism, which is a significant sector in Bhutan's economy
Biogas Generation: The installation of biogas plants, such as the one at Jigme Namgyel Institute of Engineering College, can convert food waste into bio-gas, reducing the amount of organic waste sent to landfills and the associated methane emissions. This initiative is part of the Waste and Climate Change project implemented by WWF-Bhutan	**E-Waste Management:** Establish a robust e-waste management system, including collection, recycling, and proper disposal. This is crucial given the increasing generation of e-waste in Bhutan
National Waste Management Strategy (NWMS): Aiming for Zero Waste by 2030, this strategy focuses on reducing landfill dependency, which directly contributes to lower greenhouse gas emissions.	**Public-Private Partnerships:** Foster public-private partnerships to improve waste management services, including the provision of segregation bins, waste collection facilities, and downstream processing facilities. This can enhance the efficiency and sustainability of waste management practices
Technological Innovations for Emission Control: ● Introducing anaerobic digesters for organic waste to generate biogas, an alternative clean energy source.	**Innovative Financing Solutions:** Introduce financial mechanisms such as the Payment for Environment Services (PES) to incentivize sustainable waste management practices. This can

● Upgrading landfill designs with methane capture technologies to reduce greenhouse gas emissions Develop modern waste management facilities, including sanitary landfills, material recovery facilities, and incineration plants. Ensure that these facilities are designed to withstand climate-related disasters	include exemptions from taxes and fees for entities engaged in waste collection, recycling, and reuse
Reduce, Reuse, Recycle (4R Principles): Implement the 4R principles (Reduce, Reuse, Recycle, and Responsibility) to minimize waste generation at the source. This includes promoting source segregation, recycling, and composting to reduce the amount of waste sent to landfills	**Integration with Nature-Based Solutions:** Incorporate waste management into broader nature-based solutions, such as integrating waste management with eco-tourism and wildlife conservation efforts. This can help in promoting a circular economy and reducing the overall environmental impact of waste
Research and Data-Driven Measures ● **Climate Impact Assessments:** Conducting studies to quantify emissions from existing waste systems and identify priority areas for intervention. **Waste Data Standardization:** Developing a national database for tracking waste types, sources, and emissions to better align mitigation measures with Bhutan's climate goals	**Medical Waste Management:** Implementing proper segregation and treatment protocols for medical waste to prevent hazardous materials from contaminating the environment.
Promote Circular Economy: ● Foster a circular economy by encouraging the reuse and recycling of materials. This can be achieved through public-private partnerships and the establishment of waste banks and recycling programs	**Rural Adaptation Programs:** Addressing waste challenges in rural areas by improving collection and treatment infrastructure, as waste disposal methods in these regions are often informal (e.g., open dumping or burning).

● Increasing value addition in waste by converting plastics, papers and metals into reusable materials. ● Promoting local markets for recycled goods to reduce imports of new materials and their associated carbon footprint.	
	Emergency Waste Management Preparedness: Establishing guidelines for waste management during natural disasters such as glacial lake outburst floods (GLOFs) to prevent hazardous waste from polluting water sources.
	Strengthening Agricultural Adaptation: Promoting the use of composted organic waste as a natural fertilizer to improve soil health, reduce chemical fertilizer use, and enhance resilience to climate-induced agricultural stress.

6 Innovations for Waste Management

There numerous issues and challenges in the waste sector. Although there are several options, one of the innovative ideas is to involve the private sector in waste recycling and upscaling. In this chapter, we will highlight the integration of Public-Private Partnership (PPP) model for solid waste management in Bhutan and also list some of the innovative ideas.

6.1 Integration of PPP Model in Waste Management

Engaging a Public-Private Partnership (PPP) model for solid waste management in Bhutan presents a strategic approach to address the challenges posed by urban waste generation. This model fosters collaboration among diverse stakeholders, including government agencies, private sector companies, non-governmental organizations (NGOs), and local communities, ensuring that a wide range of expertise and perspectives are integrated into waste management strategies. By facilitating capacity building and training, the PPP model enhances local skills and knowledge about sustainable practices. It also attracts private investments by providing incentives for companies willing to participate in waste management projects, such as financial support for feasibility studies and subsidies for recycling facilities. Additionally, the model promotes technology transfer from experienced private partners, leading to innovative solutions tailored to local needs. Importantly, the PPP approach emphasizes community engagement and ownership, fostering a sense of responsibility among residents for waste management. Overall, the PPP model not only addresses immediate waste management challenges but also contributes to long-term sustainability and economic growth in Bhutan's urban centers.

Engaging the PPP Model

- **Stakeholder Collaboration:** The PPP model encourages collaboration among various stakeholders, including government agencies, private sector companies, non-governmental organizations (NGOs), and local communities. This multi-stakeholder approach ensures that diverse perspectives and expertise are integrated into waste management strategies.
- **Capacity Building:** Training and capacity-building initiatives can be implemented to enhance the skills of local stakeholders. For instance, workshops and training sessions can be organized to educate stakeholders about integrated solid waste management (ISWM) practices and eco-efficient technologies.

- **Investment Facilitation:** The model can attract private investments by providing clear guidelines and incentives for private entities willing to participate in SWM projects. This includes financial support for feasibility studies and subsidies for establishing recycling facilities.
- **Technology Transfer**: Engaging private partners with experience in eco-efficient technologies can facilitate the transfer of innovative solutions for waste processing and recycling. This is particularly important in Bhutan, where the infrastructure for recycling is still developing.
- **Policy Framework Development:** The PPP model allows for the review and development of policies that support sustainable waste management practices. This includes creating a regulatory environment that encourages private sector participation while ensuring compliance with environmental standards.
- **Community Engagement:** Local ownership and participation are critical components of the PPP model. Engaging communities in waste segregation and management initiatives fosters a sense of responsibility and enhances the effectiveness of waste reduction efforts.

Benefits of the PPP Model in Waste Management

- **Resource Efficiency:** By leveraging both public and private resources, the PPP model can lead to more efficient use of financial, human, and technological resources in waste management operations.
- **Innovation Promotion:** The collaboration between public entities and private firms often results in innovative solutions tailored to local needs. This could include new recycling technologies or community-based waste reduction programs that are more effective than traditional methods.
- **Sustainability:** The PPP approach emphasizes sustainability by integrating environmental considerations into economic planning. It promotes practices such as recycling, composting, and waste reduction at source, which are essential for long-term environmental health.
- **Economic Growth**: Involving the private sector in waste management can stimulate economic growth by creating jobs in recycling industries and related sectors. This is particularly relevant as Bhutan's urban population grows, increasing demand for effective waste services.

- **Improved Service Delivery:** The engagement of private partners often leads to improved efficiency in service delivery, ensuring that waste collection and processing meet the growing demands of urban areas effectively.
- **Enhanced Transparency:** Involving NGOs in the PPP process can increase transparency and accountability, ensuring that local needs are prioritized and met through participatory governance frameworks

6.2 Innovative Waste Management Solutions in Thimphu

1. **Bamboo and Can Art:** While cans themselves are not traditional materials, the skills used in bamboo and cane crafts (Tshar Zo) could be adapted to incorporate metal cans. For instance, cans could be used as additional components in basket-making or as decorative elements in mats and containers.

Figure 21: Bamboo chimes and food cover doom[21]

2. **Wood Art (Souvenir) from Wood Waste**
    - **Key Chains and Pendants:** Small wooden carvings, a part of the traditional Bhutanese art form known as Parzo, can be crafted into key chains or pendants. These carvings can feature traditional motifs, animals, or other symbolic designs unique to Bhutanese culture.

Figure 22: Key chains for wood waste[22]

[21] https://www.youtube.com/watch?app=desktop&v=IC9hh-3zlQY
https://www.alibaba.com/product-detail/Top-selling-100-Natural-hand-woven_10000003132842.html?spm=a2700.7724857.0.0.55bc6c6ePF88mA

[22] https://www.pinterest.com/pin/270145677635140624/

3. **Plastic Waste**

- **Lanterns:** Attractive and functional lanterns made from cleaned and decorated plastic bottles.

Figure 23: Hand Painted Bottle with Fairy lights[23]

- **Trash Bins:** Practical and eco-friendly trash bins crafted from plastic bottles and other plastic waste.

[23] https://justwindup.com/product/wine-bottle-lamp-hand-painted-b/

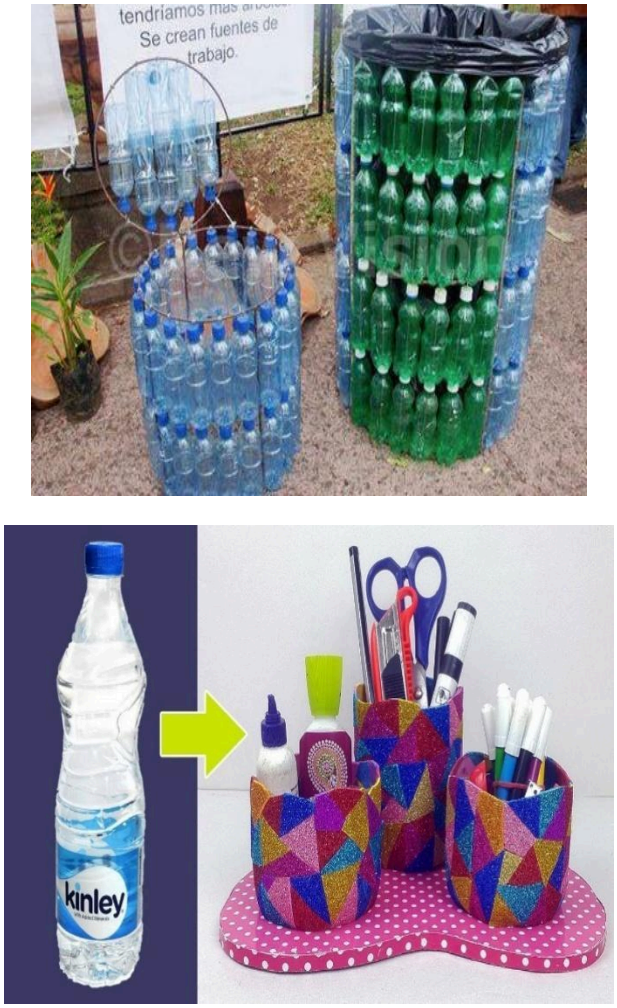


Figure 24: Recycled products from plastic waste[24]

[24] https://www.upcycleart.info/crafts/recyclable-trash-cans-with-plastic-bottles/

- **Bottle cap Coasters:** Durable and visually appealing coasters crafted by embedding bottle caps in epoxy resin, providing a protective surface for tables and countertops.

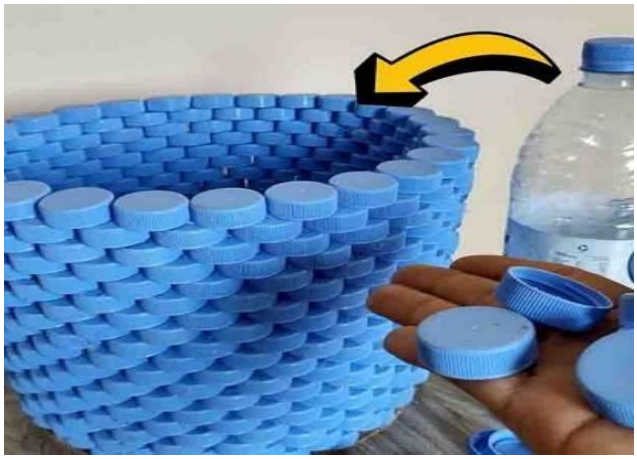


Figure 25: Laundry basket from plastic bottle cap[25]

- **Bottle cap coasters for public art:** Bottle cap coasters made from wood waste are a creative and sustainable project that transforms leftover wood materials into functional art. By repurposing scrap wood as a base and attaching colorful bottle caps, these coasters not only serve a practical purpose but also promote environmental consciousness. The final product showcases unique designs, celebrating both creativity and recycling, making them ideal for personal use or public art displays

Figure 26: Bottle Cap Coasters for Public Art (Rodgers Elementary School, 2018)[26]

[25] https://www.youtube.com/watch?v=sBvL0Ss-pT4

[26] https://www.facebook.com/photo.php?fbid=1791690437551920&id=388162401238071&set=a.637776916276617

4. Paper Waste:

- **Paper Mache Masks:** These masks are crafted by layering and molding paper pulp, often mixed with glue or water, to create intricate and detailed designs. Once dried, they can be painted and decorated to add color and texture.
- **Statues:** Using the paper mache technique, we shape and mold the paper pulp into various forms to create statues. These can range from simple figurines to complex sculptures, which can then be painted and finished to enhance their appearance.

Figure 27: Paper Mache Mask and Statues[27]

5. Tires

- **Rubber Mats:** These mats are made by linking together strips of rubber from discarded tires, often held together with heavy-duty galvanized steel rods. They are extremely durable and long-lasting, making them suitable for various environments, including industrial settings and outdoor use. The mats are available in different sizes and patterns, such as straight weave or chevron designs, and are effective at brushing off dirt and debris from shoes.

[27] https://www.youtube.com/watch?v=-4ey7DKFc_Q
https://giri.in/products/annapoorani-paper-mache-golu-bommai-15-x-7-5-inches

Figure 28: Rubber Mats[28]

6. Composting

- **Animal Feed from Wet Waste**: Food waste, especially from restaurants and markets, can be treated and repurposed as animal feed. This process not only reduces the volume of food waste but also provides a cost-effective alternative to conventional feed, supporting circular economy practices in agriculture.

Figure 29 Food Scraps as Animal Feed[29]

[28] https://philly.makerfaire.com/maker/entry/156/

[29] https://chlpi.org/news-and-events/news-and-commentary/commentary/flpc-partnership-food-recovery-project-launches-leftovers-livestock-legal-guide-using-excess-food-animal-feed/

- **Vermi Composting:** This method involves earthworms breaking down organic matter into vermicast (worm castings), a highly nutritious form of compost. Vermicomposting is particularly beneficial for small-scale farmers and gardeners, as it produces a natural soil amendment that improves water retention and plant growth.

Figure 30: Vermicomposting[30]

7. **Bio Gas from Animal Waste:** Animal waste, such as manure from cattle, pigs, or poultry, is an excellent resource for biogas production. It is collected and processed in anaerobic digesters, where microbes break down the organic material in the absence of oxygen. This process generates biogas, primarily methane, which can be used for cooking, heating, or electricity generation. The leftover material, called digestate, is rich in nutrients and can be used as organic fertilizer. This approach reduces greenhouse gas emissions from open manure pits and creates a renewable energy source, benefiting both farms and the environment.

Figure 31: Bio Gas in Semjong[31]

[30] https://rodaleinstitute.org/science/articles/vermicomposting-for-beginners/

[31] https://kuenselonline.com/use-of-biogas-in-semjong-growing/

8. **Bio Gas from Wet Waste:** Wet waste includes organic kitchen scraps, food waste, and other biodegradable materials with high moisture content. When processed in an anaerobic digester, these wastes are decomposed by microorganisms to produce biogas. This method is particularly effective for managing urban and household organic waste, diverting it from landfills. The resulting biogas can replace fossil fuels, while the slurry byproduct can be used as compost or fertilizer. This approach reduces waste disposal issues, lowers greenhouse gas emissions, and contributes to sustainable waste-to-energy systems.

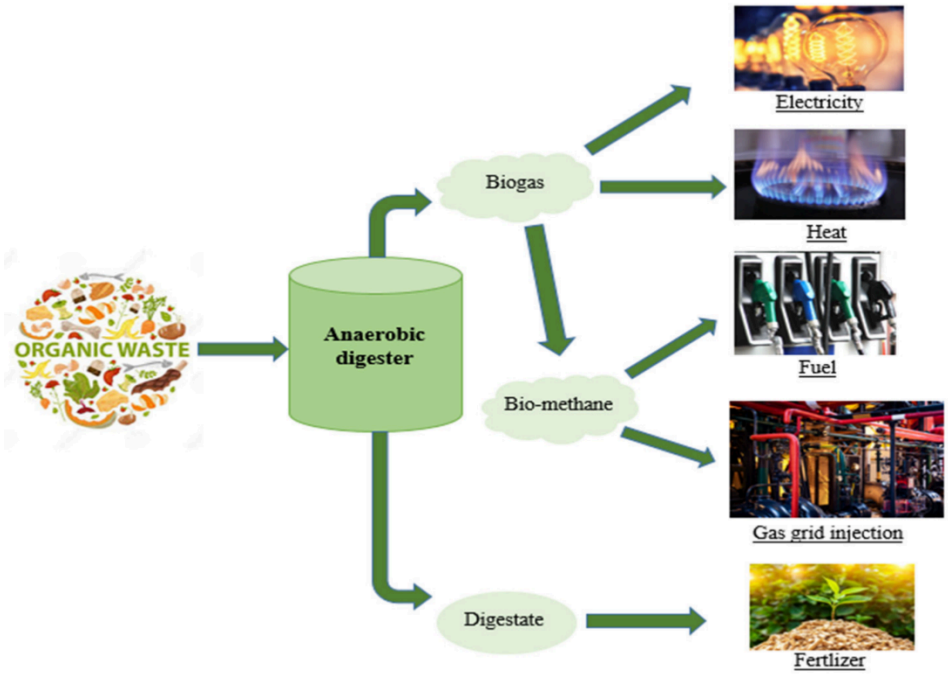


Figure 32: Recovery of Household Waste by Generation of Biogas as Energy and Compost as Bio-Fertilizer[32]

9. **Upcycled Clothing:**
   - **Old Textiles:** Old textiles can be repurposed into a variety of items such as throw rugs made from old sweaters, pillows from outgrown or stretched-out sweaters, and even decorative mittens from knit sweaters.

[32] https://www.mdpi.com/2227-9717/10/1/81

Figure 33: Jeans Transformation Ideas[33]

- **Leather Goods:** Leather goods can be upcycled by transforming old leather items like jackets, belts, or handbags into new functional pieces. For example, an old leather jacket can be turned into a unique handbag, wallet, or even a pair of shoes. This process gives new life to durable leather materials and reduces waste.

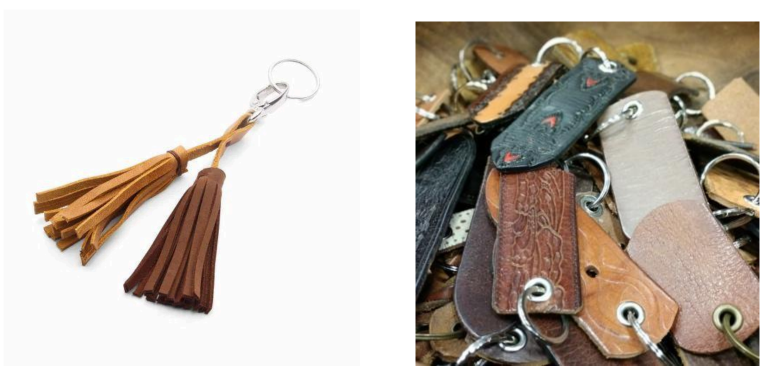


Figure 34: Upcycled Leather products for leather waste[34]

10. **Refurbishing Old Furniture:** Refurbishing old furniture involves restoring and repurposing existing furniture to make it functional and aesthetically pleasing again. This can include painting, reupholstering, or reassembling old pieces to create new items like tables, chairs, or

[33] https://www.youtube.com/watch?app=desktop&v=Smu1UEYYOwI

[34] https://www.google.com/search?q=simple+leather+charms&sca_esv=3c012d021aeba0dc&udm=7&biw=1366&bih=633&sxsrf=ADLYWILoPfY5CN_60fn9nXnTjB2OawAJAg%3A1736484347030&ei=-6WAZ8bBAdCb4-EPz-LzmQo&ved=0ahUKEwiGq6alrOqKAxXQzTgGHU_xPKMQ4dUDCBA&uact=5&oq=simple+leather+charms&gs_lp=EhZnd3Mtd2l6LW1vZGVsZXNzLXZpZGVvIhVzaW1wbGUgbGVhdGhlciBjaGFybXMyCBAAGIAEGKIESOcYUMwIWOYScAF4AJABAJgBhQKgAa4LqgEFMC40LjO4AQPIAQD4AQGYAgWgAukFwgIGEAAYBxgewgILEAAYgAQYhgMYigXCAggQIRigARjDBMICChAhGKABGMMEGAqYAwCIBgGSBwMxLjSgB5IR&sclient=gws-wiz-modeless-video#fpstate=ive&vld=cid:ca92571e,vid:JVIeWE_NxZs,st:0

shelves. This approach reduces waste and preserves the history and character of the original furniture.

Figure 35: Restoring Decades of Furniture[35]

11. Decorative/Reuse Glass

- **Candle Holder:** Upcycled candle holders made from pickle glass bottles are a creative and eco-friendly way to repurpose materials that would otherwise be discarded. Each holder showcases the unique shapes and textures of the original bottles, adding rustic charm to any decor. They are versatile for both indoor and outdoor use and can be customized with paint or decorative elements. These candle holders not only serve a functional purpose but also promote sustainability, making them a beautiful addition to any home.

Figure 36: Candle holder made from pickle glass jars[36]

[35] https://www.youtube.com/watch?v=UxGS3Pm9OI4

[36] https://www.google.com/search?sca_esv=3c012d021aeba0dc&hl=en&sxsrf=ADLYWIKpbMJ1yymfMj2RGso1XKnOKgQj9Q:1736485301894&q=candle+pickle+glass+jars&udm=7&fbs=AEQNm0Aa4sjWe7Rqy32pFwRj0UkWd8nbOJfsBGGB5IQOO6L3J6RlmmGkJpFtPEFU1BThDhV7p_lP0Xv00JJ1s9ceMMKTzJRPmT_PDQpdtUhB99Gt3Km59EWG5utssS5E2O-41nNAe7ExDZ6Ggmb-t46uxa7Nei8_9HhrryfDssQ7sbE_En7ao1s&sa=X&ved=2ahUKEwixz87sr-qKAxUm2DgGHU5WGuoQtKgLegQIChAB&biw=1366&bih=633&dpr=1#fpstate=ive&vld=cid:cea85337,vid:1T40bMFI3fc,st:0

- **Desk Organizers:** Use glass jars to organize office supplies, such as paperclips, pens, and other small items. They are also useful for storing toiletries, batteries, and sewing materials


Figure 37: Mason jar organizer[37]

- **Vases:** Use glass jars as vases for flowers, greenery, or branches, adding a touch of elegance and sustainability to your home decor. You can customize them with ribbons, paint, or twine for a personal touch.


Figure 38: Flower Vase[38]

12. Interactive and Recycling Center

[37] https://eighteen25.com/mason-jar-organizing/

[38] https://www.tiktok.com/@vitraaz/video/7374799602488216865

- **Waste deposit:** A designated area where individuals can deposit their recyclable and non-recyclable waste. This facility ensures that waste is collected efficiently and sorted correctly, reducing the likelihood of contamination and increasing the effectiveness of the recycling process. It also serves as an educational point to teach people about proper waste disposal.
- **Waste displays and sale giveaways:** Exhibits and sales areas that showcase products made from recycled materials. These displays educate visitors about the potential uses of recycled materials and promote sustainable consumerism. Giveaways or sales of these products can incentivize people to participate in recycling programs and support a circular economy.
- **Waste Sorting Games:** Interactive games and activities designed to teach people how to sort waste correctly. These games make learning fun and engaging, helping to reduce confusion about what can and cannot be recycled. They are particularly effective for children and can be adapted for various age groups to ensure everyone understands the importance of proper waste sorting.

Figure 39: Waste Sorting Recycling Truck[39]

- **Public Art:** Art installations created from recycled materials that serve as both educational tools and aesthetic attractions. Public art can raise awareness about waste

[39]https://www.google.com/search?q=board+game+waste+sorting+games+for+kids&sca_esv=9f43d3a7dae88e4e&udm=7&biw=1280&bih=665&sxsrf=ADLYWIJbimMDhpCmzVDNq2tqct_fBI2cOg%3A1735279004258&ei=nEFuZ_61D8Hc2roPwq_soAc&ved=0ahUKEwj84mFoseKAxVBrlYBHclXG3Q4ChDh1QMIEA&uact=5&oq=board+game+waste+sorting+games+for+kids&gs_lp=EhZnd3Mtd2l6LW1vZGVsZXNzLXZpZGVvIidib2FyZCBnYW1lIHdhc3RlIHNvcnRpbmcgZ2FtZXMgZm9yIGtpZHMyCBAAGIAEGKIEMggQABiABBiiBEipNID2CVj7NHACeACQAQCYAZoCoAGwlaoBBDItMTm4AQPIAQD4AQGYAg6gAqEWwgIEECMYJ8ICBRAhGKABwgIHECEYoAEYCsICBBAhGBWYAwCIBgGSBwYyLjAuMTKgB7oz&sclient=gws-wiz-modeless-video#fpstate=ive&vld=cid:d8ed327f,vid:1gMkUR8g1cM,st:0

management and the importance of recycling, while also beautifying the center and making it a community hub. It inspires creativity and encourages people to think about waste in a more innovative and sustainable way.

- **Upcycling Workshops:** Hands-on workshops where participants learn to transform discarded materials into new, useful items. These workshops promote creativity, sustainability, and community engagement. By teaching people how to upcycle, the center encourages a culture of reuse and reduces the amount of waste sent to landfills.
- **Support for Zero-Waste Festivals:** Collaboration with and support for zero-waste festivals and events. The center can provide educational resources, workshops, and infrastructure to help these events minimize waste. This support promotes a broader community commitment to sustainability, educates a wider audience about waste reduction, and fosters a culture of environmental responsibility.

Figure 40: Trash to Treasure Art Exhibition: Art created by the famous Jackie Hanson, made with a discarded panel, an array of garbage, and acrylic paint[40]

13. Innovative Technologies

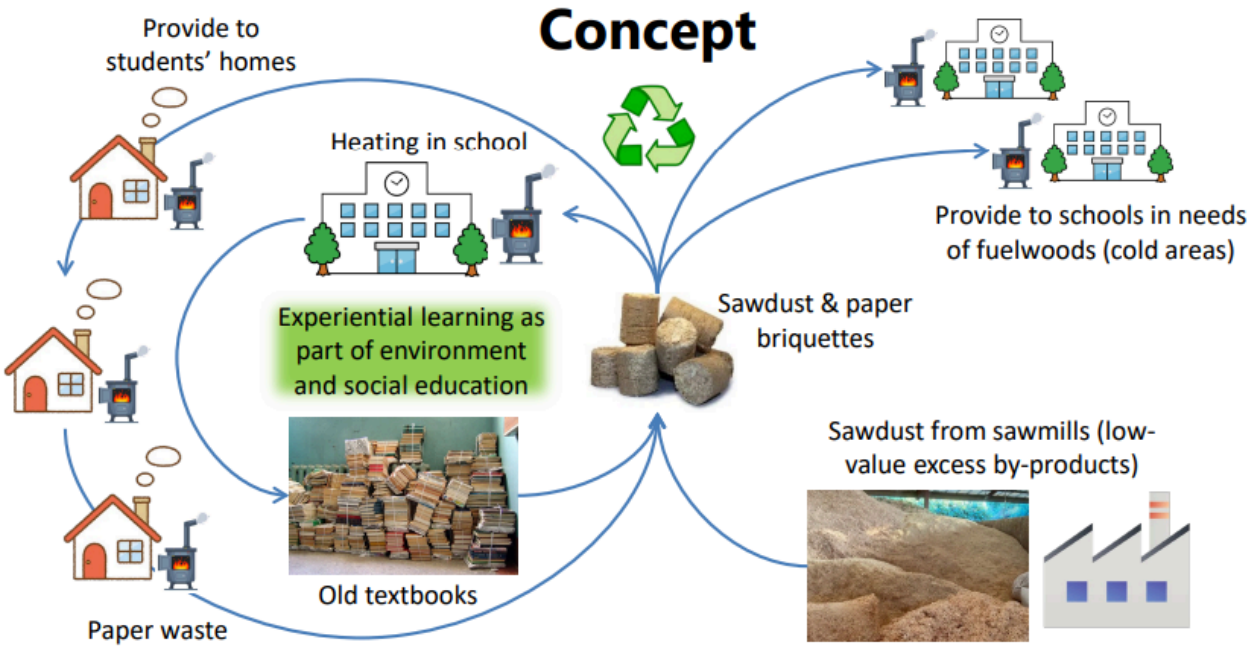
- **Waste Tracking Software:** Waste tracking software plays a crucial role in innovative technologies by collecting and analyzing data on waste generation and disposal, enabling efficient resource management and process optimization. It supports sustainability by

[40] https://www.mosaicslab.com/blog/trash-to-treasure-mosaic-art-exhibition/

identifying recyclable materials, reducing costs, and ensuring compliance with environmental regulations. By leveraging real-time insights, the software helps organizations minimize waste, achieve sustainability goals, and adopt circular economy practices, fostering innovation and reducing environmental impact.

14. Saw Dust and Paper Briquets

A sustainable solution involves repurposing old textbooks and sawdust into briquettes, providing an eco-friendly alternative to fuelwood. The process includes soaking and shredding paper, mixing it with sawdust, compressing the mixture into briquettes using a manual hydraulic press, and drying them under the sun. These briquettes can be distributed to schools in colder regions and households, reducing dependency on traditional fuel sources. Additionally, this initiative incorporates experiential environmental education, teaching student's practical skills in sustainability while promoting conservation.



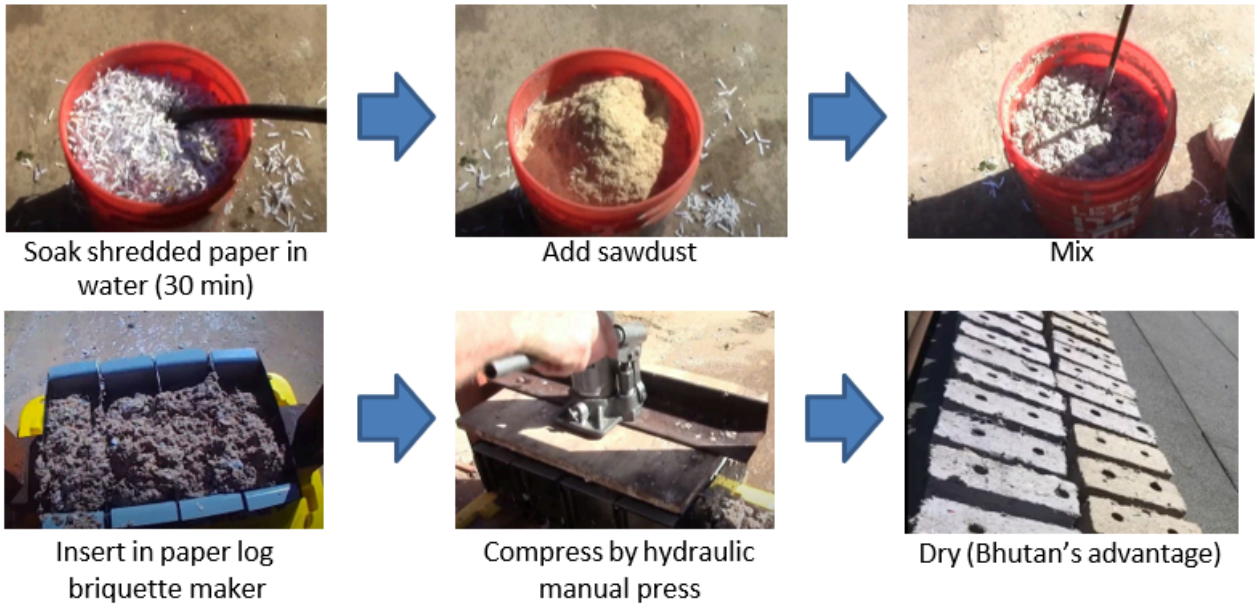


Figure 41: Making of Saw dust and paper briquettes[41]

[41] https://www.youtube.com/watch?v=BHgBCvQ_-Qg

6.3 Stakeholder Consultation on Waste Management: Insights and Innovations

On January 1, 2025, stakeholders convened for a pivotal consultation on waste management, a cornerstone of Bhutan's sustainable development strategy. This event, held as part of a pre-feasibility study, sought to engage diverse perspectives in crafting innovative, inclusive, and scalable waste management solutions tailored to the country's unique challenges and opportunities.

The consultation underscored the value of public-private partnership (PPP) models as a framework for fostering practical and impactful initiatives. Special emphasis was placed on addressing the needs of marginalized groups, including children, persons with disabilities (PWDs), and their caregivers, ensuring that proposed solutions were not only effective but also equitable. By aligning with Bhutan's principles of environmental stewardship and social inclusivity, the event demonstrated a commitment to creating solutions that resonate with the nation's broader development goals.

The event commenced with a presentation by Selwa, providing a comprehensive overview of the national policy on disabilities, children, and the organization's objectives. This was followed by a detailed presentation by the Consultant, outlining the project concept and the broader waste management landscape in Bhutan and Thimphu. The issues surrounding waste management have also been highlighted in various local newspapers and articles, which have further amplified the urgency of addressing this challenge. Participants were then introduced to 23 potential business ideas, evaluated based on their feasibility, inclusivity, and scalability.

The long list of project ideas presented are below:

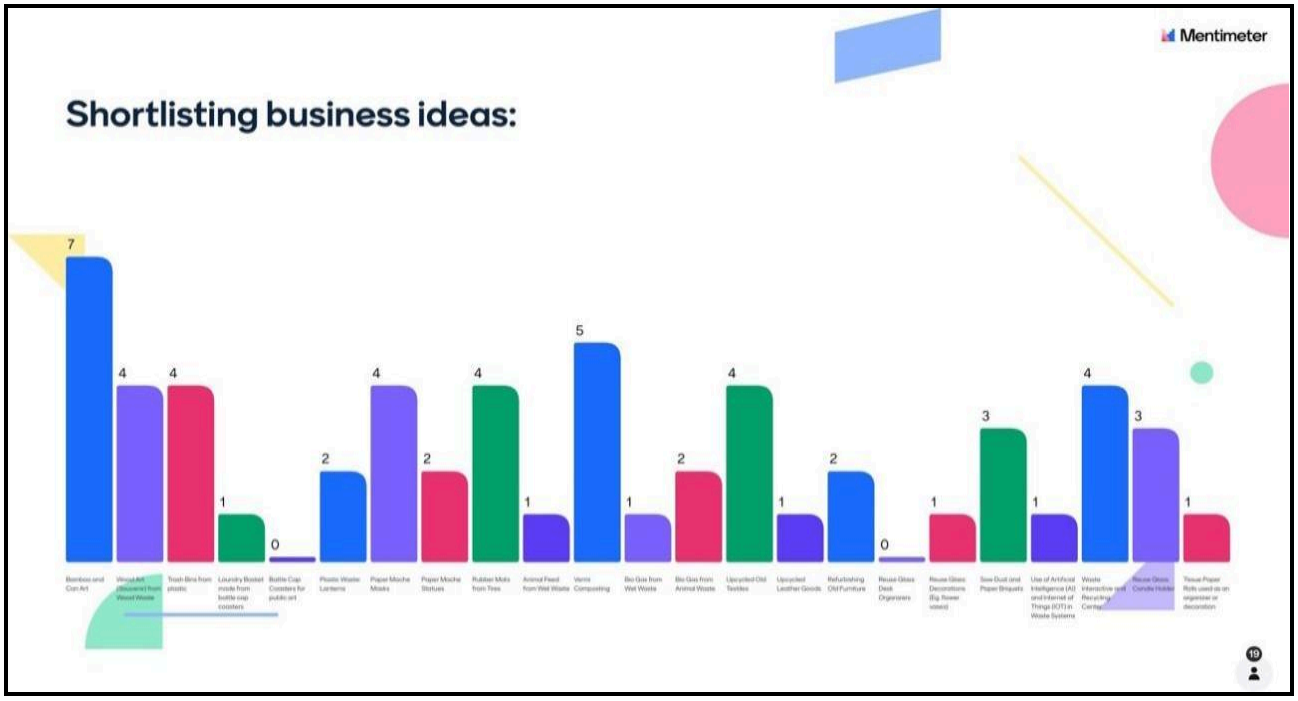
1. Bamboo and Can Art
2. Wood Art (Souvenir) from Wood Waste
3. Plastic Waste Trash Bins
4. Bottle Cap Coasters: Laundry Basket
5. Bottle Cap Coasters for Public Art
6. Plastic Bottle Lanterns
7. Paper Mache Masks
8. Paper Mache Statues

9. Rubber Mats from Tires
10. Animal Feed from Wet Waste
11. Vermicomposting
12. Bio Gas from Wet Waste
13. Bio Gas from Animal Waste
14. Upcycle Old Textiles
15. Upcycled Leather Goods
16. Refurbishing Old Furniture
17. Reuse Glass as Candle Holder
18. Use of Wine Bottles as Decorations
19. Reuse Glass as Desk Organizers
20. Saw Dust and Paper Briquets
21. Tissue Paper Rolls as an Organizer or Decorations
22. Use of Artificial Intelligence (AI) and Internet of Things (IOT) in Waste Systems
23. Waste Interactive and Recycling Center

Following this initial list, a discussion among stakeholders was facilitated to further refine the options. Each participant was given the opportunity to choose three ideas from the comprehensive list of 23. Ultimately, this led to the identification of six innovative ideas that were selected for further discussion and detailing.

Based on the group voting and discussion, following were the 6 Topics selected for further work.

1. Bamboo Art
2. Wood Art (Souvenir) from Wood Waste
3. Saw Dust and Paper Briquets
4. Paper Mache Masks
5. Upcycle Old Textiles
6. Waste Interactive and Recycling Center



Additionally, two supplementary ideas—repurposing used cement bags and producing textiles from waste—were proposed for inclusion in the project document, further enriching the scope of sustainable waste management initiatives. These strategies aim not only to reduce waste but also to create sustainable opportunities for local communities, encouraging a circular economy that benefits both the environment and marginalized groups. The comprehensive group presentation and suggestions is attached below for your reference (Appendix I).

Pictures from the Stakeholder Consultation

Discussion on the Project

Presentation on the innovative ideas

Group Photo

7 Business Models for Waste Management

This chapter provides an in-depth overview of eight innovative ideas that were identified and recommended by stakeholders during consultations aimed at building sustainable and inclusive business models. These selected ideas are:

1. **Bamboo Art:** Utilizing locally available bamboo to create artistic and functional products that blend traditional craftsmanship with modern design.
2. **Wood Art:** Repurposing wood waste into handcrafted decorative items or functional products, adding value through creativity and skill.
3. **Paper Mache Masks:** Reviving and modernizing the traditional craft of papier-mâché to produce unique masks and other decorative items, using waste paper as the primary material.

4. **Upcycled Old Textiles:** Transforming discarded or old textiles into new, fashionable, or functional items, promoting circular fashion and reducing textile waste.
5. **Upcycled Cement Bags:** Converting discarded cement bags into durable, creative products such as bags, wallets, or other utility items, giving them a new lease of life.
6. **Clothing from Recycled Products:** Designing and producing apparel using recycled materials, contributing to sustainable fashion while reducing waste.
7. **Saw Dust and Paper Briquets:** Transforming sawdust, and discarded paper into compact, eco-friendly fuel briquettes, providing a sustainable and cost-effective alternative to traditional fuels. This innovative approach not only reduces waste but also promotes sustainable energy solutions.
8. **Waste Interactive Center:** Establishing an interactive hub for education and awareness on waste management, showcasing innovative recycling techniques and hosting community engagement activities.

For each of these innovative ideas, a detailed business model has been developed. This includes identifying the necessary inputs, such as materials, resources, and tools; outlining the processes and techniques required to transform waste into valuable products; and describing the outputs, emphasizing the final products' market appeal and sustainability. A comprehensive SWOT analysis evaluates the strengths, weaknesses, opportunities, and threats of each idea to ensure their feasibility and scalability. Additionally, a financial analysis assesses the costs, revenues, and profitability, providing a clear roadmap for implementation. Through this detailed approach, each idea is designed to be practical, innovative, and capable of generating significant social, environmental, and economic value.

7.1 Business Model for Bamboo and Wood Art

This business model focuses on the production and sale of bamboo products, such as keychains, toothpicks, and cane laminate items, crafted exclusively from wood and bamboo waste materials. The initiative not only promotes sustainable waste management practices but also adds economic and social value by creating eco-friendly products. It aligns with Bhutan's Gross National Happiness (GNH) principles, which emphasize environmental conservation, sustainable development, and inclusivity for all genders and individuals, including children and persons with disabilities as well as their caregivers.

7.1.1 Objectives

The core aim of this initiative is to transform waste materials, particularly bamboo and wood waste, into value-added products. This process fosters sustainability by reducing waste and promotes economic growth through inclusive job creation. Furthermore, it raises awareness about sustainable consumption among consumers, creating a market for eco-conscious products. By emphasizing inclusivity, it supports artisans, caregivers, and individuals with disabilities, ensuring meaningful employment and skill development opportunities for all.

The significance of this business model lies in its potential to:

- **Utilize Waste Materials:** By sourcing waste wood, the business contributes to waste reduction and promotes sustainable practices.
- **Support Local Artisans:** Collaborating with local craftsmen helps preserve traditional carving techniques while providing them a source of income.
- **Promote Cultural Heritage:** The products will reflect Bhutanese culture, appealing to locals and tourists seeking authentic souvenirs.

7.1.2 Target Market

The primary market includes both local and international audiences. Locally, households and tourists are the key customers, with products like toothpicks serving daily needs, keychains acting as unique, handmade souvenirs, and cane laminate items catering to niche home decor markets. The international market encompasses eco-conscious consumers, corporate buyers looking for sustainable gifts, and online shoppers through e-commerce platforms. By catering to diverse audiences, the initiative ensures its products are both functional and culturally appealing.

7.1.3 Inputs

The inputs for this initiative are meticulously planned to ensure cost-effectiveness and sustainability:

1. **Raw Materials**: Exclusively bamboo, wood waste, and cane waste sourced from furniture workshops, construction sites, and waste collection centers. No virgin forest resources will be used.

2. **Human Resources**: Skilled artisans and designers, including individuals with disabilities, caregivers, and children with disabilities (in safe and age-appropriate roles), contribute to production and design innovation.
3. **Infrastructure**: A well-equipped workshop with tools such as wood shredder, bamboo splitters, carving tools, equipment for transportation and packaging, sanding machines, and Computerized Numerical Control (CNC) engraving machines.

Figure 42: CNC Engraving Machine[42]

4. **Utilities**: Consistent electricity, clean water, and reliable transportation.

7.1.3.1 Quantity of Materials Required

- Initial Production Run: Estimate producing 1,000 units in the first month.
- Wood Requirement: Approximately 200 kg of waste wood for initial production.

7.1.3.2 Training Requirements

- Carving Techniques: Training sessions for artisans on advanced carving techniques to enhance product quality.
- Business Management: Workshops on marketing, sales strategies, and inventory management for artisans involved in the business.

Training can be sourced from:

- Local craft organizations or NGOs focused on artisan skills.

[42] https://www.alibaba.com/product-detail/Desktop-Wood-Bamboo-Application-Leather-DIY_1601132822641.html?spm=a2700.7724857.0.0.7c4d25f7yL6Uzs

- Partnerships with vocational training institutes.

7.1.4 Process

This section provides a detailed explanation of the production process as well as the marketing strategy to promote these products. The focus is on utilizing waste wood sourced from sawmills and construction sites, ensuring sustainability while preserving Bhutanese cultural heritage. The production process begins with sourcing and preparing raw materials. Bamboo, wood, and cane waste are cleaned, sorted, and processed into manageable sizes. Designers then create innovative prototypes, incorporating feedback to ensure functionality and market appeal. During manufacturing, artisans craft products with precision, using a combination of manual skills and machinery. Quality control ensures each product meets high standards. Finally, the products are packaged in eco-friendly materials and distributed to various markets.

7.1.4.1 Sourcing Materials

- **Waste Wood Acquisition:** The primary material for producing key chains and pendants will be waste wood obtained from local sawmills and construction sites. This approach not only reduces waste but also minimizes the environmental impact associated with sourcing new timber.
- **Collaboration with Suppliers:** Establish partnerships with sawmills and construction companies to facilitate regular collection of waste wood. This collaboration ensures a consistent supply of materials while promoting community engagement in sustainability efforts.

7.1.4.2 Design Development

- **Artisan Collaboration:** Work closely with local artisans who specialize in traditional Bhutanese carving techniques. Their expertise will be instrumental in creating unique designs that reflect Bhutanese culture.


CRISS CROSS CANE
BRINK CANE
TWISTED CANE
TOHU CANE
JUTE NATURAL
TWILL BRAIDED CANE
FLAT BRAID WEAVE
BIAXIAL CANE
FADDED FIBERS

- **Cultural Motifs:** The designs will incorporate traditional motifs, animals, and symbols significant to Bhutanese heritage. This cultural connection adds value to the products, making them appealing to both locals and tourists.

7.1.4.3 Carving

- Traditional Techniques: Skilled craftsmen will use traditional tools and techniques to carve the wooden pieces into key chains and pendants. This process requires precision and artistry, ensuring that each piece is unique.

- Artisan Workshops: Conduct workshops to refine the skills of artisans, focusing on enhancing their carving techniques and encouraging creativity in design.

7.1.4.4 Finishing

- Sanding and Polishing: After carving, each piece will be sanded to remove rough edges and then polished to achieve a smooth finish. This step is crucial for enhancing the aesthetic appeal of the products.
- Natural Treatments: The finished pieces will be treated with natural oils or waxes to protect the wood and enhance its durability. This treatment not only preserves the quality of the product but also aligns with eco-friendly practices.

7.1.4.5 Quality Control

- Inspection Standards: Implement quality checks at various stages of production to ensure that each product meets high standards before packaging. This includes checking for defects in carving, finish quality, and overall craftsmanship.
- Feedback Loop: Establish a feedback mechanism where artisans can learn from quality assessments, leading to continuous improvement in production processes.

7.1.5 Outputs

The outputs include eco-friendly bamboo keychains, high-quality toothpicks, cane laminate decor items, and customized souvenir items. These products contribute to reducing waste while offering consumers sustainable alternatives. Beyond physical products, the initiative generates significant social and environmental impact by creating inclusive employment opportunities and promoting waste reduction.

7.1.5.1 Revenue Streams

Revenue is generated through various channels, including retail and wholesale sales in local markets, custom orders for events, and online platforms targeting both domestic and international audiences. Additionally, the business offers workshops and training programs to further promote bamboo and cane craftsmanship, adding another revenue stream.

7.1.5.2 Cost Structure

The cost structure consists of fixed and variable expenses. Fixed costs include initial investments in machinery, workshop setup, and training programs. Variable costs cover raw material procurement, wages, utility expenses, marketing, and packaging materials. This balanced structure ensures both scalability and sustainability.

7.1.5.3 Sustainability and Environmental Impact

This initiative directly addresses the issue of waste by repurposing bamboo, wood, and cane scraps into useful products. It fosters the use of renewable materials, reducing the environmental burden on landfills. By educating consumers and promoting eco-friendly practices, it aligns with Bhutan's national commitment to environmental conservation and sustainable development.

7.1.5.4 Partnerships and Stakeholders

Collaboration is a cornerstone of this model. Partnerships with government bodies ensure effective waste management, while NGOs provide funding and training support. The private sector contributes by supplying raw materials and expanding market reach. Community involvement is essential, with inclusive hiring practices ensuring the participation of individuals with disabilities and their caregivers, thus fostering equity.

7.1.5.5 Marketing Strategy

Branding

- **Cultural Identity:** Develop a brand identity that embodies Bhutanese culture and craftsmanship. The branding should communicate the story behind each product, emphasizing its cultural significance and artisanal quality.
- **Logo and Packaging Design:** Create visually appealing logos and packaging that reflect traditional Bhutanese art forms. Eco-friendly packaging materials should be used to align with sustainability goals.

Sales Chanels

- **Local Markets:** Set up stalls at local markets, festivals, and cultural events to directly engage with customers. This face-to-face interaction allows for storytelling about the products' cultural significance.
- **E-commerce Platform:** Launch an online store to reach a broader audience, including international customers interested in unique handmade products. Utilize social media platforms for marketing campaigns to drive traffic to the online store.
- **Partnerships with Retailers:** Collaborate with local gift shops, hotels, and tourist centers to stock products as part of their offerings, increasing visibility among tourists.

Promotional Strategies

- **Storytelling Marketing:** Use storytelling techniques in marketing materials to connect consumers with the cultural heritage represented by each piece. Highlighting the artisans' stories can create an emotional connection with potential buyers.

- **Social Media Campaigns:** Leverage platforms like Instagram and Facebook to showcase product images, artisan stories, and customer testimonials. Engaging content can help build a community around the brand.
- **Workshops and Demonstrations:** Host workshops where customers can see artisans at work or participate in carving sessions themselves. This hands-on experience can enhance customer appreciation for the craftsmanship involved.

7.1.6 SWOT Analysis

STRENGTH

1. **Abundant Waste Materials**: Bhutan's furniture workshops and construction sites provide a sustainable supply of wood, bamboo, and cane waste.
2. **Cultural Relevance**: Bamboo and cane craftsmanship align with Bhutanese traditions and enhance product authenticity.
3. **Environmental Alignment**: By using waste wood, the business promotes environmental sustainability and reduces waste in landfills, aligning with eco-friendly practices.
4. **Inclusivity**: Active inclusion of individuals with disabilities, caregivers, and marginalized groups in the workforce.
5. **Supporting Local Artisans:** The model supports local craftsmen, providing them with income and preserving traditional skills and cultural heritage.
6. **Unique Offerings:** The handcrafted nature of the products allows for unique designs that cannot be easily replicated by mass-produced items, enhancing their market appeal.

WEAKNESSES:

1. **Limited Market Awareness**: Eco-friendly products might need additional promotion to gain acceptance locally. Building brand recognition and awareness in a competitive market can take time and resources.
2. **Infrastructure Gaps**: Limited transportation and logistics in rural areas could pose challenges.

3. **High Initial Costs**: Setting up workshops and acquiring tools require substantial upfront investment.
4. **Dependency on Local Resources**: The business relies heavily on local wood supply and artisan skills, which may be affected by resource availability or changes in local industry.

OPPORTUNITIES:

1. **Tourism Growth**: Bhutan's thriving tourism industry provides a ready market for souvenirs and eco-products.
2. **Global Eco-Trends**: Increasing global demand for sustainable and ethical products creates export opportunities.
3. **Skill Development**: Training programs can enhance community involvement and improve craftsmanship.
4. **Government Support**: Favorable policies for eco-businesses can provide financial or logistical assistance.
5. **E-commerce Expansion**: Establishing an online presence can open up new markets beyond local sales, reaching international customers interested in authentic Bhutanese crafts.

THREATS:

1. **Raw Material Shortages**: Dependence on consistent waste material supply might face challenges.
2. **Market Competition**: Emergence of similar products locally or from neighboring countries.
3. **Economic Uncertainty**: Fluctuations in consumer spending or tourism rates could impact sales.

4. **Changing Consumer Preferences**: Shifts in consumer preferences towards different types of products or materials could impact demand.

7.1.7 Financial Investment

Initial Investment

Category	Description	Cost (Nu.)
Raw Materials	Waste wood, bamboo, and cane (200kg initial stock)	30,000
Tools & Equipment	Sanding machines, bamboo splitters, CNC machines	300,000
Workshop Setup	Construction/rent of workspace and facilities	150,000
Marketing & Branding	Initial marketing materials, eco-branding efforts	50,000
Training Programs	Skill development for artisans and inclusivity	70,000
Miscellaneous	Transport, office furniture, packaging	30,000
Total Initial Investment		630,000

Monthly Operating Costs

Category	Description	Cost (Nu.)
Raw Materials	Bamboo, wood, and cane waste for 200kg/month	15,000
Labor Costs	Salaries for 15 inclusive workers (artisans, disabled individuals, caregivers, etc.)	120,000
Utilities	Electricity, water, workshop maintenance	20,000
Transportation	Logistics for sourcing materials and distribution	10,000
Marketing	Ongoing promotional efforts, social media campaigns	15,000
Packaging	Eco-friendly packaging for products	10,000
Miscellaneous	Maintenance, tool repairs, other unforeseen costs	10,000

Total Monthly Costs		200,000

Revenue and Sales Breakdown

Product	Units Sold (Monthly)	Selling Price (Nu.)	Total Revenue (Nu.)
Keychains	400	150	60,000
Toothpicks (packs)	500	50	25,000
Cane Laminates	100	1,500	150,000
Jenga Game	50	300	15,000
Total Revenue			250,000

Profit and Loss Analysis

Category	Description	Amount (Nu.)
Revenue	Monthly revenue from product sales	250,000
Total Monthly Costs	Operating expenses	200,000
Net Monthly Profit	Revenue - Costs	50,000

Break Even Analysis

Category	Details	Amount (Nu.)
Initial Investment	Total setup costs	630,000
Net Monthly Profit	Profit after monthly operating costs	50,000
Break-Even Time	Initial Investment ÷ Net Monthly Profit	13 months

7.2 Business Model for Paper Mache Masks

This business model focuses on producing and selling handcrafted paper mache masks that are deeply rooted in Bhutanese culture and artistry. The venture is designed to be inclusive, providing meaningful employment opportunities to children with disabilities, persons with disabilities (PWDs), and their caregivers. By leveraging their unique abilities and fostering an empowering work environment, the business aims to promote social equity. Furthermore, the model emphasizes the preservation of Bhutan's traditional crafts and eco-friendly practices. The masks are positioned to appeal to both local and international markets, balancing cultural authenticity with sustainability.

7.2.1 Objectives:

- ✔ **Social Inclusion:** Establish an inclusive and equitable work environment where individuals with disabilities and their caregivers can thrive both economically and socially.
- ✔ **Cultural Preservation:** Showcase and preserve Bhutanese craftsmanship through the art of paper mache, reflecting Bhutan's rich cultural heritage.
- ✔ **Environmental Sustainability:** Utilize recycled materials and eco-friendly production methods to minimize environmental impact.
- ✔ **Market Expansion:** Develop a strong presence in domestic and international markets, attracting cultural enthusiasts and environmentally conscious consumers.
- **Skill Development:** Provide comprehensive training programs to enhance the artistic, technical, and entrepreneurial skills of employees, particularly PWDs and their caregivers.

7.2.2 Target Markets:

- **Local Market:**
  - ✔ Schools and educational institutions for cultural and creative art programs.
  - ✔ Bhutanese households and monasteries for decorative and ceremonial purposes.
  - ✔ Domestic tourists seeking unique and culturally significant souvenirs.
- **International Market:**

- ✔ Art collectors and enthusiasts who value authentic cultural artifacts.
- ✔ Eco-conscious buyers interested in handmade, sustainable products.
- ✔ Retail stores specializing in ethical and artisanal goods.
- ✔ Online platforms targeting global consumers, including marketplaces for sustainable and inclusive products.

7.2.3 Inputs:

7.2.3.1 Source of Materials

- **Waste Paper**
  - ✔ **Description:** The primary raw material will be sourced from various local entities, including businesses, educational institutions, and households**.**
  - ✔ **Collection Strategy:**
    - Build collaborations with local schools, offices, private organizations, and waste collection agencies to organize consistent paper collection schedules.
    - Consider implementing an incentive program to encourage participation (e.g., small discounts on products for those who contribute).
- **Natural Adhesives**
  - ✔ **Description:** Eco-friendly adhesives derived from natural sources (e.g., starch-based glues) will be used to bind the paper pulp.
  - ✔ **Sourcing Strategy:** Collaborate with local suppliers or farmers who can provide these materials sustainably.
- **Paints and Finishes:**
  - ✔ **Description:** Use non-toxic, water-based paints and finishes to ensure safety for users and environmental friendliness.
  - ✔ **Sourcing Strategy:** Partner with local artisans or suppliers specializing in eco-friendly products.

7.2.3.2 Quantity:

- **Initial estimate:** 100–300 kg of waste paper monthly.

Product Type	Units Produced	Paper per Unit (kg)	Total Paper Required (kg)

Full-Sized Masks	150	0.33	49.5 kg
Miniature Masks	300	0.1	30 kg
Decorative Items	200	0.2	40 kg
Functional Items	200	0.2	40 kg
Total Paper Waste			159.5 kg

- Additional quantities of adhesives and paints will depend on the specific designs and finishes used.

7.2.3.3 Training Required

- **Craftmanship Training:** Conduct hands-on workshops to train local artisans and community members in the techniques of paper mache mask-making. This includes skills such as pulp preparation, molding, painting, and finishing.
  - ✔ Workshops can be structured as weekend or monthly events to maximize participation**.**
- **Waste Management Training:**
  - ✔ Employees and contributors need education on proper waste segregation and preparation for reuse.
  - ✔ Awareness about sustainability and the importance of recycling should be emphasized**.**
- **Business Training:** Basic knowledge of inventory management, customer service, and marketing is crucial for team members involved in sales and operations.

7.2.3.4 Professional Support

- ✔ Collaborate with local artists and craftsmen experienced in traditional mask-making.
- ✔ Engage environmental consultants, NGOS, and waste experts for advice on sustainable practices and waste management strategies.
- ✔ **Business Consultants:** Guidance on market trends, branding, and pricing helps establish a competitive presence.

7.2.3.5 Tools and Equipment

Category	Details
Workshop Space	Dedicated area equipped with workstations for mask production.
Molds	Handcrafted and pre-designed molds for shaping paper mache masks.
Brushes and Tools	Painting brushes, sculpting tools, and finishing equipment.
Drying Racks	Shelves or racks for drying paper mache masks post-production.
Recycling Equipment	Shredders and mixers for preparing recycled paper pulp.
Storage Facilities	Spaces for storing raw materials, tools, and finished products securely.
Packaging Supplies	Biodegradable packaging materials such as paper boxes and eco-friendly tape.
Safety Equipment	Gloves, masks, and aprons to ensure safe working conditions.

7.2.3.6 Financial Resources:

- ✔ Initial funding from government grants, NGOs, or private donors committed to supporting inclusive and sustainable enterprises.
- ✔ Revenue generated through local and international sales to ensure long-term financial viability.

7.2.4 Process:

7.2.4.1 Collection:

- Set up designated collection points in communities where residents can drop off their waste paper.
- Schedule regular pickups from partner businesses and schools to maintain a steady supply of materials.

7.2.4.2 Production Process:

- **Preparation Phase:**
  - ✔ Shred the collected waste paper into small pieces using a paper shredder or manually if necessary.

- ✔ Soak the shredded paper in water for several hours to create a pulp that can be molded.

- **Molding Phase:**
  - ✔ Use molds made from durable materials (such as plastic or metal) shaped like various mask designs.
  - ✔ Apply a layer of pulp onto the mold, pressing it down firmly to ensure it takes shape. Allow excess moisture to drain off.

- **Drying Phase:**
  - ✔ Place the molded masks in a well-ventilated area or use drying racks to air-dry them completely. This process may take several days depending on humidity levels.

- **Painting and Finishing Phase:**
  - ✔ Once dry, masks can be painted using non-toxic paints that reflect Bhutanese artistic styles. Incorporate traditional motifs and colors.
  - ✔ Apply finishes (e.g., sealants) that enhance durability while ensuring they remain eco-friendly.

7.2.4.3 Resources Required:

- **Equipment Needed:** Basic tools such as blenders for creating pulp, molds for shaping masks, brushes for painting, drying racks, and safety gear (gloves, masks).
- **Workshop Space:** A dedicated space that accommodates production activities, workshops, and storage for raw materials. This could be a rented facility or a community center.

7.2.4.4 Quality Control

- Inspections ensure the masks are durable, visually appealing, and meet cultural standards.
- Faulty products are reprocessed, minimizing waste.

7.2.5 Outputs:

- **Products:**
  - ✔ High-quality, handcrafted paper mache masks available in various designs, sizes, and customizations.

- ✔ Specialty masks tailored for cultural events, personal collections, or home decor.

- **Social Impact:**
  - ✔ Direct employment and income generation for PWDs, children with disabilities, and their caregivers.
  - ✔ Increased self-confidence, skill development, and social integration for participants.
- **Environmental Impact:**
  - ✔ Reduction in paper waste through recycling and upcycling initiatives.
  - ✔ Promotion of environmentally sustainable production practices.
- **Cultural Impact:**
  - ✔ Preservation and global promotion of Bhutan's traditional artistic heritage.
  - ✔ Enhanced cultural appreciation among local and international audience

7.2.5.1 Marketing Strategies:

1. **Social Media Campaigns:**
   - ✔ Use platforms like Instagram, Facebook, and TikTok to showcase the inclusive story, eco-friendly production process, and cultural uniqueness of the masks.
   - ✔ Run paid ad campaigns targeting specific demographics such as eco-conscious buyers, art enthusiasts, and ethical shoppers.
2. **Partnerships and Collaborations:**
   - ✔ Partner with local tourism boards, cultural organizations, and NGOs to promote the masks as part of Bhutan's cultural identity.
   - ✔ Collaborate with international ethical brands and retailers to expand global reach.
3. **Participation in Events:**
   - ✔ Display products at local and international art fairs, cultural festivals, and sustainable business expos to attract attention and build networks.
   - ✔ Organize workshops and live demonstrations to engage the audience and build brand awareness.
4. **E-commerce Presence:**
   - ✔ Create a dedicated website with e-commerce functionality to enable direct online sales.

- ✔ Leverage global online marketplaces such as Etsy, Amazon Handmade, and other platforms specializing in sustainable products.

5. **Storytelling and Branding:**

   - ✔ Develop compelling narratives highlighting the stories of the artisans, their inclusion, and the sustainable nature of the products.
   - ✔ Use branding elements that reflect Bhutanese culture, such as traditional motifs and eco-friendly aesthetics.

6. **Local Engagement:**

   - ✔ Build partnerships with schools, religious institutions, and local businesses to promote masks for ceremonies, decorations, and educational purposes.
   - ✔ Encourage local influencers and public figures to endorse the products.

7. **Eco-Friendly Packaging and Messaging:**

   - ✔ Highlight the use of biodegradable packaging in marketing campaigns to attract environmentally conscious customers.
   - ✔ Use taglines or labels like "Made in Bhutan" or "Empowering Artisans" to build emotional connection.

7.2.6 SWOT Analysis

STRENGTH

- **Sustainable Practices:** The business promotes sustainability by repurposing waste paper, reducing landfill contributions, and minimizing environmental pollution.
- **Cultural Relevance:** Masks are integral to Bhutanese culture and traditions, allowing the business to resonate well with local customs and attract both local and tourist markets.
- **Community Engagement:** The model encourages community involvement through training workshops, fostering skills development, and creating job opportunities for local artisans.
- **Low Production Costs:** Utilizing readily available waste materials can significantly lower production costs compared to sourcing new raw materials.

WEAKNESS

- **Limited Awareness:** Community awareness regarding the importance of waste management and recycling may be low, which could affect participation in material collection initiatives.
- **Resource Constraints:** Initial investment in equipment and training may be challenging for a startup, especially in a developing market like Bhutan.
- **Quality Control:** Maintaining consistent quality in handmade products can be difficult, particularly when scaling production or training new artisans.
- **Market Competition:** Competing against established businesses that produce traditional crafts or imported goods may pose a challenge in terms of pricing and market share.

OPPORTUNITIES

- **Growing Eco-Consciousness:** Increasing global awareness about sustainability and eco-friendly products can drive demand for handcrafted, environmentally friendly masks.
- **Tourism Potential:** As Bhutan is known for its rich cultural heritage, there is an opportunity to market these masks as unique souvenirs to tourists visiting the country.
- **Partnerships with NGOs:** Collaborating with non-governmental organizations focused on environmental conservation could provide additional resources and funding opportunities.
- **Expansion of Product Line:** Beyond masks, there is potential to diversify into other paper mache products (e.g., decorative items, statues, educational tools) that could appeal to broader markets.

THREATS

- **Environmental Regulations:** Stricter regulations regarding waste management could impose additional operational challenges or costs if compliance becomes necessary.
- **Economic Factors:** Economic downturns or fluctuations could reduce disposable income among consumers, impacting sales of non-essential items like decorative masks.
- **Market Saturation:** The rise of alternative sustainable products or competitors entering the market could dilute market share and increase competition.
- **Supply Chain Issues:** Disruptions in the supply chain for raw materials due to environmental factors or logistical challenges could hinder production capabilities.

7.2.7 Financial Analysis

Initial Investment

Category	Estimated Cost (Nu.)	Notes
Facility setup (rent or construction)	1,500,000	Includes workshop space, storage, and display area.
Equipment and tools	300,000	Basic tools for crafting, drying, and painting masks.
Raw materials procurement	200,000	Paper waste, adhesives, paints, and eco-friendly coatings.
Training programs for artisans	150,000	Training locals in paper mache techniques and designs.
Marketing and branding	250,000	Promotional campaigns targeting tourists and eco-markets.
Licensing and regulatory fees	100,000	Approvals for business operations and export if needed.
Miscellaneous and contingency funds	200,000	Buffer for unforeseen expenses.
Total Initial Investment	**2,700,000**	

Monthly Operational Costs

Category	Estimated Cost (Nu.)	Notes
Salaries (10 artisans + 2 staff)	150,000	Includes production, admin, and sales staff.
Utilities (electricity, water, etc.)	15,000	Reduced utilities due to eco-friendly processes.
Raw material procurement	40,000	Includes recycled paper, natural pigments, etc.
Marketing and outreach	20,000	Focus on affordable, local campaigns and tourist promotion.
Maintenance and repairs	10,000	Upkeep of tools and workspace.
Miscellaneous expenses	10,000	Buffer for unexpected costs.
Total Monthly Operational Costs	**245,000**	

Monthly Revenue Projections

Product Type	Units Produced	Price per Unit (Nu.)	Units Sold (Est.)	Monthly Revenue (Nu.)	Product Type
Full-Sized Masks	150	1,500	120	180,000	Full-Sized Masks

Miniature Masks	300	300	250	75,000	Miniature Masks
Decorative Items	200	700	150	105,000	Decorative Items
Functional Items	200	500	150	75,000	Functional Items
Total Monthly Revenue				435,000	Total Monthly Revenue

Monthly Profit Analysis

Metric	Amount (Nu.)
Total Monthly Revenue	435,000
Total Monthly Operational Costs	245,000
Monthly Profit	190,000

Break Even Period Analysis

Metric	Amount (Nu.)
Total Initial Investment	2,700,000
Monthly Profit	190,000
Break-Even Period	14 months

7.3 Business Model for Upcycled Old Textiles

The integrated management of textile waste presents a transformative opportunity for Bhutan to address its growing waste management challenges while aligning with its national commitment to sustainability and Gross National Happiness (GNH). With the increasing generation of waste from discarded garments, industrial by-products, and imported goods, managing textile waste has become a pressing need. This business model aims to create value from waste by recycling and upcycling these materials into marketable products, contributing to Bhutan's circular economy. By blending traditional craftsmanship with modern sustainability practices, the initiative not only reduces environmental impacts but also preserves Bhutanese cultural heritage through innovative product designs. Furthermore, this approach fosters local employment, skill development, and community engagement, empowering individuals to participate in sustainable development. With

strong government support, a burgeoning market for eco-friendly goods, and an emphasis on cultural preservation, this initiative positions Bhutan as a leader in sustainable waste management while delivering socio-economic and environmental benefits.

7.3.1 Objectives:

- ✔ **Sustainability:** To reduce textile waste by upcycling materials and transforming them into innovative products that contribute to environmental preservation.
- ✔ **Inclusivity:** Provide opportunities for persons with disabilities, children with disabilities, and their caregivers to engage in meaningful employment and creative tasks. This can involve job creation, skill development, and providing a platform for artistic expression.
- ✔ **Product Diversity:** Broaden the product range to include functional and decorative items like table runners, bed runners, cloth bags, etc.
- ✔ **Community Engagement:** Integrate quilting techniques and offer classes/workshops to foster a sense of community, supporting both experienced quilters and beginners.

7.3.2 Target Market

- **Eco-Conscious Consumers**: Individuals, who prioritize sustainability and eco-friendly products.
- **Home Decor Enthusiasts**: Customers seeking unique, handcrafted home decor items like table runners and bed runners.
- **Persons with Disabilities & Caregivers**: Empowering individuals with disabilities and their caregivers by offering employment and skill-building opportunities.
- **Quilting Enthusiasts**: Crafters looking for sustainable quilting supplies, finished quilted products, and DIY kits.
- **Social Enterprises & NGOs**: Non-profit Organizations and social businesses looking for products that align with sustainability and social impact.
- **Local Artisans & Small Businesses**: Businesses looking for unique, eco-friendly products to sell in their stores.
- **Online Shoppers & Subscription Box Consumers**: Consumers who enjoy receiving curated, sustainable products through online stores or subscription services.
- **Corporate Clients & Event Planners**: Businesses and planners seeking eco-friendly promotional items and event decor.

7.3.3 Inputs

7.3.3.1 Sources for Textile Waste:

- The raw materials will primarily come from industrial scraps, post-consumer garments, factory waste, textile offcuts, and donations from the community. The textiles will be sorted into categories such as fabric type (cotton, polyester, wool, etc.) and condition, ensuring they are suitable for specific products, such as home decor items, or quilting materials.

7.3.3.2 Households:

- Target areas: Urban centers (Thimphu, Paro, Phuentsholing) and rural settlements.
- Engage with local communities to collect unwanted clothing and textiles through awareness campaigns.
- Establish drop-off centers in residential areas for convenient disposal.

7.3.3.3 Commercial Units:

- Partner with retail stores, boutiques, and manufacturers to gather unsold inventory and damaged goods.
- Collaborate with hotels and restaurants for discarded linens and uniforms.
- Leather scraps from limited local production and discarded leather goods.
- Old shoes, belts, jackets, and handbags from households and commercial establishments.

7.3.3.4 Institutions:

- Work with schools, colleges, and NGOs to facilitate textile donation drives.
- Organize community events to encourage the donation of used textiles.

7.3.3.5 Training Requirements

1. **Skill Development for Staff:**

- Sorting textile by material type and quality.
- Safety protocols for handling and cleaning waste textiles.
- Techniques for basic repair, upcycling, sewing techniques, recycling processes and product design to enhance local craftmanship.

2. **Community Awareness:**

- Awareness campaigns on segregation of textile waste at the source.
- Workshops on upcycling and DIY repair methods.
- Implement educational initiatives targeting communities to raise awareness about the environmental impacts of textile waste and the benefits of recycling. Use multimedia approaches (posters, social media campaigns) to reach a wider audience.

3. **Specialized Training for Supervisors:**

- Inventory management and waste tracking systems.
- Quality control and product development.

7.3.3.6 Professional Support

- **Partnerships with NGOs:** Collaborate with organizations such as Clean Bhutan for expertise in waste management practices and community engagement strategies. These partnerships can enhance credibility and outreach efforts.
- **Academic Collaborations:** Partner with local universities for research support, curriculum development, and innovation in textile and leather recycling technologies. Students can participate in internships or projects related to textile waste management.
- **Consultants:** Engage experts in sustainable fashion and circular economy practices to provide guidance on best practices and operational efficiency. These consultants can help optimize processes and ensure compliance with environmental regulations.

7.3.3.7 Tools and Equipment

Category	Tools/Equipment	Purpose
Machinery	Shredders and Fabric Cutters	Break down textiles and leather into smaller pieces for reuse or processing.
Sewing Machines	Assemble upcycled products like bags, quilts, and home decor items.	
Industrial Washing Machines	Clean collected textile waste thoroughly.	

Industrial Dryers	Quickly dry fabrics post-wash for production.	
Dyeing Equipment	Use eco-friendly processes and natural dyes to color textiles.	
Compactors and Balers	Compress textile waste into manageable bales for storage or transport.	
Facility Requirements	Sorting Stations	Categorize textiles by material type and usability.
Production Spaces	Provide space for sewing, cutting, and prototyping activities.	
Storage Units	Organize raw materials and finished goods.	
Safety and Ventilation	Ensure a safe working environment with proper ventilation.	
Transportation Logistics	Mobile Collection Fleet	Collect textile waste from households, commercial units, and institutions.
Distribution Vehicles	Deliver finished products to retailers and customers efficiently.	
Specialized Tools	Prototyping Tools	Create patterns and test product designs.
Quality Control Instruments	Inspect and ensure product standards.	

7.3.4 Process

7.3.4.1 Collection

Establish Collection Points: Set up strategically located drop-off centers in urban areas (e.g., shopping malls, community centers) and rural communities to facilitate easy access for residents.

- **Partnerships:** Collaborate with municipal waste departments and NGOs for collection.
- **Collection Drives:** Conduct regular community events to collect unwanted textiles.

Mobile Collection Service:

- Implement a scheduled mobile collection service using designated vehicles to reach areas, ensuring inclusivity in waste collection efforts. Promote this service through local media channels.

7.3.4.2 Sorting and Processing

Sorting Facility:

- Create a dedicated facility equipped with sorting stations where textiles are categorized by material type (cotton, polyester, wool, leather) and condition (usable vs. non-usable). Employ trained staff to ensure efficient sorting processes.

Washing & Drying:

- The collected textile waste will go through a washing process in industrial washing machines to remove dirt and stains. After washing, industrial dryers will be used to quickly dry the fabrics, ensuring they are ready for cutting and sewing.

Processing Machinery:

- Invest in machinery such as shredders, fabric cutters, balers, and compactors to convert sorted textiles into reusable fibers or materials suitable for production. Ensure that machinery is energy-efficient to minimize environmental impact.
- **Design & Prototyping**: Designers will create patterns and prototypes for different products, including table runners, bed runners, cloth bags, and quilts. The designs will incorporate unique patterns, textures, and eco-friendly materials. Prototypes will be tested to ensure they meet quality standards.
- **Quality Control**: After assembly, the products will undergo rigorous quality control inspections. These inspections will ensure that the products are safe, durable, and free from defects. Finished products will be carefully folded and packaged in eco-friendly materials such as recycled paper or cloth bags.

7.3.4.3 Resources Required

Machinery Investment: Acquire essential equipment including:

- ✔ Shredders and fabric cutters for breaking down textiles and leathers into smaller pieces.
- ✔ Sewing machines for product assembly.

- ✔ Dyeing equipment that utilizes eco-friendly processes (e.g., natural dyes).
- ✔ Compactors and balers to compress clothing and other textile into bales that are easier to store and transport to recycling facilities.

Facility Requirements:

- ✔ Secure a facility that accommodates sorting, processing, storage, and production activities while ensuring compliance with health and safety regulations. The facility should have adequate ventilation and space for workers.

Transportation Logistics:

- ✔ Develop a fleet of vehicles for efficient collection of textile waste from various sources as well as distribution of finished products to retailers or customers.

7.3.5 Outputs

Create a diverse range of products including:

- Traditional Bhutanese garments (gho, kira) made from recycled fabrics.
- Fashion accessories (bags, scarves) designed by local artisans using upcycled materials.
- Home textiles (cushions, blankets, table and bed runners) crafted from recycled materials that reflect Bhutanese culture.
- Recycled yarn for local weaving industries.
- **Workshops & Events**: The business will host workshops and skill-building sessions for the community, providing educational and social opportunities.
- **Job Creation:** Employing local workers for collection, sorting, and processing.
- **Social Impact:** The business will create jobs for persons with disabilities, children with disabilities, and their caregivers, helping to improve their quality of life. Specialized training programs will help individuals develop new skills, fostering greater independence and participation in the workforce.
- **Environmental Impact:** By upcycling textile waste, the business will contribute to reducing landfill waste and promoting a circular economy. The use of sustainable materials and eco-friendly processes will also minimize the environmental impact of production.

7.3.5.1 Marketing Strategy

- **Brand Development:** Establish a strong brand identity focused on sustainability, quality craftsmanship, and community engagement. The brand should communicate its mission clearly through all marketing materials.
- **Digital Marketing Campaigns:** Utilize social media platforms (Facebook, Instagram, Tik Tok) to promote products, share success stories of artisans involved in the process, and educate consumers about the benefits of recycling textiles.
- **Community Engagement Events:** Organize workshops and exhibitions showcasing the upcycling process while providing hands-on experiences for participants. These events can help build community support and raise awareness about textile waste issues.

Sales Channels

- **E-commerce Platform:** Develop an online store to reach national and international markets while providing detailed product descriptions that highlight the sustainable aspects of each item.
- **Local Markets & Fairs**: Participate in local markets, craft fairs, and exhibitions to showcase products directly to consumers while fostering community connections. This direct interaction can help build brand loyalty.
- **Retail Partnerships:** Collaborate with eco-friendly boutiques (Local and international) that align with the brand's values for consignment or wholesale opportunities. Retail partnerships can expand market reach significantly.

7.3.6 SWOT Analysis

STRENGTH

1. **Community Engagement:** Existing initiatives like Gola-Gola Bhutan demonstrate a strong community interest in addressing textile waste through donation and recycling efforts. This grassroots support can facilitate the collection and processing of textile waste.
2. **Cultural Relevance:** The business model focuses on creating traditional Bhutanese garments (gho and kira) from recycled materials, aligning with cultural practices and enhancing local pride in sustainable products.

3. **Growing Global Market for Eco-Friendly Products:** The increasing demand for upcycled, sustainable, and culturally unique products positions the business well to attract international and premium markets.
4. **Government and Community Support:** Bhutan's proactive stance on sustainability and waste management ensures potential policy support, grants, or incentives for green initiatives. Community awareness of environmental issues further strengthens public buy-in.
5. **Diverse Product Portfolio:** Combining textile and leather waste increases product variety, including recycled fibers, upcycled garments, bags, accessories, table and bed runners and high-value patchwork products.

WEAKNESS

1. **Infrastructure Limitations:** Current recycling infrastructure in Bhutan is limited, particularly for processing textile waste effectively. The establishment of sorting and processing facilities requires significant investment and time to develop.
2. **Initial Capital Investment:** High upfront costs associated with machinery, facility setup, and training programs may deter potential investors or stakeholders from committing to the project initially.
3. **Quality of Collected Waste:** The quality of textile and leather waste can vary significantly, with contamination from non-recyclable materials posing challenges for effective processing. Poor quality waste may lead to higher operational costs and lower product quality.
4. **Skilled Labor Shortage:** A lack of trained personnel for textile repair, upcycling, and recycling processes may slow operations initially.
5. **Market Development:** Limited domestic demand for recycled and upcycled products may pose challenges in achieving sales targets locally.
6. **Lack of Awareness:** Many Bhutanese households and businesses may not yet prioritize textile waste segregation, requiring extensive awareness campaigns.

OPPORTUNITIES

1. **Growing Market Demand for Sustainable Products:** There is an increasing global trend towards sustainability in fashion, providing a market opportunity for eco-friendly products made from recycled textiles. High-quality upcycled and recycled products from Bhutan could attract global markets, especially eco-conscious consumers in Europe, North America, and Asia.
2. **Tourism Industry:** Bhutan's thriving tourism sector provides an opportunity to market upcycled and culturally inspired products as unique souvenirs.
3. **Youth Engagement:** Young Bhutanese entrepreneurs and artisans are increasingly interested in sustainable and creative businesses, offering a talent pool for the venture. Furthermore, by offering training programs for local artisans and community members, the business can empower individuals while creating a skilled workforce capable of producing high-quality recycled products.
4. **Technology Integration:** Adopting advanced recycling technologies and digital platforms for marketing and e-commerce can enhance efficiency and market reach.
5. **Government Support for Sustainable Initiatives:** The government of Bhutan supports sustainable development initiatives, including waste management projects that align with the country's environmental goals. This could lead to potential funding or grants for the business model.
6. **Potential for Carbon Trading:** The project may contribute to Bhutan's carbon trading market by reducing carbon emissions through local production processes, enhancing its appeal to environmentally conscious consumers and investors.

THREATS

1. **Consumer Behavior:** Changing consumer habits in Bhutan, with an increasing inclination toward fast fashion, could counteract efforts to promote recycling and reuse.
2. **Cultural Resistance:** There may be cultural resistance to using recycled textiles due to perceptions about quality or stigma associated with second-hand goods. Overcoming these perceptions will require targeted marketing and education initiatives.

3. **Dependency on External Funding:** If the business model relies heavily on grants or external funding for startup costs and operations, any reduction in available funding could jeopardize sustainability and growth.
4. **Competition from Fast Fashion Brands:** Fast fashion brands often dominate the market with low-cost, trendy clothing options. Their aggressive pricing strategies can make it challenging for a sustainable textile recycling business to attract price-sensitive consumers.
5. **Consumer Preferences:** Shifts in consumer preferences towards fast fashion or new products may reduce the demand for recycled textiles and leather goods. If consumers prioritize new over recycled products, this could hinder sales growth.
6. **Fluctuating Raw Material Availability:** The availability of textile waste may fluctuate due to seasonal changes, economic conditions, or shifts in consumer behavior. This inconsistency can disrupt supply chains and affect production schedules.
7. **Regulatory Changes:** Changes in government policies or regulations regarding waste management and recycling could impose new compliance costs or operational restrictions that affect business viability.

7.3.7 Financial Analysis

Initial Investment

Category	Estimated Cost (Nu.)	Category
Facility Setup (sorting, production, and storage spaces)	150,000	Facility Setup (sorting, production, and storage spaces)
Machinery & Tools (shredders, sewing machines, balers, cutters, etc.)	500,000	Machinery & Tools (shredders, sewing machines, balers, cutters, etc.)
Raw Materials (initial batch of textile waste collection)	50,000	Raw Materials (initial batch of textile waste collection)
Transportation Vehicles (collection and delivery fleet)	200,000	Transportation Vehicles (collection and delivery fleet)
Training Programs for Workers (sorting, sewing, upcycling techniques)	100,000	Training Programs for Workers (sorting, sewing, upcycling techniques)
Branding and Marketing Setup (logo, website, social media campaigns)	50,000	Branding and Marketing Setup (logo, website, social media campaigns)

Miscellaneous and Contingency Funds	50,000	Miscellaneous and Contingency Funds
Total Initial Investment	**1,100,000**	**Total Initial Investment**

Monthly Operational Costs

Category	Estimated Cost (Nu.)
Raw Material Collection (logistics, campaigns)	20,000
Labor Costs (10 workers, Nu. 10,000/month average)	100,000
Utilities (electricity, water, etc.)	10,000
Maintenance of Machinery & Tools	10,000
Marketing and Distribution	20,000
Administrative Costs (rent, office supplies, etc.)	50,000
Miscellaneous Expenses	10,000
Total Monthly Operational Costs	**220,000**

Revenue and Profit Analysis

Category	Value (Nu.)
Monthly Production (units)	1,500
Average Selling Price per Product	300
Total Monthly Revenue	450,000
Monthly Operational Costs	220,000
Net Profit per Month	230,000

Breakeven Analysis

Category	Value (Nu.)
Initial Investment	1,100,000
Monthly Net Profit	230,000
Break-Even Period	5 months

Product Diversity & Pricing

Product	Units Produced (Monthly)	Average Selling Price (Nu.)	Revenue (Nu.)
Cloth Bags	500	250	125,000
Table & Bed Runners	500	400	200,000
Quilted Products (scarves, cushions, etc.)	300	350	105,000
Recycled Yarn	200 kg	100	20,000
Total Revenue			**450,000**

7.4 Business Model for Upcycled Cement Bags

The goal of this business is to create a sustainable and inclusive model by transforming used cement bags, typically discarded as waste, into useful, durable products. Cement bags are often made from strong, reusable materials, making them ideal for upcycling into items like furniture, accessories, home decor, and practical tools. This venture goes beyond environmental sustainability. It also aims to empower people with disabilities, children with disabilities, and their caregivers by providing them with opportunities for employment, skill development, and economic independence. By integrating inclusive practices into the production process, this model focuses on community-building and social empowerment, offering marginalized groups a platform to contribute to and benefit from the workforce.

As a circular economy model, this initiative will both minimize waste and promote inclusive entrepreneurship. It will help individuals from all backgrounds—particularly those with disabilities—gain valuable skills that will serve them in the long run. Additionally, it offers a tangible solution to waste management by turning cement bags into high-value products, thereby addressing the growing global demand for eco-friendly, upcycled goods.

7.4.1 Objectives

- ✔ **Environmental Sustainability**: Reduce the environmental impact of cement bags by upcycling them into functional products. The goal is to minimize landfill waste while promoting recycling, reuse, and reducing the need for raw materials.

- ✔ **Social Inclusion:** Provide inclusive job opportunities for people with disabilities, children with disabilities, and their caregivers. The initiative will focus on employing individuals who may have limited access to mainstream job markets, giving them a sense of purpose, financial independence, and recognition.
- ✔ **Empowerment Through Skill Development:** Offer vocational training programs for individuals with disabilities. By teaching skills such as crafting, sewing, and design, the model empowers them to gain confidence, build capabilities, and foster a sense of belonging in the workplace.
- ✔ **Community Support and Economic Development:** Foster a sense of community by creating an inclusive work environment. In addition to economic development for the participants, the project will positively impact local communities by creating a supportive ecosystem of collaboration and inclusion.
- ✔ **Innovation in Recycling:** Develop new and innovative ways to reuse cement bags, turning them into aesthetically appealing, functional products that meet market demands. Constant product innovation will keep the business dynamic and adaptable to consumer trends.

7.4.2 Target Market

- **Locals:** Households, tourists, and businesses looking for eco-friendly, handcrafted products.
- **Tourists:** Bhutan attracts eco-conscious travelers interested in unique, sustainable souvenirs.
- **International Markets:** Export opportunities for eco-friendly products, particularly to countries focusing on sustainability.
- **Businesses:** Local businesses requiring custom packaging, promotional items, or unique decor for offices, hotels, etc.

7.4.3 Input

7.4.3.1 Raw Materials:

- **Cement Bags:** The primary material for production. These can be sourced from local construction sites, factories, or even individual donations from consumers. They need to be collected, sorted, and cleaned before being repurposed.

- **Other Materials:** In some cases, the cement bags may be combined with other materials, such as fabric, leather, or upcycled wood, depending on the products being created.

7.4.3.2 Human Resources:

- **Craftspeople and Designers:** These individuals will design the products, turning recycled cement bags into functional items like ropes, flower pots , home accessories, cup coasters and more.
- **Trainers/Facilitators:** Specialized trainers will be hired to teach people with disabilities and their caregivers the necessary skills for producing and designing the products. The trainers should be experienced in working with diverse populations and know how to adapt their teaching methods.
- **Production Workers:** Skilled artisans and assembly-line workers will take on roles in sewing, cutting, assembling, and finishing the products. Workers will be a mix of individuals with and without disabilities, promoting inclusive teamwork.
- **Management and Operations:** Experienced managers will handle logistics, inventory, quality control, distribution, and coordination with stakeholders. There will also be a strong focus on ensuring that the workplace is accessible and accommodating for individuals with disabilities.

7.4.3.3 Funding:

- **Start-Up Capital:** To establish the business, funding will be needed for securing a workshop space, purchasing materials, and investing in tools and equipment.
- **Grants and Donations:** Some of the funding can be sourced from government programs, NGOs, and organizations that support businesses focused on sustainability and disability inclusion.
- **Crowdfunding:** Public campaigns can raise awareness and funds for the venture.

7.4.3.4 Tools and Equipment

Category	Tools/Equipment	Purpose/Function
Basic Processing Tools	Sewing Machines	For stitching cement bags into products like bags, furniture upholstery, and accessories.

Cutting Tools	Scissors, industrial cutters, and rotary cutters for cutting cement bags into required sizes and shapes.	
Stitching/Binding Tools	For reinforcing seams, stitching cement bags, and adding finishing touches to products.	
Molds and Frames	For shaping cement bags into products like furniture, planters, or sculptures.	
Measuring Tools	Tape measures, rulers, and calipers to ensure precise cutting and assembly of items.	
Cleaning Equipment	Industrial Cleaning Machine	For removing dust, residues, or any unwanted material from used cement bags before repurposing them.
Washing Station	A system or manual washing station with water tanks, brushes, and detergent for thorough cleaning of cement bags before further processing.	
Drying Machine	To dry cleaned cement bags effectively before they are used in production. This could be a large drying rack or industrial dryers.	
Assembly and Production	Hot Glue Guns	For adhering different parts of the products, especially in crafting and assembly tasks.
Screwdrivers/Power Tools	For assembling larger products or furniture (if cement bags are used as	

	upholstery or as part of a wooden frame).	
Staplers and Riveting Tools	To reinforce or attach different layers of materials (e.g., cement bags combined with wood or fabric).	
Design Tools	CAD Software	Computer-aided design software for creating product prototypes and production templates.
Graphic Design Tools	For designing printed or decorative elements to be added to products, such as logo designs or patterns on the cement bags.	
Finishing Equipment	Heat Press or Ironing Machines	For smoothing out wrinkles and shaping the cement bag materials, especially for bags or accessories.
Painting Equipment	Brushes, spray guns, and airbrushes for decorating products, adding colors, and enhancing their visual appeal.	
Polishing Tools	For giving products, a clean, finished look, especially if they are used for furniture or decorative pieces.	
Packaging Equipment	Packaging Machines	For packing finished products securely, especially for bulk items such as upcycled furniture, bags, or planters.
Labeling and Printing Equipment	For adding labels, branding, and product information onto the finished products.	

Storage Equipment	Racks and Shelving	To store raw cement bags before processing, as well as finished products waiting for sale or delivery.
Inventory Management Tools	Barcode scanners, inventory software, or tracking systems to manage raw materials and finished goods.	
Category	Tools/Equipment	Purpose/Function
Basic Processing Tools	Sewing Machines	For stitching cement bags into products like bags, furniture upholstery, and accessories.
Cutting Tools	Scissors, industrial cutters, and rotary cutters for cutting cement bags into required sizes and shapes.	
Stitching/Binding Tools	For reinforcing seams, stitching cement bags, and adding finishing touches to products.	

7.4.4 Process:

7.4.4.1 Collection and Sorting:

- Cement bags will be collected from construction sites, businesses, or individuals. These bags are often discarded, but by collecting them, we provide a sustainable alternative to sending them to landfills. The bags are cleaned, sorted, and prepared for transformation. This may involve removing any residues and ensuring the bags are safe for use.

7.4.4.2 Design and Prototyping:

- Designers will work with the team to create prototypes for products that can be made from the cement bags, such as chairs, planters, and bags. Prototypes are tested for durability, practicality, and aesthetics.

7.4.4.3 Training and Skill Development:

- Workshops will be set up to train people with disabilities and their caregivers. The training will focus on crafting techniques such as sewing, cutting, stitching, and assembling. Specialized tools will be provided for workers with physical disabilities, ensuring they have access to an inclusive workspace.

7.4.4.4 Production:

- Once workers have gained the necessary skills, they will start producing products based on the designs. The production process will be accessible, with stations tailored for individuals with varying levels of ability.

7.4.4.5 Quality Control and Finishing:

- Every product will undergo a quality check to ensure it is durable, functional, and safe. The final product will be polished, painted, or decorated to enhance its appeal.

7.4.4.6 Packaging and Distribution:

- The products will be packaged sustainably and shipped. Sales will occur through local markets, direct partnerships with retailers, or online platforms.

7.4.5 Output

7.4.5.1 Finished Products:

- These will include eco-friendly items such as recycled bags, upcycled furniture, planters, and accessories made from cement bags.

7.4.5.2 Employment:

- The project will create inclusive job opportunities for people with disabilities, children with disabilities, and their caregivers, which will help empower them financially and socially.

7.4.5.3 Community Impact:

- This business will foster a sense of social responsibility within the community by creating a space where marginalized groups can thrive and contribute.

7.4.5.4 Educational Resources:

- As part of the mission to educate others about the importance of sustainability and inclusivity, the business will develop educational materials such as tutorials, workshops, and awareness campaigns.

7.4.5.5 Marketing Strategies:

- **Inclusive Brand Storytelling:** Highlight the social impact of the business through storytelling. Share the personal journeys of the workers, particularly individuals with disabilities, to create an emotional connection with customers.
- **Social Media Marketing:** Platforms like Instagram, Facebook, and TikTok can be used to share behind-the-scenes footage of the production process, including the inclusion of people with disabilities. Engaging content such as product demos, employee stories, and DIY tutorials can increase consumer interest.
- **Community Engagement:** Organize local events to introduce the products, focusing on creating a dialogue about sustainability and inclusion. Community-based markets and pop-up stores will serve as an excellent way to build a customer base.
- **Collaborations with Influencers:** Partner with influencers who advocate for sustainability, inclusion, and disability rights. Influencers can promote the products and help spread the message of the business.
- **Corporate Partnerships and Corporate Social Responsibility (CSR):** Partner with corporations for exclusive collaborations or corporate gifts. By incorporating upcycled products into their CSR initiatives, businesses can help promote the mission of social responsibility and environmental awareness.
- **Online Presence and E-commerce:** A website and online store will allow for wider reach. Offering direct sales via e-commerce will help boost revenue and increase visibility for the business.

7.4.6 SWOT Analysis

SWOT FACTORS	DETAILS

STRENGTH	**Environmental Alignment:** The business supports Bhutan's commitment to environmental sustainability and waste management, helping reduce landfill waste and promoting eco-friendly practices.
	Social Impact: It provides employment and training for people with disabilities and their caregivers, supporting Bhutan's focus on Gross National Happiness (GNH) and social inclusion.
	Government Support: Bhutan's government encourages businesses that promote sustainability and inclusivity, potentially offering grants, subsidies, and tax incentives to support such ventures.
	Unique Products: The use of cement bags as a raw material offers a unique product line (e.g., upcycled bags, furniture, and accessories), catering to consumers who prioritize sustainability and local craftsmanship.
WEAKNESSES	**Awareness Gap:** Upcycled products, specially made from cement bags, may be unfamiliar to the Bhutanese market. Educating consumers about the durability, aesthetics, and environmental benefits will be necessary.
	Sourcing Challenges: Gathering a consistent supply of clean, usable cement bags from construction sites or distributors could be difficult. The cleaning process may also be labor-intensive and time-consuming.
	Skill Shortage: The business depends on artisans with specialized skills. There may be limited availability of trained workers, and the need for extensive training of employees, particularly those with disabilities, may delay production.
	Small Market Size: Bhutan's population is relatively small, which may restrict the immediate local market for the products. Scaling up beyond the local market could require additional investment and resources.
	Global Eco-Trend: There is a growing global demand for sustainable and recycled products, making this an ideal time to market eco-friendly, upcycled products, not only locally but also internationally.

OPPORTUNITIES	**Partnerships:** Potential for partnerships with NGOs, international organizations, or government agencies that focus on sustainability, disability inclusion, or waste management. These partnerships could provide funding, resources, and networking opportunities.
	Export Potential: There's an opportunity to export upcycled products to international markets, particularly those with strong eco-conscious consumer bases. Bhutan's clean and green image could be leveraged for global branding.
	Digital Marketing and E-Commerce: The rise of online platforms and e-commerce provides cost-effective marketing channels. By creating a strong online presence, the business could expand its customer base locally and internationally.
THREATS	**Competition:** The business may face competition from mass-produced, imported goods that are cheaper. Consumers could perceive these products as higher quality or more reliable, challenging the business's pricing strategy.
	Economic Uncertainty: Bhutan's economy is still developing, and a downturn could limit consumer spending. Additionally, changes in government policies or reduced funding for social enterprises could impact the business.
	Cultural Resistance: Traditional consumers may be skeptical about products made from used cement bags, which could hinder sales. Overcoming these cultural perceptions and educating the market will require effort and time.
	Logistical Barriers: Distribution can be challenging, especially in rural Bhutan where infrastructure might be limited. Furthermore, exporting to international markets may require navigating complex logistics and customs regulations.

7.4.7 Financial Analysis

Initial Investment

Category	Estimated Cost (Nu.)
Workshop Space (rented)	50,000
Tools & Equipment (sewing machines, cutters, cleaning machines, etc.)	300,000
Initial Raw Materials (cement bags, supplementary materials)	50,000
Training and Skill Development Programs	100,000
Furniture and Setup for Inclusive Workspace	100,000
Marketing and Branding	50,000
Miscellaneous & Contingency	50,000
Total Initial Investment	**700,000**

Monthly Operational Costs

Category	**Estimated Cost (Nu.)**
Raw Material Procurement	25,000
Labor Costs (10 workers, Nu. 8,000/month average)	80,000
Utility Costs (electricity, water, etc.)	10,000
Maintenance of Tools and Equipment	5,000
Marketing and Distribution	15,000
Administrative Costs (rent, office supplies, etc.)	50,000
Miscellaneous	10,000
Total Monthly Operational Costs	**195,000**

Revenue and Profit Analysis

Category	Value (Nu.)

Monthly Production (units)	1,000
Average Selling Price per Product	300
Total Monthly Revenue	**300,000**
Monthly Operational Costs	195,000
Net Profit per Month	**105,000**

Break-Even Analysis

Category	**Value (Nu.)**
Initial Investment	700,000
Monthly Net Profit	105,000
Break-Even Period	**7 months**

7.5 Business Model: Clothes from Recycled Products

This business model focuses on producing recycled cloth products, such as plain cloth for school uniforms and hospital use, from waste textiles. The initiative addresses Bhutan's commitment to sustainability by reducing textile waste while providing affordable, high-quality products. The project emphasizes inclusivity, engaging individuals with disabilities, caregivers, and marginalized groups in the production process, and aligns with Bhutan's Gross National Happiness (GNH) principles of sustainable development and social equity.

7.5.1 Objectives

- Transform textile waste into high-quality recycled fabric for institutional use, including school uniforms and hospital linens.
- Promote sustainable waste management by reducing textile waste.
- Create inclusive employment opportunities for diverse groups, including persons with disabilities and their caregivers.
- Ensure affordability and accessibility of recycled fabric products for schools and healthcare institutions.

7.5.2 Target Market

1. **Primary Market**: Bhutanese schools and healthcare institutions needing affordable, durable fabrics.
2. **Secondary Market**: Local garment manufacturers producing uniforms or hospital linens.
3. **International Market**: Export opportunities for eco-conscious buyers in South Asia and beyond.

7.5.3 Inputs

7.5.3.1 Raw Materials:

Waste textiles are sourced from garment factories, households, second-hand clothing shops, and local waste management facilities. These materials include used clothes, discarded fabric scraps, and other textile waste. Sorting is done to separate usable fibers from non-recyclable materials.

7.5.3.2 Machinery and Equipment:

Textile Shredders	**Function**	The textile shredder is the first machine in the recycling process. It breaks down collected waste textiles into smaller fibers. This step is essential for converting unusable fabric pieces into raw fiber, which can be further processed.
	Features	Shredders are equipped with sharp blades that cut through various types of fabric, including cotton, polyester, and blended materials. Advanced shredders have settings to ensure even-sized fibers for consistent quality in the end product.
Carding Machines	**Function**	The carding machine aligns and prepares the shredded fibers for spinning. This process improves the uniformity of the fibers and removes impurities or remaining debris.
	Features	The machine consists of a series of rotating drums and wire rollers that comb the fibers, ensuring they are evenly distributed. It creates a continuous web of aligned fibers, which is then divided into slivers (thin strands of fibers).
Spinning Machines	**Function**	Spinning machines convert the aligned fibers into yarn. This step transforms loose fibers into a continuous strand that can be woven into fabric.

	Features	Modern spinning machines allow for the adjustment of yarn thickness and strength, depending on the requirements of the final product (e.g., school uniforms or hospital linens). The machines also ensure consistency and reduce material wastage.
Weaving Looms	**Function**	The weaving loom interlaces the yarns to produce plain cloth. This is the primary step where the fabric structure is created.
	Features	Industrial looms can handle different types of yarns and create various textures, such as smooth fabric for hospital linens or slightly thicker fabric for uniforms. Automatic looms reduce the need for manual labor and increase production efficiency.
Dyeing Machines	**Function**	These machines add color to the woven fabric. Dyeing is an essential process for meeting the specific needs of institutions, such as schools and hospitals, which often require fabrics in designated colors.
	Features	Eco-friendly dyeing machines use minimal water and dyes that are biodegradable and safe for both humans and the environment. Advanced machines also have features for controlling color intensity and evenness.
Finishing Equipment	**Function**	After dyeing, the fabric undergoes finishing processes to improve its texture, durability, and overall quality. This includes treatments for softening, wrinkle resistance, and strength enhancement.
	Features	Finishing equipment includes calendaring machines for smoothing the fabric and coating machines for adding protective layers. This ensures the fabric meets quality standards and can withstand repeated use and washing.
Quality Control Tools	**Function**	These tools are used to inspect and test the fabric for defects, strength, and colorfastness.
	Features	Tools include fabric testing machines that measure tensile strength, abrasion resistance, and dye penetration. Portable inspection lights are also used to detect inconsistencies in the weave or dyeing process.
Cutting and Packaging Equipment	**Function**	Once the fabric is ready, it is cut into required sizes and packed for distribution.
	Features	Cutting machines ensure precision in fabric dimensions, while packaging equipment seals and labels the products. Packaging highlights the recycled

		content and eco-friendly production process, enhancing the product's appeal.

7.5.3.3 Human Resources:

- Skilled workers, including designers and technicians, operate machinery and supervise quality control.
- Inclusive employment ensures participation by persons with disabilities, caregivers, and artisans trained in sustainable practices.

7.5.3.4 Infrastructure:

- Workshop spaces are equipped with machinery, sorting areas, storage for raw materials, and designated sections for quality control and packaging.

7.5.3.5 Utilities:

- Electricity and water supply are essential for machinery operation and fabric processing. Transportation is needed for raw material collection and product distribution.

7.5.4 Process

7.5.4.1 Sourcing and Collection:

Textile waste is collected through partnerships with garment factories, local communities, and waste management facilities. Agreements with waste management centers and donations from households play a significant role in securing raw materials. Awareness campaigns are conducted to educate the public on the benefits of donating unwanted textiles rather than discarding them, fostering community participation.

7.5.4.2 Sorting and Cleaning:

Once the textile waste is collected, it is carefully sorted to separate usable materials from non-recyclable items. Recyclable textiles are categorized based on fiber type, color, and texture. These materials are then thoroughly cleaned using eco-friendly detergents and processes to remove dirt, stains, and contaminants. Clean materials are dried and prepared for the next phase of processing.

7.5.4.3 Shredding and Fiber Preparation:

Clean textiles are fed into shredding machines, which break them down into smaller fibers. This step ensures that the fibers are uniform and ready for repurposing. The shredded fibers are then processed through carding machines, which align the fibers and prepare them for spinning into yarn. Carding ensures consistency in the texture and strength of the final fabric.

7.5.4.4 Spinning and Weaving:

The prepared fibers are spun into yarn using spinning machines. Skilled operators oversee this process to ensure quality and consistency. The yarn is then transferred to industrial looms for weaving. Depending on the intended use, such as school uniforms or hospital linens, different textures, weights, and weaves are created to meet specific requirements.

7.5.4.5 Dyeing and Finishing:

The woven fabric undergoes a dyeing process using eco-friendly dyes that are safe for the environment and users. Fabrics are dyed in colors that align with institutional needs, such as specific shades for school uniforms or hospital linens. After dyeing, the fabric is treated through finishing processes to enhance softness, durability, and appearance. This step ensures the fabric meets quality standards for institutional use.

7.5.4.6 Quality Control and Packaging:

Each batch of fabric is subjected to rigorous quality control checks to ensure it meets institutional standards for strength, colorfastness, and texture. Faulty or substandard pieces are either recycled again or repurposed for other uses. The approved fabrics are then neatly packed and labeled with information about their recycled content and production process. Packaging is designed to highlight the product's eco-friendly and inclusive production approach.

7.5.4.7 Distribution:

The finished products are distributed to schools, hospitals, and garment manufacturers through established networks. Local transportation services are used to ensure timely delivery. Marketing and sales teams work closely with institutional buyers to secure bulk orders and long-term contracts. Export opportunities are explored for eco-conscious markets in neighboring countries.

7.5.5 Outputs

7.5.5.1 Primary Product: Recycled Plain Cloth

- **Specifications:** The primary output is high-quality plain cloth made from recycled textiles. The fabric is designed to meet the specific requirements of its end-users, such as schools and hospitals. For schools, the material is durable, comfortable, and easy to maintain, ensuring that it can withstand regular wear and frequent washing. For hospitals, the cloth is hygienic, soft, and breathable, making it suitable for sensitive uses like bedding and uniforms.
- **Customization**: Buyers can place orders for custom sizes, colors, and textures. For example, schools can request specific colors that match their uniforms, while hospitals can order fabrics with anti-bacterial finishes for medical use.
- **Market Impact:** The recycled plain cloth offers an affordable, sustainable alternative to imported fabrics, reducing Bhutan's reliance on external textile markets and supporting local industries.

7.5.5.2 Secondary Products

- **Fabric Offcuts and Scraps:** During the production process, fabric offcuts and scraps are generated. Instead of being wasted, these byproducts are repurposed into smaller products such as cleaning cloths, patches, or insulation materials, further reducing waste.
- **Eco-Friendly Packaging:** The packaging materials used to deliver the cloth are biodegradable and carry branding that promotes the environmental and social mission of the enterprise.

7.5.5.3 Environmental Impact

- **Waste Diversion:** The operation significantly reduces the amount of textile waste that ends up in Bhutan's landfills.
- **Reduced Carbon Footprint:** Recycling textiles consumes less water and energy compared to producing virgin fabric, contributing to Bhutan's broader environmental conservation goals.

7.5.5.4 Economic Impact

- **Job Creation:** The business provides inclusive employment opportunities, particularly for marginalized groups such as persons with disabilities, caregivers, and women. Jobs are

created across various stages, including sorting, cleaning, spinning, weaving, and packaging.

- **Skill Development:** Workers receive training in advanced textile recycling techniques, empowering them with transferable skills and boosting their earning potential.

7.5.5.5 Social Impact

- **Inclusivity:** The workforce structure actively includes individuals with disabilities, promoting social equity and empowerment.
- **Community Engagement:** Partnerships with local schools, hospitals, and waste management organizations foster community collaboration. Public awareness campaigns encourage responsible waste disposal and support for recycled products.

7.5.5.6 Brand Positioning and Value Addition

- **Eco-Conscious Branding:** The products are marketed under a strong eco-friendly brand that highlights their recycled content and sustainable production processes. The label ensures customers can make informed, responsible purchasing decisions.
- **Export Opportunities:** High-quality recycled fabric has the potential to enter international markets, particularly in regions where demand for sustainable and ethical products is rising. The export of these goods would bring foreign currency into Bhutan, further strengthening the economy.

7.5.5.7 Marketing Strategies

Awareness Campaigns:

- Educate schools, hospitals, and the public about the benefits of recycled fabric.
- Partner with local media and influencers to promote sustainability and inclusivity.

Institutional Collaborations:

- Collaborate with government agencies, schools, and healthcare institutions to secure long-term supply contracts.
- Leverage Bhutan's sustainability goals to access grants and subsidies.

Product Branding:

- Emphasize eco-friendliness, durability, and social impact in branding.

- Develop a recognizable logo and label indicating recycled content.

Digital Presence:

- Create a user-friendly website showcasing the products, the production process, and the social mission.
- Use social media platforms to connect with eco-conscious buyers.

Trade Fairs and Exhibitions:

- Participate in local and international expos to showcase products and attract buyers.
- Highlight the inclusivity and sustainability aspects of the business.

Export Potential:

- Explore export opportunities to eco-conscious markets in neighboring countries like India and Bangladesh.
- Partner with global organizations promoting sustainable practices.

7.5.6 SWOT Analysis

Strength	Weakness
Abundance of Textile Waste Bhutan generates significant textile waste from households, garment factories, and imports of second-hand clothing. These materials provide a steady and cost-effective supply of raw materials, ensuring sustainability and minimizing reliance on virgin resources.	**High Initial Investment** Setting up a textile recycling facility involves significant costs for procuring advanced machinery, infrastructure, and training programs. This upfront investment may strain financial resources and delay profitability.
Eco-Friendly Production Process The initiative aligns with Bhutan's strong commitment to environmental preservation and its Gross National Happiness (GNH) philosophy. By recycling textiles, the business contributes to reducing waste, conserving resources, and promoting circular economy practices.	**Limited Market Awareness** Recycled textiles are a relatively new concept in Bhutan. Schools, hospitals, and garment manufacturers may initially hesitate to switch from traditional fabric sources due to lack of familiarity or misconceptions about quality.

Inclusive Workforce Employing marginalized groups, including persons with disabilities and caregivers, supports social equity and creates meaningful livelihoods. This inclusivity strengthens community support and builds goodwill among stakeholders. **Government Support** Bhutan's government actively promotes sustainable businesses and may provide grants, subsidies, or policy incentives for initiatives that align with national goals. This backing enhances financial stability and operational viability. **Skilled Artisans** Bhutan's tradition of craftsmanship and weaving provides a skilled workforce capable of producing high-quality fabric, ensuring competitiveness in local and international markets.	**Dependence on Raw Material Supply** Although textile waste is abundant, its availability depends on consistent collection systems and partnerships. Disruptions in the supply chain could impact production schedules and profitability. **Operational Challenges** Limited technical expertise in textile recycling processes and machinery maintenance may require additional training or reliance on external consultants, increasing costs.
Opportunities	**Threats**
Export Potential Growing global demand for sustainable textiles presents significant export opportunities. Neighboring countries like India and Bangladesh, with their large eco-conscious consumer base, offer potential markets for recycled fabric. **Government and Institutional Support** Bhutan's policies encouraging sustainable development may lead to grants, tax breaks, or partnerships with public institutions like schools and hospitals, securing steady demand and financial aid. **Market Expansion**	**Competition from Imports** Low-cost textile imports, especially from neighboring countries, could challenge the price competitiveness of locally produced recycled fabric, limiting market penetration. **Economic Fluctuations** Bhutan's economy, influenced by global trends and domestic factors, may face instability. Reduced purchasing power or budget constraints in schools and hospitals could affect demand**.** **Cultural Resistance to Recycled Products**

Awareness campaigns can open new markets, including local consumers and private enterprises. The promotion of high-quality, affordable, and eco-friendly products can attract bulk buyers and foster loyalty. **Technological Advancements** Access to modern recycling technologies can improve efficiency, reduce waste, and enhance product quality, making recycled fabrics more competitive against traditional textiles. **Collaborations with NGOs** Partnerships with non-profits and international organizations focused on environmental sustainability can provide funding, technical assistance, and global exposure.	Some consumers or institutions may have reservations about using recycled materials, associating them with inferior quality or hygiene concerns. **Climate-Dependent Operations** Bhutan's reliance on hydropower for electricity means production could face interruptions during dry seasons or other climate-related events, impacting output. **Regulatory and Logistical Barriers** Exporting recycled textiles may encounter logistical challenges, tariffs, or compliance requirements, adding to operational complexity and costs.

7.5.7 Financial Analysis

Initial Investment

Category	Details	Cost (Nu.)
Machinery and Equipment	Textile shredders, carding machines, spinning machines, weaving looms, dyeing equipment	3,500,000
Infrastructure	Workshop setup, storage areas, utilities installation	1,200,000
Training Programs	Training workers, especially persons with disabilities	200,000
Raw Material Collection	Setting up a collection network, initial transportation costs	300,000
Marketing Setup	Branding, website, promotional materials	100,000
Miscellaneous Costs	Legal fees, permits, contingency funds	150,000
Total Initial Investment		**5,450,000**

Monthly Operating Costs

Category	Details	Cost (Nu.)
Raw Materials	Textile waste collection, transport	50,000
Labour Costs	25 workers @ Nu. 15,000/month each	375,000
Utilities	Electricity, water, internet	50,000
Maintenance	Machinery upkeep and repairs	30,000
Marketing and Sales	Campaigns, distribution costs	25,000
Miscellaneous Costs	Unforeseen expenses	20,000
Total Monthly Costs		**440,000**

Revenue and Sales Breakdown

Product		Units Sold	Price per Unit (Nu.)	Total Revenue (Nu.)
School Uniform Fabric		4,000 meters	100	400,000
Hospital Linen Fabric		2,000 meters	150	300,000
Total Revenue				**700,000**

Profit and Loss Analysis

Category	Details	Amount (Nu.)
Total Revenue	Total sales revenue	840,000
Total Monthly Costs	Monthly operating costs	440,000
Net Monthly Profit	Revenue - Costs	400,000
Annual Profit	**Net Monthly Profit x 12**	**4,800,000**

Break Even Analysis

Category	Details	Amount (Nu.)

Initial Investment	Total upfront costs	5,450,000
Monthly Net Profit	Revenue - Operating Costs	400,000
Break-Even Period	Initial Investment / Monthly Net Profit	**13.625 months (~14 months)**

7.6 Business Model for Saw Dust and Paper Briquets

This business model focuses on the production of eco-friendly briquettes from sawdust and waste paper. These briquettes offer an alternative to traditional fuel sources like firewood and charcoal, contributing to environmental conservation by reducing deforestation and lowering carbon emissions. The initiative also prioritizes social inclusion, involving persons with disabilities, children with disabilities, and their caregivers in various roles throughout the production and distribution processes. This approach promotes empowerment, skill development, and economic independence for marginalized groups.

7.6.1 Objectives

Primary Objectives

- **Environmental Sustainability**: To repurpose waste materials such as sawdust and paper into renewable energy sources, thus reducing landfill waste and conserving forests.
- **Social Inclusion**: To create meaningful employment opportunities and skill-building programs for persons with disabilities, children with disabilities, and their caregivers.
- **Economic Growth**: To establish a profitable and scalable business that contributes to the local economy and provides affordable fuel alternatives.

Secondary Objectives

- **Community Awareness**: To educate communities about the benefits of using sustainable energy solutions.
- **Product Development**: To ensure the briquettes meet high standards of efficiency and durability, catering to diverse market needs.

7.6.2 Target Market

Primary Consumers

- **Households**: Especially those in rural and urban areas where traditional cooking fuels are expensive or scarce.
- **Small Businesses**: Bakeries, restaurants, and other businesses that rely heavily on fuel for daily operations.
- **Institutions**: Schools, hospitals, and government facilities that require consistent and reliable energy sources.

Secondary Markets

- **Export Markets**: Regions with high demand for sustainable fuel, especially countries with deforestation or energy challenges.
- **NGOs and Green Energy Advocates**: Organizations interested in promoting renewable energy and sustainability projects.

7.6.3 Input

7.6.3.1 Raw Materials:

- **Sawdust**: Collected from sawmills, furniture factories, and wood-processing units. No virgin resources are used.
- **Waste Paper**: Gathered from offices, households, recycling centers, and paper waste collectors.
- **Water**: Used in the mixing process to achieve the right consistency.
- **Natural Binders**: Optional but can include starch or other organic adhesives to enhance briquette strength.

7.6.3.2 Human Resources:

- Inclusive teams consisting of persons with disabilities, their caregivers, and skilled labor for technical roles.

- Training programs to equip workers with the necessary skills for handling machinery and quality control.

7.6.3.3 Infrastructure:

- Storage units to stockpile raw materials safely and efficiently.
- Drying spaces for reducing moisture content in the briquettes.
- Dedicated packaging areas to ensure proper product handling.

7.6.3.4 Energy Requirements:

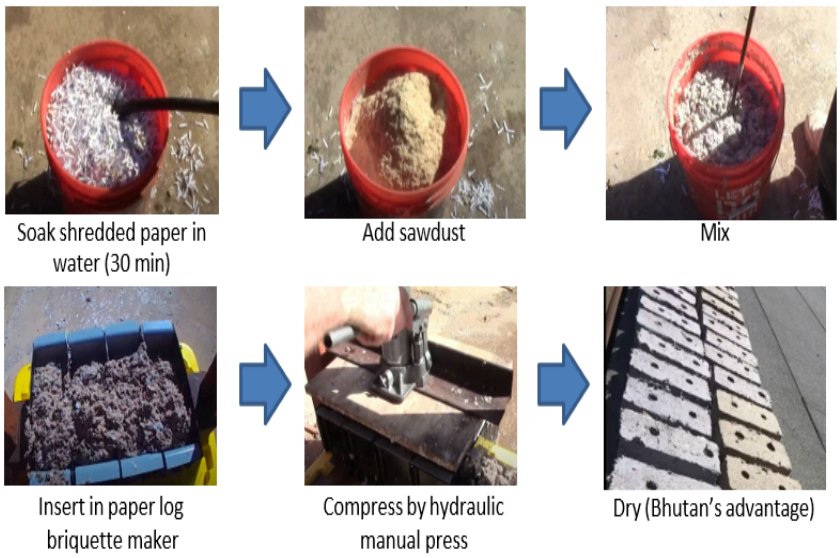
- Electricity or solar energy for operating shredders, mixers, and press machines.

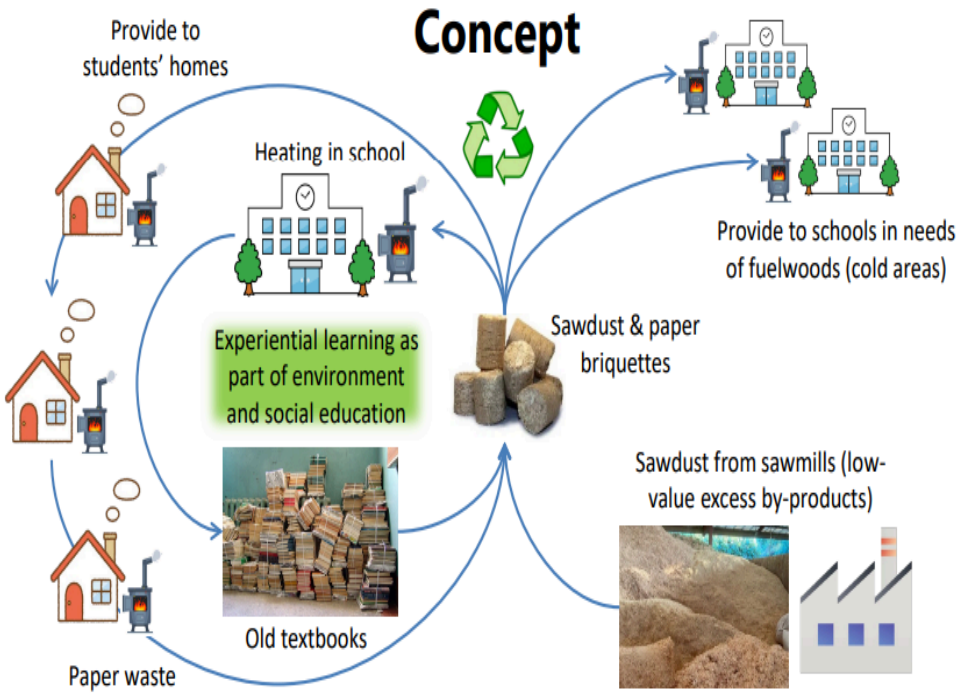
7.6.3.5 Tools and Equipment:

Equipment	Description	Purpose
Shredder	Machine for cutting waste paper into small, manageable pieces.	Facilitates mixing with sawdust.
Mixer	Equipment for blending sawdust, shredded paper, water, and binders evenly.	Ensures uniform composition of briquettes.
Briquette Press	Hydraulic or manual press for compressing the mixture into briquettes.	Shapes and densifies the briquettes.
Drying Racks/Ovens	Structures or machines for drying briquettes.	Reduces moisture content to below 10%.
Quality Testing Kit	Tools like moisture meters and calorimeters.	Measures moisture levels and heat capacity.
Packaging Materials	Eco-friendly bags and sealing equipment.	Prepares briquettes for storage and distribution.
Storage Units	Warehouses or dedicated spaces for raw materials and finished products.	Ensures proper storage to maintain quality.
Transport Vehicles	Vehicles for raw material collection and product distribution.	Supports logistics and supply chain efficiency.

7.6.4 Process

1. **Collection**: Raw materials are sourced and transported to the production facility.
2. **Shredding**: Waste paper is fed into shredders to break it down into smaller pieces, enhancing its mixability with sawdust.
3. **Mixing**: The shredded paper and sawdust are combined in specific ratios, with water or natural binders added to create a cohesive mixture.
4. **Compression**: Using briquette press machines, the mixture is compacted into uniform, dense briquettes of various shapes and sizes.
5. **Drying**: The formed briquettes are dried on racks or in ovens to achieve a moisture content below 10%, which is critical for efficient combustion.
6. **Quality Control**: Samples from each batch are tested for heat capacity, burn duration, and emissions to ensure consistency and reliability.
7. **Packaging**: The briquettes are weighed, packaged in eco-friendly bags, and prepared for distribution.





7.6.4.1 Evaluation of Heat Capacity and Combustion Characteristics

Heat Capacity

- **Energy Output**: Typical briquettes yield 4,000 – 5,000 kcal/kg. This makes them competitive with traditional fuels like charcoal.
- **Performance Testing**: Regular calorimetric testing ensures consistent energy output across batches.

Combustion Characteristics

- **Ignition Time**: Briquettes ignite within a few minutes, reducing preparation time.
- **Burn Duration**: Designed to burn steadily for extended periods, providing a reliable heat source.
- **Ash Content**: Maintaining ash content below 10% improves usability and reduces post-combustion waste.
- **Emissions**: The production process prioritizes low-emission materials to ensure compliance with environmental regulations and health standards.

7.6.5 Output

1. **Primary Product**:
    - **Eco-friendly Briquettes**: These are durable and efficient fuel alternatives suitable for household, commercial, and institutional use.
    - Briquettes are available in various sizes and shapes to cater to specific consumer needs.
2. **By-products**:
    - **Residual Ash**: Can be collected and used as fertilizer for agricultural purposes.
    - **Unusable Scraps**: Recycled back into the production process or repurposed for other applications.

7.6.5.1 Marketing Strategies

Product Positioning

- Market the briquettes as a cost-effective, eco-friendly, and socially inclusive fuel alternative.
- Emphasize the environmental and social impact of the product.

Promotion

- **Community Demonstrations**: Organize workshops to educate consumers about the benefits and usage of briquettes.
- **Collaborations**: Partner with NGOs, local governments, and sustainability-focused organizations to enhance reach.
- **Digital Marketing**: Use social media platforms to share testimonials, videos of the production process, and success stories.

Pricing Strategy

- Offer competitive pricing to attract cost-sensitive consumers.
- Introduce discounts for bulk purchases by businesses and institutions.

- Provide subsidized rates for low-income households through partnerships with NGOs.

Distribution Channels

- **Local Retailers**: Establish partnerships with small stores and markets.
- **E-commerce Platforms**: Leverage online sales channels to reach wider audiences.
- **Direct Sales**: Supply briquettes directly to businesses and institutions through contracts.

Feedback Mechanisms

- Conduct regular surveys and collect feedback from users to refine product quality and customer service.
- Involve persons with disabilities and caregivers in advisory roles to enhance inclusivity.

7.6.6 SWOT Analysis

STRENGTH	WEAKNESS
1. **Abundant Waste Resources:** Bhutan generates significant amounts of sawdust and waste paper, providing a reliable input supply. 2. **Sustainability Alignment:** Bhutan's Gross National Happiness philosophy and government policies emphasize environmental and social sustainability. 3. **Inclusive Employment Opportunities:** The model integrates persons with disabilities and marginalized groups, enhancing its social impact.	1. **High Initial Capital Requirements:** Investment in machinery, infrastructure, and training can be a financial burden. 2. **Limited Public Awareness:** The benefits of briquettes may not be well-known, requiring substantial community education. 3. **Logistical Challenges:** Collecting and transporting raw materials from dispersed locations can be time-consuming and costly. 4. **Seasonal Constraints:** Bhutan's monsoon season may hinder the drying process and affect production schedules.

4. **Eco-friendly Product:** The briquettes offer a renewable and clean energy source, reducing reliance on firewood and charcoal.	
OPPORTUNITIES	**THREATS**
1. **Government Incentives:** Policies supporting renewable energy and waste management may provide financial and operational benefits. 2. **Tourism Industry:** Eco-conscious resorts and hotels in Bhutan can adopt briquettes for heating and cooking. 3. **Schools in Colder Regions:** Schools in Bhutan's colder areas can use briquettes for heating during winter months, providing a sustainable and cost-effective solution. 4. **Export Potential:** Neighboring countries with high demand for sustainable fuel present an opportunity for growth. 5. **Community Partnerships:** Collaborations with NGOs and environmental groups can enhance reach and impact.	1. **Market Competition:** Imported alternative fuels or locally available firewood may compete with briquettes. 2. **Economic Uncertainty:** Variations in energy costs or economic downturns could impact affordability and demand. 3. **Resistance to Change**: Consumers accustomed to traditional fuels might be slow to adopt briquettes. 4. **Environmental Risks:** Natural disasters like landslides could disrupt raw material supply and distribution.

7.6.7 Financial Analysis

Initial Investment

Category	Estimated Cost (Nu.)
Facility Setup (sorting, production, and storage spaces)	200,000
Machinery & Tools (shredders, mixers, briquette presses, drying racks/ovens, etc.)	600,000
Initial Raw Materials (sawdust, waste paper)	50,000

Transportation Vehicles (collection and distribution fleet)	250,000
Training Programs for Inclusive Teams (handling machinery, quality control)	100,000
Marketing & Branding Setup (logo, website, social media, workshops)	50,000
Miscellaneous & Contingency Funds	50,000
Total Initial Investment	**1,300,000**

Monthly Operational Costs

Category	Estimated Cost (Nu.)
Raw Material Collection (sawdust, paper, logistics)	20,000
Labor Costs (10 workers, Nu. 10,000/month average)	100,000
Utilities (electricity, water, solar maintenance)	15,000
Maintenance of Machinery & Tools	10,000
Packaging Materials (eco-friendly bags, labels)	10,000
Marketing & Community Education	15,000
Administrative Costs (rent, office supplies, etc.)	50,000
Miscellaneous Expenses	10,000
Total Monthly Operational Costs	**230,000**

Revenue and Profit Analysis

Category	Value (Nu.)
Monthly Production (units of briquettes)	15,000 kg
Average Selling Price per kg	20
Total Monthly Revenue	300,000
Monthly Operational Costs	230,000

Net Profit per Month	70,000

Break Even Analysis

Category	Value (Nu.)
Initial Investment	1,300,000
Monthly Net Profit	70,000
Break-Even Period	19 months

Product Diversity & Pricing

Product	Units Produced (Monthly)	Average Selling Price (Nu.)	Revenue (Nu.)
Household Briquettes (5 kg packs)	2,000	100	200,000
Commercial Briquettes (25 kg packs)	400	500	200,000
Institutional Briquettes (bulk, 100 kg)	20	2,000	40,000
Total Revenue			300,000

7.7 Business Model for Waste Interactive and Recycling Center

In an era where sustainability and environmental consciousness are increasingly vital, the establishment of an interactive center in Bhutan dedicated to showcasing products made from waste materials represents a transformative initiative with far-reaching implications. This center aims to address pressing environmental challenges by promoting the principles of recycling and upcycling, while simultaneously celebrating Bhutan's rich cultural heritage and craftsmanship.

Addressing Environmental Challenges

Bhutan, known for its commitment to Gross National Happiness and environmental conservation, faces significant challenges related to waste management. With rising consumerism and

urbanization, the need for effective waste reduction strategies has never been more urgent. The proposed interactive center will serve as a catalyst for change by demonstrating how materials such as paper, wood, leather, and textiles can be creatively repurposed. By transforming waste into valuable products, the center will not only help reduce landfill contributions but also inspire a culture of sustainability within the community.

Empowering Local Artisans

One of the core missions of the center is to empower local artisans by providing them with a platform to showcase their skills and creativity. Bhutan has a rich tradition of craftsmanship, particularly in textiles and woodwork. By integrating traditional techniques with modern design principles, the center will enable artisans to create innovative products that resonate with both local and international markets. Additionally, through workshops and training programs, artisans will have opportunities to enhance their skills, learn about sustainable practices, and explore new avenues for income generation.

Educational Outreach and Community Engagement

Education is a cornerstone of this initiative. The center will host a variety of educational programs aimed at raising awareness about sustainable practices and waste management. Workshops designed for schools, community groups, and tourists will cover topics such as recycling techniques, creative reuse of materials, and the environmental impact of waste. By engaging local communities in these initiatives, the center will foster a sense of responsibility towards waste management and encourage collective action for environmental stewardship.

Economic Development Through Sustainable Tourism

As Bhutan continues to develop its tourism sector, the interactive center will position itself as a unique destination for travelers seeking authentic experiences rooted in sustainability. By attracting both domestic and international visitors interested in eco-friendly practices and local craftsmanship, the center can stimulate economic development in surrounding areas. The marketplace for upcycled products will provide local artisans with new revenue streams while promoting Bhutanese culture on a global stage.

Fostering Innovation and Collaboration

The interactive center will also serve as a hub for innovation in waste management practices. By showcasing successful models from Bhutan and around the world, it can inspire new ideas and solutions for addressing waste-related challenges. Collaboration among various stakeholders—including government agencies, NGOs, educational institutions, and local businesses—will be encouraged to create a network dedicated to advancing sustainable practices.

7.7.1 Objectives

Primary Objectives:

- **Environmental Sustainability:** Reduce landfill waste by recycling and upcycling materials like paper, wood, textiles, and leather. This initiative supports Bhutan's environmental goals and Gross National Happiness (GNH) philosophy.
- **Community Empowerment:** Provide meaningful employment opportunities and skill-building programs for persons with disabilities, marginalized groups, and local artisans.
- **Economic Growth:** Create a profitable business model through product sales, workshops, and partnerships, contributing to the local economy.

Secondary Objectives:

- **Educational Outreach:** Raise awareness about waste management through community workshops, school programs, and tourist engagement.
- **Tourism Promotion:** Attract eco-conscious travelers by showcasing Bhutanese culture and sustainability practices.
- **Foster Collaboration:** Build partnerships with government agencies, NGOs, and businesses to enhance the reach and impact of the center.

7.7.2 Target Market

Primary Consumers:

- **Local Communities:** Households, schools, and small businesses seeking waste reduction solutions and eco-friendly products.
- **Tourists:** Eco-conscious visitors looking for sustainable experiences and locally crafted upcycled products.

- **Institutions:** Schools, hospitals, and government offices needing waste management education or sustainable supplies.

Secondary Markets:

- **Export Buyers:** International markets interested in unique, culturally inspired recycled products.
- **Corporate Clients:** Businesses requiring eco-friendly promotional items or sustainability partnerships.

7.7.3 SWOT Analysis

Strengths	Weaknesses
Innovative Approach: The initiative introduces a creative method of upcycling waste materials into valuable, culturally significant products, aligning with Bhutan's environmental and sustainable development priorities. **Cultural Integration:** Leveraging Bhutan's rich heritage in craftsmanship, the center highlights traditional skills while modernizing designs to appeal to diverse markets. **Community Empowerment:** The center provides a platform for artisans, marginalized groups, and persons with disabilities, fostering economic inclusion and skill development. **Diverse Offerings:** A wide range of products, including textiles, bamboo and wood arts, caters to both local and international markets, expanding revenue potential. **Environmental Commitment:** The project supports Bhutan's Gross National Happiness (GNH) philosophy and environmental goals by actively addressing waste management issues.	**Initial Funding Challenges:** High upfront costs for setup, equipment, and training programs may strain resources and delay operations. **Limited Awareness:** Public understanding of recycling and upcycling benefits remains underdeveloped, requiring significant educational efforts. **Dependence on Waste Supply:** The center's operations are heavily reliant on consistent waste material availability, which may be subject to fluctuations. **Operational Costs:** Recurring expenses such as salaries, utilities, and maintenance could impact profitability, especially in the initial phases. **Limited Expertise:** The integration of modern recycling technologies and processes may require external expertise, adding complexity and cost.

Opportunities	Threats
Government Support: Bhutan's commitment to zero-waste goals and environmental sustainability provides a favorable policy environment and potential financial assistance. **Sustainability Trends:** Growing global and domestic interest in sustainable living and eco-friendly products creates a strong demand for upcycled goods. **Tourism Development:** The center can become a unique eco-tourism attraction, drawing environmentally conscious travelers and boosting local economies. **Educational Outreach:** Collaborations with schools and community groups can enhance awareness and establish the center as a thought leader in waste management. **Technological Innovations:** Advances in recycling and upcycling technologies offer opportunities to improve efficiency and reduce costs. **Partnerships and Collaborations:** Engaging with NGOs, international organizations, and businesses can provide financial support, expertise, and market access.	**Market Competition:** Established waste management companies and alternative solutions may limit the center's market share. **Economic Uncertainty:** Economic downturns could reduce consumer spending on non-essential products, including eco-friendly goods. **Regulatory Risks:** Changes in policies, such as stricter compliance requirements, could increase operational costs. **Public Perception:** Negative stereotypes about recycled products' quality could hinder acceptance and adoption. **Environmental Risks:** Operational inefficiencies or mishaps, such as improper waste handling, could damage the center's reputation and community trust.

7.7.4 Financial Analysis

Initial Investment

Category	Estimated Cost (Nu.)	Notes

Facility setup (construction, rent)	2,500,000	Includes renovation, rent, or construction costs.
Equipment for recycling/upcycling	2,000,000	
Initial raw material procurement	300,000	Collecting and sorting waste from local communities.
Training programs for artisans	200,000	Skills training for artisans and operational staff.
Marketing and promotional activities	400,000	Local campaigns, branding, and tourist engagement efforts.
Licensing and regulatory fees	150,000	Approvals from government and waste management authorities.
Miscellaneous and contingency funds	250,000	Buffer for unforeseen expenses.
Total Initial Investment	5,800,000	

Monthly Operational Costs

Category	Estimated Cost (Nu.)	Notes
Salaries (15 staff members)	250,000	Includes artisans, admin, trainers, and staff.
Utilities (electricity, water, etc.)	40,000	Operational needs for machines and lighting.
Raw material collection/sorting	60,000	Collection from households and local vendors.
Maintenance and repairs	30,000	For machinery and facility upkeep.
Marketing and outreach	20,000	Local campaigns and eco-awareness programs.
Miscellaneous expenses	20,000	Unplanned operational needs.
Total Monthly Operational Costs	420,000	

Revenue Streams

Revenue Stream	Monthly Revenue (Nu.)	Notes
Sales of upcycled products	500,000	Handcrafted items like bags, décor, and souvenirs.
Workshop and training fees	100,000	Targeting schools, tourists, and local communities.
Grants and government support	50,000	Environmental initiatives and subsidies.
Sponsorships/Corporate partnerships	30,000	Collaborations with eco-conscious organizations.
Total Monthly Revenue	680,000	

Profit and Loss Analysis

Metric	Amount (Nu.)
Total Revenue	680,000
Total Operational Costs	420,000
Monthly Profit	260,000

Break Even Period Analysis

- Break-Even Point = Total Initial Investment / Monthly Profit
- Break-Even Period = Nu. 5,800,000 / Nu. 260,000 = ~22 months

This indicates the center will recover its initial investment in ~1 year and 10 months.

Appendix I: Stakeholder Consultation Proceedings

Pre-Feasibility Study on Waste Management
Date: 1st January, 2025
Venue: Ludrong Hotel

1. A presentation was delivered by Selwa, offering an in-depth overview of the national policy on disabilities, children and the organization.
2. Following this, the Consultant presented detailed concept of the project and overall waste management scenario of Bhutan and Thimphu - Attachment 1.
3. Furter, a long list of 23 distinct ideas for waste related business using PPP concepts were presented based on specific criteria that prioritize inclusivity and practicality. These criteria include considerations for children and individuals with disabilities, as well as their caregivers. Additionally, it also focused on the scalability of the solutions, the simplicity of the technology involved, and ensuring that the ideas are not prohibitively expensive.
4. Two additional ideas of i) Use of used cement bags and ii) Production of textiles from waste were suggested to be added to the long list in the project document.

The long list of project ideas presented are below:

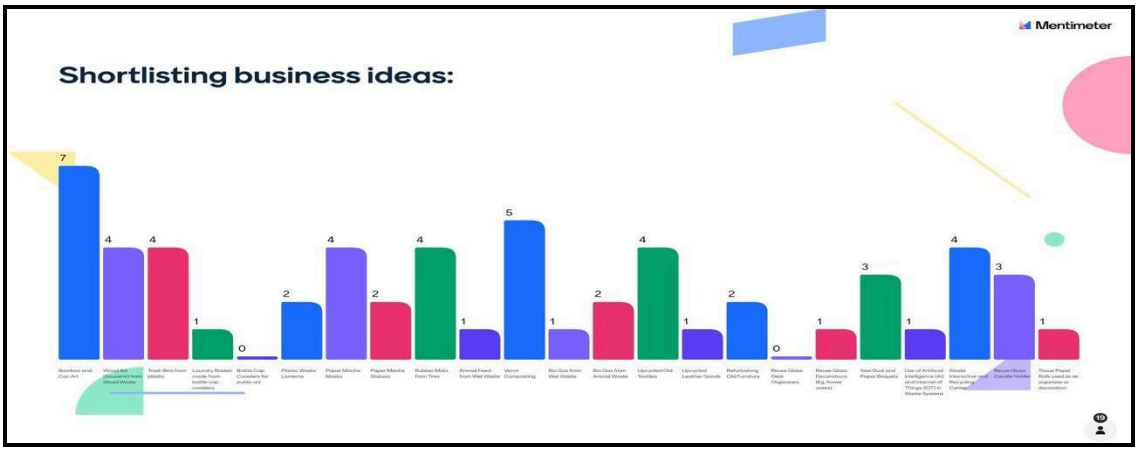
1. Bamboo and Can Art
2. Wood Art (Souvenir) from Wood Waste
3. Plastic Waste Trash Bins
4. Bottle Cap Coasters: Laundry Basket
5. Bottle Cap Coasters for Public Art
6. Plastic Bottle Lanterns
7. Paper Mache Masks

8. Paper Mache Statues
9. Rubber Mats from Tires
10. Animal Feed from Wet Waste
11. Vermicomposting
12. Bio Gas from Wet Waste
13. Bio Gas from Animal Waste
14. Upcycle Old Textiles
15. Upcycled Leather Goods
16. Refurbishing Old Furniture
17. Reuse Glass as Candle Holder
18. Use of Wine Bottles as Decorations
19. Reuse Glass as Desk Organizers
20. Saw Dust and Paper Briquets
21. Tissue Paper Rolls as an Organizer or Decorations
22. Use of Artificial Intelligence (AI) and Internet of Things (IOT) in Waste Systems
23. Waste Interactive and Recycling Center

Following this initial list, a discussion among stakeholders was facilitated to further refine the options. Each participant was given the opportunity to choose three ideas from the comprehensive list of 23. Ultimately, this led to the identification of six innovative ideas that were selected for further discussion and detailing.

Based on the group voting and discussion, following were the 6 Topics selected for further work.

1. Bamboo and Can Art
2. Wood Art (Souvenir) from Wood Waste
3. Saw Dust and Paper Briquets
4. Paper Mache Masks
5. Upcycle Old Textiles
6. Waste Interactive and Recycling Center



The participants were then divided into 6 groups and assigned to work on the details of respective business ideas based on waste. The presentation made to the floor by the groups are presented below.

Group Presentations

Six groups presented on the respective business ideas which are explained below.

Group 1 Bamboo and Can Arts

Questions	Answers
1.Is it already being done? May we replicate and it is viable to replicate?	Not done yet with waste (no information about it) May replicate
2.What is the waste input?	Bamboo from construction site Cans from houses, restaurants, schools, shops
3.What are other resources required?	● Paints and brushes ● Rings/handles ● Glue ● Sand paper ● Saw and knife ● Workshop/house ● Human resource ● Bamboo ● Cans ● Tools and equipment's
4.What do you think will be a reasonable quantity of waste to input?	One construction site bamboo or more (depend on demand and man power)

	Can- collect party cans, from shops
5.What will be the product?	● Bamboo and can cups ● Bamboo wind chimes ● Flower/vase stand ● Kitchen storage-spices ● Decoration items in the hotels or houses
6.What will be the cost of investment – estimate ok!	Estimate- 100,000
7.What will be the selling price and volume, estimate ok!	Depend on quality and size- (around Nu.50 to Nu. 250)
8.What tools and machines will be required?	● Drill machines set ● Cutter /saw ● Sanding machines
9.What will be the operational costs of the process?	Nu. 100,000
10. What trainings are required?	● Carpenter training ● Handling tools/machines training ● Labour security/safety ● Production training
11.What are some marketing strategies we can use for this product?	● Advertisement (home/hotel décor) ● Product Exhibition
12. Could you a quick SWOT-Strength, Weakness, Opportunity and Threat of the proposed idea?	● **Strength:** Job opportunity for PWDs and caregivers, skills development, reuse waste productively, resource availability and low cost. ● **Weakness:** Limited skills resulting in low quality ● **Opportunity:** Interest on waste management/products is on the rise ● **Threat:** Increase price for waste, market competition

Group 2 Wood Art (Souvenir) from Wood Waste

Questions	Answers
1.Is it already being done? May we replicate and it is viable to replicate?	Yes, it can be replicated
2.What is the waste input?	● Construction sites ● Saw mills ● Furniture Making workshops

3.What are other resources required?	• Skilled People • Tools/Machines • Art Studio • Physical Art Gallery • Online Art Gallery
4.What do you think will be a reasonable quantity of waste to input?	It depends on the product we make and demands from the customers.
5.What will be the product?	• Flower Stand • Furniture • Toys • Gift boxes • Laptop Stands
6.What will be the cost of investment – estimate ok!	Cost of Investment/Estimation = 300K
7.What will be the selling price and volume, estimate ok!	5% of cost of Investment
8.What tools and machines will be required?	• Craving Tools • Carpentry Tools • Personal Protective Equipment (PPE)
9.What will be the operational costs of the process?	5% of cost of Investment
10. What trainings are required?	• Wood Craft • Marketing and Selling • Business Management
11.What are some marketing strategies we can use for this product?	• Partnerships with Hotels • Online Business
12. Could you a quick SWOT-Strength, Weakness, Opportunity and Threat of the proposed idea?	**Strength-**Value addition to the waste **Weakness-** Unsure if there is a market or outlet available **Opportunities-**To make money, expand beyond Bhutan **Threats**-Competition, limited resources

Group 3 Saw Dust and Paper Briquets

Questions	Answers

1.Is it already being done? May we replicate and it is viable to replicate?	Yes, it can be replicated
2.What is the waste input? 3.What are other resources required?	Waste paper, saw dust, mixture and mold machine, hydraulic compressor, water, skilled personnel.
4.What do you think will be a reasonable quantity of waste to input?	2 parts Sawdust to 1 part paper pulp (2:1)
5.What will be the product?	Briquettes
6.What will be the cost of investment – estimate ok!	• Mixture Machine – 1,20,000 • Mold – 35,000 • Hydraulic Compressor – 2,50,000 • Paper – 5 per kg • Total – 4,05,000
7.What will be the selling price and volume, estimate ok!	Nu. 70 per kg of Briquettes
8.What tools and machines will be required?	Mixture Machine, Mold, Hydraulic Compressor
9.What will be the operational costs of the process?	• Labour – 40,000 • Electricity Bill – 4000 • Water Bill – 1500 • Paper and Saw Dust – 3000 • Total – 48,500
10. What trainings are required?	Trainings for Operation and Maintenance of Machines
11.What are some marketing strategies we can use for this product?	BBS, print medias, social media, exhibitions, verbal communication
12. Could you a quick SWOT-Strength, Weakness, Opportunity and Threat of the proposed idea?	• **Strength:** Market Access (Demand), availability of raw materials, cheap, eco-friendly • **Weakness:** High cost of investment, safety concerns • **Opportunities:** Employment, self-sustainability, income generation, proper waste management, reduce demand for fuel wood • **Threat:** Market Competition, capacity of the individual to handle the equipment's.

Group 4 Paper Mache Mask

Questions	Answers
1.Is it already being done? May we replicate and it is viable to replicate?	Yes, we can replicate
2.What is the waste input?	Waste Paper
3.What are other resources required?	Water, Glue and Colour
4.What do you think will be a reasonable quantity of waste to input?	• 1 mask = 5kg of waste paper • Target for a month =100 masks = 100*5=500 kg/month
5.What will be the product?	Masks, statues, and other materials if needed
6.What will be the cost of investment – estimate ok!	1 lakh
7.What will be the selling price and volume, estimate ok!	• Selling price = 500 per piece • Volume = 500kg/month
8.What tools and machines will be required?	Pulping machine, grinding machine
9.What will be the operational costs of the process?	Operational Charge: 30,000
10. What trainings are required?	Training on arts and Crafts, and operating machines
11.What are some marketing strategies we can use for this product?	Branding, advertising, promoting, marketing, and quality and Price
12. Could you a quick SWOT-Strength, Weakness, Opportunity and Threat of the proposed idea?	• **Strength**- existing raw material, labour resource, low-cost price for raw materials and electricity • **Weakness-** human capacity, infrastructure • **Opportunity**-Raw materials and market • **Threat-**sustainability, quality.
13. Any other suggestions for this business idea?	Incorporate different materials – such as soil/ clay

Group 5 Upcycle Old Textiles

Questions	Answers

1.Is it already being done? May we replicate and it is viable to replicate?	It is not exactly carried out by children or people with disabilities but similar ideas do prevail.
2.What is the waste input?	Waste input will be used and old clothes, blankets, pillows etc. discarded by the people.
3.What are other resources required?	Threads, needles, tailoring machine, scissors, iron and steaming appliances, markers, furniture, trainers, detergent powder, rooms
4.What do you think will be a reasonable quantity of waste to input?	It depends on the product we make and demands from the customers.
5.What will be the product?	Products will be scarves, traditional bags, pot mats, table runners, curtains, cushions cover, pillows, blankets and mattresses.
6.What will be the cost of investment – estimate ok!	Cost of Investment: 4 to 5 lakhs
7.What will be the selling price and volume, estimate ok!	Depends on different items we make ranging from Nu.50 to 1000
8.What tools and machines will be required?	Tailoring machine, washing machines
9.What will be the operational costs of the process?	**Operational cost**: Nu. 10,000
10. What trainings are required?	Learning how to stitch clothes, ironing, knowledge on financial management, communication and packaging and selling
11.What are some marketing strategies we can use for this product?	Social media, websites
12. Could you a quick SWOT- Strength, Weakness, Opportunity and Threat of the proposed idea?	**Strength**: variety of products can be made from the used materials **Weakness**: Due to their disabilities all the children may not be able to operate the machine and learn at the same pace **Opportunity:** If authentic and Bhutanese products are made, we can export to other countries as well **Threat**: other competitor in the same business may be a threat
13. Any other suggestions for this business idea?	Expansion of this business to making pillows, quilt, mattress and blanket and brand as Bhutanese products and even export.

Group 6 Waste Interactive and Recycling Center

Questions	Answers
1.Is it already being done? May we replicate and it is viable to replicate?	There is no as such centre which serves for the display, market networking, innovative and knowledge centre for waste products.
2.What is the waste input?	● **Organic waste** (food waste, dry leaves and grasses) ● **Recyclable waste** (plastics, paper/cardboards, metals, glass bottles, jars) ● **Non-recyclable wastes** (chips packets, broken toys) ● **Up cyclable wastes** (old clothes, fabrics, broken furniture, old tires) ● **E-waste** (old wires, computers, printers, key boards, chargers) ● **Construction wastes** (bamboos, woods)
3.What are other resources required?	● Waste deposit accessible to PWDs. ● Market networking for waste products from across the country Innovative waste segregation facilities such as ● Smart segregation bins - audio, tactile and sensors to guide users on proper segregation. ● Technology integration- AI camera to detects waste type ● Color coded features on waste bins - High contrast color with large visible symbols and universal designs (image, sign language)
4.What do you think will be a reasonable quantity of waste to input?	● **Compost -** 5-10 kg bags (reusable or biodegradable packaging) ● **Recycled products** (pet bottles, plastics) - sell to local recycling facilities for reprocessing ● **Upcycled goods** (small crafts, decorative items, planters, briquettes, bags, wallets) ● **Educational materials** (DIY kits, recycled papers, guidebooks on waste management)
5.What will be the product?	Creating an innovative knowledge hub for networking and the effective utilization of waste products.
6.What will be the cost of investment – estimate ok!	Construction (ramps, tactile paths, partitions) - 100,000.00 Educational tools - 50,000.00

	Low-Cost Composting Unit - 25,000.00 Upcycling tools - 10,000.00 Misc. - 20,000.00 Total: 225,000.00
7. What will be the selling price and volume, estimate ok!	Compost (10 kg bags) - 30/kg
8. What tools and machines will be required?	● Educational materials ● Automated sorting machines ● Recycling materials such as shredder machine ● PPE (safety gears) ● Waste bins
9. What will be the operational costs of the process?	● Maintenance ● Basic tools and equipment's ● Educational Materials ● Salary ● Utilities ● Marketing and community engagement (Workshops, campaigns) ● Consumable equipment cost
10. What trainings are required?	The center should provide the following trainings: ● Waste management and recycling ● Healthy and safety training ● Leadership and management ● Inclusivity training ● Sustainability practices ● Behaviour change
11. What are some marketing strategies we can use for this product?	● Collaboration with the experts ● Inclusivity and Empowerment ● Marketing and outreach ● Technical capacity building ● Peer to peer learning/knowledge exchange
12. Could you a quick SWOT-Strength, Weakness, Opportunity and Threat of the proposed idea?	● **Strength:** Platform for awareness, knowledge center, community engagement, reduction in landfill. Livelihood opportunities for PWDs and their caregivers. Biodiversity conservation ● **Weakness:** Financial constraint, operational cost ● **Opportunity:** Empowerment of PWDs, Advocacy, Revenue generation

	● **Threat:** Market

Other Discussion and Suggestions

Group 1 Bamboo and Can Art

- Set up an online gallery to display our products and create online marketing strategies to reach more customers. The online gallery will allow people to view our products from anywhere, while online marketing efforts, like social media posts and ads, will help attract more visitors to the gallery and boost sales.
- Collect waste materials from construction sites to utilize in our production process, ensuring we make the most of available resources and contribute to waste reduction.
- Additionally, explore the potential of cane laminate as a sustainable material option. This involves researching its properties, benefits, and applications in our product line, allowing us to innovate and expand our offerings while promoting eco-friendly practices.

Group 2 Wood Art (Souvenir) from Wood Waste

- Collaborate with influential figures, such as community leaders and decision-makers, to promote our products.
- Leverage popular platforms like TikTok to showcase these products, capitalizing on the platform's widespread appeal to reach a larger audience. This strategy will help us connect with potential customers while enhancing our brand visibility through the influence of respected individuals.

Group 3 Saw Dust and Paper Briquets

- Evaluate their heat capacity and combustion characteristics to assess their durability and effectiveness as sustainable materials. This analysis will help us understand how well these briquettes perform as an energy source and whether they can withstand regular use in our products.
- It is essential to integrate safety operations into our workflow. This involves establishing comprehensive safety protocols and training for all employees to ensure a secure working

environment. By prioritizing safety, we can minimize risks and protect our workforce while maintaining efficient production.

- Additionally, we will need to secure an initial investment to support these initiatives. This investment will cover the costs associated with sourcing materials, conducting necessary research on their properties, implementing safety measures, and setting up the infrastructure required for production. With proper funding and planning, we can effectively utilize sawdust and paper briquettes while ensuring a safe and productive operation.

Group 4 Paper Mache Masks and Statues

- Broaden our product offerings to include a diverse range of items beyond just paper mache masks. This expansion could involve designing and producing masks tailored for specific celebrations, such as Halloween, ensuring that they capture the festive spirit and appeal to customers looking for unique and themed accessories.
- It is crucial to establish a strong brand name for our products. A well-defined brand identity will not only enhance market recognition but also foster customer loyalty. This brand name should reflect the creativity and quality of our products, making it memorable and appealing to our target audience. By focusing on both product diversity and brand development, we can effectively position ourselves in the market and attract a wider customer base.
- We need to address the issue concerning the cement bags. This may involve evaluating their current usage, exploring more sustainable packaging options, or improving their storage and handling processes. By taking proactive steps, we can enhance efficiency and reduce environmental impact associated with cement bag usage.

Group 5 Upcycled Old Textiles

- Broaden our product range to include a variety of items such as table runners, bed runners, and cloth bags. These products can be designed with unique patterns and materials to appeal to different customer preferences and enhance home decor.
- In addition to these items, it is important to integrate Personal Protective Equipment (PPE) into our offerings. This could include items like masks, face shields, and other safety gear

that are essential in today's environment. By incorporating PPE, we not only address the growing demand for safety products but also align with our commitment to sustainability by using eco-friendly materials whenever possible.

- Integrate quilting ideas into our product range by exploring various quilting techniques and designs. This could involve creating unique quilt patterns, offering quilting kits for enthusiasts, or developing finished quilted products such as decorative throws, table runners, and bed runners. By incorporating these ideas, we can appeal to both experienced quilters and those new to the craft, enhancing our product diversity and attracting a wider customer base. Additionally, hosting quilting workshops or classes could foster community engagement and promote our brand within the quilting community

Group 6 Waste Interactive and Recycling Center

- Establish an online platform that effectively presents detailed information about our products, including their origin, pricing, and other pertinent specifications. This platform will enhance transparency by allowing customers to understand where the products are sourced from, thereby building trust and credibility. Additionally, it will feature clear and accessible pricing information to facilitate informed purchasing decisions.

- The incorporation of innovative ideas from various schools can significantly enhance our initiatives. For instance, the sensor-equipped trash bins developed by Motithang provide a modern solution for waste management by promoting efficient disposal practices. Similarly, the paper mache masks created by students in Samtse showcase creativity and sustainability, offering an engaging way to repurpose materials. By integrating these concepts, we can foster a culture of innovation and environmental responsibility within our programs.