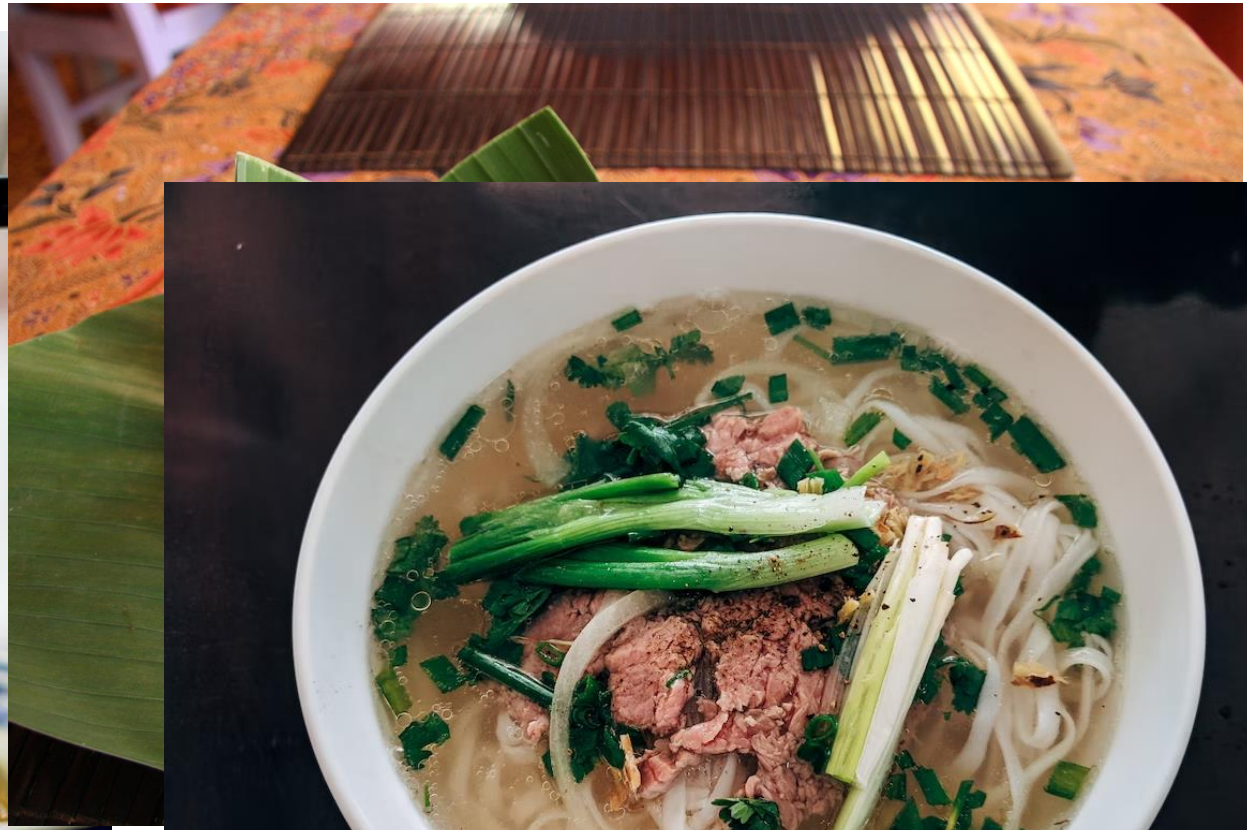


ASEAN DATA SCIENCE EXPLORERS

SAP

ASEAN FOUNDATION

Building a Sustainable Smallholder Farming Model in ASEAN

Investigating the key factors behind unsustainable farming practices among smallholders & recommending key strategies to achieve a sustainable smallholder farming model.

Team 002

Cham Swee Han
Tan Yong Ze

8 DECENT WORK AND ECONOMIC GROWTH

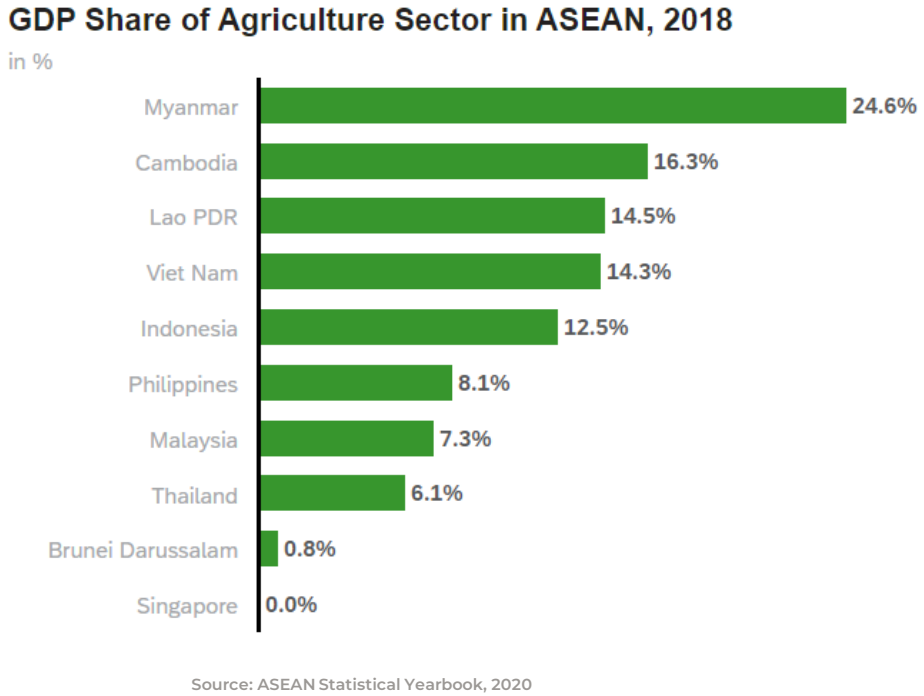
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

TAYLOR'S UNIVERSITY

SUNWAY TES Centre for Accountancy Excellence

Why is Agriculture Important in ASEAN?

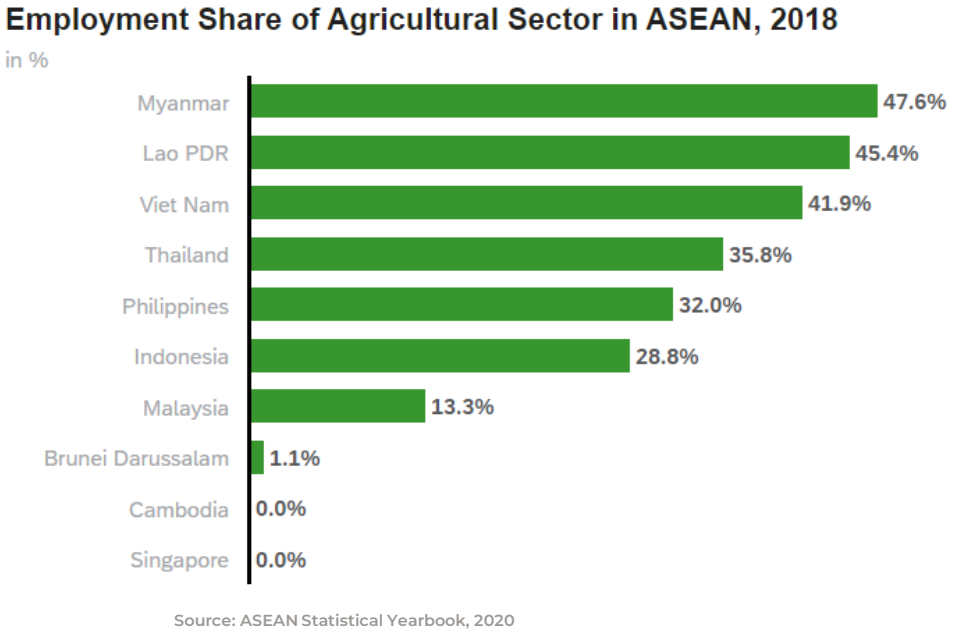


Source: ASEAN Statistical Yearbook, 2020

13.3%

ASEAN GDP contributed by agriculture sector

Why is Agriculture Important in ASEAN?



Source: ASEAN Statistical Yearbook, 2020

33.1%

ASEAN's employment contributed by agriculture sector

Agriculture sector in ASEAN account for **a substantial share of the region's GDP** and **employing an important part of the workforce.**

Smallholder Farming - Why is it Important in ASEAN?

Smallholder Farmers

>100 Million

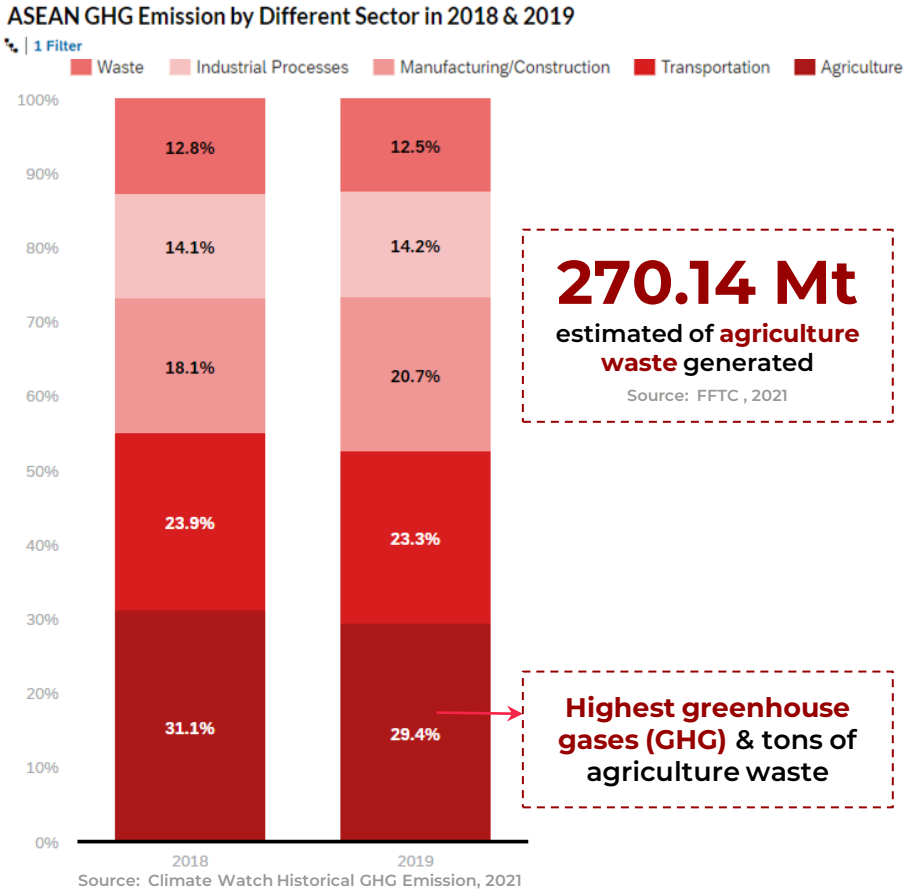
smallholder farmers in ASEAN

1/3

production of the world's food

Source: WWF & FAO, 2021

However, Smallholder Farming Has Its Issues



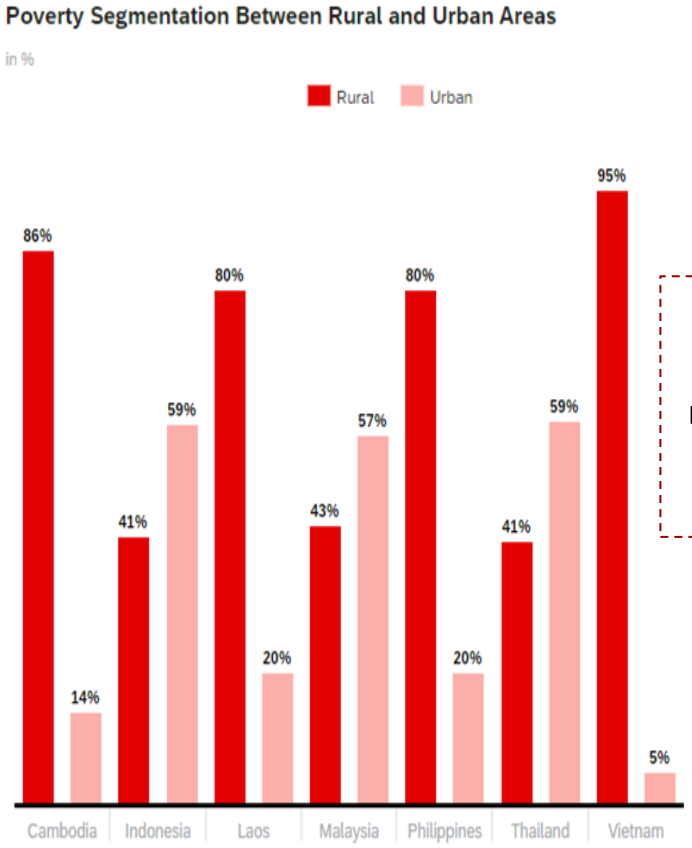
Source: Climate Watch Historical GHG Emission, 2021

270.14 Mt

estimated of **agriculture waste** generated

Source: FFTC , 2021

Highest greenhouse gases (GHG) & tons of agriculture waste



Source: IFAD, 2016.

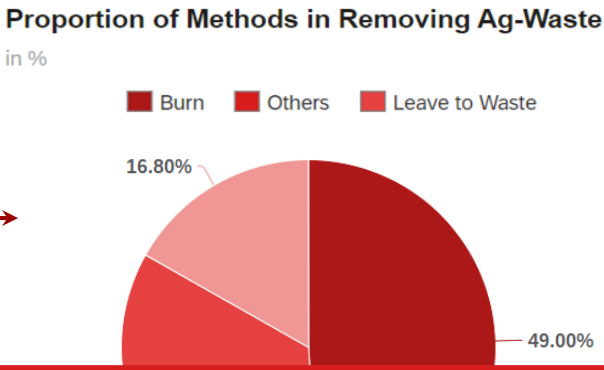
66%

people that are in poverty (including smallholder farmers) **live in rural areas**

Understanding The Current Smallholder Farming Process

Farming

Burn or Left to Waste



Smallholder Farmers particularly are practicing linear model when managing agriculture waste

Harvesting

Agriculture Waste

Source: A. Abdulsamad & G. Gereffi (Forthcoming 2018).

Source: Andini et.al (2018), Arunrat et. al (2018), FFTC (2021)

A **small %** of agriculture waste is recycled & repurposed into another product (Andini et al, 2018).

What Happens If The Linear Model is Practiced?

Potential products that could be converted from rice straw

Antibiotics

Biofuel

Asphalt

Source: Gan X., et.al (2021).

Resources - Rice Straw (Burned)

+ 1℃

Production yield decreases due to global warming

-3.2%

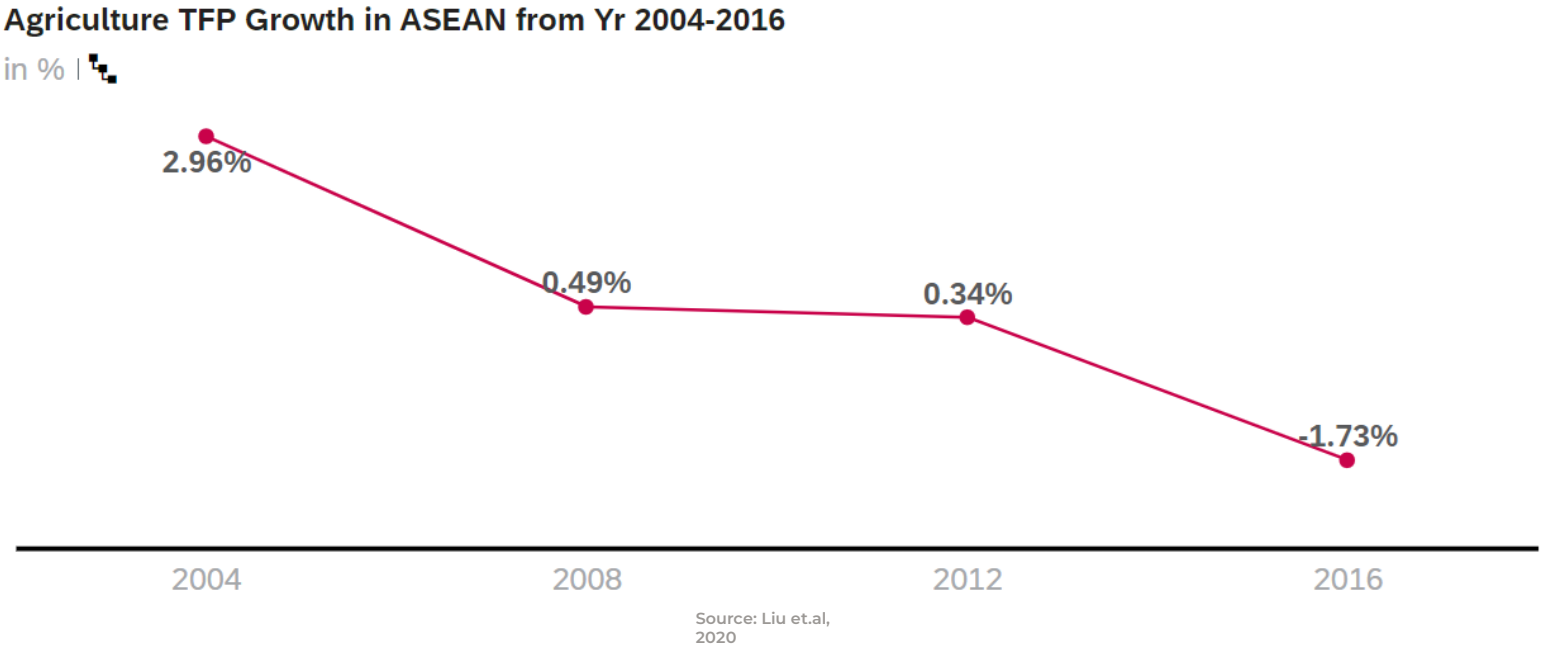
-7.4%

-3.1%

Source:(Zhao et al,(2017).

Linear model not just causes **waste of potential profitable products**, but also global warming which **decreases production yield**

In The Long Run, Will Smallholder Farming Be Sustainable?



Source: Liu et.al, 2020

"TFP should have **non-negative trend** in **sustainable production system**", FAO

However, Do Smallholder Farmers Have a Choice?

 Seed & Fertiliser Companies	25%
 Smallholder Farmers	14%
 Traders & Food Manufacturers	31%
 Supermarkets & Retail Stores	30%

Logistical Issues

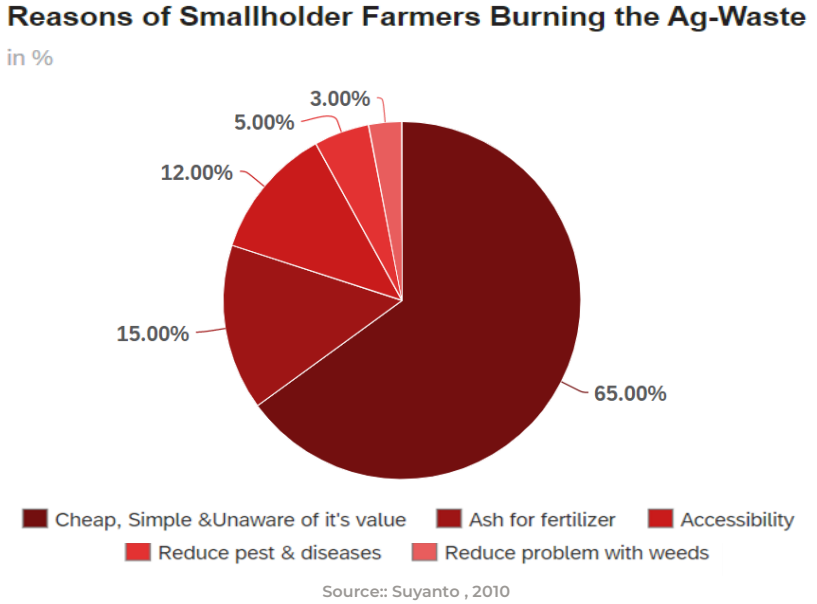
Traders become farmers' only source of revenue as most farmers live in rural areas and lack access to the urban areas.

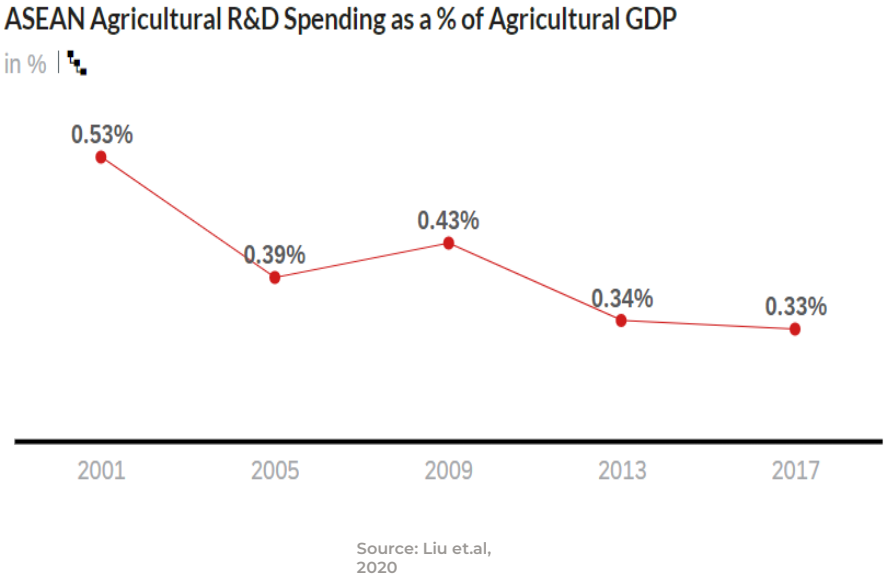
Consequences

- Farmers bargaining power decreases
- Traders set prices that are more favourable to themselves
- Farmers continue to struggle with poverty
- Farmers do not see a reason to practice sustainable farming

Source: Adapted from A. Abdulsamad and G. Gereffi (Forthcoming 2018).

Other Factors of Practicing Linear Model





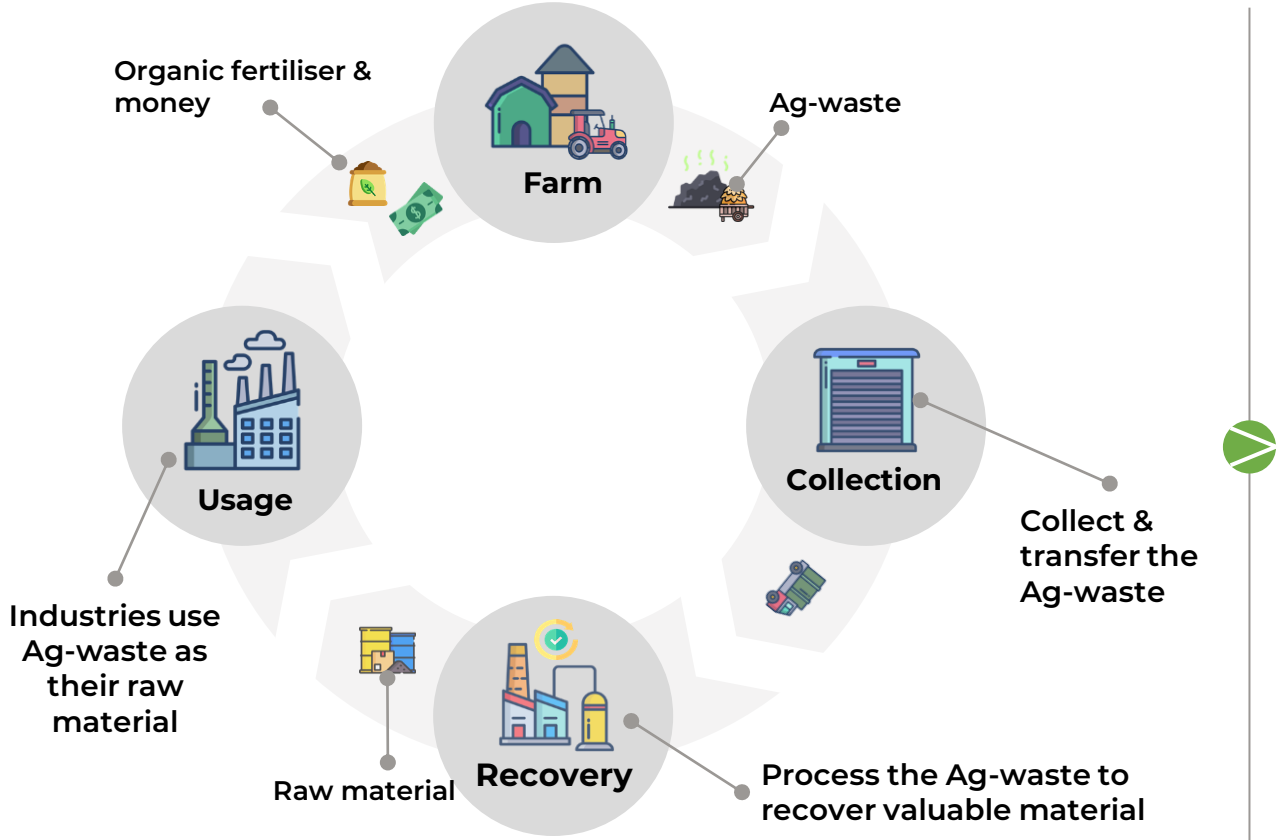
Lack of education on Ag-waste & **lack of proper waste management** leads to burning of waste .

Lack of R&D investments leads to **poor innovations** that reduce ecological impacts while increase productivity

Opportunities Always Arise Within These Problems...

Key Issues	Opportunities	Our Solution
Lack of proper infrastructure (logistics & waste mgmt)	Provide transportation, storage space & set up waste mgmt facilities	Circular Agriculture Framework 
Living in poverty	Diversify income by selling Ag-waste	
Lack of R&D investment	Attract private and foreign investments on Ag-R&D	

Redesigning The Farming Process Using Circular Agriculture Framework



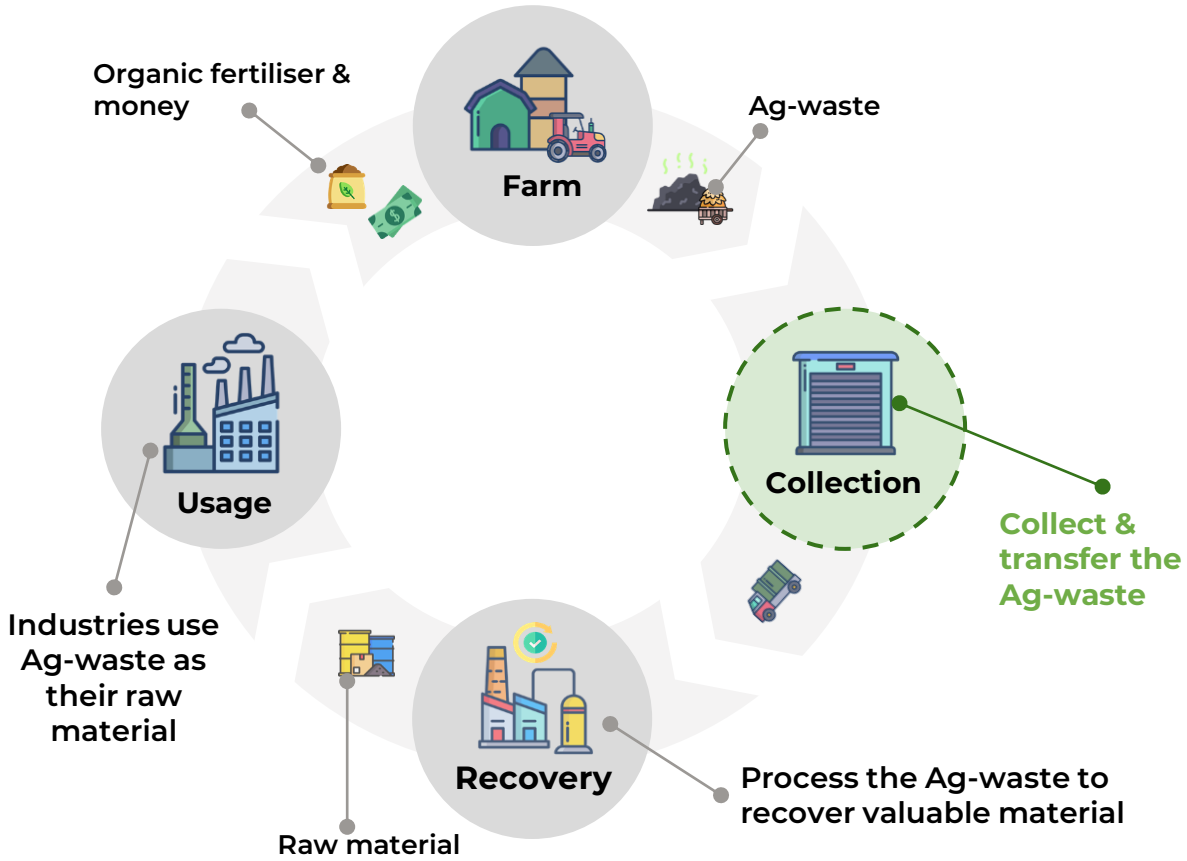
Key Strategies

RE-Collection Centers & AgriBiz

Agriculture Innovation System(AIS)

Strategy #1

- RE-Collection Center
- AgriBiz



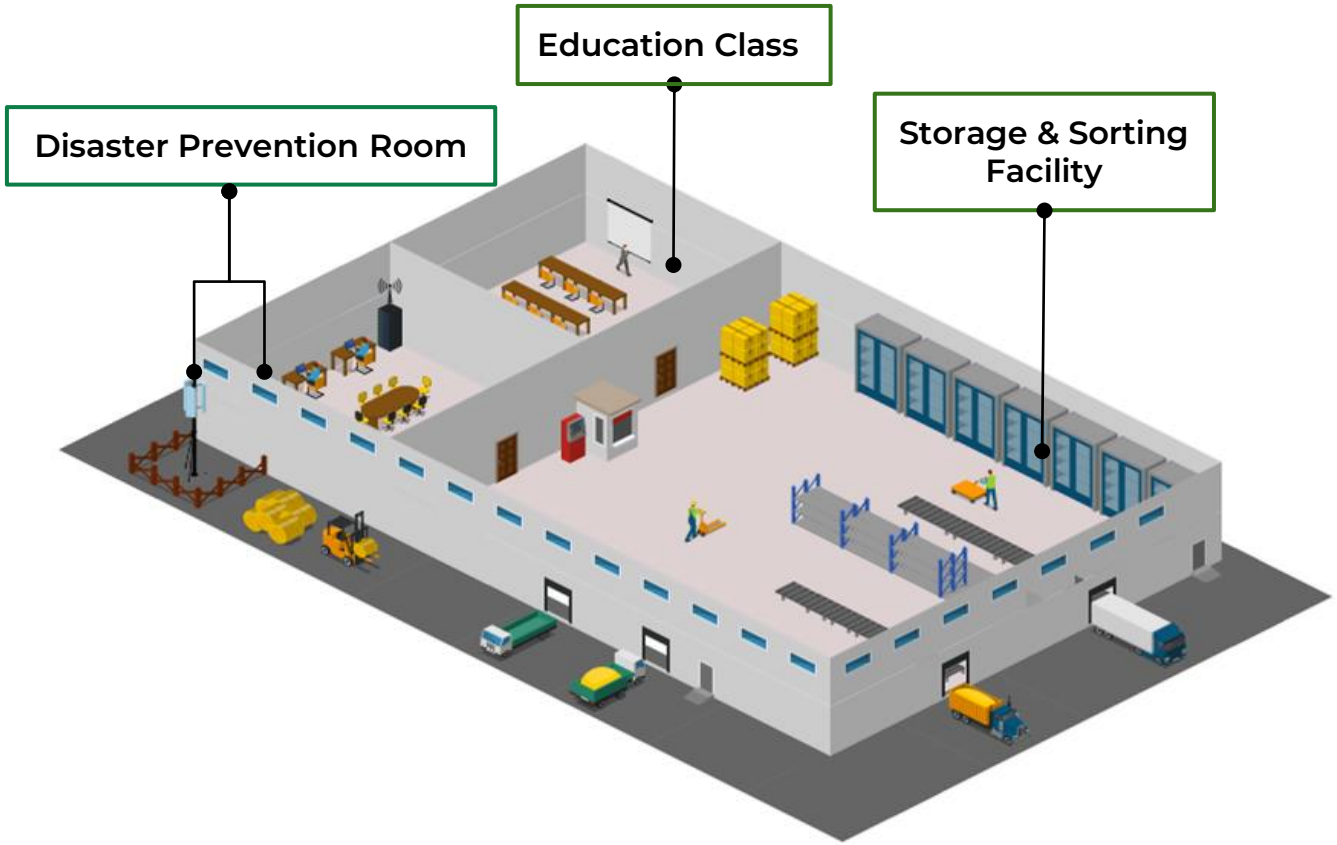
RE-Collection Center: What is it?

Central Point
To collect & process Ag-Waste & Products

Supply Chain Hub
To plan & manage the flows of the Ag. waste & products

Information Platform
To teach farmers on latest technology & receive weather alerts

RE-Collection Center - How does it work?

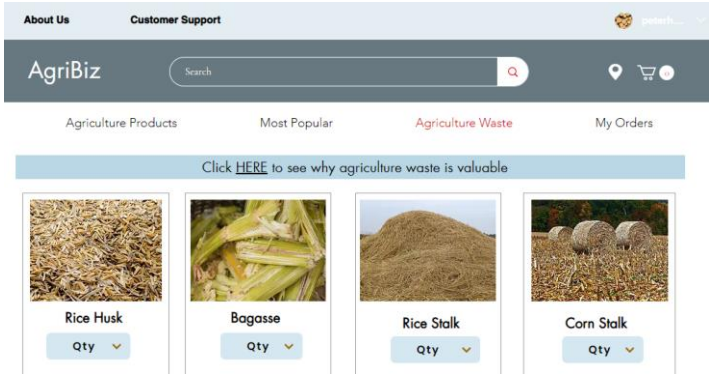


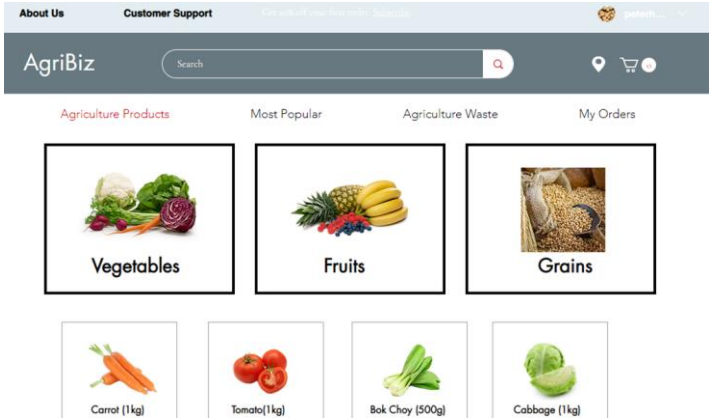
Storage & Sorting Facility
- To sort Ag-Waste & Products in a controlled conditions

Disaster Prevention Room
- To warn farmers on upcoming extreme weather

Education Class
- To teach farmers on latest farming technology

AgriBiz - What is it?





B2B Online Marketplace

To order agriculture products and waste online

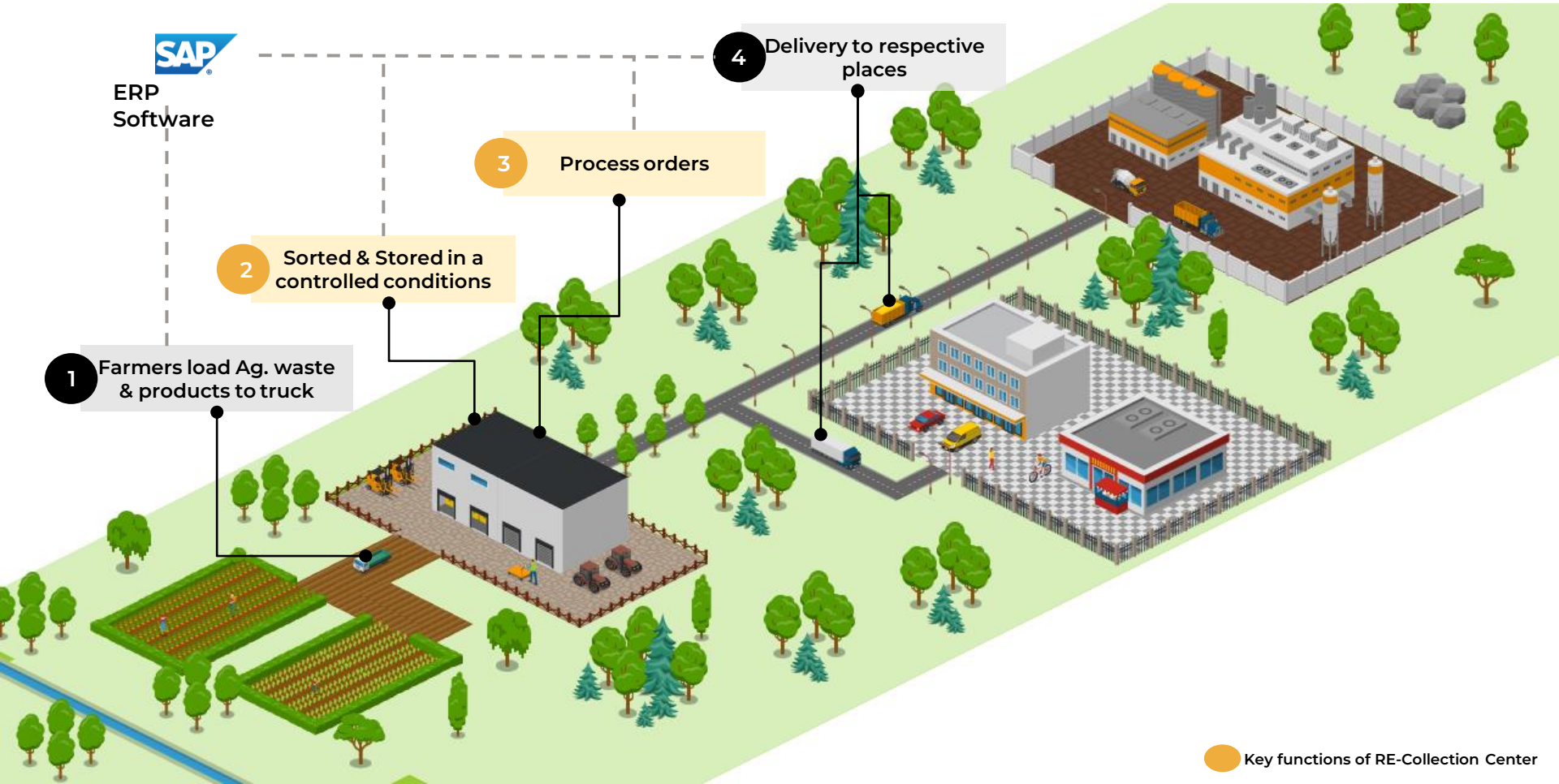
Live Tracking

To check delivery status info and expected time delivery

Awareness Platform

To educate public on the value of agriculture waste

RE-Collection Center & AgriBiz - Integrated Supply Chain

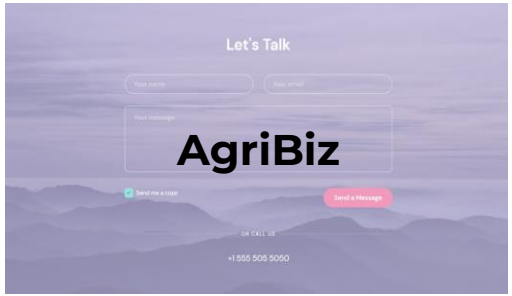


RE-Collection Center & AgriBiz - What are the goals?

Key Issues

- Lack of logistical access
- Living in poverty
- Lack of proper proper waste management

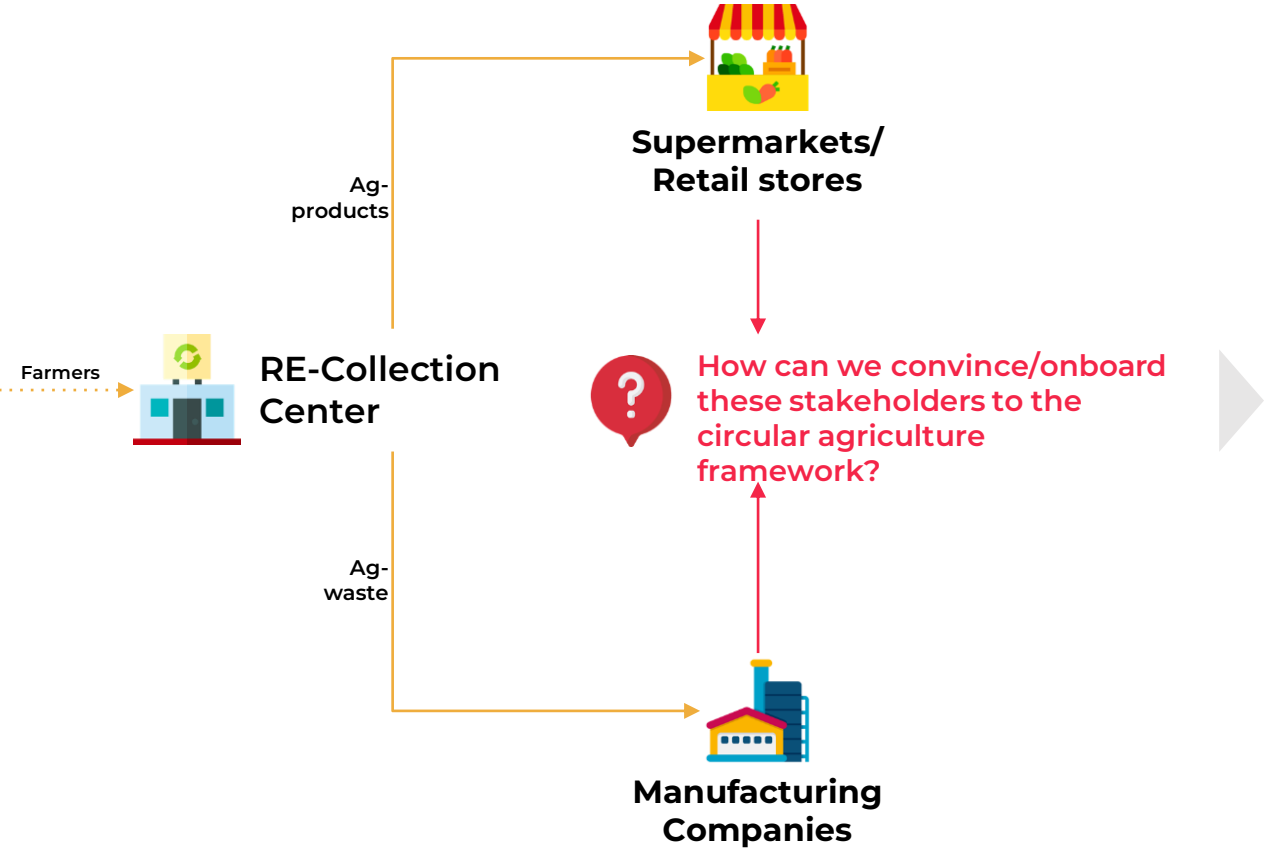
Our Initiatives



Key Impacts

- Farmers now have **better transportation access**
- Farmers now have **access to more markets** & earn an **extra source of income**
- Farmers know how to **manage waste properly** through education

How to onboard the key stakeholders in the value chain?

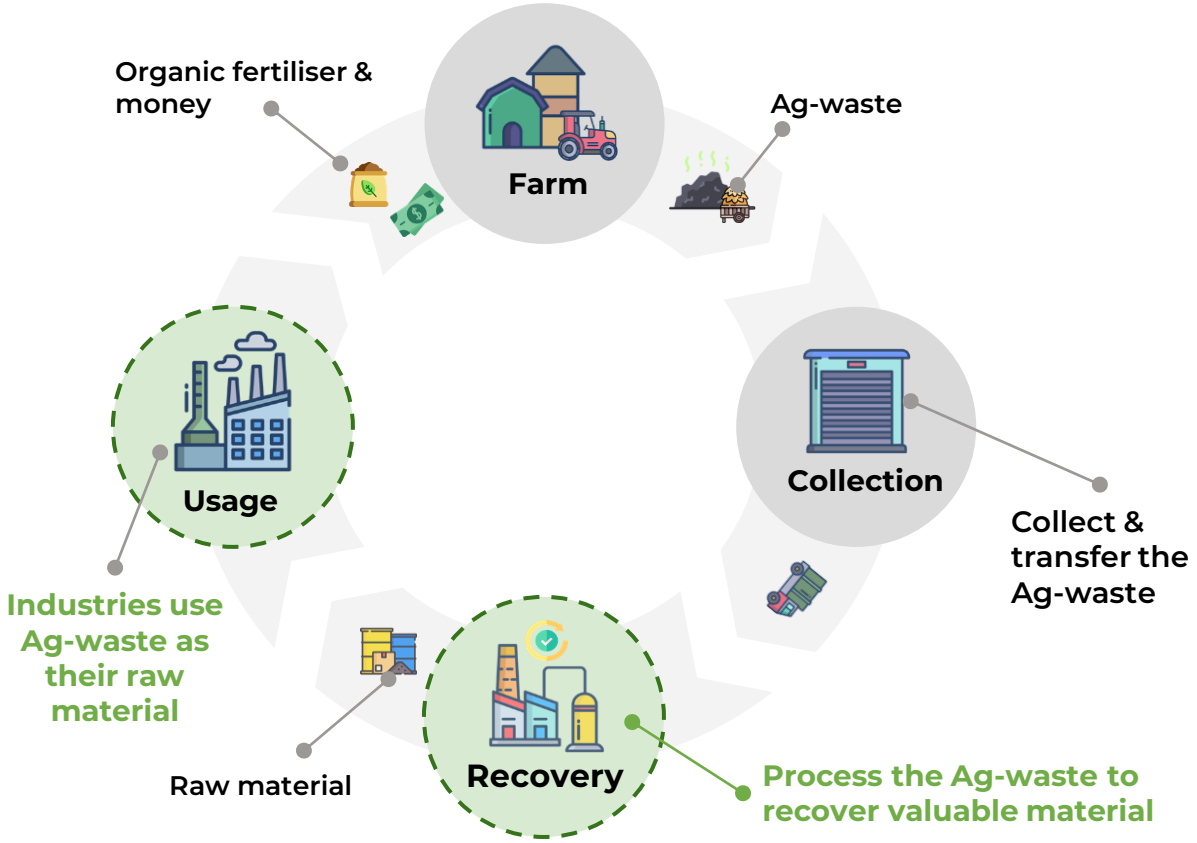


Agriculture Innovation System (AIS)

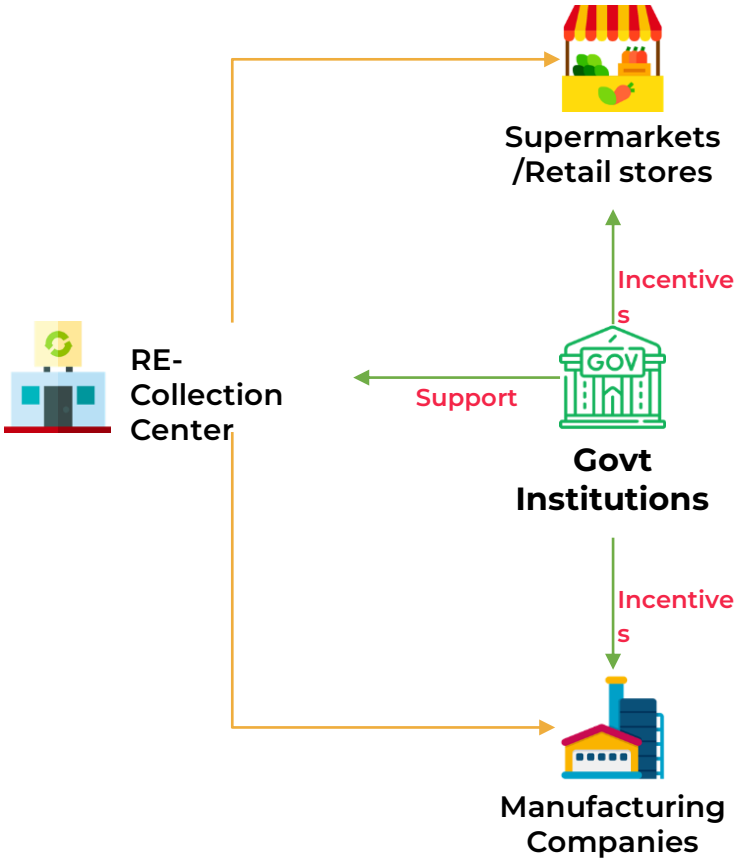
Strategy to **onboard key stakeholders** and the **next step** to achieving circular agriculture

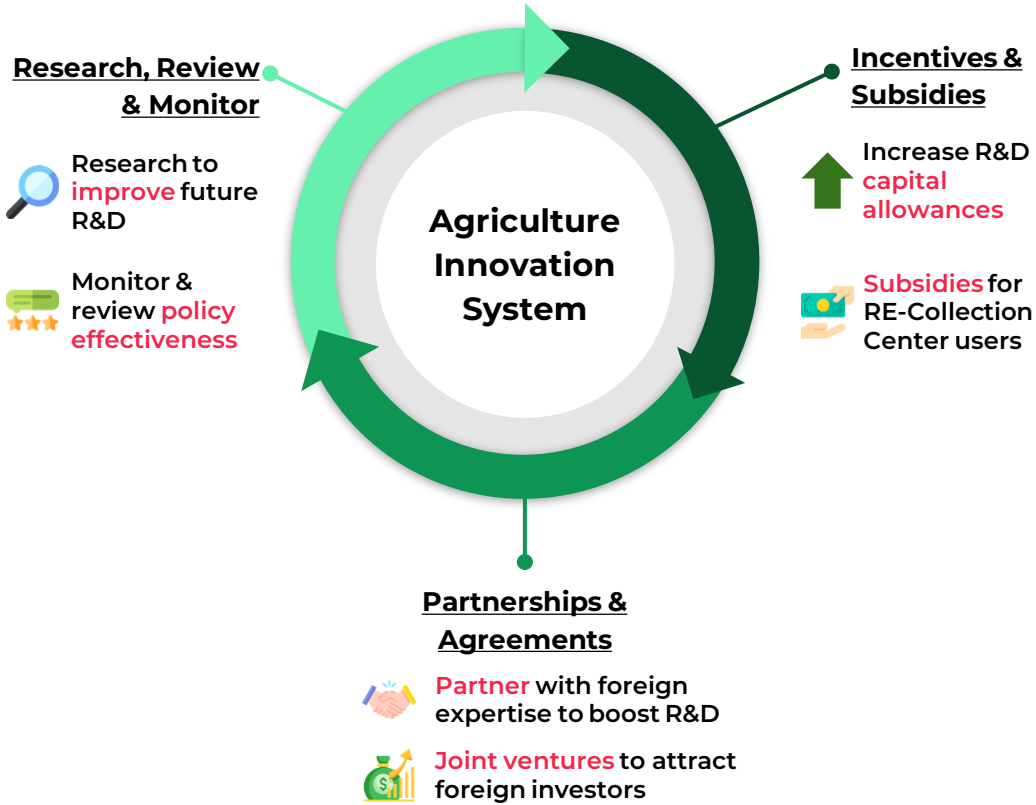
Strategy #2

Agriculture Innovation System (AIS)



AIS - What can the key stakeholders gain?





AIS - Value proposition for the government

Profitable margins

New source of income while regulating the agriculture industry

Cost reduction

RM120
Average cost of recycling

vs.

RM200
Average cost of landfill dumping

RM240
Average cost of burning waste

Source: Bizfluent, 2019.

Positive environmental impact

Reduction of GHGs, waste prevention and increase energy efficiency

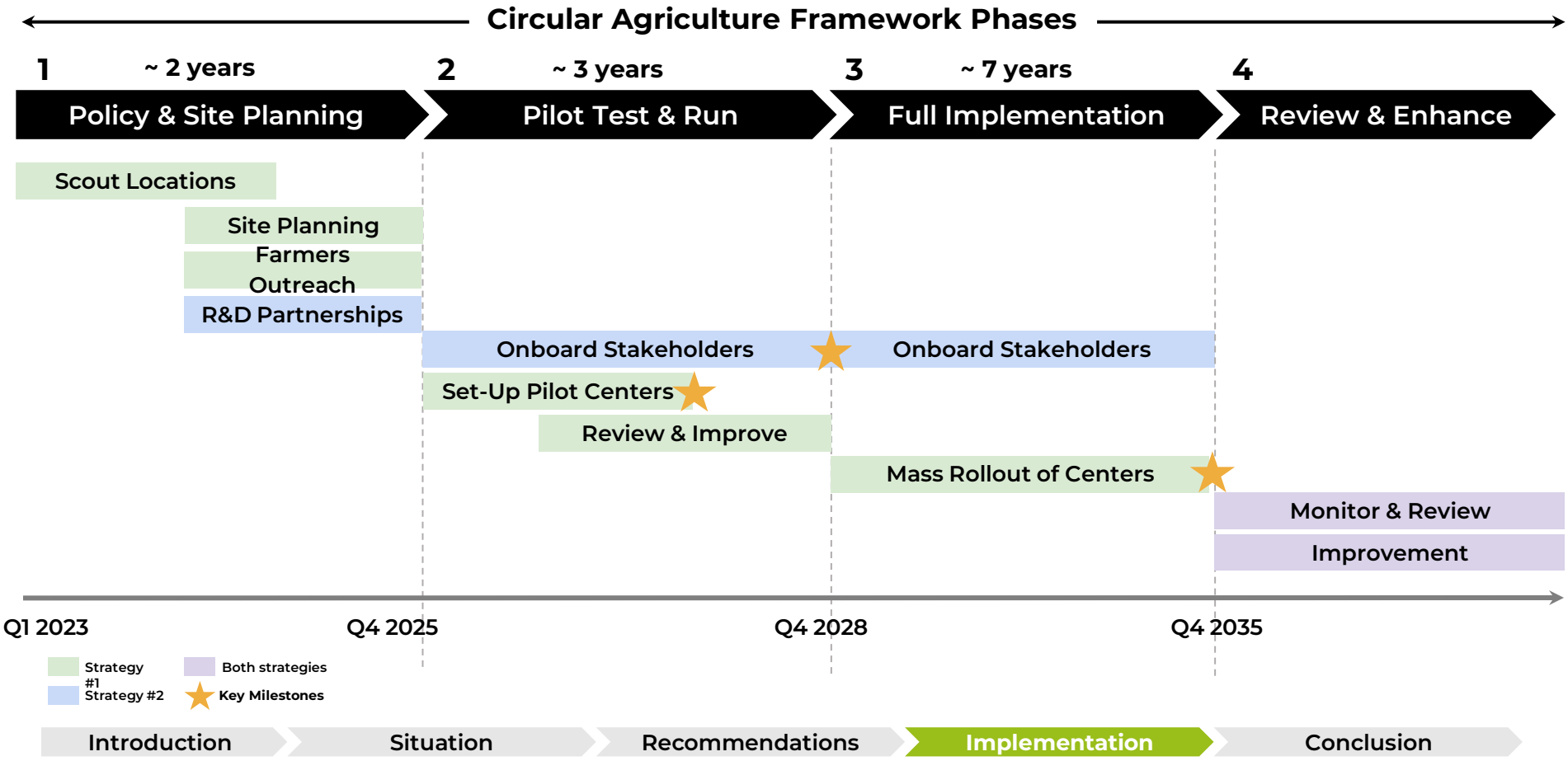
Positive social impact

Farmers' welfare are taken care of leading to positive reviews for the government

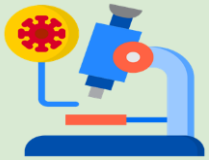
Next Steps

1. Convince and **onboard** the govt
2. Set up **task force** to manage both strategies and ag-industry
3. **Monitor** effectiveness of both strategies and **recommend actions** to ensure sustainability

4-Step Implementation Phases to Ensure Rollout Success



KPIs to measure performance success



1%

Increase in Ag-GDP into R&D

- ➔ Increment of TFP growth by 0.9% YoY
- ➔ Number of patents should double by end of Phase 4 as measurement of R&D investments

Source:: ASTI, 2020

20%

Decrease in GHG emissions

- ➔ Removing about 100 Mt of GHG pollution caused by agriculture activities
- ➔ Re-Collection Center to collect data on waste generated by farmers vs. waste managed

Source: Climate Watch, 2019

50%

Farmers have improved living conditions

- ➔ Data on farmers' income should show improvement
- ➔ Timely survey to monitor living conditions and offer help if needed

Source: IFAD, 2019

Conclusion

Key Strategy

Circular Agriculture Framework

RE: Collection Center & AgriBiz

Agriculture Innovation System

Key Issues

Lack of proper infrastructure

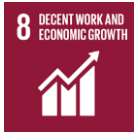
Poverty

Lack of R&D Investment

Key Impacts

Transition ASEAN's unsustainable farming model to sustainable Circular Agriculture.

Reduce GHG pollution from agriculture sector and private companies



Decent pay for the smallholder farmers and increasing agriculture productivity

ASEAN Economic Community Blueprint (AEC), 2025

- B.4 Productivity-Driven Growth, Innovation, R&D and Technology Commercialisation
- C.5 Food, Agriculture and Forestry
- D3. Public-Private Partnership

ASEAN Socio Cultural Community Blueprint (ASCC), 2025

- B.2 Equitable Access for All iv), x
- C.3 Sustainable Climate ii), iv)
- C.4 Sustainable Consumption and Production iv), x)


THANK YOU!

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Appendix

Strategy #1 - How does this solve the supply chain issue?

Seed & Fertiliser Companies | 25 %

Solution

Smallholder Farmers | 14%

Traders & Food Manufacturers | 31%

Supermarkets & Retail Stores | 30%

Solution

RE-Collection Center

Target Impact

Farmers earn a price that better reflects their efforts and productivity

20% | Smallholder Farmers

25% | RE-Collection Center

RE-Collection Center is still able to earn money and run its own operations at a reduced share compared to traders

AIS - Value proposition for farmers

Better access to selling products

Additional source of income

Fair payments that reflect their efforts

Better preparation & prevention against disasters

Action Plan to onboard farmers

1. Simplify current plan to make it easier for farmers to understand.
2. Inform farmers on high-level view of strategies when conducting land surveying.
3. Inform farmers officially through local town halls, peer-to-peer news and SMS.
4. Maintain constant contact with farmers to provide timely updates and obtain their opinion on these strategies.
5. Timely surveys to understand farmers' feelings and opinions for future improvements.

KPIs to measure performance success

	Target KPI	Action Steps
Phase 1	**10** Partnerships with overseas expertise **10** Suitable locations to set up pilot centers	→ Identify opportunities & convince overseas expertise to invest → Land survey to identify places with low effort & high return
Phase 2	**5%** Farmers to use the pilot-test centers **30%** Key stakeholders to be part of AIS	→ Expand outreach & influence in farmers' community → Offer higher incentives at early stage to attract stakeholders
Phase 3	**80%** Farmers to fully onboard strategy #1 **70%** Key stakeholders to be part of AIS	→ Strengthen outreach and expand into all regions → Implement policies to encourage stakeholders to join AIS
Phase 4	**50%** Decrease in total ag-waste **70%** Farmers have improved their living conditions	→ Identify loopholes/weakness and address them effectively → Provide farmers help if needed

1%
Increase in Ag-GDP into R&D

20%
Decrease in GHG emissions

50%
Farmers have improved living conditions

Appendix: Case Study (Turning Ag-Waste to Wonder Material).

Graphjet Technology, the State-of-the-Art Graphene and Graphite Producer from Palm Kernel Shells to Become Publicly Traded Via Business Combination with Energem Corp.

Globe Newswire - Mon Aug 1, 9:10AM CDT

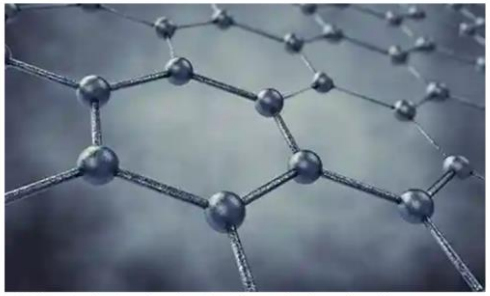
~ Transaction values Graphjet at pro forma enterprise value of $1.49 billion ~

~Transforms palm kernel shells, a common waste product, into high-demand graphene materials ~

Graphjet Technology lowers the cost of graphene production from $300-400 to $ 20-25 per gram

Graphene - the new wonder material

Scientific interest rolls in for a material that is more solid than steel and a better conductor than copper



3D illustration showing a sheet of graphene. Photograph: nobeastsofierce/Alamy

Graphene Properties:

- 200x stronger than steel
- Resistant to heat
- Ultra-light
- etc...

Adham: Ministry committed to ensuring graphite, graphene market in Malaysia is of global standard

Bernama / Bernama
August 01, 2022 20:05 pm +08

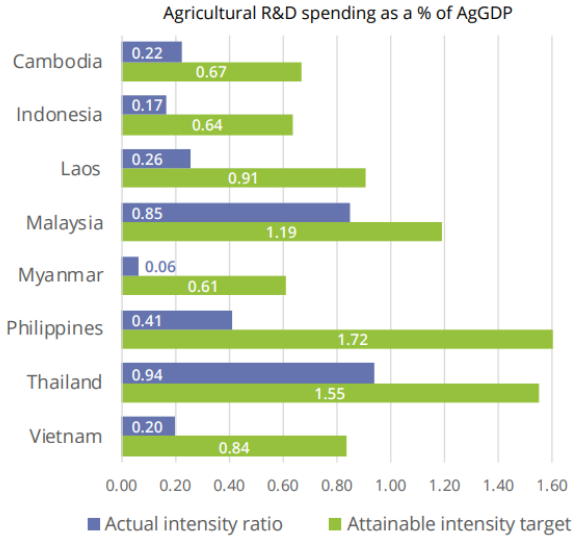
Appendix: Potential Use of Ag-Waste

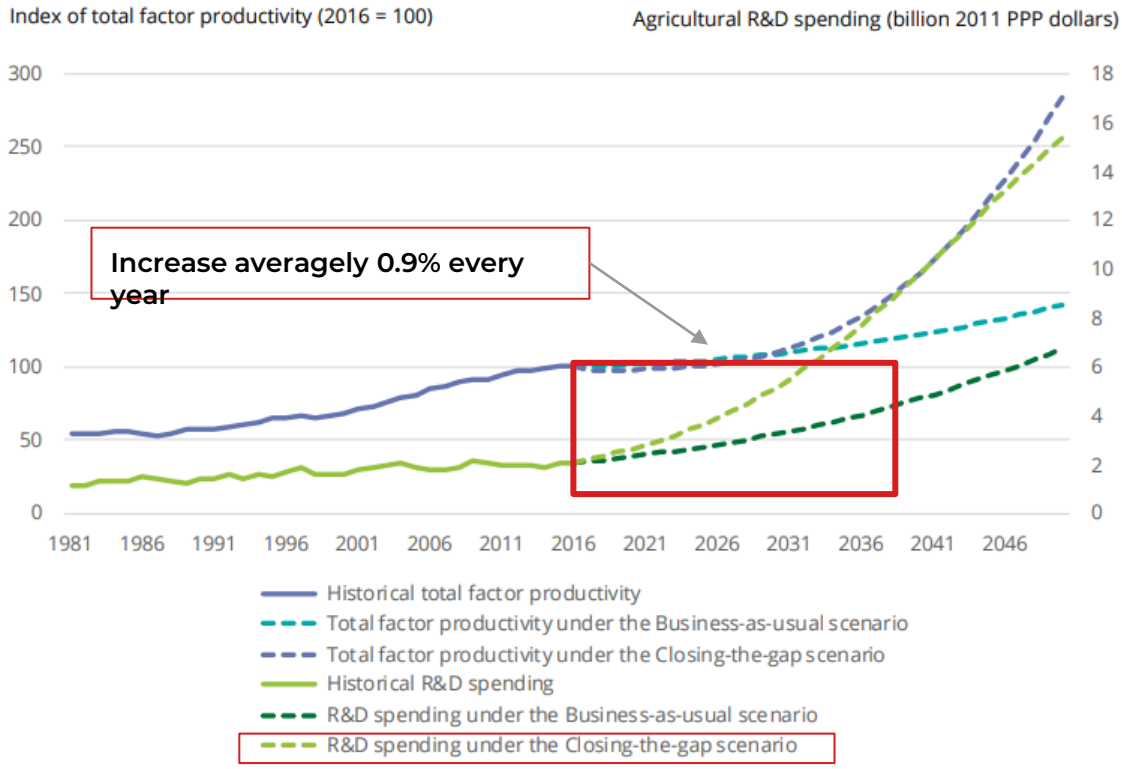
Example applications and utilization of Agriculture Waste

Agriculture Waste	Utilization
Rice Husk Ash	● Additive in cement mixes ● Water glass manufacture ● Active carbon
Rice Husk	● Electricity Production
Sugarcane Fibers	● Paper Making Pulp
Rice Straws	● Bio-Asphalt
Fruit	● Ethanol Production
Corn/Maize Stalk	● Reinforcements of Thermoplastics

Source: Adopted from UNCRD

Appendix: ASEAN's Ag GDP





Appendix: Country Case Study on Ag-waste

- An entrepreneur, Jaruwan Kammuang from Thailand turn the wasted rice husk into leak-proof food packaging.

Source: DW, 2021

- Circular Biobased Delta is a Triple Helix organization in which companies, knowledge institutions and governments actively work together to turn agriculture waste into asphalt

Source: FFTC, 2021

- Taiwan has proposed “5+2” Innovative Industry Policy that implement circular economy transformation. This policy incentivize producers and importers to use secondary materials in the products.

Source: Circular Taiwan, 2021

Partnership with Stakeholders is the Key Success,

Circular Agriculture Framework

RE-Collection Centers & AgriBiz

Agriculture Innovation System(AIS)

- Develop efficient data processing and information movement throughout organisations.
- Support the RE-Collection Center operation & planning using SAP's ERP software
- Locate possible strategic places to build RE-Collection centers

- Work with multiple stakeholders to plan & implement tax policy
- Reach out to smallholder farmers to educate circular agriculture
- Set & regulate market standard for Ag-Waste

- Set ESG goals & support Circular Agriculture Framework
- Invest in Ag R&D to turn Ag-waste into raw materials

Appendix: Waste Hierarchy

The Current Waste Hierarchy

The New Waste Hierarchy

- When the current waste hierarchy was conceived, waste management was about disposing of our waste with the minimum damage to health and the environment.
- Yet the **current waste hierarchy is limited and limiting** because it looks at things from a solely environmental standpoint, i.e. it **doesn't take into account social, economic and logistic considerations** or the need to spur a transition towards circularity.
- With the new mental frame set by the Circular Economy thinking, a new hierarchy is needed to change the mindset from **waste management to resource management.**
- This means that the driving force of the hierarchy should be not only the safe disposal of our waste but also to ensure that **the value of our resources is preserved in the economy for the new generations.**

Source: Adopted from Zero Waste Hierarchy 7.0, Zero Waste International Alliance, 2019

Appendix: Industry Market Value on Agriculture Waste

US 63.3 billion

Production of sweet beverages requires sugarcane and the residues are then distilled and ferment to obtain yeast to make alcoholic drinks and other beverages

Source: Beltrán-Ramírez, F. et. al (2019)

US 48 billion

Cellulose abundantly present in agriculture wastes are extracted through chemical treatments to make drug's filler and coating to block humidity and oxygen

Source: Kamel, R. et.al (2011)

US 46 billion

Researchers are extracting organic melanin and biopigments from agriculture waste used in cosmetics and food industry.

Source: De Oliveira, C. et.al (2017)

Appendix: Case Study for Improved Policy

45% increase of FDI investment due to improved policy

Source: FAO, 2012

10% reduction in the price of R&D lead to a 10.9% increase in R&D investment

Source: OECD, 2016

1% increase in public expenditure on R&D leads to 1.44% GDP increase

Source: DE, U.K (2018)

Appendix: ASEAN Agriculture Landscape

(in percent)

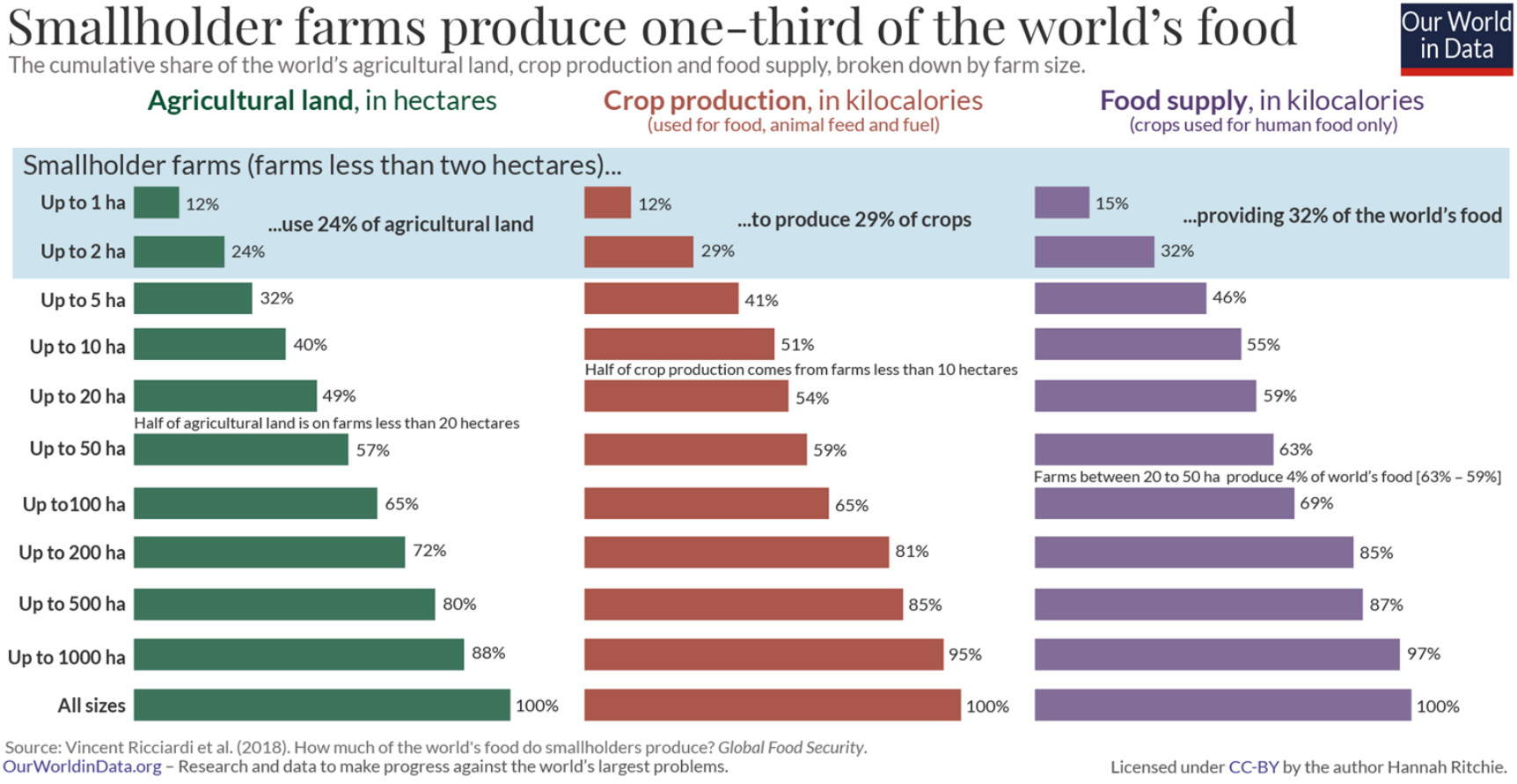
Country	GDP Share[1]		Employment Share[2]		Exports Share		Imports Share	
	2018	2019	2018	2019	2018	2019	2018	2019
Brunei Darussalam	0.8	0.8	1.1	1.9	0.2	0.2	12.3	10.0
Cambodia	16.3	16.7	-	-	19.3	19.2	10.5	10.9
Indonesia	12.5	12.4	28.8	27.3	5.5	4.8	7.5	7.0
Lao PDR	14.5	14.0	-	-	18.8	23.0	12.5	15.8
Malaysia	7.3	7.1	13.3	12.1	27.9	24.3	13.3	12.0
Myanmar	24.6	22.3	47.6	-	8.3	8.6	7.3	7.7
Philippines	8.1	9.2	32.0	22.9	8.9	9.4	11.9	12.4
Singapore	0.0	0.0	-	-	3.3	3.5	3.6	3.7
Thailand	6.1	6.2	35.8	35.0	14.0	14.4	6.1	6.5
Viet Nam	14.3	13.7	41.9	34.7	11.0	9.9	8.2	7.8
Total in percent					**9.9**	**9.9**	**7.3**	**7.4**
Total in Million US $					**142,168.5**	**141,026.2**	**101,189.2**	**102,548.7**

Source:
ASEAN Secretariat

Note:
1) GDP share refer to real (Constant Price) GDP
2) Refer to Table 3.9
"-" not available at the time of publication

Source: ASEAN Statistical Yearbook, 2020

Appendix: Importance of Smallholder Farmers



Source: Vincent Ricciardi et al. (2018). How much of the world's food do smallholders produce? *Global Food Security*.
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Appendix: Top 5 Major Agriculture Commodities in ASEAN

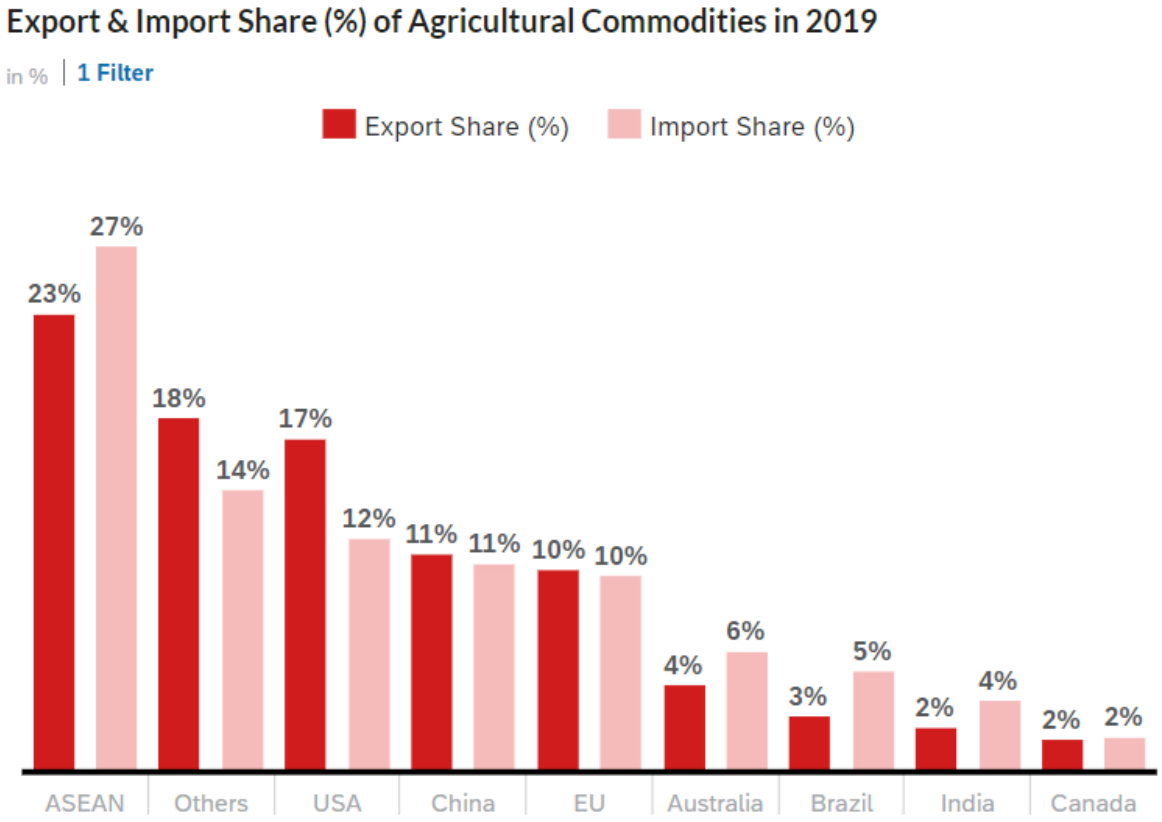
Table 10.8. Rate of Growth of ASEAN Five Major Food Commodities, 2010-2019

Products	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Paddy	1.7	2.0	3.3	(0.3)	4.1	0.6	(0.6)	0.0	1.6	(9.2)
Maize	6.3	0.7	0.0	7.4	(0.7)	1.7	0.7	6.0	17.0	2.7
Soybean	11.8	1.1	(8.8)	(6.4)	(8.3)	10.1	(0.8)	(0.1)	(34.2)	40.0
Sugarcane	(4.4)	(8.7)	33.6	2.9	(1.0)	3.2	0.5	(3.7)	14.4	22.4
Cassava	9.2	(8.6)	10.6	1.9	10.1	0.8	8.3	5.2	(8.6)	(2.0)

Source:
ASEAN Food Security Information System (AFSIS)
Database, based on country (MOA) data submission.

Source: ASEAN Statistical Yearbook, 2020

Appendix: ASEAN Agriculture Export & Import Share



Source: ASEAN Statistical Yearbook, 2020

Appendix: Global Cement Market

Country	Plants	Production capacity (Mt/yr)	GDP (US$bn)	GDP growth (%)	Industrial production growth (%)
Vietnam	58	91.42	359	5.3	5.0
Indonesia	15	63.05	1290	5.3	4.3
Thailand	11	46.65	673	2.9	-3.1
The Philippines	18	28.026	454	6.8	9.0
Malaysia	11	27.83	525	4.7	5.0
Laos	12	>3.991	20.8	8.3	11.0
Myanmar	13	3.09	111	6.8	11.4
Cambodia	1	0.96	36.9	7.0	7.0
Brunei	0	0	22.3	1.4	1.5
Singapore	0	0	339	4.1	1.7

Source: Global Cement Factbook, 2015