AI-Powered Food Waste Prevention Platform

Group Assignment
BUSA6430 (2025 S2)

Team Member(s):

Student ID	Name	Video Link
60796340	Rafsan Zamil	https://drive.google.com/file/d/1WK_TdxrfaAI11rkT33FsV7ZG77lq8zUf/view
48673455	Huang Yuchen	https://drive.google.com/file/d/1WitVmDe5DRTVhLe7AuFV_ysekxp83hYi/view?usp=drive_link
48195472	Prashish Shrestha	https://drive.google.com/file/d/12W5D_6-2XODsac6kzZPZzNz6p4oQ83Oz/view?usp=sharing
48134074	Soham Samir Kadam	https://drive.google.com/file/d/115w8UcAyz2S_fostteAekTGf05OryjMU/view?usp=sharing

Table of Contents

Introduction

One of the most significant sustainability issue of our time is the food wastage. Roughly one third of the food produced are being wasted globally (World Food Programme, 2024) and hospitality industry alone accounts for 15% of the food wastage worldwide (Tackling Food Waste through AI-Technology, n.d.). It is also contributing to climate change through green-house gas emissions. Commercial kitchens, restaurants and canteens produce a large amount of food waste on a daily basis, yet many of these lack the analytical tools to evaluate the waste patterns, identify shortcomings and execute reduction initiatives.

The combination of artificial intelligence with sustainability goals provides a potential to address this challenge. The AI system can process a large volume of operational data, identify complex patterns and provide actionable insight which can be missed by human managers (McGrath, 2024). Using of machine learning algorithms to evaluate the food flow from procurement to delivery, an organization can shift from reactive waste management to proactive waste prevention.

This is critical for several reasons. Reducing food waste directly links with reduction of methane emission from landfills, conserves water and land resources used in food production. Food waste denotes lost in revenue and extra operational expenditure economically which reduces profit margins. In a social sense too, addressing this issue helps to achieve food security goals and promote business responsibility. Understanding how AI can influence sustainable business practices prepares Macquarie Business School students to lead an organization that balances profitability with sustainable development, which is a crucial skill for business leaders of tomorrow.

Business Concept

Commercial kitchens have core limitation for food wastage. Managers see the overflowing bins but have a limited idea about what has been tossed. There is an information gap between why products are discarded, how these patterns are related with the purchasing, menu design and preparation workflow. The gap can be costly and still remain unnoticed. In NSW alone, the total cost of commercial waste removal ranges between 15$ to 300$ per bin service (Waste Clear, 2024) while accidently contributing to the environmental impact.

Traditional solution provide no relief as they are labour-intensive, unreliable and only captures snapshots instead of continuous intelligence. As the kitchen team is absorbed in service and cannot do thorough analysis of the waste. Manual techniques ignore the changing nature of trash, failing to document the change in patterns during the weekdays, weekend, seasons or during special occasions.

Our AI powered platform provides continuous, intelligent waste analysis by combing the existing digital system such as POS, inventory databases and the storage sensors. The technology uses computer vision and machine learning to monitory the food throughout its journey in the kitchen while classifying waste by category, timing and likely cause.

The AI identifies patterns over time and shows when and why waste happens after cross referencing it with sales performance menu analytics, preparation schedules and external factors.

Beyond diagnostic insights, the platform can suggest remedies like adjustment in the orders, optimization of the preparation timing, revising menu selection or focusing on staff development.
The idea directly supports the UN Sustainable Development Goals. It primarily supports SDG 12 (Responsible Consumption and Production) by achieving Target 12.3's goal of cutting food waste at the commercial level while minimizing supply chain losses (United Nations, 2025).
The solution provided further aligns with SDG 13 (Climate Action) by reduction in methane emission from decomposing food waste which are associated with wasteful production and transportation (United Nations, 2025b). It supports SDG 2 (Zero Hunger) by optimize use of resources and SDG 8 (Decent Work and Economic Growth) (The Global Goals, n.d.) by increasing efficiency and creating jobs in sustainable technology industries.

Business Model Canvas Analysis

The **customer segments** of this business focus on large restaurants, hotels, and canteens that already use digital systems such as POS and storage databases. These clients are ideal for the first stage because their data allows smooth integration of the AI system and accurate analysis from the start. As the company expands, it will target smaller restaurants that do not have digital systems by offering smart bins and sensors that collect data automatically. In later stages, local councils and food rescue groups may also benefit from reports that show food waste patterns at the community level. Similar AI food waste systems in hospitality have shown strong scalability and clear environmental benefits, proving that this model can work across different industries (Clark et al., 2025).

The **value proposition** is to provide an intelligent solution that helps kitchens reduce food waste through AI data analysis. The system connects with POS and storage data to track food from purchase to disposal. By comparing waste with sales and menu data, the system identifies inefficiencies that are often missed in daily operations. Over time, it records waste trends, showing how food waste changes across times and seasons. Based on this, the system suggests actions like changing portion sizes or updating menus. It also creates reports that highlight savings in cost, food quantity, and carbon emissions. For large clients, the company handles installation, staff training, and maintenance. As the business grows, smart bins and sensors will help smaller restaurants use the system easily. AI waste tracking devices have already reduced food waste in hotels by up to 50%, showing how data can drive consistent improvement (Sigala et al., 2025; Mandarin Oriental Hotel Group, 2024).

The **channels** used to deliver the service are based on direct partnerships with restaurants, hotels, and public organisations in the hospitality sector. The AI system operates through a cloud platform that connects with existing POS and storage systems. Later, a mobile and web version will be added to make access easier for smaller businesses. Similar mixed models that use both cloud analysis and dashboard reports are now common in sustainable technology systems (Valente de Oliveira et al., 2025).

Customer relationships are built on professional service, reliability, and collaboration. Clients are not only buying technology but entering a long-term partnership. The company

sets up the system, connects it to data, trains staff, and provides ongoing advice. Progress is shown through dashboards that display changes in food waste, cost savings, and environmental impact. As the AI learns from each kitchen's data, it becomes more accurate and supportive. The system helps humans make decisions rather than replacing them. This balance between automation and human skill builds trust and cooperation (Clark et al., 2025).

Revenue mainly comes from subscription fees for the AI platform and analysis services. Fees differ by kitchen size and data usage. Other income comes from installation, support, and reports. When smart bins and sensors are introduced, clients may rent or buy the equipment. Smart sensors and computer vision tools such as Google Cloud Vision API have shown strong results in recognising and classifying food waste images (Ferreira et al., 2025), making them useful for future product expansion.

Key resources include AI models that process images and data, secure technology that connects to client systems, and skilled staff in software, data science, and sustainability. Reliable cloud storage and security systems are essential to protect client information and maintain system performance.

Key activities include linking client data, studying waste trends, and giving practical recommendations. In the first stage, the focus is on large clients with digital systems, so the AI can produce detailed insights about waste patterns. The system identifies time-based patterns and relates them to menu choices and preparation routines. Later, the use of sensors will allow automatic data collection, helping smaller restaurants join and improving accuracy. This approach matches global trends in responsible AI systems that stress transparency, fairness, and measurable results (Valente de Oliveira et al., 2025).

Key partners include POS and software companies, hotel and restaurant groups, and government sustainability programs. Working with research institutions can improve AI performance and support ethical compliance. Real cases in hospitality show that such partnerships can greatly improve both cost savings and environmental results (Mandarin Oriental Hotel Group, 2024).

The **cost structure** covers AI development, data processing, cloud storage, and staff training. Other costs include marketing, support, and installation. When hardware is added, manufacturing and maintenance will become part of the expenses. Ongoing AI updates will ensure the balance between cost and clear reductions in waste and emissions (Sigala et al., 2025)..

Generative AI Tools Integration

Computer Vision AI (Google Cloud Vision API)

Our platform uses Google Cloud Vision API to automatically classify and categorize food waste. The data are gathered from smart bin cameras. This technology recognizes individual food items, checks states and categorizes waste.

Machine Learning Platform
We use TensorFlow-based predictive models to evaluate historical garbage data and detect recurring trends. This tools analyses different data points to identify correlations between waste volumes, menu items, service times, weather conditions, and sales patterns. After the analysis, it gives information that are unseen to human observation

Natural Language Generation (GPT-4 API)
Our system uses the GPT-4 API to translate complex data into clear, actionable suggestions. This GAIT provides detailed advise to kitchen managers (e.g., "Reduce chicken parmesan portions by 20% during weekday lunch service") and produces thorough sustainability reports that quantify environmental and financial effects.

Implementation Plan

Our AI-Powered Food Waste Prevention Platform will be implemented over the course of approximately eighteen months in a few distinct phases. This strategy ensures that everyone on the team is aware of their roles and that the project is practical. Additionally, it gives time for thorough system testing prior to a complete launch.

Phase 1: Planning and Requirement Analysis (Months 1–3):
In order to understand their food-waste issues and how their current systems operate, we will first meet with potential clients, such as large restaurants, hotels, and canteens. This aids us in determining the information we require from their storage and point-of-sale systems. We will also make choices regarding security, privacy, and how the AI will address moral dilemmas during this stage. As the implementation coordinator, I (Soham Kadam) will ensure that there is constant communication between the technical and sustainability teams.

Phase 2: System Development and AI Integration (Months 4–9):
The technical team will then construct three primary AI modules:

- Based on historical sales and waste, the Inventory Forecasting Model forecasts how much food should be bought.
- Using smart-bin cameras, the Image Recognition Model recognises food items that are thrown away (Farrukh & Sooriyaperuma, 2023).
- Recommendation engines make suggestions for things like altering menu items or portion proportions (Analytics Vidhya, 2023).

These models will be integrated by the developers into a cloud platform that interfaces with restaurant systems. The platform's support for SDG 12.3: Responsible Consumption and Production will be examined by our sustainability members (United Nations, 2023).

Phase 3: Pilot Testing (Months 10–14):
Pilot testing will be conducted in a university canteen and two hotel brands. The goal is to determine how well the system forecasts waste and how user-friendly it is for employees. In order to create improvements, I'll assist with testing management, training session planning, and feedback gathering.

Phase 4: Launch and Maintenance (Months 15–18):
Smart bins and IoT sensors that gather data automatically will be used to spread the concept to smaller restaurants after the test is successful (Frozenet, 2025). The support staff will keep maintaining and updating the AI after the launch. This methodical approach ensures that our system is ethical, useful, and prepared for long-term use.

Risks and Mitigation

Despite the enormous potential of our proposal, there are still some hazards that we must carefully consider. These include operational, privacy, and technical issues that may have an impact on user confidence and performance.

1. Technical Risk – Data Quality and Accuracy:
High-quality data is essential to the AI system. The AI may produce incorrect predictions if sales data or bin pictures are lacking (Birkmaier et al., 2023). We will regularly clean and verify data, retrain the AI using verified information, and conduct monthly performance audits in order to lower this risk.

2. Privacy and Ethical Risk – Data Protection:
Data privacy is a significant concern because the system leverages sensitive corporate information. We'll employ encryption, restrict data access to approved personnel, and eliminate any personally identifiable information. Building client confidence requires being open and honest about how data is utilised (Bear-McGuinness et al., 2025).

3. Operational Risk – Low Adoption:
Due to expense or inexperience, some restaurants can be reluctant to experiment with new AI systems. To get around this, we'll provide training sessions and user-friendly dashboards that highlight the advantages in terms of cost savings and waste reduction (Farrukh & Sooriyaperuma, 2023).

4. Environmental Risk – Device Waste:
Smart bins and sensors could create electronic waste over time. To avoid this, we'll design them to be energy-efficient, durable, and recyclable (UN Environment Programme, 2024).

By addressing these risks early, the platform can remain sustainable, ethical, and effective in reducing food waste.

Evaluation & Improvement

Key Performance Indicators (KPIs)
This AI based food waste platform's performance must be accurately evaluated.. This will ensure that it provides genuine business and environmental benefits. Key performance indicators can be used to monitor the system's effectiveness in preventing food waste. One of the main key performance indicators is the reduction of food waste percentage calculated in kilograms each month. We can also keep track of the total cost reductions made by clients through economical purchase and cost of removal as KPI. Another important measurement can be the carbon emissions reduced by waste prevention which are measured in CO_2 equivalents.

Digital Measurement, Reporting, and Verification (dMRV)

We will employ a digital measurement, reporting, and verification approach which is known as dMRV to ensure that our findings are accurate and transparent. General MRV approaches are costly and also very time consuming. They mostly rely on manual data collection which raises the possibility of inaccurate reporting. Moreover, traditional MRV faces limitations such as high costs and technical difficulties (dClimate, 2023).

To resolve these issues our system will use dMRV approach where it autonomously gathers waste data using sensors, smart bins, and POS devices in real time. This real time data can be easily accessible to make the system transparent. Every month, the system will produce reports that show the trends in waste reduction, cost cutting, and environmental benefits. Every data point can be encrypted and timestamped to make them auditable and keep the confidentiality. The ethical issues which are raised by misrepresented environmental claims are also addressed by this transparency.

AI Learning and Pattern Recognition

AI based food waste prevention systems can be a practical solution that will integrate computer vision to learn patterns, optimize ordering, and reduce avoidable losses (Clark et al., 2025). The platform will directly align with SDG 12 which is responsible consumption and production by improving resource efficiency. With SDG 13 which is climate action by preventing methane intensive landfill disposal. The United Nations environment programme reports that food waste is a huge source of greenhouse gas emissions and a significant resource inefficiency (United Nations Environment Programme [UNEP], 2021).Under the OECD framework this platform will use foundational AI Technologies such as time series forecasting, computer vision, secure data which will be assembled into AI systems that will power AI applications like dashboards, auto orders, audit reports etc.

Conclusion & Next Steps

Impact and Alignment with SDGs

The proposed AI based food waste prevention system will be integrating measurement by using smart bins and POS, learning by forecasting and computer vision models, and verification together in one cycle by reducing waste, saving costs, and accurately quantifying CO_2 emission reductions (UNEP, 2021). Key performance indicators such as percentage of waste avoided per month, cost cuttings, and CO_2 emission reduced serve as a foundation for accountability. A privacy and environment friendly approach keeps this initiative's ethical principles. Thus, the proposed initiative is technically viable, economically viable, and strategically aligned with SDG 12 & 13. It also provides actual economic value for customers. Customers will gain from reduced food bills as well as decreased waste disposal charges. The organization will employ ethical AI and transparent dMRV tracking systems and for that it will remain accountable to both the environment and customers.

Next Steps

Next, we'll implement responsible AI controls. We will reduce data, reidentify photos, and employ short retention. To ensure fairness we will track performance across many sites. To

provide transparency each recommendation will include explanations and a confidence indicator. High impact changes will require human approval. We will use minimal access and encryption to secure data as well as keep time-stamped logs. Finally, we will monitor energy consumption and prioritise repairable hardware. These procedures assure a safe, fair, and trustworthy AI system with measurable waste and CO_2 reductions.

I acknowledge that I have not used GAITs (e.g., ChatGPT) in drafting and proofreading this assignment.

References

Bear-McGuinness, L. (2025, July). *How AI Is Reducing Food Waste*. Applied Sciences from Technology Networks; Technology Networks. https://www.technologynetworks.com/applied-sciences/articles/how-ai-is-reducing-food-waste-401732

Ceanu, D. (2025, March). *AI-Powered Food Waste Analytics: Cutting Waste, Boosting Sustainability*. FrozeNet; FrozeNet Magazine. https://frozenet.com/sustainability-environment/reducing-food-waste/ai-powered-food-waste-analytics-cutting-waste-boosting-sustainability/

Clark, Q. M., Kanavikar, D. B., Clark, J., & Donnelly, P. J. (2025). Exploring the potential of AI-driven food waste management strategies used in the hospitality industry for application in household settings. *Frontiers in Artificial Intelligence*, *7*. https://doi.org/10.3389/frai.2024.1429477

dClimate. (2023, March 28). *dMRV: What is it, how it works, and why it is essential for bringing scale and accountability to the VCM*. DClimate. https://blog.dclimate.net/dmrv-what-is-it-how-it-works-and-why-it-is-essential-for-bringing-scale-and-accountability-to-the-vcm

Environment, U. (2021). *UNEP Food Waste Index Report 2021*. UNEP - UN Environment Programme. https://www.unep.org/resources/report/unep-food-waste-index-report-2021

Ferreira, J., Cerqueira, P., & Ribeiro, J. (2025). Food Waste Detection in Canteen Plates Using YOLOv11. *Applied Sciences*, *15*(13), 7137. https://doi.org/10.3390/app15137137

MANDARIN ORIENTAL EMBRACES ARTIFICIAL INTELLIGENCE TO SET A NEW STANDARD IN FOOD WASTE REDUCTION FOR LUXURY HOSPITALITY. (n.d.). https://photos.mandarinoriental.com/is/content/MandarinOriental/_DMO/_Corporate/PDFs/Press%20Releases/corporate-global-news-pdf-winnows-ai-technology.pdf

McGrath, A. (2024, July 11). *AI in Operations Management*. Ibm.com. https://www.ibm.com/think/topics/ai-in-operations-management

Onyeaka, H., Tamasiga, P., Nwauzoma, U. M., Miri, T., Juliet, U. C., Nwaiwu, O., & Akinsemolu, A. A. (2023). Using Artificial Intelligence to Tackle Food Waste and Enhance the Circular Economy: Maximising Resource Efficiency and Minimising Environmental Impact: A Review. *Sustainability*, *15*(13), 10482. https://www.mdpi.com/2071-1050/15/13/10482

Progress in Artificial Intelligence. (2025). In *Lecture notes in computer science*. Springer Science+Business Media. https://doi.org/10.1007/978-3-032-05179-0

Serrano-Gomez, J., Metson, G. S., Tina-Simone Neset, Santner, J., Hermann, L., & Matthias Zessner. (2023). EU-compliant wastewater recycled phosphorus: How much national

cereal demand can it meet? *Journal of Cleaner Production*, *429*, 139482–139482. https://doi.org/10.1016/j.jclepro.2023.139482

Sigala, E. G., Gerwin, P., Chroni, C., Abeliotis, K., Strotmann, C., & Lasaridi, K. (2025). Reducing food waste in the HORECA sector using AI-based waste-tracking devices. *Waste Management*, *198*, 77–86. https://doi.org/10.1016/j.wasman.2025.02.044

Simranjeet. (2023, January 16). *Food Waste Management: AI Driven Food Waste Technologies*. Analytics Vidhya. https://www.analyticsvidhya.com/blog/2023/01/food-waste-management-ai-driven-food-waste-technologies

Tackling Food Waste Through AI-Technology. (n.d.). AIM2Flourish. https://aim2flourish.com/innovations/tackling-food-waste-through-ai-technology-2

The Global Goals. (n.d.). *Goal 8: Decent Work and Economic Growth*. The Global Goals. https://globalgoals.org/goals/8-decent-work-and-economic-growth/

UN AI Actions. (2025, March 27). AI for Good. https://aiforgood.itu.int/about-us/un-ai-actions

United Nations. (2023, August 8). What is sustainable development? *United Nations*. https://www.un.org/sustainabledevelopment/blog/2023/08/what-is-sustainable-development/

United Nations. (2025a). *Goal 12 | Ensure sustainable consumption and production patterns*. United Nations. https://sdgs.un.org/goals/goal12

United Nations. (2025b). *Goal 13: Take Urgent Action to Combat Climate Change and Its Impacts*. Sustainable Development Goals; United Nations. https://www.un.org/sustainabledevelopment/climate-change/

Waste Clear. (2024). Wasteclear.com.au. https://wasteclear.com.au/commercial-waste-removal-costs/

World Food Programme. (2024, June 25). *5 facts about food waste and hunger | World Food Programme*. Www.wfp.org; World Food Programme. https://www.wfp.org/stories/5-facts-about-food-waste-and-hunger