S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES
A Graduate School of Nanyang Technological University

NIE NATIONAL INSTITUTE OF EDUCATION SINGAPORE

The role of PPPs in Knowledge Intensive Agriculture

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16 June 2017

Coverage

1. Why Knowledge Intensive Agriculture?
2. Why PPPs
3. PPPs in KIAs – assessment of roles
4. Going forward

1. Why Knowledge Intensive Agriculture?

Increasing productivity, efficiency, efficacy:

- Declining arable land, water and labour resources
- Ageing and declining farming community
- Earning and livelihood disparities between rural and urban
- Demand by consumers for “cleaner” food produced using sustainability standards
- Better use of modern **physical** inputs (improved seed, fertilizer, pesticides, mechanization, irrigation)

Beyond physical technologies

- Learnings from the 1st Green Revolution: Can only achieve up to a limit with physical technologies IF timely site specific knowledge is not used
- Opportunities from fast developments in digital technologies to convert data into useful knowledge
- Opportunities to share this knowledge with farmers through new media (mobiles, e-connectivities)

Example: Recovering the yield potential in seeds

Crop yield gaps require knowledge to better use the physical inputs such as seed, fertilizer, pesticides, water, etc.

Genetically modified factors?

Defining factors
- ***CO2***
- ***Radiation***
- ***Temperature***
- ***Crop features***

Limiting factors
- ***Water***
- ***Nutrients***

Reducing factors (Loss)
- ***Biotics***
  - ***Weeds***
  - ***Insect pests***
  - ***Diseases***
- ***Abiotics***

Derived from "production ecology" of C.T. de Wit, Wageningen, Netherlands

Example: KITs *(Knowledge Intensive Technologies) to support Knowledge Intensive Agriculture*

Aim to improve use of physical technologies

- Deploying and managing Improved germplasm
- Integrated Pest Management and/or Novel crop protection technologies (Teng, 1994. Experimental Agriculture 30:115-137)
- Water and Nutrient management
- Decision support systems to optimize crop output: input ratios
- Toolkits to prioritise land use and management
- Etc.

Rice Crop Manager (RCM): A web-based tool provides farmers a field-specific crop management recommendation matching a farmer's conditions

DSSAT 2017

International Training Program

Assessing Crop Production, Nutrient Management, Climatic Risk and Environmental Sustainability with Simulation Models

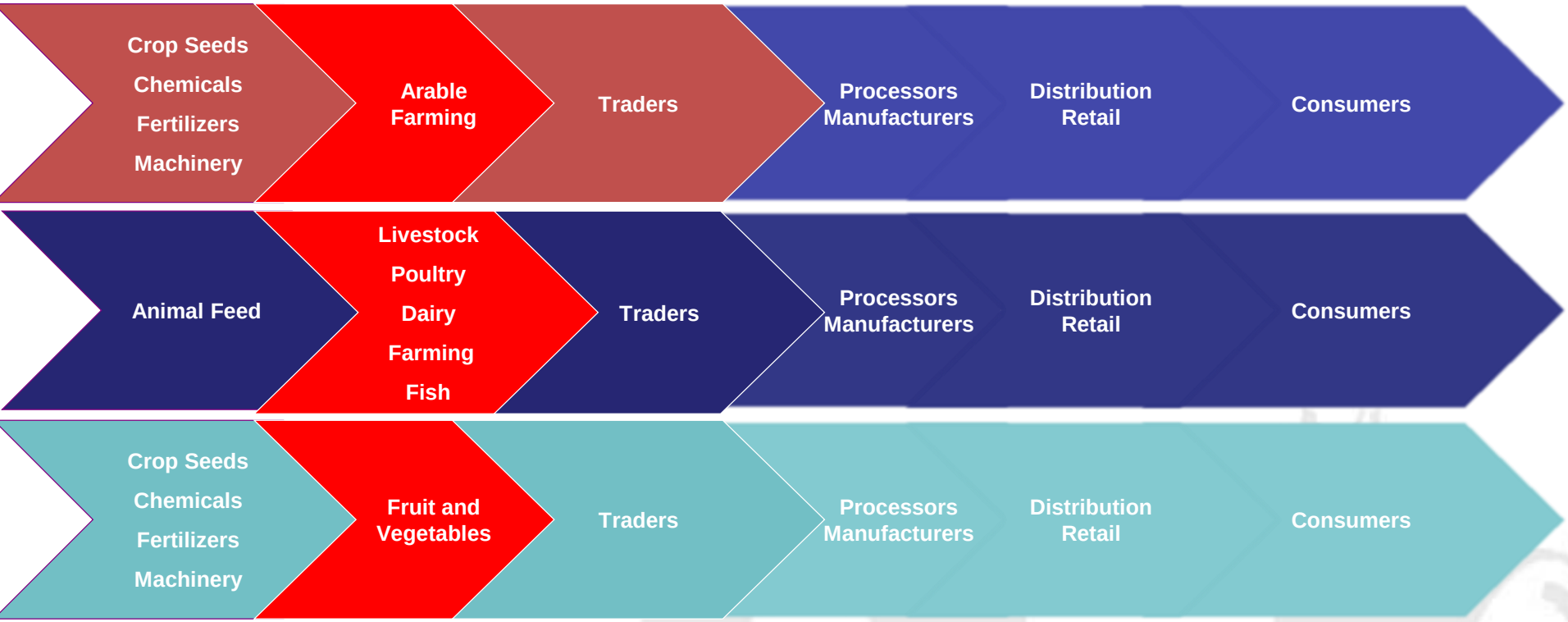
Decision Support System for Agrotechnology Transfer

DSSAT FOUNDATION

"Ecological engineering" for pest management in rice

Conservation tillage involves the planting, growing and harvesting of crops with limited disturbance to the soil surface.

2. Why PPPs?



Except for subsistence farming, today's farmers are increasingly delivering products through supply chains dominated by the private sector

The complexity of back-ends and front-ends of these supply chains require partnerships of different modalities

“Back-end”

- **R&D to develop inputs**
- **Technology transfer**
- **Husbandry (production)**

“Mid-chain”

- **Processing: From raw material to food**
- **Storage**

“Front-end”

- **Delivery to consumer (Distribution, Retail)**
- **Over-arching issues**
  - **Loss and waste, Sustainability**

No single entity working independently can address the needs of each stage

Opportunities forgone if no leveraging or synergy via partnerships

What are PPPs?

- …any (research) collaboration between public- and private-sector entities in which partners jointly plan and execute activities with a view to accomplishing agreed-upon objectives while sharing the costs, risks, and benefits incurred in the process.

……..Spielman, D. J., F. Hartwich, and K. von Grebmer. 2007. Sharing science, building bridges, and enhancing impact: Public–private partnerships in the CGIAR. IFPRI discussion paper no. 00708. Washington, D.C.: IFPRI.

- **“Describes a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. “**

3. PPPs: assessment of roles

- At each stage of the agri-food supply chain, the nature and modality of the PPP needs to be clearly stipulated and agreed upon, especially the contribution of each partner
- There are enablers to ensure success of PPPs for each stage and its modality (ies).

Types of PPPs

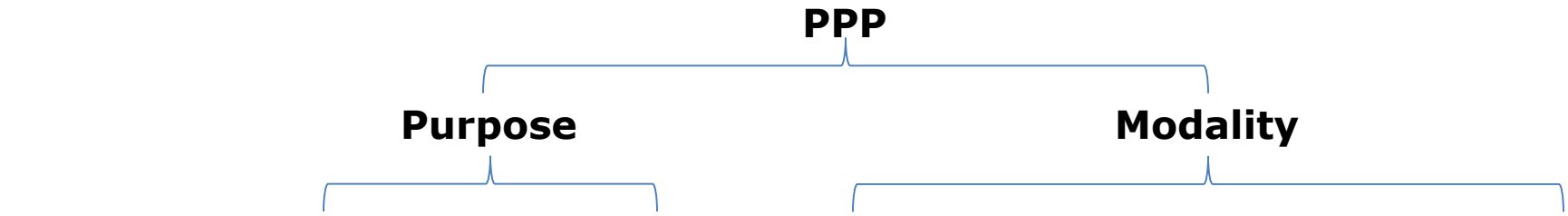
Based on Purpose

- Resourcing partnerships
- Contracting partnerships
- Collaborative or joint venture partnerships

Based on Modality

- Research partnerships
- Commercialising (Product Development)
- Sector/value chain development partnerships
- Technology Transfer/ Exchange partnerships
- Upscaling and stewardship partnerships

(Modified from Spielman et al, 2007)

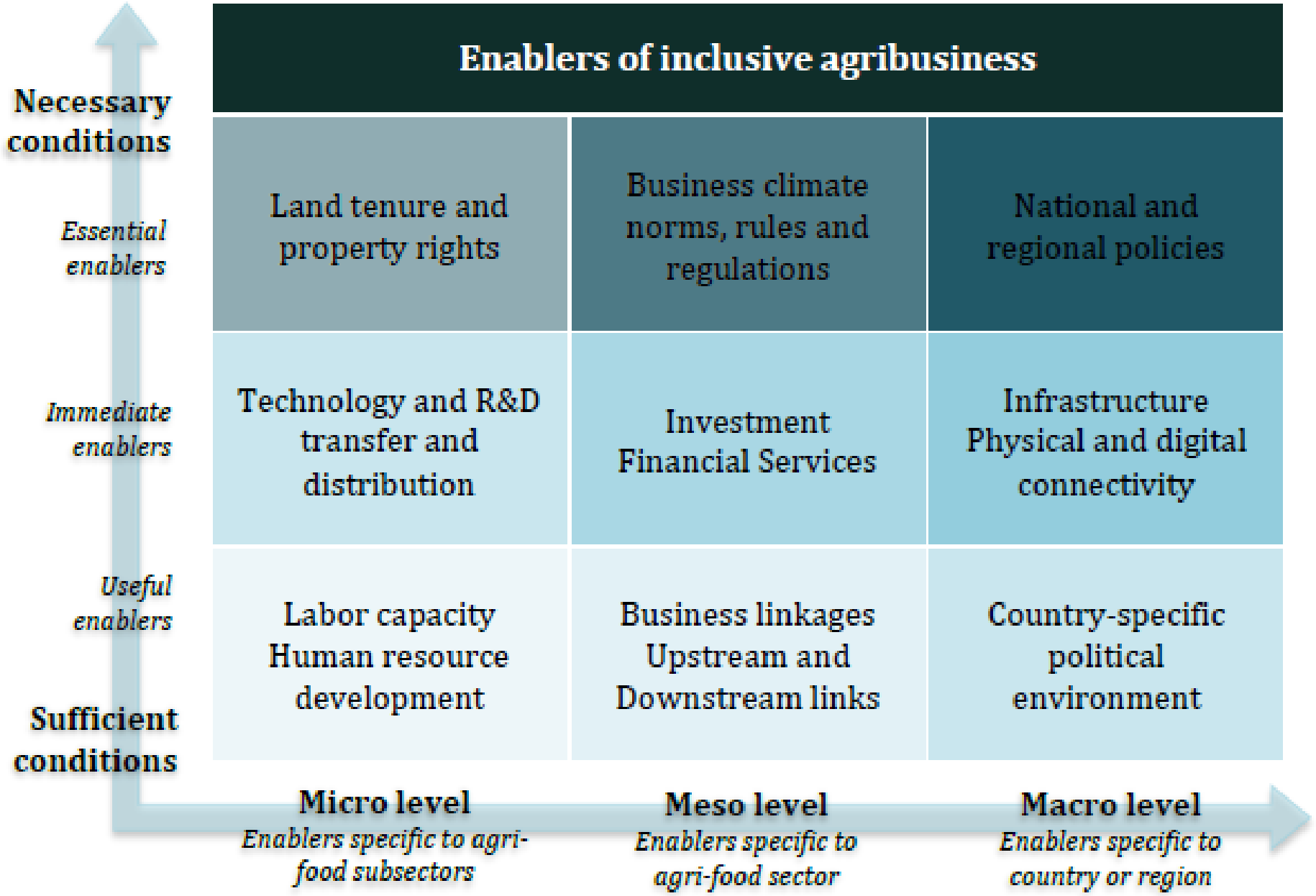


SUPPLY CHAIN	Resourcing	Contracting	Collaborative	RESEARCH	PRODUCT DEVELOPMENT	VALUE CHAIN DEVELOPMENT	TECHNOLOGY TRANSFER	UPSCALING/ STEWARDSHIP
Inputs	*	*	*	**	**	**	***	****
Production	*	*	*	*	*	*	**	***
Processing	_	*	*	**	*	*	**	***
Transport/ Storage	*	**	*	*	**	**	*	**
Re-processing/ Re-Packaging	*	*	*	*	**	**	**	**
Retail	*	_	*	*	*	**	**	***
Consumption	*	_	*	***	**	_	***	***

Note: * indicates strength of comparative advantage for PPP

Enablers of success for PPPs

- Shared common goals
- Universalization in applying knowledge -- Resource sharing paradigm
- Supportive macro-policies, regulations and instittions
- “Freedom – to – operate” – enabling regulatory and IP environment for supply-chaining
- Supportive internal systems and governance in each partner
- Mindset and culture for engagement



Teng, P. and Oliveros, J.A.P. 2017. The Enabling Environment for Inclusive Agribusiness in Southeast Asia. Asian Journal of Agriculture and Development 13(2):1-30.

Beyond Public-Private-Partnerships (PPPs)

- ***MSPs*** *(Multi-stakeholder partnerships) : various combinations of NARS, NGOs, the private sector (MNCs, SMEs), farmer groups, AROs, and the IARCs.*
- ***PPP-Ps*** *: Public-Private-Producer Partnerships? (Esther Penunia, Asian Farmers' Association)*

4. Going Forward

Need to increase agricultural productivity by 200% in small farms and 20% in commercial farms (IFPRI)

Need to increase food supply to meet >50% demand increase by 2050 (FAO, 2017)

Need to increase investments and technology generation (FAO, 2017).
Annual US$265Billion IS needed till 2030 to invest in increasing crop yields.

BUSINESS NEWS | Sun Sep 18, 2016 | 11:14am EDT

China to invest $450 billion modernizing agriculture by 2020

FAO IFAD WFP 2015 report- if business as usual investments in agriculture, then by 2030 there will still be 8% of global population under- nourished.

Emerging "Ecosystem" for PPP-Ps

AGTech ⟷ **FinTech**

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"

The Business Times | Friday, May 12, 2017

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

By Paul Teng and Christopher Vas

SINGAPORE needs to deepen its interests in food production, not just consumption, with strategic partners like Australia. One approach to this is redirecting some of its tech, digital strategies and sharing of IP to scaling up smart food zones based on technology-enabled farming (TEF).

ies that have developed technologies to make urban farming productive. Improved production capacities of at least 10-fold, less use of input materials and at least 90 per cent less use of water resources are just some headline benefits these technologies have produced.

A common opposing view to urban farms is the high capital investment and energy re-

chain. The company founders have set up their next agtech ventures and are on the path to urban farming 2.0.

So, arguably the investment, technology and operating costs show promise. What about the consumer market? Also, with Singapore's land constraints, how would an urban farm here commercialise and scale up?

Singapore currently imports over 500,000 tonnes of horticulture products from around the world. Most of the eggs and chicken consumed here come from a handful of source countries. With a very small portion of its domestic demand being homegrown, Singapore needs to consider deeper production ties.

But with Singapore aspiring to be a Smart

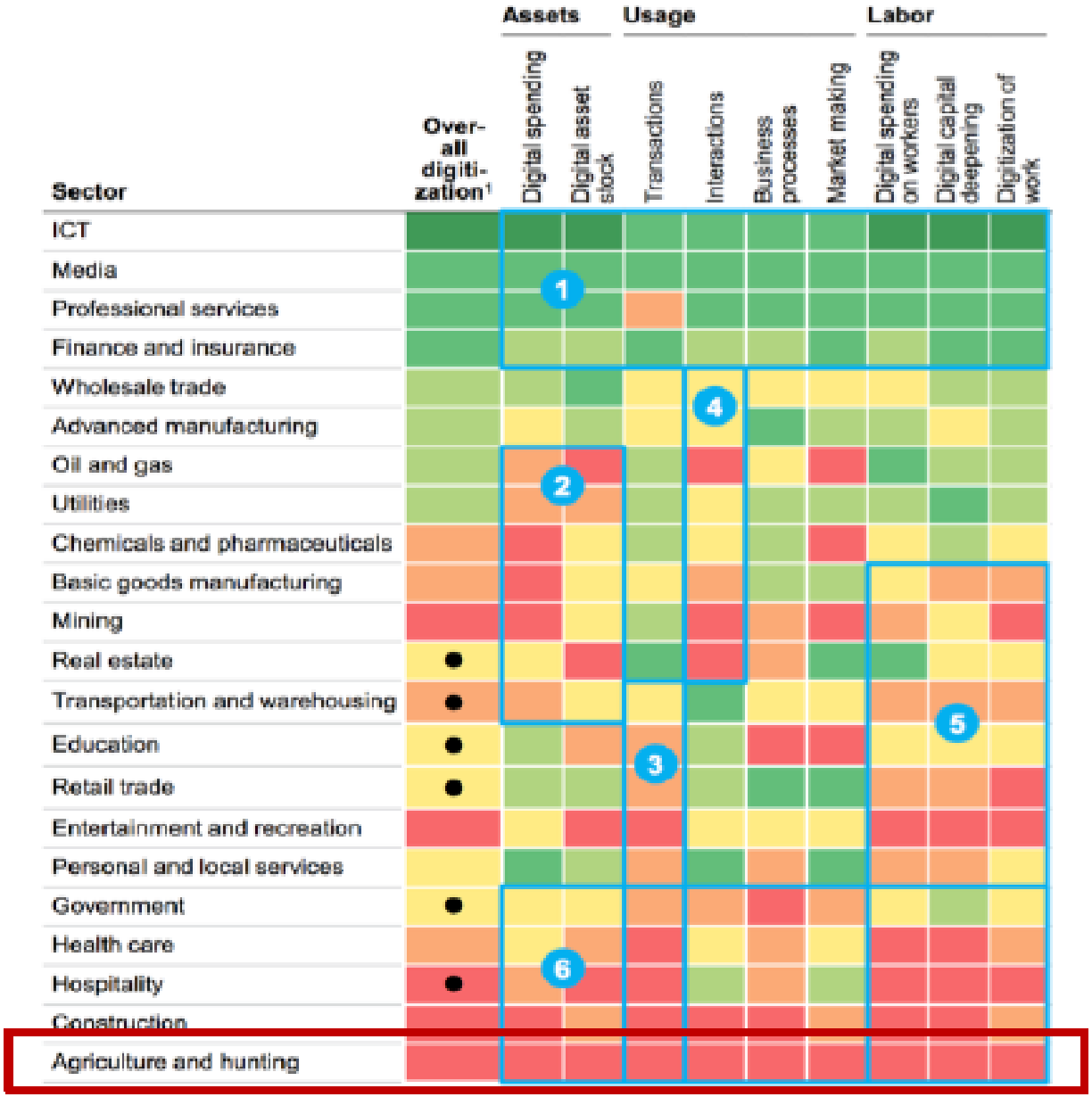
ening comprehensive strategic partnership between the two countries, it is not difficult to see a future where the Peel FZ delivers a significant portion of Singapore's food demand.

Mobilisation of this zone with proof-of-concept farms that showcase Singapore's agtech providers such as Panasonic and Sky Greens can be a logical start. This partnership

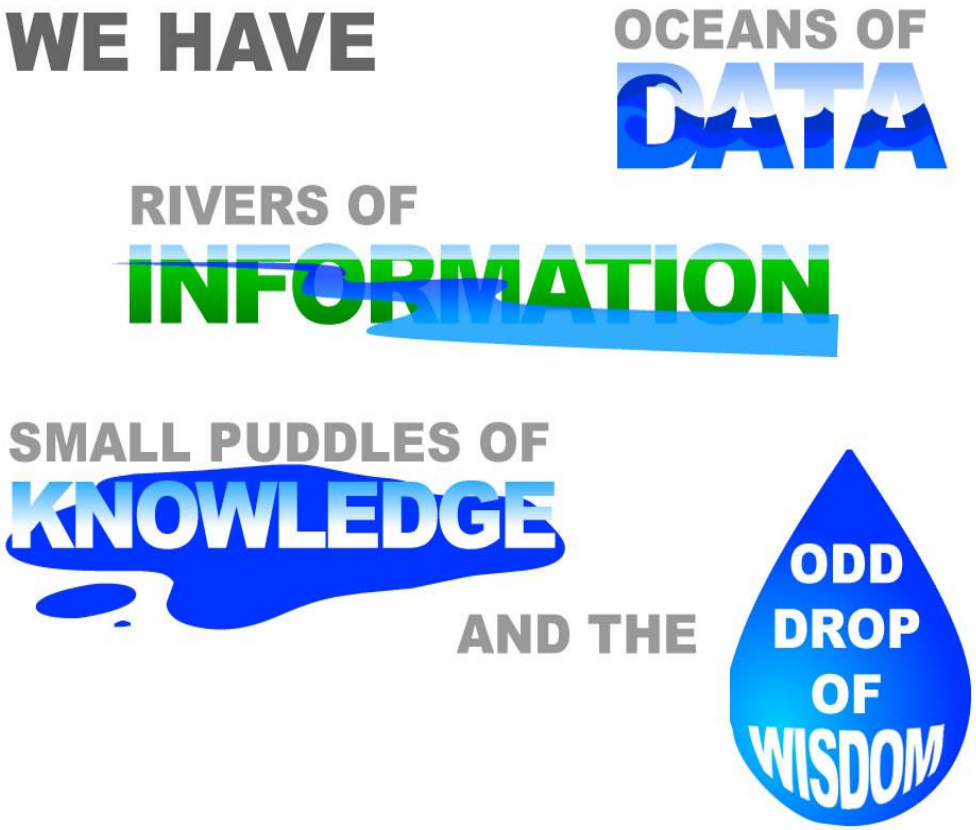
Good beginning examples from urban farms

PANASONIC INDOOR VEGETABLE FARM, Singapore

Agriculture is the least digitized industry



Source: AgFunder



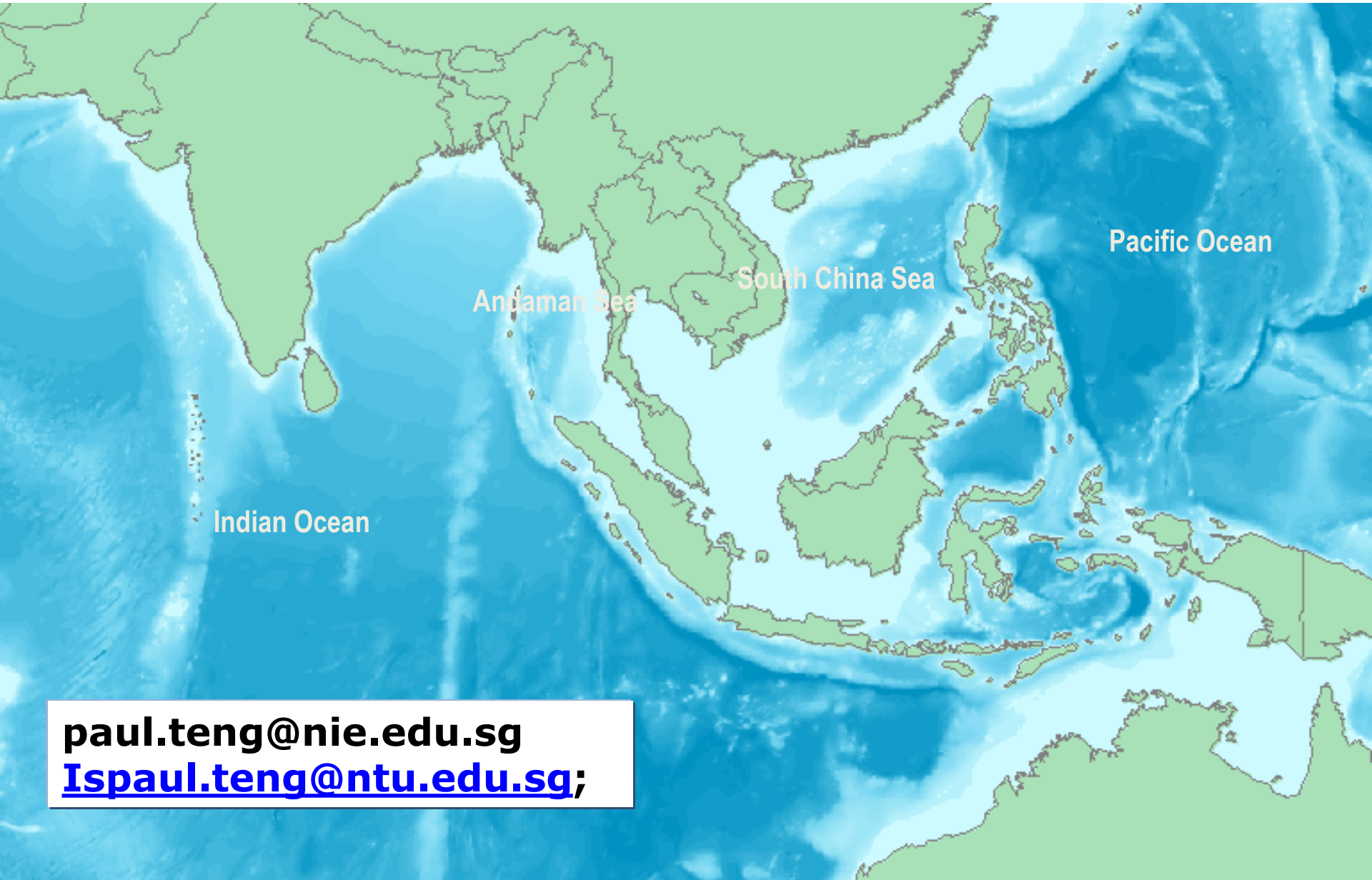
"Knowledge is King"

The Second Industrial Revolution:

- **Information-Communication Technology**
- **Miniaturization, Mobile devices**
- **The "Internet of Things"**

"Data does not equal information; information does not equal knowledge; and most importantly, knowledge does not equal wisdom" …. …..Henry Nix, 1990. Keynote Address at Annual Conference of AURISA (Australasian Urban and Regional Information Systems Association Inc.)

Thank you - 谢谢 - Terima Kasih - धन्यवाद - ありがとう – Maraming selamat - Merci - Gracias - 너를 감사하십시요 **- Thank you**



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