

KRITI

Team Kapili

CNA

Minimizing Food Waste: A Sustainable Solution for IIT Guwahati Hostel Mess (turning Waste into opportunity)

Wasted food has far-reaching effects, both nationally and globally. In India up to 33.33% of all food produced goes uneaten ,and about 95% of discarded food ends up in landfills . It is the largest component of municipal solid waste at 21%. Which increase methane emissions from landfills and carbon footprint

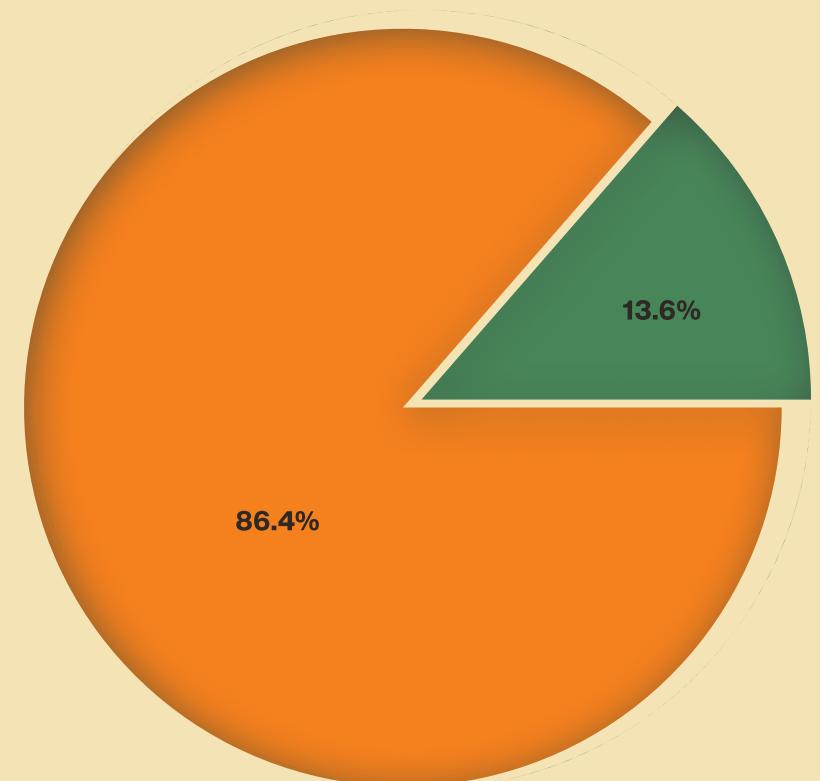
According to a report by the food and Agriculture Organisation(FAO) Of the United Nations, India wastes about 67 million tonnes of food equivalent to the food consumption of the state Bihar.

Food waste in the hostel mess at IIT Guwahati is a complex issue that requires attention at every stage of the food supply chain, from meal planning and preparation to consumption and disposal. Addressing this problem involves implementing strategies to reduce waste at each stage and promoting a culture of sustainability and responsible consumption among students and staff.

In each hostel in IIT guwahati the food waste is a major problem not just due to environmental concern but also a Financial strain. This is also contrasting to the flourishing sustainability objectives within the global context.

Around 189.2 million people in India sleep with an empty stomach , India ranks 101st out of 116 countries ,with a score of 27.5, indicating a serious level of hunger , so prevention of food waste is a matter of immense concern .

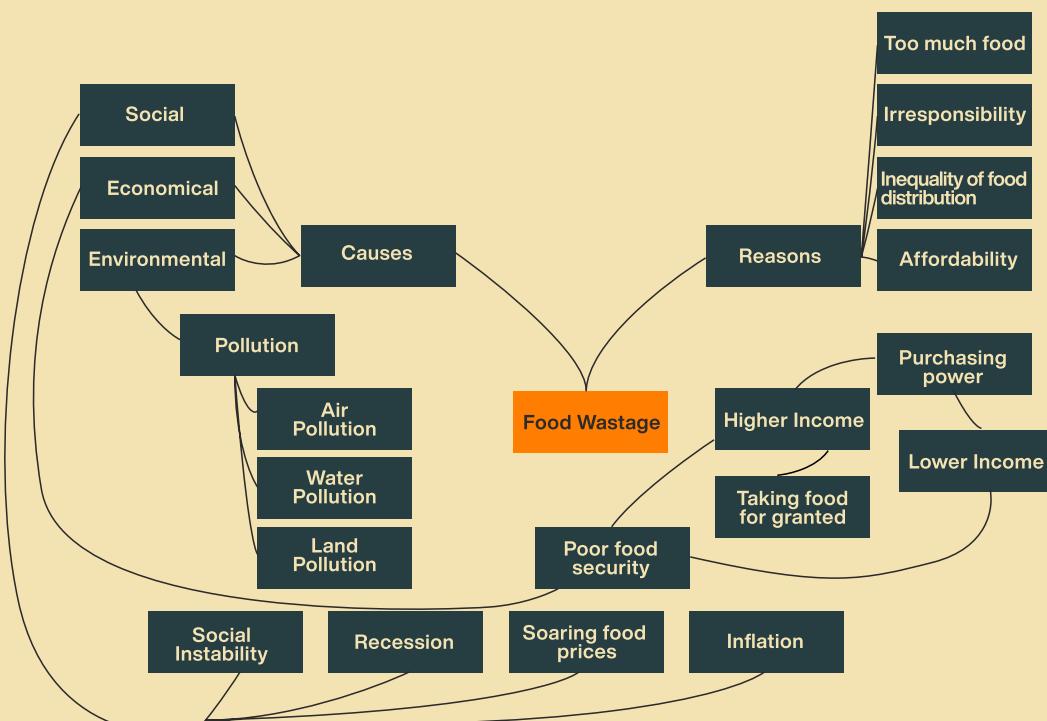
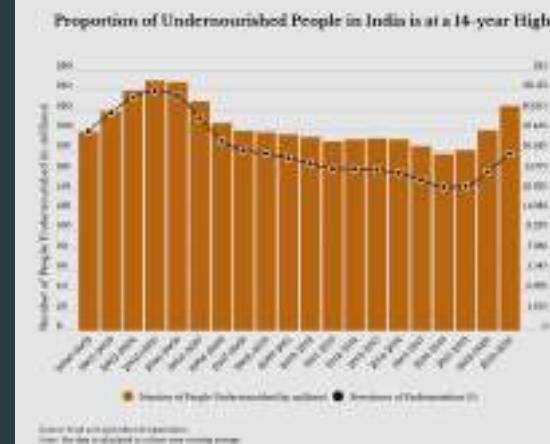
In just one single ‘ Kapili’ hostel on an average 59.57kg of food is wasted in breakfast , 68.14kg is wasted in lunch and 65.71kg is wasted in dinner. Due to such wastage , India faces the paradox of being self -sufficient in food production but not in food security.



- Yes
- No

Have you ever wasted food?

According to the Global Hunger Index 2021, India ranks 101st out of 116 countries, with a score of 27.5, indicating a serious level of hunger. India has 189.2 million undernourished people, the highest in the world. India also has high rates of child malnutrition, stunting, wasting, and anemia. Moreover, India faces the paradox of being self-sufficient in food production but not in food security, as millions of people lack access to adequate and nutritious food due to poverty, inequality, inefficiency, and wastage.



Road map for food wastage

Malnutrition and Hunger

50kg per person being thrown away on an individual level, that's tonnes of food that could be feeding the millions of people in our country who are undernourished.

Environmental Loss

Wasted food isn't just a social or humanitarian concern—it's an environmental one also. If food goes to the landfill and rots, it produces methane—a greenhouse gas even more potent than carbon dioxide. About 6%-8% of all human-caused greenhouse gas emissions could be reduced if we stop wasting food.

Health Issue

Asthma, birth deformities, cancer, cardiovascular diseases, childhood cancer, COPD, infectious diseases, low birth weight and preterm delivery are just a few of the illnesses that might strike due to the rotting food in landfills. The issue that waste creates might also include bacteria, vermin and insects which carry infections and cause diseases.

Impact on North east

North-eastern States failing to submit adequate number of proposals despite special concessions for the region is baffling. Various studies indicate that about 40% of perishable food is wasted in the country for dearth of adequate food processing units, cold chain and storage despite significant growth in the sector.

Types of Wastage

Prep Waste

Cause

Inefficient preparation techniques, over-ordering, inaccurate ingredient measurement, unclear recipes, and improper storage leading to spoilage.

Example

Vegetable peels, cores, and trimmings; meat trimmings, bones, and fat; stale bread and bakery items; eggshells and coffee grounds.

Solution

Standardize recipes, train staff on portion control and proper techniques, purchase pre-cut or pre-washed ingredients, utilize food scraps in menu items like soups or stocks, compost organic waste.

Plate Waste

Cause

Oversized portions, dishes not matching customer preferences, dietary restrictions not accommodated, inadequate menu descriptions.

Example

Inefficient cooking methods, lack of grease traps, disposable packaging choices, inadequate recycling programs.

Solution

Offer smaller portion sizes, conduct customer surveys to understand preferences, provide detailed menu descriptions and allergen information, encourage customers to "doggy bag" leftovers, donate edible food to charities.

Spoiled Food

Cause

Improper storage (e.g., incorrect temperature, cross-contamination), lack of FIFO (First In, First Out) inventory management, overstocking perishable items, power outages leading to equipment malfunction.

Example

Expired dairy products, wilted vegetables, spoiled meat, moldy bread.

Solution

Implement FIFO system, regularly monitor temperatures and equipment, purchase perishables based on demand, donate nearing-expiry items to food banks, compost unusable scraps.

Other Food Waste

Cause

Inefficient cooking methods, lack of grease traps, disposable packaging choices, inadequate recycling programs.

Example

Cooking oil waste, single-use plastic wraps, food-contaminated paper towels, non-recyclable packaging.

Solution

Utilize energy-efficient equipment and cooking methods, install grease traps and regularly maintain them, adopt reusable containers and cutlery, implement recycling programs for appropriate packaging materials, explore partnerships with food waste-to-energy conversion facilities.

Additional Considerations

Packaging waste

Choose recyclable or compostable packaging options where possible.

Liquid Waste

Utilize food scraps for broth or stock creation, explore grease recycling programs.

Technology

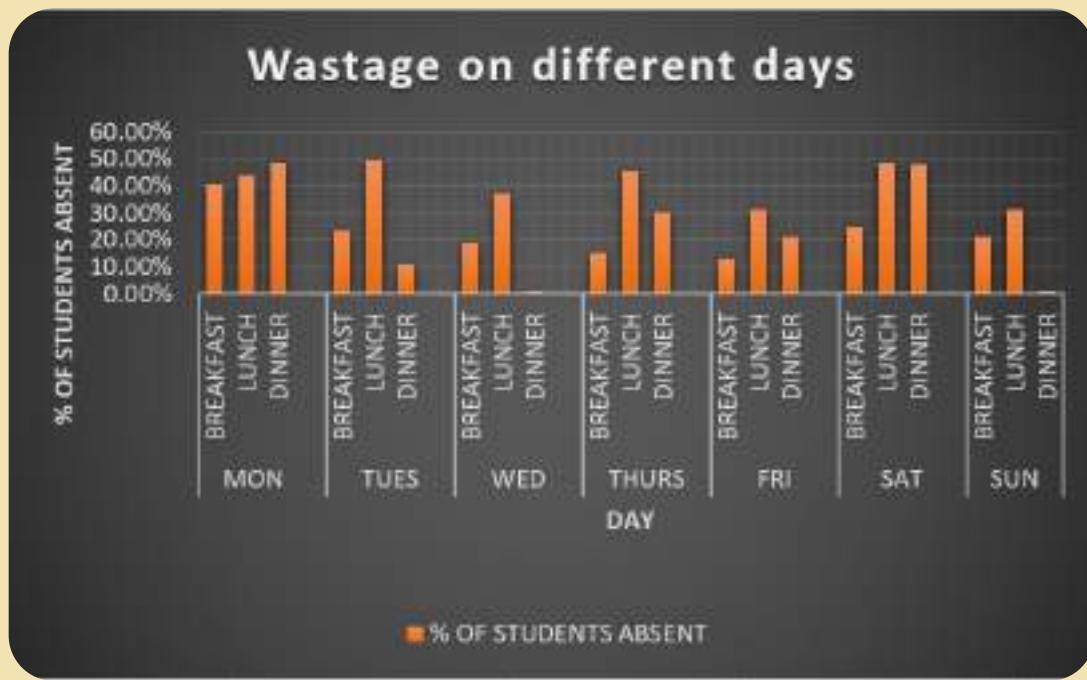
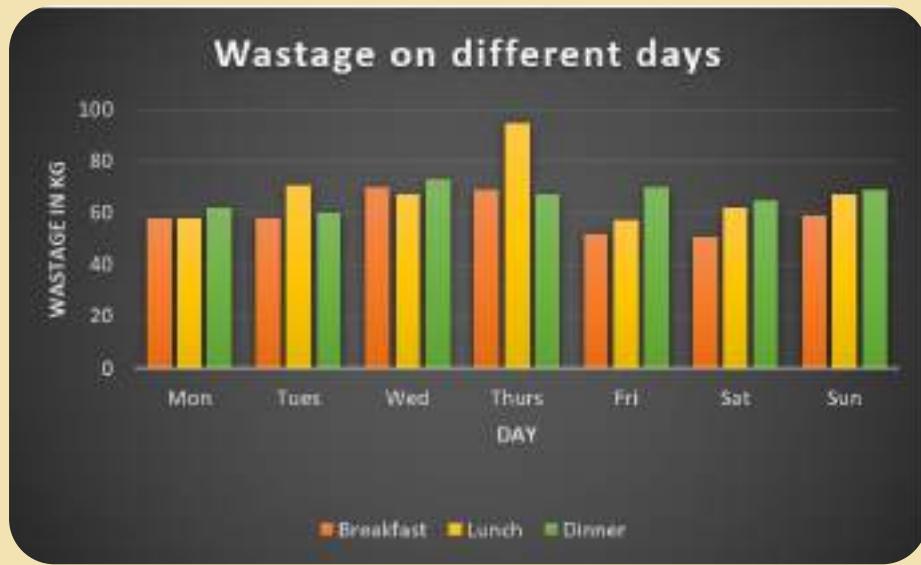
Employ inventory management software to optimize ordering and reduce spoilage.

Awareness

Conduct staff training on food waste reduction strategies and the environmental and economic benefits.

By understanding the specific types of food waste generated in your kitchen and implementing targeted solutions, you can significantly reduce your environmental impact and save money. Remember, every little bit counts in tackling this global challenge!

Data Visualisation



Interview of mess worker, manager and student

Mess Manager

Background: Mr. Mahesh, hailing from Assam, holds the esteemed position of mess manager at Kapili Hostel, where he has admirably served for the past four years, demonstrating exceptional dedication and proficiency in his role.

Pain Point: It pains me deeply to witness students and individuals mindlessly taking portions of food larger than their requirements, only to discard it without a second thought. Their disregard for those in need, including myself, weighs heavily on my conscience, especially as I am responsible for reporting monthly food wastage to my superiors and risk facing consequences, even resignation, if the wastage exceeds acceptable limits.

Expectations: I hope students and individuals consider those who go without food before their first bite each day. I anticipate that people will take only what they need from the mess counter, refraining from taking more than necessary and then thoughtlessly discarding it. If individuals adopt this practice, the problem can be resolved.



Tapan (Manager)
24 years
Unmarried

Mess Worker

Background: Mr. Rajesh, originating from Bihar, serves as a dedicated mess worker at Kapili Hostel, where he has diligently worked for the past three years, excelling in his role. He shoulders the responsibility of providing for his family, striving to ensure they have access to quality meals every day, despite the challenges he faces.

Pain Point: The most disheartening feeling is witnessing individuals who greedily request large portions of food, consuming it thoughtlessly, and discarding the excess without a second thought. Their lack of consideration fails to acknowledge the effort we put into tirelessly crafting delicious meals from morning till night, only to have them wasted in such a manner. They don't even think that there are days when my family and children have to go to bed hungry, and this harsh reality weighs heavily on my heart.

Expectations: I hope that everyone who wishes to eat consumes only what they need, without excess, as it pains me deeply to witness wastage. I consistently urge people to take food according to their needs, yet many become angry with me, disregarding the impact on less fortunate families and the environmental consequences of food waste. I hold onto hope that people will begin to consider these factors.



Jayanta Gogoi(Worker)
27 years
Married

Student

Background: Mr. Yash, originating from Maharashtra, borders at Kapili Hostel. He has been dining in the hostel mess for the last two years. He is very health-conscious so he tries to avoid outdoor food and prefers mess food.

Pain Point: The most reassuring thing is the lack of options for managing leftovers. With the cafeteria serving standardised portions, many students find themselves unable to finish their meals, leading to significant food waste. The lack of flexibility in the meal options contribute to dissatisfaction among students and increase likelihood of food being discarded.

Expectations: I hope the hostel management committee will serve only that amount of food the individual wants, moreover will try to increase the option of the food. I expect the institution to prioritize by implementing efficient measures to minimize food waste. Additionally, I wish the hostel to establish proper waste management systems, including composting facilities, to ensure that food waste is disposed of in an environmentally responsible manner.



Yash (Student)
19 years
Unmarried

Solutions at a Glance

Pre-Booking

A website enables students to pre-book meals in advance, with features for meal skipping notifications. It notifies kitchen staff of required food quantities and raw material orders, optimizing meal preparation. Additionally, it automates refunds for students who notify beforehand about skipped meals.

RFID



Implementing RFID cards for student meal attendance tracking enhances efficiency. A platform notifies the mess when a student skips meals; repeated skipping triggers a penalty notification for the mess to impose a fixed fine, promoting accountability and discouraging habitual meal skipping.

Self Throwing

Implementing designated bins with weighing machines for plate wastage disposal fosters a sense of responsibility among students, encouraging them to take ownership of their food waste. The visual feedback provided by the weighing machines enables students to quantitatively monitor their food consumption habits, leading to more mindful portion control.



Small Serving

To reduce overserving of food, we will employ smaller serving utensils, train staff on portion control, offer small tasting portions, and monitor and adjust portion sizes based on feedback. These strategies promote mindful eating habits and minimize cooked food waste.

Sorting & Reusing

Adopting alternative cooking techniques to reduce food waste. Techniques such as blanching preserve color and flavor, while roasting utilizes imperfect produce. Stir-frying repurposes leftovers, while soups and stews transform scraps into delicious dishes. Pickling and fermenting extend shelf life and add value to imperfect fruits and vegetables.

Menu Optimization

Strategies include prioritizing seasonal and local ingredients for freshness and sustainability, dynamic pricing of food to prevent wastage, embracing cross-utilization of ingredients to cater to diverse diets and adding value through preservation techniques to extend shelf life and create new products.



Biodegradation of food

Food waste is a valuable renewable energy source, contributing to environmental sustainability. It can be also used to make high value organic products like fertilizers and enzymes.

Why JIT Inventory model?

Quality	EOQ	JIT	EPQ	MEIO	Newsvend or Model	DLS	Bullwhip Effect Mitigation Models	Stochastic Inventory Model	VMI	Continuous Review Models
Cost	Below AVG	Above AVG	NIL	?	Above Avg	Below AVG	NIL	?	High	Above Avg
Adoption Curve	Easy	Moderate	Easy	Assuming already adopted	Moderate	Easy	Easy	?	Tough	Tough
Hostel Fit	?	Yes	Yes	?	NIL	?	?	Yes	NIL	Yes
Effectiveness	neutral	High	Low	Avg	Low	neutral	Avg	Low	High	Moderate
Long-term goal alignment	NIL	High	Low	NIL	NIL	NIL	NIL	Low	High	Moderate
Benefit for Students	+ve	+ve	NIL	NIL	-ve	+ve	NIL	NIL	NIL	+ve
Benefit for MessOwner	-ve	+ve	NIL	NIL	+ve	-ve	NIL	NIL	+ve	-ve

What is Just-in-Time?

Instead of overflowing warehouses, JIT companies receive materials only as they're needed for production, eliminating unnecessary storage costs and ensuring fresh, high-quality supplies. It's like a perfectly choreographed dance between manufacturers and suppliers, with each piece arriving just in time to contribute to the final product.

But, like any complex production, JIT comes with its own demanding melody. Just as a conductor relies on accurate sheet music, JIT thrives on precise demand forecasting. Misjudging customer needs can lead to stockouts or overstocking, disrupting the harmony of the entire system.

JIT shares characteristics with production methods like Kanban (visualizing workflow) and continuous flow manufacturing (minimizing bottlenecks).

JIT was popularized by Toyota in the 1970s, hence the alternative name "Toyota Production System (TPS)."

JIT requires a culture of continuous improvement and collaboration among all stakeholders.

Key Takeaway:

JIT minimizes inventory, leading to lower costs and increased efficiency.

Accurate forecasting is crucial, as miscalculations can create disruptions.

Reliable suppliers are essential, ensuring materials arrive precisely when needed.

While not a universal recipe for success, JIT can be a powerful tool for businesses with predictable demand and strong supplier relationships. Think of it as a high-performance engine - demanding a skilled driver and regular maintenance.

Advantages & Benefits of Just-in-Time

1) Lower Costs & Better Cash-Flow - By avoiding excessive stockpiling and storing costs, companies can free up valuable resources for other business activities. With reduced inventory levels, businesses can allocate their financial resources more effectively and avoid tying up capital unnecessarily. This allows for greater flexibility in managing day-to-day expenses and investing in growth opportunities.

2) Helps Ensure Items are Always In-Stock - JIT enables faster order fulfillment due to its focus on just-in-time delivery. By maintaining close relationships with suppliers and ensuring timely deliveries, businesses can respond quickly to customer demands and reduce lead times and are always in-stock. This leads to higher customer satisfaction rates and increased loyalty.

3) Improved Efficiency - Streamlined processes minimize waiting times and transport costs. JIT systems can quickly adjust to changes in demand, leading to faster production cycles and shorter lead times. Smaller batches make it easier to identify and address defects early on.

4) Reduced Waste - A quicker turnaround of stock prevents goods that have become damaged or obsolete while sitting in storage, reducing waste. This again saves money through preventing investment in any unnecessary stock and reducing the need to replace old stock.

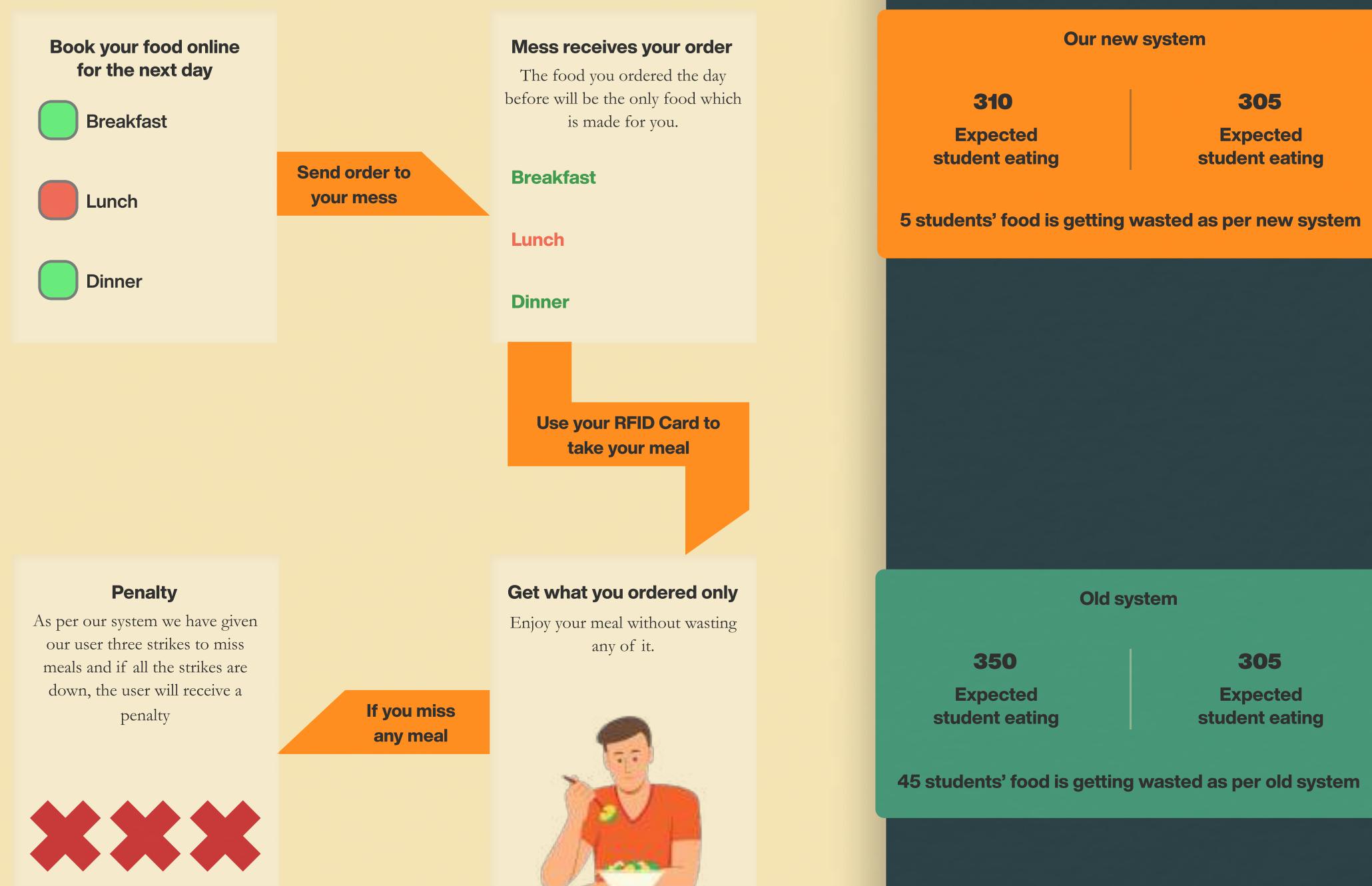
5) Smoother Production Cycles - The emphasis on "pull" systems, where production is driven by actual demand, ensures materials and components arrive just as needed. Instead of large production runs, JIT focuses on smaller batches that flow consistently through the system.

6) Better Quality - A smaller volume of stored goods means that companies have better visibility over their inventory, making it easier to identify defects or issues early on. With improved quality control measures in place, businesses can deliver superior products consistently while reducing waste from defective items.

Feasibility of JIT in Mess management in our Hostels

- 1) We already have well defined menus for each day in each and every mess in hostels which will ensure easy implementation of JIT as students can pre-book their food according to their respective diets.
- 2) Students will plan their entire next day due to this leading to smooth functioning of work and responsibilities.
- 3) This will enable mess chefs to make necessary food only thus reducing high wastage of food.
- 4) Limited food making will lead to better quality.
- 5) It will reduce the amount of storage containers and thus less space will be occupied.
- 6) Students will stay conscious about their food that what they are eating and also how much they are eating.
- 7) As penalty will be imposed on not coming to mess despite pre-booking, it will lessen the probability to skip the respective meals by students due to lethargicness and other unnecessary reasons.
- 8) It will make student's life progressive as he will wake on time for breakfast, get ready for class on time for lunch and return to hostel on time for dinner.





Menu Optimization & Reusing

Technique	Mechanism for Reducing Waste	Example Applications
Blanching	Preserves color and flavor, extending shelf life for freezing or later use	Vegetables destined for freezing, stir-fries, or further cooking
Roasting	Revives slightly wilted vegetables, utilizing imperfect produce	Root vegetables, fruits, meats
Stir-frying	Uses up leftover cooked items in quick meals	Leftover vegetables, meat scraps, tofu
Soups & Stews	Transforms scraps and leftovers into delicious dishes	Vegetable scraps, meat bones, wilted greens
Pickling & Fermenting	Extends shelf life and creates value-added products	Imperfect fruits and vegetables, condiments



Menu Optimization:

1. Strategic Menu Planning:

Optimize inventory: Plan menus based on existing stock, budget, and customer preferences. This minimizes overbuying, overproduction, and underutilizing ingredients.

Dynamic portions and pricing: Adjust portions and prices based on menu planning forecasts to prevent waste and optimize profitability.

Digital tools: Utilize software or tools to streamline recipe optimization, food cost calculations, and waste tracking.

2. Prioritize Seasonality and Locality:

Fresher, tastier, and cost-effective: Utilize seasonal and local ingredients whenever possible.

Reduced environmental impact: Support local farmers and suppliers while minimizing carbon footprint.

Negotiate bulk purchases: Build relationships and leverage bulk buying or surplus deals for cost savings.

3. Embrace Cross-Utilization:

Maximize ingredient potential: Employ the same ingredient in multiple dishes, increasing efficiency and reducing waste.

Example: Transform chicken breasts into main courses, bones into stock, and scraps into salads or sandwiches.

Cater to diverse diets: Adapt recipes with cross-utilized ingredients to cater to vegetarian, gluten-free, or low-carb preferences.

4. Value Through Preservation:

Extend shelf life and add value: Preserve and process ingredients through freezing, drying, canning, pickling, fermenting, or curing.

Transform ingredients into new products: Create jams, sauces, soups, cheeses, or charcuterie for use in dishes or retail sales.

More things to focus on

Reducing overserving of food



We can replace large ladles and spoons with smaller serving tools, encouraging smaller portions.

Train mess staff on portion control techniques and strategies for minimizing overserving. Encourage staff to engage with students and provide guidance on portion sizes when necessary.

By offering small tasting Portions of new or unfamiliar food items to encourage exploration without committing to full serving.

Continuously monitor portion sizes and plate waste levels to assess the effectiveness of strategies implemented. Adjust portion sizes and intervention strategies as needed based on feedback and observations.

Biodegradation & Biogas



Starch and cellulose, constituting about 60% of food wastes, are rich in carbohydrates, along with 20% proteins and 10% lipids.

These components make food wastes valuable for producing high-value end products like enzymes and organic fertilizer.

Food wastage, with its high organic content (70% to 90% organic matter), is ideal for biogas production.

Scientific studies indicate food waste can yield 300 to 800 liters of biogas per kilogram of volatile solids, with methane concentrations of 50% to 70%.

Compared to other feedstocks, food waste shows higher biogas production rates and methane yields, making it a valuable renewable energy source with significant environmental benefits.

Self throwing



We can keep bins or containers designated for plate wastage disposal .Students can self-dispose their plate wastage before returning their trays or plates.

This encourages a sense of accountability and ownership over their actions, motivating them to make more conscious decisions about their food consumption.

Install weighing machines underneath these bins .This will allow them to visually assess and discard any uneaten food.Weighing machines provide students with quantitative feedback on the amount of food they are wasting.

Seeing the actual weight of their plate wastage reinforces the tangible impact of their food choices, prompting diners to reconsider portion sizes and consumption habits.

Conclusion

By addressing this issue head-on ,we not only contribute to the sustainability and efficiency of our institute's food waste management , but also align ourselves with broader global efforts to reduce food waste and promote environmental awareness. Through innovative solutions such as Pre-Booking, RFID cards, Self Throwing, Small

Serving ,etc we can significantly reduce food waste encouraging a culture of responsibility and sustainability among our campus community. By implementing these strategies, we also demonstrate our commitment to social responsibility .

Moreover by encouraging partnerships with local communities and organisations we can support the needy people by collecting unserved counter cooked food in all the hostels in our campus ,this will address the immediate hunger issue ,near our campus .

Let's turn challenge of food waste management into an opportunity for positive change .

Appendix

<https://www.linkedin.com/pulse/solution-food-waste-management-college-messcanteen-abhishek-bhushan/> <https://doi.org/10.1155/2017/2370927>

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Thank You