行政院所屬各機關因公出國人員出國報告書
（出國類別：出席國際會議）

出席 Caraga 冷鏈及降低糧損高峰會會議報告

服務機關：行政院農業委員會國際處
國立台灣大學農業經濟系
中央研究院

出 國 人：温科長祖康
徐教授世勳
張研究員靜貞

出國地區：菲律賓 霧端(Butuan)
出國期間：108 年 1 月 23 日至 1 月 27 日
報告日期：108 年 2 月 12 日

摘要

本次高峰會議系 Winrock 接受美國農部委託執行之菲律賓冷鏈計畫(Philippine Cold Chain Project，PCCP)總結年度會議。該計畫盼透過冷鏈設備及技術，改善當地農業生產及採收後處理，進而提升當地糧食安全及食品安全同時透過太陽能源之利用，盼當地居民減少伐林以因應氣候變遷。主辦單位 Winrock 邀請菲律賓官方及聯合國駐菲律賓辦公室代表出席，並邀請國際冷鏈及太陽能設備大廠、金融貸款業者、參與該項計畫之當地業者與會進行經驗分享。

我國於 2013 年獲 APEC 經費支持執行「強化公私部門夥伴關係降低供應鏈之糧食損失」多年期計畫，並於 2018 年 6 月在臺北召開「強化公私部門夥伴關係降低糧食損失與浪費，以促進永續APEC糧食體系」高階政策對話會議，邀請 APEC 各會員分享各國推動降低糧食損失及減少浪費之相關政策，同時亦邀請國內外產官學界與會交流。Winrock 本案執行長 Nicholas Richards 自費來臺參加前述我國 2018 年主辦會議，向各與會代表分享經驗，並與我方建立良好合作關係。爰本次高峰會議，我方應 Winrock 邀請前往分享 APEC 計畫執行成果，報告內容不僅獲與會者讚賞，又因我國為少數非當地國籍與會代表，菲國當地政府熱烈歡迎我國之參與。

冷鏈設備之運用雖有助糧食生產及輸銷業者增加糧食供給並提高產品品質，但受限於供電能力及資金需求，使得業者往往望之卻步，因此政府部門提供業者必要的協助甚為重要。此外，引導業者投入高價農產品生產，亦為引導業者使用冷鏈系統的關鍵因素。

壹、前言

鑒於糧食產銷過程之不當處理將造成糧食未進入市場即遭受相當比例之損失，甚至在進入消費端後，產生大量糧食浪費，進而影響菲律賓等人口眾多且糧食生產不足國家之糧食安全，非政府組織 Winrock 獲美國農部贊助執行之菲律賓冷鏈計畫(Philippine Cold Chain Project，PCCP)年度活動之一，該計畫盼透過冷鏈設備及技術，改善當地農業生產、採收後處理、加工、行銷及冷鏈技術，提昇菲律賓當地農業生產力及農、漁、畜產品貿易，並促進當地居民對糧食安全及食品安全之正確認知，同時透過太陽能源之利用，盼當地居民減少伐林以因應氣候變遷。

本次會議為前述五年期計畫之總結會議，主辦單位 Winrock 除邀請菲律賓官方代表與會，並邀請聯合國駐菲律賓辦公室代表出席，此外，國際冷鏈及太陽能設備大廠、金融貸款業者均為受邀對象，另邀請參與該項計畫採用冷鏈相關設備及技術於產銷過程之當地業者與會進行經驗分享，當地對冷鏈或太陽能設備有興趣之其他糧食產銷業者亦可報名參加，於現場與產官學界專家或業者交換議題或尋求協助。

主辦單位盼能結合國際冷鏈物流及能源設備大廠，協助當地糧食產銷業者建構冷鏈系統，針對與會者經營狀況及需求，從設備需要及資金需求等層面，量身訂作，個別規劃，確實符合業者需要之方案，協助當地糧食產銷業者應用冷鏈來提升生產技術及產品品質，提高居民食品安全，並透降低糧食損失及減少浪費，增加當地糧食供給，確保糧食安全。

Winrock 總部位於美國，為美國政府出資成立之非政府組織，提供開發中及低度開發國家在農業、人力資源、經濟發展、能源環境及服務業等各項援助計畫，盼透過扶植農企業、建立冷鏈系統、確保糧食安全、建構氣候調適型農業、強化受援助國能力建構等推動國際農業發展。

我國於 2013 年獲 APEC 經費支持執行「強化公私部門夥伴關係降低供應鏈之糧食損失」多年期計畫，並於 2018 年 6 月在臺北召開「強化公私部門夥伴關係降低糧食損失與浪費，以促進永續APEC糧食體系」高階政策對話會議，邀請 APEC 各會員分享各國推動降低糧食損失及減少浪費之相關政策，同時亦

邀請國內外產官學界與會交流。Winrock 本案執行長 Nicholas Richards 因參與降低糧損及減少浪費相關工作多年，對我國執行之 APEC 計畫深感興趣，自費來臺參加前述我國 2018 年主辦會議，向各與會代表分享經驗，並與我方建立良好合作關係。爰本次高峰會議，我方應 Winrock 邀請前往分享 APEC 計畫執行成果，報告內容不僅獲與會者讚賞，又因我國為少數非當地國籍與會代表，菲國當地政府熱烈歡迎我國之參與。

貳、出國行程

日期	時間	行程內容
1/23	07:10 -10:05	BR281 桃園國際機場-宿霧國際機場
	16:30-17:15	PR2393 宿霧國際機場-霧端機場
1/24	09:00-17:30	Caraga 冷鏈及降低糧損高峰會
1/25	09:00-17:30	Caraga 冷鏈及降低糧損高峰會
1/26	09:30-17:30	Caraga 冷鏈及降低糧損展覽
1/27	07:15-08:40	PR2968 霧端機場-馬尼拉國際機場
	12:50-15:00	BR272 馬尼拉國際機場-桃園國際機場

參、會議摘要

一、本次高峰會議依不同討論主題共分成六場次：

(一)糧食損失與浪費、糧食安全、氣候變遷、食品安全及冷鏈間之關聯

(二)Caraga 地區糧食損失與浪費之現況分析

(三)個案研究：Caraga 地區冷鏈之應用現況

(四)冷鏈技術之應用及糧食損失與浪費

(五)冷鏈技術創新與應用

(六)運用冷鏈技術促進糧食體系升級

二、會議目標

(一)讓各界重視降低糧食損失與國家層級的糧食安全、氣候變遷、食品安全間之關聯性。

(二)改變民眾對於冷鏈技術、食品安全、降低糧損之態度與認知。

(三)結合糧食供應鏈各階段利害關係人找出引進冷鏈技術與融資之需求與機會，以強化糧食產銷因應氣候變遷之能力。

(四)使民眾正確認知冷鏈技術的成本效益，以及如何利用冷鏈技術改善食物與農產品的品質並提升價格與收益。

(五)結合公私部門的力量共同建立降低糧食損失與浪費，並推動提升食品安全與品質的政策。

(六)結合公私部門建立發展區域冷鏈系統之平台，以統籌相關政策之規劃與落實。

三、會議重要結論

(一)菲律賓的糧食損失主要原因來自欠缺現代化的儲運設備與冷鏈技術，目前菲國零售業只有28%使用冷鏈系統。聯合國過去在2000年至2014年間，曾在菲國推動多項試驗計畫，輔導糧食產銷業者使用現代化冷鏈技術，盼能帶動產業轉型，同時與大學合作成立技術創新中心(HUB)，協助糧食產銷業界培訓冷鏈技術人才，並協助業界取得投資資金，引進高效能之冷鏈技術，降低溫室氣體排放。未來聯合國仍透過相關計畫提供經費，輔導菲國引進最新之低碳節能的冷鏈技術。

(二)目前全球只有約10%的農產品在生產後進入冷鏈系統，另有約20%的糧

食在生產後因缺乏適當的冷藏設備而成為糧食損失。冷鏈並非只有儲存食物的功能，因為延長糧食保鮮時間，故還能協助農民將產品輸銷到更遠的地方，開拓新市場，並能減少運輸損耗，提高供給量及銷售收入。

(三)使用冷鏈有三大前提：食物必須是完全清潔與安全的、可快速與即時進入冷鏈系統、全程冷藏不能中斷，三者缺一即不可行。目前開發中國家若有意在其農糧產銷業建立冷鏈系統，必須要經過完整的成本效益評估，並透過實際的示範訓練，不斷調整才能發展出最佳的商業運作模式。

(四)Winrock 委託泰商 Freshport Asia(泰國冷鏈顧問公司)評估菲律賓冷鏈計畫(PCCP)降低當地糧損狀況，並調查當地採後運銷業者使用冷鏈之意願。發現 Caraga 當地香蕉的採收後損耗率高達 27%，為各項產品耗損率最高者，其次是番茄 17%；另在肉品方面，虱目魚與豬肉等因為單價高，業者願意費心處理，故損耗率較低，僅 6%至 8%。業者願意採用冷鏈的只有豬肉，至於香蕉因為單價過低，沒有業者願意投入冷鏈設備，另虱目魚因零售價格波動較大，必須視零售價是否能反映成本且區隔定價才有意願採用，因此難度頗高。

(五)Caraga 地區貧窮人口相當多，且極度貧窮者達 50%以上。當地地勢低於海平面，為天然災害發生頻繁地區。農業生產是最主要的經濟活動，產量雖稱豐富，但生產者欠缺冷藏設備與冷鏈來擴充市場與降低損耗，致使整體供給量仍低。當地零售商或販運銷售業者之冷鏈僅為溫度控制與物流技術的結合，目的是協助超市與零售商能增加食物上架時間，以合理價格出售得消費者，但並非真正的冷鏈系統，對於降低糧食損失與浪費的功效不大。

(六)菲律賓政府於 2004 年至 2010 年成立三個先驅性的冷鏈計畫，由北到南發展三條冷鏈系統，分別為北部碧瑤的蔬菜冷鏈、中部跨島冷鏈，以及南部民答那峨島至馬尼拉的冷鏈。雖該項計畫執行迄今十餘年，但主要問題仍在於缺乏預冷設備與冷藏空間不足，導致民間企業參與使用冷鏈系統的意願低落，認為不符成本效益。2005 年至 2013 年間，菲律賓向美國 WINROCK 申請五個冷鏈技術合作計畫，但只有一個通過，也就是

本案在 Caraga 地區推動的冷鏈計畫，以協助高經濟價值的作物產業發展為目標，主要的挑戰在於氣候變異與災害、農民技能不足、缺乏透明之價格決定機制、供應鏈不完整等，導致計畫執行困難度高。但歷經 5 年，整體計畫尚有斬獲，當地居民瞭解冷鏈系統的應用確實有助提升產品品質並確保產量穩定，但設備資金需求龐大仍為最大挑戰，即便有金融業者提供貸款協助，受制於氣候變遷對當地農產品生產的不確定性，仍使當地糧食產銷業者對於投入冷鏈運用感到卻步。

(七)有關菲律賓冷鏈產業現況，目前已經有 44 萬公噸的冷藏空間，因菲國每年仍需進口 8.4 百萬公噸的農產品，冷藏空間需求每個月約 70 萬公噸，就菲律賓現有之冷藏量能，大約還有 50%的食品無法確保獲得冷藏空間，這實際上代表的是龐大的投資商機，尤其菲國人口持續成長，消費人口的偏好價高質優的農產品，加上政府加強食品安全衛生規範與管制，預期整體產業對冷鏈需求極為迫切，目前已有世界銀行、USAID 等幾個國際機構關注此一產業之後續發展，甚至連日本政府都表達興趣來投資。

肆、心得與建議

一、鑒於氣候變遷對糧食產業造成的影響日趨嚴峻，尤其全球人口持續成長，使得糧食產業在能否穩定提供充分糧食上面臨更大的挑戰，而冷鏈系統的運用顯然有助降低糧食在生產及運輸過程中所發生的耗損，不僅提高糧食供給量，更可提供較佳品質的糧食供消費者選用，進而提高產品售價，增進農民等糧食生產者或供應商的收益。此外，經由冷鏈系統處理過的農漁產品等糧食，通常可獲得較佳之保鮮效果，延長食品效期，使得糧食浪費的情況減少，不僅可確保食品安全，亦有助維護糧食安全。

二、冷鏈系統的運用必須配合穩定的電力供應，農糧生產地區通常地處非都市區域，尤其部分發展落後國家之電力供應經常不甚穩定，若無穩定供電能力，冷鏈系統的效果亦將打折。為確保供電穩定，太陽能的運用便成為冷鏈系統業者之首選。太陽能發電設備的可移動性，使得農產品在運輸過程中，冷藏儲運車的效能可有效提高，此外，太陽能發電設備的獨立性，可

使糧食倉儲業者無需透過電力公司輸配電系統，即可視營運規模，自行架設符合自身需求的發電設備，無需擔心電力業者供電品質不穩，且太陽能設備使用年限長達數十年，不僅投入成本預期可有效回收，亦無需分攤電力業者固定成本或擔心電價浮動對成本之影響。

三、對糧食產銷業者而言，若同時投入冷鏈系統及太陽能發電設備，必將是經營成本之一大負擔，若未能獲得充分金融貸款協助，恐怕無力負擔增加的額外成本。因此，金融機構的參與亦為推廣冷鏈系統的關鍵要素，對於有心投入冷鏈及太陽能設備的糧食產銷業者而言，充分資金協助及負擔得起的融資成本是成功引進冷鏈系統的重要關鍵，尤其糧食生產或輸配業者多為小規模經營，可提供擔保的能力有限，故政府部分的扶助或協助擔保應屬必要。

四、雖冷鏈系統的運用有助提高糧食供給及品質，但倘若接受冷鏈處理的糧食產品本身價值偏低，或對生產者而言，不具高經濟價值吸引力，則可預期業者將無意投入資金引進冷鏈系統。因此，歸根究柢，引導農民及生產者投入高價農產品生產，提高收益後，才有誘因使糧食產銷業者願意引進冷鏈系統，進一步提高產品價值並擴大產品輸銷範圍，當高價產品因冷鏈系統而可接觸到更多高端消費者，將使生產者因需求增加擴大生產而增加收益，使得業者可投入更多保鮮或冷鏈技術，以利追求更多利潤，在此一正向循環下，才有助農民及生產者改善生活水準，進而提升整體國家經濟發展。

伍、附件

一、徐教授世勳簡報檔

二、張研究員靜貞簡報檔

January 24-26, 2019
Caraga Cold Chain and Food Loss Summit+Expo

APEC Approach: Enhancing Private and Public Partnerships (PPPs) for Food Loss and Waste (FLW) Reduction

Dr. Ching-Cheng Chang
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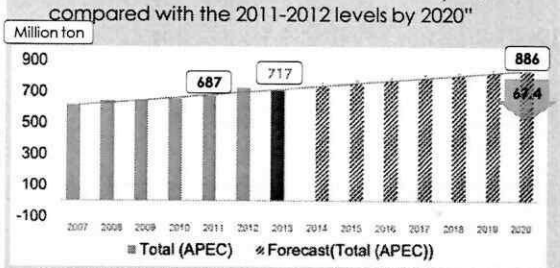
Outline

1. Summary on PPPs in FLW
2. What was Learned on PPPs
3. Recommendations for the Philippines

1. SUMMARY OF APEC PROJECT ON PPPs IN FLW

APEC Target for FLW Reduction

Food Security Roadmap (2014): "APEC economies will strive to reduce food loss and waste by 10% compared with the 2011-2012 levels by 2020"



Source: "APEC Food Security Roadmap Towards 2020", Third Senior Officials' Meeting, Beijing, China, 2014; and our estimation.

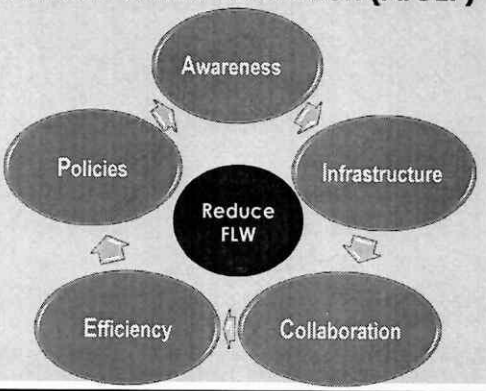
APEC Solutions for FLW Reduction

- Stock-take targets, policies and strategies for reducing FLW
- Gather information of FLW and verify/monitor them

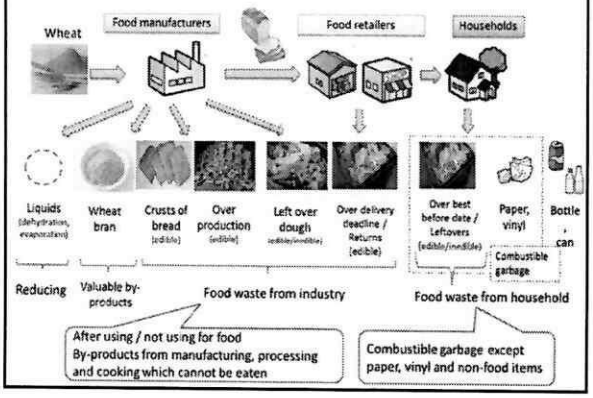
APEC Multi-year Project 2013~2018

- Identify actions and their costs, and benefits to reduce FLW
- Investigate PPP barriers and recommendations.

5 Drivers of FLW Reduction (AICEP)



PPPs in APEC: Mandatory Reporting in Japan



PPPs outside APEC

EU Resolution on Food Waste Adopted, 16

6 Success Factors

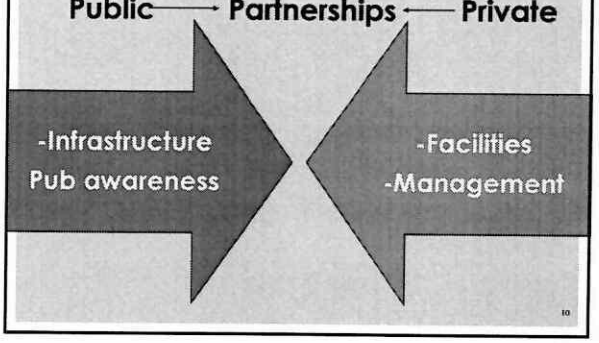
1. Strong lead organisation
2. Right mix of key players
3. Government involvement at early stage
4. Engage signatories in the early stages
5. Effective measuring and reporting framework
6. Availability of funding

"Business case" of FLW

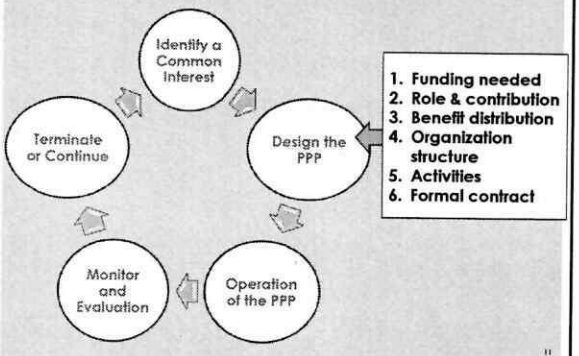
What is "PPPs"?

- Engage stakeholders in collective actions based on shared objectives

What is PPPs in FLW reduction?



A Partnership Cycle



A Regional Cold Chain System thru PPPs ➔Five Steps:

1. Dialogue between public & private sectors
2. Formulate Public Policy
3. Conduct a Feasibility Study
4. Launch a Pilot Project
5. Build a Regional Cold Chain

2. WHAT WAS LEARNED FROM PPPs IN FLW FOR APEC?

PPPs Survey on FLW Reduction - Q#1

What types of PPPs is applied in general?

ANS:
Public financial support is the most popular type of PPP

PPPs Survey on FLW Reduction - Q#2

What types of PPPs in reducing FLW have been applied?

- **Advanced economies:**
  - Mostly in food waste recycling
- **Developing economies:**
  - Agricultural enhancement & food waste recycling slightly above others

PPPs Survey on FLW Reduction - Q#3

What areas have been affected by PPPs?

-Advanced MEs:
Most affected in Food donation & recycling.
-Developing MEs:
Most affected in Food donation & agricultural facility

PPPs Survey on FLW Reduction - Q#4

What areas of FLW reduction should PPPs focus on?

- **Advanced and developing MEs:**
  - **Reduction campaign & food waste recycling** should be conducted with dominant advocates.
- **Developing MEs:**
  - strongly recommend **agricultural facility & cold chain improvement** for PPP applications.

Main Challenges in PPPs-1

✓**Working with government legislation is a rather difficult approach for reduction of FLW.**

- **Regulations & industry standards** have not been put in place or designed with an eye toward minimizing FLW
- **Tax policy** neither penalizes companies and consumers for the waste they create, nor incentivizes them to reduce waste.

Main Challenges in PPPs-2

- ✓ Disposing of food waste remains very cheap
- ✓ Expiration dates are unnecessarily conservative
- ✓ Banning feeding leftover to animals (to prevent outbreak of infectious diseases).

➔ A more feasible solution is to work with
- ➢ **Voluntary private initiatives;**
- ➢ **Consumer awareness.**

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Key Messages

➢**What is Missing?**

1. **Encourage voluntary agreements between government and companies**
2. **Promote adoption of public policies (e.g. simplify date labeling, food donation)**
3. **Support funding mechanisms for agriculture infrastructure and cold chain investment**
4. **Enable comprehensive awareness-raising campaigns.**

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3. RECOMMENDATIONS FOR THE PHILIPPINES FROM APEC

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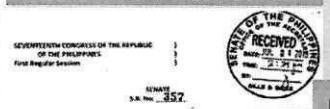
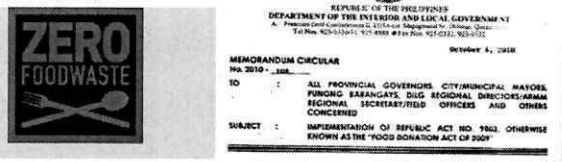
Policies in the Philippines

Zero Food Waste Act



Food Donation Act



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What is a "Food Value Chain"?

1. Think about the industry's **vision**
2. Identify the **activities** along the value chain
3. Tailor **R&Ds** to the demand of market and customers
4. Help farmers to set up **agribusiness**
5. Develop **services** sector within agriculture
6. Ensure **good quality** by standardization and accreditation
7. **Branding** & **management**

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Recommendation-1

1. Actions to address the 5 drivers (AICEP) can create massive opportunities for us.

➔ **Governments** should act as a **"Catalyst"** to ease the work of **private sectors** with **supporting policies.**

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Recommendation-2

2. Success PPPs demands commitment and collaboration among stakeholders

- **Government:** support investment to reduce FLW
- **Farmers and agribusiness:** work to ensure efficiency and compliance in delivery
- **International bodies:** work to improve rules surrounding the cross-border trade flows
- **Consumers:** adopt practices to reduce waste.

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Recommendaitons-3

Good Governance Framework is needed

1. A **transparent process** by which government develop PPPs
2. Create and ensure **"value for money"** (Quality)
3. Improve public **services** and adequate **training**
4. **Fair incentive** for all parties
5. **Fair returns** for risk takers
6. Security facing new threats and natural disasters
7. Sensible **negotiation of disputes**

26

References

- FLW Measure and Dataset: http://apec-flows.ntu.edu.tw/database.aspx
- APEC Survey Report on Feasible Solutions for Food Loss and Waste Reduction: http://apec-flows.ntu.edu.tw/upload/Publication/File/XI9A8CLAX0.pdf
- APEC Survey Report on Food Loss and Waste Reduction Policy: http://apec-flows.ntu.edu.tw/upload/Publication/File/APEC-survey-report-on-FLW-reduction-policy.pdf
- Loss Assessment on Selected Vegetables and Fruits in the Philippines: http://apec-flows.ntu.edu.tw/upload/edit/file/2%20SR_2014_B_S2-01_Ms.%20Maria%20Cecilia%20R.%20ANTOLIN.pdf

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Thank You &
Comments Welcome

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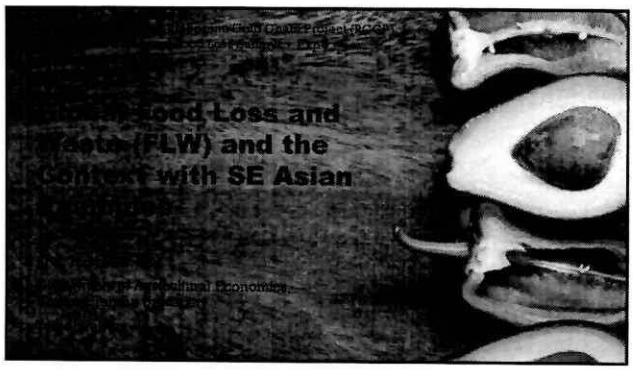

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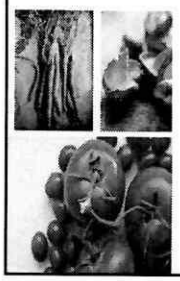


1. Introduction

Challenges_1

APEC economies face food security challenges arising from population growth, rapid urbanization, changes in diet, natural resource constraints, inequality in income and resource distribution, and climate change.

Challenges_2

Up to one-third, or approximately 1.3 billion tons, of food produced for human consumption each year is lost or wasted along the supply chain, representing enough food to feed the estimated 1 billion people around the world that are food insecure, and resulting in the waste of labor, water, energy, land and other resources used in producing that food.

Food Losses and Waste (FLW)

- 'Food losses' in the production and distribution segments of the food supply chain is mainly caused by the functioning of the food production and supply system or its institutional and legal framework.
- 'Food waste' refers to the removal of food from the food supply chain which is fit for consumption, by choice, or which has spoiled or expired, mainly caused by economic or social behavior, poor stock management, or neglect.

Source:SDG TARGET 12.3 ON FOOD LOSS AND WASTE:2018 PROGRESS REPORT

Examples of Food Loss and Waste Along the Food Supply Chain: PRODUCTION

During or immediately after harvesting on the farm

- Fruits discarded due to bruising during picking
- Crops sorted out postharvest for not meeting cosmetic standards
- Crops left behind in fields due to poor mechanical harvesting or drops in prices
- Fish discarded during fishing operations

Source: SDG TARGET 12.3 ON FOOD LOSS AND WASTE: 2018 PROGRESS REPORT

Examples of Food Loss and Waste Along the Food Supply Chain: HANDLING & STORAGE

After leaving the farm for handling, storage, and transportation

- Food eaten by pests
- Food degraded by fungus or disease
- Livestock death during transportation to slaughter or not accepted for slaughter
- Fish that are spilled or degraded after landing

Source: SDG TARGET 12.3 ON FOOD LOSS AND WASTE: 2018 PROGRESS REPORT

Examples of Food Loss and Waste Along the Food Supply Chain: PROCESSING & PACKAGING

During industrial or domestic processing and/or packaging

- Milk spilled during pasteurization and processing
- Food sorted out as not suitable for processing
- Livestock trimming during slaughtering and industrial processing
- Fish spilled or damaged during canning or smoking

Source: SDG TARGET 12.3 ON FOOD LOSS AND WASTE: 2018 PROGRESS REPORT

Examples of Food Loss and Waste Along the Food Supply Chain: DISTRIBUTION & MARKET

During distribution to markets, Including at wholesale and retail markets

- Food sorted out due to quality
- Safe food disposed of because of going past sell-by date before being purchased
- Food spilled or damaged in market

Source: SDG TARGET 12.3 ON FOOD LOSS AND WASTE: 2018 PROGRESS REPORT

Examples of Food Loss and Waste Along the Food Supply Chain: CONSUMPTION

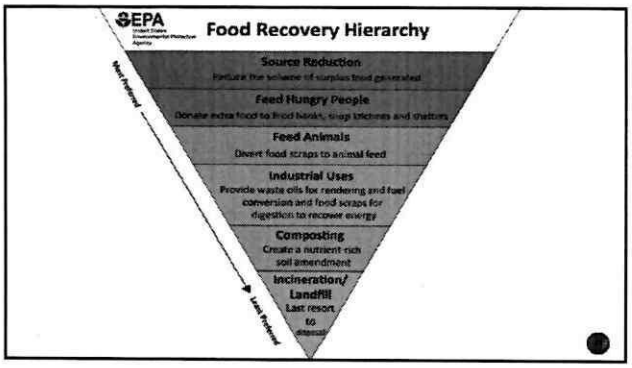
In the home or business of the consumer, including restaurants and caterers

- Food sorted out due to quality
- Food purchased but not eaten
- Food cooked but not eaten

Source: SDG TARGET 12.3 ON FOOD LOSS AND WASTE: 2018 PROGRESS REPORT

Understanding FLW in a Triple Perspectives (HLPE 2014)

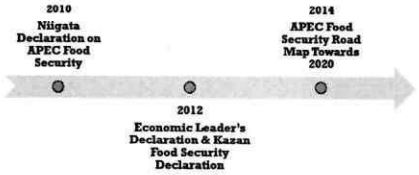
- **A systemic perspective**
  - Considering FLW not as an accident but as an integral part of food systems.
  - along food value chains
- **A sustainability perspective**
  - Including the environmental, social and economic dimensions of sustainability
- **A food security perspective**
  - For human consumption



2. Target and Measurement

APEC Food Security Roadmap

Reducing Food Losses and Waste (FLW) has been repeatedly underscored as one of the primary tasks to safeguarding APEC Food security in relevant APEC fora and Leader's meetings.



The Vision and Goal of "APEC Food Security Roadmap Towards 2020" (SOM3, Beijing, China, 20-21 August 2014):

APEC economies will strive to reduce food loss and waste (FLW) by 10%* compared with the 2011-2012 levels by 2020 in the Asia-Pacific economies. (Para. 7)

*** It is an average level for all economies. Specific indicator can be developed based on each economy's situation.**

"COMPARED TO WHAT?"

- WINSTON CHURCHILL, WHEN ONCE ASKED, "HOW'S YOUR WIFE?"

APEC Food Security Roadmap Towards 2020

10%

"APEC economies will strive to reduce food loss and waste by 10% compared with the 2011-2012 levels by 2020 in the Asia-Pacific economies

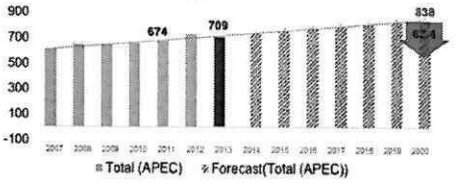
"It is an average for all economies. Specific indicator can be developed based on each economy's situation."

- Given the fact of highly diverse nature of APEC economies. The edible and inedible part of foods depend on culture and norm of each ME.
- We encourage MEs define the scope of FLW by themselves and quantify FLW for self-improvement.

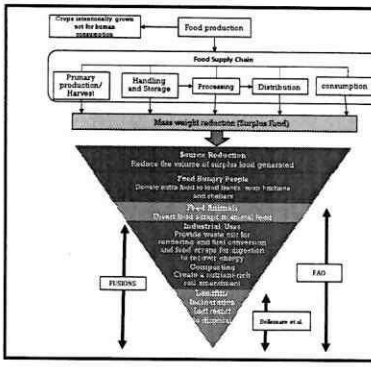
✗ Ranking ✗ Aggregation

APEC Target for FLW Reduction

Food Security Roadmap (2014): "APEC economies will strive to reduce food loss and waste by 10% compared with the 2011-2012 levels by 2020 in the Asia-Pacific economies..."



Source:"APEC Food Security Roadmap Towards 2020", Third Senior Officials' Meeting, Beijing, China, 2014; and our estimation.



Three Perspectives on FLW:

1. A Systemic Perspective – Food Supply Chain or Food System,
2. A Food Security Perspective,
3. A Sustainability Perspective.

FAO Methodology

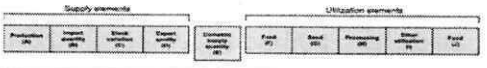
Stages	Definition
Production and Harvesting	Contains losses due to mechanical damage and/or spillage during harvest operation, crop sorting etc.
Handling and Storage	Contains losses due to storage and transportation between farm and distribution, and spillage and degradation during handling.
Processing and Packaging	Includes losses during industrial or domestic processing and packaging.
Distribution and Marketing	Includes losses and waste in the market system, including wholesale markets, supermarkets, retailers, and wet markets.
Consumption	Includes all the losses and waste at the household level.

Mass Flow Model (MFM) of FAO

- Measurable quantitative losses along the food supply chain starting with harvest until consumption by end users.
- Data used: FAO Food balance sheet of each economy in 2011 and loss ratio published by FAO (2011).

Source: Lipinski et al.(2013); Gustavsson et al., (FAO 2011)

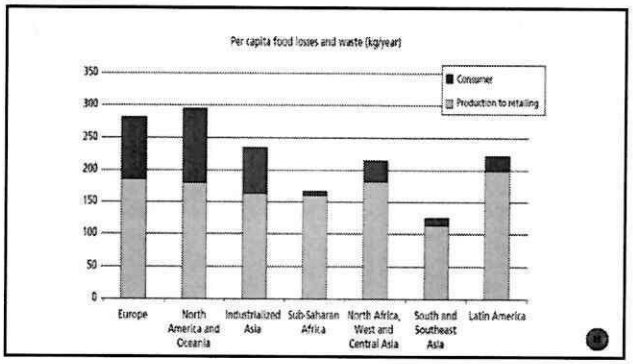
A Food Balance Sheet (FBS) presents a comprehensive picture of the pattern of an economy's food supply and utilization during a specified reference period

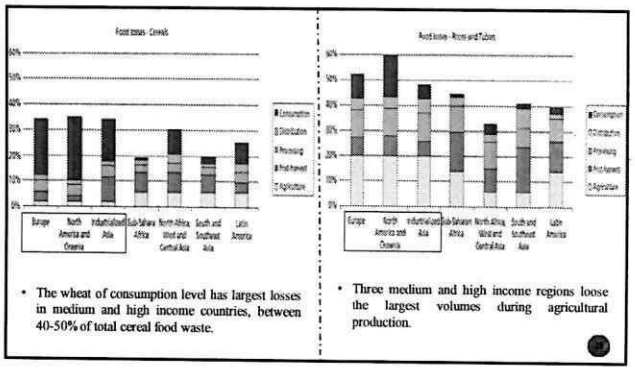


	Element	Interpretation
A	Production	Reported in primary crops for crops; carcass weight for meat; live weight equivalent for fish and total production leaving the manufacture for processed commodities.
B	Import quantity	All movements of the commodity in question into the n/region.
C	Stock variation	Changes in foremost government stocks.
D	Export quantity	All movements of the commodity in question out of the economy/region.
E	Domestic supply quantity	Sum of A, B, C, and D (of which D is negative).

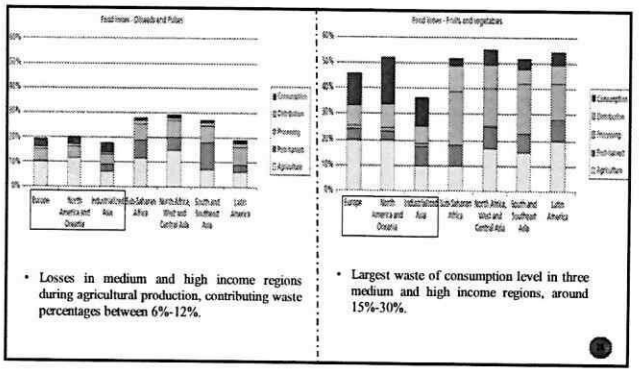
	Element	Interpretation
F	Feed	The amounts of the commodity in question used to feed animals.
G	Seed	The amounts of the commodity in question used for reproductive purposes, e.g. seed, planting, eggs for hatching or fish for bait.
H	Processing	The amount of the commodity available for human consumption as part of mixed processed food products, containing different types of commodities.
I	Other utilization	The amounts of commodity lost during handling, storage and transport between production and distribution as well as amounts of the commodity used for non-food purposes, e.g. oil for oil production and wheat for bio-energy.
J	Food	All forms of the commodity available for human consumption, e.g. wheat flour, vegetable oils etc. (although not including H).

3. Scale and Extent of FLW Globally and Across Food Supply Chain

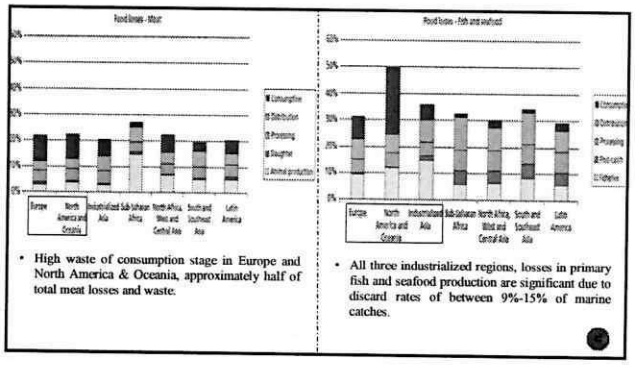




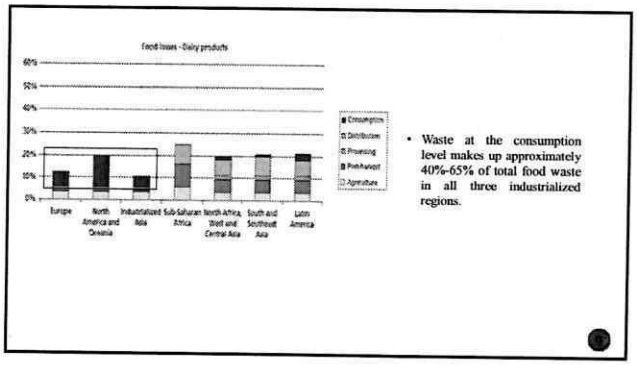
- The wheat of consumption level has largest losses in medium and high income countries, between 40-50% of total cereal food waste.
- Three medium and high income regions loose the largest volumes during agricultural production.



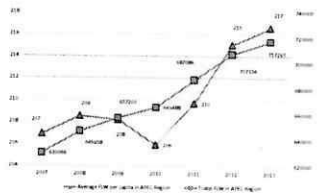
- Losses in medium and high income regions during agricultural production, contributing waste percentages between 6%-12%.
- Largest waste of consumption level in three medium and high income regions, around 15%-30%.



- High waste of consumption stage in Europe and North America & Oceania, approximately half of total meat losses and waste.
- All three industrialized regions, losses in primary fish and seafood production are significant due to discard rates of between 9%-15% of marine catches.



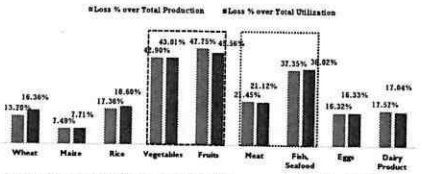
- Waste at the consumption level makes up approximately 40%-65% of total food waste in all three industrialized regions.



Region	Average region (2013)(1000 tons)	Average per capita (2013)(Kg/person)
Europe	37.601	282
North America & Oceania	29.594	331
Industrialized Asia	87.922	177
South & Southeast Asia	14.337	153
Latin America	11.878	237

1. Total quantity of the FLW increase in APEC Region; average of FLW per capita has increased since 2010 in APEC Region.
2. In APEC Region, the highest of FLW is Industrialized Asia (88 million tons), and the lowest is Latin America (11 million tons).
3. In APEC Region, the highest of FLW per capita is North America & Oceania, and the lowest is South & Southeast Asia.

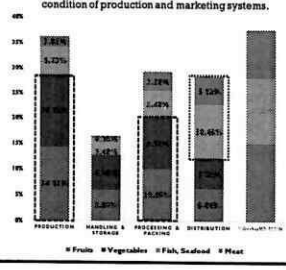
APEC food losses in volume base



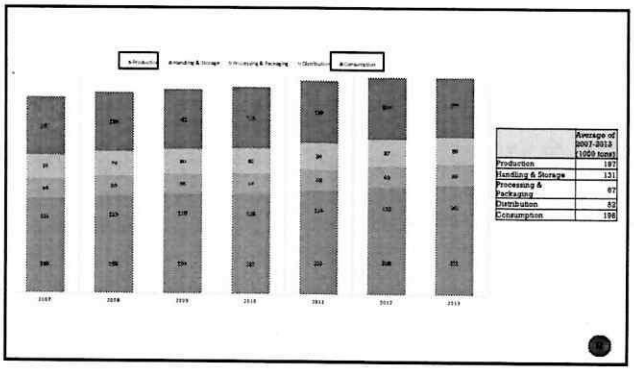
- The top four food losses commodity groups are **Fruits (45.56%), Vegetables (43.01%), Fish & Seafood (38.02%)** and **Meat (21.12%).**
- The loss percentage of **Fruits and Vegetables** are higher due to short expiration date and strict quality standard
- Compared to Fruits and Vegetables, the expiration date of **Fish & Seafood and Meat** can be extended by simply frozen treatment which results in lower food losses.

The top four commodity – by stage

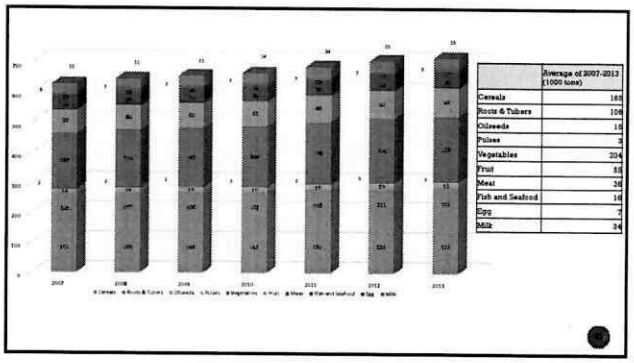
- ✓ This presentation will focus on the FSC prior to the consumption stage to observe the food losses condition of production and marketing systems.



- In the top four food losses commodity group, the loss percentage prior to consumption stage is respectively as **36.16% (Production), 16.45% (Handling & Storage), 29.20% (Processing & Packing)**, and **28.37% (Distribution)**.
- In **Fruits and Vegetables** group, the loss percentage is higher in the stage of Production and Processing & Packing.
- In **Fish & Seafood and Meat** group, the loss percentage is higher in the stage of distribution.

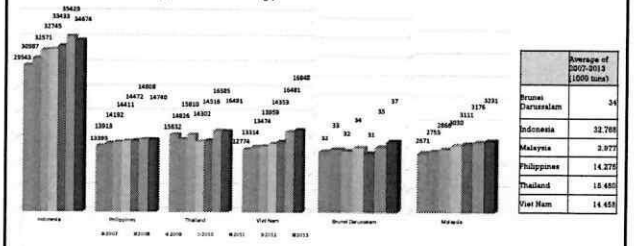


	Average of 2007-2013 (1000 tons)
Production	197
Handling & Storage	131
Processing & Packaging	87
Distribution	82
Consumption	196



	Average of 2007-2013 (1000 tons)
Cereals	183
Roots & Tubers	106
Oilseeds	16
Pulses	3
Vegetables	204
Fruit	88
Meat	36
Fish and Seafood	16
Egg	7
Milk	34

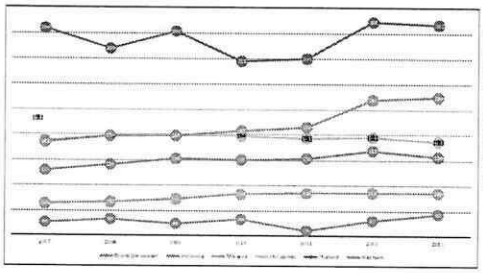
In Southeast Asia (Each Economy)



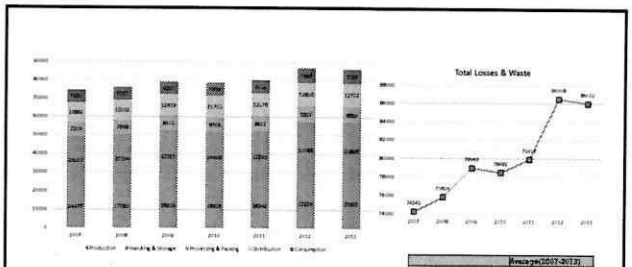
	Average of 2007-2013 (1000 tons)
Brunei Darussalam	34
Indonesia	32.768
Malaysia	3.977
Philippines	14.278
Thailand	15.480
Viet Nam	14.458

1. The highest FLW economy in Southeast Asia is Indonesia (around 32768 thousand tons), the lowest FLW economy is Brunei Darussalam (around 34 thousand tons).
2. Total of FLW in Malaysia and Viet Nam were increasing every year.

FLW per capita in Southeast Asia

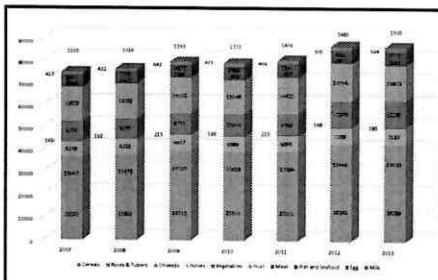


	Average of 2007-2013 (kg/person)
Brunei Darussalam	86
Indonesia	130
Malaysia	104
Philippines	152
Thailand	230
Viet Nam	163



	Average(2007-2013)
Production	26.639
Handling & Storage	27.779
Processing & Packing	8.350
Distribution	11.818
Consumption	7.008

1. Total of FLW in Southeast Asia was increasing.
2. Most FLW came from stage of production (around 27,779 thousand tons) and handling & storage (around 25,038 thousand tons).



	Average of 2007-2013 (1000 tons)
Cereals	22.962
Roots & Tubers	16.249
Oilseeds	6.947
Pulses	200
Vegetables	10.331
Fruit	15.968
Meat	2.666
Fish and Seafood	2.926
Egg	466
Milk	1.286

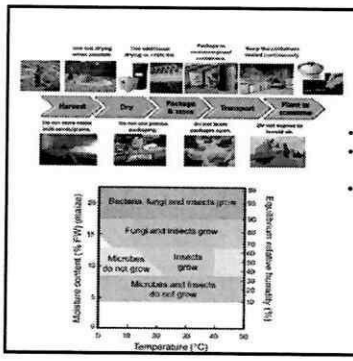
1. The highest commodity of FLW in Southeast Asia is cereals (around 22 million tons); and the lowest is pulses (around 200 thousand tons).
2. The FLW of meat and milk were increasing every year.

4. Some Toolkits of Reducing FLW In Southeast Asia

Rice Moisture Management

- **Economy:** Philippines
- **Center / Enterprise:** International Rice Research Institute
- **Solution:** Moisture content testers ensure producers known when rice is sufficiently dry and safely sealed in storage

Sources: http://apec-flows.ntu.edu.tw/



Avoid Mycotoxins Induced in Seed and, Grain and Dried Products Using Dry Chain

- **Economy:** Thailand
- **Center / Enterprise:** Rhino Research
- **Solution:**
  1. Critical seed moisture contents (or RH)
  2. A tool to measure moisture content: eRH
  3. Dry Chain for Seed and Food Preservation

Sources: http://apec-flows.ntu.edu.tw/

GPL (Grading, Packaging & Labeling) System

- **Economy:** Malaysia
- **Center / Enterprise:** Horticulture Research Centre MARDI Serdang
- **Solution:** Improve grading, packaging and labeling regulations, including the use of suitable packaging materials.

Sources: http://apec-flows.ntu.edu.tw/

Tilapia Whole-Fish Processing and Utilization

- **Economy:** Taiwan
- **Center / Enterprise:** National Taiwan Ocean University
- **Solution:** Minimize waste by developing value-add industries utilizing by-products of tilapia production for food and non-food production

Sources: http://apec-flows.ntu.edu.tw/

"Eat up food" campaign to raise public awareness of food waste

- **Economy:** Viet Nam
- **Center / Enterprise:** Ăn Hết Rồi
- **Solution:** The "Eat up food" campaign mobilize restaurants and hotels to join the campaign to encourage guests to change their eating habits.

Sources: http://apec-flows.ntu.edu.tw/

Restaurants encourage customers to stop wasting food

- **Economy:** Malaysia
- **Center / Enterprise:** Ăn Viet
- **Solution:** Restaurants offer noodles and rice portions with customizable serving size; encourage customers to order only what they can finish

Sources: http://apec-flows.ntu.edu.tw/

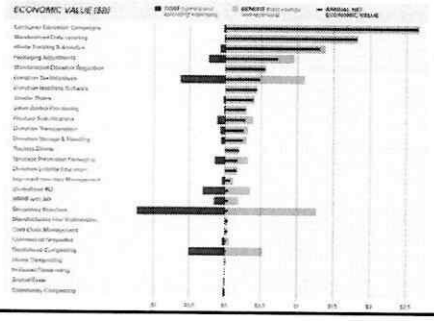
Recycling food waste

- **Economy:** Singapore
- **Center / Enterprise:** National Environment Agency (NEA)
- **Solution:** Food waste recycling pilots

Sources: http://apec-flows.ntu.edu.tw/

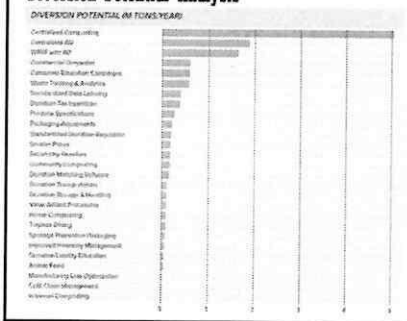
5. Social-Economic Assessment of FLW Reduction

Reducing FLW Cost & Benefit



Over $10 billion of net annual economic value was identified from implementing the 27 solutions.

Diversion Potential Analysis



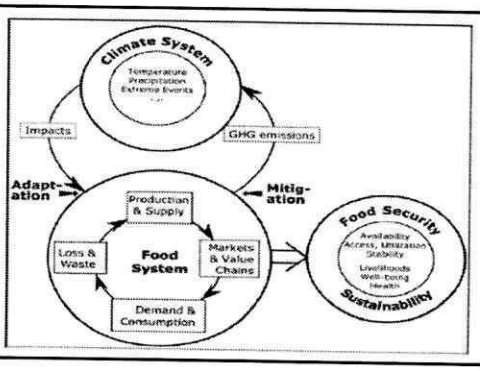
Nearly 13 million tons of annual waste was identified that can feasibly be diverted from landfills and on-farm losses.

A Call for Action for

UN Sustainable Development Goal (SDG) 12.3

By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

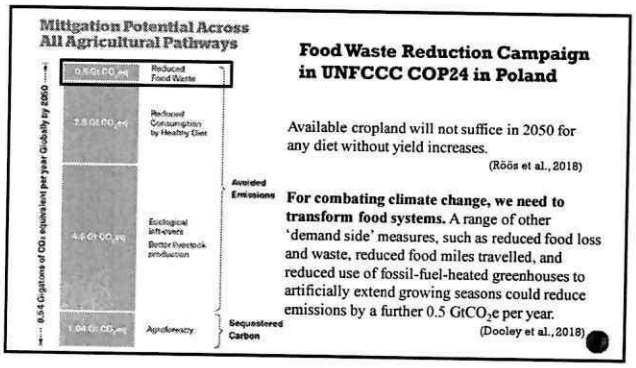
SUSTAINABLE DEVELOPMENT GOALS



Contribution to GHG Emissions from The Food System as Percentage of Total Emissions

Activity	Low estimate (%)	High estimate (%)
Entire food system	30	50
Crop and livestock	7	13
Land use and land use change	5	14
Supply chain	16	20

*Contributions from food loss and waste are included in these estimates and may account for 8-10% of total GHG emissions from all sectors



Reducing FLW for Food Security and Combating Climate Change

MANY THANKS FOR YOUR ATTENTION!