



**Asia-Pacific
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Advancing Free Trade
for Asia-Pacific **Prosperity**

Reducing Food Waste by Using Information and Communications Technology (ICT) and Innovative Technologies

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I. Purpose

The Food and Agriculture Organization of the United Nations (FAO) estimates that approximately one-third of all food globally produced for human consumption is either lost or wasted (as measured by weight, FAO, 2011b), leading to considerable economic, social and environmental costs. Indeed, the very high number of under-nourished people in the world, estimated in 2016 at 815 million, is a stark indication of the inefficiency of current food systems (FAO et al., 2017). In addition, estimated global demographic growth – at 9.3 billion people by 2050 – and the consequent 50 percent increase in agro-food demand will pose greater challenges to global food value chains.

In this context, the issue of food loss and waste has received great attention as one of the critical features of inefficient food system globally. In APEC Food Security Roadmap Towards 2020, APEC economies will strive to reduce food loss and waste by 10% compared with the 2011-2012 levels by 2020. Also, each economy recognizes Target 12.3 of the Sustainable Developing Goals (SDGs): By 2030, halve per capita global food waste at retail and consumer levels and reduce food loss along production and supply chains, including post-harvest loss.

This project was intended to reduce food waste at Processing & Packaging and Distribution & Market levels in the food value chain through information and communications technology (ICT), innovative technologies and creative ideas. The overarching goal is to reduce food waste for food security and to support APEC economies to reach the goals set by APEC and United Nations through commercial activities or no-regret options (ReFED, 2016). The objectives of the project were to:

- Share **best practices** to reduce food waste by using ICT, innovative technologies and creative ideas.
- **Encourage the private sector** to reduce food waste in the context of generating profits.
- **Build capacities** on completed and on-going APEC Projects on reducing food loss and waste.

II. Summary of Working Group Discussions

Following on plenary presentations and discussions, private and public sector participants were allocated thirty minutes to discuss and deliberate in order to come up with three to five high-level priority areas/ and issues to be addressed using ICT and innovative technologies in their respective economies. Priority areas and issues highlighted by individual economies are documented in Table 1, while the narrative in this section, and discusses the priorities and commonalities across the economies.

ICT Applications for FLW Reduction

The significant role of ICT in facilitating the reduction of FLW through both macro- and micro level solutions was acknowledged by all participating economies. Macro level ICT initiatives to address FLW reduction across APEC economies might include the development of a knowledge-sharing platform that among many issues, prioritizes information sharing on issues such as the assessment of food loss and waste measurement methodologies (Chile), as well as data storage and sharing to promote a sound understanding the importance of FLW data (ABAC). Among its many functions, such a platform might link the domestic weather services of APEC economies toward reducing food loss and waste (New Zealand), and promote and support awareness raising of consumers on food waste reduction (Philippines, Viet Nam).

Micro level ICT applications might include context-appropriate educational programs targeted to youth and which place emphasis on *valuing* food toward promoting behavior change (Malaysia, New Zealand, Peru, Viet Nam). The development of campaign mascots - as exemplified by Japan – might be considered useful in such educational and awareness raising initiatives.

Other key areas identified for ICT support by participating economies include: process innovation (Thailand), as well as facilitating information flows (New Zealand, Viet Nam, Japan) within economies. Within this context Japan specifically highlighted its priority to promote the disclosure of data and efforts of food related companies to address FLW reduction.

The lack of/inadequacy of infrastructure, technology and communication support however pose limitations in fully maximizing the potential opportunities presented by ICT to support widespread knowledge sharing on FLW reduction in some economies (Indonesia, Viet Nam, Peru). Some research and development (Philippines) might also be required toward ensuring the applicability of ICT in various contexts.

Toward addressing these needs, the New Zealand private sector participant suggested that World Bank funding could be one way to support the piloting of scalable and deployable ICT solutions to APEC economies while according priority to those ICT solutions that involve public-private collaboration.

Priority Solutions for Reducing Food Loss and Waste in APEC Economies

Food loss and waste take place across the entire food supply chain, with significant economic, environmental and social impacts. Targeting food loss and waste reduction,

therefore, necessitates the involvement of all stakeholders across the supply chain – farmers, small and medium enterprises (SMEs), retailers (ABAC, Chile, Indonesia, Peru, Viet Nam).

Strategies and solutions to reduce food loss and waste reduction at source: At the farm level, focusing on production (Peru) and small holders (Chile), improving farming systems for food security through climate change programmes and extending disaster reduction strategies to farmers (Chinese Taipei); addressing zero hunger (Indonesia, Peru and Viet Nam); enhancing the efficiency and sustainability of food systems (Chile) and reducing greenhouse gas emissions (Chinese Taipei) as a broader goal, were all identified as priorities to address food loss reduction at the production level and in post-harvest operations.

High ratio productivity urban farming and value addition through for example hydroponic farming and mechanization, largely driven by the private sector were identified as priorities for Singapore, in view of the scarcity of land and labor in the context of that economy. This priority might serve a number of economies that are currently in the process of planning and developing their urban food security agendas.

Innovative approaches prioritized for food waste reduction (focus on retail and consumer level) include:

- Logistics development following the model of Japan (Thailand)
- Cold chain systems development (Chinese Taipei)
- Food labeling strategies for reducing food waste (Chinese Taipei)
- Collaboration with food banks (Japan)
- Increasing the efficiency of urban farms (Singapore)

While circular economy strategies are well developed and implemented in some economies (Chinese Taipei, New Zealand), others (Chile) are seeking guidance to link FLW prevention/reduction to circular economy strategies and to the development of broader strategies – e.g. reducing climate change. This clearly underscores the need for and potential benefit to be derived from a knowledge- sharing platform that links APEC economies as highlighted in the foregoing section. It is, however, important that circular economy strategies are implemented in line with the *food use-not-loss-or-waste hierarchy*, i.e. only after the feasibility of the option of recovery and redistribution of food has been explored.

Stakeholder Engagement - Public sector engagement with private sector (Chile, Peru, Singapore, and Thailand) and with academia (Singapore, Philippines) were identified as key to addressing the issues. While in the most developed economies, private entities are fully engaged in implementing FW strategies, the need to develop the business case for private entities to invest in food loss and waste reduction (Chile, Indonesia, Peru) was highlighted as a necessity for others.

Furthermore, there is the need to share models of success achieved by the private sector in order to enhance public-private collaboration (Chile).

Role of APEC

Participating economies requested that APEC play a key role in addressing all of the issues highlighted above, by following up with economies; and furthermore by

promoting the importance of reporting on food loss and waste not only in quantitative terms, but also in terms of monetary value (i.e. dollar amounts), in order to have greater impact in highlighting the magnitude of the problem (Malaysia). APEC might also consider the development of a policy to reward both the private sector and households for reducing food waste (ABAC).

The Way Forward - PPRS in Chile

Going forward, participants highlighted the need for assistance from APEC to ensure the implementation of actions in member economies, specifically requesting prioritization of the following:

- The sharing of successful models/experiences to build trust and enhance Public- Private collaboration.
- The development of a knowledge platform to serve APEC economies.

Table 1: Priority Recommendations of Economies as Outlined in Plenary

Economy	Priority Areas for Intervention
Chile	<ul style="list-style-type: none"> - Private involvement is essential – develop the business case for companies for FLW reduction - Knowledge sharing for APEC economies in view of asymmetries of information - Assessment of FLW methodologies - How to make food systems more sustainable and increase efficiency – linking supply and demand - Relevance of small holders in the foodsystem. - Guidance to link FLW prevention/reduction to broader strategies e.g. circular economy strategy – how to align?
Chinese Taipei	<ul style="list-style-type: none"> - Climate change economy program – improve farming systems for food security - Disaster reduction – extension to farmers - Cold chain system introduction - Circular economy to enhance environmental benefit. - Food labeling strategy to address food donation - Reduce GHG gas
Indonesia	<ul style="list-style-type: none"> - Reduction of FL in the supply chains – focus on losses – supply chain practitioners - Target addressing zero hunger – both in quality and quantity (stunting) - ICT appropriate in selected contexts – large cities (4 biggest). Start in this context. - Food Waste Increase PPP – tax reduction -incentives – need studies on importance of PPPs in reducing FL to promote FW reduction

Japan	<ul style="list-style-type: none"> - Promote disclosure the data and effort of each food related company about FLW reduction - For Consumer awareness make or use mascot character. - Share the definition and target of FLW with APEC economies. - Collaboration with food banks
New Zealand	<ul style="list-style-type: none"> - Recognise ICT as a significant platform to reduce FLW, therefore should continue to receive publicity and attention - Facilitate linking of domestic APEC weather services to enhance FLW/ICT platforms across APEC economies - Prioritise/focus on ICT solutions that are PPPs - Micro and macro ICT solutions are needed - Promote youth education regarding FLW - Prioritise funding pilot ICT solutions which are deployable and scaleable through further funding by the WB
Malaysia	<ul style="list-style-type: none"> - APEC must follow up with economies - APEC include consideration of monetary cost of FLW (dollar amounts)in reporting on/articulating FLW - Penalty system to reduce food waste or tax/monetary rates to reduce FW (noted that the proposal of ABAC to reward rather than impose a penalty was later accepted and agreed to by Malaysia and all in plenary) - Public awareness and education for youth on <i>Valuing</i> food
Peru	<ul style="list-style-type: none"> - Focus on production - Education in schools with government support - Legislation - Fiscal plan, - supported by local and regional governments - PPP development – highest level of waste in agro-industry, need communication between public and private sectors - Prioritisation of funding by Government for technologies and use of ICTS in FLW reduction
Philippines	<ul style="list-style-type: none"> - Capacity building through local workshops to share info - Need for infrastructure development and communication support to facilitate access ICT - R and D to ensure applicability of ICT and innovative techs - R and D to promote connection between production and FLW reduction - Design and implementation of culture-relevant educational campaigns to promote awareness of FW – especially in food service.

Singapore	<ul style="list-style-type: none"> - Given the scarcity of land and labour, promote high ratio productivity through urban farming- vertical farming - FW management - ICT to increase efficiency, especially in the case of urban farms - Public engagement with private sector and academia - Value addition through urban farming- mechanized or hydroponic private sector driven but options available for private citizens.
Thailand	<ul style="list-style-type: none"> - Need to decide on adopting process innovation backed up by ICT. - PPP implementation – better links between both - Information flow using internet, ICT - Knowledge development/flow - Logistics development in supply chain ¥ learn from Japan as a model
Viet Nam	<ul style="list-style-type: none"> - Share information with private sector- retailers, wholesaler, processors..... - Consumer awareness - Practically applicable solutions involving researchers, as well as governments. - Zero hunger programme to 2025; target to reduce FLW; - Technology, post-harvest handling, preservation and processing; - Call for action to save food at household level - Food safety, animal/plant health, environment sanitation in food production
ADVISORS	
Business Advisory Council - ABAC	<ul style="list-style-type: none"> - Policy to reward rather than penalty - Data - importance must be well understood – storing and sharing - Include SMEs –farmers, retailers (market stalls) to ensure that they benefit and can contribute to reduce FLW reduction

III. Minutes by Sessions

Day 1

Opening Remarks

Dr Toshiko Abe, State minister for Foreign Affairs of Japan

Japan is honoured to serve as the host of this workshop. Our efforts on food loss and waste reduction are in line with the shared goals of the APEC economies outlined in the "Food Security Roadmap Towards 2020".

In Japan, the annual estimated amount of wasted edible food comes to 6.46 million tons. And food-related businesses account for about 55% of the loss and waste.

Therefore, not only the raising of public awareness but also the efforts of private-sector businesses will be the keys to the success of our efforts.

Private-sector businesses can gain many benefits from attempts to tackle food loss and to achieve waste reduction. Such endeavors to reduce the inefficient use of resources can have a positive impact on corporate profits. Furthermore, in light of the growing public interest in the Sustainable Development Goals (SDGs) and corporate social responsibility, companies can highlight their positive activities to their consumers.

In Japan, public-private partnerships are being strengthened to accelerate the drive to tackle food loss and to reduce waste.

To cite an example, the government is cooperating with the food industry to change the open dates of processed food. Many Japanese companies used to display best-before date labels showing "year, month and date", even on food products which had long shelf lives, although they were not legally required to do so. Now, the food industry is gradually changing this business practice and displaying "year and month" only. This approach is enabling manufacturers, distributors and retailers to efficiently manage inventory and sales.

Recently, Japan enacted new legislation to promote measures to tackle food loss and to make progress in waste reduction. Meanwhile, the general public in Japan is becoming steadily more engaged by this issue.

In this two-day workshop, the private-sector businesses will present their best practices on reducing food loss and waste, and each economy will outline its own situation and what it is doing to make headway regarding these pressing issues. I hope that the participants will gain valuable insights at this gathering and share them with each other, and that APEC's work on food loss and waste reduction will be further strengthened.

Keynote Speech – Part 1

FAO's Work to Address Food Loss and Waste Reduction: An Overview

PhD Rosa Rolle (Senior Enterprise Development Officer, Team Leader, Food Loss and Waste, Food and Agriculture Organization of the United Nations (FAO))

Dr Rosa Rolle opened by presenting the FAO's work to address Food Loss and Waste Reduction (FLW).

After giving a brief description of the background of FAO, she went on to explain about the FAO 2011 report, which was the first to bring attention to FLW, showing that 1/3 of all food is wasted. This waste not only represents a squandering of natural resources, but was also shown to produce a large quantity of greenhouse gases. Dr Rolle believes that reducing food loss and waste will provide significant opportunity to generate sustainability of the food systems.

Dr Rolle then explained that, in 2019, the FAO agreed to take action to reduce food waste by half by 2030. SDG target 12.3. With this in mind, all of the work is done according to a Food and Drink material hierarchy, focusing on prevention and reduction of food losses and waste at the source. In many developing regions work is focused on food loss and a small amount of food waste, followed by redistribution and then recycling, recovery and disposal.

Dr Rolle then explained how the FAO addresses various levels; at the Macro level where the major work is done on food loss measurement, developing Global Food Waste Indicator and Global Food Loss Index Indicator, so as to understand where the food loss is taking place; at meso level working with stakeholders and private sectors, in order to apply tools to identify critical control points, recommend solutions, and facilitate cooperation in the value chain and capacity development; and at the micro level focusing on consumers, and increasing the awareness of FLW, such as developing training materials for small children to educate children on FLW so that they learn to value food and what it takes to produce food, not just the price. Each different action taken at the different levels is done with the goal of achieving a more sustainable food system.

Dr Rolle closed her talk by stating that FLW issues are multi-dimensional and complex, and in order to deal with them, it is important to have technology and innovation at various levels, and education for all levels of society. No one organization alone can handle this problem.

The presentation was followed by questions:

Q: In the presentation are you talking about micro level actions, in development and learning. Are these actions more like recommendations or will they allow for different changes to the law?

Dr Rolle answered that they are recommendations as government prevents certain laws. It is possible to guide and recommend but they cannot provide legislation at the economy level.

Q: Are the publications you make meant for banks or for governments and when will it be launched.

Dr Rolle answered that it is designed for anybody engaged in recovery and

redistribution, and will be available online by the end of the year.

Q: 1) FAO is in charge of food loss, focusing on food waste –is that correct?
2) For your agency, are you looking at Loss and Waste together?
3) To reduce FLW, is looking at it from the agenda of solving climate change problems a way to encourage food loss and waste?

Dr Rolle answered that 1) FAO focused on Food Loss, while our partner agency is focused on food waste. 2) Loss and waste occurs at every level of the supply chain so yes. 3) Yes it is an important issue. Food waste is a producer of GHGs. Now looking at what is recyclable in terms of energy and disposal into the environment.

Presentation by speakers from the private sector - Part 1

1) Productivity improvement project using weather and demand forecasting Mr Toshio Nakano (Japan Weather Association, Japan)

Mr Toshio Nakano opened with a background, talk about Japan Weather Association, and then began talking about 3 global trends – society, science and infrastructure. In Society, with the move to society 5.0, all data is collected from devices via IoT, analyzed by artificial intelligence, so companies will need to be able to do the same to collect data. In science, Science 5.0 was proposed because AI evolves with human intelligence, and most companies have started to need AI for their business. In infrastructure, 5G will eventually be implemented into infrastructure, so there is a need to think about a 5G based society in the future.

Mr Nakano then went on to talk about the issues facing Japan. Japan has challenges of lack of human resources, and it is expected that the working population will be reduced by 40% by 2050, and also the challenge of a lack of progress in data sharing. FLW can be seen as occurring due to mismatch of information between companies.

Mr Nakano then talked about the characteristics of weather: changes in weather, such as the temperature increase by global warming; predictability, since weather is the only predictable future, so it can be used in the economy; and collaboration which is necessary for companies to face issues with weather, as 1/3 of all industries are exposed to some kind of weather risk.

Mr Nakano went into details on these three points. Regarding changes in weather, Tokyo temperatures have risen by 3%, and the heat island effect has become the most striking in the world. Global warming has also begun to affect the overall temperature each year, and this has affected the sales of products affected by the weather.

Regarding predictability, prediction accuracy has improved dramatically in recent years, particularly in Europe. Weather and demand forecasting is used in every industry and can be used to improve the business flow of food products. For example tofu is very affected by the weather, and insufficient weather forecast accuracy can result in FLW. Food production and distribution can be adjusted based on the forecast, decreasing FLW.

Regarding collaboration using weather and demand forecasting, it is possible to use the weather and forecasting information to link companies and producers to promote

collaboration. This will improve productivity by having weather forecast and demand forecast information used commonly to ensure efficient production and distribution of food stuffs.

Mr Nakano closed by stating that, in the age of society 5.0, the weather and demand forecasts can be used to relationship between various companies can function as a hub of information. The most important thing is to work together in multiple companies to solve the problems of FLW.

The presentation was followed by the following question:

Q: Your presentation emphasized value added from weather forecasting, but is it free for private companies to use?

Mr Nakano answered that it requires some payment to provide the information.

2) Food Waste Reduction Journey – Using ICT Mr CHIN NGIAP TAN (Ban Choon Marketing Pte Ltd, Singapore)

Mr Chin Ngiap Tan began by talking about Singapore as a whole, and the link to FLW. Food Waste is one of the biggest wastes in Singapore and has grown by 40% over the last 10 years. The waste is produced at various levels of society from food manufacturers to schools. At present only 17% of food waste is recycled, and in 2018, the weight of 52,000 double decker buses in food waste was thrown away. Drivers of food waste management include stresses in food security and the potential for it to be converted into usable resources.

Mr Tan then highlighted the food waste management hierarchy from Singapore, which can be used to explain the activities of FLW strategies in Singapore. The first stage of management is preventing and reducing food wastage at the source, which includes organizing events, programs and SNS to raise awareness and guide books for super markets and businesses. The second stage involves redistributing unsold excess foods, including promoting donations, ground up movements and supporting start-ups. The third stage of management focusses on recycle and treating food waste, and providing various solutions and encouraging onsite food treatment.

Mr Tan then introduced Ban Choon Marketing Pte Ltd and its 31 year history. Products owned by Ban Choon are redistributed within a few days to reduce waste, and Ban Choon also provides organic products, exporting them all over the world. In particular he introduced how the company integrated ICT into air cleaners to keep fruits and vegetables fresh for longer periods of time. The Objective was to study the effectiveness of real-time temperature monitoring system in reducing food losses, and the resulting data was collected for trend analysis.

Mr Tan then explained Real-Time monitoring technology, which could communicate information from sensor to operator. The monitoring system proved to be much more efficient at gathering information in a timely manner. He also talked about alarm profile used to determine at what point certain actions needed to be taken to reduce food loss from decomposition. Benefits of these two on the whole is increased efficiency.

Mr Tan next talked about Smart Logistics systems, which means using logistics to

reduce food waste at each stage of purchasing food through ICT solutions at each level of the food distribution process, including using IoT and real time tracking of information. This included production of the VIAGOO app: a one stop solution for companies to manage the whole process, from collecting to storing to selling. This reduces waste at each level, from warehouse to transport, and domestically benefitted reduction in waste, reduction of carbon footprint, improved productivity, and improved food safety.

Mr Tan closed his presentation by thanking Singapore food agency and enterprise Singapore for their support.

The presentation for followed by questions:

Q: You mentioned Singapore government supports this project, what kind of support from the private sector do you receive?

Mr Tan answered that the Singapore government will provide a large number of grants, depending on how interesting your project is and how inventive.

Q: Do you think it is possible to be used in another economy?

Mr Tan answered yes, and already quite a few regional start-ups in various economies use this system. It can be used anywhere.

3) Ecostock IOT Presentation

Mr Andrew Fisher (EcoStock Supplies Limited, New Zealand)

Mr Andrew Fisher began by explaining his company Ecostock, which currently transport and manages 6 buses worth of food waste a day. Ecostock puts food waste back into the system through recycling and repackaging systems. The waste they collect becomes feed, fuel and fertilizer. This is done through logistics and secure food solutions, such as collecting food at different points from the supply chain and making money out of it.

Mr Fisher explained this is done with a system called Ecotrack, which brings together six ways to break down the problem. The six steps are:

People: engaging and feeding back the information of food waste wherever it happens, and organize the food waste so that it goes to where it needs to go. Benchmark in information.

Products: Around 200 tons of food waste are moved by Ecostock a day. Packaging and food waste are separated and used in recycled systems.

Process: Waste products can be moved down a different level of the food market process, and for distributed for different uses so that it never gets wasted.

Continuous Connections: waste from farms, factories, supply chains and consumers is collected and reused from each section. This also bridges the gap between each sector and improves negotiation between them.

Continuous Communication: Ecotrack trucks use a variety of methods to be able to

communicate with clients and staff constantly. Also those trucks can be rented out to other companies so as to improve efficiency.

Continuous Closing: the business is kept as a constantly running system, and in order to keep that manageable, the company keeps everything in a closed and contained system.

Mr Fischer ended his presentation by explaining his belief that technology doesn't change things, people using technology change things. Keeping the system simple with the right technology makes it easy to run.

The presentation was met with the following questions:

Q: Is there any other company beside Ecostock doing this in New Zealand?

Mr Fisher answered no. There are five other waste management companies, but they do everything. Ecostack specializes in food waste.

Q: When you started the company, were there any policies or something from the government that allowed the company to exist?

Mr Fisher answered that there are no policies, no government support. Ecostock demonstrate that a business that can run without support or subsidies. However Mr Fisher noted that the Government spend 7 million dollars a year in APEC areas, and he would like to use some of that money in obscure regions to support and provide a business like Ecostock.

Q: What do you think are solutions for developing economies?

Mr Fisher answered that Companies should build mobile systems, but not just big companies and big economies, it is necessary for developing economies to work together with big companies.

Q: What would be the largest waste source that you handle most frequently in terms of equipment?

Mr Fisher answered that it is mainly packaged food, often from supply chain problems where supply chains run out of a room and have to dispose of unsold products. In terms of equipment, the equipment is not state of the art but it endures repeated use. In the long run Mr Fisher says Ecostock does not have government support but they will need it

Q: How do you overcome difficulties in transport?

Mr Fisher answered that Ecostock working closely with construction industry, and sharing trucks so that they are always transporting something. Also using tracking systems to be aware of when bins are full and taking steps to empty them.

Presentation by speakers from the private sector - Part 2

1) Freshness Preserving Films for Vegetables and Fruits

Mr Masahiro Kawakami (Sumitomo Bakelite Co., Ltd., Japan)

Mr Masahiro Kawakami opened by presenting about the product MAP: Modified Atmosphere Packaging. Receiving an award in January 2019 by the Japan Ministry of

Agriculture, Forestry and Fisheries, MAP has very small holes in the film that allows for exchange between CO₂ and oxygen, keeping produce fresh for a longer time. Each MAP wrapping bag contains micro holes, about 70 micrometers, and each bag is tailor made with the necessary number of holes for the product in question, allowing oxygen in and out without letting dust in.

Mr Kawakami showed a variety of samples of fruits and vegetables that were able to stay preserved and alive for a longer period of time compared to standard packaging or no packaging, thanks to the use of MAP. He then explained that Sumitomo currently sells around 50 million bags per month for around 60 different types of fruit and vegetables.

Mr Kawakami then ended with a presentation of the open lab in Tokyo, located in front of Ota Market, the largest grocery market in Tokyo. Opened June 2011, after the East Japan Earthquake, customers have the chance to feel the difference in plastic and taste the difference in foods.

Mr Kawakami then answered the following questions:

Q: Are MAP products only available in Japan?

Mr Kawakami answered that MAP products are exported to Thailand for testing purposes

Q: What sort of percentage, or how much does it cost compared to normal products?

Mr Kawakami answered that it costs double.

Q: What is the innovation of your product? Why is your product so special and how does that compare to the rest of the world

Mr Kawakami's answer is two fold

- 1) Input the nitrogen gas and CO₂
- 2) Exchange the gas control and humidity control. Our product is the gas control.

Q: How can it be adapted for machine packing?

Mr Kawakami answered that it is possible to supply a flow packaging using a pillow machine.

2) Fish Oil, Proteases and Hydrolysates from By-products of Fish Processing Dr Cesar V. Ortinero (Central Luzon State University, the Philippines)

Dr Cesar V. Ortinero began by talking about his university, and particularly about a project conducted with industry partners, on the recovery of sellable products from the fish manufacturing industry. 20-80 percent of the by-products of fish end up as waste, and so he and his team found ways to convert those by-products into something reusable for the industry, with the idea of gaining raw materials for food applications. Focusing on 4 different species of fish (Tilapia, Milkfish, Sardine and Mackerel) they found that they could recover fish oil, proteases and hydrolysates from the by-products. Regarding fish oil, they could recover large amounts from each species of fish, and are planning to characterize the fish oil, and try to put it into capsules which would be widely available.

Mr Ortinero also stated that they could collect a large amount of both crude and refined protease enzymes from each species of fish, and recover large amounts of purer hydrolysates, a large amount could be recovered.

Mr Ortinero stated that the overall goal is to maximize the use of the biological resources, and the next step involves optimizing the procedure, characterizing the proteases and hydrolysates, and then developing products within the food industry. They have also begun looking at recovering products from the peels of fruits and vegetables.

Mr Ortinero summarized his presentation as food waste reduction through waste valorization: converting FLW and putting it back into the industry as a new product to reduce the amount of waste.

Dr Rolle commented on this presentation as very interesting and that it will be interesting to see how some of the cost of protease compares to what is happening now in molecular biology, which produces protease enzymes.

3) Development of innovative food. Delivering nutritions of whole plants in a delicious way.

Mr Kuniaki Tsukada (Mizkan Holdings Co., Ltd, Japan)

Mr Kuniaki Tsukada began his presentation by introducing the history of Mizkan. Mizkan has made good use of by-products since its founding in 1804. For example, it used sake-lees (a by-product of sake production) to produce a vinegar which was sweeter and less expensive than rice vinegar. This was a great innovation that made sushi more affordable and delicious. In this way, Mizkan had its first success by thinking of ways to make use of what is usually thrown away.

Mr Tsukada then introduced the ZENB Initiative. (“ZENB” is pronounced “zenbu,” which means “whole” in Japanese. It is pronounced “Zen-B” in the US.) Mizkan launched ZENB as a global brand to realize the Mizkan Vision Statement, particularly “Act for the well-being of the earth, society and all that dwell on it” and “Evoke social changes through new taste experiences.” ZENB’s slogan is “Food, Rediscovered.” and its foods are made using whole vegetables, without additives, through a new production method which combines dehydration and micronization technologies. Currently, its offerings include ZENB Sticks and Pastes. The advantage of ZENB foods is that they are made using the whole vegetable, including core, peel, seeds, and stem, reducing FLW while increasing the amount of nutrients consumed. Mr Tsukada closed by introducing the future vision of ZENB: the 365X6 Global Dietary Platform. Approximately 100 people are currently involved in this project, developing new technologies and foods to support people’s diets globally, 365 days a year, 6 times a day (3 meals and snacks). ZENB hopes to use new technologies to create an efficient, environmentally-friendly diet. It wants to make good use of whole vegetables, including the parts that are usually thrown away, and offer more kinds of ZENB foods for different eating occasions.

The following questions were asked:

Q: Is this already in the market? How much would one package cost?

Mr Tsukada: Yes, it is available on the ZENB websites.

Q. How much does it cost per ZENB Stick?

Mr Tsukada: Because we use very unique materials and processes it is expensive right now, but once we scale up the cost should go down. We believe we can make ZENB available to many people. (As of July 2019, one ZENB Stick is approximately 300 yen.)

Q: How do you propose to use the Paste? If it has a short shelf-life then the application will not be very extensive?

Mr Tsukada: Regarding the application of the Paste, we are now asking consumers how to use it, and working with chefs and key influencers. Some simple ways to use it are to put it on ice cream or toast, or to make soup. We are developing various recipes and categories. Regarding the shelf-life, it is approximately six months, and we are trying to extend it.

Q: Do you require the contents to be organic?

Mr Tsukada: ZENB foods in Japan are not organic yet. However, we do visit the farms of our suppliers to ensure that all of the vegetables we use meet our quality assurance requirements. Additionally, ZENB launched in the U.S. in June, and those foods are organic. Due to differences in supply chain and consumer perception, ZENB JAPAN and ZENB US are slightly different.

Q: What is your corporate vision timeline for commercializing?

Mr Tsukada: The current time horizon is 10 years, in line with the Mizkan Vision Statement. Mizkan intends to expand globally in many categories, but specific numbers are not being disclosed yet.

Dr Rolle commented that, in terms of what is happening in the produce sector, a lot of fresh produce is wasted because it is not aesthetically fit. She believes this technology has the opportunity to greatly reduce FLW by making use of produce that is thrown away simply because it doesn't meet these aesthetic requirements.

Updates on FLW in APEC Region

Member Economies Report - Part 1

1) Food Loss and Waste in Chile – Advances and Challenges

Ms. Daniela Acuña (Ministry of Agriculture, Chile)

Ms Daniela Acuña started with an overview of Chile, and Chile's agriculture and food (agrifood) sector. Chile has 35.5 million hectares of agricultural land, and agriculture contributes to the employment of the whole economy. Off season agrifood from Chile accounts for 90% of the world population, and there is very diverse productivity across the whole economy. 100% of the population is fed from Chile agriculture, while agricultural exports account for 33% of the total export for the economy, and Chile products can be seen in every supermarket around the world.

Regarding Food governance, the Chile Ministry of Agriculture has different

institutions that govern different areas. The main purpose is to promote a competitive, sustainable, innovative and modern agriculture sector, and push for social engagement with rural and regional development.

Ms Acuña went on to review the advances made in Chile towards FLW. FLW governance and a domestic committee to reduce FLW, promoted and supported by FAO, are in charge of coordination actions to prevent FLW, focusing on three areas: Governance and Regulation, passing policies and laws, and arranging partnerships and networks. Research, Technology and Knowledge, which focusses on exchange of information and knowledge, and conducts R&D. And finally Dissemination, Awareness and Communication, which focusses on examining FLW problems and disseminating information to solve them.

Ms Acuña then introduced FLW projects such as Transforma Alimentos, which works on zero waste of raw materials the food industry. Also applied to a One Planet grant, which governs information regarding FLW in Chile and provides funding for counteractivities. Also conducting Awareness raising in Chile, running workshops and seminars, and booklets for consumers to prevent and reduce the waste of food.

Ms Acuña ended by talking about the challenges Chile faces, in line with working areas of the domestic community, which includes the need to raise awareness in stakeholders, collecting information of FLW, and facing the fact that Chile does not have an official data collecting system for tracking and reporting food losses and waste along the food chain

The following questions were asked:

Q: Regarding applications that did not go well, can you explain it further and what did not go well?

Ms Acuña answered that it was a private application, not from the public sector, and it is believed they did not have enough customers.

Dr Rolle commented that it will be interesting to compare the strategies and to look at what are the priorities in Chile in the future.

2) FOOD LOSSES AND WASTE MANAGEMENT IN INDONESIA

Dr Bram Kusbiantoro (Indonesian Agency for Agricultural Research and Development, Indonesia)

Dr Bram Kusbiantoro began with an introduction about Indonesia as a whole. Indonesia is rich in natural resources, the exploitation of which has played an important part in the rapid economic growth of the economy. Most of the agriculture is concentrated on Jaffa Island, which is not one of the biggest islands in the regions. Food production levels in Indonesia in 2015 was within the top 10 globally in various products, predominately in paddies, but now it is not enough to support Indonesia.

Dr Kusbiantoro then explained that, in Indonesia, FLW along the supply chain ranges between 15 and 20% in some regions in Indonesia, which would account to 13 million tons of food waste, mostly from retail, catering and restaurants, and is enough food to feed 28 million people. This makes Indonesia the world's second largest food waster after Saudi Arabia. In particular food waste is mostly generated in Jakarta. Postharvest

losses (PHL) range from 20-50%, and this is one of the biggest problems for the Indonesia government, and for agricultural development.

Dr Kusbiantoro next explained the efforts to reduce food waste include gathering information and data, designing strategies and targets implementing programs of reducing FLW including community awareness and the reviewing and improving of policies and actions in the government. For PHL, the actions include aid on handling and processing equipment and machinery, and extending aid for those areas where it is necessary.

Dr Kusbiantoro ended his presentation by highlighting the three strategies for FLW in Indonesia: Waste Handling includes increasing scope and quality, developing optimization etc., Waste Utilization including optimization of compost as fertilizer, developing waste energy etc., and Capacity Building including development of waste management data and law enforcement.

The presentation was met with the following questions:

Q: you mentioned total waste management or is it specifically food waste? Do you already have a system for separating food waste?

Dr Kusbiantoro answered that it is all for food waste and that they do have a system.

Q: You mentioned about targets – is that SDG 12.3 or your own target?

Dr Kusbiantoro answered that although it is the target of the Indonesian Agency for Agricultural Research and Development, it is based on SDG 12.3.

Q: What do food processing industries and companies do to reduce food loss and waste in Indonesia?

Dr Kusbiantoro answered that the private sector has not yet contributed to optimization of reduction of FLW. The Indonesian Agency for Agricultural Research and Development are still trying to get private sectors aware of the efforts, but this problem has been left from the last 10 years.

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optimization etc., Waste Utilization including optimization of compost as fertilizer, developing waste energy etc., and Capacity Increasing including development of waste management data and law enforcement.

3) Reducing food loss and waste in Japan

Ms Hiroko Miura (Ministry of Agriculture Forestry and Fisheries, Japan)

Ms Hiroko Miura began by explaining the definition of food loss in Japan, as it is not the same as most other economies see it. In Japan, food loss is included in food waste, and food waste is defined as food which is inedible and food which is originally edible but didn't be eaten. In FY2016 from food industries, total of food related waste was 28 million tons, including valuable by-products such as soybean meal and wheat bran. Food waste was also generated from households, at around 3 million tons.

Ms Miura explained that, in order to reduce FLW, they have the food recycling law, of which MAFF and MOE are mainly in charge. First role is reducing the generation of food loss and waste. As part of this, there are mandatory regular reports from food related industries. The government also set the target for reducing FLW for each sub type of business. Now it is formulating the new policy of food recycling law to reduce the edible FLW in the food industry. The aims to reduce the edible FLW by half by 2030.

Ms Miura then introduced the efforts being made in the food industry to reduce FLW. First is a review of delivery deadline for food, which recommends the delivery deadline for certain food products be modified. Second is review of expiration date, and encouraging manufacturers to extend the expiration date or change the labelling to avoid mentioned a specific point in time.

Ms Miura then explained that, as next year is the 2020 Tokyo Olympic and Paralympic games, MAFF has started FLW reduction methods in hotels. An example of this is using billboards to enlighten FLW reduction, and it has showed results and reduced FLW.

Ms Miura ended her presentation by talking about the “No-foodless project”, a project involving five ministries making efforts to raise public awareness and encourage action by supporting activities at each stage of the food chain, including introducing the PR character “Loss-Non”. MAFF continues to promote the efforts of reducing FLW with the government, prefectures, municipalities, business operators and consumers.

Ms Miura then received the following questions:

Q: you said you made estimation of the FLW with questioners from the companies, is that from the Ministry of agriculture directly?

Ms Miura answered yes; they measured the food loss and waste and reported it to MAFF.

Q: In terms of the identity of your campaign to food loss, how has that impacted awareness raising? It could be a very interesting tool.

Ms Miura answered that the mascot character is not major so we have to promote his use for all members at many stages.

Q: You mentioned that there is a new target, can you elaborate why you have a new target?

Ms Miura answered that the United Nations set the SDG; sustainable development goals, and they have a new target of the reduction of FLW. MAFF set the new target based on the SDGs

Q: Greenhouse gas emission from FLW is 8%, but is that the same in Japan? Did you calculate how much GHG reduction could be done?

Ms Miura answered that we did not have the data of greenhouse gas emission from FLW.

Q: In your opinion what is the most effective method to raise awareness of people to reduce FLW?

Ms Miura answered that consumer awareness is very important. MAFF made the educational poster, and the retailers used this poster to change consumer's purchasing behavior (for example, buying food with near expiration dates preferentially).

Q: How effective is the acceptance of the program?

Ms Miura answered that the problem of changing mindset is very hard for Japan. But it is very important thing. The acceptance is not immediately effective but we have to keep our challenge.

4) Inclusive Initiative to Reduce Food Loss and Waste in Malaysia

Mrs. Aniadila Kamaruddin (Malaysian Agricultural Research and Development Institute, Malaysia)

Mr Soh Chung-Ky (Bangi Golf Resort, Malaysia)

Mr Soh Chung-ky began by explaining the cooking system in the Bangi Resort Hotel in Malaysia. The program is called cook chill, and it involves cooking the food, rapidly chilling it, vacuum packaging and then refrigerating. There is also the method known as cook freeze, which includes shock freezing. This creates an inventory of food that can be used whenever needed. Mr Chung-ky explained that the majority of FLW comes from improper planning, for all people who cook. With the cook chill and cook freeze method, food will not be wasted because it can be easily stored and used for a long period of time. The cook chill method extends the shelf life of the food to 5 days, and cook freeze method increases it to one month.

Mr Chung-ky then explained how the cook freeze system works, and showed an explanatory video of how the system is used at the Bangi hotel. He used this to emphasize that the machinery is run on recipe control, so that everything is weighed and calculated exactly to how much chicken is made, meaning there is no excess or waste. He also showed how the food used is tracked so that they can be sure exactly how much food is used in cooking. This last system includes a report showing what the biggest contributor to FLW from the hotel kitchen is.

Finally Mr Chung-ky explained what happens any FLW. Any wasted food is fed to black soldier flies, which consume all left over food waste. The flies leave exoskeletons, which can be used as a natural pesticide, and feces, which can be used as a natural fertilizer. This means that the FLW is completely recycled within the hotel,

in a very efficient manner.

Mr Chung-ky then answered the following questions:

Q: How long do you actually need to store the food? Storage need energy and space, so storing for a long time costs too.

Mr Chung-ky answered that usually they finish using the product in 3 month. You cannot talk about storage energy, you have to look at the energy as a whole. As long as the energy used on the whole is efficient, then using a certain amount in storage is only about 25%.

Q: Is it only done by your hotel?

Mr Chung-ky answered that he is the only one, but he is giving seminars once every few months to share his methods and attempt to change the mindset of the people.

Q: What about fertilizer NPK?

Mr Chung-ky answered that he doesn't have that. He relies on organic fertilizer. He does use an NPK meter to find what is lacking in the soil and then top it up.

Q: In Malaysia, are you allowed to feed the black soldier fly to chicken and fish etc.?

Mr Chung-ky answered that if you do not consider Halau, maybe, but he does not know for certain. Halau would result in more issues.

Q: Shelf life can be extended up to 18 month, would this violate the expiration date?

Mr Chung-ky answered No as he uses very strict regulations. Anything more than 1/100 bacteria is unsafe by his standards, meaning the food stays fresh even when frozen.

Q: Do you have major changes taking place between freezing and thawing?

Mr Chung-ky answered that as long as the process is done properly no. Also, in contrast to MAP, he stores his products after they have been cooked, without losing any color of nutritional value.

Q: What kind of sample testing do you do to ensure the quality of your food?

Mr Chung-ky answered that in his resort they sell 6 hundred thousand meals a year. He performs actual testing on the reaction from customers. Not only that, but he also makes his products with export to Japan in mind, and if there was any issue with the food this would not be possible.

Wrap-up Day 1

Dr Rolle summarized the following points that she noted from today:

There were a lot of innovative initiatives from the Private sector that would be useful in recycling waste.

No one size fits all: it is important to find what works and what does not in the various economies and find what best fits in the specific economy.

The issue of partnership and multi-stakeholders came up frequently, as did the issue of how to raise awareness, and what would bring about changes in mindset.

A lot was also discussed regarding circular and bio economy, and we learned that a number of different approaches were applied in different economies.

When one looks at how academic systems have changed over the years, in a lot of cases that home economics has been replaced in school by ICT, but perhaps we need to bring these curriculum back.

There were a lot of interesting dimensions and approaches today that can be adapted.

Day 2

Keynote speech – Part 2

World Bank Bonds for Sustainable Development

Mr Yoshiyuki Arima

Representative of World Bank Treasury in Japan

Mr Yoshiyuki Arima began his presentation by discussing the focus of the World Bank, and how they are borrowing money from private sector capital markets, and that FLW focused bonds that get pretty good demand.

He then went on to introduce the World Bank, also known as the International Bank for Reconstruction & Development (IBRD). Its goals are to end extreme poverty and boost shared prosperity, and over the past 70 years has been the largest source of development. The current focus is on helping member economies find sustainable solutions to pressing challenges like climate change and gender equality.

Regarding FLW, Mr Arima stated that the World Bank is offering bonds to Japanese retail investors which highlight the challenge of FLW and projects being supported by the World Bank. World Bank has been issuing Green Bonds, which is raising awareness of climate risk. Now the World Bank is moving on to “Beyond Green Bonds” with “Sustainable Development Bonds”. This triggered investors to introduce new investment strategies to include more ESG principles using SDGs as a framework. World Bank has been working with the Government Pension Investment Fund (GPIF), the largest pension fund on the planet, on a joint research project and the very first research report was launched in April last year. (The report can be downloaded from the World Bank’s web site).

Mr Arima also talked about other bonds that the World Bank has been issuing, which include bonds focusing on women empowerment, health and nutrition bond, sustainable cities, and water and ocean bonds, the latter of which includes the plastic waste issue affecting the oceans.

Mr Arima ended his presentation by describing the Capital at Risk Notes program by the World Bank. This program facilitates risk transfer solutions for the World Bank and its clients using the capital markets. A recent example of this is the Pandemic Emergency Financing Facility, a rapid response fund for economies affected by pandemic outbreaks.

Best Practices Presentation

Presentation by speakers from the private sector - Part 3

1) Economized Buy

Mr Zaif Siddiqi (NTT DOCOMO INC., Japan)

Mr Zaif Siddiqi began by explaining that NTT DOCOMO strives to achieve SDGs as well as sustainable social development and social responsibility.

In line with the MAFF definition of food loss, Mr Siddiqi explained that the largest amount of food loss in Japan comes from the home meaning that the consumer is the biggest contributor.

Mr Siddiqi then explained the DOCOMO app Economized Buy (EcoBuy): a digital application that motivates consumers to be part of food loss reduction program, by awarding points to consumers who buy products that are nearer the expiration date. Retailers send notification to the app that tells consumers what products will give points if bought. Earned points can then be used for DOCOMO d-POINTS and others, including shopping transactions. EcoBuy is still at the proof-of- concept stage, and requires support from government, retailers and manufacturers to provide various methods to support it. Other possible uses for EcoBuy and potential future developments include a concierge service, notifying consumers whether the product they bought is still left over, and if it is then they can receive recipes on how to use the leftover food, resulting in further FLW reduction on the consumer end.

Mr Siddiqi showed a video explaining how EcoBuy was being tested in store, and the results showed that stores that the store which used EcoBuy earned a 15% increases in sales, and there was a 29% increase in FLW reduction. Other than point earning purpose consumers, 77% of EcoBuy users participated in the program because of their awareness on food loss reduction. As more consumers retailers and manufacturers get involved, and as government policies support the program, the EcoBuy will likely expand.

Mr Siddiqi then talked about DOCOMO's efforts to reduce FLW in production. DOCOMO intends to introduce a hydroponic solution: growing plants in a nutrient solution water, without soil, in an indoor environment. The benefits of this solution include producing only a reduction in the amount of out of shape vegetables and protection from insects, which reduces lost because these products cannot be sold. This solution also reduces impact on the climate as there is no excess water being wasted. Mr Siddiqi included an explanation of a collaboration with the hydroponic solution partner.

Mr Siddiqi next explained Sustainable Farming by IoT and Cloud Operations (SuICO), an DOCOMO's system that promotes farming by anybody, solutions to agricultural issues, and contributes to SDGs. The SuICO package of consultation, hardware and software is scalable to any company. The program is eventually intended to be used with EcoBuy to sell hydroponic crops, which would encourage consumers to buy even oddly shaped items.

Mr Siddiqi ended his presentation by expressing the DOCOMO hope to globalize

EcoBuy and SuICO, creating a model from Japan in the commercial and APEC community.

The presentation was met with the following questions:

Q: How do you consider the case where consumers donate to the food bank association?

Mr Siddiqi answered that DOCOMO collaborates with the food banks rather than competing with them. EcoBuy is still at the proof-of-concept, but it is necessary to find out how to bring the food bank into the chain. Was it consumed or not, where did it end up: these are the statistics that need to be collected. Also the reward points will also be given as a donation to food banks, so those activities are supported as well.

Q: MAFF talked about extending the expiration date of products by month. What would be the effect be on EcoBuy?

Mr Siddiqi answered that, usually, the expiration date will be put by month for items that already have a longer expiry date. Some products don't last as long, and EcoBuy focuses on those.

Q: How do you get points from agrifood for EcoBuy?

Mr Siddiqi answered that EcoBuy also allocates points for out of shape or non-standard products.

Q: For the SuICO system, is there an indication for the minimal operation size in terms of hectares? What is the cost?

Mr Siddiqi answered a minimum of 6 thousand square meters to start the project. Cost depends on the type of facility required, and cheaper facilities will be weaker, but roughly startup costs around 5 to 10 million dollars. Mr Siddiqi added that there is confirmation from partners that SuICO is providing growth for those not related to the farming industry.

Q: What sort of potential increase in membership or client do you expect?

Mr Siddiqi answered that DOCOMO would like more members, but this program has included different rewards and different partners. This will be an open platform inviting any users to be part of the system, so it will expand. More important is to contribute to social responsibility. It would not be a high margin business, it's more about making sure DOCOMO has its piece of business, but at the same time it benefits the business programs.

Q: Regarding EcoBuy, how do you ensure retailers are involved?

Mr Siddiqi answered that DOCOMO -members will be approaching different convenience stores and franchises on its own, but it will also be key to have government involvement putting policies and measures that ensure the retailers have to be part of the system, and that allows a process and cycle to be created. But that will take time, so that is why awareness and education are important.

Q: Can this be duplicated in other economies?

Mr Siddiqi answered yes, as long as there is support by various institutions, the same as it is in Japan.

Dr Rolle followed by commenting on the potential particularly of EcoBuy, for generating win-win and change, such as awareness factors by rewarding the consumers. She commented that she sees a lot of potential across yesterday's discussions, particularly as awareness came up a lot, and it is a very important element, and this app seems to have a lot of potential to raise awareness.

Updates on FLW in APEC Region Member Economies Report - Part 2

1) Certification of healthy market stalls of primary food and feed Miss Patricia Marañón Calderón (SENASA, Peru)

Ms Patricia Marañón Calderón opened by introducing SENASA: the National Agrarian Health Service and part of the ministry of agriculture in Peru, whose work focusses on animal and plant health, and food safety, with objectives including contributing to food safety. SENASA is one of three sub systems of the food safety domestic system in Peru, COMPIAL, and has support of regional government and local government.

Ms Calderón then explained the objectives of food safety are to ensure the safety of food for human consumption, protect life and health of people with a preventive and comprehensive approach.

Ms Calderón then explained the objectives of food safety are to ensure the safety of food for human consumption, protect life and health of people with a preventive and comprehensive approach. SENASA's work is focused on monitoring, controlling and managing food safety. One of the major ways they do this is with the certification of healthy market stalls, which came about from bad practices of sanitary inspections in Peru. The objective is to improve sanitary conditions of commercialization of food and feed in market stalls. By improving the sanitary conditions and distribution in the markets, it will result in less food loss.

Ms Calderón explained the use of the ICT as part of the strategy, through creating a virtual platform for registered stalls of the markets of supply. The developed activities include the creation of an organic health surveillance unit, actualization of the organization charts in the municipalities, and training civilians, including planning and executing sanitary inspections. Other innovative technologies include informative media for consumers such as radio slots related to food hygiene and manipulation practices.

Ms Calderón explained the results included achieving 7,983 stalls in 2018 that are certified as healthy. These results motivated SENARA to keep working on and improving the project.

Ms Calderón concluded that the local governments that participated showed improvement in hygiene practices, and the experience allowed them to install healthy market in super markets, and the use of ICT enabled register of market stalls. She also gave a demonstration of the register and showed how it allowed for easier control of

manufacturing and transport practices.

2) A Case Study of Agriculture Industry in Chinese Taipei Ms. Shu-Ting Yu (Council of Agriculture, Chinese Taipei)

Ms Shu-Ting Yu opened with an introduction of Chinese Taipei, where each person creates 158 kilograms of FLW per year. Food supply can be divided into five stages – production, harvesting/post-harvest, processing, marketing channels, and the consumer side. In most parts of the world, food loss occurs in the first three stages, and focusing on those stages, the Council of Agriculture is aiming to introduce new tools of IoT and ICT to gather the wisdom of R&D personnel to carry out research and development to provide industry and farmers with strategies for decision-making in value chain activities. One example of this is the plan to enhance farmer's autonomous disaster prevention ability, which includes training and notification, along with support before and after a disaster occurs.

Ms Yu then focused on the rice navigation industry as an example, to highlight the problems in production, harvesting and processing. To solve these problems, the Council of Agriculture is promoting the Agriculture Industry Technology Development program, which is intended to gather the energy and resources of private and public sectors, to stop any problems they encounter. Ms. Yu highlighted three case studies that have used this program to improve the rice navigation industry. Ms. Yu concluded her presentation by explaining that in the future, the Council of Agriculture intends to perfect the cold chain logistics systems. There are still gaps in this system in Peru so there are plans to continue public private partnership, and use government resources to continuously reduce FLW.

3) Loss and waste in Thailand

Dr Choochat Watanawan (Ministry of Agriculture and Cooperatives, Thailand)

Dr Choochat Watanawan opened with an overview of Thailand FLW, where food loss is 32% of the global supply weight, and 24% of global supply by energy content. FLW occurs along the entire value chain, from harvesting to consumption, but more than 35% of the loss is from the consumption, production and storage stages.

Dr Watanawan then talked about the Thailand Policy on food losses. The national food committee in Thailand started in 2008, and now has three domestic sub committees, two of which focus on food loss and food waste respectively. The major step of these committees with the 12th National Economic and Social Development Plan, which aims to promote and support research and development of technology and innovation, adjust the agricultural production systems to comply with the climate change, and create a link between the manufacturing sector to improve Transportation, Logistics and Telecommunications. Dr Watanawan also commented that the National agenda on waste management to create awareness and understanding that leads to reduction, reuse and recycling of FLW.

Dr Wattanawan next talked about the food losses in Thailand and the implemented policy and prevention. In Thailand the definition of food losses is a decrease in edible food mass throughout the entire supply chain, taking place mostly in the post-harvest area, and predominantly made up of fruits and vegetables. Thailand traditional market is from grower to retail market, or going through middlemen, wholesale market, and then the supermarket, to reach the consumer.

Dr Wattanawan stated that the measures to reduce food loss in Thailand include providing cold storage and transportation facilities, initiating and coordinating awareness programs, applying appropriate packaging techniques, and supporting research in the area of value addition and supply chain management.

Dr Wattanawan then talked about the reaction from the private sector on food losses, which was to reduce food losses in modern chain, with such methods as purchasing from farmers directly, creating a social awareness of food waste, such as awareness campaigns in supermarkets and restaurants, and change lost food to meals through donations for under privileged.

Dr Wattanawan then talked about the technology and innovation for reducing food losses, looking at case studies for chili and durian fruit, which highlighted some of the methods used to reduce food loss for example by drying the chili before storage, or recycling the byproducts from Durian.

Dr Wattanawan ended his discussion by summarizing the points discussed in his presentation.

Keynote speech – Part 3

Review APEC projects on reducing FLW

Dr Ching-Cheng Chang

Research Fellow, Institute of Economics, Academia Sinica

Dr Ching-Cheng Chang began by commenting that food waste is a global challenge, but for APEC it is very important as APEC covers 40% of the world population. APEC is also the first region to have an official agreement to reduce food loss and waste under the food loss umbrella. The goal of safe guarding APEC food security is set for 2020, not 2050, and the dialogue reducing FLW already began in 2010. In 2014 they established the food security roadmap, which states that the goal is to reduce the FLW by 10% on average by 2020 in the Asia-Pacific. Dr Chang explained that this goal flexible but a workable target for APEC.

Dr Chang then introduced several projects that have been funded and supported by APEC with FLW in mind. Each of these projects focused on improving the efficiency and productivity of food supply chain including postharvest logistics and cold chain, balancing between food security and raising demand for food safety, promoting public private partnership along the food supply chain, and strengthening APEC cooperation on food security and climate change. Of the six case study projects introduced, Dr Chang highlighted that the last two had key findings to promote product efficiency and emerging domains action and showed that solving FLW is a way to achieve sustainable APEC food security, which means it has become a win-win strategy.

Dr Chang next talked about the multi-year project “Strengthening Public-Private Partnership to Reduce Food Losses in the Supply Chain”. This is the first five year project funded by APEC, and was intended to identify key issues, seek best practices and find practical solutions to FLW. It was supported by three pillars of approach to address the issues: food loss and waste assessment, best practice and toolkits, and capacity building seminars and surveys.

Dr Chang then highlighted that the feasible solutions to FLW reduction implementation of face issues along the up-stream, mid-stream and down-stream sections of the food production process, so there is a need to have continuous dialogue to address the policy issues. At the end of the project APEC is still trying to address many policy issues, first by strengthening public and private partnership, the main recommendation of which is that the policy supporting donation activities needs to be a low cost solution which could be implemented quickly. She stated that it is important to think not only about the best solutions but also of the ones that can be implemented quickly.

In addition, Dr Chang introduced many recommendations from APEC to improve FLW reduction, such as the importance of working with FAO and other international activities, and creating new business strategy to meet food security challenge.

Dr Chang ended her presentation by introducing the need for the implication for ICT and innovative technologies, as ICT can play multiple rolls, such as on the consumption side, where public communication can be enhanced with ICT, and websites and social media can be effective tools to improve communication. It can also be used as a way to provide more healthy and valuable foods, and safer food. Dr Chang added that there are areas for future collaboration that can be improved. The first is that there is a need for more resources and skills, and technical requirement.

The second is the need for variations in the level of development, and finally the third is in data collection transparency.

Next Steps on FLW in APEC

Discussion

Next steps of food loss and waste in various APEC economies.

Dr Rolle began with a reminder of what had been discussed over the last two days. The workshop started with several presentations from the private sectors, highlighting innovative techniques that can be applied across multiple economies. Some of these can be applied to improve shelf life, logistics, and maximize the use of food. Dr Rolle highlighted that they looked at FLW reduction from a number of different perspectives from across the supply chain, and at some of the options that could be used in the next step in terms of recycling and circular economy. Dr Rolle added that they also looked at a lot of strategies and approaches that apply across various economies to address FLW, and the need to look at different kinds of technology and approaches for different levels. Finally Dr Rolle added that the workshop showed that there is a very important role for ICT and a lot of innovation opportunity for FLW reduction.

Dr Rolle then asked the economies to discuss amongst themselves on what are the

most important methods to address the FLW problem, which was followed by each economy presenting a number of recommendations.

The Viet Nam representatives suggested:

- Sharing information with the private sector in any economy, particularly retailers, wholesalers.
- Raise Consumer awareness.
- Providing practically applicable solutions involving researchers as well as governments.
- Zero hunger program by 2025, targeted to reduce FLW.
- Areas where more ICT would be necessary to achieve goals focusing on technology, preservation and processing.
- The need for a call for action to save food at household level.
- Raising awareness for food safety, animal/plant health, and environment sanitation in food production.

The Thailand representatives suggested:

- ICT is important but there is a need to decide process innovation backed by ICT, public private partnership implementation and better partnerships.
- Government should develop links between public and private sectors.
- Information flow using the internet and ICT.
- Logistic development in the supply chain learning from Japan.
- Knowledge development and flow.

The Chinese Taipei representatives suggested:

- Climate change economy wide program to improve farming systems for food security.
- Disaster reduction extension to farmers.
- Cold chain system introduction.
- Circular economy to enhance environmental benefits.
- Food labelling strategy to address food donations.
- Reducing greenhouse gas.

The Singapore representatives suggested:

- Scarcity of land and labor means the need for high ratio productivity through urban farming.
- FLW management,
- Using ICT to increase efficiency especially in urban farms.
- Public engagement with private sector and academia.
- Value addition through urban farming through mechanization of hydroponic methods, driven by the private sectors but with options available for private citizens.

The Philippines representatives suggested:

- Local workshops for capacity building and stakeholders.
- Need for infrastructure development and communication support to facilitate access to ICT.
- R&D to ensure applicability of ICT and innovative technology.
- R&D to promote connection between production and FLW.

- Design and implementation of culture-relevant education campaigns to promote awareness of FLW.

The Peru representatives suggested:

- Focus should be on production.
- Education in school with support of the government.
- Legislation for economies that already have the rules established and fiscalization plan supported by local and regional governments.
- Necessary to develop public private partnerships as this can address the highest level of waste in agro-industry.
- Communication between public and private sectors.
- Prioritization of funding by the government for technologies and the use of ICT in FLW reduction.

The New Zealand representatives suggested:

- Recognizing ICT as significant platform to reducing FLW and therefore should continue to receive publicity and attention.
- Facilitate the linking of domestic APEC weather services to enhance FLW ICT platforms.
- Prioritize and focus ICT solutions that are public/private partnerships such as funding.
- Micro and Macro ICT solutions.
- Promote inclusion of youth education regarding FLW.
- Prioritize funding pilot ICT solutions which are deployable and scalable through further funding via the World Bank.
- Recognize that FLW has impacts on sustainability and economic long term impacts.

The Chile representative suggested:

- Private involvement is essential so developing business cases for companies for FLW reduction is necessary.
- Knowledge sharing for APEC economies to face asymmetries of information.
- Assessment of FLW methodologies.
- Focus should be how to make the food system more sustainable and increase efficiency linking supply and demand.
- Relevance of involvement of small holders in the food system.
- Important to work on guidance and tools to link FLW reduction with broader strategies such as circular economy strategy.

The Japan representatives suggested:

- Promote disclosure of data and effort of each food related company about FLW reduction
- Consumer awareness through mascot characters, share the definition and target of FLW with APEC economies
- Collaboration with Food Banks.

The Indonesia representative suggested:

- Reduction of FLW in supply chain focusing on losses by supply chain practitioners.

- Target addressing zero hunger in quality and quantity.
- ICT appropriate in selected contexts such as large cities
- Increase public private partnership through tax reduction and address the need for studies on importance of public private partnership introducing and promoting FLW reduction.

The Malaysia representatives suggested:

- APEC must follow up with economies.
- APEC should consider adding consideration of cost of FLW.
- Must be some form of penalty system to reduce FLW or tax/monetary rates.
- Public awareness and education for a younger generation on valuing food.

The APEC Business Advisory Council (ABAC) representatives suggested:

- Policy of reward rather than penalty
- Data importance must be understood, including storage and consistency.
- The need to include small to medium enterprise (SMEs) including farmers and market stalls
- Inclusion of public private partnerships in Chile.

The Thailand representative added for public private partnerships in Chile that the policy should be applied to APEC economy, to ensure full implementation of actions to reduce FLW.

The Chile representative added that there is a need to implement methodologies to answer the long term needs to private sector, and that the experience and successful models on public private partnership could be shared to build trust of the private sector to enhance public private collaborations. Also recommended to develop a knowledge platform.

Dr Rolle summarized that this was a very good set of suggestions that could be used to support the package of what transpired at the workshop, in terms of going forward working together towards reduction of FLW, in an economy context and also across various economies. She intends to use the information, and analyze and categorize the report on the workshop using the best recommendations she received.

Dr Rolle added that, in terms of what FAO could potentially try to do, as a proposal, in the context of the international awareness day, is that it could be considered in context of promoting FLW reduction and how to use ICT.

Dr Rolle added that there is a need to make action to make change by 2030, and it necessary to get people motivated and sensitized.

Wrap-up Day 2

Dr Rolle ended the workshop by saying she would use the information from the representatives to make the report of the workshop event, which will then be used during the next event in Chile.

IV. Program

Date: July 10-11 ,2019

Venue: Hotel Metropolitan Edmont, Tokyo, Japan

Host: Ministry of Foreign Affairs Japan

Day1 July,10	Activities
09:00-09:30	Registration
09:30-09:55	Opening Remarks
09:55-10:00	Group Photo
Inputs from Experts	
10:00-10:30	<p>Keynote speech – Part 1 FAO’s Work to Address Food Loss and Waste Reduction : An Overview Rosa Rolle, PhD Senior Enterprise Development Officer Team Leader, Food Loss and Waste Food and Agriculture Organization of the United Nations (FAO)</p>
Best Practices Presentation	
10:30-12:00	<p>Presentation by speakers from the private sector - Part 1</p> <ol style="list-style-type: none"> 1) Productivity improvement project using weather and demand forecasting Mr Toshio Nakano (Japan Weather Association, Japan) 2) Food Waste Reduction Journey – Using ICT Mr CHIN NGIAP TAN (Ban Choon Marketing Pte Ltd, Singapore) 3) Ecostock IOT Presentation Mr Andrew Fisher (EcoStock Supplies Limited, New Zealand) <p>Discussion will follow after each presentation.</p>
12:00-13:30	Lunch
Best Practices Presentation	
13:30-15:00	<p>Presentation by speakers from the private sector - Part 2</p> <ol style="list-style-type: none"> 1) Freshness Preserving Films for Vegetables and Fruits Mr Masahiro Kawakami (Sumitomo Bakelite Co., Ltd., Japan) 2) Fish Oil, Proteases and Hydrolysates from By-products of Fish Processing Dr Cesar V. Ortinero (Central Luzon State University, the Philippines) 3) Development of innovative food. Delivering nutritions of whole plants in a delicious way. Mr Kuniaki Tsukada (Mizkan Holdings Co., Ltd., Japan) <p>Discussion will follow after each presentation.</p>

15:00-15:20	Coffee Break
15:20-16:45	<p>Member Economies Report - Part 1</p> <ol style="list-style-type: none"> 1) Food Loss and Waste in Chile – Advances and Challenges Ms Daniela Acuña (Ministry of Agriculture, Chile) 2) FOOD LOSSES AND WASTE MANAGEMENT IN INDONESIA Dr Bram Kusbiantoro (Indonesian Agency for Agricultural Research and Development, Indonesia) 3) Reducing food loss and waste in Japan Ms Hiroko Miura (Ministry of Agriculture Forestry and Fisheries, Japan) 4) Inclusive Initiative to Reduce Food Loss and Waste in Malaysia Mrs Aniadila Kamaruddin (Malaysian Agricultural Research and Development Institute, Malaysia) Mr Soh Chung-Ky (Bangi Golf Resort, Malaysia) Discussion will follow after each presentation.
16:45-17:00	Wrap-Up Day1

Day2 July,11	Activities
09:00-09:30	Registration
Inputs from Experts	
9:30-10:00	Keynote speech – Part 2 World Bank Bonds for Sustainable Development Mr Yoshiyuki Arima Representative of World Bank Treasury in Japan
Best Practices Presentation	
10:00-10:45	Presentation by speakers from the private sector - Part 3 1) Economized Buy Mr Zaif Siddiqi (NTT Docomo Inc., Japan)
10:45-11:00	Coffee Break
Updates on FLW in APEC Region	
11:00-12:30	Member Economies Report - Part 2 1) Certification of healthy market stalls of primary food and feed Ms Patricia Marañón Calderón (SENASA, Peru) 2) A Case Study of Agriculture Industry in Chinese Taipei MsShu-Ting Yu (Council of Agriculture, Chinese Taipei) 3) Loss and waste in Thailand Dr Choochat Watanawan (Ministry of Agriculture and Cooperatives, Thailand) Discussion will follow after each presentation.
12:30-14:00	Lunch
Inputs from Experts	
14:00-14:30	Keynote speech – Part 3 Review APEC projects on reducing FLW Dr Ching-Cheng Chang Research Fellow, Institute of Economics, Academia Sinica
Next Step on FLW in APEC	
14:30-15:30	Discussion
15:30-16:00	Wrap-up Day 2 Participants submit the workshop questionnaire.

V. Profile of Speakers

Keynote speech – Part 1

Rosa Rolle, PhD



**Senior Enterprise Development Officer Team Leader,
Food Loss and Waste in the Nutrition and Food
Systems Division of the Food and Agriculture
Organization (FAO)
Email: Rosa.Rolle@fao.org**

Dr Rosa Rolle led the team that designed and implemented the Save Food Asia-Pacific Campaign in Bangkok, Thailand in August 2013, during her 7-year tenure (2009 - 2015) at the FAO Regional Office for Asia and the Pacific, and supported the design and implementation of domestic Save Food Campaigns and multi-stakeholder networks to promote awareness and to address the issues. As Team Leader of Food Loss and Waste in the Nutrition and Food System Division at headquarters, she is actively engaged in various dimensions of the work of the Organization to tackle the issues. Her recent work has focused on support to the development, design and implementation of surveys, studies and innovative projects to address quality management and post-harvest loss reduction as well as the reduction of consumer level food waste. Rosa holds MSc and PhD degrees in Food Science from the Ohio State University, Columbus Ohio, USA, and a Higher National Diploma in Applied Chemistry (UK). Prior to joining FAO she conducted post-doctoral research in food biochemistry and zoology at the University of Florida, Gainesville, Florida, USA and served as a consultant to both public and private sector institutions.

Presentation by speakers from the private sector - Part 1

1) Dr Toshio Nakano



**Senior Engineer
Japan Weather Association
Email: toshio@jwa.or.jp**

Dr Toshio Nakano is the Senior Engineer of Innovative weather solutions section of Japan Weather Association. Weather can be predicted with physical analysis including what has not happened before. He has launched a product demand forecasting project and conducts consulting for many companies as a project leader.

2) Mr Tan Chin Ngiap



Project Director
Ban Choon Marketing Pte Ltd.
Email: ngiap@banchoon.com.sg

Mr Tan Chin Ngiap is the project director at Ban Choon Marketing Pte Ltd. An industry veteran, he had held various roles in many IT organisations. President for South East Asia Information Technology Organisation (SITO) for 4 years. Served four terms (7 years) as the Chairman of Micro Computer Trade Association of Singapore (MTAS), now merged as SITF, in year 2018 the association name changed to SG Tech. On the panel of Judges for the SG:D Techblazer Awards, the Nation’s highest accolade for tech innovation, the awards aim to provide recognition and endorsement to Singapore-based organisations and companies. During his term with MTAS, he created the first computer show in Singapore, SITEX. It is now recognised as the biggest premier computer show in Singapore. He sat on the cluster committee IT2000 Singapore Served as a committee member of the formation of ‘standards for hard disk.’ In the Food Industry, He was a committee member on the Singapore standards of “TR 24, Cold Management of Leafy vegetable and fruits.” Was a committee member on the Singapore standards of “Organic Urban Farming.” Currently serving as a committee member on Singapore Standard on” Waste management Food Retail and wholesale/Distribution establishment.” Completed a successful test trial using NASA technology to extend shelf life of fruits & Vegetable Completed a successful test trial using real time monitoring to improve wastage.

3) Mr Andrew Fisher



Founder and owner of EcoStock Supplies Ltd, or
EcoStock
Email: andrew.fisher@ecostock.co.nz

Mr Andrew Fisher is a pioneer in the field of food-waste recovery who is eager to share ideas and learn from others. He is far-sighted, steadfast, and uses ICT and other innovative technologies collaboratively to eliminate or reduce food waste. His business’s combined efforts with industry have prevented over one million tonnes of food being wasted.

Presentation by speakers from the private sector – Part 2

1) Mr Masahiro Kawakami



**Senior Sales Manager
Food Packaging Sales Dept. Films & Sheets Division
Sumitomo Bakelite Co., Ltd.
Email: mike@sumibe.co.jp**

Mr Masahiro Kawakami is overseas sales manager for MAP (=modified atmosphere packaging) product who has been working for this product line for the past two years. Contributing prolong shelf life of vegetables and fruits and reduce of food loss, MAP products have been started to use in some of APEC economies as a trial, through mutual testing events both clients' place and our laboratory in Tokyo. Mostly in APEC economies, way of food cultures are quite different from that in Japan, unique fruits have been imported to Japan and done tests in our Tokyo laboratory in order to verify the good performance of MAP.

2) Dr Cesar V. Ortinero



**Associate Professor
Department of Environmental Science Central Luzon
State University
Email: cvortinero@clsu.edu.ph**

Dr Cesar V. Ortinero is an associate professor in the Department of Environmental Science, Central Luzon State University, Philippines where he teaches courses in environmental toxicology, environmental science and environmental management. He is currently involved in research projects on waste valorization and sustainable drug discovery. He completed his PhD in Engineering (Urban and Environmental Engineering) at the Kyoto University, Japan.

3) Mr Kuniaki Tsukada



Manager
New Business Development, Mizkan Holdings
Email: kuniaki-tsukada@mizkan.co.jp

Mr Kuniaki Tsukada is Manager, New Business Development, Mizkan Holdings. He has been with Mizkan for 15 years and has been spending most of his career in sales and marketing function with the experience in the UK and in the US for 5 years. During his career, as a brand lead / category management lead, he has been involved in many researches to understand consumer needs and market trends across Japan, UK, and US. Also, through product launch and consumer campaigns, he has been interacting with local consumers where he deepens his consumer insight. He joined ZENB business last fall, and led ZENB Initiative web site launch in Nov 2018, and ZENB Brand/DTC web site in Mar 2019.

Keynote speech - 2 **Mr Yoshiyuki Arima**



Representative Japan
World Bank Treasury, Tokyo, Japan
Email: yarima@worldbank.org

Mr Yoshiyuki Arima joined the Treasury of the World Bank in Tokyo, Japan in March 2000. As a Representative World Bank Treasury in Tokyo, Mr Arima is engaging in Investor Relations and New Products for Japanese investors. Mr Arima is responsible for the overall relationship of the World Bank with Japanese investors. Prior to joining the World Bank, he worked for Bank of Tokyo Mitsubishi UFJ for 11 years in the corporate finance business, including export and import finances for trading companies, banking loan businesses, and M&A business for Japanese corporates. He also worked for the securities arm of Bank of Tokyo Mitsubishi UFJ in New York to engage in Trading/Sales for US Treasury Bonds, Repo / Reverse Repo Transactions, and CME / CBoT Financial Futures.

Presentation by speakers from the private sector – Part 3

1) Mr Zaif Siddiqi



**Executive Director & Board Member NTT Docomo
Overseas Branches
Corporate Sales and Marketing Department II, NTT
DOCOMO INC.
Email: zaif.siddiqi.vw@nttdocomo.com**

In April 2016, Mr Zaif Siddiqi was assigned as an Executive Director in the Corporate Sales & Marketing Division at NTT DOCOMO Inc. to develop and lead the global enterprise business. In addition, in July 2018, he was appointed to serve as a Board Member of NTT DOCOMO USA, China, Asia, Europe and Brazil to strategize the enterprise ICT business in the areas of IoT, connected cars and new business innovation. Prior to the current assignment, his professional contributions were at companies such as Vodafone, Microsoft and Verizon Business.

Mr Zaif Siddiqi earned his bachelor's degree from International Islamic University, Malaysia, in the faculty of Economics and Management Sciences with a minor in Business Administration. He speaks native Japanese, English and Urdu and has over 40 years of living experience in Japan.

VI. List of Participants

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