



Expert Working Group Meeting on Food Wastage in Southeast Asia

23–24 August 2012

Organised by the RSIS Centre for Non-Traditional Security (NTS) Studies

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SECURITY STUDIES



EXPERT WORKING GROUP MEETING ON FOOD WASTAGE IN SOUTHEAST ASIA

REPORT

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A Note on the Terms Used in This Report

The literature on food wastage typically defines ‘food loss’ as taking place at the production, post-harvest and processing stages of food supply chains. By contrast, ‘food waste’ typically occurs at the end of the food chain and is associated with the behaviour of retailers and consumers. The term ‘food wastage’ can be interpreted as the process or general phenomenon of potentially edible food being made unavailable through both waste and loss.

It should also be noted that research on and discussions of food wastage usually distinguish between industrialised countries and developing countries. Consumer and retail waste are seen to be more salient for industrialised

countries while post-harvest losses are considered the greater problem in developing countries. The discussions at this Expert Working Group Meeting reflect this to some extent. However, in the industrialising countries of Southeast Asia, increasingly wealthy cities exist side by side with agricultural sectors dominated by smallholder farming, which suggests that an urban-rural framework may be useful.

Finally, it should be noted that this report does not reflect a consensus view. Rather, it is a synopsis of the range of views contributed over the course of the Meeting.

Executive Summary

The wastage of food is one of the most salient yet under-recognised global issues in the effort to combat food insecurity. The implications of the estimated 30–50 per cent global food wastage for energy, soil, water and human resources are substantial. Just how significant is not clear: relatively little data is available on the intricacies of food wastage and its impact on the world's food systems. Southeast Asia as a region suffers from a lack of information on food wastage along supply chains in key food commodities. In order to address wastage issues, developing accurate and relevant information on the scope and causes of food wastage is essential.

Estimates suggest that up to 10 per cent of total global greenhouse gas emissions can be attributed to lost and wasted food. Beyond the environmental implications, food wastage has ramifications for food availability. Food prices and availability in some countries may be affected by the wastage of food traded on international markets. At the local level, losses on small farms impact the farmers and villagers who consume the food produced by those farms.

The causes of food wastage are situation-specific, but two broad trends are apparent. In developing countries, most food wastage occurs at the early stages of the supply chain such as harvesting, storage and transport, with relatively little waste occurring at the consumer level. In industrialised countries, on the other hand, consumer behaviour and government interventions that promote surplus production of particular food commodities are the major causes. However, this broad divide between developing and industrialised countries fails to capture the nuances of food wastage in Southeast Asia, including the fundamentally different trends found in urban and rural settings. In fact, emerging evidence suggests that consumer waste is increasing in the cities of industrialising China and Brazil, and in similar urban environments in Southeast Asia.

It is within the context of these issues that the RSIS Centre for Non-Traditional Security (NTS) Studies convened the Expert Working Group Meeting on Food Wastage in Southeast Asia, with the aim of building

knowledge and networks to address food wastage. This meeting, held on 23–24 August 2012 in Singapore, was supported by Singapore's National Security Coordination Secretariat (NSCS). It brought together 60 international and regional experts on food wastage, including researchers, government representatives, agronomists, post-harvest supply chain practitioners, retailers and civil society. Several key points emerged from the meeting, as articulated below.

- **The adoption of modern technologies in the early stages of supply chains (harvest, storage, transport) in Southeast Asia is still relatively low. There are thus potentially large benefits to prioritising interventions in this area.**

The interventions required to reduce wastage in the production-oriented and fragmented traditional supply chains of Asia are known but not as yet widely implemented. Of particular importance are measures aimed at the early stages of supply chains such as production planning (so as to align with market requirements); resource-efficient production and processing practices; modern preservation and packaging technologies (which will enhance food availability, safety and shelf life); and transportation and logistics. Such interventions are necessary because early-stage losses account for a majority of the food wastage in Asia. In India, for example, poor storage infrastructure alone leads to approximately 6 to 10 per cent of food grain stocks being damaged beyond edibility.

To support the needed interventions, the public sector would have to put in location-appropriate policies to create an enabling environment. It would also need to invest in capacity development of supply chain stakeholders from 'farm to bowl'. Lines of communication between smallholders, processors and wholesalers and other actors along food supply chains should also be strengthened. There is thus a need to identify tangible measures to better implement such supply chain interventions and share knowledge on best practices among supply chain stakeholders.

In traditional supply chains, programmes could begin by engaging small-scale farmers at the point of production to address key factors that aggravate pre- and post-harvest losses, including poor infrastructure, inadequate information and lack of access to markets. One approach would be to form and strengthen small-scale farmer cooperatives.

Programmes and interventions to reduce wastage in food supply chains need to be accompanied by the development of the necessary infrastructure. For example, the construction of storage facilities near the point of production will help extend the life of fresh produce. There is also potential for technology to play a greater role in improving efficiencies in food supply chains. Such practical interventions can make a significant dent in food wastage in Southeast Asia, and should be a priority for countries in the region.

- **As Southeast Asia urbanises, food wastage issues now more prevalent in industrialised countries are likely to become more salient, and interventions targeting the retail and hospitality sector, and consumer behaviour and attitudes, would need to be increasingly emphasised.**

Emerging research suggests that consumer and retail food wastage is increasingly a factor in the cities of industrialising countries. There are various factors driving high levels of food wastage in cities, one of the more significant of which is that urban consumers show a preference for abundance and flawless appearance. Such purchasing behaviour motivates supermarkets to ensure that their shelves are fully stocked, and their fresh fruits and vegetables unblemished, which increases the likelihood of wastage. They also lead to hotels serving a surfeit of food when catering for special occasions. In cities such as Singapore and Hong Kong, supermarkets and banquets account for a large part of the food wasted. Thus, addressing food wastage in urban Southeast Asia requires that policymakers look at ways to shift attitudes and behaviours regarding food and food wastage, unlike interventions in earlier stages of food supply chains where solutions are primarily technology- and operations-based.

In the face of such trends, Southeast Asia may find it more relevant to examine food wastage along urban and rural lines, rather than framing discussions and actions using the more usual industrialised-country versus developing-country distinction. Cities such as Singapore, Manila, Jakarta and Bangkok have much to gain from comparing strategies to reduce food wastage, particularly in the areas of retail and consumption. Likewise, food production and post-harvest supply chains, which are mostly situated in the rural areas of Southeast Asia, could benefit from greater knowledge sharing and cooperative strategising to reduce food wastage. Furthermore, overlapping dimensions such as urban and peri-urban agriculture should be explored, and the important linkages between urban and rural food wastage interventions addressed. Importantly, given the critical interdependencies between countries, and between urban and rural food security stakeholders, food wastage issues should be addressed as a region.

- **Food is most valuable as food, therefore prevention of wastage and recycling of edible food should be prioritised in urban environments. Where food wastage is unavoidable, opportunities to create value from food waste should be explored.**

Any approach to addressing food wastage in urban environments should place prevention as the fundamental priority. This is because, as noted earlier, a major cause of food wastage in cities is avoidable, as it hinges on consumer attitudes towards purchasing and consumption. Emphasising prevention also guards against unlooked-for eventualities such as wasted food being generated in order to create other products from potentially edible food.

While prevention is the ideal, the reality is that food waste occurs, some of it unavoidable. Reusing food could be one way to tackle this. However, while some food processing companies and retailers have introduced innovative steps to reuse lost, wasted or unsold food, disposing of food is often perceived as being cheaper and less contentious than using or re-using it. This issue is becoming more pertinent as Southeast Asia continues to experience the rise of corporate grocers beyond major urban areas.

In terms of improving the utilisation of food waste in Southeast Asia's urban centres, an area of potential growth is the redistribution of edible food to those who suffer from a lack of economic and physical access to food. There is currently a lack of incentive for the retail and hospitality sector to redistribute food waste. At the same time, awareness of the role of food banks is still relatively low. Policy measures to encourage the donation of food could thus include introducing tax incentives, imposing fees for food waste disposal, and developing a robust and safe food redistribution system. Retailers and the hospitality industry are also concerned about the legal ramifications of providing food for redistribution. They are particularly worried about questions of responsibility for food safety. Thus, there is a need for a review of relevant laws to address such fears in a way that does not compromise the need to ensure safe food for all.

There is also the possibility, although not widely utilised, of leveraging on available industrial technology to create value from food waste. The urban centres of Southeast Asia could lead the way in developing such practical and economically efficient industrial uses for food waste. Examples include the conversion of food waste to biogas as a source of electricity for food production, and reprocessing food waste (typically unsold processed food) to produce food for human consumption with added nutritional value. Internationally, there are a range of initiatives to process food waste back to food supply chains but few have been implemented in Southeast Asia.

- **The lack of accurate research on food wastage in Southeast Asia was identified as a major barrier to devising targeted plans to address food wastage.**

While accurate research data is important for devising plans to address food wastage, there is still a lack of such data for Southeast Asia. This is partly due to the inherent difficulties of measuring how and what food is wasted. As such, research methodologies and information systems to address the lack of quantitative data on food wastage were an important area of discussion, and diverse projects implemented in various regions were discussed. They included a study using Life Cycle Assessment (LCA), a scientific methodology which not only determines the

extent of wastage of a particular commodity along its supply chain but also the commodity's environmental footprint; the UK's Waste & Resources Action Programme (WRAP), which conducts significant quantitative research into household and commercial food wastage; and the African Postharvest Losses Information System (APHLIS), a web-based system which provides quantitative data on cereal grain post-harvest losses.

In addition to issues of methodology and systems, Southeast Asia faces the problem of transparency. Some supply chain actors are either reluctant to provide data or indifferent to the need for such research. Nevertheless, the lack of perfect statistical data should not serve to restrict action on food wastage. In this regard, the region needs to focus on more than the measurement of food wastage and the difficulties of doing so; it has to channel attention towards research on strategies to reduce food wastage.

In order to develop effective strategies, one of the key research paths relates to the relationship between various industry actors and transparency of information. Research should focus on developing an understanding of the overall problems associated with food wastage, and how these will affect supply chain and government actors. Considering the limitations on resources available for research, more attention should be given to utilising existing information, and leveraging the skills and expertise of knowledgeable supply chain actors. To move the research agenda forward, leadership from all parties involved is also essential.

Conclusion

On reflecting on these issues, several priorities emerge for policy stakeholders in Southeast Asia. First, government partnerships with agricultural development stakeholders could be enhanced to better assist smallholder farmers and encourage the sharing of best practices. Second, there is a need to incentivise the development and use of improved food storage, transport and packaging in traditional supply chains. Third, policies could be modified to reduce and prevent retail and consumer food wastage in urban environments. Finally, there is scope for enhanced government support for innovative means of using food that is wasted in urban environments.

Global and Regional Food Wastage

This session provided an overview of the dynamics of food wastage at the global as well as regional level, including factors contributing to the problem, and insights into the extent of food waste and loss. There was particular focus on Southeast Asia and food wastage within traditional supply chains. The activities and research of Save Food, one of the few global movements to address food wastage, were also outlined.

Causes of food waste and why it matters

Approximately 33 per cent of all food is either lost or wasted at the global level, an equivalent of 1.3 billion tons of food per year. In the US, food wastage amounts to an estimated 40 per cent of its food, or 80 million tons, each year. In Singapore, 570 million kg of food is wasted each year. Food is lost or wasted at all stages of the food supply chain, from production on the farm or pond, to food being served on a plate.

The exact causes of food wastage vary throughout the world and are very much dependent on local conditions in a given economy. Some of the factors contributing to food wastage are abundance, beauty and cost. Abundance is not only seen at the farm level, in the form of excess production, but also at the household level, with consumers purchasing more food than is actually consumed. Abundance is particularly evident in more developed countries. The US and Europe, for example, produce 10 times more consumer waste per capita than South and Southeast Asia. The second contributing factor is beauty. Consumers increasingly expect food to be free of any blemishes, believing that even small markings may affect taste. Lastly, food is relatively cheap, particularly in more affluent countries. In such countries, the percentage of household income spent on food is low – 7 per cent in the US and 8 per cent in Singapore.

Current levels of food wastage are unsustainable ethically, economically and environmentally. With roughly 1 billion people undernourished globally, the wastage of one-third of all food appears morally callous. Economically, food wastage is tantamount to squandered money. In the US, it is estimated that, every year, the

wastage amounts to about USD240 billion, or USD2,200 for a family of four. Regrettably, there is generally not enough research being done to estimate and quantify the economic cost of food wastage at various levels, whether global, regional or national. Food wastage also has a substantial environmental footprint. When food is lost or wasted, so are resources such as water, land and energy used to grow and process foods. For example, with agriculture accounting for 70 per cent of global water usage, as much as 1,350 cubic km of water per year is embedded in food lost or wasted globally. Food wastage is also implicated in unnecessary greenhouse gas emissions arising from the production and transport of food. Given that there are significant direct and indirect benefits from reducing food wastage, this issue warrants urgent attention.

Food losses in Southeast Asia

The factors contributing to food wastage in Southeast Asia are different from factors in developed countries such as the US, and are often related to inefficiencies in the traditional food supply chains that predominate in the region. The characteristics of traditional agricultural supply chains lend themselves to being more vulnerable to food losses. Unlike modern supply chains, traditional supply chains are more oriented towards production, consist of fragmented production units, are made up of multi-layered channels, and see limited use of post-harvest technologies.

Post-harvest losses for fruits and vegetables in traditional supply chains can be extremely high, ranging between 15 and 50 per cent, and are often due to poor packaging and storage, pest infestation, poor transportation practices and logistics systems, inadequate market facilities and lack of basic infrastructure. In light of these problems, there is potential to overcome such losses by increasing the region's capacity in food processing. However, the food processing sector is knowledge-intensive and requires significant investment and technology.

Rice also suffers from high losses at every step of the food supply chain. Losses in Southeast Asia are estimated to be between 10 and 37 per cent, and rudimentary farm

storage facilities that are vulnerable to pest infestation and moisture are a major cause. For fish and seafood, another key dietary element in Southeast Asia, factors that contribute to losses include lack of basic infrastructure, the cost of utilities, limited access to cold storage equipment, poor transportation systems and lack of a knowledge base in processing technology.

The Food and Agriculture Organization of the UN (FAO) espouses a systemic approach to food wastage that addresses inefficiencies across supply chains and focuses on building alliances and partnerships with different stakeholders. Some of the interventions required include: production planning in line with market requirements; resource-efficient production and processing practices; modernisation and upgrading of preservation and packaging technologies; and improvements in transportation and logistics. The public sector needs to put in place appropriate policies to create an enabling environment. There is also a need to invest in capacity development – of regional institutions, national government officials, development agencies and stakeholders along the post-harvest chains. This can only be done successfully with the help of other partners and stakeholders including the private sector. The cumulative investment requirements for East Asia from 2005/2007 to 2050 are estimated at USD1,684 billion for primary crop production and USD1,266 billion for downstream support services such as cold and dry storage, rural and wholesale markets, and first-stage processing.

The Save Food initiative

Save Food, launched in 2011, is a joint initiative of the FAO and Messe Düsseldorf GmbH to tackle global food losses. The FAO had published new research on the extent and causes of, and potential solutions for, global food losses. The studies confirmed that better packaging can help to protect food, especially in low-income countries. The initiative aims to promote networking among stakeholders in the food industry (including those from the packaging industry, policymakers and researchers) with a view towards developing solutions to reduce food wastage along food supply chains. At the launch of the initiative, sponsors and participants signed the Save Food Declaration as a mark of their commitment to tackling the problem of global food loss.

An important component of the Save Food effort is a worldwide media campaign aimed at increasing awareness of food loss and waste at the global level. As part of its action plan, the initiative will host regional Save Food congresses where the regional dimensions of food wastage can be discussed and appropriate solutions identified with a broad range of stakeholders, with a view towards raising interest and mobilising funding for the implementation of regional food wastage reduction programmes.

Discussion

To address the problem of food abundance in developed countries, producers and industry need to be engaged in the dialogue about food waste since they are the ones producing the excess supply in the first place. Failing this, higher taxes and costs should be imposed on industry to encourage reduction of food wastage. Moreover, consumers must also be made aware of the consequences of poor dietary habits.

While abundance is one of the main factors behind food waste in developed countries, such is not the case for developing countries. In Southeast Asia, the reasons for food losses are complex and are often associated with inefficiencies in the region's food supply chains. The FAO does a lot of work to integrate small farmers into food supply chains by identifying issues on the ground, and engaging farmer leaders through capacity building as well as knowledge and awareness building. Unfortunately, the post-harvest sector in many developing countries has been neglected for many years by governments from a policy and investment point of view. In terms of investment on research and development (R&D) in the sector, the picture is highly asymmetric. A minor proportion of global R&D is devoted to the post-harvest sector (including storage and transport) compared to the food production sector.

While the public sector and donor agencies such as the FAO have been instrumental in improving the post-harvest sector in developing countries for many years, much still remains to be done and the investments required are significant. It is for this reason that the private sector must be encouraged to play a role by helping to provide an enabling environment and infrastructure.

The Extent of Regional Food Wastage

The extent of wastage seen in vegetables, a highly perishable food type yet one the most important commodities for food security and nutrition, was a focus in this session. The presenters also provided insights into aspects of food wastage in Hong Kong and Singapore, both cities that are relatively affluent and import-dependent.

Post-harvest losses in the supply chain for vegetables in Southeast Asia

According to research by 'AVRDC – The World Vegetable Center', an estimated 66 per cent of global post-harvest losses are attributed to South and Southeast Asia. Research also demonstrates that improving private sector, public sector and civil society stakeholder knowledge on vegetable value chains can build resilience in supply, including on issues of loss and waste. The AVRDC employs a post-harvest approach to minimising losses, preserving quality, maintaining nutritional content and ensuring year-round availability while seeking to empower women and guarantee an equitable distribution of income along the vegetable value chain.

In case studies of the vegetable sectors of Vietnam and Lao PDR, hot, humid weather is found to be the most common reason for post-harvest losses at the farm level. It is also a significant factor for losses at the transport, trade and retail stages. The AVRDC therefore recommends a number of low-cost technologies to prevent post-harvest losses, including solar dryers, evaporative coolers, portable hydro-coolers, fermentation, modified atmosphere packaging and preservative paste. There are existing technologies for addressing post-harvest losses but they are not widely implemented in the region's fruit and vegetable sector.

To increase awareness of post-harvest vegetable losses in the region, knowledge-intensive capacity-building activities and the dissemination of information are important. Capacity building would be best facilitated through the training of trainers. To maximise results,

training and knowledge-building exercises should be conducted in local languages. Addressing post-harvest losses would lead to higher productivity gains for the vegetable sector in Southeast Asia.

Food waste in Hong Kong

According to 2010 data, the scale of food wastage in Hong Kong is the highest compared to the other Asian tigers – Singapore, Taiwan and South Korea. Thirty-six per cent of Hong Kong's municipal waste is attributable to domestic, commercial and industrial food sources. Notably, the volume of domestic food waste has declined; but commercial and industrial food waste has risen to significant levels, amounting now to some 800 metric tonnes per day.

In Hong Kong, Friends of the Earth (FOE) has been active in monitoring the extent of food wastage and in campaigning for greater intervention on the part of governments and retailers. It has also been part of cooperative efforts to recycle wasted food. FOE studies show that a majority of the food wasted in Hong Kong is generated by supermarkets and banquets. There are few government initiatives to curb food waste in Hong Kong beyond a voluntary food waste recycling partnership scheme. Specifically, efforts to reduce food waste in Hong Kong are conducted by civil society, particularly environmental groups. Such groups coordinated a food bank alliance and pushed for the donation of perishable food (that would have been wasted) from supermarkets and wet markets to food banks.

One strategy could be to charge retailers and households for food waste by volume or weight, as is the policy in Taiwan. Additionally, FOE seeks to address the people's disconnect from the sources of the food that they eat, which leads to wastage due to a lack of appreciation of the real value of food.

Food waste in Singapore

There is a dearth of data on food wastage in Singapore, at least from formal sources. Some indication of the

extent of the problem in the city can be gleaned from Food Waste Republic, a project by journalism students. Focusing on retail and consumer food waste, the group gathered data through a range of informal methods. The project observed that food waste is a self-perpetuating cycle driven by preference for 'abundance and goodness' on the part of consumers. Customers choose food by appearance when grocery shopping, and they tend to over-buy and stockpile food.

Profit-driven reasons for food waste on the part of retailers and suppliers include filtering grocery to eliminate those that appear less than perfect and ensuring the appearance of full shelves. Other reasons include poor management characterised by ineffective inventory control, over-preparation, and unsupervised and poorly trained staff.

There are a number of ways to tackle food waste in Singapore, including educating young people about their food sources through farm visits and ground-up initiatives like encouraging the sale and purchase of marked-down products, improving training of food and beverage (F&B) management and staff, and developing systems to address unsold food products from supermarkets.

Discussion

Increasing the level of awareness and knowledge is critical to preventing food waste. Such measures are however hampered by a lack of accessible and reliable data, limited scientific research, and scarce funding for such research. There are isolated efforts at mapping out and monitoring food waste from the level of production (i.e., post-harvest loss) to consumption (commercial, industrial and domestic consumption), particularly when there is a need for integrated data to help in identifying the sources of food waste and the appropriate solutions. More such efforts are needed. Governments should give greater attention to gathering quantitative information on food waste, as in many instances, interest groups and non-governmental organisations (NGOs) are the only actors to survey, investigate and collect data.

Addressing difficulties in gathering reliable data also require increased transparency from commercial and industrial actors.

Beyond the collection of data, there is a need for all stakeholders to show greater commitment. Multi-stakeholder cooperation would be essential in developing viable and efficient systems for retail and hospitality companies to redistribute food through food banks. Many companies now hesitant about donating food due to worries over the financial and legal liabilities of giving away unsafe food, as well as potential damage to their image and branding, may change their minds if such systems are in place. To increase confidence in the food redistribution system, legalised food banks with the capacity to verify that the recycled food is safe for consumption may have to be established, which means that governments would have to work on laws to ensure food safety.

In Hong Kong's case, the development of successful food bank alliances was a result of pressure from civil society, which brought the issue of food waste into the media spotlight by linking it to growing concerns about incinerators and landfill plans. Collaborating with the media can help pressure the private sector and the government to regulate and reduce food waste.

The private sector should be encouraged to address food waste as part of corporate social responsibility (CSR) efforts. When entertaining, companies should consider reducing excess food at banquets, a common sight designed to give the impression of success and wealth. For example, the number of courses could be reduced.

Finally, there needs to be a cultural shift and increased awareness about food waste. Rising consumerism and profit-driven interests associated with the developing and modernising countries of Southeast Asia perpetuate the cycle of food waste. Initiatives from NGOs and youth movements can incentivise people to donate food.

Interventions along Food Supply Chains

This session highlighted strategies and points of intervention to reduce and prevent food wastage along supply chains, in particular, the storage, packaging and consumer stages. Food packaging is an underutilised intervention which can reduce food spoilage during storage and transportation, and extend shelf life. Finally, addressing consumer food wastage requires interventions which result in a shift in attitudes and behaviours towards food.

The role of storage in preventing food loss along India's food supply chains

In developing countries like India, poor storage facilities and lack of infrastructure contribute significantly to post-harvest food losses. Storage facilities such as warehouses play a vital role in agricultural marketing; rural banking and financing; and ensuring food security. Good storage infrastructure enables markets to relieve pressure during harvests and to maintain uninterrupted supply of agricultural commodities during off seasons. Efficient storage can also be utilised to address problems of supply extremes, which is a common issue in food distribution chains.

In India, the procurement, storage and distribution of staple grains is centrally managed through the Food Corporation of India (FCI). The FCI is responsible for procuring one-third of food grains produced in the country. India's food grain procurement policy has the broad objectives of assuring farmers of a Minimum Support Price (MSP) for their produce, and improving the ability of low-income families to access subsidised food grains. The FCI also delivers market interventions to keep prices stable, thereby contributing to overall food security in the country.

Food grain stocks procured by the FCI are released through the Public Distribution System (PDS), where they are sold to low-income families at a subsidised rate. However, due to a lack of storage capacity, an estimated 6–10 per cent of food grain stocks are damaged annually by moisture, insects, rodents and fungi. The degree of

wastage is nearly doubled in the case of easily perishable commodities such as fruits and vegetables.

India's warehousing capacity is currently about 108.75 million metric tonnes. It has been estimated that an additional 35 million metric tonnes will be required in next five to ten years. As such, to prevent food wastage, the government needs to accelerate the construction of additional warehouses. In a major step forward, the government instituted the Warehousing Development and Regulatory Authority (WDRA) in 2010 with the aim of improving storage capacity. Following this, the FCI, in early 2012, approved the construction of modern silos at 10 sites in as many states.

Also, India's apex development bank, the National Bank for Agriculture and Rural Development (NABARD) announced a scheme in 2011 aimed at encouraging the development of additional warehouses, silos and cold storage facilities for both dry and wet agricultural commodities. The scheme will provide direct loans to eligible individuals, private entities, cooperatives and public sector agencies. Through these efforts, India hopes to improve its storage capacity and prevent unnecessary wastage of food grains.

The role of packaging in preventing food loss in developing countries

Packaging is a key intervention for preventing food loss after harvest. It keeps produce dry and moist, thereby preventing contamination by microbes and improving food safety. By increasing the resilience of food from harvest to point of retail, packaging lengthens the period of availability of seasonal products and contributes to stability in food supply. Packaging also reduces total waste by extending the shelf life of foods. The packaging industry, which is growing at a rate of 3–5 per cent annually, is now the world's third-largest industry after food and pharmaceuticals.

The benefits of packaging have been recognised by some institutions, prompting them to develop better solutions for farmers. For example, the International Rice

Research Institute (IRRI) has developed a farmer-friendly 50kg storage bag that allows cereal grains to be stored safely over an extended period. The bags are made from a tough, transparent multi-layer polyethylene material which incorporates a gas barrier that restricts oxygen and water vapour movement. Such cost-effective solutions could help reduce post-harvest losses in developing countries.

Food packaging could also be useful for enhancing the attractiveness of food products to consumers, which indirectly help to reduce wastage. For example, an Egyptian olive oil producer designed a premium box packaging for export markets. The box was made out of recycled light wooden boards covered with traditional papyrus hand-painted with scenes from Ancient Egypt. Besides extending the product's shelf life and helping to make the food product more desirable to consumers, the production of the packaging also sustains the livelihoods of craftsmen, women and artists.

Most developing countries have however not fully tapped the potential that packaging holds for reducing food wastage. Misconceptions about the cost of packaging and its environmental impact are a contributing factor. The benefits of packaging need to be better communicated to public- and private-sector stakeholders. These stakeholders need to understand that, through selecting appropriate material and design, it is possible to balance competing considerations such as product characteristics (including features that ensure longer shelf life); marketing considerations (including distribution needs and consumer needs); environmental and waste management issues; and cost.

Consumer food waste

Interventions in food supply chains would not be sustainable without recognising food waste at the consumption stage. Unlike the operational stages of food supply chains, addressing consumer food waste fundamentally requires thinking about how to shift attitudes and behaviours regarding food and food wastage. To consumers, the utility of food is not restricted to its nutritional value; it is integral to many aspects of social and cultural life. As such, food is wasted not only

due to general household operational reasons but also because of cultural practices and religious observances such as celebrations, family feasts, acts of hospitality and demonstrations of opulence.

Several behavioural shifts are needed. First, consumers should shop wisely. They could plan meals in advance, use shopping lists, buy from bulk bins, and avoid impulse buying. Importantly, they should be cognisant of the marketing tricks used to encourage customers to buy more food than necessary. Second, consumers should be made aware that fruit and vegetables with imperfect appearance can still be consumed, and they should be encouraged to buy them. Such consumer education could go some way towards addressing the problem of food being discarded due to their size, shape or colour not meeting consumer expectations. Finally, it is important that consumers understand sell-by and best-before dates. These are often simply manufacturers' suggestions for peak quality and are not strict indicators of whether the food is still safe for consumption.

When eating out, consumers should order appropriate portions. Restaurants often provide half portions upon request at reduced prices. Thus, requesting smaller portions not only helps restaurants reduce food wastage, but also helps consumers save money. Consumers can also ask restaurants to pack up leftovers for later consumption. Households should also be encouraged to donate non-perishable food and unspoiled perishable food to local food banks, soup kitchens, pantries and shelters.

Awareness-raising through public education should be at the heart of efforts aimed at reducing and preventing consumer food waste. There is a major role for community-based action to supplement general education providers; and all age groups and demographics should be involved. Publicising information (such as data on waste at all stages of the supply chain) at retail outlets and supermarkets could help. Awareness campaigns should be accompanied by action plans such as segregated collection systems for waste and the installation of anaerobic digesters and/or composters.

Finally, research on food waste at the consumer level is important for understanding the scope of the issue and developing targeted responses. Reliable estimates of the magnitude of food wastage are still lacking, particularly in developing countries. Research institutions should thus explore methodologies for evaluating consumer food waste. As food waste cuts across sectors, it is imperative that a number of disciplines and interested parties (such as community health, social welfare, charitable and religious groups) are engaged in any research that is undertaken. Findings resulting from such multi-disciplinary research could be utilised by policymakers, researchers, the private sector and civil society, and disseminated to households via public education campaigns and the media.

Discussion

To alleviate concerns about packaging waste and its environmental impact, there should be a clear objective set to use the minimum amount of unsustainable material necessary. Packaging should be designed to be reusable, refillable, returnable, recyclable and durable to the greatest extent possible. Furthermore, bulk delivery of solids and liquids to food processing operators should be encouraged, as this can help eliminate unnecessary packaging.

Consumers need to have a good understanding of use-by and best-before dates. Use-by dates are typically used for products that are easily perishable and could become

dangerous to eat after a certain period. Best-before dates on the other hand are used for products that may lose quality after a certain period but are still safe to consume. Many consumers do have some understanding of this distinction. Nevertheless, public information on labelling systems should continue to be disseminated, as it could help reduce food wastage further. It is also important to ensure the efficiency of labelling systems through review and regulation.

Targeting appropriate stakeholders is essential when engaging and educating the community on food waste. Young children are an important demographic, given that schools can give pupils the opportunity to learn practical food waste recycling skills to take home and share with their families. Primary school teachers should also be trained on the use of innovative materials in their lessons on reducing food waste.

Communal gardens are an effective means for engaging all sections of the society. London, for example, has city farms and community gardens in housing estates, near railways, on temporary land and in community centres. These urban green spaces are funded through charitable and municipal sources, and are managed by the local community. Such farms, besides helping people develop a greater connection to their food, also provide health and therapeutic benefits. Urban food producers consume more fresh produce than non-producers, and city farms can offer a range of benefits for people's well-being.

Research Methodologies and Information Systems

This session provided examples of research and information systems that could be further utilised to address the global dearth of quantitative information on food wastage. Projects from various regions were discussed: a life cycle assessment of mango in Australia; a research and programme delivery initiative in the UK; and a post-harvest losses information system in Africa.

Researching food wastage through Life Cycle Assessment (LCA)

There are insufficient interventions to prevent and reduce food wastage internationally; a key reason for this is that the economic justifications for reducing food wastage are often not adequate incentives in themselves. The environmental costs and burdens of food waste are underutilised as a catalyst for action on the issue. One explanation for this is the lack of data on the environmental footprint of food commodities.

To measure the environmental impact of a particular food commodity, LCAs are useful as they provide transparent quantitative information. LCA is a science-based method for assessing the environmental performance of products and services. It involves mapping various stages along food supply chains, including the farming, distribution and consumer stages. LCAs could thus provide additional support for action to reduce food wastage, as well as serve as a platform and entry point for implementation of such actions. The data from LCAs could also be used to prevent the shifting of a burden from one area to another in a supply chain, or from one impact to another.

An LCA of fresh mango grown and consumed in Australia was undertaken in 2009. This LCA measured the environmental profile of mango waste, in particular its water footprint and carbon footprint. It was found that the most effective way to improve the environmental footprint of the mango is to reduce waste at the point of distribution and consumption. LCA is an effective approach for agrifood and multinational corporations aiming to improve their environmental metrics. It could also serve as a platform for achieving national and corporate environmental goals, given that without

quantitative analysis there is no basis from which to set targets.

An integrated approach to consumer food waste research

The Waste & Resources Action Programme (WRAP), a research and programme delivery organisation funded by the UK, has been working on food waste since 2007. This programme has been driven by targets and industry agreements, and features the involvement of multiple sectors. A key factor in its success has been the retail sector's willingness to engage with the project.

Consumer food waste research is challenging to conduct for a number of reasons. Two key factors are that it is hard to establish a baseline and that there are numerous boundary issues. WRAP has conducted research across four fronts including quantities, nature and causes of food waste; general consumer attitudes and behaviours; helping consumers to keep and store food to its possible lifetime; and helping consumers to fully utilise the food that they buy.

WRAP conducted a pioneering research project in 2009 on household food and drink waste. The project involved studying the behaviour of 3,000 households using a large workforce to collect information. There were numerous categories of food waste, and a profile was then developed of what is wasted by weight and classification. This detailed profile allowed for targeted action based on a mapping of consumer food waste. Findings from this project have been used in policies and community strategies to reduce household food waste. These have been made actionable by providing households with practical interventions and options rather than moral arguments.

It was noted that a research study has to be constructed carefully and must take an integrated approach. The baseline, particularly its details, is important. The availability of the range of expertise required (both social scientists and scientists) and partnerships with retailers, local authorities, the public and government are also crucial.

Finally, while the food security literature often highlights the prevalence of consumer waste in developed economies, it is clear that it is not a problem exclusive to wealthy states. There is some evidence of the issue in industrialising countries such as China and Brazil. As with many aspects of food wastage, there is not much information on the specifics of this trend and further research needs to be conducted.

Supplying cereal grain post-harvest losses information: The African Postharvest Losses Information System (APHLIS)

In Africa, information on cereal grain post-harvest losses is available through the APHLIS. The APHLIS project came about through the European Union (EU) Joint Research Centre seeking assistance with food supply calculations in Africa as it was missing crucial information on post-harvest losses.

The APHLIS is a web-based information system that monitors losses by weight using data supplied by a network of local experts across the continent. The methods and data are displayed in a transparent manner, with users being given the information to determine how figures are derived. Improved data can be added to the system at any point so that loss estimates can become more accurate over time – this process is however time-consuming and expensive.

Annual and seasonal loss estimates are provided for maize, wheat, barley and sorghum, by volume and percentage of total production. The system produces data tables, maps of losses, and post-harvest loss tables by crop, country and province. The profile of loss figures takes into account factors such as climate, crop type and scale. Factors such as the percentage of a crop that is taken to market at harvest, the amount of rain at harvest, storage duration, and grain borer infestations all modify the data. The user then sees loss estimate tables and maps. Post-harvest loss profiles are adjusted from loss increments at all post-harvest stages so the figure does not accumulate throughout the process. The system also measures the quality of post-harvest data sources (including academic studies) and indicates which cereal was studied, the climate, farm type and methodology. There is also a downloadable version of the calculator that is able to generate loss estimates for a small area.

Taken together, the APHLIS generates estimates that are transparent in calculation; contributed and verified by local experts; based on primary national units; and are upgradeable as more reliable loss data become available. Given the type of information provided, the APHLIS is generally considered to be more beneficial for policymakers and strategy developers than agricultural practitioners.

Discussion

Quantifying 'possibly avoidable' food waste as opposed to 'unavoidable' food loss, and developing targeted actions to reduce wastage, is difficult because determining food loss and food waste can be subjective. In recent decades, as food has become more available, what consumers consider to be suitable for consumption has changed. For example, some may not consider bread crusts and potato skins to be portions that should be eaten. Furthermore, food items consumers would have considered a luxury a couple of decades ago now fall into the possibly avoidable category of waste. Possibly avoidable waste is also a result of the rapid decline of culinary skills in the UK.

With up to 90 per cent of home refrigerators in the UK operating at an inappropriate temperature, the widespread lack of refrigerator maintenance is not only a food waste concern but also a public health issue, particularly in regard to food poisoning. This could be addressed by improving refrigerator design, which may involve introducing new regulations. For example, refrigerators could be designed with a temperature display on the outside. Furthermore, the shelf life of food is affected by the journey from shop to home. On average, there is a 12-degree fluctuation during the journey due to cold bags not being used and high car temperatures.

Losses towards the production end of the supply chain are tracked by WRAP resource maps which integrate data along fruit and vegetable supply chains. However, much of the UK's fruit supply is imported so this is a difficult exercise. Production issues may also skew results. For example, when fields are ploughed back to eliminate grass blades, green leafy vegetables close to the blades may be destroyed as well, and this loss may not be captured. Data collection capacity would therefore have to be increased by a fairly large amount if such front-end losses are to be included.

There are various models for managing and funding food wastage research programmes. The mango LCA conducted by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) was an internally funded project. Researchers took the opportunity to conduct the project after being given access to data. The APHLIS was launched and funded by the EU. Since the project was established in 2009, there has been consistent interest from policymakers in post-harvest losses, and funding has been forthcoming. Funding for the UK's WRAP initiative resulted from the need to adhere to European requirements to reduce landfills, particularly given the climate change implications of food waste. It is now much more difficult to get public funding for waste research projects in the UK, particularly for information campaigns, so funding is more industry-driven.

Expert Working Group (EWG) Summaries

On day two of the Meeting, participants divided into three EWGs to deliberate three key food wastage issues: knowledge and research gaps; supply chain interventions; and creating value from food waste in

urban environments. Discussions in each EWG were structured around several fundamental questions pertinent to the topics.

EWG 1: Addressing gaps in knowledge: Paths for research and prospects for information systems in Southeast Asia

Food wastage is a complex issue that is gaining visibility in Southeast Asia. The extent of wastage in the region varies depending on supply chains and national features, but increasing recognition of the economic and environmental consequences has prompted an interest in developing effective strategies to address the problem. Although a general understanding of the overarching issues pertaining to food wastage in the region exists, research into effective strategies to manage the issue remains in its early stages.

Overcoming methodological challenges

One key barrier to research on food wastage has been challenges in developing effective measurement tools and mechanisms to collect accurate data. This is largely due to two factors: transparency issues, which make it hard to gain access to accurate information from various supply chain actors; and the inherent difficulty of measuring how and what food is wasted. To date, research on food wastage in Southeast Asia has focused on attempts to accurately measure food lost or wasted, and on discussions of data gathering problems, rather than what strategies could reasonably be implemented to reduce loss and waste along supply chains. Rather than concentrating on the rigid pursuit of perfect statistics, the region should encourage more research on such strategies.

In order to develop effective strategies, one of the key research paths to explore relates to the relationship between various industry actors and transparency of

information. At present, one of the main barriers to obtaining reliable data about food loss and waste is the lack of transparency at various points along supply chains. Despite the fact that it is likely that supply chain actors often collect information about the scale and scope of food loss or waste for their own benefit, it is very difficult to obtain this information, accurate or otherwise.

Role of supply chain stakeholders

Supply chain actors are often not asked to provide data; but when they are, there is a lack of transparency on their part. One reason for this may be that these actors do not want to admit to inefficiencies. There are also few incentives or accountability measures to encourage the provision of accurate information.

Although engagements with supply chain actors have been difficult and relatively limited to date, the important role that they can play in the collection and distribution of information, and the eventual reduction of food wastage, cannot be overstated. Cooperation with industry parties could lead to a better understanding of the scale and scope of food wastage at each step of the supply chain, and could allow for strategies to be developed in direct partnership with those best equipped to reduce the problem. Furthermore, if greater transparency could be achieved, existing information about food wastage could be leveraged and unnecessary duplication of information reduced, allowing scarce research resources to be allocated elsewhere.

To improve collaborative relationships with supply chain actors, there is a need to first determine the ways in which all parties can be seen to benefit from transparency. Information sharing should be incentivised by highlighting the high economic costs of food wastage, the benefits of reducing it for all involved and the prospects for incorporating food wastage reduction into corporate social responsibility (CSR) policies. To tap the potential advantages from industry involvement in developing strategies to tackle the food wastage problem, focus should also be given to emphasising industry leadership of and ownership over the issue.

To address the issue of food wastage in Southeast Asia, there would be a need for greater government engagement. At present, food wastage is often missing from political agendas, mainly due to competing government preoccupations and an inability to see the potentially far-reaching security implications of food wastage. One strand of future research, therefore, should centre on determining the links between food wastage and food security. These links are not well understood, but should be explored and made more apparent so that regional governance bodies will begin to think about addressing food wastage as part of national security strategies. To encourage government engagement, research should thus focus on framing food wastage in terms of resilience of supply for the purposes of maintaining food security. This avenue of research is important because both companies and governments are concerned with supply chain risk assessment, and neither wants to rely on vulnerable or wasteful systems.

Food waste research in Singapore

In Singapore's case, understanding food waste in the context of wider supply chain resilience and food security is of key importance. Singapore, which imports the majority of its food, has minimal control over external supply chain actors and so is at risk of food insecurity if supply chains are vulnerable.

From Singapore's perspective, future research should also focus on strategies to minimise food waste at controllable

points of the supply chain, such as the consumer level. These strategies may include introducing mechanisms to highlight the personal economic costs of food waste to consumers, or incentivising the use of new technologies to reduce waste. Despite the difficulties associated with developing metrics, Singapore should also focus on developing a greater understanding of how and why consumer food waste occurs.

Avenues for research

In addition to these strategies, research should focus on understanding the likely trajectory of food wastage by examining local and global consumption patterns. Trends often associated with development and increased urbanisation – higher consumption of meat and fast food for example – will impact the scale and scope of food wastage and how it can be addressed. One potential method of examining these trends could be a comparison of how one food product is consumed across different supply chains and also across countries at different stages of economic development. Such research could help illuminate likely consumption trends for the products that are most important in Southeast Asia (such as rice). Research should also seek to understand how food wastage reduction mechanisms have been developed and utilised in other nations, in order to determine what strategies may work in Singapore and the wider region. Overall, despite the difficulties in collecting accurate information about food wastage in Southeast Asia, there is certainly a need to continue and expand research activities in this field, in order to develop effective strategies to address the issue.

Research should also focus on developing an understanding of the overall problems associated with food wastage, and how these will affect supply chains and government actors. Considering the limitations of resources for research, attention should be focused on utilising information that is already in existence, and leveraging the skills and expertise of knowledgeable supply chain actors. Leadership from all parties involved is essential for moving the research agenda forward and developing effective and collaborative strategies.

EWG 2: Sharing best practices in supply chain interventions: Technologies, processes and programmes

There is a need to identify tangible supply chain interventions and share knowledge on best practices among stakeholders in food supply chains. In Southeast Asia, the post-harvest stages account for the majority of food losses. Such losses occur mainly in traditional supply chains characterised by production by small-scale farmers. Key factors that aggravate post-harvest losses include poor infrastructure, inadequate information and lack of access to markets.

Preventing food wastage in traditional supply chains

One approach would be the formation and strengthening of small-scale farmer cooperatives or, as in the case of the Philippines, the organisation of farmers into production clusters. Through these clusters, farmers can proactively plan their production in cooperation with consolidators servicing high-value markets. Such clusters allow farmers to better manage quality. They also facilitate consolidation of products on a significant scale. The process also enables farmers to enter into collaborative arrangements with consolidators and institutional buyers, and can result in more innovative and efficient supply chains which lead to dynamic markets. This gives small farmers who act collectively the benefits of stable markets and potentially higher returns.

There is potential for technology to play a greater role in improving efficiencies in food supply chains. For example, mobile phones can help farmers improve agricultural productivity by giving them access to

basic financial services, market linkages and technical advice. Apart from price benefits and greater return on investments that stem from improved productivity, communications technology could be employed to enable smallholder farmers to receive pricing information and other current market data. This assists producers to determine the timing of planting, harvest and storage, as well as which markets to target. In communicating to farmers, it is important to consider the most appropriate sources of information and methods of delivery. In the Philippines, for example, farmers are found to give greater credence to information from scientists than from other sources.

The construction of storage facilities near the point of production can also help reduce food wastage; appropriate storage can extend the life of fresh produce by several days for example. The development and upkeep of storage infrastructure is costly and takes considerable private- and public-sector investment. In situations where such investment is not forthcoming, one approach to consider is for local storage facilities to be funded by a consumer tax. Running costs are another issue. For example, some in developing countries may not be able to pay for the electricity needed for refrigeration facilities. In addition, some countries lack the energy infrastructure required for electricity services. Governments should play a role in ensuring that storage facilities and electricity are available and affordable, which may involve the use of price regulation and subsidies.

Addressing the need for access to information

Lines of communication between smallholders, processors and wholesalers and other actors along food supply chains should be strengthened. In Indonesia, for example, the availability of platforms for diverse actors to come together to discuss pertinent issues has paved the way for viable solutions. Market inefficiencies due to poor communication have been found to contribute significantly to food wastage, particularly in terms of price responses. During a recent planting season in China, farmers grew considerable amounts of cabbage in response to good prices, which subsequently led to oversupply and the disposal of excess. In the case of kiwifruit from the US and New Zealand, dumping occurred due to efforts to maintain high prices for the fruit.

Regulation could be a solution to the problem of dumping produce in order to prop up market prices. For example, waste could be taxed at point of garbage collection, or dumping of edible produce could be made illegal. Temporary excess supply could also be dealt with by prolonging shelf life through methods such as freeze-drying, or by reprocessing into different products such as jam and sauces.

Supporting interventions with infrastructure and policies

Programmes and interventions to reduce wastage along food supply chains need to be accompanied by the development of necessary infrastructure. Segregated bins are needed to separate food from other types of waste. However, provision must also be made for the waste to then be reused or reprocessed. The dumping of separated waste into a single dumper by waste collectors has been

observed in Southeast Asia, undermining public efforts to recycle wasted food. A key reason for this is the current low value of food waste. As long as its value remains insignificant, waste collection companies will not have any incentive to process the sorted waste.

It was argued that governments should introduce laws to increase the rate of recycling. An example of a government initiative to reduce waste and encourage recycling is the South Korean government's volume-based waste fee system which has been in operation since 1995. The system requires every household to purchase specially designed plastic bags for waste disposal. Waste is charged on a quantity basis, with the disposal of recyclable materials not subject to any charge. Furthermore, waste collectors are mandated by law to refuse to serve households that have not separated their waste properly; and a fine may be imposed on such households. Lessons can also be learned from Europe's producer responsibility scheme. This scheme, which is the cornerstone of the EU's environment policy, extends the responsibility of the manufacturer beyond the point of sale – through to the utilisation of their products. It therefore places obligations on producers to manage the quantities, composition and packaging of their products.

Some countries, such as the UK, have issued new guidelines which require food retailers to use packaging that carries only use-by and best-before dates. Labels depicting sell-by and display-until dates are not permitted. Such dates are not useful to consumers and could instead lead to confusion over whether the food is still safe for consumption.





Participants of the Expert Working Group Meeting on Food Waste in Southeast Asia

The Meeting was attended by regional and international experts from diverse sectors. In his opening remarks, Amb. Barry Desker (front row, third from right) highlighted the increasing urgency of addressing food waste given rising food insecurity in the region. Standing next to him are Prof. Paul Teng and Assoc. Prof. Mely Caballero-Anthony.

EWG 3: Creating value from food wastage in urban environments

Food is most valuable as food for consumption; therefore any approach to addressing wasted food in urban environments should consider prevention the fundamental priority. The redistribution of edible food to people with limited access to food can be undertaken through food banks and other donation systems. Wasted food can also be utilised for industrial purposes (however, only in cases where food is rendered inedible does this become an economically efficient use of wasted food).

Preventing food waste in urban environments

Singapore and Brunei are highly dependent on food produced in other countries, and thus have limited control over wastage during the production and transportation processes. They could nevertheless further reduce their food wastage footprint through increasing local food production. Incentives could be provided to promote urban agriculture such as vertical farms and community gardens. Given that urban farming is somewhat prevalent already in Singapore, it was highlighted that preventing food loss through producing food locally is already in the Singaporean consciousness. There is scope for improvement, however, as Singapore still has an abundance of green spaces with very little produced from them.

One recommendation for reducing food wastage is to simplify and make the food supply chain more efficient in urban environments. This may, however, be less relevant to import-dependent cities. There is also scope to raise awareness and increase appreciation of the real value and sources of food. One further possibility is to improve household food handling, which would include checking refrigerator temperatures and general storage practices.

Schools could be roped in to implement programmes to encourage the prevention of food waste. School gardens, community farms, farmers' markets and cooking programmes can likewise be avenues for increasing awareness among young people. Primary school students should be targeted, and taught to understand the value

of food and where it comes from. Tapping the older generation, who appreciate food more, to educate and engage the younger generation could be a useful strategy. Teaching students to grow, harvest, prepare and cook their own food arms them with knowledge on the negative ramifications of food wastage. Ecotrophology, an interdisciplinary approach which includes the physiological, economic and technological principles of healthy nutrition and practical applications, can be a valuable part of school curriculums.

The private sector can also play a part. They could be encouraged to integrate food wastage into their corporate social responsibility (CSR) activities. There is also room to challenge the notion that extravagance in food when entertaining is a reflection of higher social/corporate status. In Singapore, the National Trades Union Congress (NTUC) promotes CSR in the business community, and its resources can be utilised to promote efficiency, environmental protection and the community's well-being. In the Philippines, some restaurants have started charging customers for leftover food. In the case of banquets held in hotels, the management can avoid legal problems over food safety by requiring event organisers who want leftover food to be turned over to them to sign a waiver.

There is also scope to create value from food already wasted in urban environments. Nevertheless, in the hierarchy of value in the recycling of wasted food, the most value is retained when edible food is redistributed for human consumption. Industrial usage of wasted food is currently one of the least valuable means of recycling food.

Redistributing edible food

In terms of improving the utilisation of wasted food in Southeast Asia's urban centres, an area of potential growth is the redistribution of food that is still edible to those who lack economic and physical access to food. However, there are currently few incentives for the retail and hospitality sector to do so. In addition, the role of food banks is not widely understood and appreciated.

Reducing food waste in the retail and hospitality sector, therefore, requires that such hindrances to food donation be addressed. Policy measures such as tax incentives and the charging of fees for disposal of food waste could serve to incentivise action by the sector. Establishing a robust and safe food redistribution system is also important. The example of the network of organisations involved in food collection and redistribution in Hong Kong should be considered in other cities.

Retaining the value and safety of edible food waste is crucial in order to be able to redistribute food for consumption. Food safety regulations that find a balance between protecting consumers and maximising the potential value from food waste are required. Food banks and other community organisations say that regulations are often too stringent, which prevents them from collecting a large amount of potentially safe food from restaurants, hotels and supermarkets. A registration or licensing system for food banks could be implemented to ensure that these organisations follow the same safety standards and practices as the food industry. Ensuring that food safety technology and practices from the food industry extend to the redistribution process would be feasible with public- and private-sector commitment. Retailers should help to secure the food safety chain from the supermarket to the food bank. They could, for example, donate refrigerated trucks. Where adequate storage and transport facilities for perishable goods are not available, food with considerable storage life is most suitable for redistribution.

In an effort to protect consumers, some countries have implemented time stamp requirements for food served in food courts, restaurants and hotel banquets. Guidance on the safety parameters of food temperatures may also be given. However, there are concerns that these regulations are too stringent and lead to disposal of edible food. Policymakers should consider making exceptions for licensed food donors and collection organisations. Employees and volunteers involved in the donation and collection of food waste should be properly trained to ensure food safety. Policymakers should consider supporting and investing in programmes that employ professional food handlers to train food bank volunteers.

Industrial use of wasted food

Although not widely utilised, industrial technology is readily available to create value from food waste. There is an opportunity for urban centres in Southeast Asia to develop practical and economically efficient industrial uses for food waste.

In Singapore, the Agri-Food and Veterinary Authority (AVA) has pilot projects to convert waste into animal feed, compost and biogas. It consolidates fish trimming waste and soybean waste for conversion into fish feed. The internal organs of animals, which are often thrown away during meat processing, are turned into animal feed which is then exported to Malaysia. There are further opportunities for Singapore to expand on these projects to become a more prolific producer of animal feed from food waste material. In the context of high and volatile grain prices driving up the price of animal feed, a ready supply of feed that is less vulnerable to grain market prices could result in more affordable feed options for the region's farmers, which would in turn lower the production cost of meat and subsequently retail prices.

Internationally, there are a range of initiatives to process food waste back to food supply chains but few have been implemented in Southeast Asia. Examples include the conversion of food waste to biogas as a source of electricity for food production, and reprocessing food waste to produce food with added nutritional value for human consumption. Using its existing pilot projects as a basis, Singapore can facilitate and advance cost-effective technology for the composting and digestion of organic waste for conversion into biogas as well as for sludge and waste-water treatment.

Urban centres should also implement waste segregation – in households as well as the retail and hospitality sector – to facilitate recycling and conversion of food waste for commercial use. In the context of urban farming, there is an opportunity for households, communities and farming ventures to produce fertiliser and other agricultural inputs from food waste. In addition, supermarkets could grow their own produce at their own greenhouses or in their own farms to minimise post-harvest losses stemming from inefficiencies in transport and delivery systems.

Additional Documents

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Waste & Resources Action Programme (WRAP), 2009, *Household food and drink waste in the UK*, Banbury.

Programme

<u>23 August 2012 (Thursday)</u>		09:30	Participant Introductions
Nanyang Executive Centre (NEC) Nanyang Technological University Singapore			Dr Andrew Powell Chief Executive Officer Asia BioBusiness Pte Ltd Singapore
09:00	Welcome Remarks Associate Professor Mely Caballero- Anthony Head Centre for Non-Traditional Security (NTS) Studies; Secretary-General Consortium of Non-Traditional Security Studies in Asia (NTS-Asia) S. Rajaratnam School of International Studies (RSIS) Nanyang Technological University Singapore	10:00	Session 1: Global and Regional Food Losses and Waste
			Presentations
			Mr Jonathan Bloom Editor Wastedfood.com USA
			Dr Rosa Rolle Senior Agro-Industry and Post-harvest Officer Regional Office for Asia and the Pacific Food and Agriculture Organization of the UN (FAO) Thailand
09:05	Opening Remarks Ambassador Barry Desker Dean S. Rajaratnam School of International Studies (RSIS) Nanyang Technological University Singapore		Mr Gernot Ringling Managing Director Messe Düsseldorf Asia Pte Ltd Singapore <i>Represented by Ms Beatrice Ho, Senior Project Manager</i>
09:20	Meeting Outline Professor Paul Teng Senior Fellow and Advisor to the Food Security Programme Centre for Non-Traditional Security (NTS) Studies S. Rajaratnam School of International Studies (RSIS); Dean Graduate Programmes and Research National Institute of Education Nanyang Technological University Singapore	10:40	Discussion

PROGRAMME

11:40	Session 2: The Extent of Regional Food Wastage	14:45	Discussion
	Presentations	16:00	Session 4: Research Methodologies and Information Systems To Address Food Wastage
	Dr Robert J. Holmer Regional Director, East and Southeast Asia AVRDC – The World Vegetable Center Thailand		Presentations
	Ms Michelle Au Deputy Environmental Affairs Manager Friends of the Earth Hong Kong		Dr Bradley Ridoutt Principal Research Scientist Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australia
	Ms Miak Aw Hui Min and Ms Estelle Low Project Founders Food Waste Republic Singapore		Dr Julian Parfitt Principal Resource Analyst Oakdene Hollins United Kingdom
12:25	Discussion		Professor Rick Hodges Visiting Professor of Grain Postharvest Management Natural Resources Institute University of Greenwich United Kingdom
14:00	Session 3: Interventions To Prevent Wastage in Food Supply Chains	16:45	Discussion
	Presentations		End of Day One
	Mr Anjan Mandal Chief Executive Officer L N Bangur Group India		
	Dr Nerlita M. Manalili Managing Director NEXUS Agribusiness Solutions Philippines		
	Professor Albert McGill Consultant Future for Food Australia		

24 August 2012 (Friday)**09:00****Recap of Day 1**

Dr Andrew Powell
Chief Executive Officer
Asia BioBusiness Pte Ltd
Singapore

09:15**Session 5: Expert Working Groups (EWGs)**

EWG 1: Addressing gaps in knowledge on food wastage: Paths for research and prospects for information systems in Southeast Asia

EWG 2: Sharing best practices in supply chain interventions: Technologies, processes and programmes to reduce food wastage

EWG 3: Creating value from food waste in urban environments

11:15**Open Session: The Way Forward**

Dr Jackson Ewing
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11:45**Closing Remarks**

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End of Meeting

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BOOKS

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Paul Teng and Sally Trethewie

NTS CONFERENCE REPORT

MacArthur Asia Security Initiative Dissemination Meeting on Non-Traditional Security (NTS) (21–22 November 2011)

Expert Working Group Meeting on an Asian Rice Futures Market (22–23 March 2012)

Policy Roundtable on Asian Non-Traditional Security (30–31 July 2012)

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Lorraine Elliott

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About the RSIS Centre for Non-Traditional Security (NTS) Studies

The **RSIS Centre for Non-Traditional Security (NTS) Studies** conducts research and produces policy-relevant analyses aimed at furthering awareness and building capacity to address NTS issues and challenges in the Asia-Pacific region and beyond.

To fulfil this mission, the Centre aims to:

- Advance the understanding of NTS issues and challenges in the Asia-Pacific by highlighting gaps in knowledge and policy, and identifying best practices among state and non-state actors in responding to these challenges.
- Provide a platform for scholars and policymakers within and outside Asia to discuss and analyse NTS issues in the region.
- Network with institutions and organisations worldwide to exchange information, insights and experiences in the area of NTS.
- Engage policymakers on the importance of NTS in guiding political responses to NTS emergencies and develop strategies to mitigate the risks to state and human security.
- Contribute to building the institutional capacity of governments, and regional and international organisations to respond to NTS challenges.

Our Research

The key programmes at the **RSIS Centre for NTS Studies** include:

- 1) Internal and Cross-Border Conflict Programme
 - Dynamics of Internal Conflicts
 - Multi-level and Multilateral Approaches to Internal Conflict
 - Responsibility to Protect (RtoP) in Asia
 - Peacebuilding

- 2) Climate Change, Environmental Security and Natural Disasters Programme
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 - Stability of Energy Markets
 - Energy Sustainability
 - Nuclear Energy and Security
- 4) Food Security Programme
 - Regional Cooperation
 - Food Security Indicators
 - Food Production and Human Security
- 5) Health and Human Security Programme
 - Health and Human Security
 - Global Health Governance
 - Pandemic Preparedness and Global Response Networks

The first three programmes received a boost from the John D. and Catherine T. MacArthur Foundation when the RSIS Centre for NTS Studies was selected as one of three core institutions to lead the MacArthur Asia Security Initiative in 2009.*

Our Output

Policy Relevant Publications

The **RSIS Centre for NTS Studies** produces a range of output such as research reports, books, monographs, policy briefs and conference proceedings.

Training

Based in RSIS, which has an excellent record of post-graduate teaching, an international faculty, and an extensive network of policy institutes worldwide, the Centre is well-placed to develop robust research capabilities, conduct training courses and facilitate advanced education on NTS. These are aimed at, but not limited to, academics, analysts, policymakers and non-governmental organisations (NGOs).

Networking and Outreach

The Centre serves as a networking hub for researchers, policy analysts, policymakers, NGOs and media from across Asia and farther afield interested in NTS issues and challenges.

The Centre is the Coordinator of the ASEAN-Canada Research Partnership (2012–2015) supported by the International Development Research Centre (IDRC), Canada. It also serves as the Secretariat of the initiative.

In 2009, the Centre was chosen by the MacArthur Foundation as a lead institution for its three-year Asia Security Initiative (2009–2012), to develop policy research capacity and recommend policies on the critical security challenges facing the Asia-Pacific.

It is also a founding member and the Secretariat for the Consortium of Non-Traditional Security (NTS) Studies in Asia (NTS-Asia).

More information on our Centre is available at www.rsis.edu.sg/nts

About the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University

The S. Rajaratnam School of International Studies (RSIS) was inaugurated on 1 January 2007 as an autonomous School within Nanyang Technological University (NTU), upgraded from its previous incarnation as the Institute of Defence and Strategic Studies (IDSS), which was established in 1996.

The School exists to develop a community of scholars and policy analysts at the forefront of Asia-Pacific security studies and international affairs. Its three core functions are research, graduate teaching and networking activities in the Asia-Pacific region. It produces cutting-edge security related research in Asia-Pacific Security, Conflict and Non-Traditional Security, International Political Economy, and Country and Area Studies.

The School's activities are aimed at assisting policymakers to develop comprehensive approaches to strategic thinking on issues related to security and stability in the Asia-Pacific and their implications for Singapore.

For more information about RSIS, please visit www.rsis.edu.sg

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