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Enhancing Green MSMEs' Competitiveness for a Sustainable an d Inclusive Asia-Pacific: Food Sector Waste Redu ction in Food Supply Chain

APEC Small and Medium Enterprises Working Group

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Executive Summary

A recent study from the Food and Agriculture Organization of the United Nations (FAO) revealed that one-third of the world's food production (about 1.3 billion tons) ends up as waste, the equivalent of approximately USD 2.6 trillion (approximately THB 80.8 trillion) per year. To address the problem of food waste, Sustainable Development Goal (SDG) Target 12.3 was established to halve per capita global food waste at the retail and consumer levels, and reduce food losses along production and supply chains, including post-harvest, losses by 2030. Several efforts (e.g., laws, regulations, economic measures, public and private partnerships) have been implemented by economies to reduce food waste and they have issued challenges to micro, small and medium enterprises (MSMEs), which account for over 97% of all business and employ over half of the workforce across Asia–Pacific Economic Cooperation (APEC) economies.

The objective of this study is to examine the best practices, policies and actions of APEC member economies on reducing waste in food supply chains, in the context of promoting competitiveness for MSMEs. To fulfill this objective, four methods were used to collect and analyze the data. First, this study organized the APEC Workshop on Enhancing Green MSMEs' Competitiveness for a Sustainable and Inclusive Asia–Pacific: Food Sector Waste Reduction in Food Supply Chain from 13–14 January 2022. Second, an online questionnaire was launched to collect food waste-related data in all APEC economies. Third, this study organized in-depth interviews with representatives of MSMEs and organizations regarding best practices for reducing food waste. Finally, we reviewed literature, including from government reports and academic sources, documenting food waste reduction efforts in APEC economies.

When considering the food waste that is generated by MSMEs, not all APEC economies have food waste data that is specific to that group of businesses. While all APEC economies have policies to address the problem of food waste, none have a specific MSME food waste reduction target, nor policies or plans for reducing food waste economy-wide. The greatest challenge hampering MSME food waste reduction policies in many APEC economies is entrepreneur awareness. Moreover, the study found that only a small number of APEC economies has implemented MSME food waste reduction in the food retail and food service industries. Conversely, there are food rescue organizations in a majority of APEC economies. Food donation is still not required for supermarkets, food storage facilities or warehouses in many APEC economies.

A majority of APEC economies still do not have any laws protecting food donors from civil liability with respect to personal injury, disease or death suffered by any person from consuming food that was donated or distributed by donors, unless it can be proven that the food donors failed to comply with the rules. Nevertheless, several APEC economies have implemented laws or measures offering procedural guidance and financial/tax benefits for food donations. From a technological perspective, a majority of APEC economies use modern technologies, including applications to reduce or manage MSME food waste/surplus food, but these technologies are used only by large companies in big cities.

A majority of APEC economies believe that public-private partnerships are a better and more effective method for reducing MSME food waste, including: 1) Greatly improved data quality due to the connection with many key stakeholders; 2) More effective policy, knowledge-sharing, and enforcement/compliance; and 3) Increased government budget efficiency. On the other hand, a key disadvantage of public-private partnerships is the conflict between businesses drive for profits and environmental considerations. Another disadvantage is the

inadequate capacity of government personnel to monitor and evaluate public-private partnership projects.

By analyzing a successful MSME case study, four key factors that lead to the successful reduction of food waste were identified, including: 1) Creating a network of people (i.e., young, smart farmers and a community surrounding the farm); 2) Using innovation and technology to facilitate farming and save time; 3) Producing and sharing knowledge through several channels (e.g., learning centers); and 4) Considering the environment at every step of the process.

After synthesizing all of the information, this study yielded several key recommendations for reducing MSME food waste in APEC economies, which can be summarized as follows.

There are eight general recommendations, including: 1) Promote research to explore the full utilization of agri-food products and by-products (reduction), food bank systems (recovery) and food waste recycling (recycling); 2) Provide government support, including cross-ministerial collaboration between agencies in charge of agriculture, industry, labor, food safety, social welfare and environment; 3) Establish laws and regulations to support food waste reduction across the supply chain; 4) Strengthen food education and related campaigns to increase anti-food waste awareness; 5) Require additional food waste management training for the issuance of sanitary permits for businesses; 6) Establish cooperation among parties to share knowledge and best practices on food waste reduction with the support of the government and corporate donations; 7) Build a surplus food database that captures supply and demand, with food waste classified by location, production facility, restaurants, shopping centers and agencies; and 8) Improve the efficiency of logistics and transportation systems.

There are 11 main solutions to prevent food waste, including: 1) Improve cold chain infrastructure; 2) Increase the shelf life of products through improved packaging; 3) Design ecofriendly packaging; 4) Encourage smart purchasing; 5) Provide food waste prevention education to staff and customers; 6) Promote staff engagement; 7) Increase the capacity of packing and delivery; 8) Promote food waste measurement; 9) Promote good inventory management; 10) Promote and adopt ecolabelling schemes; and 11) Promote food waste prevention programs with daily tracking, competition and goal setting.

There are four important recovery solutions for food waste, including: 1) Promoting upcycling (e.g., using old bread to make croutons for salads); 2) Providing economic incentives to support food donation, such as tax incentives, along with standardized regulations; 3) Working with local companies (converting waste to biogas, composting, etc.); and 4) Using modern technologies and innovation. Examples of modern technologies include: Mobile-ICT solutions to reduce food loss and waste; A graded packaging and labeling system; Mobile applications that send notifications about food surpluses; Applications for sharing foods; Smart bins; and Technology that enables commercial kitchens to track and avoid food waste.

There are six key solutions to address MSME concerns about surplus food donation, including: 1) Promoting transparent and accountable monthly reporting; 2) Encouraging partners to release donors from any responsibility once the food is handed over; 3) Promoting data-driven operations and partnerships; 4) Promoting awareness campaigns and policy support; 5) Promoting well-established food banks and business units; and 6) Promoting the five main principles for facilitating surplus food donations, which includes: Free: all services are free of charge; Flexible: hassle-free services that are customized to meet partner needs; Safe: partners are released from responsibility if something food safety-related happens to recipients; Accountable: reports, including on social and environmental impacts, are regularly sent to partners; and Disclosure options: partners can choose whether they want to be identified or to remain anonymous.

There are 11 important recommendations for MSMEs to promote public-private partnerships, including: 1) Help MSMEs overcome barriers by identifying sustainable innovations; 2) Promote finance innovation for MSMEs by supporting to research and development that is targeted at preventing and reducing food waste; 3) Pilot test food waste management within the community and establish a local food waste baseline; 4) Foster skills to reduce, reuse or recycle food waste generated by MSMEs; 5) Require food waste management training prior to the issuance of sanitary permits for businesses and mainstream sustainable production and consumption (SCP) by establishing an SCP Council; 6) Integrate SCP principles into city environment codes and city development plans, and strictly monitor establishments for food safety, as mandated by law; 7) Conduct hazard analysis and critical control points (HACCP) training for food service establishments; 8) Promote and adopt and ecolabel schemes for the food service sector; 9) Support the adoption of digital management measures by MSMEs; 10) Create an enabling environment for private sector activity by issuing regulations that facilitate doing business and by providing incentives, subsidies and financial support; and 11) Ensure that basic infrastructure, including water, road, energy and other basic business needs, are in place.

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List of Acronyms

ABAC	APEC Business Advisory Council
ADEME	Agence De La Transition Écologique
APEC	Asia-Pacific Economic Cooperation
BAMX	Bancos de Alimentos de México
BAP	Banco de Alimentos Perú
BCG	Bio-Circular-Green
B2B	Business to Business
B2C	Business to Consumer
CEO	Chief Executive Officer
CH_4	Methane
CO_2	Carbon Dioxide
COA	Council of Agriculture
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSV	Creating Shared Value
DIGESA	Directorate on Environmental Health and Food Safety
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization
FEFO	First-Expire-First-Out
FIT	Food Intel Tech
FIFO	First-In, First-Out
FLAWLESS	Food Loss and Waste by Leveraging Economic Systems
FLW	Food Loss and Waste
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HACCP	Hazard Analysis and Critical Control Points
ICT	Information and Communications Technology
IEC	Information, Education and Communication
IoT	Internet of Thing
LGPGIR	Ley General para la Prevención y Gestión Integral de los Residuos
MMA	Ministry of the Environment
MOHW	Ministry of Health and Welfare
MSMEs	Micro, Small and Medium Enterprises
MINAGRI	Ministry of Agriculture and Irrigation
MINSA	Ministry of Health
NEA	National Environment Agency
NDCs	Nationally Determined Contributions
NGOs	Non-Governmental Organizations
R&D	Research and Development
3Rs	Reduce, Reuse & Recycle
P4G	Partnering for Green Growth and the Global Goals 2030
PCC	Pacific Coast Collaborative
PCFWC	Pacific Coast Food Waste Commitment
PPP	Public Private Partnerships
SCP	Sustainable Production & Consumption
SDG	Sustainable Development Goal

List of Acronyms (continue)

SMART	Specific, Measurable, Achievable, Relevant, and Time-Bound
SMEWG	Small and Medium Enterprise Working Group
SOS	Scholars of Sustenance
UN	United Nations
UNEP	United Nations Environment Programme
VEA	Viet Nam Environmental Administration Office
WRAP	Waste & Resources Action Programme
YSF	Young Smart Farmers

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1. Introduction and Overview of MSME Food Waste Reduction

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Micro, small and medium-sized enterprises (MSMEs) account for 97% of Asia–Pacific Economic Cooperation (APEC) businesses, employing more than half of the labor market. MSMEs contribute significantly to economic growth, with their share of GDP ranging from 40–60% in most economies. However, MSMEs still face barriers accessing and participating in the global value chain, accounting for less than 35% of direct exports (APEC, 2022).

Promoting MSME competitiveness in APEC economies to support sustainable and inclusive regional economic growth is of key importance. Among the sustainable solutions, food waste reduction offers multifaceted wins for people and the planet, including MSMEs, by improving food security, addressing climate change, saving money and reducing pressures on land, water, biodiversity and waste management systems. Yet, this enormous potential from food waste reduction has, until now, been woefully underexploited (United Nations Environment Programme: UNEP, 2021).

The United Nations Environment Programme (UNEP) estimates that around 931 million tonnes of food waste were generated in 2019, accounting for 17% of total global food production (11% in households, 5% in food service and 2% in retail) (2021). For high-income economies, the food waste generated by households equaled 79kg/capita/year, followed by the waste from the food service industry at 26kg/capita/year, and retail at 13kg/capita/year. Upper middle-income and lower middle-income economies generated approximately 76 and 91kg/capita/year of food waste, respectively. Regionally, Southeast Asia produced the highest level of food waste, equal to 82kg/capita/year, followed by Australia and New Zealand at 81kg/capita/year. North America and East Asia generated 69 and 64kg/capita/year of food waste, respectively.

Across the food supply chain in East and Southeast Asia, the Food and Agriculture Organization (FAO) revealed that for cereals and pulses, about 15% of food waste was generated in the storage stage, 15% in the transportation stage, 16% in the processing and packaging stage, and 4.5% in the wholesale and retail stage (2019). For fruits and vegetables, most food waste was generated in the storage stage (50%), transportation stage (13%), processing and packaging stage (16%), and wholesale and retail stage (12.7%). Maintaining a holistic and systematic collection of waste and waste statistics in the food sector, implementing good management practices to reduce food waste and food surpluses, and preventing undue impact on natural resources and the environment remain issues that APEC economies must push forward and apply good practices with international cooperation.

To address the problem of MSME food waste, Thailand's Ministry of Foreign Affairs initiated the project "Enhancing Green MSMEs' Competitiveness for a Sustainable and Inclusive Asia - Pacific Phase II Food Sector Waste Reduction in Food Supply Chain" to study the best practices, policies and actions of APEC member economies to reduce waste in food supply chains. The project provided key recommendations for food waste reduction to MSMEs, with the aim of promoting MSME competitiveness for a sustainable and inclusive Asia.

To fulfill this objective, four methods were used to collect and analyze the data. First, this study organized the APEC Workshop on Enhancing Green MSMEs' Competitiveness for a Sustainable and Inclusive Asia – Pacific: Food Sector Waste Reduction in Food Supply Chain from 13–14 January 2022. Second, an online questionnaire was launched to collect food waste-related data from all APEC economies. Third, the research included in-depth interviews with representatives from MSMEs and other organizations regarding best practices for food waste reduction. Finally, we reviewed the literature on efforts to reduce food waste in APEC economies, including government reports and academic sources.

To address the heterogenous definitions of food waste-related terms from past studies, this study defines the following terms in a similar manner to UNEP (2021):

Food: Any substance – whether processed, semi-processed or raw – that is intended for human consumption. "Food" includes drink and any substance that has been used in the manufacture, preparation or treatment of food. "Food" also includes material that has spoiled and is considered no longer fit for human consumption. It does not include cosmetics, tobacco or substances used only as drugs. It does not include processing agents used in the food supply chain, such as water to clean or cook raw materials in factories or at home.

Food loss: "Food loss" refers to all human-edible crop and livestock commodity quantities that are – either directly or indirectly – discarded, incinerated or otherwise disposed of, completely exiting the post-harvest/slaughter supply chain. These qualities do not re-enter the supply chain in any other form (such as for animal feed, industrial use, etc.), up to, and excluding, the retail level. Losses that occur during storage, transport and processing, also of imported quantities, are all included in this definition. Losses include the commodity as a whole, with its non-edible parts.

Food surplus: "Food surplus" refers to food that is redistributed for consumption by people, used for animal feed or used for biobased materials/biochemical processing.

Food waste: "Food waste" is defined as food and associated inedible parts that are removed from the human food supply chain in the following sectors: the manufacture of food products (under certain circumstances); food/grocery retail; food service; and households. "Removed from the human food supply chain" means one of the following end destinations: landfill, controlled combustion, sewer, litter/discards/refuse, co/anaerobic digestion, compost/aerobic digestion or land application.

Inedible (or non-edible) parts: Components associated with a food that, in a particular food supply chain, are not intended to be consumed by humans. Examples of inedible parts associated with food could include bones, rinds and pits/stones. "Inedible parts" do not include packaging. What is considered inedible varies among users (e.g., chicken feet are consumed in some food supply chains but not others), changes over time, and is influenced by a range of variables, including culture, socioeconomic factors, availability, price, technological advances, international trade and geography. See also "edible parts."

Edible parts of food waste: Food that is removed from the human food supply chain, ending up at the following destinations: landfill, controlled combustion, sewer, co/anaerobic digestion, compost/aerobic digestion or land application. See also "inedible parts."

2. Current Status of Food Waste and Policies Addressing MSME Food Waste Reduction

2. Current Status of Food Waste and Policies Addressing MSME Food Waste

The first part of this chapter provides information on the current status of food waste in APEC member economies. The second part presents measures and policies that are aimed at reducing MSME food waste.

2.1 The current status of food waste in APEC member economies

While, the UNEP (2021) estimates that the amount of global food waste that was generated in 2019 was around 931 million tonnes, most APEC economies collect limited food waste data with very low confidence. Household food waste data showed higher confidence than food service and retail data. Moreover, no APEC economy collects data on the food waste generated by MSMEs. By collecting food waste data from other sources, this study assessed the current situation of overall food waste in APEC economies as follows.

2.1.1 Australia

The Department of Agriculture, Water and the Environment (2022) reports that food waste costs the economy around AUD 36.6 billion annually. The amount of food waste that is generated each year is around 7.6 million tonnes across the supply and consumption chain, equaling about 312kg per person. Food waste accounts for approximately 3% of Australia's annual greenhouse gas emissions. In addition, Australia uses around 2,600 gigalitres of water to grow food that is wasted – this is equivalent to the volume of water in five Sydney Harbours, and the amount of land used to grow wasted food exceeds 25 million hectares, a landmass larger than the state of Victoria.

2.1.2 Brunei Darussalam

In response to the online questionnaire, Brunei Darussalam reports that food waste comprises 32% of the domestic overall waste. Brunei Darussalam has three landfills. Based on data reported in 2019 by the Department of Environment, Parks and Recreation (JASTRe), the top four categories of municipal solid waste that was disposed of at Brunei Darussalam's main landfill (Sungai Paku Engineered Landfill) were: 1) 32% food waste; 2) 29% plastic; 3) 11% green materials; and 4) 10% paper. People in Brunei Darussalam generate around 1.25 kg/person/day of waste.

2.1.3 Canada

Canada estimates its total food waste at 35.5 million tonnes annually, with approximately 71% categorized as food loss and 29% as food waste. This is equivalent to more than half of Canada's total annual food supply. Over 200kg of food waste is thrown out by single-family Canadian households annually. Fruits and vegetables account for most the domestic food waste (Warner, 2022). Of the total food loss and waste (FLW), nearly one-third (11.5 million tonnes) is thought to be avoidable, estimated to be worth nearly CAD 50 billion at retail. Similar to other APEC economies, there does not appear to be specific data on food loss and waste specifically from MSMEs in Canada.

2.1.4 Chile

In Chile, a previous study reports that the average creation of municipal solid waste (MSW) is about 1.15kg/day/person (Cayumil et al., 2021). Of the overall amount of MSW produced, 44.9% is generated in the metropolitan region of Santiago, the capital city of Chile. This waste is mainly composed of food and green waste, which accounts for 58% of the total generated waste. Approximately 50% of the waste is disposed of in sanitary landfills, however, the use of open dumps accounts for ~27% of disposal and processing. Recently, UNEP (2021)

reported that 1,401,043 tonnes/year of household food waste is generated in Chile, about 74kg/capita/year.

2.1.5 People's Republic of China

According to the information presented by the invited speaker at the APEC workshop, annual food loss in the People's Republic of China is estimated to be more than 35 billion kilograms, and food waste is estimated to be around 30–50 million people's rations annually. This information was reported by the Domestic Food and Strategic Reserves Administration of China. There are three main factors that lead to food waste by small and medium-sized enterprises in China that produce food. First, the storage facilities of these MSMEs are aging. Second, the standards for cold chain distribution and transportation systems are not high. Third, the food is overprocessed. In China's food consumption chain, food waste mainly comes from commercial catering, public canteens and family catering. Increasing mass consumption in China has also led to more catering waste from special events, such as festivals, birthdays, weddings, funerals, and so on.

2.1.6 Hong Kong, China

The Environmental Protection Department (2022) reports that Hong Kong, China produces 3,255 tonnes of food waste out of an overall 10,809 tonnes of municipal solid waste. This accounts for 30% of total MSW, comprising the largest MSW category. Of the food waste disposed of at landfills daily, about 778 tonnes is generated by commercial and industrial sources, such as restaurants, hotels, wet markets, and food production and processing facilities. According to the Environment and Ecology Bureau, domestic food waste has dropped by 17% from 0.37kg/capita/day in 2013 to 0.30kg/capita/day in 2019 (Feeding Hong Kong, 2021).

2.1.7 Indonesia

The Ministry of National Development Planning (2021) reports that from 2000–2019, FLW generation in Indonesia reached 23–48 million tonnes/year. Food loss occurred during production, post-harvest and storage, and processing and packaging, while food waste was generated during distribution, market sales and consumption. Food loss decreased from 61% of total FLW in 2000 to 45% in 2019, while food waste generation increased from 39% of FLW in 2000 to 55% in 2019. The largest critical loss point is at the consumption stage, with the amount of food waste generated ranging from 5–19 million tons/year. Moreover, DBS Bank (2021) reports that Indonesia has a high rate of food waste, producing 121kg of food waste per capita, per year. Out of this total, 56% is produced by households, 28% by food services and 16% by retail operations.

2.1.8 Japan

The Japanese people have a long tradition of saying "Itadaki-masu" before every meal, which is often translated as "I humbly receive." This phrase shows respect and gratitude for the people who prepared the meal, as well as for the farmers who produced the food. Another word that reflects a common perspective among the Japanese people is "Mottainai," an adjective that conveys a sense of regret over waste. These words and traditions encourage the Japanese people to avoid wasting food as much as possible. Since 2015, the total volume of FLW (including inedible foodstuffs) declined from 28.42 million tonnes to 25.31 million tonnes in 2018. After classifying FLW into household-generated and non-household-generated waste (food-related businesses), such as restaurants, manufacturers, wholesalers and retailers, Japan's Ministry of the Environment (2021) reports that FLW generated by non-households is greater than the waste generated by households. In 2018, FLW generated by

non-households is about 7.66 million tonnes, while FLW generated by households is about 17.65 million tonnes.

2.1.9 Republic of Korea

A previous study indicates that the amount of food waste produced by the Republic of Korea has increased 31%, from 16,032 tonnes in 2013 to 21,065 tonnes in 2019. This is equal to 407 grams of food wasted every day (Jong-Hoon et al., 2022). Food waste at food production facilities also continuously increased, up from 1,010 tonnes/day in 2016 to 1,452 tonnes/day in 2019. Additionally, one-fourth of food that is thrown away in Korea never even makes it to the table. This increase in food waste is strongly linked to the growing availability of meal kits and food delivery services. Changes in consumer behavior have increased demand for conveniently packed foods, processed foods and food delivery, producing more food waste. Similar to other APEC economies, the availability of statistics on the amount of food waste generated by private food companies was limited.

2.1.10 Malaysia

The amount of food waste in Malaysia increased from 16,964 tonnes/day in 2019 to 17,041 tonnes/day in 2020, but then decreased to 17,007 tonnes/day in 2021. The landfill operator SWCorp Malaysia reports that 4,081 tonnes of food that was wasted was still edible (Meikeng, 2022). The Lost Food Project distributed over 1.17 million kilograms of surplus food as of November 2021, which averages to about 26.5 tonnes of food surplus per week or 3.8 tonnes/day. According to SWCorp, 4,005 tonnes of food that is wasted each day could feed 2.9 million people three meals a day (The Malaysian Reserve, 2022).

2.1.11 Mexico

In Mexico, about 20 million tonnes of FLW (35% of total food produced) occurs each year from farm to point of purchase. This represents $25 billion in economic loss, or 2.5% of Mexico's gross domestic product (GDP). Around 11 million additional tonnes is wasted by households, reaching an overall total of around 30 million tonnes of FLW. The amount of FLW in primary production – before food leaves the farm – is unknown, so the true figure might be much higher than 30 million. The highest percentage of food loss occurs during primary production, distribution and in households.

2.1.12 New Zealand

During 2020, New Zealand's households and commercial businesses sent more than 300,000 tonnes of food to the landfill (Ministry of Primary Industries, 2021). Household food waste reached approximately 61kg/capita, accounting for 291,769 tonnes/year (Sunshine Yates Consulting, 2018). Retail food waste is estimated to comprised 13kg/capita/year of all food waste and diverted products. Fresh vegetables (27%), bakery goods (23%), meat and fish (19%) and fresh fruits (17%) are the highest contributing categories of discarded products (Goodman-Smith et al., 2020). In addition, research conducted from 2017–2018 finds that cafes and restaurants created 24,375 tonnes of food waste per year. Out of this amount, 61% is considered avoidable food waste and 39% unavoidable (e.g., eggshells, banana skins, bones, etc.). About 7% of all food waste is considered spoilage,[1] 60% preparation waste[2] and

[1] Spoilage occurs from over-purchasing ingredients or from poor stock rotation, which causes food to go bad and be discarded before it is even used.
[2] Preparation waste occurs in the kitchen and includes things like vegetable peelings, eggshells or toast that gets burnt. It also includes any unsold food that is left at the end of the day.

33% plate waste.[3] From cafes and restaurants offering prepared foods, such as scones, sandwiches, pies, etc., 30% of preparation waste is unsold food (Mainvil et al., 2018).

2.1.13 Papua New Guinea

According to UNEP (2021), household food waste in Papua New Guinea is equal to 91kg/capita/year, accounting for 798,767 tonnes/year. The Secretariat of the Pacific Regional Environment Programme (SPREP) (2021) reported that the predominant waste material found in food outlet/restaurant samples is organics at 52%, followed by plastics at nearly 20% and paper and cardboard at 13%. The predominant waste material typically found in hotel samples is organics, primarily food waste, at nearly 40%, followed by plastics at 18%, paper and cardboard at 15%, and glass at 10%. From samples taken in the retail, wholesale and supermarket category, the predominant material is typically paper and cardboard at 36%, followed by organics at 32% (primarily food) and plastics at 22%.

2.1.14 Peru

A previous study estimated that the amount of FLW in Peru increased from 10.750 million tonnes in 2007 to 14.406 million tonnes in 2017. The processing and packaging of food generated the largest share of FLW, creating 3.986 million tonnes, followed by agricultural production (3.257 million tonnes), post-harvest handling (2.502 million tonnes), consumption at the household level (2.422 million tonnes) and distribution (1.931 million tonnes) (Bedoya-Perales and Dal' Magro, 2021). For the food service sector, the socioenvironmental company sinba reports that Peruvian restaurants generate between 40kg and 500kg of waste/day, 75% of which is organic waste, most from leftover food. Only 4% of this waste is recycled (Forsyth, 2018).

2.1.15 The Philippines

The Department of Environment and Natural Resources (2018) reports that biodegradable waste comprises about half (52.31%) of MSW, although the primary data suggest that the figures can range from 30% to as much as 78%. Typical biowaste consists of kitchen or food waste and yard or garden waste. From the available information, it could be estimated that 86.2% of compostable waste is food waste, while 13.8% is leaves and twigs. Recyclable waste accounts for almost a third (27.78%) of MSW, estimated to be in the range of 4.1% to 53.3%. In addition, UNEP (2021) estimates that 9,334,477 tonnes of household food waste is generated annually in the Philippines, accounting for 86kg/capita/year. According to the 2018 census conducted by the Philippines Statistics Authority, restaurants and accommodation services comprise 75.2% and 13.4% of the food service industry, respectively.

2.1.16 Russia

In Russia around 70 million tons of solid waste are generated annually. Food waste accounts for about 25% of this volume (17,9 million tons per year). On average, a Russian throws away about 88 kg of food a year. 94% of food waste in Russia is dumped in landfills and carbon footprint of this waste is estimated at 64 million tons of CO2 eq. Food waste generated by households accounts for 71% of total food waste in Russia and food waste generated by food-related businesses – for 29%.When the types of food waste are separated, the top three consist of: 1) Cereal products (bread and pasta products), which ranked first in household waste (62%) and third in wholesale and retail food waste (12%); 2) Dairy products (milk, kefir, yoghurt, cheese, fermented milk) were the most prevalent in wholesale and retail waste (47%) and ranked fifth (5%) in consumer waste; and 3) Potatoes comprised 15% of consumer waste and 11% of wholesale and retail waste.

[3] Plate waste is whatever customers leave behind on their plate uneaten.

2.1.17 Singapore

Higher levels of economic activity in 2021, compared to COVID-impacted 2020, resulted in more waste that was generated and recycled in Singapore. The total amount of food waste generated in 2021 was 817,000 tonnes, which was 23% more than the 665,000 tonnes generated in 2020. Food waste in 2021 accounted for about 12% of the total waste generated. While the amount of food waste generated increased, the amount of food waste recycled also increased, which resulted in the food waste recycling rate remaining steady at 19% (National Environmental Agency, 2022).

2.1.18 Chinese Taipei

Food waste increased from 168,600 tonnes in 2003 to the maximal amount (i.e., 834,500 metric tons) in 2012. After regulations promoting the recycling of foodstuffs for use as organic fertilizers, soil cultivators, soil conditioners, or feed for livestock animals (especially for swine), the amount of food waste declined from about 795,000 tonnes in 2013 to 595,000 tonnes in 2018 (Tsai, 2020). The representative from Chinese Taipei shared that the amount of food waste produced by MSMEs is calculated based on the number of businesses that have adopted policies to reduce food waste. For example, the food waste generated by the Homemakers United Foundation is approximately 0.1%. The ATF, a foodbank alliance of Chinese Taipei, reports that food waste from supermarkets and hypermarkets is approximately 3%.

2.1.19 Thailand

The Pollution Control Department (2022) reports that in 2021, overall food waste in Thailand accounts for 38.76% of solid waste, equal to 9.68 million tonnes or 146kg/capita/year. Thailand does not specifically track food waste from MSMEs. Overall, edible food waste accounts for 39.5%, while inedible parts account for 60.5% of total food waste. Food waste generated by department stores comprises the highest share of this total, accounting for 54.9%, followed by food waste generated by households (43%) and hotels (37%).

2.1.20 United States of America

Nearly 40 million tonnes of food waste is generated in the United States every year, estimated to be 30–40% of the entire US food supply. Food is the single largest component taking up space in US landfills, comprising 22% of MSW (RTS, 2022). According to the US Environmental Protection Agency (2020), food waste generated by the food service sector is equal to 64kg/capita, followed by food waste generated by households and retail, which is equal to 59kg/capita and 16kg/capita, respectively. US nonprofit ReFED (2022) also reports that a staggering 35% of all food goes unsold or uneaten, the equivalent of almost 90 billion meals' worth of food annually and valued at USD 418 billion, roughly 2% of US GDP.

2.2 Activities and policies addressing MSME food waste

In an effort to reduce food waste, APEC launched the Food Security Roadmap Towards 2030. This roadmap focuses on establishing an open, fair, transparent, productive, sustainable and resilient APEC food system. APEC recognizes the need for a whole system approach along the agri-food value chain. Likewise, APEC acknowledges that all areas of this value chain are interdependent and must work together to deliver food security under the Roadmap framework. The key action areas include: Digitalization and Innovation (Digital transformation); Productivity (International Trade); Inclusivity (MSMEs along the agri-food value chain); Sustainability (Adaptation and Mitigation); and Public-Private Partnerships. According to information from various sources, there are no specific activities or policies in APEC economies that directly address food waste generated by MSMEs. Nevertheless, most APEC

economies have introduced policies and promoted activities to alleviate the overall problem of food waste, to include MSMEs. The policies and activities implemented by APEC economies are detailed below.

2.2.1 Australia

Australia does not implement any specific food waste programs targeting MSMEs. In general, policies and programs are committed to reducing food waste by targeting different actors in the food value chain (e.g., manufacturing, retail, consumers) and in priority food sectors, such as meat, bread and dairy. According to the Department of Agriculture, Water and the Environment (2022), Australia aims to halve food waste by 2030, in alignment with UN Sustainable Development Goal 12.3. Actions to reduce food waste are laid out in the Domestic Food Waste Strategy; the Roadmap for reducing Australia's food waste by half by 2030; and the Domestic Waste Policy Action Plan. Some of these actions include:

(1) *Establishing Stop Food Waste Australia as part of the Domestic Food Waste Strategy*: A $4 million investment to establish Stop Food Waste Australia in 2020, which will implement the Australian Food Pact, sector action plans and other initiatives to reduce food waste across the supply chain. Stop Food Waste Australia is led by Fight Food Waste Limited and WRAP UK, in partnership with the Department of Agriculture, Water and the Environment. It is supported by a consortium of partners representing the whole food supply chain and government;
(2) *Developing the Australian Food Pact, a voluntary agreement for industry*: The Australian Food Pact brings together organizations from all parts of the food chain to identify solutions to reduce food waste and increase productivity;
(3) *Diverting more food to the food rescue sector*: Redistributing food that would otherwise be wasted helps feed more than one in five Australians who do not have adequate access to food;
(4) *Supporting education campaigns*: Increasing public awareness about the scale of the food waste problem and its negative impacts is an important part of reducing food waste, particularly in households; and
(5) *Facilitating research and technological improvements*: Investment in agricultural efficiency and innovation, waste treatment infrastructure and ways to create value from food waste reduces the amount of food waste that ends up in landfills.

Australia has implemented food waste reduction programs in the retail food industry (e.g., grocery stores, convenience stores, fresh markets) and the food service industry (e.g., restaurants, cafeterias, catering operations). While these are not targeted at MSMEs specifically, MSMEs and larger retailers are eligible to participate in the Australian Food Pact, representing a key point in the food supply chain.[4]

There are two central food rescue organizations working to reduce MSME surplus food in Australia – Foodbank and OzHarvest. These two organizations deliver food to charities and people in need. OzHarvest services MSMEs and larger businesses, including supermarkets, cafes, delis, restaurants, corporate kitchens, airlines, hotels and other food businesses. Foodbank operates on a larger scale.[5] Stop Food Waste Australia has developed a "sector action plan," which aims to, among other things, increase the volume of edible, nutritious food recovered; decrease the volume of food waste all along the value chain; and improve the distribution of rescued food to assist food insecure people in Australia. This plan does not specifically target MSMEs, but they are included.

[4] A list of signatories to the Australian Food Pact can be found here: https://www.stopfoodwaste.com.au/australian-food-pact/.
[5] See https://www.ozharvest.org/ and https://www.foodbank.org.au/?state=nsw-act for more information.

2.2.2 Brunei Darussalam

The government has taken pro-active measures to address waste challenges, such as ensuring that a sustainable and efficient waste management system is in place. Recognizing the gaps in its recycling infrastructure and ecosystem, the government has developed its recycling industry, achieving a significant increase in rate of recycling by adopting policies, setting up institutional mechanisms and establishing multistakeholder partnerships. Various initiatives and programs have been implemented with the primary goal of minimizing waste generation, particularly through the introduction of the 3Rs initiative (reduce, recover, recycle). The government has established targets of one kilogram of waste/person/day and a recycling rate of 30% by 2035. To achieve these goals, the government has developed key strategies, namely: waste minimization; cost effective, efficient and sustainable waste collection; the adoption of waste-to-resource technologies; youth empowerment; and enhanced enforcement.

Regarding food waste, some organizations are working to raise awareness, such as Green Brunei, Kilang Reroot and Eco Ponies Garden. Brunei Darussalam does not have a specific MSME food waste reduction program in the food retail industry. However, there are MSME food waste reduction initiatives in the food service industry, such as the promotion of composting by Eco Ponies Garden. There are no food rescue organizations specifically working with MSMEs to reduce surplus food in the economy. Joint ventures involving public and private equity have invested in MSMEs in Brunei Darussalam.

2.2.3 Canada

The Canadian government launched a Food Waste Reduction Challenge to stimulate and accelerate innovative solutions to food loss and waste. The Challenge has attracted over 500 applicants, many of which are MSMEs developing new business models and technological solutions that prevent and divert food loss and waste across the supply chain. Similar to other APEC economies, Canada does not have specific MSME food waste reduction targets, policies or plans. Canada focuses on providing capacity building and training for entrepreneurs on food waste reduction.

There are food rescue organizations dedicated to reducing MSME surplus food in Canada. In June 2020, the Canadian government launched a $50 million Surplus Food Rescue Program to address an urgent surplus of perishable commodities that could not be routed through the supply chain due to the closure of restaurants and other food service- and hospitality-related businesses from COVID-19. The program was designed to rescue surplus commodities that would otherwise have gone to waste, ensuring the food reached vulnerable populations in Canada. Several food rescue and food security organizations are working with numerous community agencies to ensure that surplus veal, chicken, duck, turkey, eggs and seafood are reaching households in need. Organizations that are funded under the Surplus Food Rescue Program include: Second Harvest; Food Banks Canada; Les Fermes Dani; Canadian Produce Marketing Association; Fisher River Cree Nation; Clearwater Seafood, in partnership with Membertou to Mi'kmaq communities; and La Tablée des Chefs (Agriculture and Agri-Food Canada, 2022).

2.2.4 Chile

In Chile, the government has not adopted any law that could facilitate or require food recovery and donation. However, the Chilean government has created several multistakeholder initiatives to tackle FLW. In 2014, the Ministry of the Environment created the Inter-ministerial Committee on Sustainable Consumption and Production, tasked with designing the Domestic Program for Sustainable Consumption and Production and committing to a 17% reduction in food loss and waste by 2022. In 2017, the government established the

Committee for the Prevention and Reduction of Food Loss and Waste to lead the economy's initiative. The Committee is responsible for developing a normative legal framework relevant to food loss and waste, researching and quantifying food loss, raising consumer awareness, and promoting research, knowledge, and innovation to reduce food loss and waste. In 2018, the Domestic Committee developed a manual to help public and private actors reduce and avoid FLW.

In 2019, the Domestic Committee divided participating members into three working groups to develop an action plan to achieve its overall objective of reducing food loss and waste, and supported efforts to develop a more accurate methodology to quantify food loss and waste along the supply chain. In 2020, the Ministry of Agriculture began working on transforming the Committee into a Commission, giving the body a more permanent status, as well as access to more ministerial resources. As of 2021, the Committee had not developed a legal framework. Another relevant document is the Organic Waste Strategy 2040, which aims to increase the recovery of organic waste generated at municipal levels from 1% to 66% by 2040. Most initiatives focus on recovering and composting food. While the strategy does mention reducing FLW as an important component, it mostly talks about supporting the Committee and does not offer strategies for preventing FLW.

In the private sector, the Chilean Food Banking Network (Red de Alimentos) is a non-profit that created Chile's first food bank in 2010. They join companies and social organizations in rescuing food, diapers and personal hygiene products that are suitable for further distribution. As of 2020, the group distributed over 6.5 million kilograms of food, partnered with 294 beneficiary organizations, worked with 168 volunteers and served over 240,000 people.

2.2.5 People's Republic of China

In terms of laws and regulations to reduce food waste, the Food Safety Law of the People's Republic of China establishes the requirements for food production and operation. In addition, the Law of the People's Republic of China on Anti-Food Waste requires food producers and operators, including MSMEs, to take necessary actions to improve food storage, transportation and processing to prevent the deterioration of food quality during transport. Steps should be taken to avoid the excessive use of raw materials and excessive processing of foods. The law also requires households to reduce food waste at the source.

Examples of relevant food waste and food loss prevention policies include the Food Conservation Action Plan, which aims to accelerate the reduction of food loss during grain processing and to reduce food waste from catering. Another relevant policy was issued by the State Council in 2017 to accelerate the development of cold chain logistics and cold chain management.

2.2.6 Hong Kong, China

To tackle the challenge of food waste in Hong Kong, China, the Government issued A Food Waste and Yard Waste Plan for Hong Kong 2014–2022 (Food Waste Plan) and the Waste Blueprint for Hong Kong 2035 (Blueprint) to map out strategies for food waste management. The Blueprint aims to achieve "waste reduction, resources circulation and zero landfill" by 2035. In 2011, the Hong Kong Productivity Council launched the Food Waste Recycling Project in Housing Estates, which provided a budget of HKD 60 million to housing estates to install on-site composting machines. Phases 1 and 2 of the project included 35 housing estates, with residents benefiting from food waste education, food waste collection and recycling activities. In August 2021, the Government passed a Waste Charging Scheme, which requires households to pay for their waste disposal. By charging for the disposal of MSW, the Government's goal is to gradually reduce per capita MSW disposal by

40–45% and increase the recovery rate to about 55%. Households are estimated to spend around HKD 33 to 55 a month for waste disposal under the new charging scheme.

In addition, the Government has organized a campaign called the Food Wise Hong Kong Campaign, which aims to encourage and facilitate the separation and collection of unavoidable food waste, in order to enhance recycling and achieve a carbon neutrality target by 2050. The Government also promotes food donation campaigns to charitable organizations from commercial establishments with surplus food. Through the Environment and Conservation Fund, the Environmental Protection Department has been supporting non-governmental organization food recovery projects, through which surplus food is collected from the commercial sector and donated to those in need to achieve the goal of caring for society and reducing food waste (Environmental Protection Department, 2022).

2.2.7 Indonesia

According to the Ministry of National Development Planning (2021), Indonesia has launched a FLW management strategy. The strategy includes five major tracks: 1) Behavioral Change: This track focuses on training regional institutions, capacity building for food workers, and educating consumers to increase knowledge about FLW and to change behavior; 2) Improving Food System Support: This track develops farm businesses and provides infrastructure and facilities that support more efficient food production processes that also contribute to reducing FLW; 3) Strengthening Regulations and Optimizing Funding: This track optimizes appropriate funding for improving food infrastructure, developing FLW regulations at the economy and regional levels and strengthening inter-ministry/agency coordination on FLW issues; 4) Utilization of Food Loss and Waste: This track facilitates the development of a food distribution platform, FLW handling that supports a circular economy and developing an FLW utilization pilot at the city/regency scale; and 5) Development of FLW Study and Data Collection: This track highlights the need for integrated data collection on FLW generation through the census, as well as the development of studies to complement FLW data collection in Indonesia.

According to the FLW management strategy, the generation of food waste from consumption is targeted to decrease as much as 35% from 2022 to 2030. By 2045, it is estimated that FLW reduction can reach 55.88%. In addition to these government policies, there are several social initiatives that contribute to the reduction of food waste, such as food banks and food sharing. Garda Pangan is a pioneer in food management, collecting surplus food for distribution to people in need or processing it into compost or animal food. The organization also runs a gleaning program in the agricultural sector, collecting crop residues that are still edible. Additionally, FoodCycle distributes surplus food from restaurants, weddings and vendors of fast-moving consumer goods to people in need. This non-profit also reprocesses leftover food into new food products.

2.2.8 Japan

In Japan, the Food Recycling Law was enacted in 2001, aimed at reducing food waste generation and promoting the recycling of food waste, with a focus on food-related businesses. The law includes four suggestions for how to recycle food: composting; producing fodder for livestock; manufacturing oil and fat products, such as biodiesel and printing inks; and utilizing methane from fermentation. Currently, most food waste in Japan is composted but in recent years, some food companies have recycled organic waste by supplying food waste, such as soybean meal, bread and steamed rice, to be used as livestock feed.

As an example,[6] in the town of Aya in Miyazaki prefecture, in the southern part of Japan, organic waste is considered separate from burnable garbage. Organic waste is collected from each household and composted, with the compost then sold to local farmers as "Aya's Natural Fertilizer" at a low price. This initiative was made possible through cooperation with local communities, as the organic waste is collected separately from other types of waste. Japan has other campaigns to reduce food waste, such as the 3010 campaign, which aims to reduce food waste from parties by encouraging people to focus on eating food, rather than talking with friends, for the first 30 minutes of the party and the last 10 minutes of the party. When the party ends, people are encouraged to check if there is remaining food and if there is, to eat it.

2.2.9 Republic of Korea

In 2005, the Korean government introduced a measure banning food waste in landfills and in 2013, the government banned waste water, after the waste has been separated. The government also introduced a measure requiring food recycling by using biodegradable bags for composting; an average family of four pays $6 per month for biodegradable bags. The fee equals 60% of the cost to run the project, which has increased the amount of recycled food waste from 2% in 1995 to 95% today. The government allows this recycled food waste to be used as fertilizer or as animal feed.

In addition to instituting serious compulsory measures, the Korean government has also introduced innovations such as Smart Bin Weighing and Collecting, which uses radio-frequency identification technology to identify and record data on discarded food waste. Those who has disposed of the waste are charged by weight, which reduced food waste in Seoul by 47,000 tonnes over six years. The practice has become more widespread, with a reported 75,425 smart trash bins in Korea as of January 2019, covering 38.2% of the Republic of Korea and 54% of Seoul. The Republic of Korea is also urging people to reduce the weight of their food waste by reducing its water content. This has helped people pay less for food waste recycling and has also saved the government $8.4 million in waste collection over the same six-year period.

The water-reduced food waste is turned into compost for urban farm use. Community gardens in Seoul have grown six-fold in the past seven years, covering a total area of 170 hectares, equal to 240 football fields. Most gardens are established in the spaces between apartment buildings, on the roofs of schools or municipal office buildings, or along the ground floors of apartment buildings. Local governments supported 80–100% of the initial costs of establishing these urban gardens because in addition to producing food, they bring people together as a community. The government also plans to install a food waste composter to support urban farming.

2.2.10 Malaysia

On March 30, 2020, the Malaysian Food Donor Protection Act of 2020 entered into force (Daphnee & Jack, 2020). The Act stipulates that food donors will not be held civilly liable for any personal injury, disease or death suffered from consuming donated food unless it can be proven that the injury, illness or death was caused by the negligence or willful misconduct of the food donors; the food donors failed to comply with food safety and food hygiene; the food was not safe for consumption; or the food donations or distributions were not made in good faith. The Act broadly defines "food donor," which includes anyone who donates or distributes food to any person without receiving payment or any other form of compensation, including volunteers, corporations, government agencies, supermarkets, hotels, restaurants,

[6] Source: Edahiro and Yoneda https://www.japanfs.org/en/news/archives/news_id027817.html

or institutions, charity organizations or other organizations or legal entities and their directors, agents and employees.

Malaysia's food waste management is carried out by the Solid Waste Management Department, which oversees both solid waste management and other sanitation. However, this entity alone is not sufficient for managing food waste from all sectors, such as restaurants, supermarkets and households (Sulaiman & Ahmad, 2018). Some Malaysian restaurants have attempted to reduce food waste by using the Zero Food Waste Hero concept, which allows customers to choose a serving size and increase it for free. The approach also allows customers to serve themselves basil leaves from plants that are made available at every table.

2.2.11 Mexico

In the public sector, legal and institutional frameworks related to food loss and food waste in Mexico are as follows:

(1) Prevention and Integral Waste Management General Act 2003 (LGPGIR) defines household waste as organic waste (Article 18). Food waste less than 10 tons is considered urban waste and managed by municipalities. Waste above 10 tons is considered special handling waste and managed by states. Final waste disposal occurs at either landfill or open-dump sites.
(2) The promotion of improved food waste management after the 2016 Paris Agreement specifically mentions new general legislation for integral waste management, local tariffs for waste disposal, new finance and public policy approaches and efficient use of bio-digestion.
(3) In 2017, the Mexican government established an FLW working group, engaged the assistance of the World Bank Group and produced a conceptual framework for an FLW economic strategy.

In the private sector, the Mexican Foodbanking Network (Bancos de Alimentos de México – BAMX) is a network of 55 food banks that distributes food and essential products around Mexico. They rescue discarded food from restaurants, hotels, supermarkets and farmers, donating them directly to people in need. BAMX works with 2,466 beneficiary organizations, such as soup kitchens, shelters and community pantries, has a network of almost 20,000 volunteers and as of 2020, distributed over 120 million kilograms of food. Notable food waste-related programs in Mexico that are run by the private sector include:

(1) Pacto por la Comida, which engages in voluntary agreements with private entities to reduce food loss and food waste. The organization works with entities throughout the food chain (businesses, trade associations and sector representatives, local and economy-level government institutions, consumers) to put food waste on the public agenda and reduce food waste on a day-to-day basis. Members included Unilever, Ingredion, WWF, Walmart Mexico and Nestle.
(2) The FLAWLESS program (Halving Food Loss and Waste by Leveraging Economic Systems) is a collaboration between the UK charity Waste & Resources Action Programme (WRAP) and BAMX. The project aims to halve global food loss and waste by accelerating commercially viable models and transforming the economics of food system partnerships around the world, addressing barriers with viable solutions.

2.2.12 New Zealand

According to the Ministry for the Environment (2021), the government of New Zealand has supported a number of initiatives to reduce food waste through the Waste Minimisation Fund (WMF). Some projects and organizations that have benefited from the WMF include: 1) Love Food Hate Waste – an ongoing domestic education campaign that provides resources,

recipes and tips to help households reduce food waste; 2) Kai Ika – a collaborative project that collects fish heads, skeletons and other previously discarded fish parts for redistribution to families and community groups in Auckland who value these items; and 3) KiwiHarvest – a food rescue organization that works with food businesses across New Zealand to redistribute quality food that is unable to be sold for a variety reasons, such as oversupply or the item is nearing its "best before" or "use by" date. The strategic outcome goals for 2021 WMF funding aimed to improve tools to avoid food waste, such as data and analysis, and provide practical resources to inform effective behavior change; increase the domestic capacity of existing food rescue organizations and; support primary and processing sectors in the redesign of materials, products and services to minimize organic waste.

Along with a few APEC economies, New Zealand launched the Food Act 2014, known as the "Good Samaritan" clause, which protects businesses if they donate food. Donors are not liable if the donated food makes people sick, as long as the food is safe and suitable when donated; the food is donated with any necessary information to keep it safe and suitable for consumption; and the food has its original labelling. Food with a shelf life of less than two years must have a date; this is shown on the label as "use by" if the food could make people sick if consumed after a certain date, or as "best before" if the food declines in quality after a certain date but is still safe to be consumed. A label with "baked (bkd) on" or similar indicates that the product is bread with a shelf life of less than seven days. Food that has passed its "use by" date must not be donated. Food marked with a "best before" date can be donated after the date has passed if it is still fit to eat (Ministry of Primary Industries, 2021).

New Zealand restaurants are responsible for making sure their food is safe to eat at the time they serve or sell it. It is up to each business to decide if they allow customers to take home their uneaten food. Allowing customers to take home uneaten food helps reduce food waste. Government-funded organizations also provide food rescue and food donation services across New Zealand. The New Zealand Food Network collects quality surplus and donated bulk food. The Aotearoa Food Rescue Alliance supports local food rescue efforts. The Kore Hiakai – Zero Hunger Collective supports community food organizations domestically and is also working to help solve the root causes of poverty-related hunger.

2.2.13 Papua New Guinea

There is little information about food waste policies in Papua New Guinea. There is no dedicated legislative framework for the management of organic waste or solid waste. The regulation of organic waste is spread across several pieces of legislation and include the Public Health Act 1973, as amended (e.g., food waste), and the Domestic Capital District Commission Act 2001, as amended (e.g., as part of municipal waste collection and environmental health responsibilities). Organic waste does not clearly fit within any one piece of legislation. Relevant laws also vary according to the location across Papua New Guinea (SPREP, 2020).

2.2.14 Peru

In the public sector, the Peruvian government launched a joint Country Programming Framework with the FAO (Marco de Programación de País MPP 2018–2021) in 2018, which seeks to develop a "sustainable food system and access to safe and nutritious food, preferentially for the most vulnerable populations," among other goals. The Ministry for Agriculture and Irrigation (MINAGRI) attended the First Latin–American Summit on Food Loss and Waste held in Bogotá, Colombia, from October 10–11, 2019. Aside from these programs, Peru has established legal frameworks regarding FLW, including the following:

(1) In 2016, Peru adopted Law 30498 promoting food donation and facilitating the transport of donations in natural disaster situations; this is also known as the "Food Donation Law." The Food Donation Law offers procedural guidance and financial/tax benefits for food donations in two distinct situations:
    a. The donation of food that has lost commercial value but is still safe for human consumption:
        - The donated food should be distributed to people in need for free, either directly or through charities registered with the tax authority.
        - Any person or legal entity can be a donor.
        - Donors must adhere to certain procedures, such as preserving the expiration date; donation recipients are required to maintain records of donated foods and the beneficiaries.
        - Compliance is overseen by the General Directorate on Environmental Health and Food Safety (DIGESA), under the Ministry of Health (MINSA).
    b. The donation of food (and other necessary goods and services) during "states of emergency" following natural disasters:
        - Specific tax benefits are extended to certain donated goods following a natural disaster and a government-declared "state of emergency." These "goods" may include basic necessities, such as food and medicine, but are explicitly detailed during each state of emergency decree.
        - This law has not been put into action yet, so it is uncertain how much it will influence food donation during times of crisis.
(2) On the third year of the law's enactment, the "encouragement" of food donation will become a "requirement" for supermarkets, food storage facilities and warehouses. However, as of 2020, the Ministry of Social Development and Inclusion (MIDIS) had not finalized enabling regulations for this obligation, so there are currently no formal procedures for compliance or legal consequences for not donating food.
(3) In July 2019, the Peruvian government adopted Law 30988 promoting the reduction and prevention of food loss and waste, also known as the "Law Against Food Loss and Waste." This law promotes coordinated, multistakeholder efforts to reduce and prevent food loss and waste at all stages of the food supply chain.
(4) While the Food Donation Law recognizes the relationship between food loss and waste and food donation, the Law Against Food Loss and Waste does not include any reference to food recovery or food donation. However, the regulation for the Law Against Food Loss and Waste, adopted in March 2020, accounts for this disconnect, featuring provisions that endorse greater food donation.
(5) Food donations fall under the Food Safety Act and its enabling regulation, the General Health Law, as well as the Health Norms for the Storage of Foods for Human Consumption.

In the private sector, the Peruvian Food Bank (Banco de Alimentos Perú – BAP) is a non-profit created in 2014 to redirect food surpluses to food insecure populations. BAP recovers food from wholesale markets and facilitates donations to over 240 beneficiaries, manages 200 volunteers and as of 2020, has rescued over 16,000 tons of food. In addition, there is the socioenvironmental company sinba, founded in 2016 in Lima. They collect food waste from restaurants and transform it into "punba," healthy pig food, through a biotechnological process. The punba is then delivered to associated pig farms, generating a positive impact. The organization also offers waste management, training, collection and processing services.

2.2.15 The Philippines

The Philippines launched the Ecological Solid Waste Management Act of 2000 (Republic Act 9003) in 2001. This law refers to the systematic administration of activities that provide for the separation of waste at the source, including transportation, storage, transfer, processing, treatment and disposal of solid waste and all other waste management activities that do not harm the environment. Local government units have the primary responsibility for effective and efficient solid waste management. In 2020, the proposed Food Surplus Reduction Act was passed by the House of Representatives. The bill mandates the implementation of a Domestic Zero Food Waste Campaign to raise awareness about the impact of food surpluses, as well as outlines strategies for decreasing wasted food at food-related businesses and at the household level. The bill also establishes linkages between food businesses, food banks and local government units for creating a community-based food distribution system for the food insecure. Under the Food Surplus Reduction Act, guidelines and standards will be provided for the collection, storage and distribution of edible food donated to food banks. A self-sufficiency program will also be created, providing skills training in managing food banks and livelihood programs in order to avoid dependence on donations. Local government units will be required to enter into contracts with waste management and recycling enterprises to recycle inedible food waste into fertilizers or compost. There will be penalties for selling food donations or for causing edible food surplus to be unfit for human consumption (Cervantes, 2020)

There are several efforts within the private sector to reduce food waste. For example, Pilipinas Kontra Gutom has formalized partnerships with more than 30 different groups, including non-governmental organizations, large corporations and technology and media companies. Rise Against Hunger accepts canned or processed food donations that are close to expiring, as well as discontinued products, seasonal items and production overruns, among many others. Future Food Together focuses on developing toolkits, frameworks and training programs for the food service sector; increasing awareness among consumers about the impact of their dietary choices; engaging with the local governments of key tourist destinations and with the government on integrating sustainability practices into their policies and sectoral action plans, as well as providing support for implementation (Future Food Together, 2022).

2.2.16 Russia

In Russia a draft law on foodsharing – on the possibility of retail chains to donate to charity organizations products whose shelf life is coming to an end– is being developed. According to the bill, retailers will be exempt from paying VAT on products donated for charity projects. A number of food-sharing initiatives have developed in Russia recently. Among them is first food bank in Russia "Foodbank Rus" It realizes projects with producers and retailers, for example, with X5 Retail Group, to donate products to help people in need An increasing number of companies are recognizing their responsibility for managing their environmental impact and are striving to uphold the principles of sustainable development.

2.2.17 Singapore

Singapore has used campaigns to raise awareness about food waste reduction, as well as support capacity building and training for employees on food waste reduction. The government of Singapore collaborates with various industry stakeholders under the Food Waste Reduction Outreach Programme, such as supermarkets, food retail establishments and schools, to display educational materials and conduct talks and roadshows. Singapore also launched the third "Say YES to Waste Less" campaign in 2021, with a focus on encouraging the public to lead a sustainable lifestyle by reducing the use of disposables and food waste.

The campaign leveraged a comprehensive suite of media touchpoints, such as outdoor, digital and social media channels. In support of the 2021 campaign, 169 partners representing close to 3,000 premises committed to various actions to reduce food waste and/or the use of disposables, an increase from 95 partners across 2,100 premises in 2020. These partners included corporations, social enterprises, interest groups, non-governmental organizations and Community Development Councils.[7]

To drive awareness of food waste reduction across the supply chain, Singapore developed food waste minimization guidebooks for retail food establishments, supermarkets and food manufacturing facilities. These guidebooks provide step-by-step instructions and case studies to help businesses develop a food waste minimization plan tailored to their needs. Guidelines on the proper handling and redistribution of unsold or excess food have also been incorporated into the guidebooks.

There are several food rescue organizations focused on reducing MSME surplus food in Singapore, including: 1) Fei Yue Community Services (www.fycs.org); 2) Food Bank Singapore (www.foodbank.sg); 3) Food From the Heart (www.foodfromtheheart.sg); and 4) Willing Hearts (www.willinghearts.org.sg). There are also food waste recycling companies and suppliers of on-site food waste treatment systems (e.g., 800 Super Waste Management Pte Ltd and A smart Life Ptd Ltd) that offer business-to-business and business-to-consumer solutions for managing surplus or imperfect food, so that it is not wasted.

2.2.18 Chinese Taipei

Chinese Taipei does not have a MSME food waste reduction target and does not have policies/plans at the economy-wide level. However, government agencies promote food donation, food waste management and capacity building campaigns to reduce food waste. There are many activities aimed at reducing food waste. For example, the Ministry of Health and Welfare (MOHW) hosted a Foodbank Experience Sharing Conference in 2018. In the same year, the Environmental Protection Administration organized the Food Cherishing Festival, followed by the launch of a Food Recovery Award in 2019. The Council of Agriculture (COA) implemented an APEC multiyear project called "Workshop on Strengthening Public-Private Partnership to Reduce Food Losses in the Supply Chain" from 2013–2018. In 2019, an Expert Consultation on Reducing Food Loss and Waste (FLW) for Addressing Interlinked Challenges of Food Security and Climate Change was held. The following year, the COA launched a project titled "Reducing Food Loss and Waste along the Food Value Chain in APEC During and Post-COVID-19 Pandemic." This initiative included capacity building and training for entrepreneurs on food waste reduction in 2021. Additionally, the Food and Agriculture Education Law was finalized in 2021, and the New Taipei City Government organized the New Taipei City Sustainable Food Forum in 2018.

MSME food waste reduction practices in the retail food industry (e.g., grocery stores, convenience stores, fresh markets) have been implemented in Chinese Taipei. Examples include: 1) The Homemaker United Foundation, which uses a pre-order system to manage stock and avoid food waste. Unsold vegetables and fruits become employee meals; 2) The PX Mart offers discounts on products with short expiration dates and also collaborates with local foodbanks to donate unsold food; 3) The Simple Mart has an outlet that sells unsold food by offering discounts; 4) Family Mart and 7–11 follow the instructions of the MOHW to implement the First-In, First-Out (FIFO) method for stock management. They also built databases to keep track of their products; and 5) The Agriculture Investment and Development Co. Ltd. uses lower grades of fruits to produce juice and chips.

[7] More information may be found here: http://cgs.gov.sg/sayyes.

Chinese Taipei has also implemented MSME food waste reduction practices in the food service industry (e.g., restaurants, cafeterias, catering operations): 1) Cookmania organizes periodic food waste reduction events with chefs turn fruit peels and other potential food waste into edible dishes; and 2) Taidatable implements a circular economy by using food waste to feed black soldier flies, generating biogas. The black soldier flies can later be used as fertilizer for plants. Further MSME surplus food reduction practices include: 1) The Chinese Christian Relief Association has been administering a 1919 Food Bank program since 2010. They collect surplus food from wholesalers and supermarkets and distribute it to those in need. The organization also sets up supermarket-style food pantries, where people can pick up food directly. They have a central kitchen for cooking surplus food and getting it to those in need; and 2) The ATF, a foodbank alliance of Chinese Taipei, collects surplus food from wholesalers (Carrefour) and supermarkets for organizations in need.

2.2.19 Thailand

In Thailand, there are at least three main plans and policies including: (1) the Sustainable Consumption and Production Plan 2017–2038; (2) the Greenhouse Gas Reduction Action Plan for the Municipal Waste Sector 2021–2030; (3) the Domestic Food Management Strategic Plan (II) 2018–2037; and (4) the Bio-Circular-Green Economic Model, or BCG.

Many private entities have also started taking action to reduce food waste. Among food retailers, one supermarket is leading, while convenience stores and other supermarkets are following. Strategies include seasonal planning with food producers, promoting "ugly" produce, offering price reductions for prepared food in the evenings, food surplus sharing and composting. Among hotels and restaurants, measures include pledging to reduce food waste, staff training, food surplus sharing and monitoring food waste. Canteens, such as those at the United Nations' Economic and Social Commission for Asia and the Pacific (ESCAP), the Pollution Control Department and Chulalongkorn University, gather data and use a biodigester. Private organizations, namely the Scholars of Sustenance Foundation, help match food donors to recipients, provide food safety training and engage in public outreach. Thailand is drafting a Roadmap for Food Waste Management, with the ultimate target of halving food waste by 2030 (73kg/capita/year). The main strategies include preventing and reducing food waste; establishing networks, such as signing memorandums of understanding between the public sector and the food service and retail sectors, and promoting green restaurants; raising awareness and changing consumer behavior; managing surplus food; promoting the management and utilization of food waste; establishing a data system for food waste; developing a curriculum, guidelines and knowledge aimed at reducing food waste; promoting research, development and technology to reduce food waste; improving laws and regulations to support food waste management; and providing economic incentives to encourage the reduction of food waste.

2.2.20 United States of America

At the economy level, the US Department of Agriculture (USDA) and the US Environmental Protection Agency (EPA) set a goal in 2015 to reduce food waste by half by 2030. This updated approach used 2016 as a baseline, when 328 pounds of food waste per person were sent to landfills, controlled combustion, sewer, co/anaerobic digestion, compost/aerobic digestion and land application. The 2030 goal aims to reduce this number by 50% to 164 pounds per person. Working with USDA, the Food and Drug Administration (FDA) and state and tribal partners, the EPA plans to secure action on the 2030 goal by working with leaders in the food system (e.g., private, government, nonprofit, academia, faith) to promote

successful interventions and tools to advance the sustainable management of food (USEPA, 2022a).

At the state level, a study (Schultz, 2017) reports that in 2017, more than 33 bills addressing food waste were introduced in 12 states. For liability protection, the United States enacted the federal "Bill Emerson Good Samaritan Act" to protect donors and recovery organizations from criminal and civil liability arising from the age, packaging or condition of donated food. The United States also extends tax incentives to small farmers and businesses that bear a significant expense to harvest, prepare and store food for donation that would otherwise be discarded. Ten states (i.e., Arizona, California, Colorado, Iowa, Kentucky, Missouri, Oregon, South Carolina, Virginia and West Virginia) and the District of Columbia offer a tax incentive for food donations.

The labels on food products (sell by, use by, best by, enjoy by) are generally indicators of quality, not safety. Aside from infant formula, the federal government does not regulate food date labels. States have filled this void with laws that often create more confusion, not less, and some are considering ways to simplify food labels and to educate the public about what these dates mean. California enacted legislation in 2017 (AB 954) requiring the state department of food and agriculture to promote the terms "best by" and "use by" to communicate quality and safety dates, respectively. Organic waste bans prohibit entities that generate large quantities of food waste from sending that waste to landfills. A ban compels food waste generators to reduce their output and find better ways handle the waste they are unable to eliminate, either by donation, composting or anaerobic digestion (the process of turning food waste into biogas).

2.2.21 Viet Nam

In the public sector, the Ministry of Natural Resources and Environment and the Viet Nam Environmental Administration Office (VEA) has pushed the 3Rs (reduce, reuse, recycle) campaign. In terms of policies on solid waste and food waste, the "Strategy on Integrated Solid Waste Management" from 2009 and its revision in 2018 address solid waste, collection rates, landfills, plastic waste, classification of waste at source and recycling facilities, with a target strategy for 2025 regarding solid waste (i.e., 90% of all solid waste will be collected and treated to meet environmental protection requirements, including increasing the recycling, reuse and reuse of energy) (Nguten, 2022; Reportlanker, 2020).

The private sector has set up Food Bank Viet Nam, with a plan to develop a "mobile food bank" system or a free food pick up and distribution station, including food bank "restaurants" that sell cheap food for the underprivileged across all regions. Another important part of the project is the creation of an emergency food bank to provide food during natural disasters, such as floods and hurricanes, which occur every year in Viet Nam, with support from the Viet Nam Red Cross Committee and the Youth Social Welfare Center (Food Bank Viet Nam, 2021).

2.3 Summary

This chapter summarizes the current status of food waste and policies addressing MSME food waste reduction in APEC economies. The data were drawn from several sources. The study revealed that no APEC economies have food waste data that is specific to MSMEs. While all APEC economies have policies and measures to address the problem of food waste, there are no direct MSME food waste reduction targets, policies or plans at the economy-wide level. A small portion of APEC economies have implemented MSME food waste reduction approaches in the retail food industry and the food service industry. There are food rescue organizations focused on reducing MSME surplus food in a majority of APEC economies.

Food donations are still not required for supermarkets, food storage facilities or warehouses in many APEC economies. Moreover, a majority of APEC economies have still not implemented laws protecting food donors from any civil liability with respect to any injury, disease or death suffered as a result of consuming food donated or distributed by food donors.

3. Challenges and Opportunities, Plus the Role of Modern Technologies in Reducing Food Waste

3. Challenges and Opportunities, Plus the Role of Modern Technologies in Reducing MSME Food Waste

This chapter provides information about some of the challenges MSMEs are facing at the economy and firm levels, as well as efforts to close those gaps. This chapter also sheds light on opportunities for reducing MSME food waste and the role of modern technologies.

3.1 Challenges

3.1.1 Economy level

According to the information provided by invited speakers at the APEC workshop organized from 13–14 January 2022, as well as from the literature review, several challenges in particular obstruct the reduction of food waste in APEC member economies.

The first challenge is the lack of policies, regulations and incentives supporting the reduction of food waste. For example, in Russia the current tax regime makes food sharing services economically impractical because the cost of throwing out food is lower than donating it. In addition, sanitary and epidemiological regulations prohibit the sale of incompletely peeled vegetables and fruits, although they can still be eaten.

The second challenge is the lack of awareness from the public and private sectors. The public and private sectors still do not understand the true cost of food waste. Moreover, the literature reveals a lack of public awareness about the need to separate food waste at the source, such as the survey conducted by Hashim et al. (2021) in Malaysia. The survey showed that Malaysian awareness about composting food waste is relatively low, with a lack of composting facilities and insufficient knowledge about the composting process identified as contributing factors. A review of food waste management and composting in Malaysia is expected to help communities understand the importance of separating food waste and composting to prevent environmental pollution. The representative from Brunei Darussalam also noted lack of entrepreneur awareness as a challenge hampering MSME food waste reduction policy/plans in Brunei.

The third challenge is difficulty finding the most cost effective solution for creating value out of food waste.

The fourth challenge is lack of access to appropriate food waste reduction technologies. This problem stems from a lack of access to capital in order to invest in food waste reduction technologies. The lack of novel technologies that can address the food waste problem is also evident in several APEC member economies. For example, Canada's food waste reduction challenge includes two streams that are specifically for novel technologies at the prototyping or testing phase that either extend the life of perishable food or transform surplus food (or food by-products) that would otherwise be lost or wasted. Extending technologies find ways to slow the degradation of perishable foods, lengthening the amount of time these food items may be stored before spoiling. Transforming technologies convert surplus food, food by-products or food waste into other products, including food for humans, food for animals/insects (e.g., animal feed) or into non-food products. These streams target technologies that are in the early development phase to accelerate their advancement and prospective deployment into the Canadian market. Successful solutions are advancing technologies to make them more effective, efficient, scalable and competitive.[8]

[8] More details about the semi-finalists in these technology streams of the challenge can be found at: https://impact.canada.ca/challenges/food-waste-reduction-challenge-novel-tech/semi-finalists.

The fifth challenge is the lack of food waste data collection, especially on MSMEs. As mentioned in the second chapter, the findings from the UNEP (2021) indicate that a majority of economies in the world, including APEC economies, collect limited food waste data with very low confidence. Household food waste data showed higher confidence than food service and retail data. While most large private companies have begun to measure food waste generation from their operations, only a small portion of MSMEs have begun to do the same.

The sixth challenge is the lack of efficient logistics and transportation systems. This challenge leads to higher costs of production and reduces the profitability of food waste management for MSMEs. Efficient logistics and transportation systems can reduce delivery times, extend the shelf life of food and reduce food damage.

The seventh challenge is the lack of budget to address the food waste problem. For example, a previous study revealed that an insufficient budget has slowed the progress of food waste management in Malaysia (Hashim et al., 2021).

The eighth challenge is a lack of composting facilities and insufficient knowledge about the composting process. According to information from several sources, a majority of APEC economies turns food waste into compost. Improving composting facilities and knowledge about the composting process can increase the utilization of food waste.

The ninth challenge is the reliability and consistency of raw food waste. It is difficult to use raw food waste in industrial and agricultural processes without consistency. As a result, the ability to use food waste is reduced.

The tenth challenge is culture and tradition in several APEC member economies. Food waste is most likely the result of mass consumption trends stemming from commercial catering, festivals, weddings and so on.

3.1.2 Firm level

To consider the challenges of food waste at the firm level, invited speakers at the APEC workshop and the literature review highlighted several challenges that obstruct the reduction of MSME food waste in APEC member economies.

The first firm level challenge is a lack of entrepreneur awareness and few MSME policies to reduce food waste.

The second challenge is reducing MSME food waste at the three critical waste points: raw material input, processing and packing/filling. At the raw material input point, waste is generated from excessive trimming caused by poor quality raw material or equipment. At the processing point, food waste comes from spillage, damage and poor quality caused by inappropriate equipment design and poor quality control. At the packing/filling point, food waste is generated by poor packing equipment and improper packing. Distribution is a critical waste point outside MSMEs, with damage and spoilage usually occurring from improper and inadequate packing (Figure 1).

Figure 1. Food waste and its underlying causes in MSMEs

Source: Rolle (2022)

The third challenge is that MSME storage facilities are old. This challenge discourages food waste management because it is difficult to improve the production line process to reduce food waste.

The fourth challenge is the lack of cold chain distribution. Investing in cold chain distribution is costly for MSMEs because it is difficult to obtain economies of scale benefits.

There are several challenges in food waste diversion for the hospitality sector. Examples include: 1) Limited options to divert food waste from landfills; 2) Limited space for composting; 3) No composting facility nearby; 4) The odor from composting can attract rodents, pests, stray cats and dogs; 5) Composting is too time consuming and too complex; and 6) Inconsistent waste collection.

3.1.3 Efforts to close the gaps

Most APEC member economies have identified and implemented various solutions to reduce food waste among government agencies and businesses. Examples of highlighted solutions include education campaigns, capacity building, improved handling and transportation and food recycling. These solutions can be grouped into three main categories: prevention, recovery and recycling.

Examples of prevention solutions include: Increasing food waste education and campaigns through posters and other communication materials in dining establishments; Promoting the sharing of best practices and other solutions for food waste management; Making use of food-related days, such as World Food Day, to encourage people to reduce food waste; Promoting food saving training; Establishing a cold chain infrastructure; Developing packaging technology; Reducing the amount of food served at dining establishments; Promoting the reduction of raw food waste, especially among catering companies; Fostering smart purchasing by encouraging people to plan ahead to avoid over-shopping; Promoting food waste inspections and audits for MSMEs.

Examples of recovery solutions include measures to support food donations: Implementing food donation tax incentives; Promoting standardized regulations; Developing and using matching software; Promoting the development and adoption of Internet of Things (IoT) technology for food storage and food transportation; Improving transportation, storage and handling; and Promoting liability protection and education. With regards to recycling solutions, examples include using food to make compost, biogas or animal feed. Facilitating collaboration between stakeholders in the food supply chain and governments can prevent, recover and recycle food waste.

Several examples that have already been implemented in APEC economies include: in Australia, rescuing food from supermarkets and promoting campaigns to raise entrepreneur awareness about food waste reduction through "Stop Food Waste Australia"; in Canada, promoting food waste education campaigns; in Chile, fostering communication and the sharing of best practices to prevent and reduce food loss and waste through the "No Food Loss Project"; the Food Waste Recycling Act and the mobile technology solution "NTTDOCOMO" to reduce food loss and waste in Japan; the grading, packaging and labeling (GPL) system in Malaysia; the Domestic Food Waste Prevention Project, the Foodbank Project and Love Food Hate Waste project in New Zealand; the mobile application MakanRescue in Singapore; the community-based foodbank and Tasteme application in Chinese Taipei and; the smart bin in Korea. While these efforts not specifically targeted at MSMEs, they can be used by MSMEs to reduce food waste.

3.2 Opportunities and the role of modern technologies

Food waste causes approximately USD 2.6 trillion in financial damage per year (FAO, 2014), about USD 700 billion in environment damage per year and costs society about USD 900 billion a year (FAO, 2014). Food waste also has a negative impact on the environment through carbon dioxide (CO_2) and methane (CH_4) emissions, the greenhouse gases that cause global warming. Farming resources, such as land, water, energy and other inputs, are wasted if the food that is produced is not harvested. Another environmental impact from the large amounts of food waste in landfills is the contamination of groundwater, drinking water supplies and other water supply sources, such as lakes or rivers, which destroys the organisms that live in those environments. Food waste piles around landfills are also a breeding ground for parasites in animals, which are carriers of infectious diseases that can be spread to the environment, such as diarrhea, cholera, skin diseases, respiratory allergies, malaria, tuberculosis and others. Therefore, reducing food waste can improve business income, public health and the environment (Wang et al., 2017; Gössling & Peeters, 2015).

Technology can play an important role in creating value from food waste (Figure 3). Opportunities that were identified and highlighted are as follows. At the prevention stage, for industry, examples include: on-board processing and packaging innovations in the wild prawn industry; supply chain monitoring and improvement to reduce banana quality loss; and reducing canning loss in the abalone industry. At the consumer level, examples of technology creating value include consumer food waste applications. At the redistribution stage, examples include the foodbank application and tax reforms to create incentives for businesses to increase food donations. In addition, technology can be used to convert food waste into new products, such as transforming potato waste into pre-biotics or extracting nutraceuticals from wine industry waste. Food waste can also be used to make compost or animal feed in agriculture. Last, but not least, technology can be used to convert food waste into new materials or bioenergy.

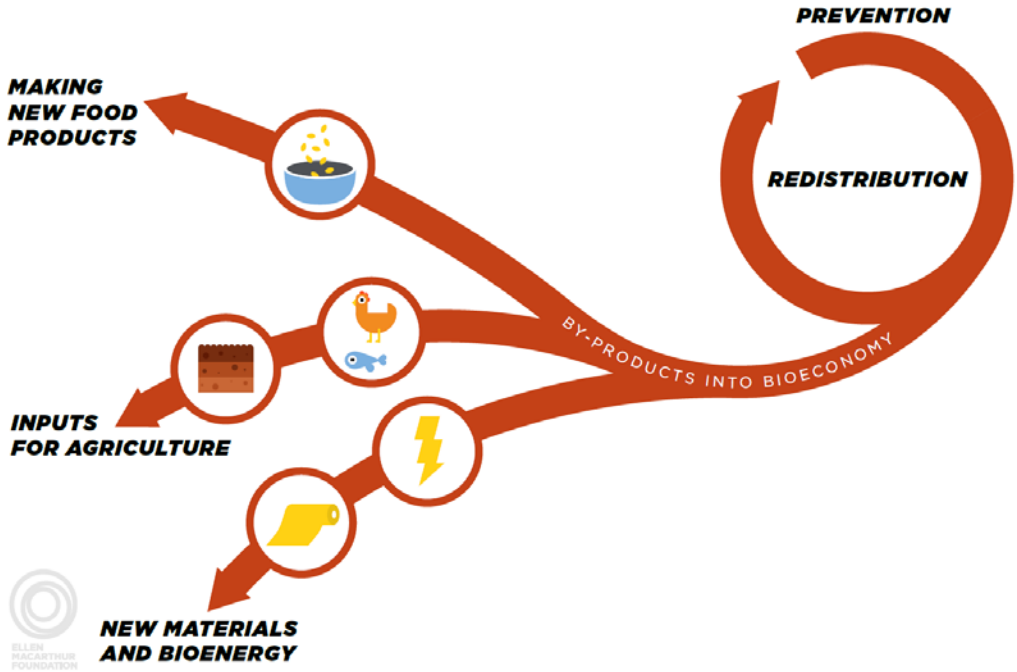


Figure 2. Five opportunities to create value out of food waste and the role of modern technologies

Source: Ellen MacArthur Foundation and Lapidge (2022)

Among technologies for commercial kitchens, Food Intel Tech (FIT) enables the tracking and reduction of food waste and associated costs at multiple locations. By using the FIT program, commercial kitchens can access a dashboard with in-depth data analytics and user-friendly data visualization. LightBlue Environmental Consulting has worked with JW Marriott to use its expertise and technological solutions to help the hotel chain reduce food waste. JW Marriott staff were trained onsite in food waste prevention and capacity building workshops using iCloud-based analytic software. From October 2018 to July 2020, the hotel saved around 118 tons of food – the equivalent of rescuing about 236,000 meals – reducing food waste by 33% per cover and eliminating 295 tons of CO_2. Another successful use case for the FIT program is J'Aime by Jean-Michel Lorain. From October 2020 to April 2021, around 51.6% of food waste was reduced per cover, saving 707 kilograms of food – the equivalent of 1,414 rescued meals – and 1,767 kilograms of CO_2 was reduced.

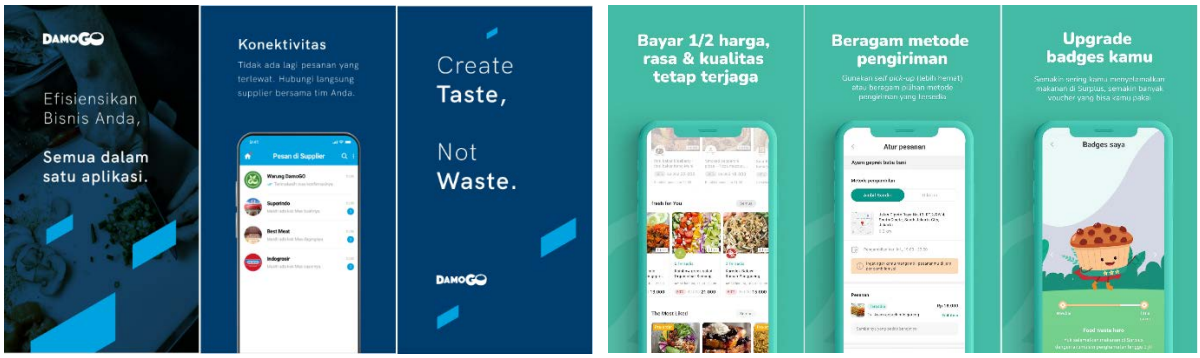
Several APEC economies have adopted digital applications to reduce food waste. For example, in Japan the mobile application "Tabete" (Figure 3), which means "Please eat" in Japanese, was launched in big cities like Tokyo and Osaka in 2018. The aim of this application is to use digital technology to save food that might otherwise be wasted. This application allows stores to post pictures and prices of food that needs to be saved. Registered consumers can search for nearby stores, place an online order, pay and pick up the order at an agreed time. This mobile application is now available in over 500 stores in Tokyo and Osaka and has more than 200,000 registered members. Another interesting measure in Japan is a platform that collects information about foods that have passed their "savory period," the best time for freshness, but are still safe to eat. These food items are sold through the operating chain "ecoeat" at lower prices.[9]

[9] Source: https://www.globaltimes.cn/content/1200497.shtml

Figure 3. Features on the Tabete application

Source: Japan News

Still other examples are Surplus Indonesia and Damogo, applications that connect the general public with partner shops and restaurants that have surplus or unsold food (Figure 4). In the Philippines, "SoilMate" offers an IT solution to divert food waste from the landfill to composting (Figure 5). This application is used in the metro Manila area to route unavoidable organic waste from landfills by connecting businesses and communities to a composting subscription service through the mobile application. The application monitors activities, tracks the progress of the waste, and measure the personal and collective impacts of reducing food waste, which includes reducing greenhouse gas emissions and building healthy soil.



(a) Damogo application (b) Surplus Indonesia application

Figure 4. Features on mobile food waste reduction applications in Indonesia

Source: Google Play

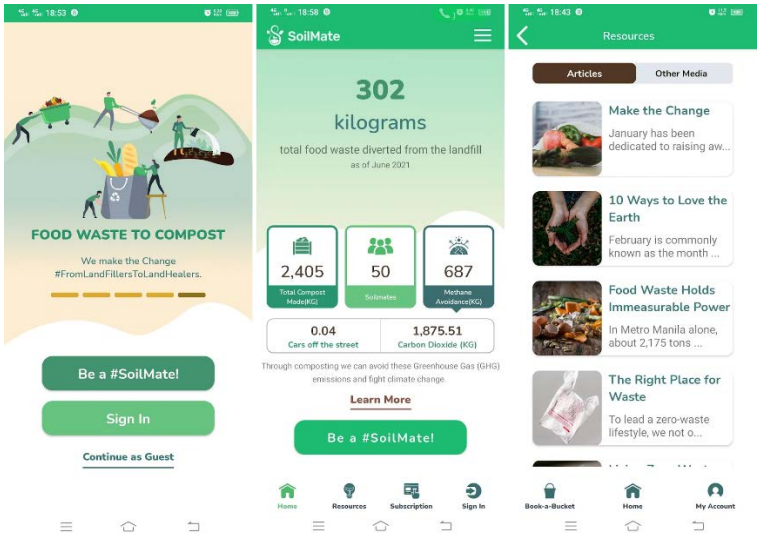
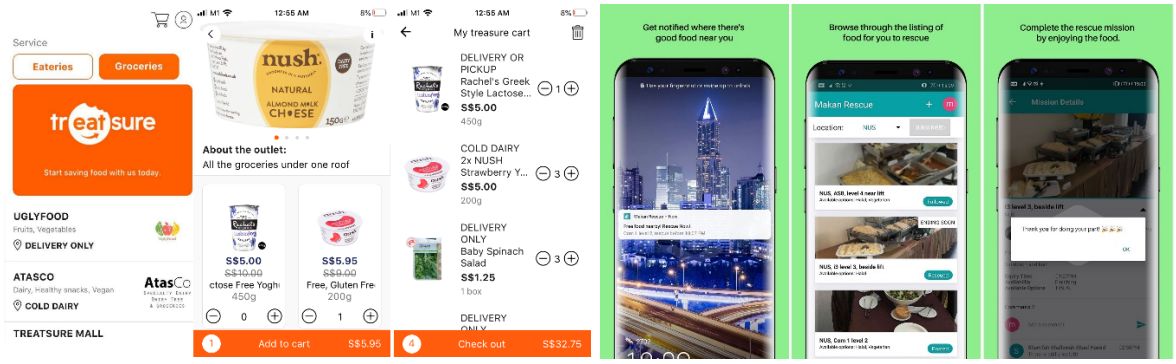


Figure 5. Features on mobile application SoilMate in the Philippines

Source: Google Play

In Chinese Taipei, various platforms are used such as "Tasteme," an application for sharing leftover food from restaurants and bakeries. Consumers can order the leftovers at discount prices through the application. There are also many e-commerce platforms, such as Superbuy Market (https://www.superbuy.com.tw/index.php), where customers can purchase the right amount of food at any time.

Singapore also utilizes food waste reduction technologies, such as applications to encourage food donation in the community, including Treatsure, Makan Rescue and OLIO (Figure 6). On-the-ground groups facilitate food rescue efforts via Telegram, such as Food Rescue @ Events and Food Rescue @ Seng Kang. Food waste treatment solutions include on-site food waste treatment systems that convert food waste into compost, non-potable water or biogas; black soldier fly treatment facilities; and centralized food waste treatment facilities that use anaerobic co-digestion. There are also food waste tracking solutions that some premises (e.g., hotels) have adopted to help measure and identify the sources of food waste, including Winnows, LeanPath and Lumitics, facilitating the implementation of efforts to decrease the amount of food waste that is created.



(a) Treatsure application (b) Makan Rescue application

Figure 6. Features on mobile food waste reduction applications in Singapore

Source: Google Play

3.3 Summary

There are several challenges to reducing MSME food waste in APEC economies, including lack of entrepreneur awareness; lack of understanding about the true cost of food waste; limited options to divert food waste away from landfills, inability to determine the most cost-effective solution to create value out of food waste; problems with logistics and transportation; lack of a policy and regulatory framework; lack of access to capital to invest in food waste reduction technologies; lack of reliable and uniform food waste that can be feedstock; limited space for composting and odors that can attract rodents, pests, stray cats and dogs; and inconsistent waste collection.

At the same time, there are also several opportunities for MSMEs that reduce food waste, including improving profits by reducing costs and increasing the value added of food; reducing their carbon footprint and enhancing consumer demand; and using food waste to make new food products, inputs for agriculture and bioenergy. From a technology perspective, a majority of APEC economies utilize modern technologies, including mobile applications, to reduce or manage MSME food waste/surplus food, but these modern technologies are used only by large companies in big cities.

4. Best Practices for MSME Food Waste Reduction

4. Best Practices for MSME Food Waste Reduction

According to the 2021 Food Waste Index Report, in 2019, out of about 5.3 billion tons of food that was consumed, about 931 million tons was waste (17% of food for consumption). This food waste came from three sectors: households at 569 million tons, accounting for 61%; food service at 244 million tons, accounting for 26%; and retail at 118 million tons, accounting for 13%. In some economies, food waste from the service sector produces more food waste than households, such as in China (Liu, 2014) and Malaysia (Papargyropoulou et al., 2016). This chapter provides information about the best practices for MSMEs and surplus food rescue organizations to reduce food waste in the retail food and food service industries. This chapter also presents two case studies that capture the best practices for MSMEs and surplus food rescue organizations.

4.1 Best practices from the retail food and food service industries for reducing MSME food waste

The main causes of food waste in retail food and food service include damage and spoilage of food ingredients; inadequate cold chain infrastructure; delays in transit; volatile customer demand; adaptation or incorrect order cancellations; customer over-forecasting and overstock; inefficient handling and storage; customer service is focused on quantity and variety of merchandise; misleading date labeling or label confusion; and the presence of shelf-life regulations, quality requirements and hygiene rules that require large quantities of still edible food to be discarded. It was found that hotels accounted for approximately 70% of avoidable food waste (Vol, 2014).

The concept of waste as a hierarchy of food recovery (USEPA, 2022b) is a key concept used in retail food and food service waste reduction. The hierarchy represents a sequence of food management steps to prevent food waste, shifting the food to other uses. At the top of the hierarchy is the source reduction or prevention of food waste. This, first and foremost, is the best approach to reducing losses, maximizing food while minimizing both environmental and economic impacts. The least acceptable option is sending the food to a landfill by reducing waste in each step. The details are shown in Figure 7 below.

The retail food and food service businesses in each economy have similar key success factors, but there may be different tools used for each step of the operation. The details are as follows:

1. Systematic inventory management: Implementing a systematic operation system, such as ensuring that raw food materials are procured with the least amount of waste, or that the storage of food ingredients complies with "first in-first out" system standards. A systematic operation can leverage technology to make operations more efficient. This is the case with Raley's supermarkets, which utilizes an innovative technology called "Date Check Pro" to improve stock sales and ensure the accuracy of product expiration dates and product turnover, thereby solving food waste problems. In two years, more than 500,000 pounds of food waste was prevented by identifying nearly expired products with Date Check Pro. Some products only needed to be rotated to the front of the shelf, while other products needed to be sold at a discount to reduce food waste.

2. Food waste measurement: Collecting food waste data for the purposes of analysis, planning, improvement and development of action systems to reduce food waste. As an example, Leanpath implemented three steps for measurement collection: 1) Track daily to collect food waste data and increase employee awareness; 2) Introduce competition, with leaders encouraging teams to focus and understand the importance of preventing food waste; and 3) Goal setting by reviewing already collected food waste data, identifying opportunities

and setting specific, measurable, achievable, relevant and time-bound (SMART) goals to drive success.

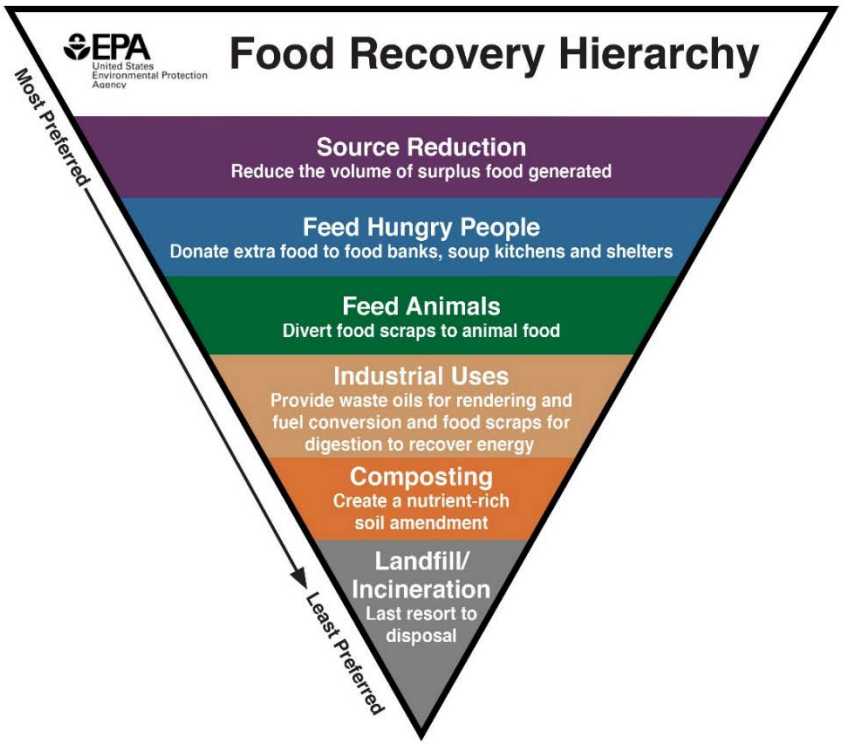


Figure 7. Food recovery hierarchy

Source: USEPA (2022)

3. **Raising awareness:** Raising awareness within the organization that reducing food waste is not the duty of just one party but everyone who is connected to the hotel, including executives, chefs and staff. By providing food waste training to all staff, not just the kitchen or garden department that process waste, employees in every department should know that the organization prioritizes such matters.
4. **Promoting participation:** Strengthening participation in food waste reduction for both employees and customers. For employees, provide food waste reduction training, organize an employee exchange seminar between departments, campaign for employees to reduce food waste in the staff canteen and give prizes to employees who don't leave food on their plates (food lover). For customers, hang a campaign sign in the restaurant showing daily food waste amounts and the number of people who could be fed with that wasted food.
5. **Facilitating good networks and alliances:** Sharing knowledge and practices on food waste reduction, and connecting with others to utilize, donate or sell surplus food to customers. Currently, there are startups developing applications to make these types of connections faster and more efficient. For example, DamoGO is a social impact food startup that connects consumers directly to unsold food from restaurants, bakeries, grocery stores and farm pick-up points for half the price. Using DamoGO is as simple as downloading the app and receiving notifications about discounted meals that are available at nearby stores. Customers can purchase the meals via the application and choose food from a restaurant at a later point. It's a win-win situation for both farmers, since they can earn more, and consumers, who receive discounted healthy food that also helps save the planet.

Singapore provides one of example of implementing successful MSME food waste reduction in the retail food industry and the food service industry, with best practices that

include:[10] 1) Conducting waste audits to analyze the composition of food waste and identify the main sources of, and reasons for, food waste; 2) Improving inventory management by having an electronic inventory management system or software to help track stock levels more effectively, employing data analytics tools and working with suppliers to conduct demand forecasting, taking into account factors such as weather, competition, economic situations and consumer confidence, as these can affect consumer purchasing; 3) Controlling storage conditions to prevent spoilage of stored food; 4) Adopting first in-first out (FIFO) and first expire-first out (FEFO) policies; 5) Adopting cold chain management; 6) Encouraging customers to reduce waste; and 7) Partnering with food distribution organizations to reduce food waste effectively by donating excess food products that are still good for consumption to those in need.[11]

4.2 Best practices from surplus food rescue organizations for reducing MSME surplus food

Economies in different regions have focused more on the issue of managing surplus food to help solve the food waste problem by taking action in both the public and private sectors. In Europe, for example, France implemented legal measures on surplus food management in 2016, enforcing a provision under the Environment Code called Law N.2016-138 the fight against food waste (Law N.2016-138 of 11 February), which is mainly focused on reducing the amount of food waste generated by entrepreneurs.

This law requires that food be donated to people in need rather than throwing it away. The law is in line with the hierarchical pyramid to prevent food waste, including policy measures to reduce the amount of food wasted by the main agencies that oversee the management of surplus food and food waste. These agencies include France's Environmental and Energy Management Organization (Agence de la transition écologique – ADEME) and food banks. These entities have broadened their networks across sectors with the support of the government and corporate donations. There are more than 80 food distribution centers to help the poor and more than 6,500 volunteers. The food banks will transport donated food from the agriculture, manufacturing and large retail sectors for donation to those in need.

In the Americas, the United States has a relatively large amount of surplus food due to government subsidy policies that produce more agricultural produce than needed. The Federal Food Donation Act of 2008 was enacted to encourage government agencies to donate surplus food to public charities, with provisions. A government food procurement of USD 25,000 or more requires contracting with a business that provides surplus food, and that food must be donated to a charitable organization based on the 1996 federal Bill Emerson Good Samaritan Act. As mentioned in Chapter 2, the United States enacted the Good Samaritan Act to protect donors and recovery organizations from criminal and civil liability arising from the age, packaging or condition of donated food. In that exemption from civil and criminal liability for businesses that donate food, the most important measure is tax incentives. The United States has extended measures to incentivize food donations for a long time through the USEPA, in coordination with the Department of Agriculture. The United States focused on building a supply and demand database of surplus food and food waste. More than 1.2 million sources

[10] Best Practices can be found at: https://www-sfa-gov-sg-admin.cwp.sg/docs/default-source/food-retailing/guidelines-for-food-preparation-and-distribution-activities-for-charitable-causes-(updated-8-oct-2021).pdf?sfvrsn=67f989a9_2

[11] More practices and case studies can be found in "Food Waste Minimisation Guidebook for Supermarkets" available at https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/food-waste-management/food-waste-management-strategies

of surplus food or food waste have been mapped across the economy, including industrial factories, restaurants, shopping centers and agencies that accept surplus food donations or recycle food waste at more than 4,000 locations. There are also a number of charities that collect surplus food from businesses to distribute to communities in need, such as City Harvest, the first organization to manage food rescue. For restaurants, Copia is a food rescuer that uses an app to match those who want to donate surplus food to those who need it.

In Asia, under APEC, member economies, including foreign organizations in that economy, have focused on the issue of handling surplus foods. For example, Hong Kong, China's Domestic Strategic Plan tackles food waste along the value chain by focusing on reduction at the source and using food waste to generate electricity, which is scarce in Hong Kong, China.

In Australia, state governments have passed laws that limit food donors' risk of being sued for donated food that causes health problems. The Civil Liability Amendment (Food Donation) Act 2005 was passed in New South Wales, with similar statutes now on the books in other Australian states.

The law states that people who donate food to charity that is safe to consume at the time of donation and without charge are exempt from civil liability. The food aid organization OzHarvest collects quality surplus food from pre-screened stores, supermarkets and hotels, delivering to more than 3,000 charities under the concept of "take what you need, give if you can."

In the realm of managing surplus food, Australia has quite a variety of programs, but two are notable for their particular focus on food surpluses including the Organics Collections Grants and the Organics Infrastructure (Large and Small) Program.

Local councils and businesses are eligible for Organics Collections Grants, and support must involve collecting surplus food from households or farms. The Organics Infrastructure (Large and Small) Program encourages the establishment of infrastructure to recycle surplus food for organizations in Indonesia, which generates the second largest amount of food waste in the world. An application called "Surplus" helps users reduce surplus food. In the future, in addition to managing surplus food in each economy, cooperation between surplus food rescue organizations among economies and regions should be established.

The key successes for managing surplus food include:

1) Data driven operations

The use of various statistical data to make decisions about surplus food rescue operations in a focused area. The data can be used to design a systematic operation and surplus food rescue progress can be measured. As a result, the responsible party can directly address food waste and food scarcity problems. For example, the foundation SOS Thailand uses statistical data related to food scarcity as a tool for identifying target groups that will provide assistance. SOS Thailand explores the environment of the area and collects the necessary information about the sites to support every decision. In addition, the foundation collects surplus food rescue data and data on communities that are prone to continued food shortages. All data is be used to assess performance and the social and environmental impacts from continuous operations. The foundation also uses technology for operations such as the food warrior application.

2) Cooperation among the parties

The successful rescue of surplus food in Thailand is impossible without cooperation from business partners in the food industry, such as hotels, restaurants, malls, convenience stores, food factories and educational institutions. These partners continually

donate food. In addition, cooperation from partners in other fields is also very important. These partners include the media, research institutes, and representatives from the international organization, government and private sectors that are not directly involved in the food industry. These entities have contributed to the operation of SOS Thailand in various ways, such as by raising awareness of food waste management for the public, providing information support and facilitating research related to food waste management. The information and research helps the foundation explore new approaches and opportunities to improve operational efficiency.

Garda Pangan, a social enterprise in Indonesia, emphasized that cooperation among partners is one of the keys to reducing food surplus. The success of Garda Pangan's operations is due to the following principles: 1) Free: No service fees are imposed; 2) Flexible: The service is hassle-free and flexible in order to meet the partner's needs; 3) Safe: Partners are safe from any responsibility if something happens to beneficiaries with regard to food safety; 4) Accountable: Monthly reports, including social impact and the environmental impact assessments, must be transmitted to the partner on a regular basis; and 5) Disclosure option: Options for disclosure are provided to partners.

4.3 A case study of Uncle Ree's Farm

The consultant conducted an in-depth interview with an MSME in Thailand called Uncle Ree's Farm, which developed an interesting business model that transforms food waste into urban vegetable plots.

In brief, Uncle Ree's Farm is an urban agricultural farm located in the middle of Bangkok at Soi Petchkasem 46 in a limited space of only 100 square meters. The enterprise consists of an earthworm farm, a Himalayan mushroom farm, a vegetable greenhouse and animal husbandry. Uncle Ree started his business in 2013 with the idea of creating an urban farm that is a hub for safe, non-toxic and cheap food, creating a better quality of life for the city's residents. His vision also includes eliminating food waste by using discarded food scraps as food for earthworms; the worms then produce excrement that is used to make fertilizer for plants. The food scraps are also used as animal feed at the Happy Farm Agricultural Technology Learning Center, which is also located at Uncle Ree's Farm. Eventually, the produce that the farm grows is cooked at Uncle Ree's restaurant, which features mushroom-topped pizza and Korean kimji set' made from green vegetables, and is also brought to Bangkok restaurants that share a similar ethos about urban agriculture.

This agricultural farm is not only a small business (MSME) that cares about the quality of life for urban residents, but it is also a community-based learning center, transferring knowledge to people who are interested in integrated farming. For example, a microgreens urban farming workshop to learn about growing vegetables in small spaces, such as pea sprouts, okra and young kale, takes only three to seven days, and no agricultural background is needed. This has resulted in the creation of a network of urban farmers to whom Uncle Ree's Farm has been able to pass on knowledge through more than 80 workshops, or about 5,000 people.

Uncle Ree's offers seeds, soil, fertilizer, earthworms and microbial compost. Buyers can use these products to fill prepared containers at home, reducing plastic use and encouraging people to easily grow vegetables by themselves. Recently, Uncle Ree's Farm also introduced an environmentally-friendly device called "Bio Trash" that allows anyone to easily dispose of food waste at home and turn it into compost for plants. Households or restaurants can simply put food scraps into the bin and ferment it for about 45 days, after which the compost is ready to use. Figure 8 shows some of the products that are sold, and the knowledge that is provided, at Uncle Ree's farm.

(a) Soil improvement

(b) Fertilizer from earthworms

(c) Growing vegetables

(d) Equipment for growing mushrooms

Figure 8. Products sold and knowledge provided at Uncle Ree's Farm

Source: Uncle Ree's Farm

The key to Uncle Ree's business operations consists of four concepts:

1. *Creating a network of people:* The network is comprised of 1) Young Smart Farmers (YSF), which is an alliance of fellow farmers from all over the economy who are interested in integrated farming; and 2) the community that surrounds the farm, established by using a creating shared value (CSV) approach (what the business receives, the community also receives).
2. *Using innovation:* Currently, Uncle Ree's Farm uses technology and the internet as a control system. At every step, Uncle Ree solved problems on his own, comparing the process to Legos – everything must be connected to the system. For example, bio-fermented water from food waste can be used to water the vegetable gardens using the "iFarm" application developed by Uncle

Ree and AIS Digital for Thais. The application also improves efficiency and saves time with functions that enable scheduling the electricity and water to turn on and off, or measuring the temperature in the mushroom cultivation room. This is how the farm uses innovation to make farming easier.

3. *Producing knowledge:* In addition to creating a learning and training center, Uncle Ree wrote a book called *My Little Farm, Vol. 3* with Baan Lae Suan Publishing House. The book includes content about making your own worm fertilizer, but Uncle Ree also talks about how to overcome the various limitations of urban organic farming, such as space or time constraints. While urban farming if feasible for most, it does require taking sequenced steps. Uncle Ree documents the problems and obstacles through stories and drawings of the processes to benefit the reader as much as possible.
4. *Considering the environment:* The brand image of Uncle's Ree Farm is imprinted in every step of the process starting with food waste, which is an unsolvable problem in urban society. Uncle Ree began by addressing the root cause of the problem – households – turning waste into good soil and from the soil, producing safe agricultural products, eventually expanding the practice to various networks with the same sense of care for the environment.

4.4 Case Study of the Scholars of Sustenance Foundation

The Scholars of Sustenance Foundation (SOS) is Thailand's first food rescue foundation, established in 2016 with the mission of promoting a food distribution system that reduces unnecessary waste and creates equality for those in need. The foundation does this through the daily distribution of high-quality surplus food from food-related businesses, such as hotels, convenience stores, restaurants and related operators, to communities in need of assistance in Bangkok, Phuket, Hua Hin, Chiang Mai and other provinces throughout the economy.

To date, the foundation has transferred over two million kilograms of surplus food, or 8.7 million meals, to 426 communities. This means that the foundation has reduced the carbon footprint of 3.9 million kilograms of food by diverting it from landfills. Its main mission is to pass on excess food to the most vulnerable in society, with the aim of solving food scarcity while also reducing food waste in order to sustainably strengthen domestic food security.

Food distribution guidelines are determined by order of urgency. The foundation chooses to help recipients who need help most urgently (Level 5), namely disadvantaged people in slum communities. Recipients with the lowest level of urgency will receive some assistance (Level 1), such as an orphanage under the care of the government. SOS projects can be divided into three types:

1) Surplus food recovery projects

1.1) The Food Conservation Project involves the systematic collection and delivery of good quality surplus food to those in need by using refrigeration trucks to pick up excess food from businesses such as hotels, shopping malls, retail outlets and others. Every step of the excess food acquisition process must pass food hygiene and safety checks before the food is distributed to orphanages, shelters, low income communities and other vulnerable societal groups.

1.2) The Surplus Food Center Project is a food collection and delivery system created by Berli Jucker PCL (BJC), a partner of the SOS Bangkok office, to recover excess food. Each day, BJC's refrigerated logistics system transports raw materials to its branches in Bangkok. At those branches, the vehicles pick up excess food to bring back to the main food

distribution center for the SOS operations team to collect and distribute. This creates an efficient logistics system that eliminates the need to patrol various locations around Bangkok.

1.3) The Community Refrigerator Project collaborates with shopping mall operators theCOMMONS and Samyan Mitrtown to set up refrigerators in various communities to accept excess food donations. In-store operators and the general public can donate food to a central refrigerator, and the SOS Foundation will collect the food to distribute to the needy.

2) Projects to deliver meals to communities

2.1) The Food Conservation Kitchen Project uses volunteers to cook nutritious surplus food for various communities. When enough surplus food is donated, SOS and community volunteers will cook the food in a community kitchen and distribute it to people in other communities, providing hot, clean, safe and nutritious food. These are foods that truly "cooked by the community for the communities."

2.2) Cook Rak for SOS Project is open to volunteers who want to cook for communities, especially those that have been severely affected by the pandemic. The project asks for support from people who are interested in donating food or in participating in the Food Conservation Kitchen Project but cannot show up in person. Anyone can cook in their own homes and contact SOS to pick up and deliver the food to the foundation's office. From there, SOS will distribute the food to the communities.

3) The Food Waste Reduction Project

3.1) This project is an extension of the Food Conservation Kitchen project, ensuring that all food waste management processes are utilized to the maximum extent. For example, during the implementation of the Food Conservation Kitchen project, the foundation realized that leftover vegetables from cooking could be used as fertilizer to grow new vegetables for the project.

Through all of the projects, the foundation has recovered 3,600 tons of excess food and passed 14 million meals to the needy, which is the equivalent of reducing greenhouse gas emissions by 6,500 tons. At the same time, the foundation has reduced food expenses for 4.7 hundred thousand people in 566 communities by up to THB 560 million (based on a cost of THB 40 per meal). The foundation receives tremendous cooperation from partners, including the private sector, government, civil society, non-governmental organizations and international organizations. SOS is also a member of the Global Food Banking Network, working to jointly develop food banks that promote sustainable food management systems under the Sustainable Development Goals (SDGs) in Sections 2 and 12 for Thailand in 2030. Figure 9 illustrates the activities of SOS Thailand.

According to the in-depth interview, factors that shaped the success of SOS include:

1) Data driven operations

One of the factors that contributed to the success of the foundation was the use of statistical data to guide decision-making on surplus food salvage operations in various areas of Thailand. This resulted in a systematic operation with clear, measurable results that are able to solve the problems of food waste and food scarcity directly. The foundation uses statistical data to identify target groups to assist and will always survey the area's environment to collect necessary information from the field before making a decision. In addition, the foundation continues to collect information about salvaging excess food and communities that are prone to food shortages, in order to continuously assess performance and the social and environmental impacts of the operation.

(a) Prepared quality surplus food

(b) Collecting good quality surplus food

(c) Zero hunger mission of SOS

(d) Cooking surplus food for a community

Figure 9. Activities of the Scholars of Sustenance Foundation (SOS)

Source: The Scholars of Sustenance Foundation (SOS)

2) Developing the potential of personnel in the organization (no framework, providing opportunities for self-growth)

The SOS Foundation focuses on the regular development of personnel in the organization, giving employees the opportunity to participate in knowledge sharing and in contributing opinions about organization's development in various fields. As a result, employees perform their duties more efficiently and work to move the organization toward success.

3) Creating an efficient personnel operation system

The foundation emphasizes building an efficient personnel operation system through daily assessments of employee performance. Foundation employees must report to the department head every day, which allows the department head to accurately track performance and formulate an effective plan for future activities toward the organization's goals.

4) Creating partnerships

Successfully salvaging excess food in Thailand would not have been possible without the cooperation of business partners involved in the food industry, such as hotels, restaurants, shopping malls, convenience stores, food factories and educational institutes, which have always supported the foundation's operations through food donations. In addition, cooperation from other partners, such as the media, research institutes, and representatives from

international organizations, government agencies and the private sector that are not directly involved in the food industry, has also contributed to the success of the foundation through donations, raising awareness about food waste management with the public, and supporting information and research related to food waste management. This support brings new approaches and opportunities that the foundation uses to constantly improve efficiency.

4.5 Summary

There are several best practices for MSMEs in the retail food and food service industries on reducing food waste. The first best practice is using systematic inventory management – the procurement of food raw materials should have the least amount of waste and the storage of food ingredients should comply with first in-first out standards. Using an innovative technology can identify products that are close to expiring and reduce food waste. The second best practice is introducing food waste measurement. MSMEs can analyze food waste data and establish a plan for reducing food waste. Three steps are recommended, including: 1) Daily tracking; 2) Competition; and 3) Goal setting. The third best practice is raising awareness within the organization. The fourth best practice recommends promoting the participation of employees and customers in food waste reduction. Finally, the fifth best practice is establishing good networks and alliances to share knowledge and best practices on food waste reduction, and to connect with others to utilize, donate or sell surplus food to customers.

There are several best practices from surplus food rescue organizations for reducing MSME surplus food. The first is to impose a law requiring food be donated to people in need rather than throwing it away. The law should also limit food donors' risk of being sued for donating food that causes health problems. The second best practice is establishing cooperation among the parties (e.g., hotels, restaurants, malls, convenience stores, food factories, educational institutions, media, international organizations, government and non-food private sector) with the support of the government and corporate donations. Establishing cooperation between surplus food rescue organizations in APEC economies to effectively manage surplus food is also recommended. The third best practice is providing tax incentives for reducing food waste. Finally, the fourth best practice is building a supply and demand database of surplus food and food waste classified by locations, industrial factories, restaurants, shopping centers and agencies.

By analyzing the case study of a successful MSME, there are four key factors contributing to the successful reduction of food waste, including: 1) Creating a network of people (i.e., Young Smart Farmers and the community surrounding the farm); 2) Using innovation and technology to facilitate farming and save time; 3) Producing knowledge and providing it through several channels (e.g., a learning and training center, friendly guide books); and 4) Considering the environment at every step of the process. There are four key factors that determined the success of the surplus food rescue organization in the case study, including: 1) Data driven operations; 2) Developing the potential of organization personnel; 3) Creating an efficient personnel operation system; and 4) Creating partnerships.

5. The Role of Public-Private Partnerships in Addressing MSME Food Waste

5. The Role of Public-Private Partnerships in Addressing MSME Food Waste

Food loss and waste is a system-wide issue that occurs at all stages of the food system, and all stakeholders have a role to play. This includes all orders of governments, the agriculture and food industry, the waste management sector, non-profit organizations, academia and consumers themselves. This chapter provides the current status and best practices for enhancing public-private partnerships to address MSME food waste.

5.1 The current status of public-private partnerships in addressing MSME food waste

Public-private partnerships can help foster system-wide collaboration and encourage the participation of MSMEs that may face unique challenges, including capacity, expertise and financial barriers. Food waste is a complex issue that requires the deployment of multidimensional solutions. Public-private partnerships can facilitate the development and implementation of a suite of solutions that can be adapted by all stakeholders according to their specific needs, including MSMEs.

In 2021, APEC launched the Food Security Roadmap Towards 2030, which includes the effort to reduce food waste. The roadmap focuses on the role of public-private partnerships (PPP). APEC member economies are committed to working in partnership with the private sector, led by the APEC Business Advisory Council (ABAC), to shape and enhance the functioning of the APEC food system, recognizing the central role of the private sector throughout the food value chain in food production and processing, distribution, trade and investment, and committing to the following actions: 1) Promoting regular dialogue between the public and private sectors within each economy to advise the Policy Partnership on Food Security (PPFS) on how to enhance the business environment for the food sector; and 2) Reviewing the functioning and terms of reference of the PPFS to ensure a meaningful partnership with ABAC and the broader private sector that better reflects the priorities and interests of the private sector and seeks to optimize their involvement (APEC, 2021).

According to the online questionnaire, a majority of representatives from APEC economies believe that PPPs are a better and more effective way to achieve MSME food waste reduction. Their strengths include: 1) Greatly improving data quality due to the connection with many key stakeholders; 2) Making policy, sharing knowledge and more effective enforcement/compliance; and 3) Increasing government budget efficiency. On the other hand, an important disadvantage of PPPs for MSME food waste reduction is the conflict between the profit motive of businesses and environmental considerations. Therefore, incentives and performance requirements are need to be clearly established in the contract. Another disadvantage is the inadequate capacity of government personnel to conduct monitoring and evaluation of PPP projects.

Additionally, a majority of representatives from APEC economies report that PPPs have been applied to MSMEs as consultative, policy development and planning partnerships. Public financial support for private organizations, both businesses and non-profit organizations, are also available as loans, insurance and grants. A majority of APEC member economies agree that improvements that should be taken to support the public-private partnership on MSME food waste reduction are: 1) Calculating food waste data; 2) Applying technologies to help MSMEs achieve food waste reduction; and 3) Increasing outreach and engagement efforts to drive awareness and provide an overall direction for businesses to reduce food waste.

While PPPs are key solutions for solving the food waste problem, a majority of APEC economies still have not formally established any PPPs, and the degree of PPP varies across

APEC economies. Examples of APEC member economies that have established PPPs to reduce food waste include the following.

5.1.1 Australia

Australia launched the Australian Food Pact on October 21, 2021, an ambitious voluntary agreement that will bring together a broad range of Australian organizations from all parts of the food chain into a new precompetitive collaboration to make the food system more sustainable, resilient and circular. The pact will be delivered by Stop Food Waste Australia, a partnership of 20 peak industry bodies, federal, state and local government organizations, and the four major food rescue organizations that will support stakeholders in achieving food waste reduction goals. The pact will work with organizations to reduce food waste by developing a tailored plan, including (Stop Food Waste Australia, 2021):

- *Sustainable product design, buying and sourcing:* resource efficient, low waste product development workshops, ideation and innovation sessions (such as the role of consumer insight and packaging innovation in reducing food waste); reviewing customer value propositions, quality standards or product specifications to improve crop utilization and exploring sustainable procurement and whole crop purchase arrangements.
- *Whole of supply chain optimization:* value chain waste mapping, root cause and food waste hotspot analysis, lean and green auditing, solutions development and piloting; and mainstreaming and embedding successful solutions.
- *Behavior and cultural change:* supporting consumer behavior change (like the Love Food, Hate Waste campaign) and a business-facing cultural change campaign (Guardians of Grub) to reduce food waste in homes and businesses.
- *Unlocking new value:* working together to scale up food rescue and reduce food waste and food insecurity, including the potential to utilize a growing app-based ecosystem. Collaborative engagement with the Fight Food Waste CRC's Transform program, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and others to identify new ways to create value from surplus food, food processing wastes and the materials in mixed food waste streams.

5.1.2 Indonesia and Mexico

Partnering for Green Growth and the Global Goals 2030 (P4G),[12] the Halving Food Loss and Waste by Leveraging Economic Systems (FLAWLESS) launched a voluntary agreement called GRASP 2030 in Indonesia and Pacto por la Comida in Mexico. GRASP 2030 and Pacto por la Comida are PPPs that implement a target-measure-act-invest approach to tackling FLW, measuring their waste, taking concrete action to produce measurable food loss and waste reduction, and monetizing these savings through innovative financial products. Twenty signatories have signed on to GRASP 2030 and Pacto por la Comida, including major businesses in Indonesia and Mexico. The partnership has also developed three FLAWLESS financial products, including carbon credits, sustainability-linked loans, through which banks reward companies that meet environmental targets with better rates, and Leanpath's "pay as you save" model, which provides technology to measure waste and enables kitchens to formulate action plans to repurpose that waste, reaping financial benefits (P4G, 2022).

5.1.3 Japan

In Japan, the Food Recycling Law mentions the roles of the government and the private sectors in food recycling. The government is responsible for developing the Basic Plan

[12] A global platform pioneering green partnerships to deliver inclusive and sustainable growth.

and requirements. The Basic Plan includes setting targets for food waste reduction and the recycling rate, as well as measures to promote recycling, while the requirements are things food-related businesses must comply with for recycling food waste. In addition, the government also needs to provide advice and recommendation to businesses, raise awareness and share knowledge about food waste. The roles of food-related businesses are reducing food waste generation, recycling food waste and providing periodical reports, especially for food-related businesses that generate food waste in excess of 100 tonnes per year.

5.1.4 Republic of Korea

In the Republic of Korea, various stakeholders related to food waste (i.e., producers, collectors, processors and the government) are involved in food waste management. The 25 local districts under the Seoul Metropolitan Government play a crucial role in food waste management. Each local district is responsible for supervising the separate discharge of food waste, developing discharge regulations, setting up a collection and treatment system, collecting food waste, treating the waste at a local district-managed facility, and collecting user fees from waste generators. In Seoul, the main food waste producers are households, restaurants, cafeterias and food markets. Food waste producers are responsible for reducing the amount of food waste and ensuring proper separation and discharge. This consists of houses and small-scale restaurants, where generated food waste is collected and treated by local districts.

Food waste producers with large amounts of waste can either treat their own food waste or consign it to a treatment facility regulated by the government. All food waste producers that consign food waste to public or private treatment facilities must bear the cost of collection, transportation and treatment conducted by local districts or treatment facilities. More recently, some producers have begun to treat food waste themselves by using earthworm compost bins or decomposition devices. The Ministry of Environment and the Seoul Metropolitan Government both help local districts and food waste producers by developing treatment technologies and setting up technical standards and guidelines to ensure that food waste is treated properly. They also provide subsidies to local districts to construct food waste treatment facilities and check the operational status of treatment facilities. If any local district wants to construct a food waste facility, it has to produce a basic plan and a feasibility study of the project capacity.

5.1.5 The Philippines

A case study that demonstrates the role of PPPs in reducing food waste in the Philippines is the Sustainable Diner Project. The project's overall goal is to integrate and promote sustainability among stakeholders: the government, restaurants and the dining public. The locations of the project are Cebu City, Quezon City and Tagaytay City. The government launches policy-related activities (i.e., SCP) that are incorporated into plans and policies, domestic certification schemes and technical support for policy makers. The food service sector incorporates sustainability into long-term goals supported by studies and analysis, train and influence staff to practice SCP and provide consumers with sustainable dining options. The dining public organizes awareness campaigns (i.e., information, education and communication materials), promotional activities, SCP integration into the school curriculum and collaboration with consumer representatives.

5.1.6 Singapore

There are two major PPP projects on MSME food waste reduction in Singapore, including food waste reduction and prevention, and food waste management. For the food

waste reduction and prevention project, MSMEs can tap into government assistance schemes to implement food waste minimization initiatives, such as the National Environment Agency's (NEA's) 3R Fund, Enterprise Singapore's Enterprise Development Grant and the NEA's Food Resource Valorisation Award.[13] The awards are intended to encourage businesses, including MSMEs, to adopt solutions or initiatives to convert food waste, such as homogenous by-products, rejects and mixed food waste, into products that contribute to a sustainable economy.

For the food waste management project, there is an Industry Steering Committee for Circular Economy for Food, which was formed in 2019 to bring together industry associations, research institutions and government agencies to focus on the valorization of food waste. It serves to bridge the gap between food waste generators, technology providers and potential users through awareness creation. The project engages government agencies involved in the areas of environment, food, industries and research, as well as trade associations.

5.2 Best practices for enhancing public-private partnerships to address MSME food waste

5.2.1 The Pacific Coast Food Waste Commitment in the United States

One of the case studies that demonstrates the role of PPPs in addressing food waste in North America is the Pacific Coast Food Waste Commitment (PCFWC), initiated by the Pacific Coast Collaborative (PCC). The PPC aims to dramatically reduce greenhouse gas emissions and create a vibrant, low carbon regional economy by transforming energy systems, buildings, transportation and food waste management. As a pillar of the PCC, the PCFWC's goal is aligned with the SDG 12.3 target of preventing and reducing food waste across the food supply chain by 50% by 2030. There are four states and provinces involved in this collaboration, including California, Oregon, Washington and British Columbia. There are also many project partners and business involved in the PCFWC.

There are four steps that created an effective PCFWC. First, the signatories submit their food waste data to ReFED, and the data is anonymized and aggregated. Second, working groups (produce, dairy and food recovery) were developed based on signatory data and input. At this stage, a policy roundtable is organized. Third, pilot projects influenced by signatory data and input were launched to explore shared challenges and opportunities. Last, knowledge and information was shared among PCFWC members and made public to inform others in the food supply chain.

5.2.2 Waste & Resources Action Programme's Courtauld Commitment 2030

Another case study is the Waste & Resources Action Programme's (WRAP's) Courtauld Commitment 2030, a voluntary commitment to tackle food and packaging waste. The Courtauld Commitment 2030 is a UK success story, enabling collaborative action across the entire UK food chain to deliver farm-to-fork reductions in food waste, greenhouse gas emissions and water stress that will help the UK food and drink sector achieve global environmental goals. The scope of the Courtauld Commitment's food waste reduction target will remain unchanged from the Courtauld Commitment 2025 (covering manufacture, retail,

[13] - NEA's 3R Fund (https://www.nea.gov.sg/programmes-grants/grants-and-awards/3r-fund)
- Enterprise Singapore's Enterprise Development Grant (https:// www.enterprisesg.gov.sg/financial-assistance/grants/for-local-companies/enterprise-development-grant/overview)
- NEA's Food Resource Valorisation Award (https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/food-waste-management/food-resource-valorisation-awards)

hospitality and food service, and household), as will the level of ambition for impact (a 20% reduction compared to 2015).

The Courtauld Commitment has been operating since 2005. More than 165 organizations from the private and public sector worked together to reduce food waste by 27% across the whole supply chain between 2007 and 2018, saving the equivalent of nearly $19 billion for food businesses and consumers. The initiative also reduced greenhouse gas emissions by the equivalent of 5.3Mt of CO_2 per year. By December 2020, the Courtauld Commitment awarded almost 7 million British pounds to redistribution organizations in England. WRAP research revealed a 45% increase in UK redistribution in 2020 versus 2019 – over 92,000 tonnes, worth 280 million British pounds and the equivalent of 220 million meals. Moreover, 249 businesses are now committed to implementing the target, measure, act approach in their operations (WRAP, 2021).

5.3 Summary

Establishing PPPs to addressing MSME food waste is recommended. There are at least four steps that create effective PPPs. First, MSMEs should establish a food waste baseline and submit their food waste data to a domestic focal point, where the data is anonymized and aggregated. Second, working groups are developed based on food waste data and input. Third, pilot projects based on data and input are launched to explore shared challenges and opportunities. Last, knowledge and information is shared among members and made public to inform others in the food supply chain.

To foster PPP development, it is recommended to: 1) Support MSMEs in overcoming barriers to identify sustainable innovations; 2) Finance innovation in MSMEs by supporting research and developing targeted measures to prevent and reduce food waste; 3) Pilot test food waste management within the community and estimate a local food waste baseline; 4) Foster skills development to reduce, reuse or recycle food waste generated by MSMEs; 5) Require food waste management training for the issuance of sanitary permits for businesses, and mainstream SCP by establishing an SCP Council; 6) Integrate SCP principles in the city environment code and the city development plan, and strictly monitor establishments for food safety, as mandated by law; 7) Conduct HACCP training for food service establishments; 8) Promote and adopt ecolabel schemes for the food service sector; 9) Support the digital transformation of MSMEs; 10) Create an enabling environment for private sector activity by developing regulations that facilitate doing business and by providing incentives, subsidies and financial support; and 11) Ensure that basic infrastructure, including water, roads, energy and other basic business needs, are in place.

6. Conclusion and Recommendations

6. Conclusion and Recommendations

6.1 Conclusion

This handbook aims to study the best practices, policies and actions of APEC economic member economies in reducing waste in food supply chains. Key recommendations for food waste reduction are provided to MSMEs to promote competitiveness and a sustainable and inclusive Asia. To fulfill this objective, four methods were used to collect and analyze the data. First, this study organized the APEC Workshop on Enhancing Green MSMEs' Competitiveness for a Sustainable and Inclusive Asia – Pacific: Food Sector Waste Reduction in Food Supply Chain from 13–14 January 2022. Second, an online questionnaire was launched to collect food waste-related data from all APEC economies. Third, the research included in-depth interviews with representatives of MSMEs and other organizations regarding food waste reduction best practices. Finally, we reviewed the literature on efforts to reduce food waste in APEC economies, including from government reports and academic sources.

Chapter 1 provides an introduction to the current study. Chapter 2 summarizes the current status of food waste and policies addressing MSME food waste reduction among 21 APEC member economies. The analysis showed that none of the APEC economies have data on food waste that is specific to MSMEs. While all APEC economies have policies and measures to tackle food waste, there are no targets, policies or plans that directly reduce MSME food waste at the economy-wide level. Only a few APEC economies have taken steps to reduce MSME food waste in the retail food and food service industries. While a majority of APEC economies have food rescue organizations that are focused on reducing MSME surplus food, supermarkets, food storage facilities and warehouses are not required to make food donations in many APEC economies. Furthermore, a majority of APEC economies still do not have laws protecting food donors from civil liability in the event of personal injury, disease or death suffered by any person from consuming food donated or distributed by food donors.

Chapter 3 provides information about the challenges that MSMEs are facing at the economy and firm levels. Information about efforts to close the gaps in opportunities through the adoption modern technologies are detailed. This study found that there are several challenges to reducing MSME food waste in APEC economies, including lack of entrepreneur awareness; lack of understanding about the true cost of food waste; limited options to divert food waste away from landfills; inability to determine the most cost-effective solutions for creating value out of food waste; problems with logistics and transportation; lack of policy and regulatory framework; lack of access to capital to invest in food waste reduction technologies; lack of reliable and uniform food waste for use as feedstock; limited space for composting and odors that can attract rodents, pests, stray cats and dogs; and inconsistent waste collection. At the same time, there are several opportunities MSMEs can obtain by reducing food waste. From a technology perspective, a majority of APEC economies use modern technologies, including applications, to reduce or manage MSME food waste/surplus food, but these technologies are use only by large companies in big cities.

Chapter 4 outlines the best practices for MSME food waste reduction in the retail food and food service industries and in surplus food rescue organizations. In addition, this chapter also presents two case studies that capture the best practices for MSMEs and surplus food rescue organizations. For the retail food and food service industries, the first best practice is using systematic inventory management. The second best practice is introducing food waste measurement. Three steps are recommended for implementation, including: 1) Daily tracking; 2) Competition; and 3) Setting goals. The third best practice is raising awareness within the organization. The fourth best practice recommends promoting the participation of employees and customers in food waste reduction. Finally, the fifth best practice is establishing good

networks and alliances to share knowledge and practices on food waste reduction, and connecting with each other to utilize, donate or sell surplus food to customers. For surplus food rescue organizations, the first best practice is imposing laws requiring food to be donated to people in need rather than throwing it away. The second best practice is establishing cooperation among the parties (e.g., hotel businesses, restaurants, malls, convenience stores, and food factories; educational institutions; media; international organizations; government; and the non-food private sector) with the support of the government and corporate donations. The third best practice is providing tax incentives to reduce food waste. Finally, the fourth best practice is building a supply and demand database of surplus food and food waste classified by locations, industrial factories, restaurants, shopping centers and agencies. By analyzing the case study of a successful MSME, four key factors were determined to lead to the successful reduction of food waste, including: 1) Creating a network of people; 2) Using innovation and technology to facilitate farming and save time; 3) Producing knowledge and providing it through several channels; and 4) Considering the environment at every step of the process. Four key factors determined the success of the surplus food rescue organization in the case study, including: 1) Data driven operations; 2) Developing the potential of personnel in the organization; 3) Creating an efficient personnel operation system; and 4) Creating partnerships.

Chapter 5 provides the current status and best practices for enhancing PPPs to address MSME food waste. There are at least four steps that create effective PPPs: 1) MSMEs should estimate a food waste baseline and submit their food waste data to a domestic focal point, where data is anonymized and aggregated; 2) Develop working groups based on food waste data and input; 3) Launch pilot projects based on data and input to explore shared challenges and opportunities; and 4) Share knowledge among members and make that knowledge publicly available to inform others in the food supply chain. To foster PPP development, it is recommended to: 1) Support MSMEs in overcoming barriers to identify sustainable innovations; 2) Finance innovation in MSMEs by supporting research and development targeted at preventing and reducing food waste; 3) Pilot test food waste management within the community and estimate a local food waste baseline; 4) Foster skills development to reduce, reuse or recycle food waste generated by MSMEs; 5) Encourage requiring food waste management training for the issuance of a sanitary permit for businesses and mainstreaming SCP by establishing an SCP Council; 6) Integrate SCP principles into the city environment code and the city development plan, and strictly monitor establishments on food safety, as mandated by law; 7) Conduct HACCP training for food service establishments; 8) Promote and adopt ecolabel schemes for the food service sector; 9) Support digital transformation for MSMEs; 10) Create an enabling environment for private sector activity by developing regulations and providing incentives, subsidies and financial support; and 11) Ensure that infrastructure and other basic business needs are in place.

6.2 Recommendations

According to the information provided and discussed in all chapters, key recommendations for reducing MSME food waste for APEC economies can be summarized as follows:

6.2.1 General recommendations for MSMEs

1) Promote research to explore the full utilization of agri-products and by-products (reduction), food bank systems (recovery) and food waste recycling;
2) Government support is needed, including cross-ministerial collaboration between entities in charge of agriculture, industry, labor, food safety, social welfare and environment;

3) Establish laws and regulations to support food waste reduction across the supply chain;
4) Strengthen food education and campaigns to increase food waste awareness;
5) Require food waste management training for the issuance of sanitary permits for businesses;
6) Establish cooperation among the parties to share knowledge and practices on food waste reduction with the support of the government and corporate donations;
7) Build a supply and demand database of surplus food and food waste classified by locations, industrial factories, restaurants, shopping centers and agencies; **and**
8) Improve the efficiency of logistics and transportation systems.

6.2.2 Solutions to prevent food waste

1) Improve cold chain infrastructure;
2) Improve packaging to increase the shelf life of products;
3) Design ecofriendly packaging;
4) Encourage smart and proper purchasing;
5) Provide education to staff and customers;
6) Promote staff engagement;
7) Increase the capacity of packing and delivery;
8) Promote food waste measurement;
9) Promote good, systematic inventory management;
10) Promote and adopt ecolabelling schemes; **and**
11) Promote food waste prevention programs with daily tracking, competition, and goal setting**.**

6.2.3 Recovery solutions for food waste

1) Promote upcycling (e.g., use old bread to make croutons for salads)
2) Provide incentive measures to support food donation, such as tax incentives, along with standardized regulations;
3) Work with local companies (convert waste to biogas, composting, etc.);
4) Use modern technologies and innovation, such as temperature and water content control systems, quality control systems, packing and storage improvements.
    a. Examples of modern technologies include: mobile technology solutions to reduce food loss and waste; graded packaging and labeling system; mobile applications to send notifications about food surpluses; applications for sharing foods; smart bins; technology that enables commercial kitchens to track and avoid food waste**.**

6.2.4 Solutions to address MSME concerns about surplus food donation

1) Promote transparent and accountable monthly reporting;
2) Partners are released from any responsibility once the food is handed over;
3) Promote data-driven operations and partnerships;
4) Promote awareness campaigns and encourage policy support;
5) Promote well-established food banks and business units;
6) Implement five main principles to facilitate surplus food donation:
    a. Free: all services are free of charge.
    b. Flexible: hassle-free services are customized to meet partner needs.
    c. Safe: partners are released from responsibility if something happens to the beneficiaries that is related to food safety.
    d. Accountable: reports, including social and environmental impacts, are regularly sent to partners

e. Disclosure options: partners can choose whether they want to be identified or remain anonymous; **and**

6.2.5 Recommendations for MSMEs to promote public-private partnerships

1) Support MSMEs in overcoming barriers to identify sustainable innovations;
2) Promote finance innovation in MSMEs by supporting research and development targeted at preventing and reducing food waste;
3) Pilot test food waste management within the community and estimate a local food waste baseline;
4) Foster skills development to reduce, reuse or recycle food waste generated by MSMEs;
5) Require food waste management training for the issuance of sanitary permits for businesses and mainstream SCP by establishing an SCP Council;
6) Integrate SCP principles into the city environment code and the city development plan, and strictly monitor establishments for food safety, as mandated by law;
7) Conduct HACCP training for food service establishments;
8) Promote and adopt ecolabel schemes for the food service sector;
9) Support digital the transformation of MSMEs;
10) Create an enabling environment for private sector activity by developing regulations that facilitate doing business, including providing incentives, subsidies and financial support; **and**
11) Ensure that basic infrastructure, including water, road, energy and other basic business needs, are in place.

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