APEC 2016 Expert Consultation on Food Losses and Waste in Retail and Consumption

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APEC Multi-Year Project: "Strengthening Public-Private Partnership to Reduce Food Losses in the Supply Chain" (M SCE 02 2013A)

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Summary - Working Draft

Summary of Proceedings Day 1

Panel Session 1: Evidence And Causes of Food Waste in the Consumer and Retail Levels

Presentation 1: Reducing Food Waste in APEC: Implications for Retailers and Consumers – Dr. Don Gunasekera, Industry Research Fellow, Institute for Supply Chain and Logistics Victoria University, Melbourne, Australia

Roadmap: Key issues - Current trends - Assessment of the problem -Policy directions and strategies

Key Issues

The dimensions to consider in reducing food waste and loss are manifold. Following current trends of rising global incomes and continuous population growth, the question of food security becomes an ever more pressing matter. The importance of diminishing food waste is further compounded by continuous urbanization, which removes labor from the food production process. Especially the APEC region is home to tremendous movements from rural towards urban areas. Therefore, combining efforts to increase food supply whilst diminishing food losses and waste could assist in the sustenance of the global population.

However, losses and waste do not occur equally globally. Developing nations face bigger losses along the initial stages of the supply chain, that is within production, handling, storage, and processing. In contrast, developed economies suffer predominantly from waste in the distribution and consumption stages. As economies mature, farming cooperatives develop that hold contracts with supermarkets and serve as large scale suppliers. Combating food waste, the loss of food fit for human consumption, begins within supermarkets and high income individuals.

Current Trends

Causes of food losses and waste are manifold. The most fundamental reason is that food is inherently perishable. Furthermore, household compositions play a key role in determining behavior as eating out and single households are increasing. Similarly, consumer perceptions shape retail behavior, as expectations towards the desired shape and appearance of food can affect sales. Lastly, insufficient transportation, storage, and cooling technologies play a key role in generating food waste and loss, particularly so in developing economies.

Consumer attitudes are evident from a study by Rolle (2014), which contains a survey inquiring about sentiments regarding food loss and waste in the Philippines. The most cited reason for food

waste is "forgot to cook" and food waste is self-estimated to account for less than 5% of total purchases. Pressingly, consumers in the Philippines do not appear to be concerned about wasteful behavior as over 70% of respondents replied that they do "not care at all" or "only a little" about food waste.

Assessment of the Problem

Four strategies to combat food loss and waste are proposed, which are awareness raising, collaboration and coordination of initiatives, policy and program development, and investing in programs and projects. Awareness raising in particular, sees a lot of development as the Australian government and NGOs publish material in a variety of languages.

For developing economies, field studies can aid in identifying the critical loss points in the supply chain. Furthermore, regionally targeted loss reduction strategies can be beneficial in reducing food loss and waste.

Policy Directions and Strategies

As a developed nation, Australia suffers from minimal amounts of post-harvest loss due to readily available technology. Furthermore, efforts are being made to reduce food waste by packaging "less desirable" foods, such as oddly shaped carrots, into bags and distributing them at lower prices. Such advanced planning helps in ameliorating waste. Furthermore, packaging technology is developed to ensure long-lasting shelf-life.

Food that is about to expire or beyond expiry date is often distributed to low-income households. Similar initiatives occur in large-scale canteens and food providers. Therefore, cooperation between retailers, the public sector, and consumers ensures that minimal amounts of food are wasted.

Lastly, current data sets are not harmonized across Australia. To further ensure consistency, the federal government has to ensure that data collected from local and state governments is properly harmonized.

Presentation 2: Consumer's Food Choices and the Roles of Retailers in Reducing Food Waste in APEC Region – Dr. Miranda Mirosa, New Zealand Ministry for Primary Industries NZ/China Postharvest Loss and Food Waste Research Fellow

Roadmap: Food Waste: Possible Definitions - Food Waste: Features and Causes – Trends in Reduction – Opportunities for Creating Partnerships

Food Waste: Possible Definitions

Food waste has multiple definitions that often vary depending on the organization. A prevalent definition is given by the FAO, which defines food loss as "the decrease in quantity or quality of food". In contrast, the EU FUSIONS project gives a more extensive definition in the form of "Food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composed, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)".

Parfitt et al. (2010) further distinguish between three types of household food waste: unavoidable, possibly avoidable, and avoidable .The first, avoidable kitchen waste, refers to inedible food parts such as bones, which are often generated during cooking and preparation. The second, possibly avoidable waste, is defined as parts that are fit for human consumption but are not eaten due to local customs and preparation methods. A prominent example featured is banana peels. The last, avoidable kitchen waste, refers to food wasted that is or was edible, such as suboptimal foods, leftovers, and scraps.

Food Waste: Features and Causes

Three key global trends contribute significantly to food waste behavior: urbanization, changing diets, and increasing globalization of commerce. Urbanization causes a growing distance between producers and consumers. Therefore, the consumers tend to forget how food is grown and rely on packaging information to determine food spoilage. Furthermore, in recent years the composition of diets has changed from starches to meats, fish, fruits, and vegetables. The goods preferred perish more quickly, which leads to higher levels of food waste. Increasing globalization of commerce and the rapid diffusion of large-scale mass distribution has allowed for a diversification in diets in developing economies. However, supermarkets often contribute to high expectations on quality and freshness which leads to further consumer food waste. Furthermore, modern attitudes towards consumption further exacerbate food waste. Abundance of food, low prices, sales promotions, preparation of excessive portion sizes, and increasing anxiety about food safety are all contributing factors to current food waste.

The socioeconomic characteristics associated with wasteful behavior are: a lack of cooking skills, immunity to the cost of food waste, and expectations of high quality. In New Zealand, the ones who discard significant amounts of food are found to be younger (18-24), have young children, or earn more than $100,000 a year. However, general attitudes towards food waste even among the young tend to be negative, thus indicating that significant change is possible.

Trends in Reduction

Developments among consumers are manifold. In particular, education serves as a cost effective solution to food waste. Simple methods such as teaching how to make shopping-lists, proper refrigerator use, and utilizing web resources that help estimate portion sizes can aid in reducing food waste. Cooking methods that minimize waste, as well as an additional emphasis on eating parts that are traditionally considered "inedible," such as offal, are also being emphasized. Furthermore, consumer products that emphasize being generated and recovered from food waste are being marketed as high-end life-style products

Retailers have contributed by offering smaller portion alternatives of goods, having individually vacuum sealed products, switching from canned to reseal-able containers, and having freshness strips within produce containers. Furthermore, many retailers have started initiatives to enlist technology in reducing food waste, such as the Sainsbury Food Rescue app, which allows consumers to utilize the contents of their fridge to the fullest extent. Other initiatives aim to reduce over-purchasing of goods, such as Tesco's "buy one, get one later free" campaign.

Public contributions are occurring through legislation that enables the donation and repurposing of food. In the United States, the Bill Emerson Good Samaritan act reduces the liability of large scale retailers who decide to donate food. Countries like France, in contrast, have mandated that supermarkets are to donate discarded food to charities or allow it to be turned into animal feed, compost or energy.

Opportunities for Creating Partnerships

An intersectional approach that involves retailers, NGOs, and the public sector was mentioned as key to combat food waste. The "love food; hate waste – New Zealand" NGO campaign gained public funding to investigate the extent of food loss and waste in New Zealand. By surveying households and physically counting generated waste, they estimated that $872,000,000 of food is wasted annually in New Zealand. Public media campaigns, such as television appearances, and posters that appeal to economic, emotional, and moral rationale managed to generate significant amounts of public awareness.

International knowledge sharing can also serve as a tool in diminishing food waste, as can be seen through the collaboration between the People's Republic of China and New Zealand. Initiatives such as "Operation Empty Plate" are now raising awareness of food loss issues within the PRC.

Panel Session 2: Understanding the Potential Impacts of Reducing Food Losses and Waste in the Consumer and Retail Sectors

Presentation 1: Impact of Reducing Food Loss and Waste in EU – Dr. Monika Verma

Roadmap: Motivation and Data – Case Studies and Results – Considerations and further Research

Motivation and Data

The motivation behind Wageningen UR's involvement in studying food loss and waste is seated in issues of economic affordability, food security, and climate consideration. Through its prolific work, Wageningen UR has made contributions in empirical and theoretical analysis of food losses and waste across the globe.

In particular, through use of MAGNET, an extension of the widely used GTAP model, it becomes possible to estimate the economic and health impacts of changes in the global economic environment. Therefore, issues like changes in tariffs or poor harvests can be simulated and studied within a mathematical framework.

Those estimates serve as a "what if?" scenario and are contingent on a wide variety of factors. Calibration of parameters, such as how likely consumers substitute one food category for another, needs to be conducted carefully to ensure accurate results. Therefore, economic models such as MAGNET are reliant on secondary research and researcher discretion; careful consideration is advised when studying and relying on the results of such estimation.

Case Studies and Results

Under EU sponsored projects, MAGNET has been applied to conduct case studies predominantly focused on the EU. When investigating a 50% reduction in household and retail food waste within the EU, results indicate that minor savings of 23 Euro per capita per year can be achieved. Furthermore, the reduction in food waste allows for lower allocation of land for food production and therefore frees up an area roughly the size of Belgium.

Another case study analyzed the price transmission effects of a reduction in food losses along the European supply chain to SSA. A less than 8% reduction in prices within the EU resulted in a reduction of less than 0.8% in SSA. Such low levels of price transmissions can be attributed to tariffs, logistic costs, and trade shares. Furthermore, food producers within SSA will suffer due to the strengthened competition from the European Union. Therefore, reductions in food losses in Europe will most likely have a minor impact on improving food security within SSA.

Considerations and further Research

In general, model based analysis allows investigating the wider economic implications of changes in policy and economic circumstances. However, at the current stage the models do not factor many facets of food waste and loss reduction into account, such as the cost of waste reduction or possible benefits through increased recycling. While the sophistication of models is ever increasing, keeping in mind what can and cannot be accomplished through model based analysis is crucial when relying on results for policy formation.

Dr. Verma is currently conducting research into the relationship between per capita income, food consumption, and body weight. The work on this topic is for the eventual inclusion into the MAGNET model to better predict impact on health and diet outcomes.

Presentation 2: Impact Assessment of Reducing Food Loss and Waste On Food Security in the APEC Region – Prof. Shih-Hsun Hsu, National Taiwan University, Chinese Taipei

Roadmap: Food Waste: Introduction and Goals - Methodology and Data Set – Scenario Design – Results – Conclusions and Suggestions

Introduction and Goals

Limited amount of work on the economic effects of food loss and waste have been done in the APEC region. To rectify this, the study applies the "Reducing Food Waste by Households and in Retail in the EU" (2013) report by Rutten et al. within an APEC context; specifically, the study investigates welfare and food security impacts of a variety of different waste and loss reduction scenarios.

Methodology and Data Set

The study uses a GTAP model, which is a multi-regional Computable General Equilibrium (CGE) model, to conduct its analysis. The GTAP framework allows investigating the interconnectedness of agents within an economy, such as consumers and firms. It is used in conjunction with the Mass Flow Model as proposed in the 2011 FAO report, which provides the food loss and waste estimates used for each sector and region.

Three economic regions are considered for the study: high income APEC members (APEC_H), upper middle income APEC members (APEC_UM), and lower middle income APEC members (APEC_LM). The classification scheme follows the World Bank guidelines which defines high income countries as having a GDP/capita above US$12,000, upper middle income countries as having a GDP/capita below $12,000 and above US$4,000, and lower middle income countries as having a GDP/capita below $4,000 and above US$1,000.

Scenario Design

Five scenarios are put forward for consideration. The first scenario (uniform) models a uniform reduction in food waste, i.e. for consumers and retailers, of 10% for each of the three APEC regions. This is done following the "APEC Action Plan for Reducing Food Loss and Waste, 2014," which established the goal of a 10% reduction in food loss and waste by 2020 using 2012 as a base.

The second scenario (non-uniform) considers the fact that developed and developing nations incur losses at different stages of the supply chain. In particular, developed nations experience higher food waste, i.e. higher amounts of food discarded in consumption and retail, while developing nations incur higher food losses, i.e. within production, transport, and processing. Therefore, high income countries experience a 10% reduction in food waste, upper middle income countries experience a 5% reduction in waste and losses each, and lower middle income countries reduce food losses by 10%.

The third scenario follows the procedure of the second scenario while scaling the reductions by a factor of 2. This is a more ambitious, yet feasible goal for the APEC region as a whole. Therefore, high income countries experience a 20% reduction in food waste, upper middle income countries experience a 10% reduction in waste and losses each, and lower middle income countries reduce food losses by 20%.

The fourth scenario includes a 100% tariff reduction for grains in the lower middle income regions and a 10% export tax increase within Thailand and Viet Nam.

Lastly, the fifth scenario considers a 1% increase in the total factor productivity within the manufacturing and service sectors of the lower-middle income countries.

Results

GDP growth results appear fairly negligible with the exception of the fifth scenario, which generates a 1% increase in GDP for lower middle income economies.

Food prices, as measured through an index of food prices weighted by expenditure share, decrease in the first three scenarios with the third scenario displaying the largest effect for all three regions. In contrast, tariff reductions do not affect prices in a significant fashion while productivity growth causes prices to rise within the lower middle income economies.

In contrast, food demand decreases for high income countries in the first three scenarios, as less food waste implies lower demand for food. Similar cases occur for the upper middle and lower middle economies within the first scenario. However, under the second and third scenario demand for food increases in these countries as diminished losses raise supply, which in turn

allows prices to decrease. Lastly, under tariff reductions food demand barely changes while a productivity increase enables lower income countries to purchase more food, thus raising demand.

Food security for lower middle income APEC members is most positively affected under scenario 2 and 3, which increases demand for domestic products while diminishing demand for imported goods. Furthermore, the low skill wages to rice price ratio, a ratio that captures how fast the wages of unskilled labor rise compared to rice prices, shows similar strong gains. Thus, an approach as outlined in scenario 2 and 3 will make lower middle income APEC members more resilient to global price fluctuations.

Lastly, welfare, as measured by equivalent variation, increases significantly under scenario 2 and 3. In particular, estimates for scenario 2 and 3 indicate a 14.3bil and 28.1bil US$ welfare increase, respectively. This gain stems predominantly from an increase in competitiveness within the upper and lower middle income economies. In contrast, scenario1 shows minimal welfare gains while scenario 4 and 5 reduce welfare within APEC.

Conclusion and Recommendation

The results of this study indicate that food loss and waste reduction carries the potential to severely increase human welfare in a nutritional and economic aspect. However, it is important to keep in mind that the results presented in this paper are what-if scenarios that do not consider the costs of food loss and waste reduction. Thus, they do not serve as an economic forecast, but as a maximum boundary for possible investments into food loss and waste.

Comparatively, the 10% food loss and waste reduction set in the *APEC Action Plan for Reducing Food Loss and Waste (2014)* is less ambitious when compared on an international scale. As economic benefits are tied into food loss and waste reduction, a more ambitious target such as a 50% waste and loss reduction of the Sustainable Development Goals (SDG) of the United Nations should be considered.

Section 3: Member Economy Reports on Food Waste

People's Republic of China – Mrs. Xia Danping
Food loss and Waste analysis in the People's Republic of China focuses on the entire food chain. As a staple crop, the situation of grain losses is important. Currently, roughly 50% of grain produced ends being stored instead of immediately sold. However, poor storage facilities and techniques contribute to degradation in quality and quantity. Similarly, excessive processing and spillage during transportation further contributes to grain losses. In response the State Administration of Grain of China (SAG) is launched a 3 year initiative in 2015 to study food losses and waste in grain production. Regarding consumer behavior, the SAG surveys households in 12 provinces in 11 regions, which generates a sample size of over 30,000 responses; the information gathered includes details on consumption records and general household information. However, as waste quantities were self-reported, respondents struggled accurately accounting for waste generated. To counter this complication, the SAG implemented a

novel measuring mechanism using WeChat, a popular chat application. Instead of self-reporting, participants take pictures of their food before and after consumption; these pictures are subsequently sent to the SAG which then more accurately estimates the volume of food waste.

Furthermore, the SAG is currently working on raising awareness of food loss and waste issues. Initiatives, such as the "n+1" ordering style, which encourages people to order dishes totaling the number of people at the table plus one, are designed to prevent excessive food orders. The "clear your plate" campaign invites participants to upload a picture of their dishes before and after eating to social media to raise awareness of food waste. Additionally, the SAG is encouraging cafeterias and dining halls to reduce portion sizes to avoid unnecessary food waste.

The SAG also promotes campaigns targeted at school students and family consumers. Events such as the World Food Day, held on October 16th of every year, generate public awareness and help educate all layers of society. By encouraging consumers through social media and improving laws and regulations, the SAG aims to diminish food waste in China; a particular focus is set on diminishing food waste generated by overconsumption of food, as many modern health complications are tied to poor and excessive diet choices.

Indonesia – Mr. Apriyanto Dwi Nugroho

Currently the supply chain in Indonesia consists of 5 to 6 steps, enabling higher losses as goods move from farm to fork. To alleviate this issue, the Indonesian government is taking steps to allow for a more direct distribution to consumers.

The Ministry of Agriculture and National Agency of Statistics conducted a National survey in 2012 among 12 Province considered the main paddy rice producers. In total 13,200 households and 3.300 milling unit were surveyed. Ultimately, the goal was to estimate food losses and waste in Indonesia. Through this survey, it was uncovered that 1.36% is lost in harvesting, 16.88% in drying, and 37.15% in milling.

On the consumer side, a 2013 study by Novitasai, Anriany, and Maritianto investigated food waste volumes by surveying 32 restaurants. In Indonesia, the highest amount of per capita waste is generated by those aged 20 to 59. Furthermore, a case study on three different restaurants indicated that portion size appears to directly influence rice waste while not being tied to vegetable and other waste.

In 2008, Law No. 18 was passed for Municipal Solid Waste (MSW), which encourages a reduction and recycling of food loss and waste. To comply with this reduction, clearer labeling, a reduction in processing, and recycling of food scraps are encouraged.

To further investigate the dimensions of household food waste, the Ministry of Agriculture designed a survey that collects information on calorie intake as well as socioeconomic characteristics. Furthermore, similar surveys are being conducted on different sectors of the food industry, which can then be used to estimate a total amount of waste generated.

Current measures to fight food loss and waste are public education campaigns, improvements in logistics systems, a comprehensive produce grading system, as well as adopting practical farming technology. Additionally, encouraging a reduction or options in portion sizes are under consideration.

Republic of Korea – Ms. Dawoom Park

In 2010, Korea generated about 14,000 tons of food waste per day, roughly 0.28 kg per capita, which is higher than in France or Sweden. However, food waste has been decreasing in Korea since 2007. Almost 70% of the total food waste is generated at households and small retail stores or restaurants. This is tied inherently to Korean culture, as a plethora of side dishes is generally served with every meal. As a result, more food is served than needed; this dietary pattern is a main factor contributing to the high per capita rates of food waste.

Currently, the handling of food losses and waste is rather complex in Korea, as a variety of agencies are responsible depending on the point of occurrence. For example, while the Ministry of Agriculture is responsible for production losses, the Ministry of Environment is in charge of overall waste statistics. Therefore, multiple agencies are in charge of estimating and reporting food losses and waste.

Initially, Korea took an approach toward turning food waste into resources. However, the focus switched towards a more efficient prevention strategy as of recently. Currently, two main categories of policies are being enacted: the first is a weight-rate disposal scheme and the second are measures to reduce food waste. The former is a volume-based fee system which has been implemented across Korea in 2010. In this system, households pay for waste processing depending on the volume of trash generated. The latter measure is tied to the aforementioned specifics of Korean food culture. Current efforts are on raising consumer awareness on the dimensions of food waste. In particular, schools, government agencies, restaurants, and universities are targeted as they can aid in educating consumers. In 2010, 10 months after the campaign start, first successes were reported as food waste was reduced by 40% in government agencies and by 36% in universities.

More recent developments include a weight-based disposal scheme that will allow for more accurate data collection. Combating food waste and loss is especially important for Korea due to its low food self-sufficiency rate. Educating consumers and ensuring cooperation between different government agencies will help in reducing waste in Korea.

Malaysia – Dr. Razali bin Mustaffa

In Malaysia, 45% of all solid waste is food waste, which is roughly 3,000 tons of preventable food waste daily. Relatively low disposal costs and convictions regarding the edibility of retail food waste contribute to the amount of waste produced. Malaysia aims to reduce greenhouse gas emissions by 45% by 2030 – following the action plan submitted to the UN Climate Change Conference Paris; food waste is currently the largest contributor to greenhouse gas emissions in Malaysia.

Within the retail system losses were highest amongst wholesalers. As an intermediate between producers and supermarkets, small markets, and exporters, wholesalers incur 65% of total food waste.

Within food production in 1985 paddy rice postharvest losses were about 28.5% which reduced to about 11.31% in 2015. Losses were particularly high during storage, milling, drying, and transportation, which have all improved over time. Comparatively, Malaysia fares well in paddy rice post-harvest losses, as estimates range from 20 to 25% on average for Southeast Asia. Fruits, on the other hand, incur post-harvest losses between 20 to 50%, which is substantially higher than 5 to 25% losses in developed countries.

The Malaysian Agricultural Research and Development Institute identified a plethora of issues contributing to post harvest losses in rice and fruits and vegetables. For rice, high post-harvest losses can be diminished through harvesting at 90% maturity and improvements in packaging, harvesting, and milling technology. Similarly, improvements in transportation and packaging as well as minimally processed products are expected to yield substantial improvements in losses among fruits and vegetables.

Furthermore, initiatives such as MyGAP and SALM are encouraging farmers to utilize best practices in farming while also encouraging organic agriculture. Despite awareness of the benefits of composting, many farmers are not yet composting food losses and waste.

Most cited reasons for losses in postharvest are a lack of knowledge (30%), a lack of funds (25%), a lack of infrastructure (20%, especially cold rooms, refrigerated trucks, good roads to farms), and a lack of good workers (10%).

Additional data collection is conducted by a wide variety of agencies in Malaysia, such as the FOMCA (Federation of Malaysian Consumers Associations) and hypermarkets like TESCO, Giant, AEON, and Mydin

Currently, the SWCorp is working on legislation regarding the separation of solid waste in cooperation with the Ministry of Urban Wellbeing, Housing and Local Government, Malaysia. Total food waste is about 40%, about 15,000 tons daily, of household waste, which if saved could feed 2 million people in hunger. About 20% of the daily waste could still be consumed and is therefore wasted. A study by SWCorp found the average amount spent on food for a 5 person household is RM900. Thus about RM225 is being thrown away every month, which cumulates to about RM2700 every year.

The MySaveFood campaign received funding from the FAO in 2015 and aims to establish a network through which it can raise public awareness. Food loss and waste can be effectively fought if a strong network of the public sector, private sector, NGOs and passionate individuals is established. The campaign also educates citizens through schools programs, information events, discussion groups, and mass media events.

Peru – Mr. Fernando Martinez

There is an active relationship between the Peruvian retail sector and consumers. Law number 29571, known as Consumers Defense Code, introduces a consumer complaints system; the system is designed to give access to safe products and services as well as an effective mechanism of protection. The the complaints ledger allows consumers to record complaints or claims related to products or services. These claims are subsequently analyzed by INDECOPI (the National Competition Authority) that must determine the validity and possible penalty on a case by case basis. This procedure affects foods loss and waste in the Peruvian retail sector as improper inventory management can leas to punishments by INDECOPI.

The Peruvian institutions are principally evaluating food loss in some crops but not food waste. For example, the international Potato Center is implementing a qualitative study of the loss in potato value chain. By surveying producers, processors and traders in major local and regional markets the main causes for the loss in potato value chain are studied. Through these efforts, key loss factors were identified such as overcrowding, lengthy loading and unloading, lack of safety and quality standards in warehouses, rough handling, and quality based selection.

As part of its "Competitiveness and Sustainability of Agricultural Chains for Food Security and Economic Development" project, the Inter-American Institute of Cooperation for Agriculture(IICA) is reviewing and updating its Methodology for the Evaluation of Agri-Food Chains(MECA). The methodology was developed in1991to increase institutional capacities to reduce food losses along agricultural chains. The methodology identifies the common causes and origin of losses through the analysis of agricultural chains consisting of 26 components and 4 categories. The prioritized chains are maize and potato and the investigation is in coordination with the International Potato Center; the study is expected to include policy proposals and suggestions for improvement.

The Ministry of Foreign Trade and Tourism(MINCETUR), in a joint effort with the World Bank and State Secretariat for Economic Affairs(SECO) of Switzerland, published the document "Comprehensive analysis of the logistics chain in 5 Peruvian export chains: cocoa, coffee, onion, quinoa and grapes". This study found that the principal causes for losses in the logistics process are poor packaging, inadequate cooling, poor storage, and wrong transportation; in total, the aforementioned factors represent around 10%-20% of total logistics cost. In order to reduce food loss and waste, Peru considers it necessary to push for reduction measures such as studying the applications of food loss and waste, the development of apps to help consumers cut food waste, and public policies to reduce food waste at the consumer level.

The Peruvian Food Bank is a Non Governmental Organization(NGO) founded in 2015 and provides social services managing donations of food and hygiene products. Furthermore, it aids in supplying private enterprises. That is, the Peruvian Food Bank acquires products that cannot be sold but are still edible or usable and delivers these products to charities and similar organizations.

The Philippines – Dr. Amelita R. Salvador

The Philippine Center for Postharvest Development and Mechanization (PhilMech) follows a twin mandate of research and development. The organization conducts studies on a wide range of topics such as efficient dehydration, product handling and storage, agricultural waste and by-product utilization, pest and disease prevention and control, and appropriate mechanization technology. Once feasibility is established, PhilMech teaches farmers the use of new technologies and aids in the adoption of advanced management techniques. Through a modernization process, PhilMech aims to reduce food losses and waste within the Philippines.

Due to a lack of accurate data in the Philippines, PhilMech decided to investigate post-harvest losses in paddy rice; it is estimated that roughly 16.47% of rice is lost after harvest, the majority of which occurs at the milling stage (5.52%).

On the consumer side, losses are estimated to be around 9g per person per day, which is roughly two tablespoons worth of rice. A back of the envelope calculation totals this to 630 tons of daily rice wastage; considering the reality of hunger in the Philippines, such wasteful behavior is concerning. However, while the numbers seem disproportionate, a large amount of wasted food gets recycled as animal feed.

Some other crops that were investigated are mangos, bananas, cabbage, onions, eggplants, potatoes, and carrots. Mangos, onions, and carrots incur most of their losses in the retail stages while bananas, cabbages, eggplants, potatoes and carrots experience losses in the post-harvest stage.

In the case of eggplants, transportation and inadequate containers are key contributors to food losses. As much as 35% of produce is lost during transportation. Sweet potatoes , on the other hand, get mostly damaged during harvesting as the machines used are rather crude; however, research is conducted in less damaging harvesting methods.

To combat the areas in which waste occurs, PhilMech lobbied to have modern rice mills funded and made available to qualified farmers. The modern rice mils increased milling recovery from 60 to 65%. Furthermore, the rice husks generated in the milling process are subsequently used as fuel for power generation; the entirety of rice is used productively instead of wasted. Furthermore, current efforts exist to encourage the consumption of brown rice. Government canteens and cafeterias serve brown rice on specified days to acclimate Philippinos to brown rice. Furthermore, research on small scale mills with a milling recovery as high as 72% is currently conducted.

Other technologies currently under development include a cable car transportation system that is aimed to result in lower losses compared to animal based transport. Furthermore, additional investments into cold chains and improved packaging materials are currently deployed to minimize food waste and losses. However, developments do not solely focus on technological aspects as market studies are conducted on minimally processed onions and coconut water based energy drinks.

Singapore – Ms. Hou Jih Wong

Food waste accounts for about 10% of the total waste generated in Singapore. The total amount in 2015 was 785,500 tons of food waste of which 13% is recycled. Some of the food waste is repurposed into animal feed while the majority is sent to incineration facilities. Food waste has grown by 50% over the past 10 years, as increasing affluence makes discarding food easier. Furthermore, demand for aesthetically pleasing food as well as high expectations of freshness have driven this development. Due to the limited agricultural sector, Singapore does not experience high demand for re-purposing food waste as animal feed as is the case in other countries.

Therefore, Singapore adapted the "Sustainable Singapore 2015" blueprint, which aims to transform Singapore into a zero waste nation. To achieve this goal, a hierarchy of waste reduction was established. The highest priority was given to food waste prevention followed by charitable donations. Recycling and recovery are given lower priority as only limited demand for food waste exists in Singapore. Furthermore, two pilot programs for co-digestion plants are in progress. A co-digestion plant allows for food waste, which is collected from hospitals and government facilities, to be turned into biogas.

Consumer surveys in Singapore indicate that eight out of ten are concerned about throwing away food. However, the survey also indicated that there exists an unwillingness to compromise on freshness and quality; prime reason for the discarding of food was unpleasant smell or diminished taste. Most listed reasons to justify reductions in food waste were additional savings and environmental protection. Furthermore, six out of ten respondents indicated that they would waste less food if they had better information available on how to fully utilize and safely store food.

Based on this information, an outreach program was started that encourages adoption of smart food purchasing, as well as giving guidelines on preparation and storage guidance. The program uses multiple channels such as conventional media, social media, and educational institutions.

Chinese Taipei – Prof. Shih-Hsun Hsu

In Chinese Taipei, data gathering is not centralized and multiple organizations are in charge of collecting information. Furthermore, the retail landscape is diverse as a multitude of different businesses, such as traditional markets, supermarkets, hypermarkets and so forth exist. According to 2014 Council of Agriculture statistics, there are a total 300,000 agri-food businesses of which about 80% (237,000) are food retailers and restaurants.

According to statistics published by the Environmental Protection Administration (EPA), total leftovers recycled in Chinese Taipei in 2014 were estimated at 72 million tons. Food waste in Chinese Taipei has been decreasing from around 96 kg per capita in 2003 to 52kg per capita in 2014. However, the number published by the EPA is likely underestimating the true extent of food waste, as it only counts food waste recycled by environmental agencies, communities, campuses, and government organizations. Instead, a more comprehensive overview of food waste in the entire food supply chain can be

generated using a Mass Flow model; the model is based on a framework proposed in Global Food Losses and Food Waste (2011) by the FAO and allows for estimates across five stages of the food supply chain.

Total food loss and waste in Chinese Taipei is estimated at 3.68 million tons per year, which amounts to 158.41 kg per capita. The majority of waste is considered consumption waste at roughly 80.09 kg per capita; however, the overall levels of waste in Chinese Taipei are relatively low as the APEC wide average per capita amount of waste and losses is 242kg

According to Allen (2012), there are 319 townships that had food waste recycling systems in 2009. 75% of food waste gets re-purposed as pig feed while the remainder is composted.

Currently, the Taiwanese government is actively engaging in food waste and loss reduction measures. A major policy from the central government, the Act on Governing Food Safety and Sanitation, is currently being implemented by the Food and Drug Administration as well as the Ministry of Health and Welfare. The measure is aiming to encourage retailers to minimize food losses and waste. Furthermore, in June 2016, a draft for legislature to establish a public food bank has been under discussion.

Similarly, local governments are also engaging in food loss and waste reduction campaigns. The "Better Market, Happy Taipei" (2016) campaign encourages consumers to buy locally produced and seasonal produce to reduce environmental costs as well as food waste. The Taichung city government has been a pioneer in Chinese Taipei by establishing the Taichung Food Bank in January 2016 under cooperation with the Red Cross. In total, it opened 3 food bank branches and 30 distribution centers to aid those in need as well as reducing food losses and waste. The food bank manages to supply roughly 3000 households monthly and stocks a wide variety of items from food to shoes. Active engagement by the retail sector can also be observed. The Taipei Agricultural Products Marketing Company estimates that roughly 20 to 30 tons of fruits and vegetables are wasted daily in-house. Instead of landfilling the waste, recommendations for energy recovery were given. Furthermore, management at the I-MEI Foods Company considers labeling only a best before date as insufficient. Instead, a dual labeling standard that offers a best before and expiry date was suggested.

Following Canning (2011) research was conducted into the Food Dollar Series of Chinese Taipei, i.e. the division of a dollar spent on food among actors along the entire food supply chain, by using input-output data from 2001 to 2011. The results indicate that NT100 spent by consumers on domestically produced food will net NT22.7 (22.7%) to farmers in Chinese Taipei. Comparatively, this is a high share as farmers in the U.S. and Canada have a 14.1% and 17% share, respectively. Therefore, some room to incentivize farmers to invest in better harvesting technologies might exist.

Thailand – Mr. Chusak Chuenprayoth
In Thailand, farming cooperatives strive to improve the food loss and waste situation. One such example is from Dontoom farm, which consists of about 30 smallholder

farmers from 13 families. Located near Bangkok, the cooperative focuses on planting Morning Glory. The produce is for retailers in Thailand and the UK and their their net income is roughly 6,000 US$ per person annually. The group cooperates with the international food security center, GLOBALG.A.P (Global Partnership for Good Agricultural Practice). and THAIGAP. Working as a group allows them to avoid hiring outside labor and invest in infrastructure. By having a packaging center closely located to the farms, the coop is able to have harvested morning glory arrive in the United Kingdom on the following day. Furthermore, any waste generated is used as feed for the edible fish of the nearby lake.

Retailers are also involved in reducing food loss and waste. While retail waste is estimated to be less than 1% in Thailand, compared to 15% in consumption and a 31% total, Tesco Lotus is raising awareness among consumers while also aiming to reduce supply losses. By educating and supporting farmers to plant quantities matching demand, Tesco Lotus reduced pre-purchase rejction from 2.15% to 0.13%. Furthermore, instead of purchasing from other wholesalers, Tesco Lotus began directly sourcing from Farmers and therefore minimizing logistics costs and travel time of produce. Lastly, multiple large market chains are donating damaged or unsellable food to charitable organizations Social media campaigns to educate consumers on food waste are held in cooperation with the FAO. The campaign encourages consumers to critically examine food purchasing behavior while also educating about proper food storage methods.

Viet Nam – Mr. Pham Cong Dung
The retail landscape in Viet Nam consists of 724 supermarkets,132 commercial centers, nearly 9000 traditional markets and hundreds of convenient shops. Gross retail sales of goods and services in Vietnam are about 130 billion US$ and the market share for traditional and modern retail channels are 80% and 20%, respectively. The population of Vietnam is 90 million of which 67% live in rural areas; the poverty rate in rural Viet Nam is nearly 30% according to the Human Poverty Index compared to a National Poverty Index of 13%.

Currently, only few studies on food loss and waste in Vietnam exist. One study was conducted in 2007 and investigates post-harvest losses in rice, maize, soybeans, and groundnuts. The study found that losses in the Mekong Delta are higher than in the Red River Delta at 13.7% and 11.6%, respectively. Furthermore, the study suggests that about 70% of all post harvest losses incurred are at the drying, storage, and milling stages. Another study on losses in rice at the Mekong River Delta as well as coffee beans in Central Viet Nam has been funded by the World Bank in 2016

A current initiative is the "Stop Wasting Food in Vietnam" program in Ho Chi Minh City. Initiated by NGOs, the program began in 2015 and is planned to run for 3 year with the main focus being on awareness raising on regular and social media. Furthermore, 30 restaurants are cooperating to provide food for underprivileged children.

Summary of Proceedings Day 2

Panel Session 4: Innovations for Food Waste Reduction

Presentation 1: Approaches to Reducing Food Loss in Kyoto City – Ms. Junko Katsumi, Director of Waste Reduction Promotion, Environment Policy Bureau, City of Kyoto

Roadmap: Waste in Kyoto – Measurement Methods – Food Loss Prevention Actions

Waste in Kyoto

Waste in Kyoto was increasing for about 40 years before reaching a peak at 820,000 tons in the year 2000. Active waste reduction measures were successful in decreasing overall waste to 440,000 tons by 2015. Currently, processing this amount of waste costs the city 26.1bil Yen per year, which is roughly 250mil US$, making it a key reason to further reduce food loss and waste; the ultimate goal being a reduction to 390,000 tons by 2020.

On further breakdown, 51% of the waste generated in 2015, which amounts to roughly 225,000 tons, came from households while the remaining 49% , which totals to roughly 215,000 tons, were attributable to businesses and public entities. Food waste in particular was 194,000 tons and 188,000 tons for households and businesses, respectively. Therefore food waste constitutes a substantial portion of waste generated by both sides.

Measurement Methods

The city of Kyoto has conducted empirical waste studies for the past 35 years, allowing it to access a wealth of data to pursue its goal to become the most beautiful city in the world. Household waste is measured by sampling 268 bags of trash generated by 216 houses. The bags are subsequently taken to processing facilities and then classified and measured by hand. Classification is done in a two-stage scheme, with the first stage determining rough waste group, such as food, paper, plastic, and so forth, while the second stage categorizes food waste more accurately into three groups: untouched food, leftovers, and cooking waste. Therefore, of total food waste generated by households, 60.6% was cooking waste, 22.3% leftovers, and 17.1% untouched food. A remarkable discovery was that 31.9% of untouched food is thrown away before the expiration date.

Similarly, 137 businesses are categorized by type of establishment into one of 37 categories. The waste produced is measured and classified in the aforementioned two-stage scheme. In terms of food waste, leftovers are particularly high among restaurants while retailers suffer from high amounts of untouched food at 23% and 32% of total business food losses, respectively.

Food Loss Prevention Actions

Utilizing the data available, the city engages citizens and businesses through a multitude of initiatives. Public relations campaigns encourage restaurants to provide take-home containers and patrons to eat without leaving leftovers. In a similar vein, retailers are asked to minimize packaging and improve labeling to diminish premature discarding of food.

Furthermore, mascot characters serve to encourage households and young children to participate while businesses that follow best practices are rewarded with certificates and designated take-home containers. Thus, Kyoto uses the wealth of data available to pursue its goal to further reduce food waste by setting quantitative targets, ordinance, and campaigns.

Presentation 2: Approaches to Reducing Food Loss and Waste in Retail and Logistic Industry in the Asia Pacific Region – Prof. Tzong-Ru Lee

Roadmap: The Role of Logistics in Food Waste - Methods to Improve Logistic Chains - Consumer Engagement

The Role of Logistics in Food Waste

Logistics, i.e. the process of planning and implementing efficient transportation, are crucial in the improvement of the food loss and waste situation in the APEC region. Issues such as wrong scheduling, i.e. the ordering of excess quantities during busy seasons that subsequently need to be returned, and product characteristics, such as easily damaged produce, contribute to food loss and waste. Therefore, improving data collection and logistics efficiency are important considerations when tackling food loss and waste.

Methods to Improve Logistic Chains

Approaches to solving those supply chain issues are manifold. Traditional methods, such as data collection and simulations allow identifying weak spots in the supply chain for targeted solutions. Similarly, modern methods such as big data analysis and supply chain management further help in identifying areas to improve in logistics. Using modern technology allows minimizing touch-points, that is points at which interaction with food occurs, and thus reduce accidental bruising and damaging. Lastly, just in time supply methods, such as employed in Taiwanese sunset markets, can also help in minimizing food waste as all produce is procured, shipped, and sold within a day.

Consumer Engagement

However, improving logistics will only help fight losses for suppliers and retailers. It is similarly important to engage customers and generate a dialogue that encourages reflecting on food waste. Initiatives should aim to educate consumers to properly store food to avoid premature spoilage. Furthermore, when grocery shopping, customers

should minimize physical contact with produce while also considering buying visually less appealing fruits and vegetables.

Panel Session 5: Survey Implementation and Challenges in Retail Sector

Presentation 1: Policy Impacts and Determinants of Food Loss and Waste in Korea – Prof. Doo-Bong Han

Roadmap: Food Waste in Korea - Policy Actions on Supply - Policy Actions on Demand

Food Waste in Korea

Food waste can be considered a form of depreciation on food production and is therefore detrimental to economic growth. While depreciation is a thoroughly studied subject, food loss and waste has not been given the same attention. Especially the efficacy of food waste and loss reduction policies needs additional investigation. Therefore establishing and studying a counter-factual, that is a "what-if" scenario that considers no change in policy, is worth pursuing.

Korea is heavily dependent on outside food imports, while still incurring substantial food loss and waste. Studying past measures to address food loss and waste is valuable in reducing losses even further. In particular, cereal and vegetables constitute roughly 80% of total food loss and waste in Korea and thus deserve special attention.

Policy Actions on Supply

Three broad measures were taken on the supply side to minimize food losses: maximizing distribution efficiency (1980 to mid-1990s), improving measures to ensure food quality (mid 1990s to mid-2000s), and supply chain management (mid 2000s to present). To study each measures impact on the two high loss categories, cereal and vegetables, a regression analysis was conducted that included factors such as level of logistics development, precipitation, typhoon occurrence, and total food supply.

For cereal, precipitation, logistics efficiency, and amount of supply were positively correlated with food losses. Therefore, an increase in either one of those factors correlates with higher losses. Similarly, fruits appear to be negatively correlated with logistic developments. One possible explanation for this discrepancy is that logistics development is tied to economic development, and therefore higher losses occur with higher income. In contrast, vegetables benefit from more developed infrastructure and logistics.

Policy Actions on Demand

Changes in the societal structure of Korea have also contributed to increases in food waste. In addition to an increase in one person households, rising incomes have enabled consumers to eat at restaurants more often. Korean food culture encourages a plethora of smaller side dishes to be prepared, which exacerbates the food waste in restaurants as not all sides are eaten. Over time, the Korean government enacted a variety of measures to encourage a reduction in food waste. In 1995, the Korean government pioneered a volume based waste fee (VBWF) system; instead of a flat waste collection fee, increasing amounts of waste are charged at higher rates. This is done via government issued plastic bags that become more expensive with volume. The VBWF system helped in reducing municipal food waste by 13.96% over the 1994 to 2004 period. More recently, the Korean government enacted measures to separate waste by type.

Furthermore, the Korean government is encouraging citizens and restaurants to reduce food waste voluntarily. Campaigns to increase food donations and to limit side dishes are encouraging all strata of society to participate.

Similar to the food loss case, a regression analysis was conducted on food waste levels. Using data from 1992 to 2014, the study investigated the correlation between food waste and variables such as population size,   government budget for waste management, the inclusion of the VBFW system, and mandatory food separation. Results indicate that VBFW system helped reducing food waste while the separation strategy increased food waste. However, the reason why the separation policy contributes to food waste requires further analysis.

Presentation 2: Existing International Efforts in Data Collection, Impact Assessment and Reduction in APEC Region – Dr. Witsanu Attavanich

Roadmap: International Efforts In Quantifying Food Waste - National Efforts In Quantifying Food Waste - Impact Assessments - Efforts Within APEC

International Efforts In Quantifying Food Waste

At the international level, the UN's Food and Agricultural Organization (FAO) is the main organization collecting data. The statistics collected by the FAO are widely used in a range of international publications and research papers. Thi et al (2014) uses this data to show that food waste per capita displays an "inverse u" shaped relationship with GNI, thus food waste increases initially with economic development but diminishes after a certain threshold value.

National Efforts In Quantifying Food Waste

On the national level, in contrast, data collection and availability are heavily dependent on the country in question. In the United States, for example, organizations such as ReFED, USDA, and US EPA are main providers of data. ReFED estimates that within the U.S. roughly 85% of food losses and waste occur at the retail and household level.

Comprehensive data is sparser in the SEA region; however, a noteworthy agency is the Singaporean National Environmental Agency. The agency collects information on a wide range of topics such as consumer behavior and supermarket waste. Similarly, the Pollution Control Department in Thailand collects data on supply chain losses and municipal waste generation. Lastly, Australia provides and maintains a public waste database; unfortunately, reporting does not follow a unified standard and is therefore limited in comparability.

The FAO reports that while the need for comparable and substantial data is significant, currently available data focuses on select industries or stages of the supply chain. Furthermore, complexities in measurement, differences in products, as well as a lack of international guidelines make establishing comparable data difficult.

Impact Assessments

Impact assessments of food loss and waste face a similar situation, as the current literature focuses predominantly on resource usage instead of transmission mechanisms and welfare changes. Using the Aglink-Cosimo model for the ten-year period 2014-23, Okawa (2015) focuses on the trade impacts of a food waste and loss reduction. The research finds that reductions in food waste will substantially benefit consumers as less meat products are wasted and therefore lower amounts need to be purchased. However, this consequently implies that producers of meats will suffer due to lower demand.

Efforts Within APEC

Efforts to reduce food waste and losses in South East Asia are generally focused on campaigns towards civil society. In Malaysia, initiatives such as MySaveFood aim to educate households on key factors that contribute to food spoilage and how to minimize waste. Similarly, the Ministry of Education in Thailand is actively cooperating with the FAO in educating children on food losses and waste.

While efforts are predominantly on the consumer side, retailers have begun in adopting measures to manage food losses as well. Tesco Lotus of Thailand, for example, is donating food to those in need while also encouraging consumers to be mindful of food waste. Furthermore, groups like the Royal Project Foundation Bangkok are working on improving packaging methods to reduce accidental food damage and bettering the image of visually less appealing produce.

Panel Session 6: Public- Private Partnerships and Bottlenecks for Policy Implementation – Incentives and Best Practices

Presentation 1: Reducing Food Waste Actions in Consumer and Retailer Levels – Ms. Po-Lee Sham

Roadmap: Organizational Structure – Community Engagement – Waste Prevention
Food Co-Op – Retailer Survey and Government Recommendations

Organizational Structure

The Homemakers United Foundation (HUF) is a Taiwanese grass-roots movement
that began in 1987 and was formally established in 1989. It employs and educates
women, in particular mothers, on policy issues such as food loss and waste. In 2001,
the Homemakers Union Consumers Co-op(HUCC) was funded, which purchases and
delivers food; it currently features 55 delivery stores. These stores serve 70,000
families and are connected to 110 farmers and producers across Taiwan.
Furthermore, the initiative has a total of 13 full-time employees, 120 volunteers, and
a total of 20,000 supporters on Facebook.

Community Engagement

HUF began a trash sorting program in 1989 and realized that 40 to 60% of waste
generated by households consists of leftover food. Capitalizing on this information,
HUF began to study the use of food waste in composting and invited 1200 Taipei City
households in 2000 to join a pilot composting program. Following new legislation in
2006 that mandated a separation of different types of waste, HUF members began
reminding people at trash pickup points of correct waste separation.

Despite these efforts, research conducted in 2013 indicated that 7.5million waste bins
of leftovers are still incinerated annually. If stacked vertically, these trash bins would
reach a height of 13,000 Taipei 101 buildings. Thus, instead of focusing on food waste
recycling, a new emphasis on food waste prevention was set.

Consequently, a new initiative was launched in 2013 called the "Cherish Food
Program." The program features educational activities such as workshops and forums
to educate women on food loss and waste while also surveying participants for data
collection. Furthermore, HUF engages students from the elementary to
undergraduate level in activities that solidify the importance of cherishing food and
the environment.

Waste Prevention Food Co-Op

The co-op (HUCC) is a closed system that exclusively serves member households.
Before becoming eligible, prospective members attend a 2 hours introduction course;
after becoming a member, roughly 900 products, which are sourced from local farms,
are available for purchase. A strong emphasis is placed on organic and sustainable
farming when choosing products for inventory. Additionally, to ensure minimal food
waste modern cooling chains and packaging are utilized; waste reduction is not
limited to technological aspects as visually unappealing produce is stocked as well.

Inventory management is a key issue for HUCC, as food is produced without the use of preservatives. In 2014, the co-op attempted to forecast inventories for festival heavy seasons using past data and preorder discounts. Despite these efforts, significant losses were incurred due to overstocking of moon cakes and frozen food products. In response, pre-orders were re-designed in 2015 which removed products from the physical store and only made them available for pre-order sans discount. While initial complaints were high, eventually customers got used to the system and food waste was reduced from the previous years.

Retailer Survey and Government Recommendations

To gain an understanding of retail food waste, HUF surveyed 15 chain retailers of which 7 replied. All responding retailers agreed that reducing food waste will be beneficial to the environment and all but one stated that they are currently taking actions. Furthermore, losses for hypermarkets and supermarkets are estimated to be between 0.5% to 3% and 0.01% to 1.2% of annual sales, respectively. Given sales statistics, waste can be estimated to total to $4 billion.

Ultimately, the Taiwanese government is encouraged to coordinate and set up targets for food loss and waste reduction in line with international efforts such as the Sustainable Development Goals. Methods such as incentivizing food donations and educating consumers are some of the recommended steps in reducing food loss and waste in Taiwan.

Presentation 2: Waste Not, Want Not: Saving Food and the Environment - *Tse-Xin Organic Agriculture Foundation*

Tse-Xin Organic Agriculture Foundation is associated with the Buddhist Bliss and Wisdom Organization; the organization includes about 70,000 members, 3 schools, and 2,000 students and teachers.

In 1995 organic agriculture was unknown in Chinese Taipei. The founder and spiritual master of the Bliss and Wisdom Organization, the late Venerable Shih, Jih Chang, promoted organic farming as a mean to cherish the work of farmers. His efforts developed into a system designed to provide organic products to the public. Through cooperation with farmers, the BWO established a retail network.

Instead of discarding visually unappealing produce, the monastery decided to use the products for cooking; products such as pancakes or juice do not depend heavily on the initial appearance of the product. In order to inspire similar food saving in others, the organization aims to educate consumers. Furthermore, by establishing a food grading system, produce that is unlikely to be sold can be used for alternative uses.

In the food recovery programs, after identifying product quality, appearance, and freshness products are sent to schools, mass events, cafeterias associated with the organization. Thus,. 350 tons, or 7% of production, were used in the food recovery programs of 2015. Additionally, some products like cabbage residue are used as animal feed in the associated life projection park. Lastly, crops destroyed in typhoons are recovered by processing unappealing pomelo into cake, jam, and juice.

Presentation 3: Is There a Desirable Pathway to Reach a Food-Secured Future in APEC? – Prof. Ching-Cheng Chang

According to food loss and waste assessments conducted by National Taiwan University based on 2011 data, 670 million mega tons of food is discarded annually in the APEC region. This volume accounts for roughly 25% of total supply/utilization of the region and is equivalent to economic losses of 310~336 billion US$. In relative terms, the loss constitutes 16.4% of household consumption and 19.6% of total value-added in APEC.

Study results indicate that reductions in food losses and waste could lead to an increase in welfare as food prices decrease and therefore increase food demand. In particular, lower middle income APEC economies will experience faster wage than food price growth, thus strengthening food security. However, unlocking these gains is not free and reduction in food waste and losses is costly. Investments into hardware, human resources and infrastructure might be necessary to optimally decrease food loos and waste.

Currently, the significant amount of food losses indicates that the market is currently operating sub-optimally. Therefore, governments will play a key role in ensuring a sustainable decrease in food loss and waste. Aiding in the process of determining strategies to diminish food loss and waste is a crucial goal of the projects next year. Some key areas to focus on are nutrition security, food quality and safety, and human and environmental development.

Following the waste hierarchy, priority should be given to methods that prevent food loss and waste outright. Minimization, reuse, and recycling are also desirable strategies while energy recovery and disposable are less encouraged. However, the status quo within APEC is not well documented; therefore, the APEC Expert Consultation 2016 includes a waste survey to catalogue different waste reduction strategies of all member economies.

The survey is expected to be completed by the end of July and results will be presented at the seminar in Peru on September 22nd.