TOWARDS INDUSTRY 4.0 IN PALM OIL MILL

ROBOLAB TECHNOLOGY SDN BHD

www.robolab.com.my

ROBOLAB

for Smart Industry

Chee-Fai, TAN *PhD AMN PEng*
Co-Founder / Chief Technical Director
Robolab Technology Sdn Bhd

www.robolab.com.my

Hello, I am CheeFai

- Chief Technical Director, Robolab Technology Sdn. Bhd.
- Vice President, MSM International Ltd.
- Vice President, Institution of Engineers Malaysia
- Individual Specialist, UNESCO
- Fellow, ASEAN Academy of Engineering & Technology (ASEAN AET)
- Fellow, Institution of Engineers, Malaysia
- ASEAN Chartered Professional Engineer, ASEAN Engineer, APEC Engineer, International PE
- Member, Royal Netherlands Institutes of Engineers (KIVI)
- Senior Member, China Mechanical Engineering Society (CMES)
- Research Scholar, Eindhoven University of Technology, The Netherlands
- Ten Outstanding Young Malaysian Award 2014 Honoree

欧亚经济论坛 | 丝绸之路国际创
西安与世界一
XI'AN. CR NITH THE
2017年10月1日 星期日
今日马六甲
宋德祥吁中小型企業
迎接工業4.0提升經營
须作好適應改變
Next Industry Revolution: Opportunities and Challenges for Small and Medium Ind es
IET The Institution of Engineering and Technology
青商潮積
潮商青年委员会协办
马来西亚马六甲技术大学
陈志辉博士
主讲
新工业革命如何改变我们的经济和创造价值
槟榔屿潮卅会馆礼堂
17/9/2017 (Sun)
2pm - 4.30pm
入场免费
陈志辉博士
未来的物流
THE FUTURE OF LOGISTICS
陈志辉博士
IR. DR. CHEE-FAI, TAN
Fraunhofer
IEM
IEM
FUTURE ENGINEER
Inspiring the workforce of to
陳志輝：互聯、數據、集成、創新及轉型
工業4.0 5核心點
陳志輝：以智能製造為導向
工業4.0改變人類生活
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亚太工程组织联合会第27届全体大会暨第5届国际学术研讨会
The 27th General Assembly & The 5th Convention of FEIAP


2019世界机器人大会
WORLD ROBOT CONFERENCE

“ You cannot wait until a house burns down to buy fire insurance on it. We cannot wait until there are massive dislocations in our society to prepare for the Fourth Industrial Revolution.”

Robert J. Shiller

2013 Nobel laureate in economics,
Professor of Economics,
Yale University..

Waves of Technology Revolution

Agricultural Revolution

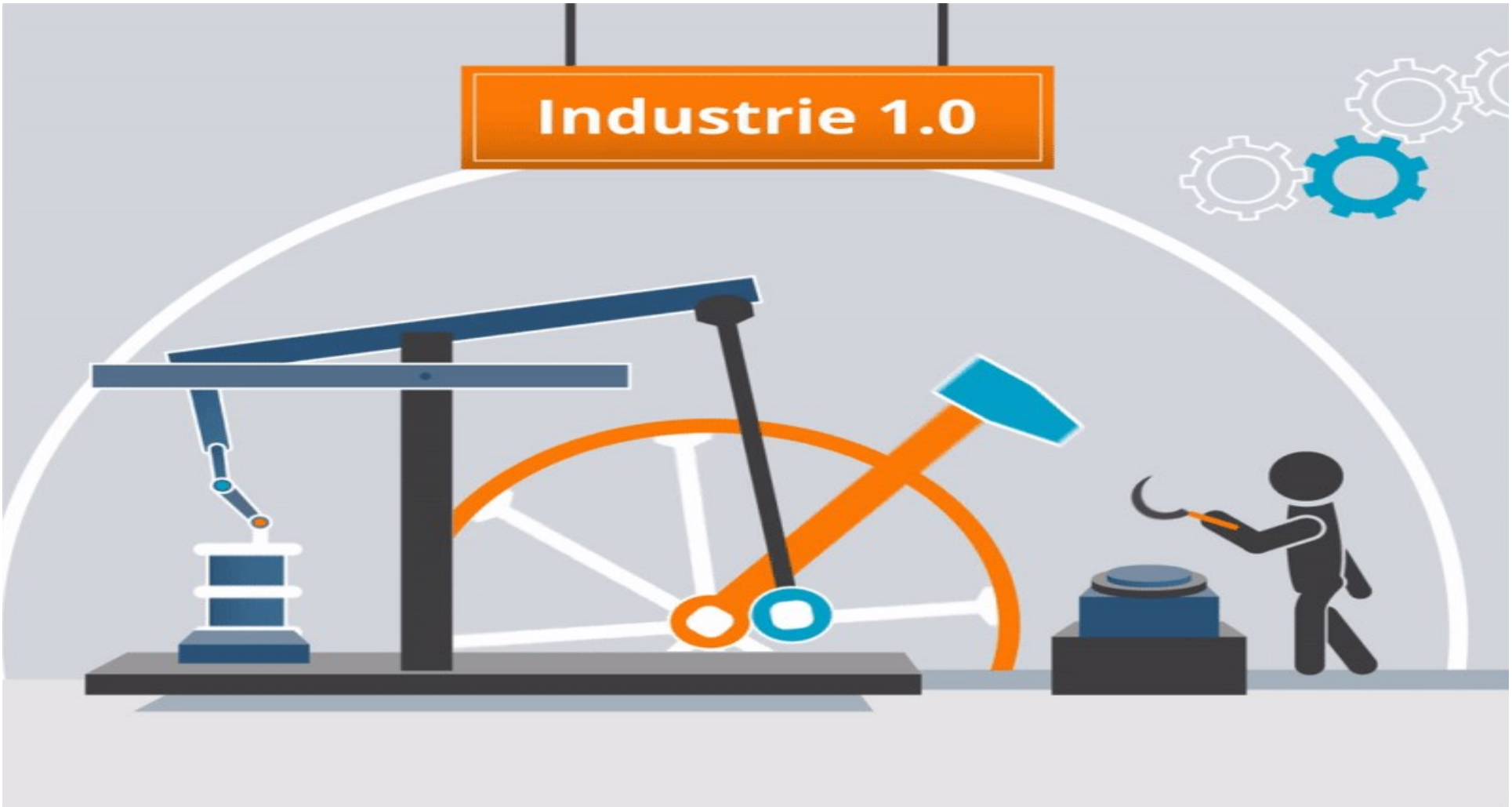
Industrial Revolution

Electronic Revolution

IT Revolution

Physical and Cyber Systems

Source: Prof. Chuah HT


Industrie 1.0

The 4th Industrial Revolution Is Upon Us.

FROM INDUSTRY 1.0 TO INDUSTRY 4.0

PRODUCTIVITY

FIRST
INDUSTRIAL REVOLUTION

Introduction of mechanical production facilities with the help of water and steam power

1784

First mechanical loom

SECOND
INDUSTRIAL REVOLUTION

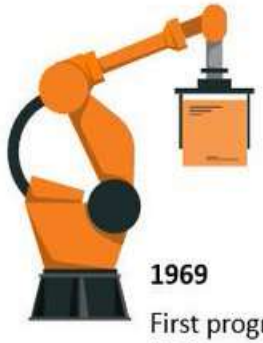
Introduction of a division of labor and mass production with the help of electrical energy

1870

First assembly line

THIRD
INDUSTRIAL REVOLUTION

Use of electronic and IT systems that further automate production

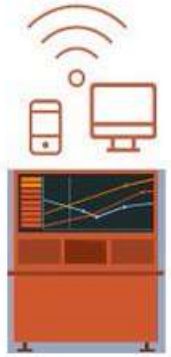


1969

First programmable (PC)

FOURTH
INDUSTRIAL REVOLUTION

The Digital Connected World



1800

1900

Principles of Scientific Management

TQM

2000

- *Lean*
- *Six Sigma*

INTEROPERABILITY

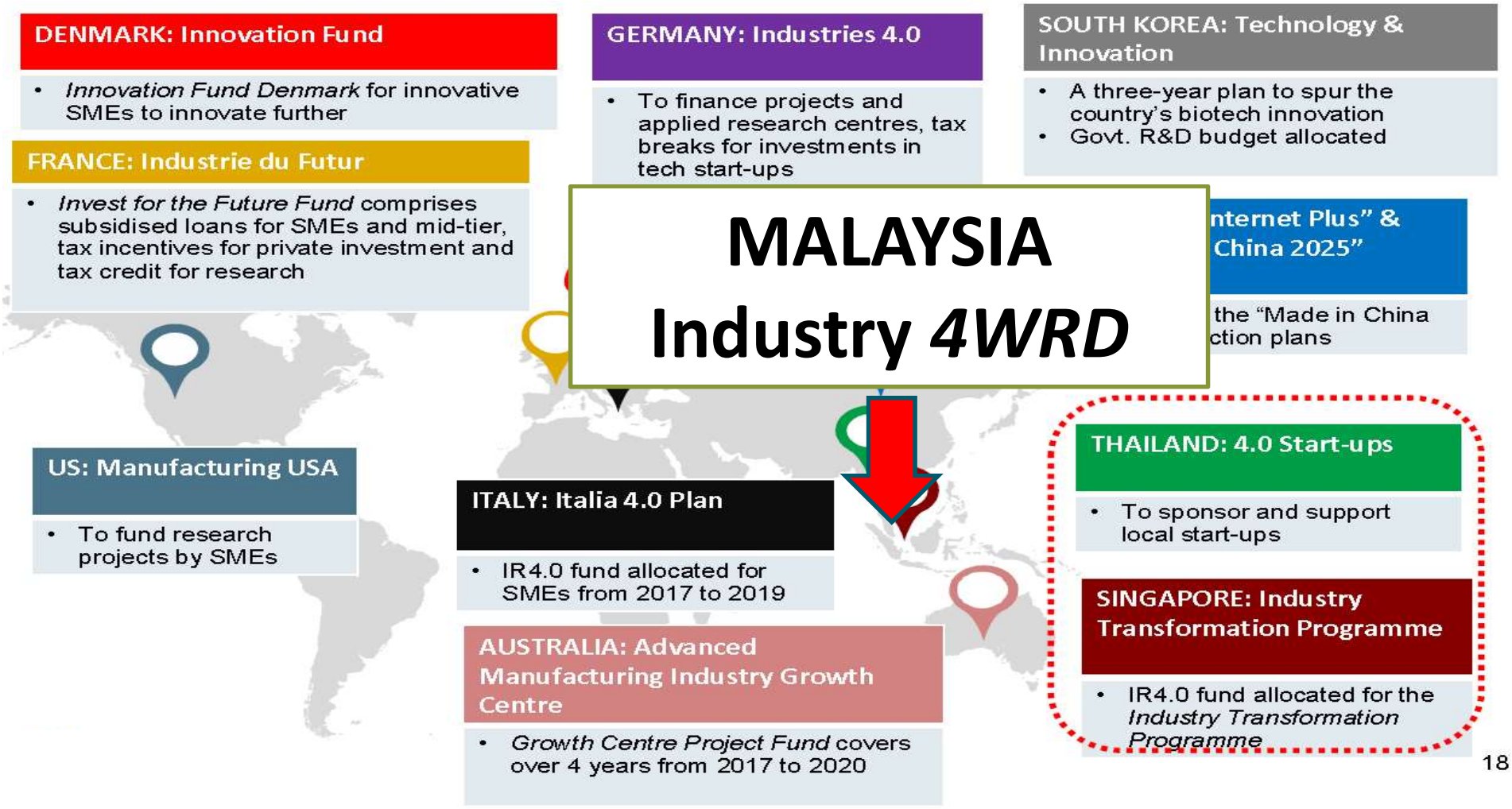
machines, devices, sensors and people that connect and communicate with one another.

INFORMATION TRANSPARENCY

the systems create a virtual copy of the physical world through sensor data in order to contextualize information.

DECENTRALIZED DECISION-MAKING

the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible.


DENMARK: Innovation Fund
• *Innovation Fund Denmark* for innovative SMEs to innovate further
FRANCE: Industrie du Futur
• *Invest for the Future Fund* comprises subsidised loans for SMEs and mid-tier, tax incentives for private investment and tax credit for research
GERMANY: Industries 4.0
• To finance projects and applied research centres, tax breaks for investments in tech start-ups
SOUTH KOREA: Technology & Innovation
• A three-year plan to spur the country's biotech innovation
• Govt. R&D budget allocated
MALAYSIA
Industry *4WRD*
nternet Plus" &
China 2025"
the "Made in China
ction plans
US: Manufacturing USA
• To fund research projects by SMEs
ITALY: Italia 4.0 Plan
• IR4.0 fund allocated for SMEs from 2017 to 2019
AUSTRALIA: Advanced Manufacturing Industry Growth Centre
• *Growth Centre Project Fund* covers over 4 years from 2017 to 2020
THAILAND: 4.0 Start-ups
• To sponsor and support local start-ups
SINGAPORE: Industry Transformation Programme
• IR4.0 fund allocated for the *Industry Transformation Programme*

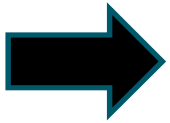
Trends in Globalised World

- Faster Pace
- Borderless World and Opportunities
- Convergence
- Personalization and Individualization
- More informed and Higher Expectations- Seamless Mobility, Seamless Relationship
- Cost Effectiveness
- Knowledge in Power

Source: Prof. Chuah HT

Past and Current

- Small groups of experts
- Hardware
- Big capital investment
- Controlled Environment
- Local markets
- Single specialization
- Manual/Semi-auto



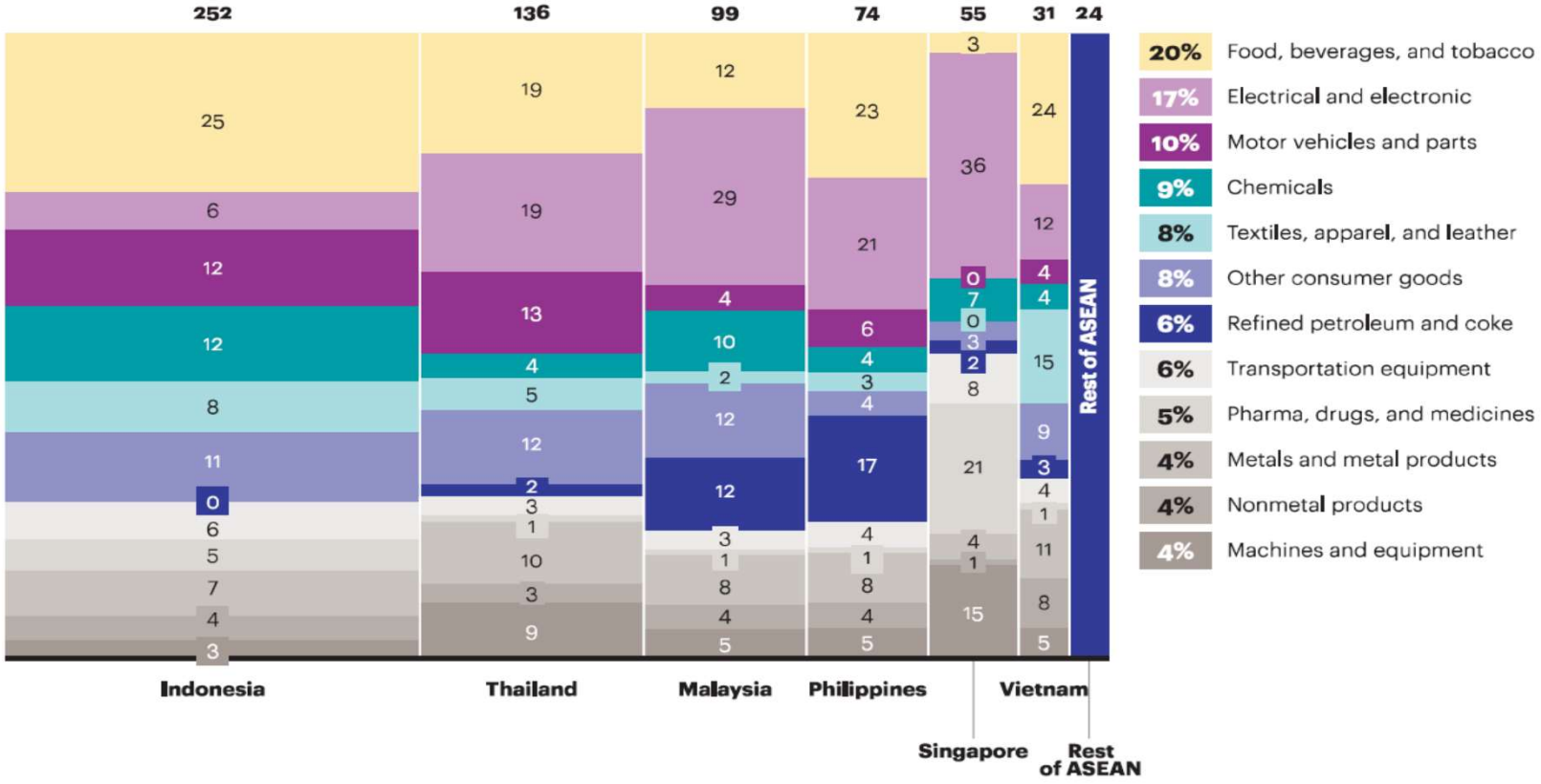
Future

- Human Centric
- Knowledge creation
- Software
- Small investment
- Open market
- Free market
- Multi-disciplinary
- Automation/AI

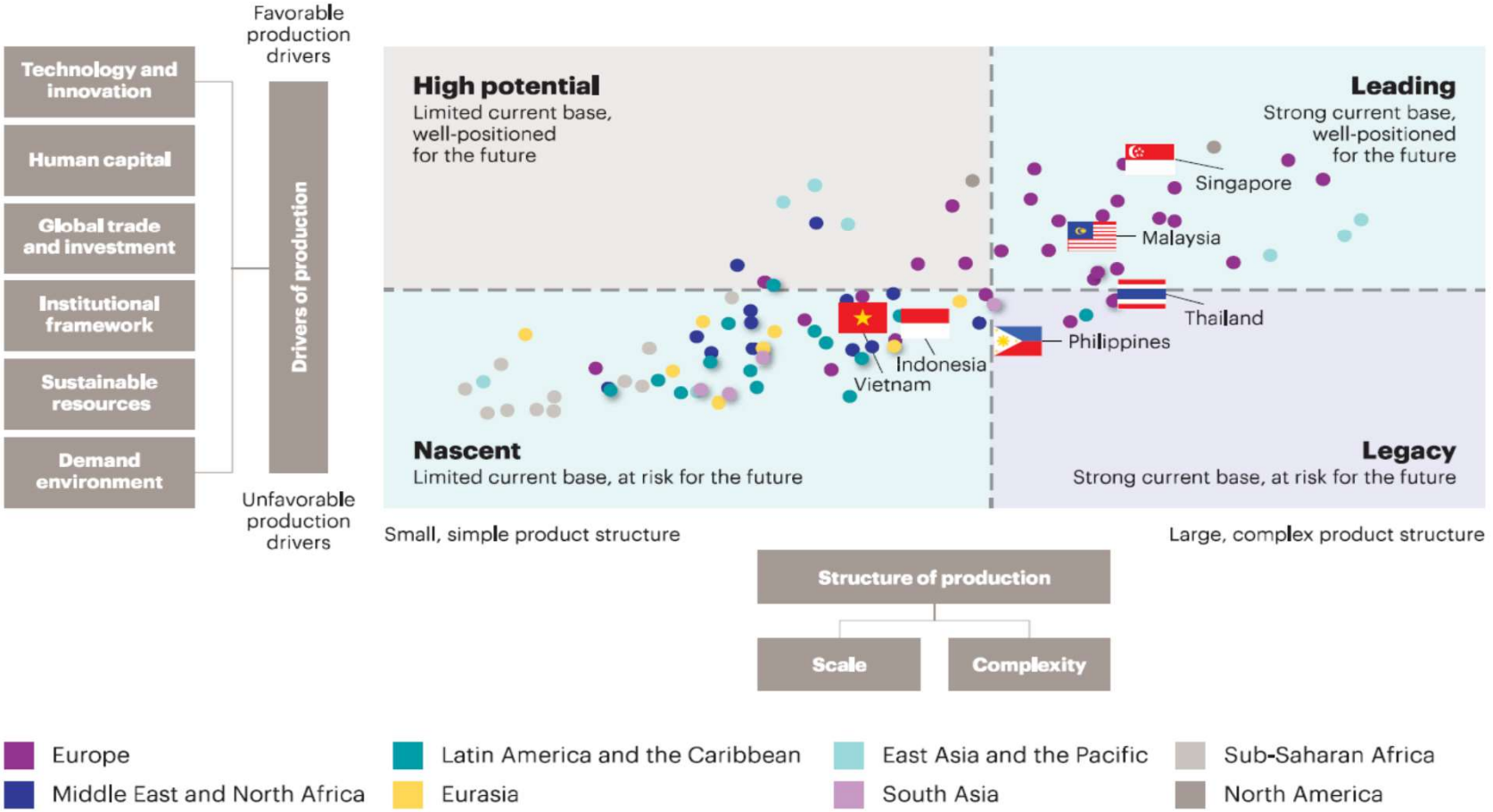
Source: Prof. Chuah HT

Manufacturing value added

($ billion, 2018f)



World Economic Forum country readiness framework

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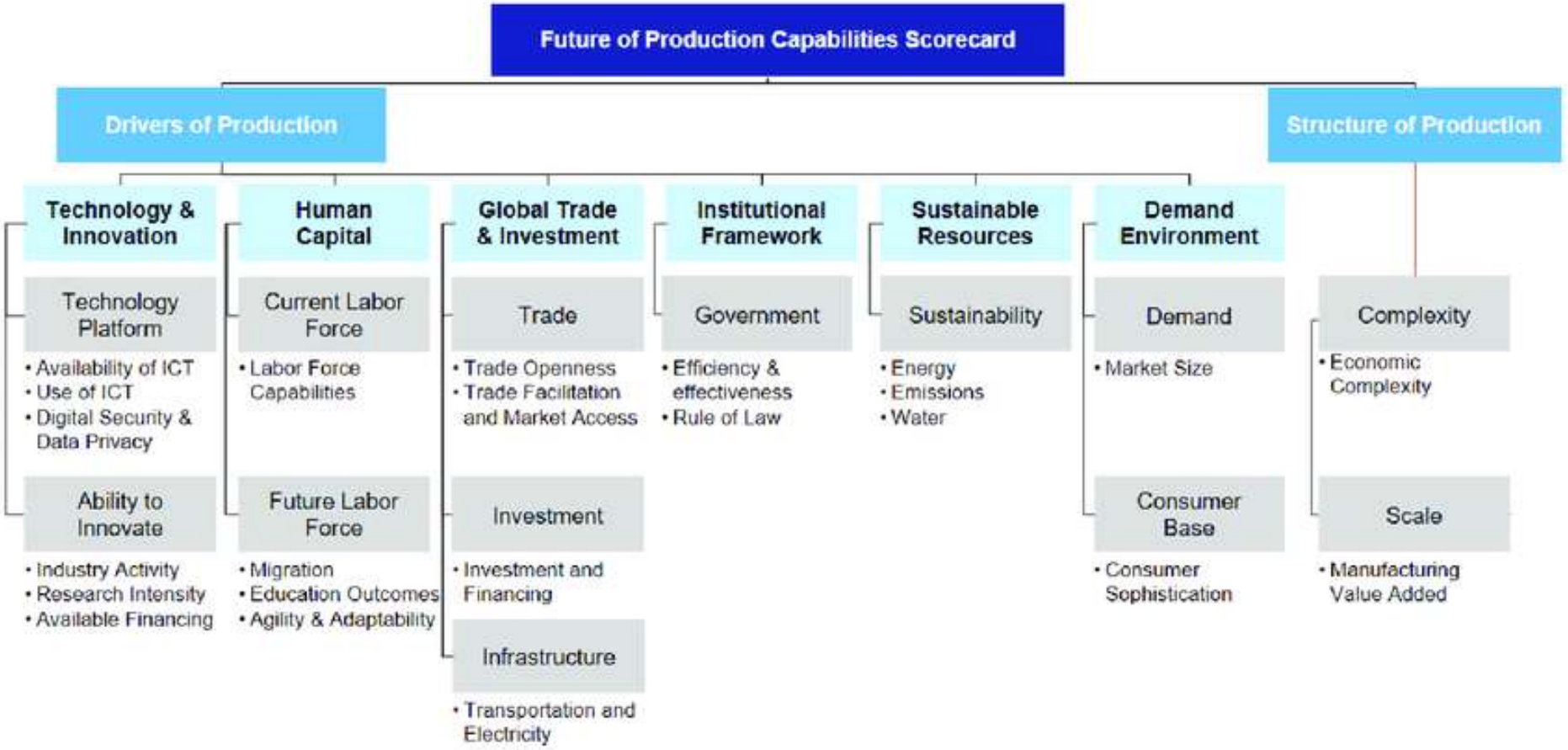
WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

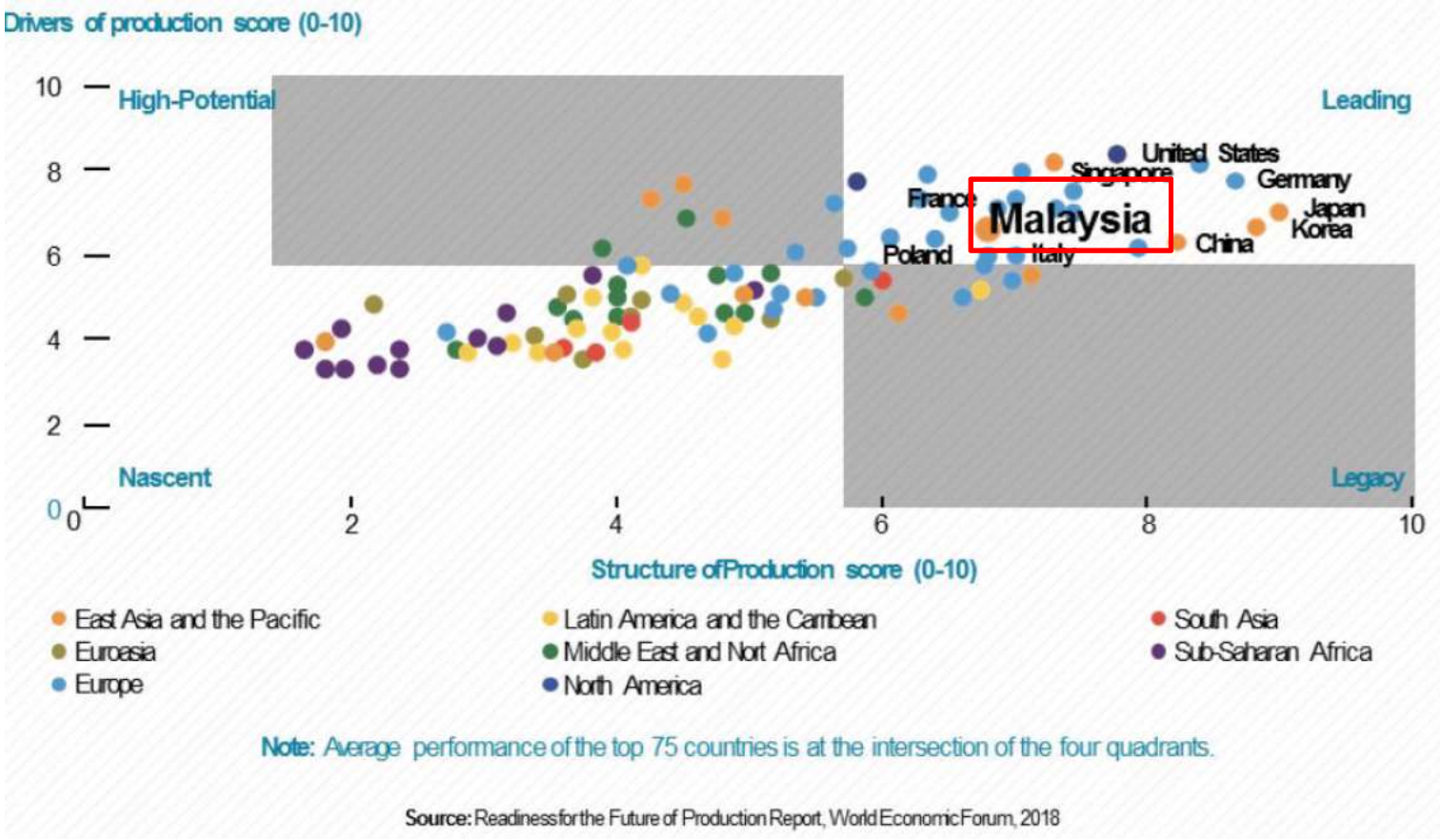
Insight Report

Readiness for the Future of Production Report 2018

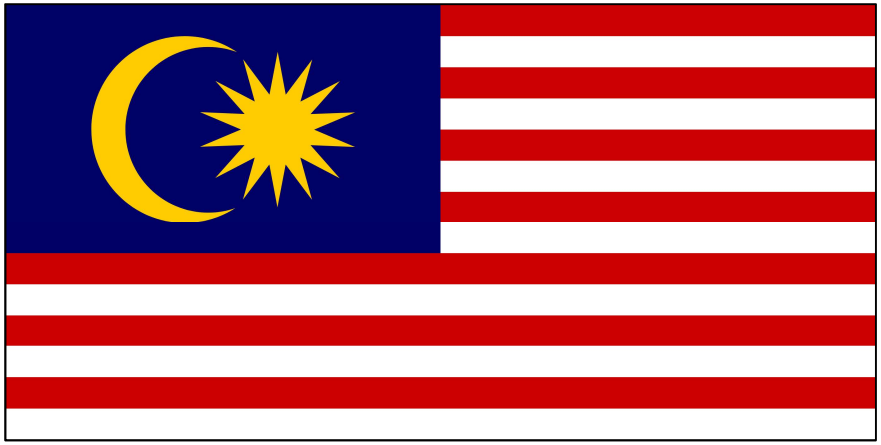
In collaboration with A.T. Kearney


Future of Production Capabilities Scorecard
Drivers of Production
Structure of Production
Technology & Innovation
Human Capital
Global Trade & Investment
Institutional Framework
Sustainable Resources
Demand Environment
Technology Platform
• Availability of ICT
• Use of ICT
• Digital Security & Data Privacy
Ability to Innovate
• Industry Activity
• Research Intensity
• Available Financing
Current Labor Force
• Labor Force Capabilities
Future Labor Force
• Migration
• Education Outcomes
• Agility & Adaptability
Trade
• Trade Openness
• Trade Facilitation and Market Access
Investment
• Investment and Financing
Infrastructure
• Transportation and Electricity
Government
• Efficiency & effectiveness
• Rule of Law
Sustainability
• Energy
• Emissions
• Water
Demand
• Market Size
Consumer Base
• Consumer Sophistication
Complexity
• Economic Complexity
Scale
• Manufacturing Value Added

Malaysia Readiness for Industry 4.0




10
High-Potential
Leading
Most future-ready
Malaysia
6.8, 6.5
Drivers of Production
Least future-ready
0
Nascent
Legacy
0
Structure of Production
10
Small / basic
Large / complex



Key economic indicators

Population millions	31.7	**GDP per capita** US$	9,360.5
GDP US$ billions	296.4	**Unemployment rate** %	3.5

Key production indicators

Manufacturing value added 2010 millions US$	79,820.6	**Manufacturing value added growth** Annual %	3.9
Manufacturing value added in economy % GDP	23.9	**Medium hi-tech & hi-tech industries** % of manu. value added	42.6
Manufacturing employment % working population	16.5	**CO2 emission per unit of value added** kg/USD	0.4

Region	Country	Structure of Production Score	Structure of Production Rank	Drivers of Production Score	Drivers of Production Rank
Leading Countries					
	Austria	7.46	9	6.79	18
	Belgium	6.51	24	6.80	17
	Canada	5.81	33	7.54	7
	China	8.25	5	6.14	25
	Czech Republic	7.94	6	6.01	26
	Denmark	6.29	27	7.20	10
	Estonia	5.75	34	6.00	27
	Finland	7.00	14	7.16	11
	France	6.87	18	6.89	14
	Germany	8.68	3	7.56	6
	Ireland	7.34	10	6.85	15
	Israel	6.43	25	6.24	23
	Italy	6.99	15	5.90	30
	Japan	8.99	1	6.82	16
	Korea, Rep.	8.85	2	6.51	21
	Malaysia	6.81	20	6.51	22
	Netherlands	6.32	26	7.75	5
	Poland	6.83	19	5.83	31
	Singapore	7.28	11	7.96	2
	Slovenia	6.80	21	5.71	32
	Spain	6.05	29	6.23	24
	Sweden	7.46	8	7.40	9
	Switzerland	8.39	4	7.92	3
	United Kingdom	7.05	13	7.84	4
	United States	7.78	7	8.16	1

Drivers of Production 6.5

Driver	Weighting	Rank	Score /10
Technology & Innovation	20%	23rd	**5.9**
Human Capital	20%	21st	**6.5**
Global Trade & Investment	20%	7th	**7.4**
Institutional Framework	20%	30th	**6.6**
Sustainable Resources	5%	60th	**6.0**
Demand Environment	15%	17th	**6.3**

Structure of Production 6.8

Structure	Weighting	Rank	Score /10
Complexity	60%	30th	**6.8**
Scale	40%	7th	**6.8**

Figure 8: Top 10 factors affecting business performance

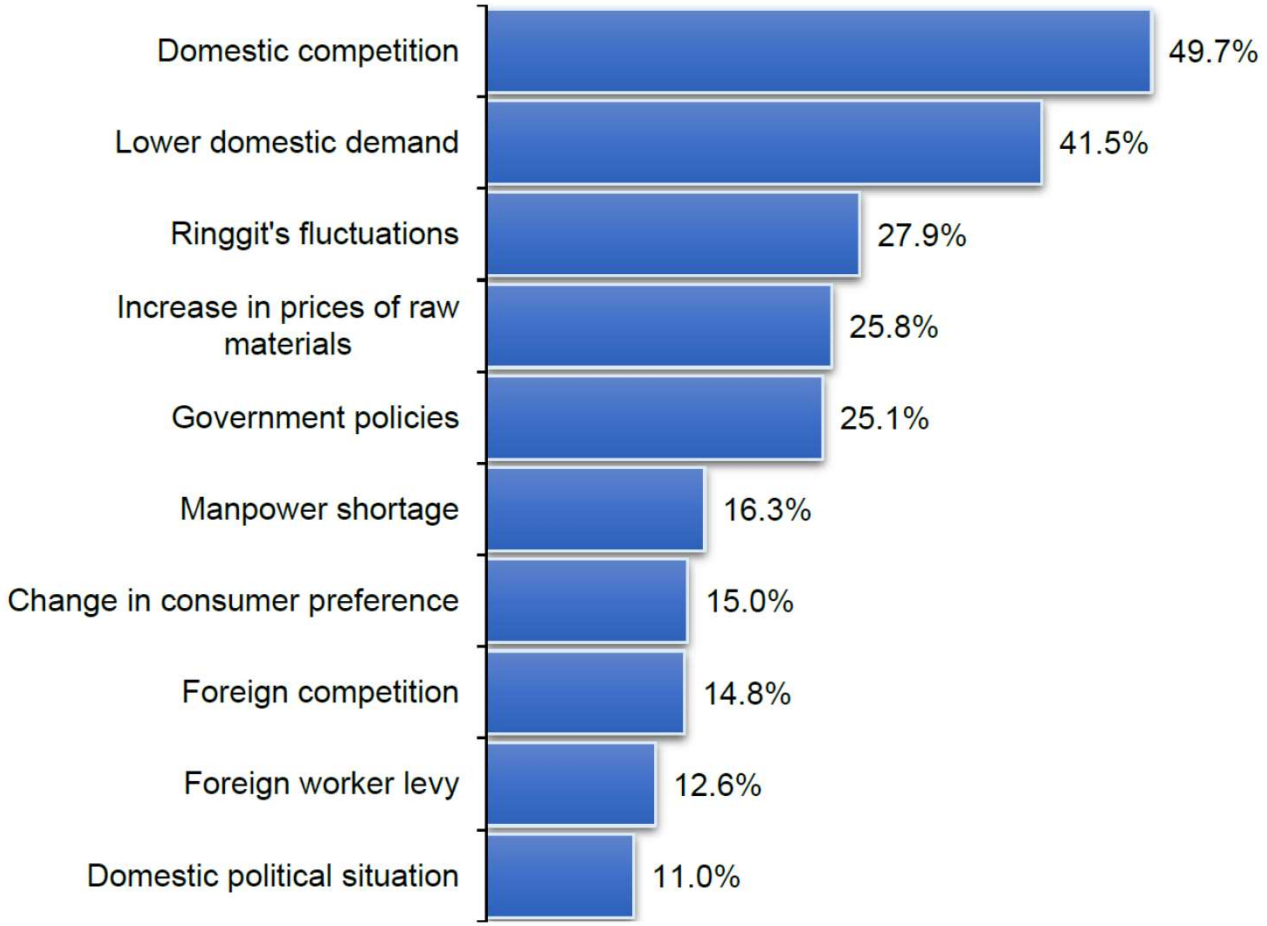


Table 3: Top five factors affecting business performance by selected sectors*

		Domestic competition	Lower domestic demand	Ringgit's fluctuations	Increase in prices of raw materials	Government policies	Manpower shortage	Foreign competition	Excess production capacity
Wholesale and retail trade	Score (%)	58.3	48.7	36.7	27.6	21.6			
	Ranking	1	2	3	4	5			
Manufacturing	Score (%)	42.3	40.3	29.1	36.2			30.6	
	Ranking	1	2	5	3			4	
Professional and business services	Score (%)	53.0	35.5	24.0		23.5	19.1		
	Ranking	1	2	3		4	5		
Construction	Score (%)	50.4	49.6	21.4	27.5	25.2			
	Ranking	1	2	5	3	4			
Real estate	Score (%)	42.6	50.8		24.6	39.3			29.5
	Ranking	2	1		5	3			4

** According to highest sample size*

The Role of Government

Industry4WRD - National Policy on Industry 4.0

Study on Future of Manufacturing: Industry 3+2

Industry 4.0 Taskforce
* Infrastructure and Ecosystem
* Funding and Incentives
* Talent and Human Capital
* Technology and Standards
* SMEs

National Internet of Things (IoT) Strategic Roadmap

Launching of National IoT Strategic Road Map

Embracing Industry 4.0 in Malaysia

MALAYSIA PRODUCTIVITY BLUEPRINT
Driving Productivity of the Nation

A blueprint created to address productivity challenges holistically in order to boost economic growth

DIGITAL MALAYSIA

Malaysia Digital Economy 2017:

Industry4WRD – Readiness Assessment

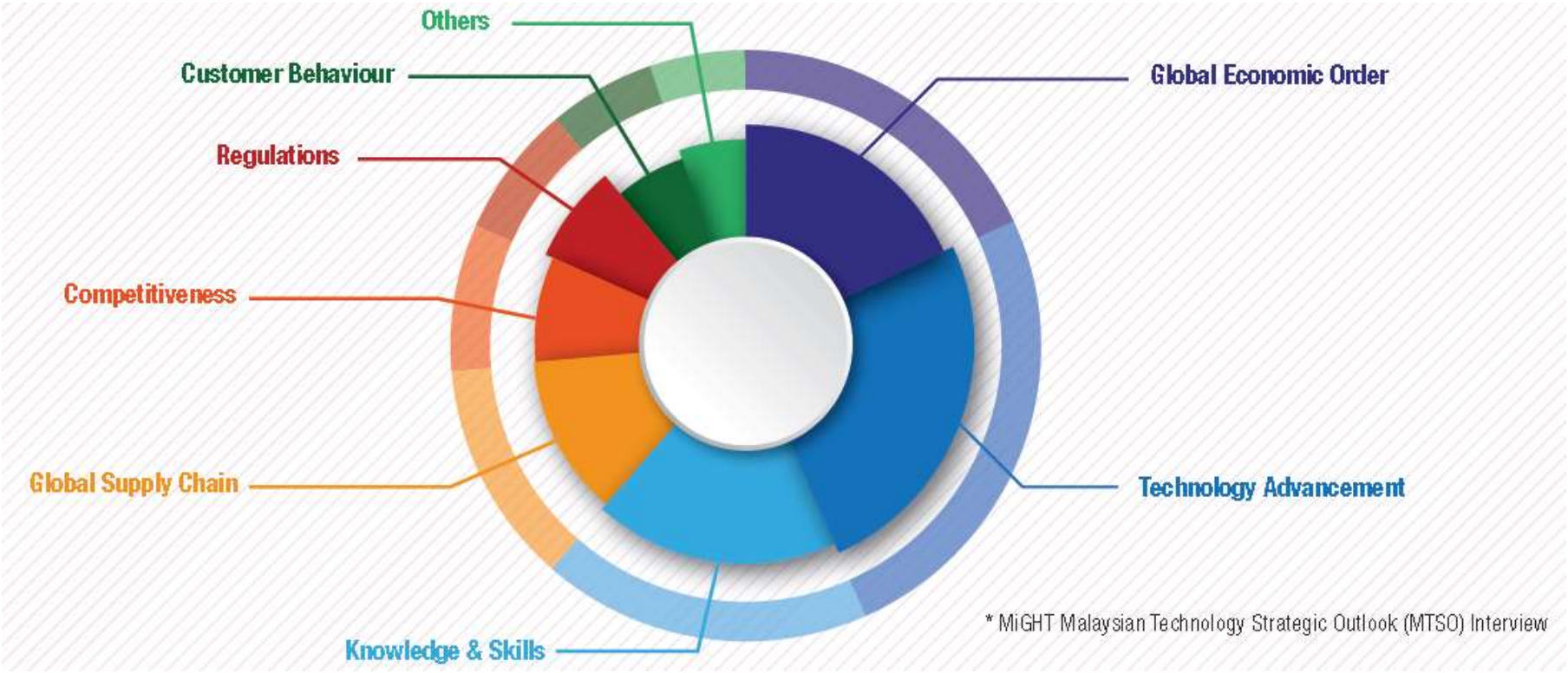
DFTZ
DIGITAL FREE TRADE ZONE

Establishment of Digital Free Zone to stimulate internet based innovation

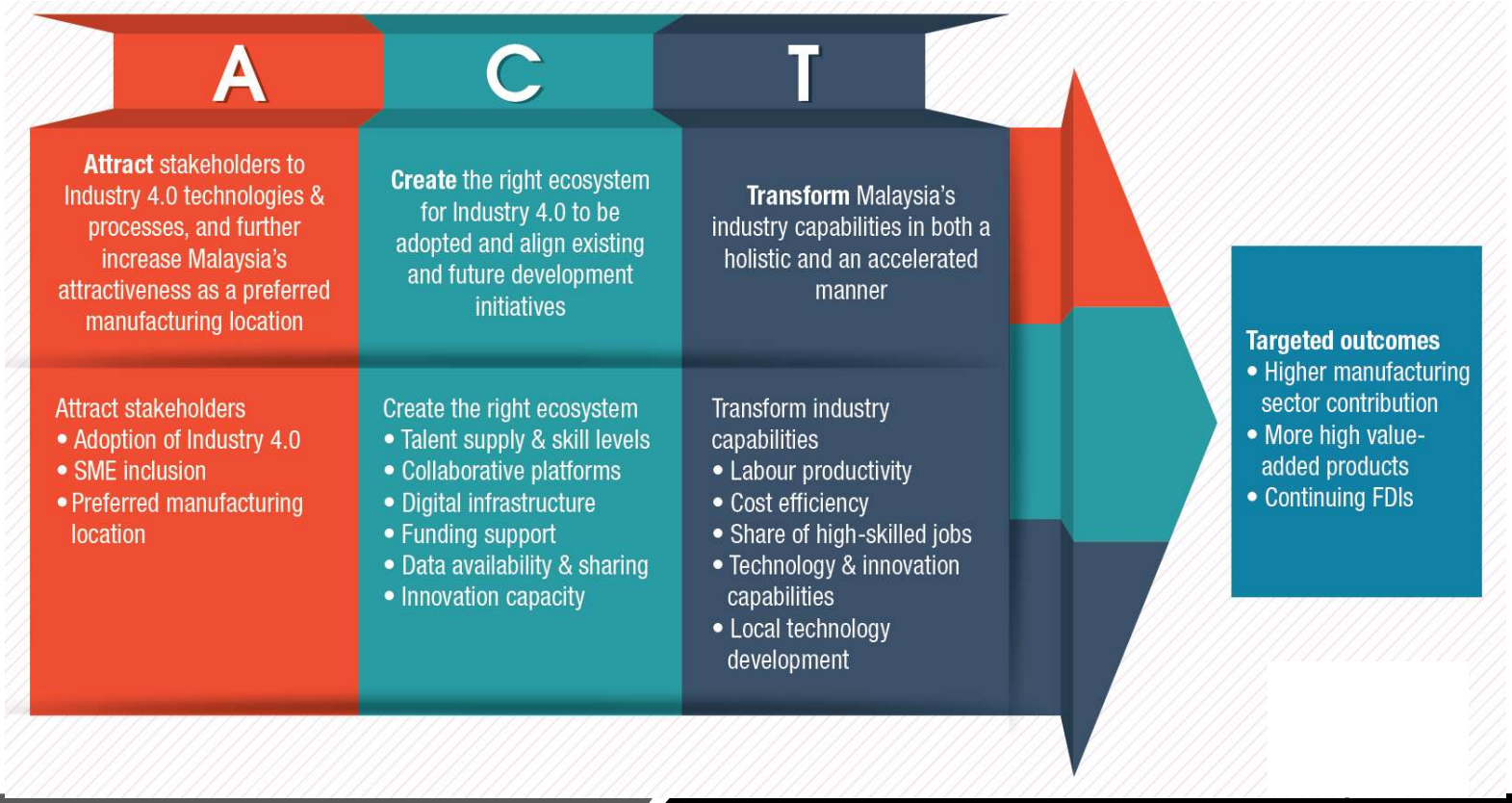
Building Analytics Capabilities: 20,000 data professionals and 2,000 data scientists by 2020

LAUNCHED ON 31 OCTOBER 2018

I4 Transformation Drivers



Objective

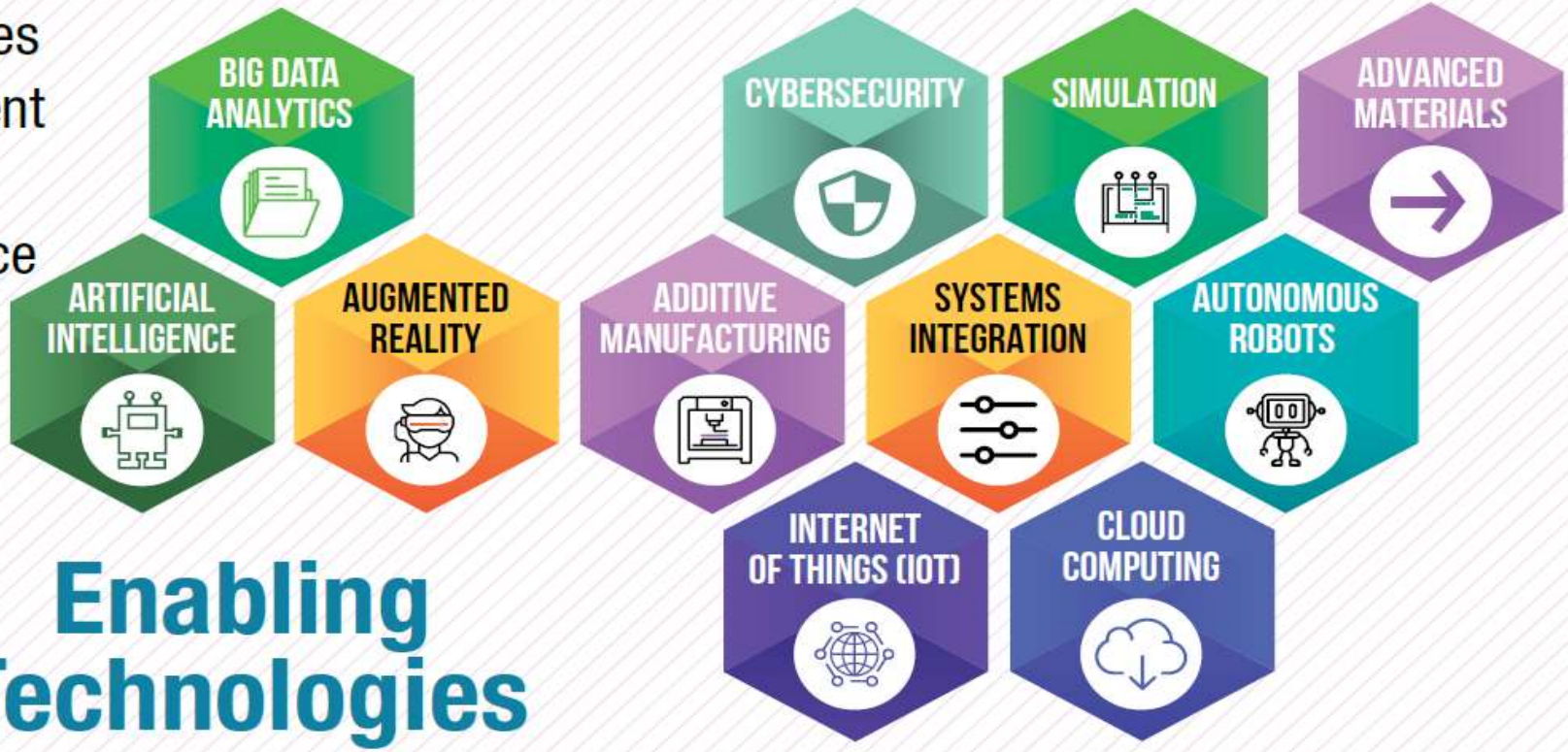

A
C
T
Attract stakeholders to Industry 4.0 technologies & processes, and further increase Malaysia's attractiveness as a preferred manufacturing location
Create the right ecosystem for Industry 4.0 to be adopted and align existing and future development initiatives
Transform Malaysia's industry capabilities in both a holistic and an accelerated manner
Attract stakeholders
• Adoption of Industry 4.0
• SME inclusion
• Preferred manufacturing location
Create the right ecosystem
• Talent supply & skill levels
• Collaborative platforms
• Digital infrastructure
• Funding support
• Data availability & sharing
• Innovation capacity
Transform industry capabilities
• Labour productivity
• Cost efficiency
• Share of high-skilled jobs
• Technology & innovation capabilities
• Local technology development
Targeted outcomes
• Higher manufacturing sector contribution
• More high value-added products
• Continuing FDIs

Specific Goals

- To increase the level of productivity in the manufacturing industry per person from RM106,647 by 30%;
- To elevate the absolute contribution of the manufacturing sector to the economy from RM254 billion to RM392 billion;
- To strengthen the Malaysian innovation capacity and capability as reflected by improvement in Global Innovation Index ranking from 35th to top 30; and
- To increase the number of high-skilled workers in the manufacturing sector from 18% to 35%.

Technology

Technologies advancement and convergence



Enabling Technologies

The digitalisation of the production-based industries are driven by these technological drivers

Malaysia Moving Forward

Upskilling and reskilling

Inclusive involvement of SMEs

Significant evolution in Innovation

Focus funding support

Good digital infrastructure

The Strategic Enablers

Funding

Infrastructure

Regulation

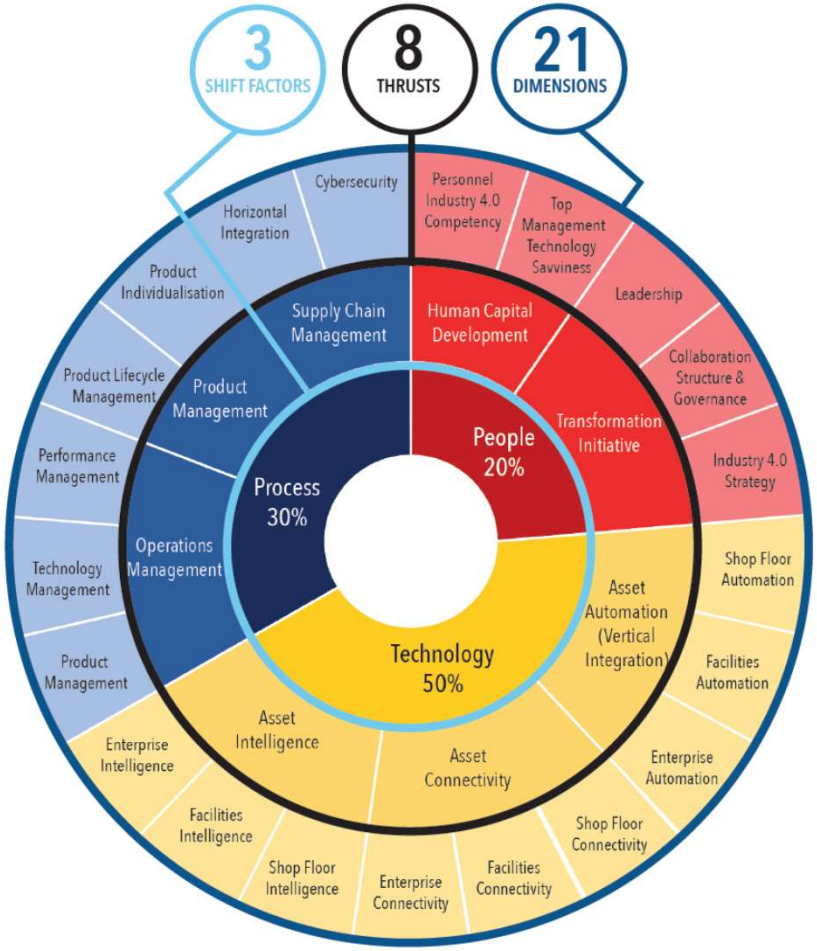
Skills and Talent

Technology

Industry4WRD

READINESS ASSESSMENT


1
Public announcement & awareness
2
Company registers interest
3
Industry4WRD - RA Technical / Steering Committee review
4
Assessment process takes place
5
Full report
6
Table to Industry4WRD - RA Technical / Steering Committee
7
Inform assessment results to company

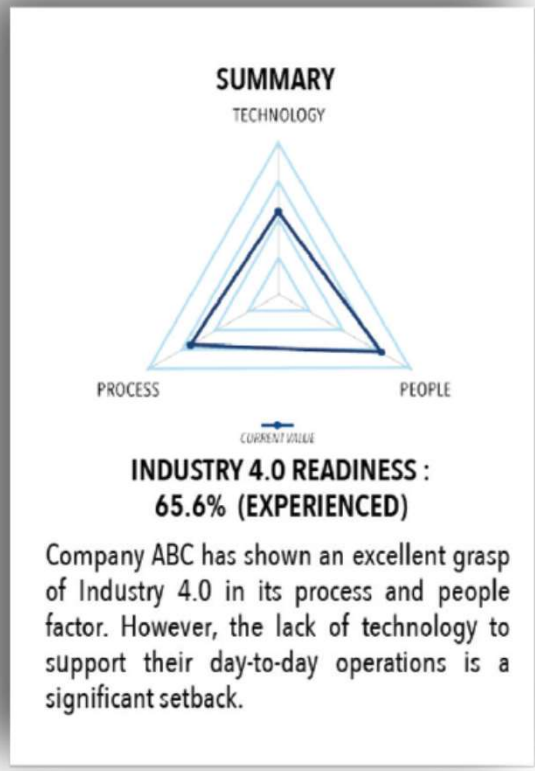

3
SHIFT FACTORS
8
THRUSTS
21
DIMENSIONS
Cybersecurity
Horizontal Integration
Product Individualisation
Product Lifecycle Management
Performance Management
Technology Management
Product Management
Personnel Industry 4.0 Competency
Top Management Technology Savviness
Leadership
Collaboration Structure & Governance
Industry 4.0 Strategy
Shop Floor Automation
Facilities Automation
Enterprise Automation
Shop Floor Connectivity
Facilities Connectivity
Enterprise Connectivity
Shop Floor Intelligence
Facilities Intelligence
Enterprise Intelligence
Supply Chain Management
Product Management
Operations Management
Process 30%
Human Capital Development
Transformation Initiative
People 20%
Asset Automation (Vertical Integration)
Asset Connectivity
Asset Intelligence
Technology 50%

Shift factor: **PEOPLE**	Focuses on the people and the entire organisation by emphasising on strategies towards having a suitable set of workforce. This can be achieved through the development of the required human capital and sustainable transformation activities with regards to organisational strategies, collaboration and governance.
Shift factor: **PROCESS**	Focuses on the management system involved in running business operations, supply chain and product lifecycle, by emphasising on smart and strategic public-private partnerships, security, sustainability and product co-creation.
Shift factor: **TECHNOLOGY**	Focuses on the application of intelligent, connected and automated technologies, measured at three different layers of the business: shop floor, facilities and enterprise.

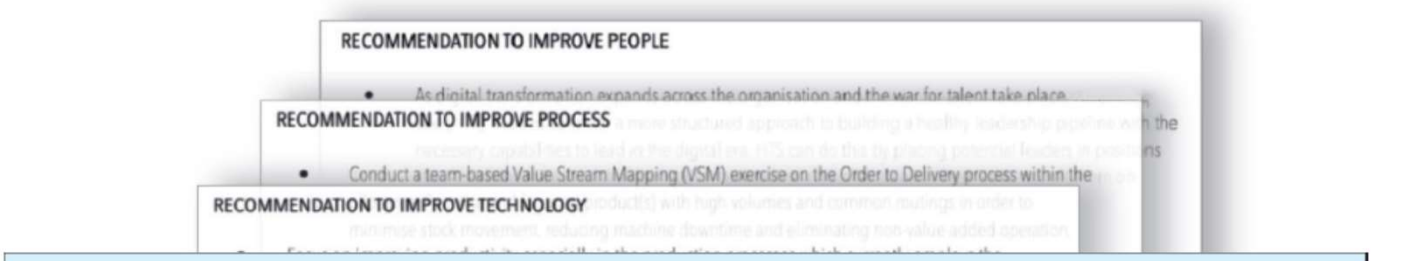
Readiness Profile and Scoring

READINESS PROFILE	PERCENTAGE SCORED	GENERAL DESCRIPTION
Conventional	0 % to 20 %	Operation remains "as is" with no intention or initiative to move into Industry 4.0 adoption.
Newcomer	21 % to 40 %	Has interest to pursue Industry 4.0 but with none or very minimal efforts or initiatives.
Learner	41 % to 60 %	Has interest to pursue pilot line Industry 4.0 adoption in operation, with existence of planning and strategies, efforts or simple and patches of initiatives being implemented. Ready for some system adoption.
Experienced	61 % to 90 %	Has pursued small to medium scale Industry 4.0 adoption initiatives in operation, horizontal integration and ready for large scale system adoption.
Leader	91 % to 100 %	Has implemented large scale Industry 4.0 adoption initiatives (company-wide) and system integration.


PEOPLE
PROCESS
TECHNOLOGY
Some investments within technology area
Technology plan / roadmap not properly addressed
Limited connectivity to Enterprise layer without much consideration to Shop Floor layer
Automation only at Enterprise layer
Very manual driven and requires a lot of human intervention


SUMMARY
TECHNOLOGY
PROCESS
PEOPLE
CURRENT VALUE
INDUSTRY 4.0 READINESS :
65.6% (EXPERIENCED)
Company ABC has shown an excellent grasp of Industry 4.0 in its process and people factor. However, the lack of technology to support their day-to-day operations is a significant setback.

IMPROVEMENT PLAN



SPECIFIC ACTION			
Shift Factor (Thrust)	TECHNOLOGY (Asset Connectivity)		
Initiative	Connectivity Improvement Implementation		
Description	Implement connectivity improvement to connect critical function horizontally and vertically to support Industry 4.0 requirements		
Estimated Timeline	6 months	**Priority**	Medium
Expected Deliverables	Highly available connectivity throughout Shop floor, Facilities, and Enterprise		

Key economic indicators

Population millions	5.6	**GDP per capita** US$	52,960.7
GDP US$ billions	297.0	**Unemployment rate** %	2.1

Key production indicators

Manufacturing value added 2010 millions US$	52,782.2	**Manufacturing value added growth** Annual %	-1.2
Manufacturing value added in economy % GDP	18.2	**Medium hi-tech & hi-tech industries** % of manu. value added	80.4
Manufacturing employment % working population	11.1	**CO2 emission per unit of value added** kg/USD	0.2


High-Potential
Leading
Singapore
7.3, 8.0
Nascent
Legacy
10
0
Most future-ready
Drivers of Production
Least future-ready
0
Structure of Production
10
Small / basic
Large / complex

THE SINGAPORE SMART INDUSTRY READINESS INDEX

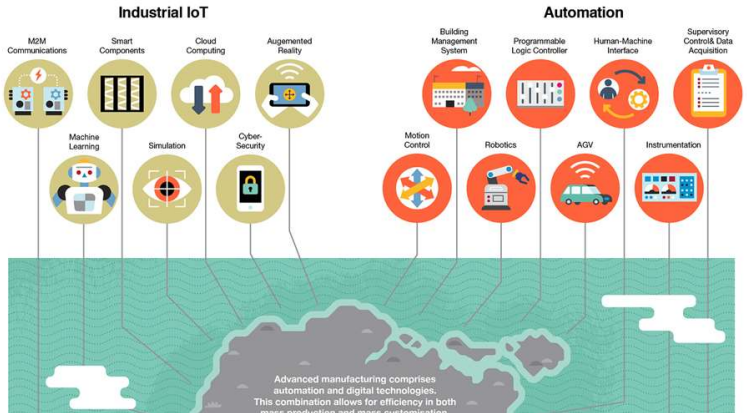
Launched on November 2017, the Singapore Smart Industry Readiness Index© (“The Index”) is the world's first Industry 4.0 tool that is developed by the Singapore Economic Development Board (“EDB”) to catalyse the transformation of industrial sectors during this 4th Industrial Revolution.

Singapore's smart factory future

Manufacturing in 2017:	By 2024, advanced manufacturing will:[5]
1/5 of GDP[1]	30% Boost labour productivity by ~30%
2,000+ companies[2]	S$36b Add S$36b (US$26b) in total manufacturing output and revenue for local and foreign companies
400,000+ jobs[3]	Create 22,000 new jobs with average salaries up to 50% higher
$176,000 in value-added per worker[4]	

Advanced manufacturing technologies are redefining manufacturing on a global scale

Thanks to its vast industry footprint and commitment to innovation, Singapore sits at the forefront of the advanced manufacturing revolution. By leveraging automation and digitalisation, companies can boost their competitiveness and develop new solutions and business models.



Key economic indicators

Population millions	69.0	**GDP per capita** US$	5,899.4
GDP US$ billions	406.9	**Unemployment rate** %	0.8

Key production indicators

Manufacturing value added 2010 millions US$	116,650.5	**Manufacturing value added growth** Annual %	3.6
Manufacturing value added in economy % GDP	28.7	**Medium hi-tech & hi-tech industries** % of manu. value added	40.7
Manufacturing employment % working population	16.5	**CO2 emission per unit of value added** kg/USD	0.5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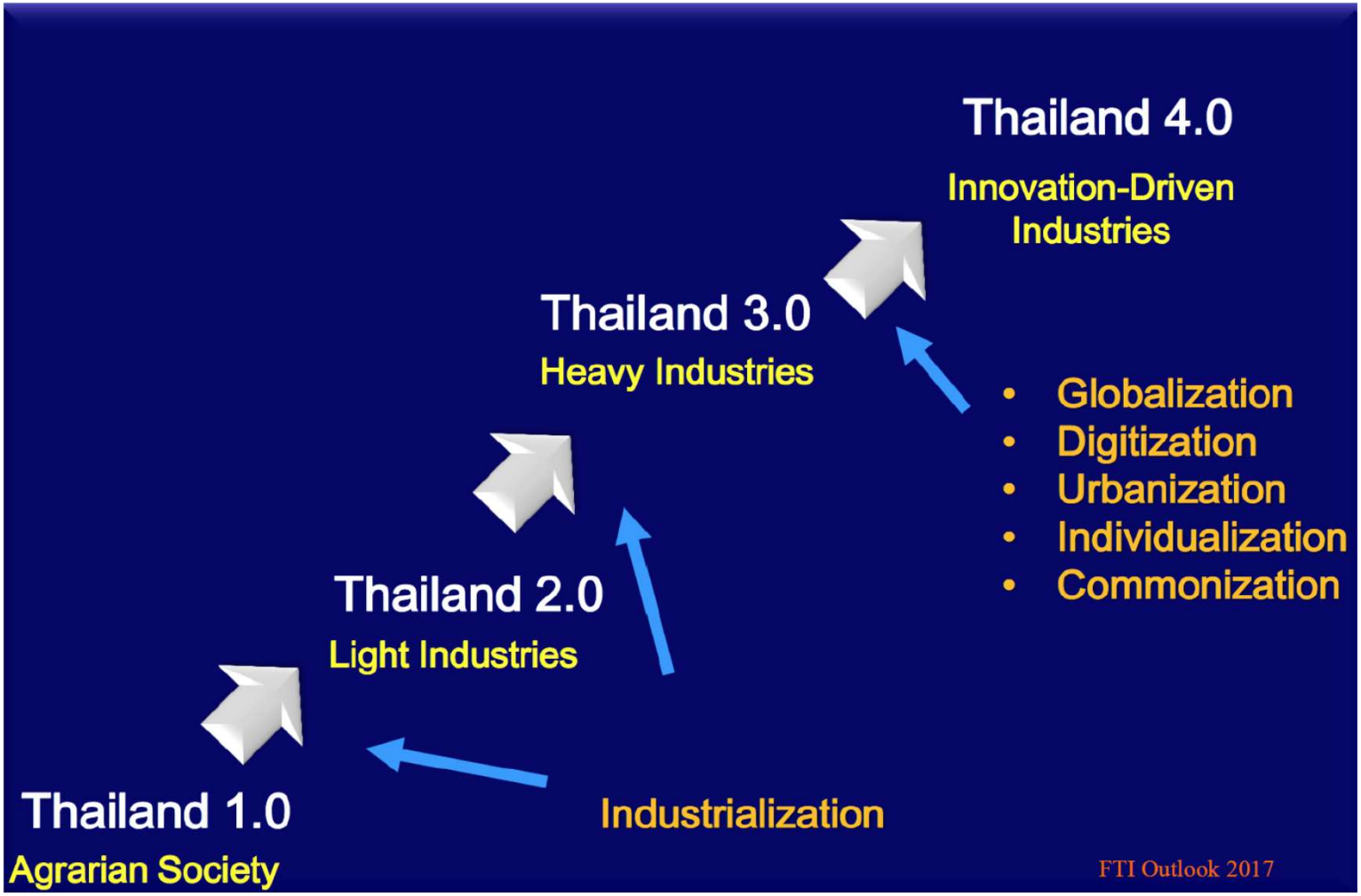
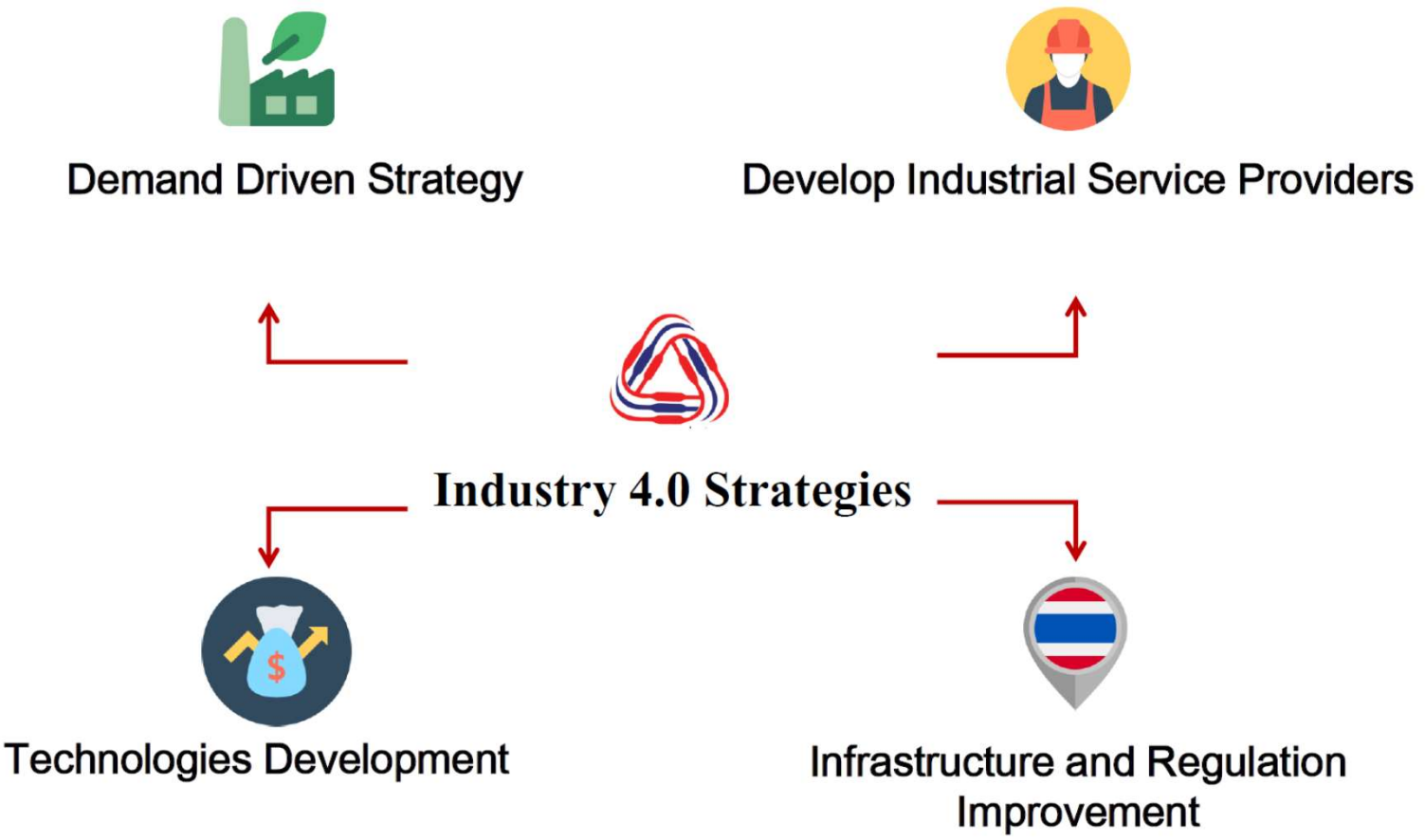

Thailand 4.0
Innovation-Driven Industries
Thailand 3.0
Heavy Industries
Thailand 2.0
Light Industries
Thailand 1.0
Agrarian Society
Industrialization
• Globalization
• Digitization
• Urbanization
• Individualization
• Commonization
FTI Outlook 2017


Demand Driven Strategy
Develop Industrial Service Providers
Industry 4.0 Strategies
Technologies Development
Infrastructure and Regulation Improvement

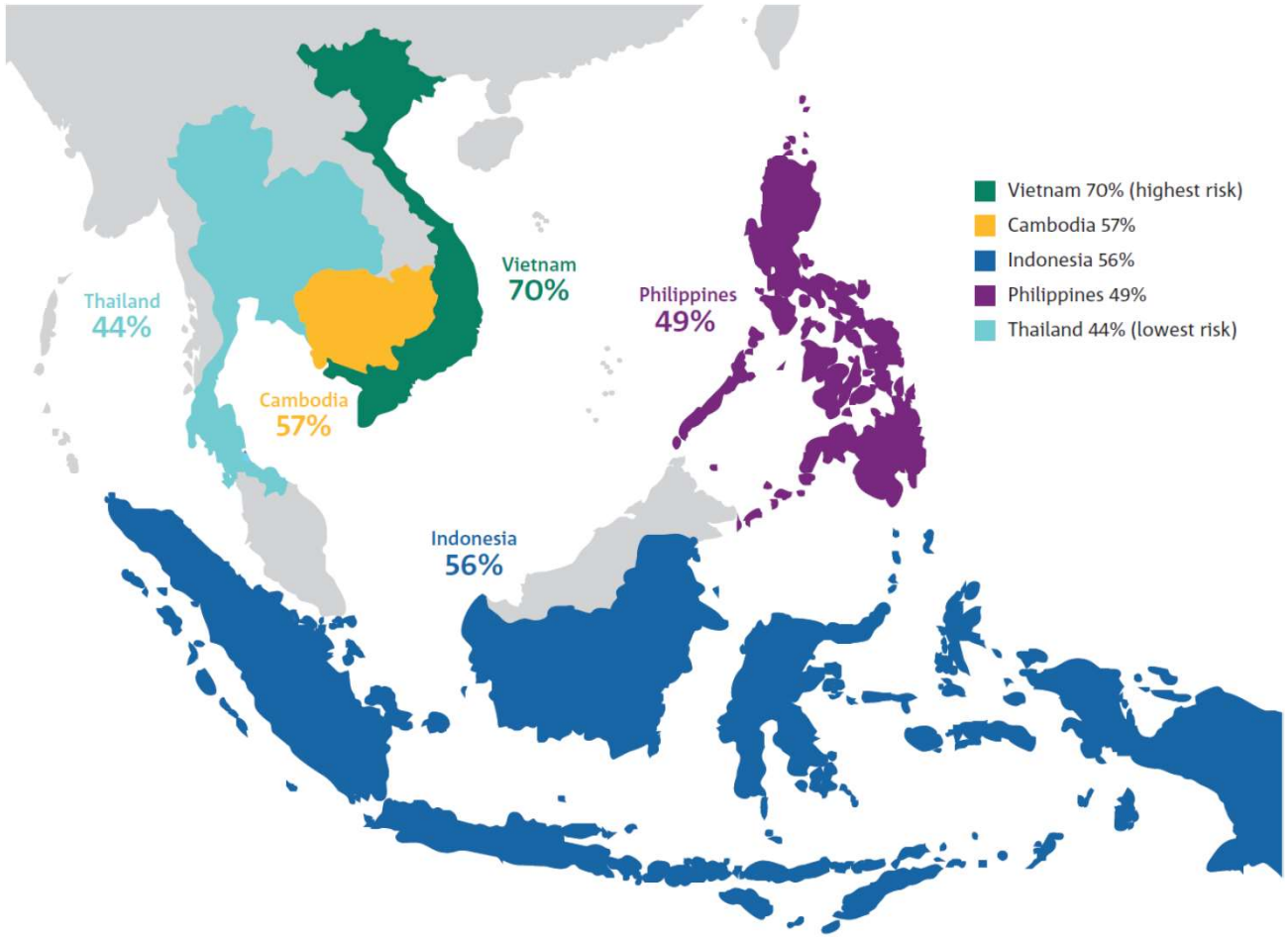
Key economic indicators

Population millions	92.6	**GDP per capita** US$	2,173.3
GDP US$ billions	201.3	**Unemployment rate** %	2.3

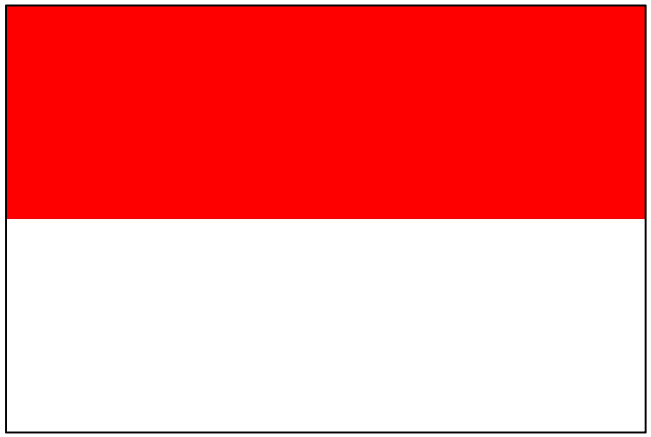
Key production indicators

Manufacturing value added 2010 millions US$	34,512.0	**Manufacturing value added growth** Annual %	9.8
Manufacturing value added in economy % GDP	21.0	**Medium hi-tech & hi-tech industries** % of manu. value added	40.4
Manufacturing employment % working population	14.4	**CO2 emission per unit of value added** kg/USD	1.7


10
High-Potential
Leading
Most future-ready
Drivers of Production
Viet Nam
5.0, 4.9
Least future-ready
0
Nascent
Legacy
0
Structure of Production
10
Small / basic
Large / complex



Percentage of wage workers at high risk of automation in ASEAN-5



Key economic indicators

Population millions	258.7	**GDP per capita** US$	3,604.3
GDP US$ billions	932.4	**Unemployment rate** %	5.6

Key production indicators

Manufacturing value added 2010 millions US$	225,673.8	**Manufacturing value added growth** Annual %	5.6
Manufacturing value added in economy % GDP	21.8	**Medium hi-tech & hi-tech industries** % of manu. value added	35.1
Manufacturing employment % working population	13.5	**CO2 emission per unit of value added** kg/USD	0.4


High-Potential
Leading
Nascent
Legacy
10
0
Most future-ready
Drivers of Production
Least future-ready
Indonesia
5.4, 4.9
0
Structure of Production
10
Small / basic
Large / complex

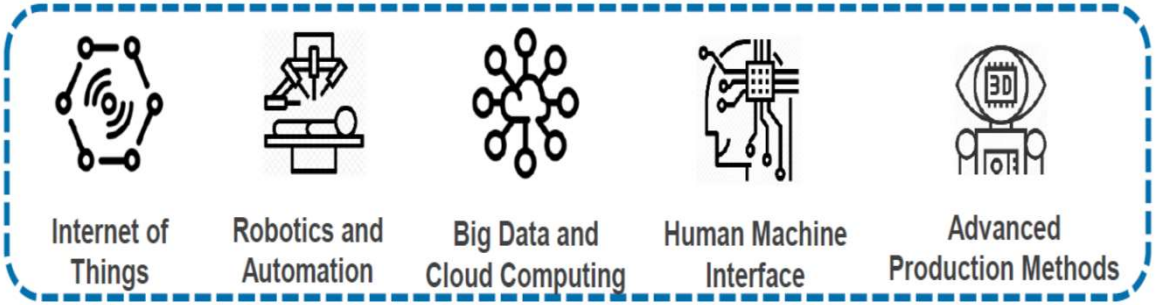
203 Billions
USD output in 2017

25
Million Workers

20%
GDP Contribution

6 - 7%
Annual Growth

Focused Technologies In The Indonesia Industry 4.0 Roadmap



Prioritized Activities To Expedite The Implementation of Industry 4.0

1. Enhance domestic raw material processing
2. Redesign industrial zones by building a nationwide industry zoning roadmap
3. Increased involvement in global sustainability trends such as Electric Vehicles and Renewable Energy
4. Empower SMEs with new technologies
5. Develop national scale digital infrastructure
6. Engage top global manufacturers to accelerate knowledge transfer
7. Upskill human resources by redesigning education curriculum
8. Collaborate with universities and private sector to establish innovation ecosystems
9. Prepare incentives for technology investments
10. Realign relevant regulation and policies to support the roadmap

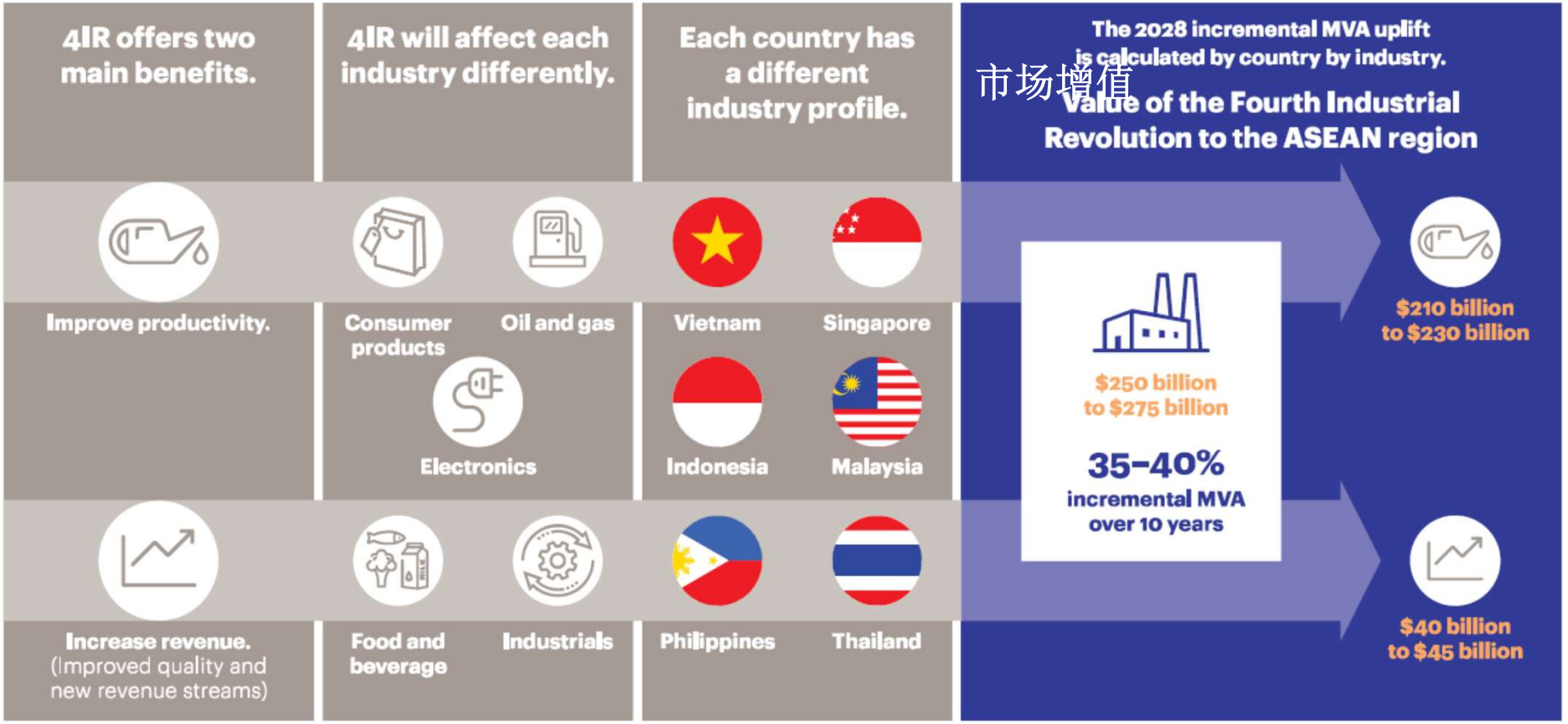
SOURCE: MINISTRY OF INDUSTRY, PRESS RELEASE, BUSINESS SWEDEN ANALYSIS

The Challenge of ASEAN

- The region is at risk of being left behind
- ASEAN manufacturers are not yet prepared for 4IR

- Enduring low labour costs
- No immediate customer demand
- Difficulties in accessing required experts
- A complex and fragmented supplier ecosystem
- Unclear and very short term oriented business cases

The value of ASEAN manufacturing could skyrocket



QUESTIONS???

- "There are multiple technologies for 4IR, but what are the applicable solutions for us as manufacturers? How do we prioritize the solutions?" **—industrials manufacturer**
- "A large-scale rollout for 4IR is highly unlikely as it impacts on our current operations. There are too many solutions and providers that we need to assess, and we don't have the necessary capabilities. Besides, it is difficult to justify the payback for such a significant investment." **—agribusiness company**
- "Are the solutions secure? We have a significant level of confidential information." **—petrochemicals manufacturer**

1. What are the near-term opportunities for 4IR to maximize a company's value?

- **Major uncertainty about solutions and priorities.** Although numerous use cases and solutions are available, there is uncertainty about where to start and how to prioritize the use cases. "Most of our plants are already automated, but not 4IR [ready]. Where are the applicable solutions? They are mostly in logistics, but not yet in manufacturing." **—semiconductor manufacturer**

- **Steep costs and myopic business cases.** There is a perception of significant investment requirements and narrow consideration of productivity benefits. "We are focused on rolling out a single ERP and CRM system. Widespread adoption of 4IR use cases are limited because we require a one-year payback period." **—industrials manufacturer**

2. How can solutions be implemented in a sustainable and structured manner?

- **Lack of clarity about scalability.** There is uncertainty around scalability of pilots across machines, factories, and geographies. "We have been piloting use cases for years, but scaling is a struggle as each factory is different." **—agribusiness company**

- **Complex and fragmented supplier and solution ecosystem.** Manufacturers struggle to navigate a complex ecosystem to support sustainable E2E changes. "We are ready to invest, but we need assistance from vendors. Which is the best solution? There are so many scattered solutions, but limited E2E solutioning." **—automotive MNC**

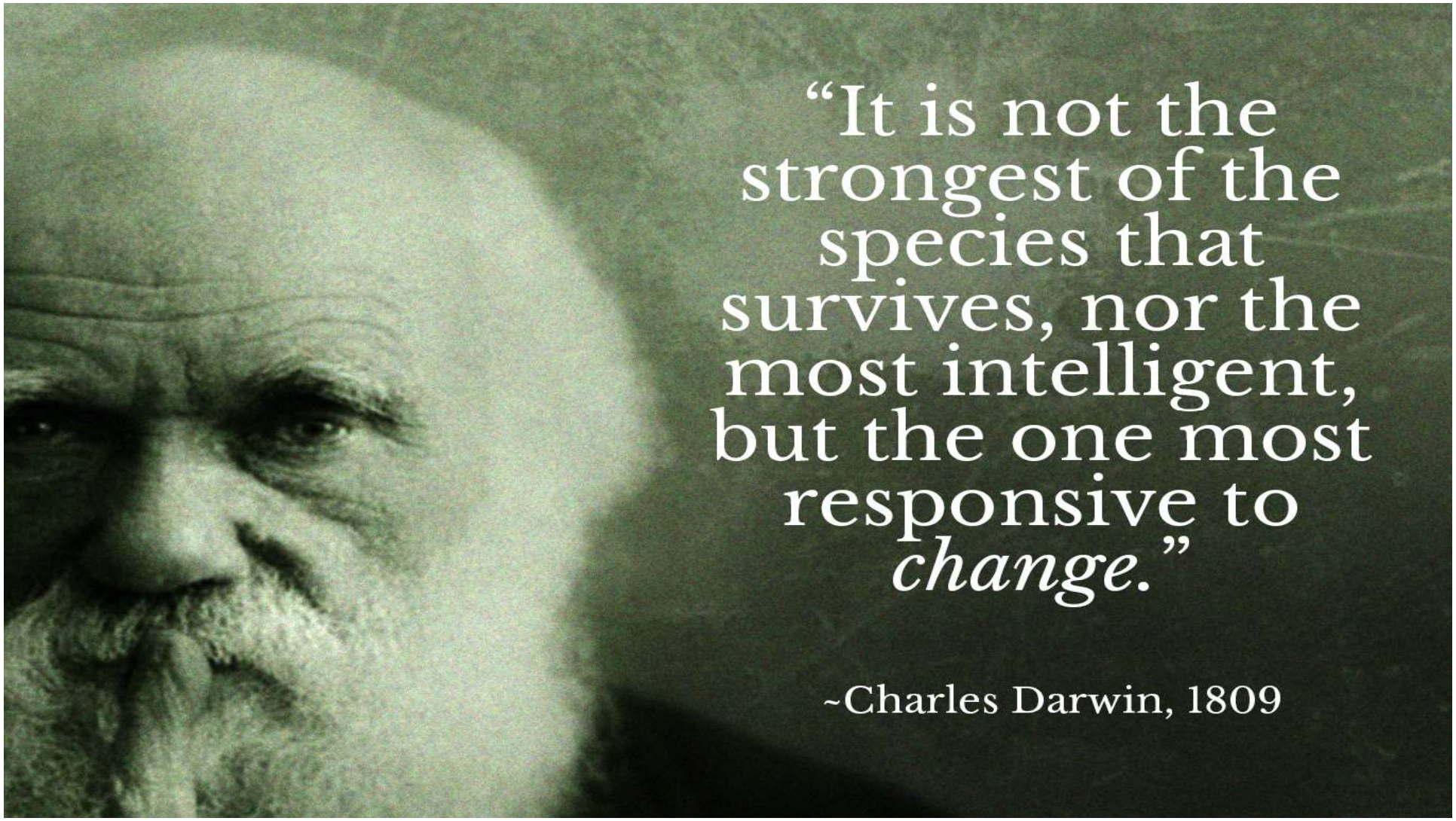
- **Significant challenge in stepping up capabilities.** Manufacturers have difficulty accessing appropriate digital skills not only in terms of understanding available 4IR solutions, but also for operating, troubleshooting, and deriving insights from data. "We have simple single input–output controls but need the right skills to work the more advanced technologies." **—cement manufacturer**

- **Inadequate connectivity and data infrastructure.** There is a lack of a suitable connectivity backbone and data collection and management infrastructure to support 4IR technology. "Intermittent issues with Wi-Fi connectivity on the production floor can be detrimental to the utilization of the new technology as the technology is extremely reliant on always being connected." **—automotive MNC**

3. How can the expected operational disruptions be managed to ensure business continuity?

- **Concerns about business interruption and continuity.** Manufacturers face the risk of operational disruption and need to consider non-invasive solutions that are implementable while the plant is running. "Some of our plants are [more than] 25 years old. They aren't designed to be connected. We [will] have to shut down the plant to upgrade the systems, and we can't afford that." **—petrochemicals company**

- **Cybersecurity risks during pilots and scale-up.** Manufacturers are concerned about sandboxing pilot environments to avoid disruptions and guarding against cybersecurity threats with widespread connectivity and numerous endpoints. "Security for connected solutions is a top priority across the network, data and OT and IT systems. It needs to be E2E and centrally managed" **—solutions provider**


"It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to *change.*"
~Charles Darwin, 1809

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