



HS202 PROJECT

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GROUP 38

"FOOD WASTE MANAGEMENT"

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Title

FOOD WASTE MANAGEMENT



Abstract

Food waste is a global problem that has significant economic, social, and environmental impacts. The amount of food waste generated every year is staggering and is expected to increase with the growth of the world's population. Food waste management is a critical issue that needs urgent attention to mitigate its negative effects. Effective food waste management strategies can help reduce the amount of waste generated and ensure that food is used efficiently. This abstract will explore the challenges associated with food waste management, the benefits of effective management, and the various approaches that can be adopted to reduce food waste. It will highlight the importance of collaboration between stakeholders, including consumers, retailers, and governments, to achieve sustainable and effective food waste management. The abstract will conclude with a call to action for a more holistic and collaborative approach to address the global problem of food waste.

Definition of Problem

Problem Statement

- A third of the food produced for human consumption globally, about 1.6 billion tonnes per year, is lost or wasted.
- Approximately between 5.39 to 13.69 people die per minute due to hunger.
- The cost of food waste globally is estimated at around USD 2.6 trillion – of which USD 1 trillion is incurred from greenhouse gas (GHG) emissions, water scarcity, biodiversity loss, increased conflicts and loss of livelihood due to issues such as soil erosion, nutrient loss, reduced yields, wind erosion and pesticide exposure.
- Food waste accounts for 4.4 giga-tonnes (Gt) of CO₂ eq. per year, which represents 8% of global anthropogenic GHG emissions ³. In comparison, the overall emissions from China, USA and India are 12.45, 6.34 and 3.00 Gt of CO₂ eq. per year.



Problem Identification

Food waste is a global issue that poses significant environmental, economic, and social challenges. Some of the key problems associated with food waste include:

- **Overproduction**: In many countries, there is a culture of overproduction of food, which leads to a surplus of food that is often wasted.
- **Inefficient supply chains**: Inefficient supply chains can lead to food spoilage, overstocking, and inadequate storage facilities, resulting in significant amounts of food waste.
- **Consumer behavior**: Consumers often waste food by purchasing more than they need, not consuming food before it spoils, or not using leftovers effectively.
- **Misunderstanding of expiration dates**: Consumers often misunderstand the meaning of expiration dates, leading to the disposal of food that is still edible.
- **Inadequate infrastructure**: Many countries lack the necessary infrastructure to manage food waste effectively. This includes inadequate waste disposal systems, composting facilities, and recycling programs.
- **Economic incentives**: In some cases, it may be more profitable for businesses to dispose of food waste than to find alternative uses for it, leading to an inefficient use of resources.
- **Climate change**: Food waste is a significant contributor to greenhouse gas emissions, which exacerbates climate change.
- **Food insecurity**: The amount of food that is wasted globally could be used to feed millions of people who suffer from food insecurity.

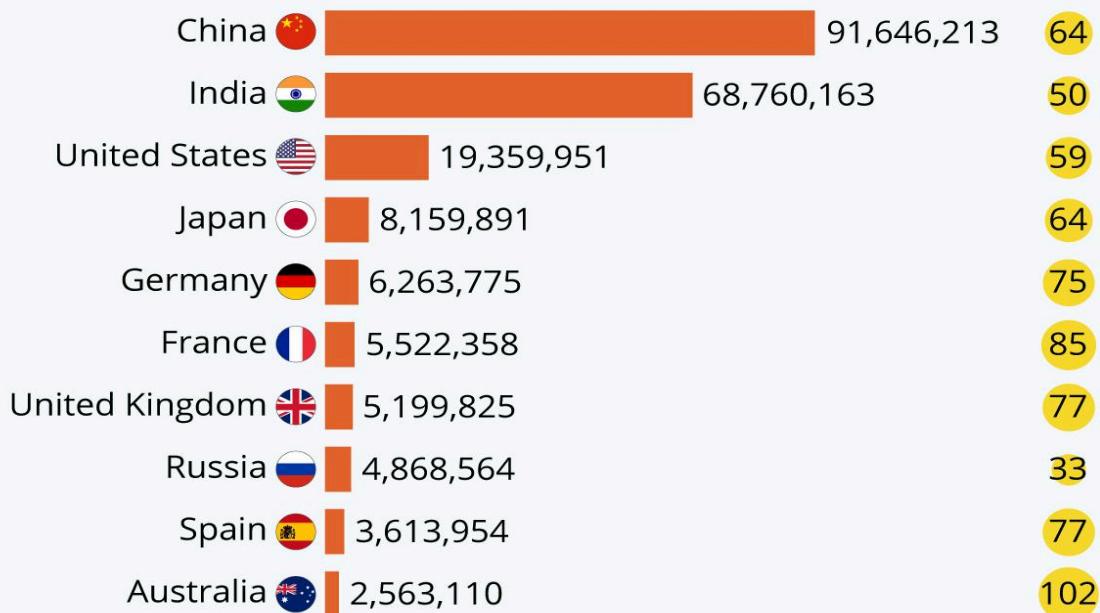
Addressing these key problems requires a comprehensive approach that involves education and awareness-raising campaigns, improvements to food supply chains, investment in infrastructure, changes in consumer behavior, and the development of effective legal and regulatory frameworks. Collaboration between stakeholders, including consumers, producers, retailers, and policymakers, is critical to addressing food waste challenges.

The Enormous Scale of Global Food Waste

Total annual household food waste produced in selected countries*



- Total food waste per year (tonnes)
- Estimated food waste per capita (kg)



* UNEP estimates with high or medium confidence

Source: UNEP Food Waste Index Report 2021



statista A logo consisting of the word "statista" in a bold, dark blue sans-serif font next to a stylized white "S" icon.

Detailed description of the problem

Food waste is a significant global problem that arises from the unnecessary disposal of edible food. According to the United Nations, around one-third of all food produced globally is lost or wasted each year. This amounts to approximately 1.3 billion tonnes of food, which is enough to feed three billion people.

Food waste occurs at all stages of the food supply chain, including production, processing, distribution, and consumption. At the production stage, food is wasted due to weather conditions, pests, and diseases that affect crops, as well as overproduction and failure to harvest. During processing, food waste can occur due to spoilage or damage during transportation. At the distribution stage, food can be wasted due to inefficiencies in the supply chain, such as inadequate storage facilities, inaccurate demand forecasting, and transportation issues. Finally, at the consumption stage, food waste can occur due to over-purchasing, misinterpretation of expiration dates, and insufficient storage and preservation.

Food waste has significant economic, social, and environmental consequences. Economically, food waste represents a loss of valuable resources and contributes to increased costs for producers and consumers. Socially, food waste exacerbates food insecurity, as edible food is wasted while millions of people suffer from hunger and malnutrition. Environmentally, food waste generates greenhouse gas emissions, contributes to climate change, and wastes water and other resources used in food production.

Efforts to reduce food waste involve various strategies, including improving supply chain efficiencies, educating consumers about food

storage and preservation, donating excess food to food banks and charities, and composting food waste to reduce its environmental impact. However, a more coordinated and comprehensive approach is needed to address this complex issue and mitigate its far-reaching effects.

Current developments in the domain

There have been several recent developments in the domain of food waste management, including the following:

- **Policy and legislative action:** Governments around the world are implementing policies and regulations to reduce food waste. Policy interventions play a significant role in managing food loss and waste. In India, the government has implemented SAMPADA (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) - the national policy for developing an integrated cold supply chain for agricultural products - in collaboration with public and private stakeholders.
- **Technology innovations:** There are several technological innovations being developed to reduce food waste. For example, smart packaging that monitors food spoilage and expiration dates can help consumers reduce food waste by informing them when food is about to expire. Additionally, there are apps that allow consumers to buy surplus food from restaurants and grocery stores at discounted prices, reducing food waste and providing affordable meals.

- **Collaborative efforts:** Collaboration between different stakeholders is an important aspect of reducing food waste. Initiatives such as the Food Waste Reduction Alliance in the United States and the WRAP Courtauld Commitment in the United Kingdom bring together retailers, manufacturers, and governments to reduce food waste throughout the supply chain.
- **Circular economy approaches:** A circular economy approach to food waste management focuses on reducing waste and keeping resources in use for as long as possible. This approach involves reducing waste at the source, redistributing surplus food, and using food waste for composting and energy generation.
- **Education and awareness:** Education and awareness campaigns can help consumers understand the impact of food waste and provide them with strategies to reduce waste. These campaigns can be delivered through social media, public service announcements, and school-based programs.

Overall, these recent developments demonstrate the growing awareness of the importance of reducing food waste and the need for collaborative efforts to address this global issue.

Significance of resolving the problem

Resolving the problem of food waste is crucial for several reasons, including:

- **Environmental sustainability**: Food waste contributes to greenhouse gas emissions, which are a significant contributor to climate change. Reducing food waste can help mitigate the environmental impact of food production and disposal.
- **Economic benefits**: Reducing food waste can save money by reducing costs associated with disposal, transportation, and production.
- **Food security**: Food waste is a significant contributor to food insecurity, and reducing waste can help ensure that food is available to those who need it.
- **Natural resource conservation**: Food production requires the use of natural resources such as water, land, and energy. Reducing food waste can help conserve these resources.
- **Social benefits**: Resolving the problem of food waste can improve social equity by ensuring that food is available to all and reducing the impact of food waste on marginalized communities.
- **Ethical considerations**: The amount of food waste globally is alarming given that millions of people suffer from food insecurity. Reducing food waste is an ethical consideration that can help ensure that food is distributed more fairly and sustainably.

Objectives to solve the problem

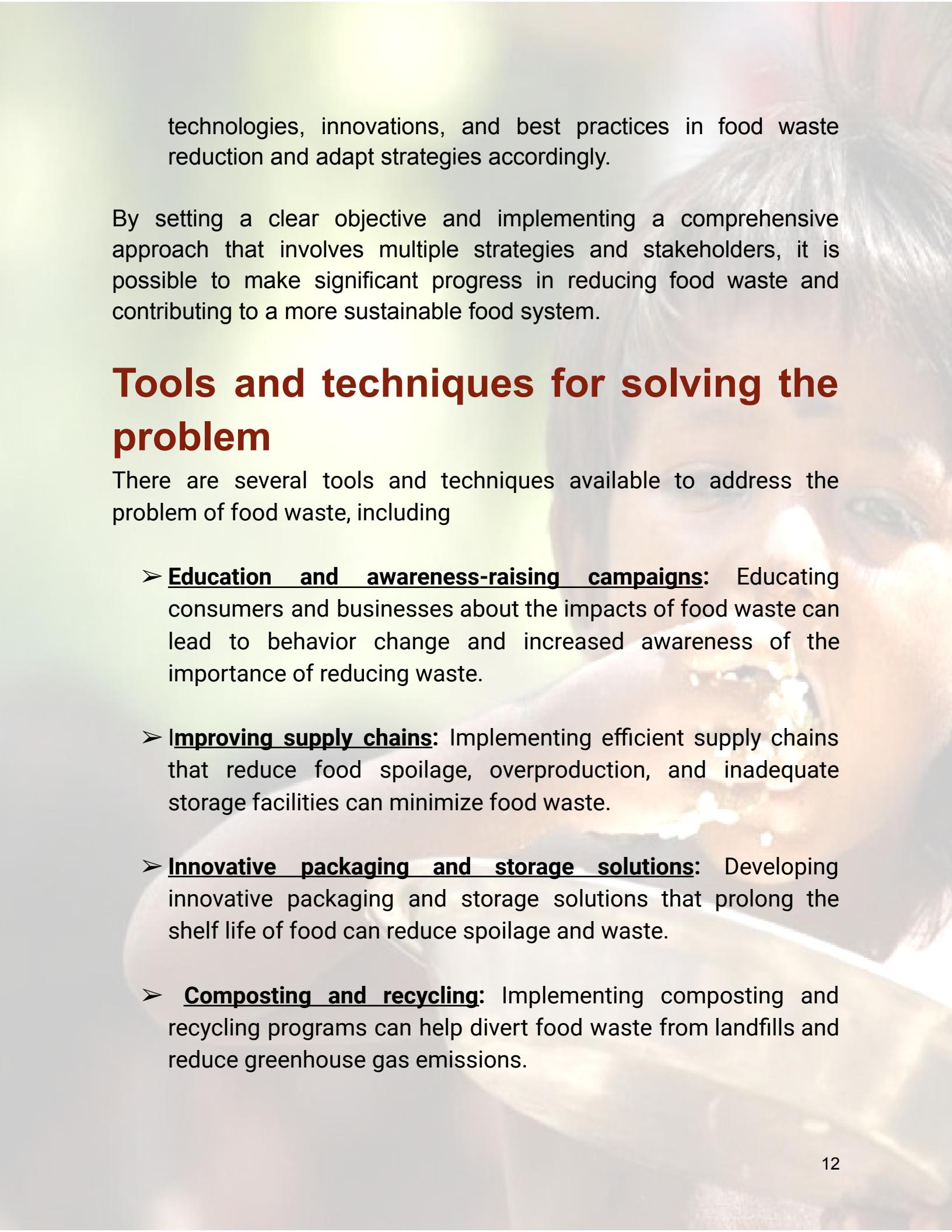
To reduce food waste by 50% within the next 12 months in a mess or in a local community.

Setting a specific and measurable objective is crucial in solving the problem of food waste. In this case, the objective is to reduce food waste by 50% within the next 12 months in a local community. This objective is clear, measurable, and time-bound, which makes it actionable and achievable.

Here are some potential steps to achieve this objective:

- **Awareness and Education:** Conduct educational campaigns to raise awareness about the impact of food waste on the environment, economy, and society. Educate individuals, households, businesses, and organizations about the importance of reducing food waste and provide practical tips and guidelines on how to do so.
- **Food Rescue and Redistribution:** Establish partnerships with local food banks, shelters, and charities to rescue surplus food from grocery stores, restaurants, and other sources, and redistribute it to those in need. Implement effective logistics and coordination systems to ensure safe and efficient food collection, storage, and distribution.
- **Source Reduction:** Work with local farmers, producers, and retailers to optimize their supply chains, reduce overproduction, and minimize food waste at the source. Encourage and facilitate donations of imperfect or surplus produce to reduce food waste before it reaches consumers.

- **Composting and Recycling:** Improve existing composting and recycling programs to divert food waste from landfills and convert it into valuable resources, such as compost or biogas. Provide infrastructure, resources, and education to enable households, businesses, and institutions to properly separate and manage food waste.
- **Policy and Regulations:** Advocate for or support local policies and regulations that promote food waste reduction, such as mandatory food waste reporting, tax incentives, or landfill bans. Collaborate with local government agencies, NGOs, and other stakeholders to develop and implement effective policies and regulations to tackle the issue.
- **Monitoring and Evaluation:** Establish monitoring and evaluation mechanisms to track progress towards the objective. Regularly measure and analyze food waste data, evaluate the effectiveness of implemented strategies, and identify areas for improvement. Use the findings to inform decision-making and adjust strategies as needed.
- **Collaboration and Engagement:** Foster collaboration among various stakeholders, including individuals, households, businesses, local government, NGOs, and community organizations. Engage the community through events, workshops, and other activities to encourage participation and ownership in food waste reduction initiatives.
- **Continuous Improvement:** Continuously assess and improve strategies and initiatives based on feedback, lessons learned, and changing circumstances. Stay informed about emerging



technologies, innovations, and best practices in food waste reduction and adapt strategies accordingly.

By setting a clear objective and implementing a comprehensive approach that involves multiple strategies and stakeholders, it is possible to make significant progress in reducing food waste and contributing to a more sustainable food system.

Tools and techniques for solving the problem

There are several tools and techniques available to address the problem of food waste, including

- **Education and awareness-raising campaigns:** Educating consumers and businesses about the impacts of food waste can lead to behavior change and increased awareness of the importance of reducing waste.
- **Improving supply chains:** Implementing efficient supply chains that reduce food spoilage, overproduction, and inadequate storage facilities can minimize food waste.
- **Innovative packaging and storage solutions:** Developing innovative packaging and storage solutions that prolong the shelf life of food can reduce spoilage and waste.
- **Composting and recycling:** Implementing composting and recycling programs can help divert food waste from landfills and reduce greenhouse gas emissions.

- **Food recovery and redistribution:** Implementing food recovery and redistribution programs can help ensure that surplus food is provided to those who need it.
- **Donation programs:** Establishing donation programs for unused or surplus food can reduce waste and provide food to those who need it.
- **Government policies and regulations:** Developing effective legal and regulatory frameworks that incentivize waste reduction and encourage responsible disposal practices can encourage businesses and consumers to reduce waste.
- **Technology solutions:** Developing technology solutions such as mobile applications and data analytics can help identify and address food waste in supply chains and consumer behavior.

Addressing the problem of food waste requires a comprehensive approach that involves the implementation of multiple tools and techniques. Collaboration between stakeholders, including consumers, producers, retailers, and policymakers, is critical to addressing food waste challenges effectively.

Detailed Work Plan and Survey

Food waste management is an important issue that requires careful planning and implementation to ensure successful and sustainable results. Here is a detailed work plan for food waste management:

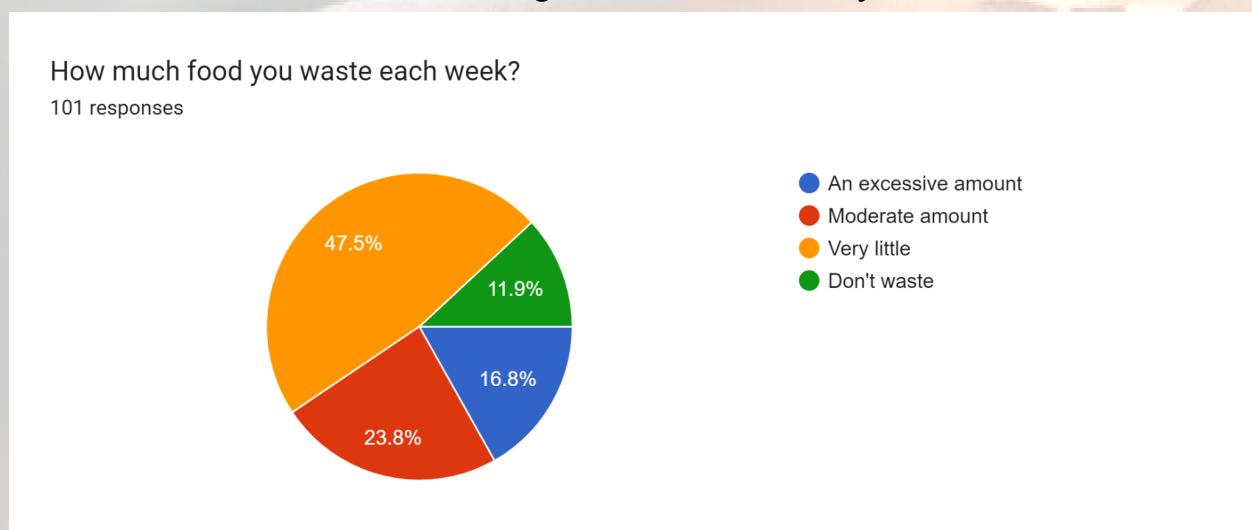
- **Conduct a baseline assessment:** Conduct a comprehensive assessment of the current state of food waste in your organization or community. This includes identifying the sources and types of food waste generated, the volume of food waste produced, and the current disposal practices.
- **Set goals and targets:** Establish realistic goals and targets for food waste reduction, reuse, and recycling based on the assessment conducted in step one. These goals and targets should be specific, measurable, achievable, relevant, and time-bound (SMART).
- **Educate stakeholders:** Educate all stakeholders, including staff, suppliers, customers, and the community, about the importance of food waste reduction and the strategies being implemented. This can be done through training programs, workshops, and awareness campaigns.
- **Implement food waste reduction strategies:** Implement food waste reduction strategies such as portion control, menu planning, and inventory management to reduce the amount of food waste generated.
- **Reuse surplus food:** Implement strategies to reuse surplus food such as donating to food banks, soup kitchens, and other charitable organizations. This can also include creative reuse of surplus food within the organization, such as using excess food to create new menu items.

- **Implement food waste recycling or composting:** Implement food waste recycling or composting programs to divert food waste from landfills. This can include setting up composting facilities or partnering with local composting facilities.
- **Monitor and evaluate:** Regularly monitor and evaluate the food waste management plan to ensure that goals and targets are being met. This includes tracking the amount of food waste generated, diverted, and recycled or composted.
- **Continuously improve:** Continuously improve the food waste management plan based on the results of monitoring and evaluation. This may include implementing new strategies or refining existing ones.

By following this work plan, you can successfully manage food waste in your organization or community, reduce environmental impact, and promote sustainable practices.

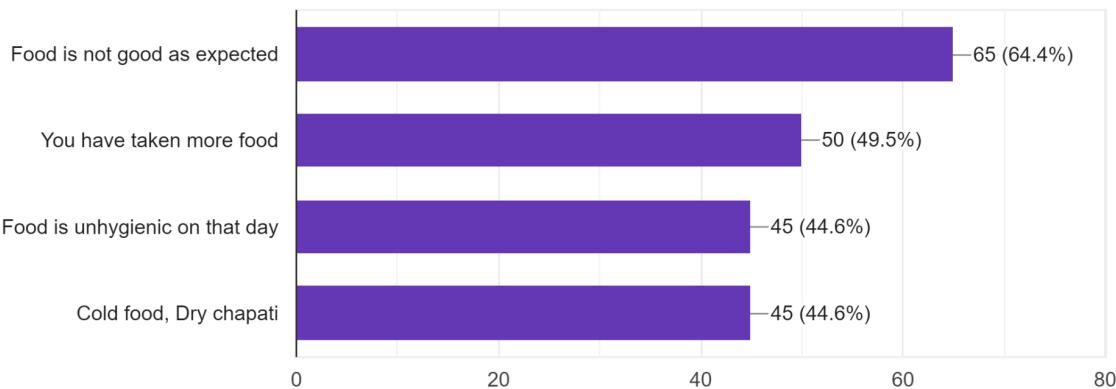
For example, we have conducted a survey in our college for food management.

These are the results that we got from our survey.



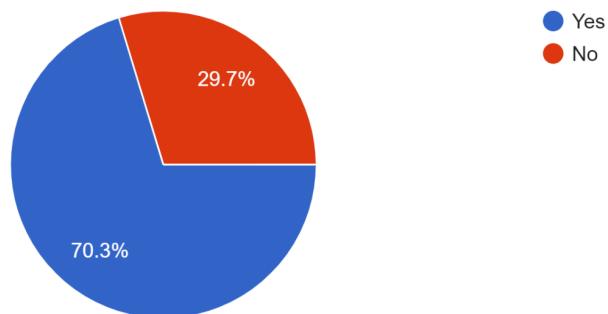
What are the main reasons for throwing away food?

101 responses



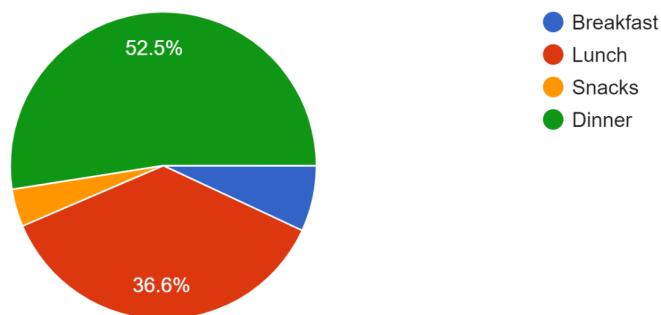
Do you know about the environmental impact of food waste?

101 responses



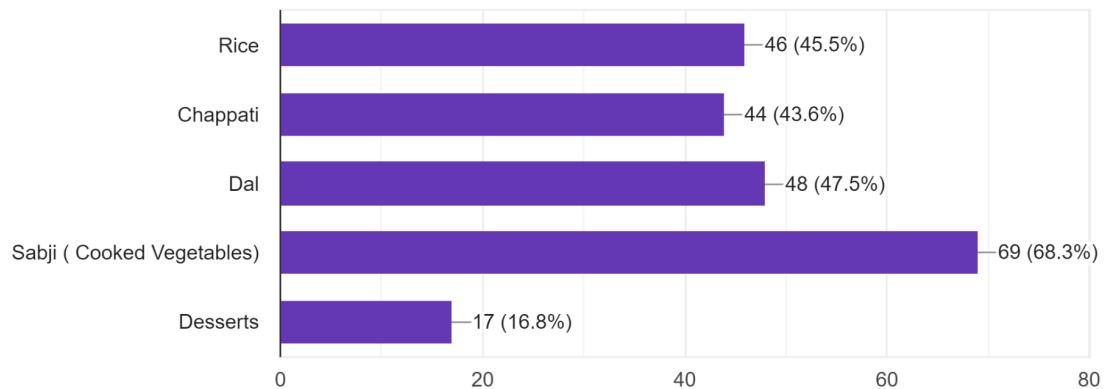
Which time you think food waste is most?

101 responses



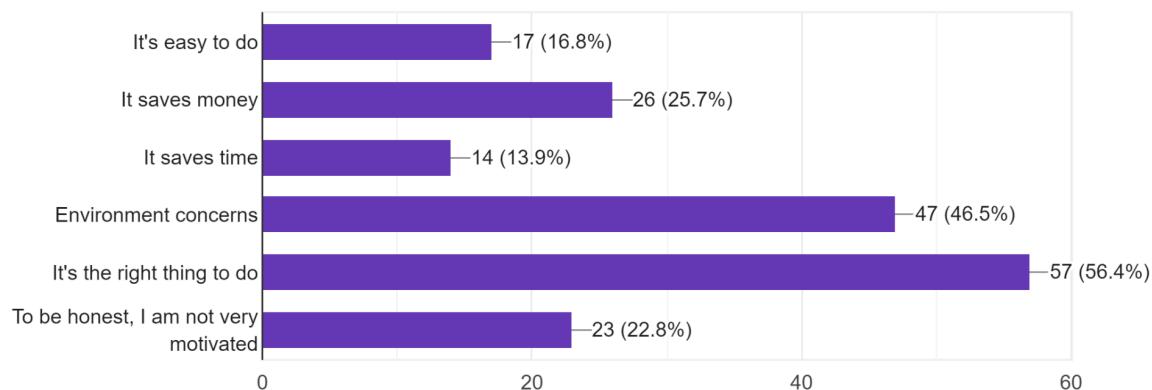
What food item do you find gets wasted most?

101 responses

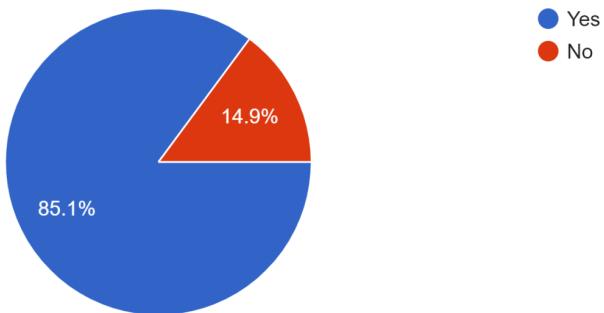


What motivates you to avoid food waste?

101 responses



Do you think food waste reduction should be part of school curriculum?
101 responses



From the survey, we can conclude that

- 1) Most people throw food when they find that food is not as good as expected or when they have taken more food.
- 2) People (around 30%) don't know about the environmental impact of food waste.
- 3) People found that mostly food is wasted in lunch or dinner.
- 4) Sabji, dal and rice are most wasted.
- 5) Most people think that food waste should be part of the school curriculum.

Causes of Food Waste

Food waste occurs at various stages of the food supply chain, from production and processing to distribution, retail, and consumption. Several factors contribute to food waste, including:

- **Overproduction and Overconsumption:** Farmers may produce more food than is necessary due to uncertainties in demand or to ensure they have enough to sell. This often results in excess food being wasted.

- **Inefficient Supply Chain:** Inadequate storage facilities, transportation delays, and poor handling practices during the supply chain can result in food spoilage and waste.
- **Food labeling and expiration dates:** Consumers may discard perfectly good food due to confusion about "sell-by" or "best before" dates, which do not necessarily indicate that the food is spoiled or unsafe to eat.
- **Strict Food Standards:** Stringent cosmetic standards imposed by retailers and consumers often result in the rejection of imperfect or misshapen fruits and vegetables, leading to food waste.
- **Lack of infrastructure and technology:** Inadequate infrastructure for food storage, processing, and transportation in developing countries can result in significant food losses.

Environment Impact of Food Waste

Food waste is a significant environmental issue that has far-reaching impacts on the planet. Here are some of the key environmental impacts of food waste:

- **Greenhouse gas emissions:** When food is wasted, it ends up in landfills where it decomposes and produces methane, a potent greenhouse gas that contributes to climate change. According to the United Nations *Food and Agriculture Organization (FAO)*, food waste is responsible for about 8% of global greenhouse gas emissions.

- **Land and water use:** Producing food requires significant amounts of land and water resources. When food is wasted, these resources are essentially squandered, leading to unnecessary environmental degradation. This includes deforestation for agriculture, excessive water usage in irrigation, and habitat destruction to make way for food production.
- **Energy consumption:** The production, transportation, and processing of food requires energy, primarily in the form of fossil fuels. When food is wasted, all the energy used in its production and transportation also goes to waste, contributing to additional environmental impacts, such as air pollution and climate change.
- **Biodiversity loss:** Agriculture and food production often rely on intensive farming practices that can lead to loss of biodiversity, including the use of pesticides, monocultures, and destruction of natural habitats. When food is wasted, it represents a loss of these resources and the biodiversity they support.
- **Water pollution:** Pesticides, fertilizers, and other chemicals used in agriculture can end up contaminating water sources when food is wasted and left to decompose in landfills or disposed of improperly. This can lead to water pollution, impacting aquatic ecosystems and human health.
- **Resource depletion:** Food production requires the use of various resources, including fertile land, fresh water, energy, and nutrients. When food is wasted, these resources are wasted as well, contributing to resource depletion and reducing the availability of these valuable resources for other uses.

- **Economic impact:** Food waste also has economic implications, as it represents lost value and wasted resources. This includes the costs associated with producing, processing, and



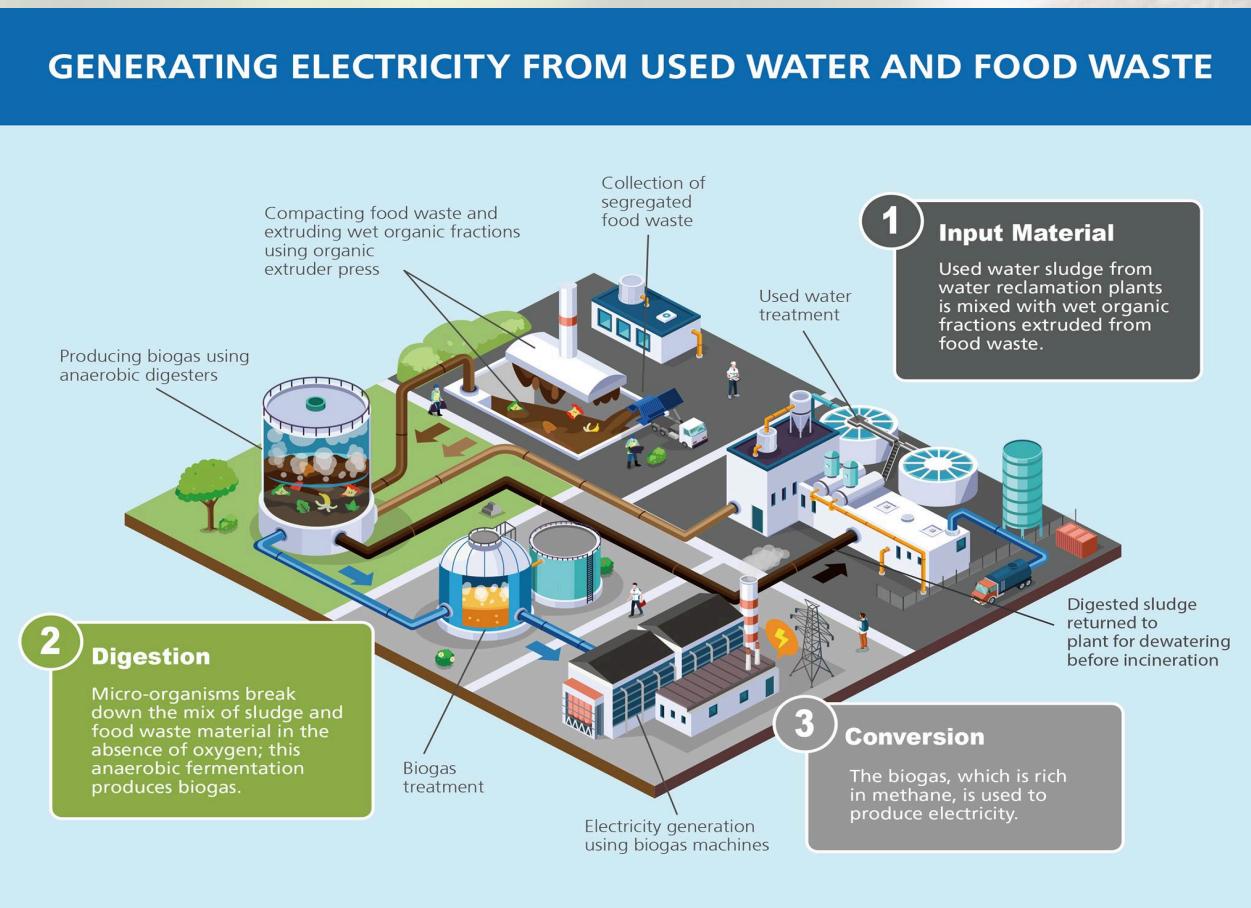
transporting food that ultimately goes to waste, as well as lost revenue for farmers, producers, and retailers.

Solution

Food waste management is a critical issue that needs to be addressed to reduce environmental pollution and conserve resources. Here are some possible solutions for managing food waste:

Producing electricity from food waste:

GENERATING ELECTRICITY FROM USED WATER AND FOOD WASTE



Producing electricity from food waste is an innovative and sustainable approach to waste management. This process, known as anaerobic digestion, involves breaking down organic matter in the absence of oxygen, which produces biogas. Biogas can be used to generate electricity or as a source of fuel for heating and cooking.

The process of anaerobic digestion not only generates renewable energy, but it also reduces greenhouse gas emissions by preventing food waste from ending up in landfills, where it would release methane, a potent greenhouse gas. Moreover, the residual material left after the anaerobic digestion process, called digestate, can be used as fertilizer.

Producing electricity from food waste has significant potential for reducing waste and generating renewable energy. It is a promising solution for addressing both energy and environmental challenges simultaneously.



Composting: Composting is a natural process that turns food waste into a nutrient-rich soil amendment. Composting can be done at home or on a larger scale, such as at a community garden or commercial composting facility.

➤ **Food donation:** Rather than throwing away edible food, it can be donated to food banks or other organizations that help feed people in need. Many grocery stores and restaurants also have programs in place to donate surplus food.



➤ **Anaerobic digestion:** This is a process that uses microorganisms to break down food waste in an oxygen-free

environment, producing biogas and nutrient-rich fertilizer.



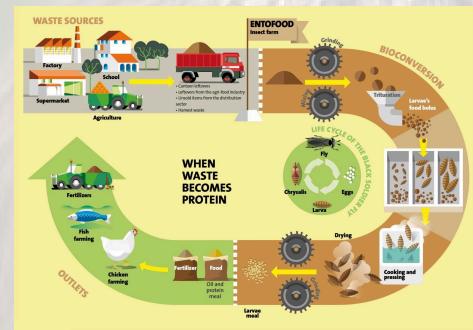
➤ **Food waste reduction:** One of the most effective ways to manage food waste is to reduce the amount generated in the first place. This can be achieved through better meal planning, proper food storage, and using leftovers creatively.



➤ **Industrial-scale composting:** Large-scale composting facilities can handle large volumes

of food waste and produce compost that can be used for agriculture and landscaping.

- **Bioconversion:** This process uses insects or bacteria to break down food waste and produce protein-rich animal feed or biofuels.
- **Recycling:** Some food waste can be recycled, such as used cooking oil and grease, which can be turned into biodiesel.



Overall, food waste management requires a multi-pronged approach, combining a variety of solutions to effectively manage and reduce the amount of food waste generated.

Conclusion

Food waste management is an essential aspect of sustainable development. Food waste is a global problem that has significant environmental, social, and economic consequences. Managing food waste can help reduce greenhouse gas emissions, conserve natural resources, and provide economic benefits.

There are several approaches to managing food waste, including reducing food waste at the source, redistributing surplus food to those in need, recycling food waste through composting or anaerobic digestion, and recovering energy from food waste.

To achieve a sustainable food waste management system, it is crucial to adopt a comprehensive approach that involves all stakeholders, including individuals, businesses, governments, and civil society organizations. By working together, we can reduce food waste and create a more sustainable future for ourselves and the planet.

Contribution of each member

Team Members	Contribution
Aditya Kumar	Survey form and problem identification.
Akash Garg	Objectives to solve the problem.
Archit shakya	Detailed work plan to minimize food waste.
Ashwani Kumar	Causes of food waste and solution

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