RESHAPING AGRICULTURE AND DEVELOPMENT IN SE ASIA

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SEARCA Senior Fellow (Honorary)

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The Context

1. From current to an envisioned future:
   Taking stock
   The Vision

2. The Transformation (Re-Shaping)
   Process - Opportunities & Action
   Imperatives
1. From current to an envisioned future: Taking Stock

- Segmented use between 16% arable land (food security) and 10% permanent crops (export income)
- Land loss to non-agriculture uses (c 3%/year) and competition for water and labour from other sectors
- *Arable land per capita in Southeast Asia is about 0.11 ha.*
- ASEAN countries produce much (top 3 for a range of agrifood products) but still depend on imports from outside region to meet needs for animal feed (soybean) and wheat
- Still high prevalence of hunger and under-nutrition and emerging urban “over-nutrition” with NCDs
## ASEAN Agriculture

### Agriculture’s contribution to GDP continues to decline.

<table>
<thead>
<tr>
<th>Country</th>
<th>Employment in Agriculture, % of total employment, 2016 or nearest year</th>
<th>Agriculture, % of GDP 1990</th>
<th>Agriculture, % of GDP 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>-</td>
<td>0.98</td>
<td>1.2</td>
</tr>
<tr>
<td>Cambodia</td>
<td>64.3 (2014)</td>
<td>50.12</td>
<td>26.3</td>
</tr>
<tr>
<td>Indonesia</td>
<td>32.9 (2015)</td>
<td>17.55</td>
<td>14.0</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>72.2 (2010)</td>
<td>45.06</td>
<td>19.5</td>
</tr>
<tr>
<td>Malaysia</td>
<td>11.4</td>
<td>14.89</td>
<td>8.8</td>
</tr>
<tr>
<td>Myanmar</td>
<td>53.2 (2015)</td>
<td>57.26</td>
<td>25.5</td>
</tr>
<tr>
<td>Philippines</td>
<td>27.0</td>
<td>19.14</td>
<td>9.7</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.1</td>
<td>0.34</td>
<td>0.0</td>
</tr>
<tr>
<td>Thailand</td>
<td>31.2</td>
<td>10.01</td>
<td>8.3</td>
</tr>
<tr>
<td>Vietnam</td>
<td>41.8</td>
<td>38.74</td>
<td>18.1</td>
</tr>
</tbody>
</table>

**Agriculture is still an important source of livelihood to many people in lower-income economies**

➢ 100 Million Smallholder Farmers

Source: ADB Key Indicators 2017
### ASEAN: Dependency on Cereal Imports

<table>
<thead>
<tr>
<th>Country</th>
<th>Cereal Import Dependency Ratio, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>100</td>
</tr>
<tr>
<td>Singapore</td>
<td>100</td>
</tr>
<tr>
<td>Malaysia</td>
<td>72.6</td>
</tr>
<tr>
<td>Philippines</td>
<td>17.8</td>
</tr>
<tr>
<td>Timor Leste</td>
<td>15.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>15.0</td>
</tr>
<tr>
<td>Cambodia</td>
<td>-1.3</td>
</tr>
<tr>
<td>Myanmar</td>
<td>-2.0</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>-5.2</td>
</tr>
<tr>
<td>Vietnam</td>
<td>-12.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>-29.4</td>
</tr>
</tbody>
</table>

Cereal import dependency ratio (%) (3-year average) in Asia. Countries with negative cereal dependency ratios are those which are net exporters of cereals. Data was not available for some countries in the UN FAO website. Latest data available for the countries above is for the period **2011-13.** (UN FAO 2017)

In 2017/18, Indonesia expected to become world’s largest wheat importer, at 12.5 M tons! .....USDA/FAS
## HIGH VARIABILITY IN CROP YIELDS BETWEEN COUNTRIES, 2015/16

<table>
<thead>
<tr>
<th>ASEAN member</th>
<th>CORN</th>
<th>RICE</th>
<th>SOYBEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield t/ha</td>
<td>Yield t/ha</td>
<td>Yield t/ha</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2.95</td>
<td>4.71</td>
<td>1.33</td>
</tr>
<tr>
<td>Malaysia</td>
<td>-</td>
<td>4.01</td>
<td>-</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.93</td>
<td>3.90</td>
<td>-</td>
</tr>
<tr>
<td>Thailand</td>
<td>4.31</td>
<td>2.53</td>
<td>1.73</td>
</tr>
<tr>
<td>Vietnam</td>
<td>4.60</td>
<td>5.75</td>
<td>1.46</td>
</tr>
<tr>
<td>Myanmar</td>
<td>-</td>
<td>2.76</td>
<td>-</td>
</tr>
<tr>
<td>Cambodia</td>
<td>-</td>
<td>2.34</td>
<td>-</td>
</tr>
</tbody>
</table>

### Farmers’ Record Yields

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield t/ha</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (Rainfed)</td>
<td>22.3 t/ha</td>
<td>Chile</td>
</tr>
<tr>
<td>Corn (Irrigated)</td>
<td>26.8 t/ha</td>
<td>Chile</td>
</tr>
<tr>
<td>Soybean</td>
<td>10.8 t/ha</td>
<td>MO, US</td>
</tr>
<tr>
<td>Wheat</td>
<td>15.5 t/ha</td>
<td>NZ</td>
</tr>
<tr>
<td>Rice</td>
<td>18.0 t/ha</td>
<td>China</td>
</tr>
</tbody>
</table>

*From: Fisher, Edmeades & Byerlee, 2013*
Disturbances are the norm: SE Asia has among highest frequency of severe weather events

### Rice loss due to floods (ha)

<table>
<thead>
<tr>
<th>Year</th>
<th>Thailand</th>
<th>Philippines</th>
<th>Myanmar</th>
<th>Malaysia</th>
<th>Lao</th>
<th>Indonesia</th>
<th>Cambodia</th>
<th>Brunai</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>46,794</td>
<td>8,880</td>
<td>29,531</td>
<td>430</td>
<td>27,179</td>
<td>55,884</td>
<td>31,105</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>219,83</td>
<td>1,808</td>
<td>7,695</td>
<td>430</td>
<td>29,821</td>
<td>103,76</td>
<td>1,010</td>
<td>486</td>
</tr>
<tr>
<td>2009</td>
<td>30,000</td>
<td>12,679</td>
<td>1,001</td>
<td>766</td>
<td>27,921</td>
<td>24,909</td>
<td>2,500</td>
<td>191</td>
</tr>
<tr>
<td>2010</td>
<td>10,735</td>
<td>12,679</td>
<td>6,424</td>
<td>766</td>
<td>37,053</td>
<td>24,909</td>
<td>38,563</td>
<td>91</td>
</tr>
<tr>
<td>2011</td>
<td>698,56</td>
<td>89,396</td>
<td>34,574</td>
<td>795</td>
<td>95,944</td>
<td>37,053</td>
<td>15,062</td>
<td>21</td>
</tr>
<tr>
<td>2012</td>
<td>1,284,1</td>
<td>12,808</td>
<td>16,478</td>
<td>-</td>
<td>1,191</td>
<td>29,233</td>
<td>201,86</td>
<td>23</td>
</tr>
<tr>
<td>2013</td>
<td>1,284,1</td>
<td>2,319</td>
<td>29,047</td>
<td>-</td>
<td>-</td>
<td>72,571</td>
<td>16,510</td>
<td>15</td>
</tr>
</tbody>
</table>

### Rice loss due to Diseases and pests and others (tons/yr)

<table>
<thead>
<tr>
<th>Year</th>
<th>Thailand</th>
<th>Philippines</th>
<th>Myanmar</th>
<th>Malaysia</th>
<th>Lao</th>
<th>Indonesia</th>
<th>Cambodia</th>
<th>Brunai</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>469,53</td>
<td>1,868</td>
<td>101</td>
<td>430</td>
<td>27,179</td>
<td>55,884</td>
<td>31,105</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>-</td>
<td>-</td>
<td>8,174</td>
<td>-</td>
<td>29,821</td>
<td>103,76</td>
<td>1,010</td>
<td>486</td>
</tr>
<tr>
<td>2009</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>27,921</td>
<td>24,909</td>
<td>2,500</td>
<td>191</td>
</tr>
<tr>
<td>2010</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37,053</td>
<td>24,909</td>
<td>38,563</td>
<td>91</td>
</tr>
<tr>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>95,944</td>
<td>37,053</td>
<td>15,062</td>
<td>21</td>
</tr>
<tr>
<td>2012</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1,191</td>
<td>29,233</td>
<td>201,86</td>
<td>23</td>
</tr>
<tr>
<td>2013</td>
<td>1,284,1</td>
<td>1,232</td>
<td>7,335</td>
<td>430</td>
<td>-</td>
<td>635</td>
<td>15</td>
<td>-</td>
</tr>
</tbody>
</table>

Data source: ASEAN Food Security Information System, as presented in Q2 2014
A development driver: ASEAN is urbanizing fast and has a growing middle class

**SE Asia had 634.5 M people in mid-2016! 46.8% urban**

<table>
<thead>
<tr>
<th>Country</th>
<th>% Urban 2016 or closest year</th>
<th>Population Mid 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>77.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Cambodia</td>
<td>20.9</td>
<td>15.2</td>
</tr>
<tr>
<td>Indonesia</td>
<td>53.7 (2015)</td>
<td>258.7</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>39.7</td>
<td>6.6</td>
</tr>
<tr>
<td>Malaysia</td>
<td>74.8</td>
<td>31.7</td>
</tr>
<tr>
<td>Myanmar</td>
<td>29.2 (2015)</td>
<td>52.9</td>
</tr>
<tr>
<td>Philippines</td>
<td>44.3</td>
<td>103.2</td>
</tr>
<tr>
<td>Singapore</td>
<td>100.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>44.5 (2013)</td>
<td>67.5</td>
</tr>
<tr>
<td>Vietnam</td>
<td>33.9 (2015)</td>
<td>92.7</td>
</tr>
</tbody>
</table>

The Growing ASEAN Middle Class!

Have disposable income of US$ 16 - 100 per day in 2012

- **Estimated to grow to 400 Million by 2020!**

Trends in Food and Diet from urbanization and increasing urban household incomes

**Food Demand Changes in South East Asia**

- Most food is purchased
- Reduced per capita consumption of rice, e.g. Singapore, 47 kg
- Increased diversity in the food groups consumed
- Rise in high proteins and energy dense diets
- Rising popularity of convenience food and beverages; Westernization of diets
- Increased consumption per capita of wheat and wheat-based products
Prevalence of undernourishment (%) (3-year average) (UN FAO 2017)

- Higher % household income spent on food, More malnutrition
- Micronutrient deficiencies higher in poor households

Is 10% acceptable?
2. The Transformation (Re-Shaping) Process – Opportunities & Action Imperatives

• Opportunities to be discussed in Forum Sessions:
  – Managing Climate Uncertainties and Water Scarcity
  – The Promise of Information Technology
  – Agro-industrial Value Chains and Integration of Smallholders
  – Farm Tourism and Family Farming

• Imperatives
  1. Embrace Disruptive technologies and approaches
  2. Build Transformational leadership
  3. Recognize the inevitable (employability and 21st CC): Relevant education for agriculture graduands
  4. Bridge the rural:urban divide
  5. Promote harmony in cross-country governances
  6. Plan for the future of food
2.1 Embrace Disruptive Agricultural Technologies (AgTech)

- **Farm Management Software, Sensing & IoT**
  - Ag data capturing devices, decision support software, big data analytics
- **Robotics, Mechanisation & Equipment**
  - On-farm machinery, automation, drone manufacturers, grow equipment
- **Novel Farming Systems**
  - Indoor farms, aquaculture, insect, algae & microbe production (excludes consumer home grow kits)
- **Novel seeds**
  - Biotech seeds, NBT seeds
- **Bioenergy & Biomaterials**
  - On-farm ag waste processing, biomaterials production, anaerobic digesters (excludes supply chain companies)
- **Agribusiness Marketplaces**
  - Commodities trading platforms, online input procurement, equipment leasing used by farmers
- **Farm-to-Consumer eGrocery**
  - Online platforms for farmers to sell and deliver their produce direct to consumers
- **Miscellaneous**
  - Land management tech, financial services for farmers, etc.

**FAO: $265 Billion/yr investments needed**

*Modified From: AgFunder 2018*
Digital agriculture: “Internet of things” (IoT)

AgFunder: “$4.6B invested in AgTech (2016)”

Data-Enabled Agriculture
- Mobile Computing
- Data Sensor Input
- Satellite & Imagery
- Drones
- Wireless Communications
- Genetics

Knowledge Intensive Agriculture
- Technology Enabled Farming (TEF)

Extensive Farms

Agriculture is the least digitized industry

Can technology-enabled urban farms be a winner for S’pore?
FINTECH

computer programs and other technology used to support or enable banking and financial services.

China’s agriculture financing has an RMB three trillion gap, according to a report released by the Chinese Academy of Social Sciences (in Chinese).

Agriculture fintech’s potential RMB three trillion market in China

Linda Lew, Technode, Mar 30, 2017

Fintech startups as enablers of change

Strategies and interventions that have been implemented seem to have favoured the ‘already included’, with little benefits for the ‘unreached’. With increasing penetration of smart phones and other technologies, collaboration between fintech startups and traditional formal institutions will define the future of financial inclusion in India.

Given that time-sensitive small loans are the biggest challenge that farmers face, it’ll be interesting to see solutions such as record-keeping platforms that enable small and marginal farmers to keep records, track their farming activity and build a credit profile. This would help farmers in effectively building a knowledge base that will help them –

— Get access to favourable loan terms that correlate with their farming activities
— Meet immediate credit needs

Can Fintech entrepreneurs save India’s farmers?

By Shweta Vitta | August 25, 2016. Unitus Seed Fund
Gene-Editing biotechnologies (CRISPR, TALENs, Zinc Finger Nucleases)

- **Capability – Ability to edit native crop genes** coding for important traits and generating **non-transgenic plants**
- **Genome-edited crops** being improved include, soybean, maize, wheat, rice, potato, tomato, and peanuts

Technologies not fully utilized but with high potential impact on food production in ASEAN
Agricultural transformation is key to economic development

- **Agricultural transformation** lies at the core of poverty reduction, food security, and improved nutrition. With few exceptions, countries that have moved toward middle-income status have been initially driven along that path of economic growth by the transformation of their agriculture sector.

- The drivers of agricultural transformation are multidimensional, interrelated, and change over time: First, there are elements of “transformation readiness” -- changes to a country’s institutional framework, governing mechanisms, and political environment. Second, the quality of the national agricultural plan or strategy is critical. Last, there are drivers related to delivery mechanisms.

- One commonly absent component of transformation readiness relates to low support for transformation leadership. Transformations depend on talented people spurring them, with access to the right tools. The success of any agricultural transformation relies on how well millions of smallholders and small- and medium-size enterprises can be helped to change farming practices as quickly and effectively as possible. The critical enabler, without which an agricultural transformation is likely to fail, is a frontline “change agent” that helps farmers modify their practices.

- **New program under consideration -- Centre of Excellence for Smallholder Farm Management, to produce, inter alia, these change leaders. A Private-Public Sector Initiative.**
2.3 Recognize the inevitable (employability and 21st CC): Relevant education for agriculture graduands

ECOSPERITY 2018

• While more young people are going to school…
• …Education is not adequately preparing them for the workforce
  – Nearly 50% of subject Knowledge acquired during 1st year of a 4 yr degree will be outdated by the time students graduate
  – 46% of Asia’s employers report difficulties filling jobs today
  – Only 40% of executives believe new employees have requisite job skills
• Living and working longer magnifies these challenges
  – 65% of children entering primary school today will have jobs that do not yet exist!
  – Workers need to ensure relevance
We need to empower our next generation of agricultural graduates with skills that make them competitive and transferable.

7 Critical Skills for the Jobs of the Future

- Critical Thinking and Problem Solving. ...
- Collaboration Across Networks and Leading by Influence. ...
- Agility and Adaptability. ...
- Initiative and Entrepreneurship. ...
- Effective Oral and Written Communication. ...
- Assessing and Analyzing Information. ...
- Curiosity and Imagination…

https://singularityhub.com/2017/07/04/7-critical-skills-for-the-jobs-of-the-future/
2.4 Bridge the rural:urban divide

Rural wages are still much lower than equivalent urban wages

Gross Value Added per Worker, by Sector

Source: World Bank
*Author Estimates based on GVA by Sector, and Employment by Sector
# Poverty and Income Inequality in SE Asia

<table>
<thead>
<tr>
<th>Regional Member</th>
<th>Proportion of Population below $1.90 a Day (2011 PPP) (%)</th>
<th>Proportion of Population Living below $3.10 a Day (2011 PPP) (%)</th>
<th>Income Ratio of Highest 20% to Lowest 20% b</th>
<th>Gini Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast Asia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>2.6 0.0 (2013)</td>
<td>17.0 0.9 (2013)</td>
<td>8.1 6.5 (2013)</td>
<td>0.428 0.379 (2013)</td>
</tr>
</tbody>
</table>

ADB 2018
Access to sources of food production in urban areas

Technology Enabled Panasonic Indoor Farm, Singapore

➢ 120 “Plant Factories” now in commercial production in Japan

➢ 26 high tech urban farms now in Singapore compared to 5
Educating the urban public on where food comes from and how it is produced
Building awareness of and support for agriculture and farmers

Launched on 4 July 2018
<table>
<thead>
<tr>
<th>VALUE CHAIN AREA</th>
<th>FROM...</th>
<th>TO...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>Urbanisation encroaching on agricultural land</td>
<td>Taking advantage of utilised land in cities for urban agriculture</td>
</tr>
<tr>
<td></td>
<td>More complex and lengthy distribution channels to supply food to urban areas</td>
<td>Minimising time to market by concentrating production in cities</td>
</tr>
<tr>
<td></td>
<td>Climate and land degradation impacting crop yields</td>
<td>Environmentally-controlled conditions to maximise production</td>
</tr>
<tr>
<td></td>
<td>Traditional agricultural techniques</td>
<td>Sophisticated vertical farming, applying latest technologies</td>
</tr>
<tr>
<td><strong>Food Waste</strong></td>
<td>Lack of storage facilities</td>
<td>Modern, cold storage systems</td>
</tr>
<tr>
<td></td>
<td>Restaurant waste</td>
<td>Internet of Things (IoT) in the kitchen</td>
</tr>
<tr>
<td></td>
<td>Low consumer awareness</td>
<td>Taxes and information campaigns to raise awareness</td>
</tr>
<tr>
<td></td>
<td>Limited waste capture</td>
<td>Composting and energy capture</td>
</tr>
<tr>
<td><strong>Traceability</strong></td>
<td>Limited traceability of food from farmgate to fork</td>
<td>IoT and fully traceable supply chains</td>
</tr>
<tr>
<td></td>
<td>Limited price transparency, and risks of food fraud and food safety concerns</td>
<td>Greater price transparency, and better management of food fraud and food safety risks</td>
</tr>
<tr>
<td><strong>Nutrition</strong></td>
<td>Consumption of highly processed and junk food</td>
<td>Healthy and affordable fresh food available with maximum convenience</td>
</tr>
<tr>
<td></td>
<td>Growing cases of food allergies</td>
<td>“Free-from” foods tailored to allergies</td>
</tr>
<tr>
<td></td>
<td>Unfortified food</td>
<td>Food fortification</td>
</tr>
<tr>
<td></td>
<td>High sugar/fat products</td>
<td>Product reformulation, low fat/sugar products</td>
</tr>
</tbody>
</table>

**Increasing demand by urban consumers for “sustainably produced food!”**

**Use cities to produce food**

**Zero Waste**

**Know your food**

**Agriculture for Nutrition**
2.5 Promote Harmony in cross-country governances

Think Regional
Act Local

- Transferability of food approvals
- Harmonization of regulations
- Skill mobility
- Seamless trade

Avenues for Policy Intervention

- Increase the area farmed or arrest the decline in farm land
- Support efforts at increasing food production in food surplus countries or food importing competitors
- Develop alliances with Asia's food bowls
HARMONIZING AGRI-DEVELOPMENT ECOSYSTEMS IN ASEAN

Academia
Universities Research Inst.

National, Regional Policy makers & Regulatory Bodies
Laws, Taxes, Incentives, Guidelines for Investment, Safety, Efficacy, Approval

Public Equity
IPOs

Technology Transfer

Entrepreneurs
Start-ups/SMEs
Management
Scientific Advisory Board

Support Industries
Consultants, PR firms
Marketing firms, Media

Corporate And SME R&D

Public Sector

Investment Banks
Private Equity
Venture Capital
Angel Investors
Multi – National Companies

Private Sector

Consultants, PR firms
Marketing firms, Media

Entrepreneurs
Start-ups/SMEs
Management
Scientific Advisory Board

Support Industries
Consultants, PR firms
Marketing firms, Media

Corporate And SME R&D

Public Sector

Investment Banks
Private Equity
Venture Capital
Angel Investors
Multi – National Companies

Private Sector
2.6 Plan for the future of food

Beyond conventional food: New food technologies for Future Food (without agriculture!)

Artificial vegetable protein

Meat Alternative Protein (MAP) versus Animal Sourced Food (ASF)

“Impossible Foods”, Redwood City, CA. $75M

Plant-based meat and cheese substitutes

• Hamburger patty that bleeds

Haem (animals) = Heme (plants)

Animal protein without animals

• Hamburger meat from the lab

• Technology-enabled food farming

Mainstreaming Alternative Foods

From $350 to $25 per hamburger patty

Source: The Economist, March 7 2015
ASEAN Economic Community (AEC) 2015

1. Single market and production base
2. Competitive economic region
3. Equitable economic development
4. Fully integrated region in the global economy

ASEAN VISION 2025

ASEAN SOCIO-CULTURAL COMMUNITY BLUEPRINT 2025

an ASEAN Community that engages and benefits the peoples and is inclusive, sustainable, resilient, and dynamic.

ASEAN POLITICAL-SECURITY COMMUNITY BLUEPRINT

A rules-based community; A cohesive, peaceful, stable and resilient region; A dynamic and outward-looking region in an increasingly integrated and inter-dependent world; non-traditional security
Thank you - 谢谢 - Terima Kasih - ขอบคุณ - ขอบใจ - Maraming selamat - cảm ơn - ขอขอบคุณ - ភូមិសុខ្ម័រ - 感謝

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