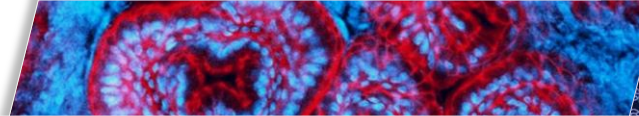


25 March 2019

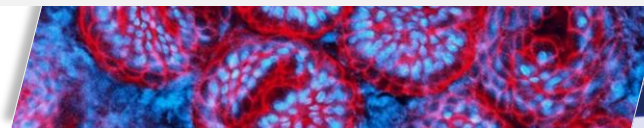


Agency for  
Science, Technology  
and Research

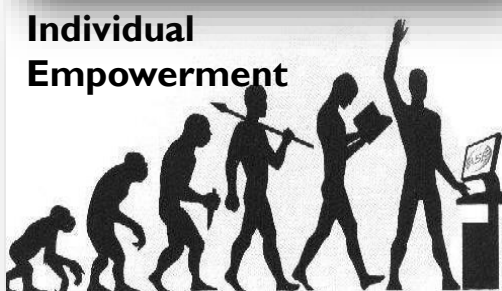


## Chances and Challenges of R&D Management in the 21<sup>st</sup> Century

Dr Raj.Thampuran, Managing Director, A\*STAR



# GLOBAL TRENDS AND CHALLENGES



# TECHNOLOGY EVOLVING AT AN UNPRECEDENTED PACE

*Affecting the way we work, live and play*

Time taken to hit  
50 million users



< 1 week

35 Days



Angry Birds



3.5 years

Facebook

Television

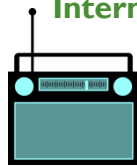


4 years



Internet

13 years



Radio

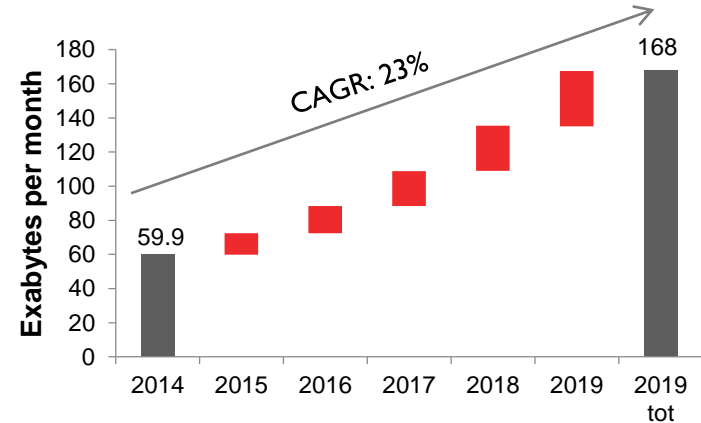
38 years



75 years

Telephone

## Global internet traffic to triple by 2019



Source: Cisco

## By 2020...



6 Billion  
Smartphones in  
circulation

Source: g2Innovation

By 2025...

2 – 3 Billion

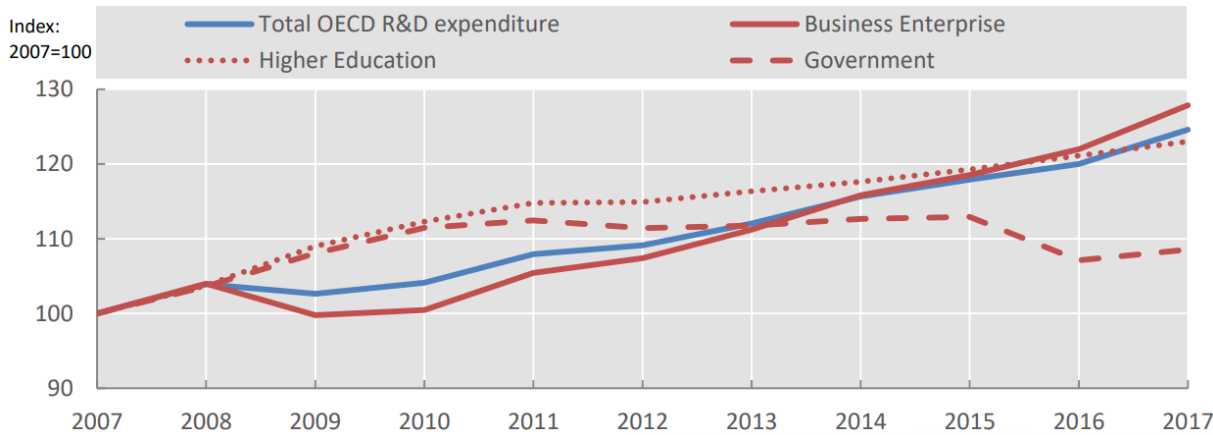
More people  
with Internet  
access

- Digitalisation
- Internet of Things
- Big data
- Artificial Intelligence

# OPPORTUNITIES: SHIFT TOWARDS OPEN INNOVATION

Companies increasingly seek and use external ideas, instead of relying only on their own

R&D expenditure trends in OECD countries, 2007-2017



**Business R&D continues to be the main global driver of R&D growth**

Source: OECD Main Science and Technology Indicators (MSTI) Database (Feb 2019)

**More collaborative operating models outpace traditional R&D**

Source: PwC's Innovation Benchmark (2017) Base: 1,222

Open innovation

61%

Design thinking

59%

Co-creating with customers, partners, suppliers

55%

Traditional R&D

34%

Innovating in emerging markets, exporting to developed markets

34%

Taking risks, failing fast, trying again

31%

Internal incubators

27%

Investing in start-ups via corporate venture capital

21%

# OPPORTUNITIES: RISE OF ASIAN MARKETS

Asia's growth will generate opportunities for public private partnerships through open innovation

## ASIA'S GROWING APPETITE

In the last five years since the global financial crisis, Asia's consumption continued to increase and grew at a phenomenal rate as it ploughed forward through the biggest global downturn in 100 years - without the help of the US, Europe or Japan.



**Key Growth Categories**

**Health**  
In 2010 average Asian life expectancy was **72.2 years** compared to 56.9 years in 1970.

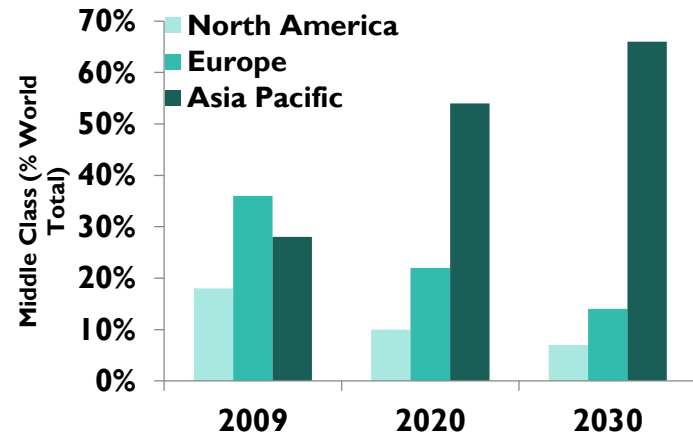
**Luxury Items**  
In 2013 **China** overtook Italy and France to become the world's 3rd largest luxury market.

**F&B**  
In 2020 Grocery shopping will grow to **US\$180 billion**, an increase of 200% from 2010.

#DBSinsights | www.dbs.com/insights | DBS Asian Insights Gamechangers shaping the Asia of Tomorrow | DBS

- **Asia:** fastest growing region with rising middle class.
- Middle class population in Asia will double by 2030 -> increased consumption in Asia.
- Information gap on Asian phenotypes and preferences.
- With Asian economies thriving and the rising middle class, companies will increasingly conduct research and innovation in Asian markets to better meet the needs of the Asian consumers.

Evolution of the earth's economic centre of gravity AD 1 to 2025

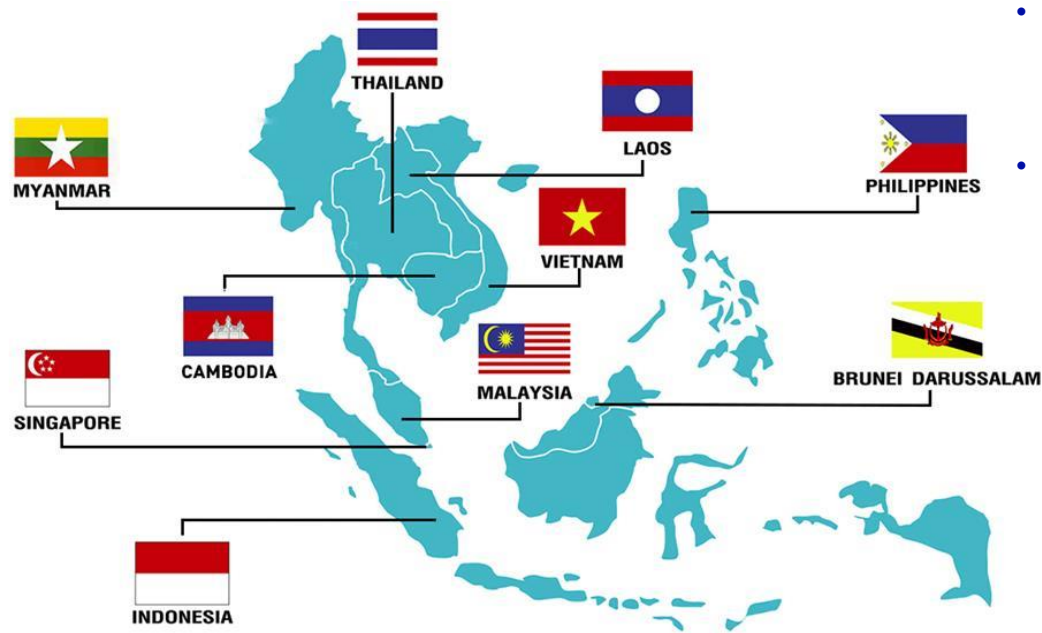


Sources: DBS Bank, OECD

# OPPORTUNITIES: ASEAN – FASTEST GROWING REGION IN THE WORLD

**Population 633 mil;  
Growing middle class**

- ASEAN's middle income class to increase from 29% in 2010 to 65% by 2030



- ASEAN's annual growth is projected to average 5.2% from 2016 – 2020
- Could become the fourth largest single market in the world with GDP potentially growing fivefold to US\$10 trillion by 2030

	Brunei (2004)	Cambodia (2015)	Indonesia (2013)	Laos (2002)	Malaysia (2015)	Myanmar (2002)	Philippines (2013)	Singapore (2016)	Thailand (2015)	Vietnam (2013)
<b>GERD/GDP</b>	0.04%	0.12%	0.08%	0.04%	1.30%	0.16%	0.14%	2.36%	0.63%	0.37%

Source: Enterprise Singapore, Straits Times, World Bank

# CHALLENGES FOR R&D MANAGEMENT

## Traversing scientific disciplines

*Problems are becoming more complex, requiring solutions from multiple disciplines*

- Training of talent across disciplines
- Collaboration between multiple research performers, and private and public sectors



## Increasing need to translate R&D investment into economic and social outcomes

*Ensuring relevance of R&D being conducted.*

- Prioritisation of R&D initiatives to address key challenges
- Identifying new measures of success



# FUNDAMENTALS FOR STRONG R&D MANAGEMENT

Strong  
Leadership

Governance

Focused on  
Outcomes  
Value Creation

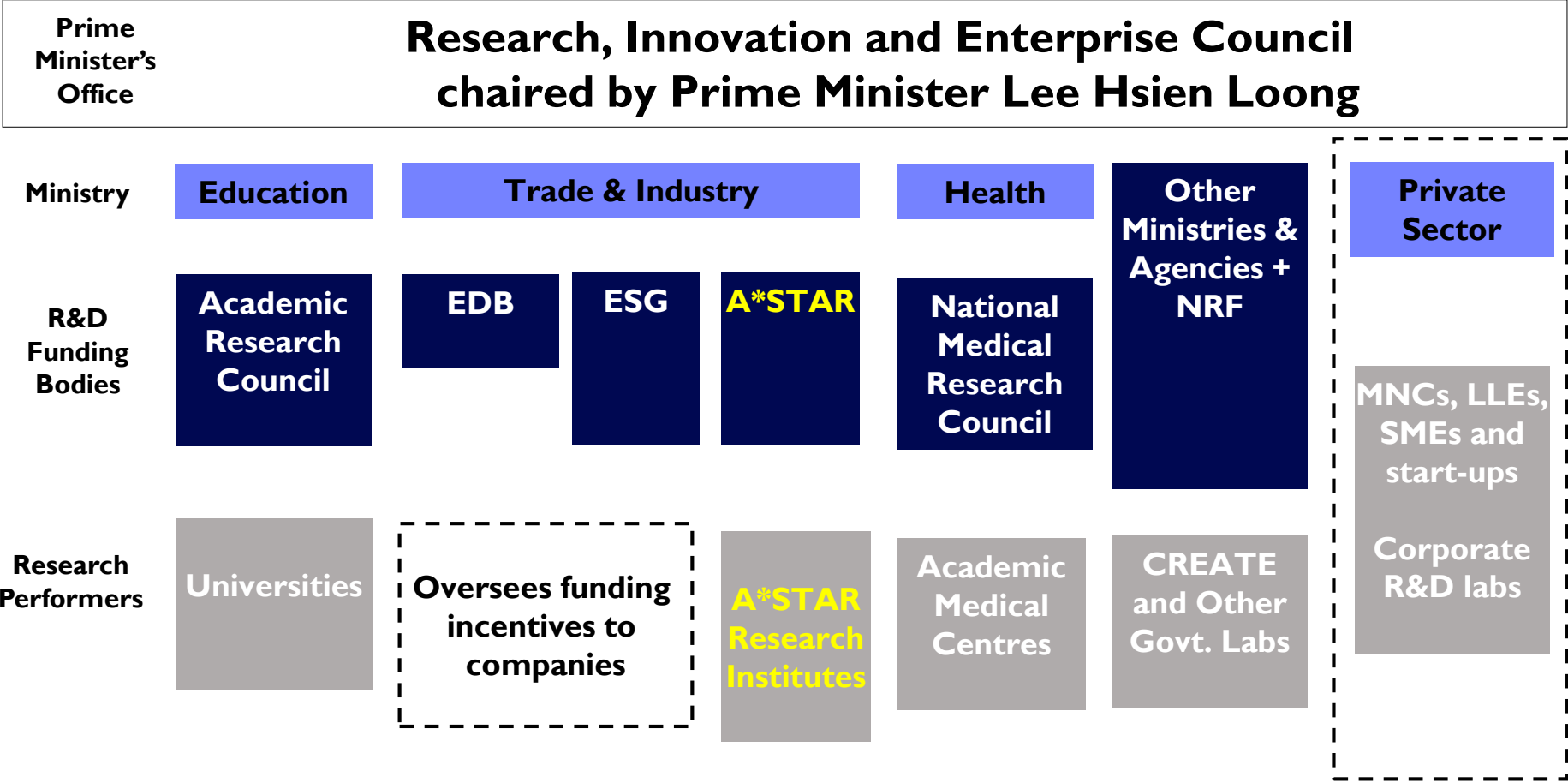
Fostering  
Public-Private  
Partnerships

Long-term  
Planning

Talent  
Development



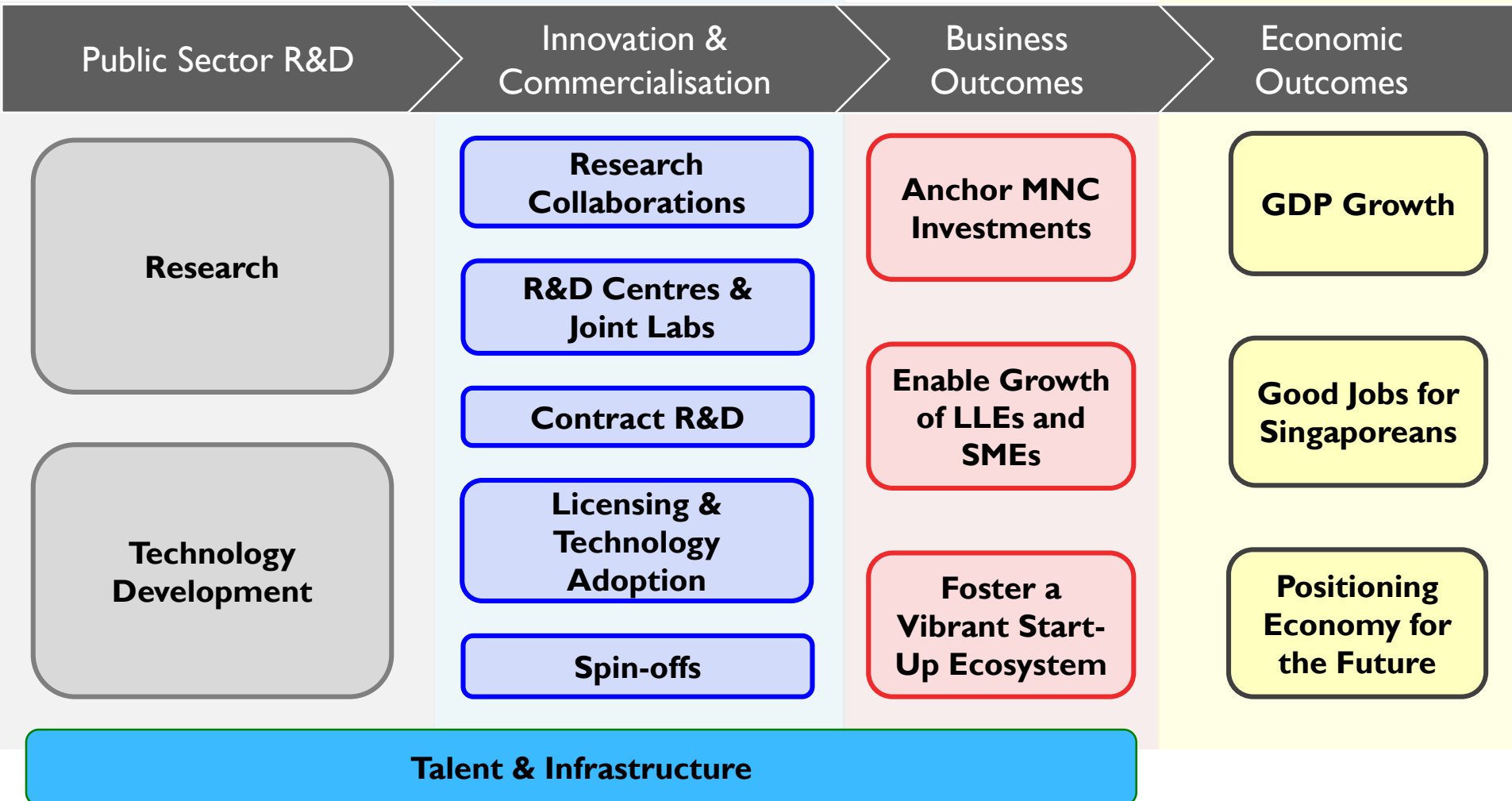
# COORDINATED NATIONAL FRAMEWORK AND GOVERNANCE, LED BY THE PRIME MINISTER



Legend:  
 EDB: Economic Development Board  
 ESG: Enterprise Singapore  
 NRF: National Research Foundation

# FOCUSED ON VALUE CREATION

## Economic Value Creation Framework



# OPEN TALENT STRATEGY

*Building a strong core of Singaporean research talent, complemented by rich diversity of international researchers*



## Creating the Pipeline

STEM Outreach to improve STEM pipeline and enthuse young to take up science & research as a career



## Investing in the Pipeline

Scholarships strategy to meet scientific talent needs

- Singaporean core
- International diversity
- Sizing of scientific talent needs



## Developing the Pipeline

Post-PhD development of early career researchers, and development of leaders



# FOSTERING PARTNERSHIPS ACROSS THE RIE ECOSYSTEM



# THANK YOU

# DISRUPTIVE TECHNOLOGIES WILL CREATE OPPORTUNITIES AND CHALLENGES



## **Internet of (Every)Thing**

- Network of physical objects connected via internet
- Machines & devices talking to one another



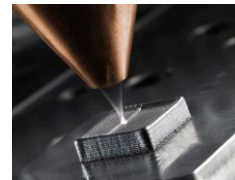
## **Big Data Analytics**

- Collection, organization and analysing large sets of data
- Patterns and useful information that is important for business decisions



## **Smart Robotics & Intelligent Adaptive Automation**

- Adaptive and Reconfigurable Robotics Systems
- Human-Robot Collaborative Systems
- Learning Robotic Systems



## **3D Additive Manufacturing**

- Integrated Design & Simulation platform
- Multi-Materials & Micro-Features
- On-Site/In-Situ Direct Manufacturing/Repair
- 3D Biomedical Applications
- 3D Customized Food Fabrication



## **Industrialisation of Personalised Medicine and Synthetic Biology, and Drug Delivery and In vitro Toxicology Systems**

- Manufacturing of Nanomedicine and Drug Delivery Systems
- Automation and High-throughput In Vitro Toxicology
- Industrialization of Synthetic Biology Bioprocesses



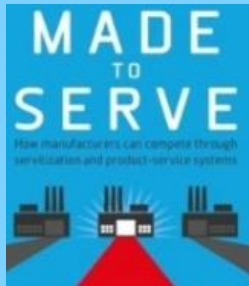
## **Zero Waste Remanufacturing**

- Smart Remanufacturing at large scale
- Manufacturing Waste-to-Resource Conversion
- Industrial Symbiosis

# DISRUPTIVE TECHNOLOGIES WILL CHANGE THE FUTURE OF BUSINESSES

## Manufacturing

The  
"Bespoke"  
Economy



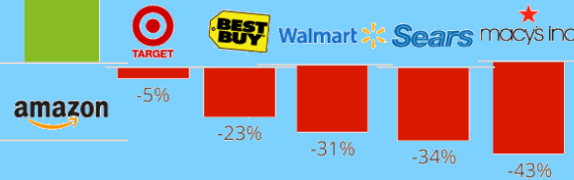
Servitisation of  
Manufacturing

## Retail

+112%



Share price change in 2015 of  
US's largest retailers



## Financial Services

Platform-based,  
data intensive, and  
capital-light biz models

- Payments
- Mkt provisioning
- Investment management
- Insurance
- Deposits & lending
- Capital raising

Source: WEF Future of Financial Services Report 2015

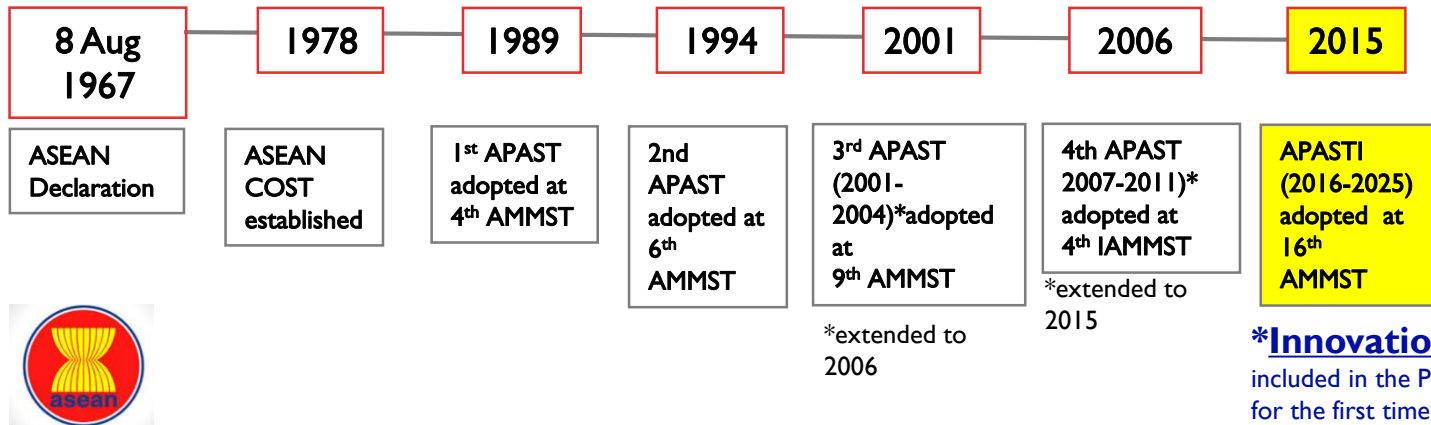
Empowered Customers, Investors, Consumers

## New Business Models

The  
"Sharing"  
Economy



# ASEAN PLAN OF ACTION ON SCIENCE, TECHNOLOGY & INNOVATION (APASTI)



**Overview**

- 8 August 1967 in Bangkok, Thailand, with the signing of the ASEAN Declaration (Bangkok Declaration)
- Founding Fathers of ASEAN: 5 Foreign Ministers - Adam Malik (Indonesia), Narciso R. Ramos (Philippines), Tun Abdul Razak (Malaysia), S. Rajaratnam (Singapore) and Thanat Khoman (Thailand)



AMMST - ASEAN Ministerial Meeting on Science and Technology

APAST - ASEAN Plan of Action on Science and Technology

APASTI - ASEAN Plan of Action on Science, Technology and Innovation

IAMMST - Informal ASEAN Ministerial Meeting on Science and Technology



# ASEAN'S NEW FRONTIER OF GROWTH: SCIENCE & INNOVATION

ASEAN Plan of Action on Science, Technology and Innovation (APASTI)  
2016-2025

## **Collaboration (PPP)**

- Strengthen collaboration among academia, research institutions, networks of centres of excellence and the private sector

## **Talent Mobility, P2P Connectivity and Inclusiveness**

- Enhance mobility of scientists and researchers
- People-to-people connectivity
- Strengthen engagement of women and youth in STI

## **Vision**

A **Science, Technology and Innovation-enabled ASEAN**, which is innovative, competitive, vibrant, sustainable and **economically integrated**

## **Public Awareness and STI Enculturation**

- Raise public awareness
- Strengthen STI enculturation

## **Enterprises Support**

- Establish innovative system and smart partnership to nurture STI enterprises, raise competitiveness

# 9 FOCUS AREAS FOR ASEAN IN SCIENCE, TECHNOLOGY & INNOVATION

Biotechnology

Microelectronics  
and Information  
Technology

Space  
Technology and  
Application

Food Science  
and  
Technology

Marine  
Science and  
Technology

Material  
Science and  
Technology

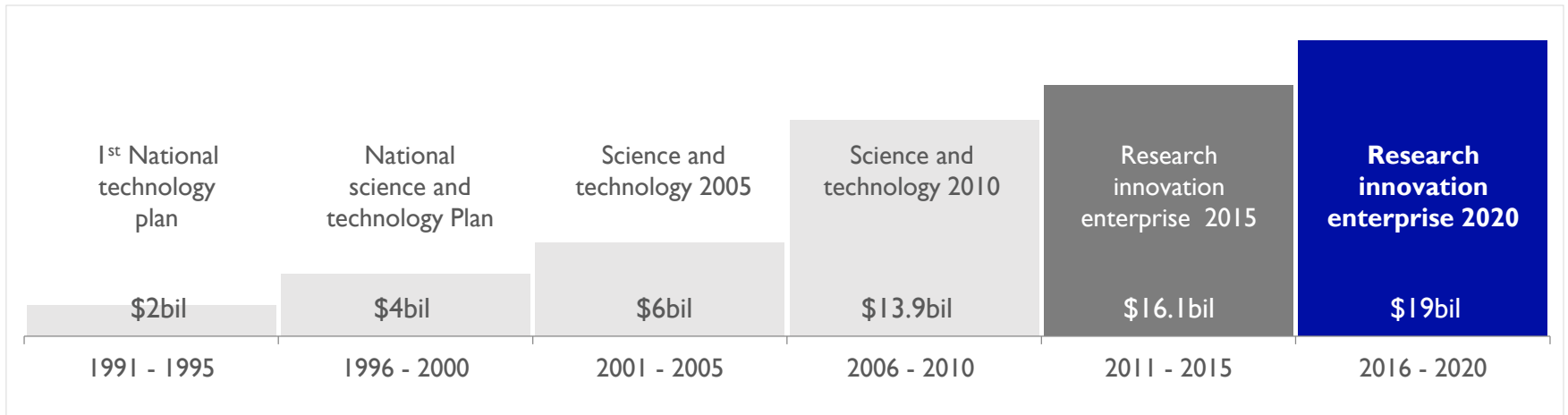
Meteorology and  
Geophysics

Sustainable Energy  
Research

S&T Infrastructure  
and Resource  
Development

# SINGAPORE'S STORY

## RIE2020: STRATEGIC THRUSTS



Ensure **excellent science** and invest strategically in curiosity driven and mission oriented research



**Strengthen** flow through from research to economic and societal **impact**



**Greater national coordination** of multi-stakeholder and multi-disciplinary collaboration



**Sustain a robust and diverse** research base and innovation **workforce**

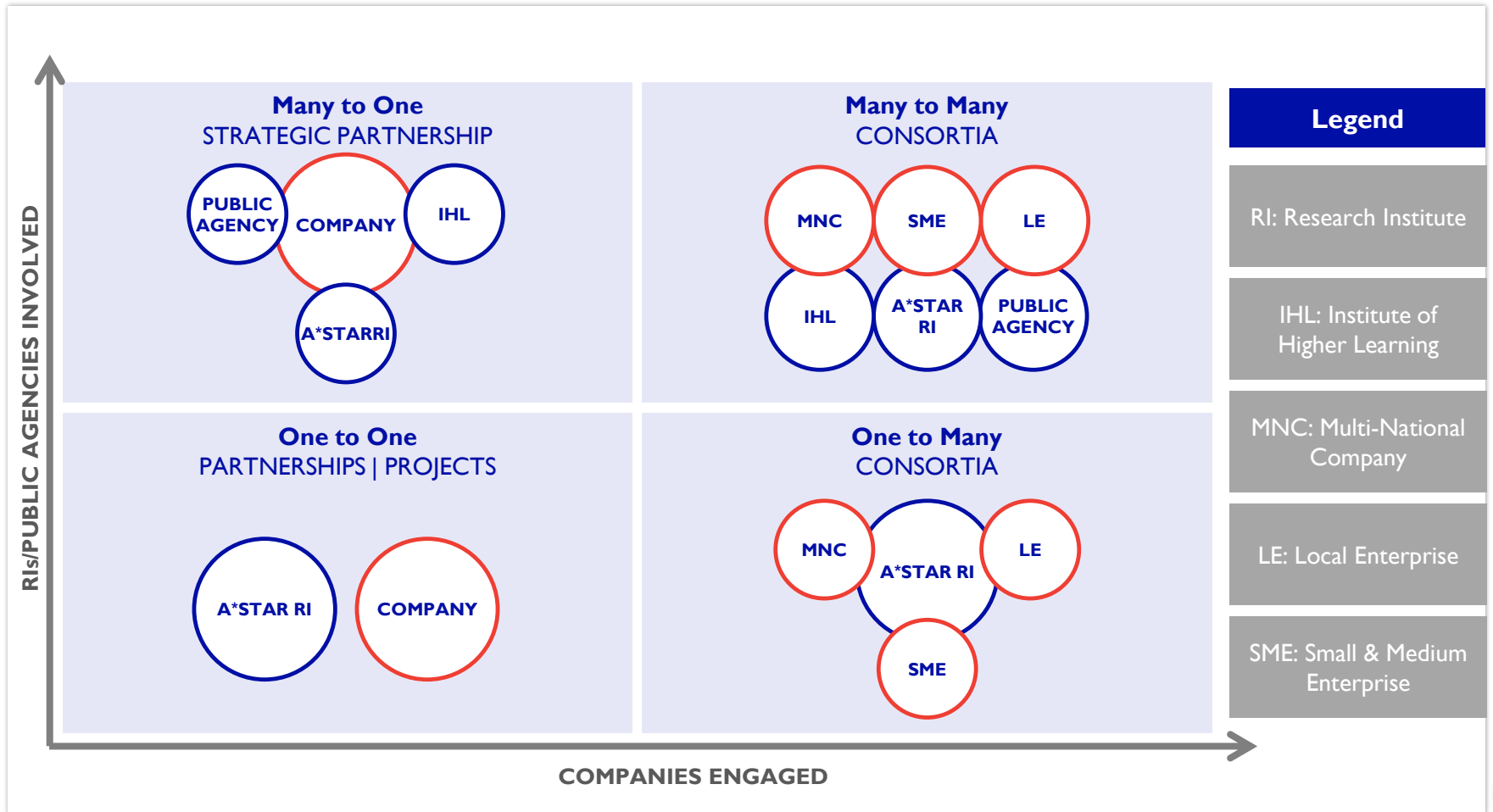


**Ensure responsiveness** to pursue new opportunities and technology developments



**Emphasis on competitive funding**

# MODALITIES FOR OPEN INNOVATION



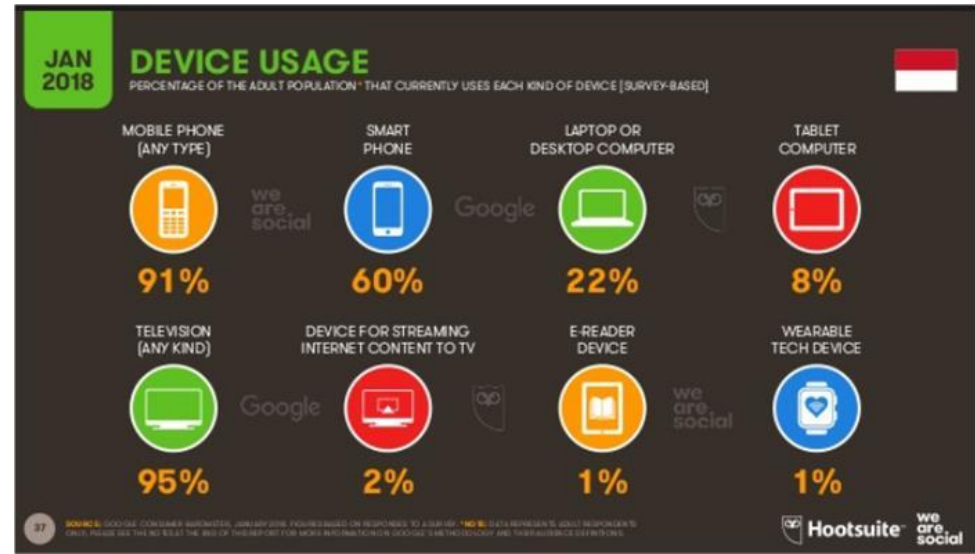
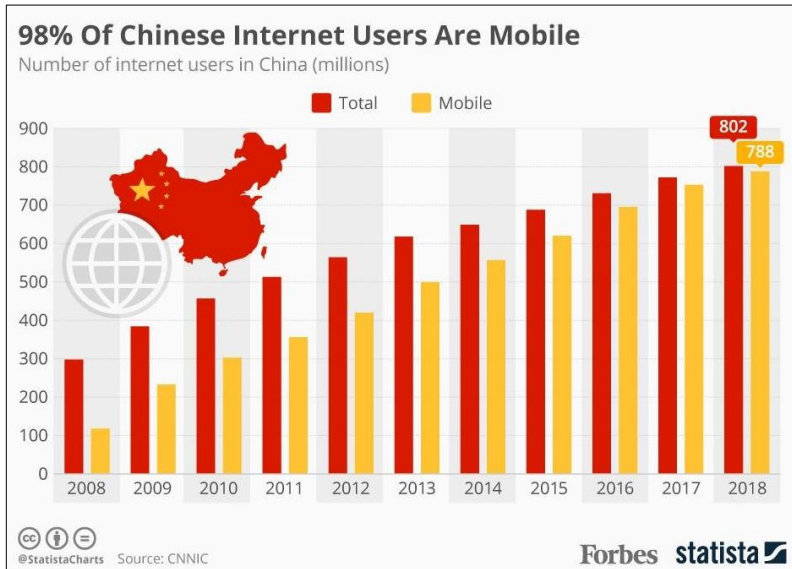
# INTEGRATING DIFFERENT PERFORMERS

- In the past, Singapore had been focused on building up its innovation ecosystem, and capabilities.
- With the increasingly complex and multidisciplinary nature of R&D, the involvement of different players is needed.
- Public-sector performers need to translate output into outcomes that create value for the economy



# GROWING TECHNOLOGY CONSUMPTION IN ASIA

*With Asian economies thriving and the rising middle class, companies will increasingly conduct research and innovation in Asian markets to better meet the needs of the Asian consumers.*



**More than 800 million internet users (57.7% of China's population), of which 98% are mobile users.**

Source: Forbes

