

CASE STUDY · SINGAPORE, 2015 TO 2026

Food waste in Singapore and where AI can help.

Three problem statements, the evidence for each, who is doing what, and where universities fit.

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ABOUT YOUR SPEAKER



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Twenty-five years leading digital and AI transformation across Asia and the Middle East: national smart-city programmes, critical infrastructure and enterprise operations. Today I help leadership teams put AI into production with controls they can show a board, an auditor and a regulator.

Built	A governed AI platform serving more than 6,000 engineers, with zero security incidents
Certified	ISO/IEC 42001 Lead Auditor Professional (BSI) · AIGP (SMU) · Registered Management Consultant
Serving	CTCB CPSC Advisory Board · UN ESCAP AI for Developing Countries Forum
Awards	CDO Vision Award 2026 · Singapore's Most Influential Data & AI Leaders 2026 · Google Trailblazer Transformation Award 2024

Independent analysis from public sources. The views in this session are mine.

THIS SESSION

Six parts, from the numbers to a research agenda.

01

The problem in numbers

Eleven years of NEA data, and what the statistic cannot see.

02

Rules and infrastructure

The segregation rules, Tuas Nexus and the households gap.

03

Predict and prevent

Forecasting and kitchen tracking: what the evidence shows.

04

Collect and recover

Contamination, sensors, routing and surplus matching.

05

Value and model

Nudges, the business case and the carbon question.

06

Who is doing what

Government, industry, community and the universities.

Then: where university work is thin, routes in, a research agenda and questions for discussion.

THE CASE IN ONE SLIDE

A steady problem, new rules coming, and gaps a university can fill.

790,000 t

of food waste in 2025, about 11% of all waste

18%

recycled; 18% or 19% every year since 2019

2027+

Tuas Nexus food waste line; existing premises follow

~40%

of food waste from commerce and industry; the rest has no published split

Sources: [3] MSE, 7 Jul 2026; [1] [2] NEA statistics, Jun 2026; [13] NEA Green Bond Report, Mar 2026; [5] MSE, 5 Feb 2024.

01

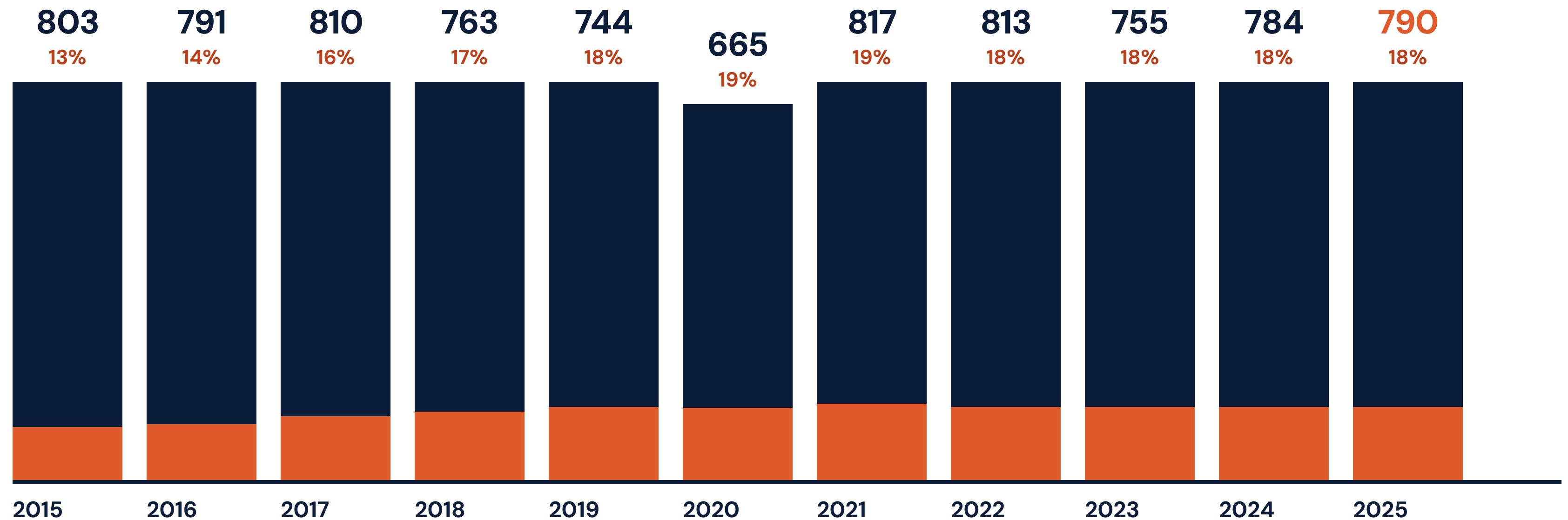
The problem in numbers.

Eleven years of official data, and the part the statistic cannot see.



FOOD WASTE, '000 TONNES A YEAR · NEA

The tonnage holds steady, and so does the 18%.



Source: [2] NEA, Waste and recycling statistics 2015 to 2025. Orange: recycled share (NEA rounded rate). 2020 dip coincides with COVID-19.

WHAT THE STATISTIC CANNOT SEE

Prevention and rescued food do not show up in the headline.

~40%

Commerce and industry

The government's share for these sources. No split is published for households, hawkers and small outlets.

Not counted

Rescued food

"Food that is rescued or redistributed is not reflected in our food waste statistics." Minister, July 2026.

2017

Last household study

Food was about half of household waste disposed, and over half of that was avoidable.

Sources: [5] MSE, 5 Feb 2024; [3] MSE, 7 Jul 2026; [26] NEA household waste study, Dec 2017.

TARGETS AND LANDFILL

The national targets have not yet moved.

30%

less waste to landfill per person per day by 2030
against 2018; Zero Waste Masterplan, 2019

Flat

"about the same" as the 2018 baseline
Parliament, February 2025

2035

Semakau, the only landfill, expected to fill
more than half full, January 2024

2027

Zero Waste Masterplan review due
announced June 2026

Sources: [8] Zero Waste Masterplan, 30 Aug 2019; [9] MSE, 5 Feb 2025; [10] MSE, 9 Jan 2024; [7] MSE, 7 Jul 2026.

02

Rules and infrastructure.

Segregation for large new premises, a plant that keeps moving, and households outside the rules.



RESOURCE SUSTAINABILITY ACT · SINCE 8 MARCH 2024

Large new premises must segregate, treat and report.

Malls and hotels with more than 3,000 sqm of food and function space, food factories with more than 750 sqm of operations, and large multi-user food factories, in buildings planned from 2021.

About 360 premises would be in scope once existing buildings join. They have no date.

Sources: [11] Regulations S 194/2024; [4] NEA, Jun 2026; [12] NEA, 4 Mar 2020.



The rule for existing premises waits on one plant.

2025

Jan 2019 · NEA target after the Ulu Pandan trial [15]

2024

Mar 2020 · existing premises, plant "operational in 2024" [12]

Mid-2026

May 2024 · construction delays reported [14]

2027+

Mar 2026 · "progressively from 2027 onwards" [13]

No date

Jun 2026 · existing buildings "in tandem with" Tuas Nexus [4]

Food waste is pulped and co-digested with used-water sludge; the Ulu Pandan trial gave about 40% more biogas than digesting the two apart [15].

HOUSEHOLDS AND HAWKER CENTRES

The largest unmeasured share sits outside the rules.

No household mandate

"We do not have plans" to require it; trial participation could not be sustained. October 2025.

RFID charging judged hard

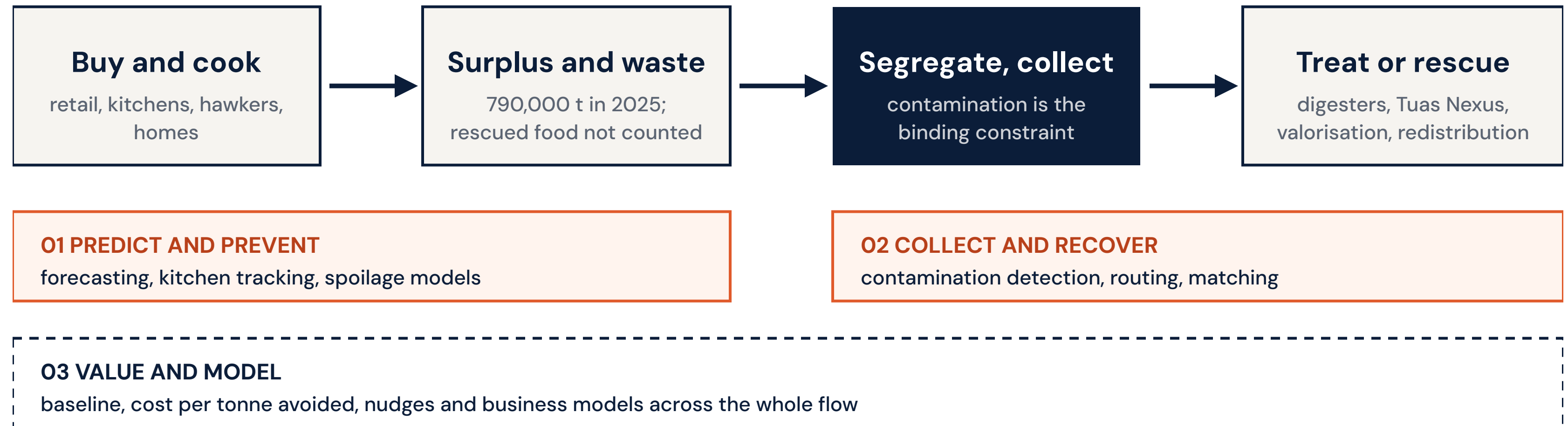
High-rise blocks share a refuse chute, so weighing per household is difficult. July 2026.

Tray return since 2021

A natural point to separate hawker food waste. No published pilot results found.

Sources: [16] MSE, 15 Oct 2025; [17] MSE, 7 Jul 2026; [68] NEA, May 2021; [55] NUS CDE, Nov 2021.

Three problem statements map onto one flow.



Sources: [3] [35] [13]. The mapping is my reading.

03

Predict and prevent.

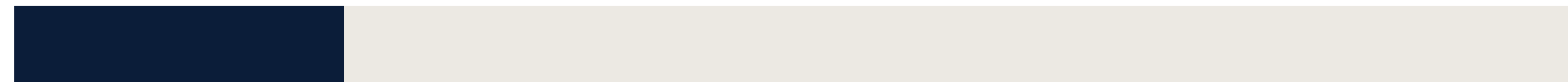
The strongest evidence of the three, with limits that matter for local food.

REPORTED FOOD WASTE REDUCTION · BY WHO MEASURED IT

Independent results are smaller than the sales figures.

Retail forecasting, 1,300+ stores

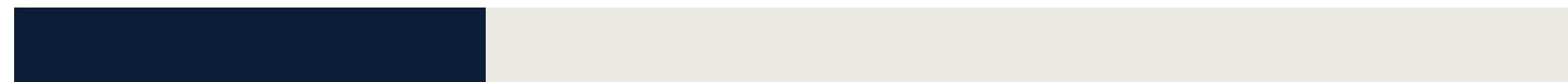
Independent pilot



14.8%

Hotel kitchens, year one

Programme study, 42 sites



21%

IKEA production waste vs 2017

Company-reported



54%

Kitchen CV range

Vendor claim (Winnow)



40–70%

Sources: [40] PCFWC, Dec 2022; [42] Champions 12.3, 2018 (restaurants 26% [43]); [39] Ingka, Sep 2022; [31] Winnow via TechNode, Jul 2026 (Lumitics: 30% in six months). Measures differ by row.



THE BEST INDEPENDENT RESULT · 2020 TO 2022

Forecasting cut store waste by 14.8%.

AI ordering pilots in more than 1,300 stores of two US grocers. Results were visible after about eight weeks.

The main barrier was not the model. Merchandising, finance and operations had conflicting goals.

Source: [40] Pacific Coast Food Waste Commitment, Dec 2022. Vendor marketing figures for the same category run higher.

KITCHEN TRACKING IN SINGAPORE AND BEYOND

Camera tracking works where staff act on the numbers.

54%

IKEA production waste

Against 2017, over about four years, with Winnow and 20,000 staff trained. Excludes plate waste.

4.1% → 2.3%

SATS waste intensity

FY2021 to FY2023, after AI tracking in its Singapore kitchens. Company-reported.

Jul 2026

Lumitics sold to Winnow

The Singapore vision company, used by Pullman Hill Street and others, now UK-owned.

Sources: [39] Ingka, 20 Sep 2022; [34] SATS Sustainability Report FY2022-23; [31] TechNode, 16 Jul 2026; [32] Green Globe.

TWO LIMITS FOR SINGAPORE

Local food and local habits are harder to model.

ACCURACY

Mixed dishes after eating

A 2025 study found vision models did worse on stews and fragmented food: most of what hawkers and canteens throw away.

ADOPTION

Someone must change a decision

Each gain came from kitchen and store staff acting on the data, not from the model alone.

Sources: [47] Rokhva and Teimourpour, arXiv, Jul 2025; [39] [40].

A spoilage model keeps safe food out of the bin.

AI

model predicts growth of bacteria such as Salmonella under real storage conditions

SFA

FRESH is run by NTU with SFA and A*STAR
launched April 2021

Retail

supermarket chains exploring adoption
per NTU

1

of only two academic AI prevention projects found with the SMU-X dashboard

Sources: [50] NTU, 20 Apr 2026; [51] NTU, 27 Apr 2021; [52] SMU, 8 Jun 2023. The count is my reading.

04

Collect and recover.

One constraint keeps recurring: what goes into the bin.



THE RECURRING FAILURE

Contamination has stopped more projects than technology has.

40%

IUT Global, 2011 · up to 40% of intake contaminated; built for 800 t/day, collected 120-130 [37]

~300 t

Changi, 2019 · a year through 11 digesters; staff cannot tell digestible waste apart [35]

~40%

Blue bins, Feb 2026 · contamination "remained at about 40%" (recyclables) [19]

Contamination detection at the point of disposal is the most valuable collection use case here, ahead of route optimisation.

The last line is my reading of [37] [35] [19].

SENSORS, SMART BINS AND ROUTING IN SINGAPORE

Pilots exist; published results do not.

2022–23

BINgo

FairPrice and A*STAR AI and IoT sorting bins for recyclables at three sites. No results published.

2023

Fill-level sensors

800 Super's trial delayed by procurement and manpower problems. No results published.

SMU

Routing research

Ant-colony routing for municipal waste; not for segregated food waste.

Sources: [38] A*STAR, 6 Oct 2022; [20] MSE, 4 Jul 2023; [21] MSE, 11 Sep 2025; [53] SMU.

MATCHING SURPLUS WITH PEOPLE WHO CAN USE IT

Rescue works at useful scale.

612 t

redistributed by the Food
Bank Singapore

2024

300,000+

meals rescued in Singapore
through Yindii

2025, company release

1,095 t

imperfect produce sold by
FairPrice

2024; ~75 t redistributed

**Jan
2025**

Good Samaritan Food
Donation Act in force

donors protected if conditions met

Sources: [27] FBSG AR 2025; [29] Yindii, Dec 2025; [28] FairPrice SR 2024; [25] GSFDA 2024. Too Good To Go is not in Singapore [30].

05

Value and model.

Nudges with good evidence, a business case on self-selected sites, and a weak carbon leg.

BEHAVIOURAL MEASURES · MOST NEED NO AI

Plates, signs and portions have the best controlled evidence.

19.5%**Smaller plates**

Nordic hotel buffets, plates 3 cm smaller. Peer-reviewed field experiment.

20.5%**A sign to come back**

Inviting guests to return for more, in the same experiment.

2021**Rice-level menu card**

Four NUS canteens, run by students with the ministry as mentor. No published effect size.

Sources: [45] Kallbekken and Sælen, Economics Letters, 2013; [54] NUS Zero Waste.

About 7 to 1 for hotels and restaurants.

7:1

hotels, 42 sites

21% less kitchen waste in year one (2018)

7:1

restaurants, 114 sites

26% less in year one (2019)

14:1

cross-sector average, 1,200 sites

2017; not the hotel figure

Caveat

sites chose to take part

shows what is possible, not typical

Sources: [42] Champions 12.3 and WRAP, 2018; [43] 2019; [44] WBCSD, Mar 2017.

THE CARBON QUESTION

Value in Singapore rests on cost, compliance and landfill life.

Incinerated, not landfilled

Methods that credit avoided landfill methane are unlikely to apply here.

Tax on large emitters

S\$45 a tonne from 2026, on about 50 facilities, not on a hotel's or hawker's bin.

No Singapore model

No published cost-per-tonne or carbon model for food waste was found.

Source: [24] NCCS. The analysis is mine.

06

Who is doing what.

Government, industry, the community and the universities.



Plenty of activity, spread thinly.

Problem	Government	Industry and community	Universities
Predict and prevent	NEA guides; Love Your Food programmes	Hotels on Lumitics and Winnow; SATS; FairPrice forecasting [32] [34] [28]	NTU FRESH; SMU-X dashboard; NUS canteen nudge [50] [52] [54]
Collect and recover	Tuas Nexus, 400 t/day from 2027 [13]	800 Super, ALBA, Cora; BINgo; Food Bank; Yindii [18] [38] [27] [29]	NUS digesters; A*STAR, RP, Mottainai valorisation; SMU routing [55] [23] [60] [53]
Value and model	TREASURES; Closing the Resource Loop [48] [22]	Marina Bay Sands: 65% diverted (2024) [36]	A*STAR SIMTech audit method [59]

Hospitality vendors named only where the hotel or vendor has said so publicly.

UNIVERSITY ACTIVITY BY PROBLEM AREA · FROM PUBLISHED WORK

Strong on products, thin on prediction and the value model.

Institution	Predict and prevent	Collect and recover	Value and model
NUS	Some	Active	Some
NTU	Active	Active	Some
SMU	Some	Some	None found
SUTD	None found	Some	None found
SIT	None found	Some	None found
A*STAR	None found	Active	Some
Polytechnics	None found	Active	None found

My grading from [58] [50] [52] [53] [55] [56] [23] [59] [60]. "None found" means nothing published.

SELECTED PROJECTS

The university work closest to the three problems.

Who	Project	AI used
NTU and NEA	TREASURES, Node 1 Waste Flow & Analytics, S\$35m to 2030 [48] [49]	Modelling remit
NTU FRESH	Spoilage model so safe food is not discarded [50]	Yes
SMU-X, FairPrice	Write-off dashboard flagging high-loss outlets [52]	Yes
NUS CDE, NEA	Digester at East Coast Lagoon Food Village [55]	No
NUS, SEC, NTU	Black soldier fly blueprint for urban food waste [56] [57]	No
A*STAR, Mottainai	Three CTRL valorisation awards, S\$5.3m combined [23]	No
Republic Poly	Okara protein and peptides, licensed in 2026 [60]	No

WHERE UNIVERSITY WORK IS THIN

Five gaps a new programme could fill.

Forecasting outside retail. Hawkers, caterers, central kitchens and canteens.

Household and hawker measurement. No repeated survey or diary panel; the last NEA study was 2017.

Vision data for local food. No published Singapore set of food waste images.

Collection logistics. Moving segregated food waste from existing premises to Tuas Nexus.

A cost and carbon model. Cost per tonne avoided, for operators and for the state.

My reading of [58] [26] [47] [13] [59]. Valorisation chemistry is the crowded area.

Routes in, and what each suits.

Route	Suits	Pace
TREASURES Node 1	A food waste flow and analytics workstream in a funded centre, to 2030 [48] [49]	Months
NEA CTRL calls	Industry and institutions co-apply [22] [23]	Call cycle
SMU-X	Low-cost analytics pilot on a real data set [52] [62]	One term
SIT work-study	Students placed in an operator for 8 to 12 months [63]	Semester
NUS Zero Waste	Canteen trials before hawker centres [54]	Semester
NTU FRESH	Shelf-life and spoilage trials with retailers [50]	Months

INTERNATIONAL BENCHMARKS

Universities elsewhere own the baseline.

-17%

Wageningen

Runs the Dutch national food waste monitor; waste fell 17% from 2015 to 2023.

Panels

Leeds and Ohio State

Household surveys and food diaries, repeated on a schedule.

Open

ReFED

A public cost-benefit model of 40+ solutions, not just a tonnage.

Sources: [64] Rijksoverheid, Sep 2025; [65] Leeds, Jan 2021; [67] Ohio State; [66] ReFED. Seoul's weight-based fees: 47,000 t less over six years, reported [46].

A RESEARCH AGENDA

Seven questions to put to the universities.

Baseline. How much food waste do households, hawkers and small outlets produce, and how much is avoidable?

Forecasting. Can a demand model cut overproduction at a central kitchen, against a control group?

Local vision data. Can an open image set lift accuracy on mixed dishes?

Contamination at source. Can a camera or sensor catch it before the digester?

Collection design. Least-cost routes from existing premises to Tuas Nexus.

Nudges at the tray return. Do portions and signage work in hawker centres?

The value model. Cost per tonne avoided for each measure, published openly.

My recommendations, drawn from [65] [67] [40] [47] [35] [13] [45] [66].

07

What leaders can take from it.

Seven lessons, a pilot checklist and questions to take back.



LESSONS 1 AND 2 · BEFORE THE TECHNOLOGY

LESSON 01

Measure first.

The national statistic cannot see prevention or rescued food.

ACTION

Set a weighed baseline before any pilot starts.

LESSON 02

Fix the input before the machine.

Contamination sank IUT Global and holds back Changi's digesters.

ACTION

Fund detection and staff training ahead of treatment capacity.

Lessons are my reading of the record: [3] [37] [35].

LESSONS 3 AND 4 · WHERE TO INVEST

LESSON 03

Back prediction where someone will act.

Every gain came from staff changing what they order or cook.

ACTION

Choose partners who will change the decision, not only host the tool.

LESSON 04

Ask universities for the thin areas.

Valorisation is well served; measurement and modelling are not.

ACTION

Commission forecasting, measurement, vision data, logistics and the value model.

Lessons are my reading of the record: [39] [40] [58].

LESSONS 5 TO 7 · MAKING IT LAST

LESSON 05

Use existing institutions.

TREASURES, CTRL and SMU-X give funding, a host and a pace.

ACTION

Anchor the work where it outlasts one grant.

LESSON 06

Plan for vendor change.

A sale, a restructure and a liquidation in the record.

ACTION

Own the data and make sure it can move.

LESSON 07

Count value in Singapore terms.

Food cost, disposal, compliance and landfill life.

ACTION

Do not plan on carbon credit income.

Lessons are my reading of the record: [48] [22] [31] [37] [24].

FOR GOVERNMENT

Count what policy wants to change.

Count prevention

Rescued and prevented food is invisible in the main statistic today.

Use the 2027 review

The masterplan review is the natural moment to change the measure.

Give it a method

A university-run baseline, on the Wageningen model, would make the count credible.

My recommendations, drawn from [3] [7] [64].

PILOT CHECKLIST

A checklist for a food waste AI pilot.

Control	What good looks like	Why, from the record
Baseline	Four to eight weeks of weighed waste first	Retail results showed from ~8 weeks
Control group	Comparable sites without the tool	Business-case sites self-selected
Measure named	Production, plate or store waste	IKEA's 54% is production only
Local accuracy	Tested on the site's own dishes	Vision weakens on mixed dishes
Contamination	Checked at the point of disposal	IUT Global, Changi, blue bins
Staff and goals	Trained teams, goals that agree	Main barrier in retail pilots
Data and privacy	Cameras on bins, data owned by operator	Vendor churn
Value method	Cost per tonne avoided, with its parts	No Singapore model published

My recommendations. Sources: [40] [42] [39] [47] [37] [35] [19] [31].

REPORTING

What is often misreported.

Often said	What the record shows
Food waste at a record high	2025 (790,000 t) was below 2021 (817,000 t). [2]
All large premises must segregate	New buildings only; existing ones have no date. [4]
Mandatory reporting since 2021	Reporting began with segregation in March 2024. [11]
Singapore is adopting RFID bins	Judged hard with shared chutes. [17]
IKEA halved all food waste	54% of production waste. [39]
14:1 return for hotels	Cross-sector average; hotels about 7:1. [44] [42]
Too Good To Go in Singapore	Its first Asian market is Japan. [30]

Dates to re-check.

When	What to look for
2027	Zero Waste Masterplan review: food waste target, household measure, counting rescued food.
2027 onwards	Tuas Nexus food waste line, and the date for existing buildings.
Jun 2027	2026 statistics: whether food waste recycling moves off 18%.
2026 to 2030	TREASURES grant calls, and whether Node 1 takes on food waste.
Ongoing	Results from Singapore sensor and smart-bin pilots.

EVIDENCE AND METHODOLOGY

How strong each claim in this case is.

Claim	Rests on	Grade
Food waste generated, recycled and recycling rate, 2015 to 2025	NEA statistics tables, June 2026	Measured, official statistics
Commercial and industrial sources are about 40% of food waste	MSE written reply, February 2024	Official estimate, no method published
Rescued food is not in the statistics	MSE written reply, July 2026	Official statement
RSA dates for new and existing buildings; Tuas Nexus timing	Regulations S 194/2024; NEA pages; Green Bond report	Primary legal and agency documents
Blue-bin contamination about 40%	MSE replies, 2023 and 2026	Official, aggregated sampling
Independent retail forecasting pilots averaged 14.8%	Pacific Coast Food Waste Commitment, 2022	Measured, multi-retailer pilot
IKEA cut production food waste 54% against 2017	Ingka Group, 2022	Company-reported, unaudited
Kitchen vision tracking cuts 30% to 70%	Winnow and Lumitics materials	Vendor claim
Smaller plates cut buffet waste 19.5%	Kallbekken and Sælen, 2013	Peer-reviewed field experiment
Hotels and restaurants return about 7:1	Champions 12.3, 2018 and 2019	Programme study, self-selected sites
University activity by problem area, and the gaps	University and agency releases, read October 2026	My call, from what is published
Engagement routes, research agenda and controls checklist	My reading of the record cited against each	My call

January 2011 to October 2022.

Jan 2011	IUT Global, then Singapore's largest food waste digestion plant, folds. Built for 800 t/day, it collected 120-130 t/day, with up to 40% of intake contaminated.	[37]
Dec 2016	NEA starts co-digesting food waste with used-water sludge at Ulu Pandan. In January 2019 it reports about 40% more biogas than digesting the two apart.	[15]
Dec 2017	NEA household waste study: food is about half of household waste disposed, and over half of that is avoidable.	[26]
7 Mar 2019	NEA says segregation will be mandatory for large commercial and industrial food waste generators from 2024.	[72]
30 Aug 2019	Zero Waste Masterplan: 30% less waste to landfill per capita per day by 2030, 70% overall recycling, food named a priority stream.	[8]
Jun 2021	Tray return becomes mandatory at hawker centres, coffeeshops and food courts; enforcement from September.	[68]
Nov 2021	NUS and NEA pilot a containerised digester at East Coast Lagoon Food Village.	[55]
Feb 2022	NUS, the Singapore-ETH Centre and NTU start a black soldier fly blueprint for urban food waste.	[56]
Oct 2022	FairPrice and A*STAR launch BINgo AI/IoT smart bins for recyclables at three sites.	[38]

February 2023 to January 2026.

Feb 2023	MSE puts blue-bin and chute contamination at about 40%. Olio restructures and its Singapore head leaves.	[74] [70]
Jun 2023	SMU and FairPrice report a student-built write-off dashboard with predictive analytics.	[52]
8 Mar 2024	Food waste segregation, treatment and reporting start for new large malls, hotels and food factories.	[11] [4]
May 2024	Tuas Nexus hit by construction delays; completion reported as mid-2026.	[14]
1 Jan 2025	Good Samaritan Food Donation Act 2024 comes into force.	[25]
5 Feb 2025	Waste to landfill per capita per day is “about the same” as the 2018 baseline.	[9]
Mar 2025	Sembcorp completes the sale of its waste business, rebranded Cora Environment in September 2025.	[69] [21]
15 Oct 2025	MSE: no plan to require households to segregate food waste; trial participation could not be sustained.	[16]
1 Jan 2026	Carbon tax rises to S\$45 per tonne. TREASURES, the NEA and NTU research centre, starts its term.	[24] [48]

February 2026 to July 2026.

24 Feb 2026	Blue-bin contamination “remained at about 40%”.	[19]
Mar 2026	NEA Green Bond report: Tuas Nexus food waste line “progressively from 2027 onwards”.	[13]
20 Apr 2026	NTU reports an AI model that predicts microbial growth so safe food is not thrown away.	[50]
17 Jun 2026	2025 statistics: 790,000 t of food waste, 18% recycled. Zero Waste Masterplan review announced for 2027; TREASURES launched.	[1] [7] [48]
7 Jul 2026	Parliament: rescued food is not counted in the statistics; RFID charging judged hard with high-rise chutes.	[3] [17]
16 Jul 2026	Winnow announces it has acquired Lumitics, the Singapore food waste vision company.	[31]
Jul 2026	Three Closing the Resource Loop food valorisation awards reported, S\$5.3m combined.	[23]

FOR DISCUSSION

Six questions to take back.

- 1 Do we know how much food we waste, by site and by type, today?
- 2 Who would change an order or a recipe because of a forecast?
- 3 How clean is our segregated food waste, and who checks?
- 4 Which of the five gaps would a university partner fill for us?
- 5 Where would the work live after the first grant ends?
- 6 What is our cost per tonne avoided, and how did we count it?

TAKE IT FURTHER

The full case and a tool.



The Singapore food waste case study

Full text, five motion figures, 74 numbered sources and the FAQ.
terencekok.com/research/case-studies/singapore-food-waste



AI value ledger

Grade a pilot's value claim by what it rests on before it goes to the board.

THANK YOU

Thank you.

Questions and discussion.

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Connect on LinkedIn

SOURCES · 1 OF 5

Numbered as on the case study page.

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