



$\frac{10}{10}$ | MySTIE FRAMEWORK

Trailblazing the Way for Prosperity,
Societal Well-Being & Global Competitiveness



10-10 Malaysian Science, Technology, Innovation and Economy (MySTIE) Framework

Trailblazing the Way for Prosperity, Societal Well-Being & Global Competitiveness

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10-10 Malaysian Science, Technology, Innovation and Economy (MySTIE) Framework

Trailblazing the Way for Prosperity, Societal Well-Being & Global Competitiveness

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Ministry of Plantation Industries and Commodities
(formerly known as Ministry of Primary Industries) (MPIC)
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Ministry of Tourism, Arts and Culture (MoTAC)
Ministry of Women, Family and Community Development (KPWKMD)
Ministry of Works (KKR)
National Economic Action Council (NEAC)
Bank Negara Malaysia (BNM)
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Malaysian Water Association (MWA)
Malaysian Water Partnership (MyWP)
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International Medical University (IMU)
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Universiti Islam Antarabangsa Malaysia (UIAM)
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Universiti Malaysia Kelantan (UMK)
Universiti Putra Malaysia (UPM)
Universiti Sains Islam Malaysia (USIM)
Universiti Sains Malaysia (USM)
Universiti Teknologi Malaysia (UTM)
Universiti Teknologi Mara (UiTM)
Universiti Teknologi Melaka (UTeM)
Universiti Teknologi Petronas (UTP)
Universiti Tunku Abdul Rahman (UTAR)

FOREWORD BY THE MINISTER OF SCIENCE, TECHNOLOGY & INNOVATION (MOSTI)



The role of science, technology and innovation (STI) in developing an economy is indisputable. Malaysia gladly acknowledges the fundamental influence of STI on the economy and its impact on societal development. Given the strong linkages between the two, the Ministry introduces the term “STIE” to highlight the importance of an ecosystem approach as an engine for nation building.

The release of the 10-10 MySTIE Framework is crucial as we embark on a journey of socio-economic transformation powered through the creation of a vibrant STIE ecosystem. The Framework will pave the way for the nation to improve its innovative and creative capability as a means of enhancing economic competitiveness and quality of life.

This Framework serves to bring together diverse stakeholders to collaboratively nurture a strong national STIE ecosystem for the robust development of sectors, thereby enabling a shared prosperity for all citizens of Malaysia. It will bring together partners from different strata of society, leaving no one behind.

I hope that this will be a new dawn for Malaysia, in forging a trajectory to become a dynamic global leader in key niche areas.

Congratulations to the team at the Academy of Sciences Malaysia (ASM) for formulating a forward-thinking tool that will serve as an enabler to facilitate a collaborative and transformative mechanism for high impact and inclusive development of the nation, powered by STI.

KHAIRY JAMALUDDIN

FOREWORD BY PRESIDENT OF THE ACADEMY OF SCIENCES MALAYSIA (ASM)

At the Academy of Sciences Malaysia (ASM), we believe in making science, technology and innovation (STI) a basis for economic development and societal well-being. This is even more necessary now as a result of the significant impact that COVID-19 has had on the world. Much like countries across the globe, Malaysia needs an economic recovery plan that will not only stimulate current economic sectors but spawn new sources of economic growth and societal development. It is necessary for the plan to be an inclusive one and move away from a silo approach.

As the nation's thought leader for matters related to STI, having a bird's eye view of the ecosystem inspired ASM to develop a tool that lays the foundation for the integration of STI with the economy. This will enable Malaysia to reach new heights by harnessing STI to impact its socio-economic growth, resilience and competitiveness.

With the 10-10 MySTIE Framework, we hope to inject new life into Malaysia's research, innovation and enterprise activities. The Framework provides a fresh holistic ecosystem approach to co-create a new future for the nation.

The 30 National STIE Niche Areas provide an opportunity to build collaborative networks and platforms towards establishing vibrant innovation ecosystems across Malaysia. These ecosystems in turn need to be strengthened through regular foresighting to be agile, relevant and impactful over time. The 10-10 MySTIE Framework serves as an integrative tool for government, researchers, innovators, industries and communities to work together to transform Malaysia into a harmonious, progressive, prosperous and sustainable nation.

I hope that Malaysians will embrace this challenge and rise to the moment.



PROFESSOR DATUK DR ASMA ISMAIL FASc



Part I

Introducing the 10-10 *MySTIE* Framework

- 01 10-10 *MySTIE* Framework
- 02 The Journey to Identify National STIE Niche Areas (2021-2025) using the 10-10 *MySTIE* Framework
- 03 30 National STIE Niche Areas

01

10-10 *MySTIE* Framework

Introduction

The 10-10 Malaysian Science, Technology, Innovation and Economic (*MySTIE*) Framework is an integration of 10 key Malaysian socio-economic drivers with 10 global leading science and technology drivers aligned to our strengths and needs.

This Framework provides a systematic approach to transform Malaysia into a knowledge-intensive economy by design. It aims to generate shared economic prosperity across the diverse ecosystems in the country and shift Malaysia up the global innovation value chain.

This Framework will enable key sectors of the economy to become more knowledge-intensive and innovation driven. This will enhance the competitiveness and sustainability of Malaysian industries. It is designed to enhance the quality of life of the *rakyat*.

How was the 10-10 *My*STIE Framework Derived?

Emerging Science, Technology and Innovation (STI) are poised to change the current production-based economy to a knowledge-intensive economy. Such STIs are redefining the socio-economic landscape as well as challenging the conventional boundaries of operation. They provide immense opportunities for value creation to enhance productivity, efficiency and societal well-being. Mega trends, such as rapid urbanisation, demographic shifts and technological breakthroughs are triggering far-reaching impacts on all stakeholders. The world is facing unprecedented risks that require a sound STIE ecosystem to mitigate these challenges. Recognising this, ASM in 2015 embarked on Emerging Science, Engineering and Technology (ESET) Study to provide S&T Foresight as part of ASM's flagship initiative on Envisioning Malaysia 2050.

The ESET study culminated in three major outputs as follows:

284

products, services, technologies, possible applications and outcomes relevant for Malaysia towards 2050

95

emerging technologies and their interlinkages based on Malaysia's strengths and needs in 3 phases:

Present (2015-2020)

Probable future (2021-2035)

Possible future (2036-2050)

21

impactful emerging technologies towards realising Progressive Malaysia 2050, based on feasibility and attractiveness for Malaysia's context, guided by global trends and risks

SCAN HERE TO READ THE
Science & Technology Foresight Malaysia 2050 -
Emerging Science, Engineering & Technology (ESET) Study Report



Timeline Towards 2050: Malaysia's 95 Emerging Technologies



Source: ASM, 2017

Subsequently, ASM undertook a series of analyses to identify the top Science and Technology (S&T) drivers that can develop Malaysia's socio-economic sectors. Research capabilities, outputs (publications, patents and commercialisation activities), outcomes and the research building blocks (e.g. public and private Centres of Excellence (CoEs) and research institutes) were evaluated in order to derive the 10-10 MySTIE Framework.

Science & Technology Drivers

Global trends on the top S&T drivers that can spearhead economic growth were analysed to identify the potential innovations that can have a major impact on the socio-economic development of communities across the globe.

This analysis was supplemented with other global studies, patent analysis and technology trajectories over the past 10 years.

Following this, the 95 emerging technologies identified in the ESET study were clustered into 10 S&T drivers.

Socio-economic Drivers

The 10 socio-economic drivers were identified by analysing national research priority areas, such as:

- 12 National Key Economic Areas (NKEA)
- Ministry of International Trade and Industry's (MITI) 3 catalytic sub-sectors and 2 high potential growth areas
- 9 National Science Research Council (NSRC) Priority Areas
- 7 Ministry of Education (MOE) Research Grant Clusters

Additionally, industrial ecosystems in multiple economic sectors as examined in "A Study on Knowledge Content in Key Economic Sectors in Malaysia" (MYKE III) (EPU, 2016) were used as supplementary evidence. Surveys and interviews with business leaders were also conducted to identify dynamic capabilities* of each sector.

**Dynamic capabilities (absorptive, adaptive and innovative capabilities) show the ability of the sector to absorb shocks, evolve and change to stronger positions of competitive advantage.*

The Formulation of the 10-10 MySTIE Framework



1. National Priority Areas

- 9 NSRC Priority Areas
- 12 NKEA
- MITI (3+2)
- 7 MOE Research Grant Cluster

2. Research Capability

- Publication and Patent Analysis
- MRU Research Capability Index (Quantum and Quality of Publication, (Research Building Block))

3. Analysis of Emerging and Declining Technologies

- Global Patent Analysis
- Technology Investment Analysis

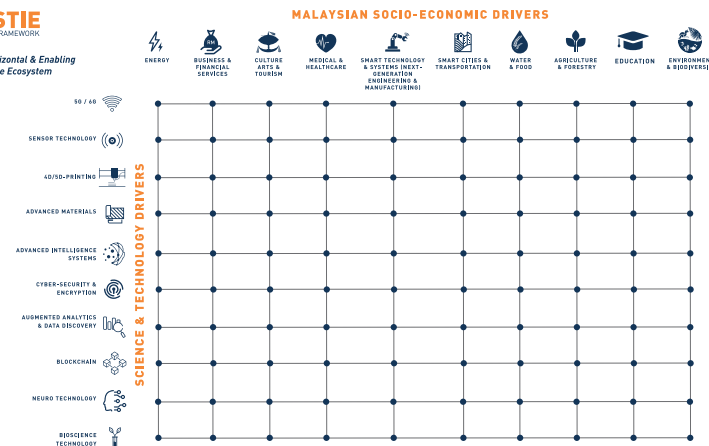
4. Industry Analysis

- MyKE Study III (Phase 1 and Phase 2)
- Surveys and Interviews with Business Leaders

5. Global trends

- Top 10 technology drivers
- Global technology drivers

10-10 MySTIE
FRAMEWORK
Building the Horizontal & Enabling
the Vertical in the Ecosystem



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**5G/6G**

Next-generation mobile networks that enable higher frequencies, capacity and lower latency.

**SENSOR TECHNOLOGY**

High-performance sensors, including microelectromechanical systems (MEMS), magnetic materials and piezoceramics, wearable biosensors and printable wearable electrochemical sensors.

**4D/5D-PRINTING**

Printing using smart materials that change forms according to the environmental changes or responding to stimulus, and print parts as simultaneous multilayer curved layers, making the objects stronger and more cost competitive than 3D printing.

**ADVANCED MATERIALS**

New, stronger, durable and efficient heat and energy conducting materials that have wide industrial, biological, medical and other applications.

**ADVANCED INTELLIGENCE SYSTEMS**

Machines, computer systems and virtual reality technology that mimic the human experience and intelligence processes, which include the use of visual machine systems, speech recognition, expert systems and swarm technology.

**CYBER-SECURITY & ENCRYPTION**

Technologies, processes, practices and methods that protect information and communication systems (networks, devices and data), mitigating risks associated with malicious attack, digital hijacking, unauthorised access and damage to systems and data.

**AUGMENTED ANALYTICS & DATA DISCOVERY**

Advanced data discovery methods that enable users to gain insights into patterns of the data generated using various statistical methods, pattern recognition, machine learning, natural learning and other advanced data analysis tools.

**BLOCKCHAIN**

Digital ledger system that is democratic, incorruptible, efficient, verifiable and holds permanent record of every transaction of value among multiple economic agents.

**NEURO TECHNOLOGY**

Technology that enables the study of brain processes, brain-computer interface, decision-making, behaviour and neurological disorders.

**BIOSCIENCE TECHNOLOGY**

Technology that uses biological processes, systems or living organisms to manufacture products or produce technology based on molecular biology, bionics, bioengineering, genetic engineering and nanotechnology.

10

SOCIO-ECONOMIC DRIVERS



ENERGY

This sector is constituted by a complex and inter-related network of entities involved in the production, management and distribution of energy to fuel the economy and improve the quality of life of the *rakyat*. This includes both renewable and non-renewable energy sources.



BUSINESS & FINANCIAL SERVICES

This sector encompasses services that support business functions broader economy, such as Information Communication Technologies (ICT), logistics, financial services and other professional services.



CULTURE, ARTS & TOURISM

Malaysia is a confluence of diverse range of people and cultures. This sector covers a wide array of activities including expression and application of creative content and artworks. Tourism sector leverages on the diverse cultural heritage and natural resources of Malaysia.



MEDICAL & HEALTHCARE

Medical and healthcare encompass all goods, services and payment mechanisms for prevention, restoration, cure, maintenance of one's physical, mental or emotional well-being.



SMART TECHNOLOGY AND SYSTEMS (NEXT-GENERATION ENGINEERING & MANUFACTURING)

Smart technology and systems that create resilient utilisation of resources through self-monitoring, troubleshooting, optimising and integrating manufacturing processes and supply chains. This allows for adaptive data-driven decisions and intelligent cyber-physical systems.



SMART CITIES & TRANSPORTATION

Smart cities and transportation involve integration of physical and natural infrastructure with advanced technologies to deliver sustainable, resilient, and prosperous living conditions.



WATER & FOOD

Water and food are core to the sustainable development of communities across the globe. This demands a well-integrated ecosystem to ensure water and food security to address the challenges of rising population, urbanisation, climate change and economic disparities.



AGRICULTURE & FORESTRY

Agriculture and forestry is an important socio-economic driver for Malaysia. Agriculture encompasses crops, livestock, and fisheries. Agriculture and forestry are key sectors for food security, employment and revenue generation for the country.



EDUCATION

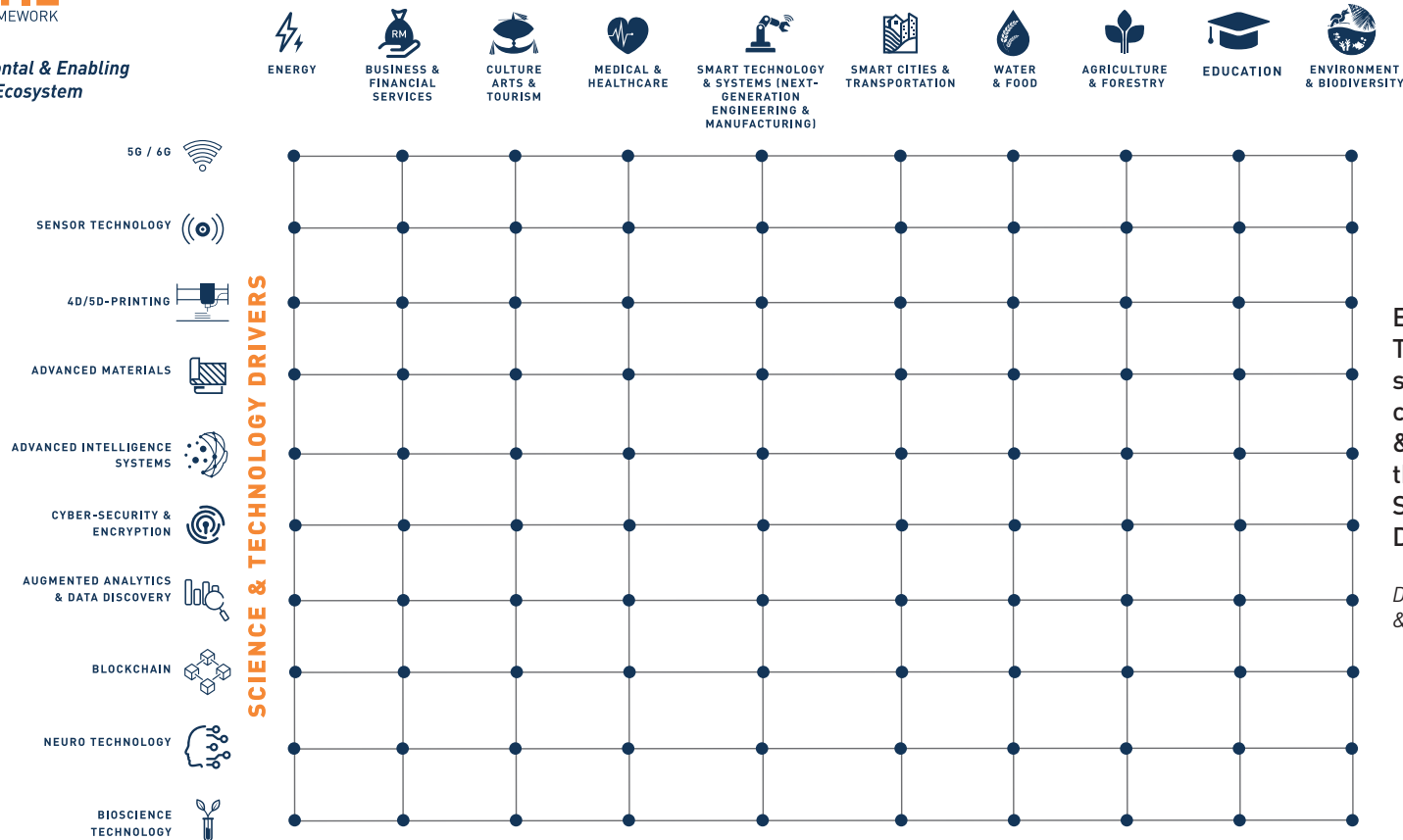
Education spans from pre-school to post-doctoral and continuing education. The purpose of education is to nurture a creative society and a skilled workforce. The education sector is also an important revenue earner for the country.



ENVIRONMENT & BIODIVERSITY

Preserving and conserving the natural environment and biodiversity of Malaysia are important in harnessing its value for sustainable development. This requires a sustainable approach to unlocking the value of terrestrial and marine ecosystems.

MALAYSIAN SOCIO-ECONOMIC DRIVERS



Each Science & Technology Driver should explore core technologies & applications for the 10 Malaysian Socio-economic Drivers

Driving Fundamental & Translational Research

Each Malaysian Socio-economic Driver should explore how the 10 Science & Technology Drivers will value-add and enhance their global competitiveness

10-10 *MySTIE* Framework: An Example of Establishing Center of Excellence

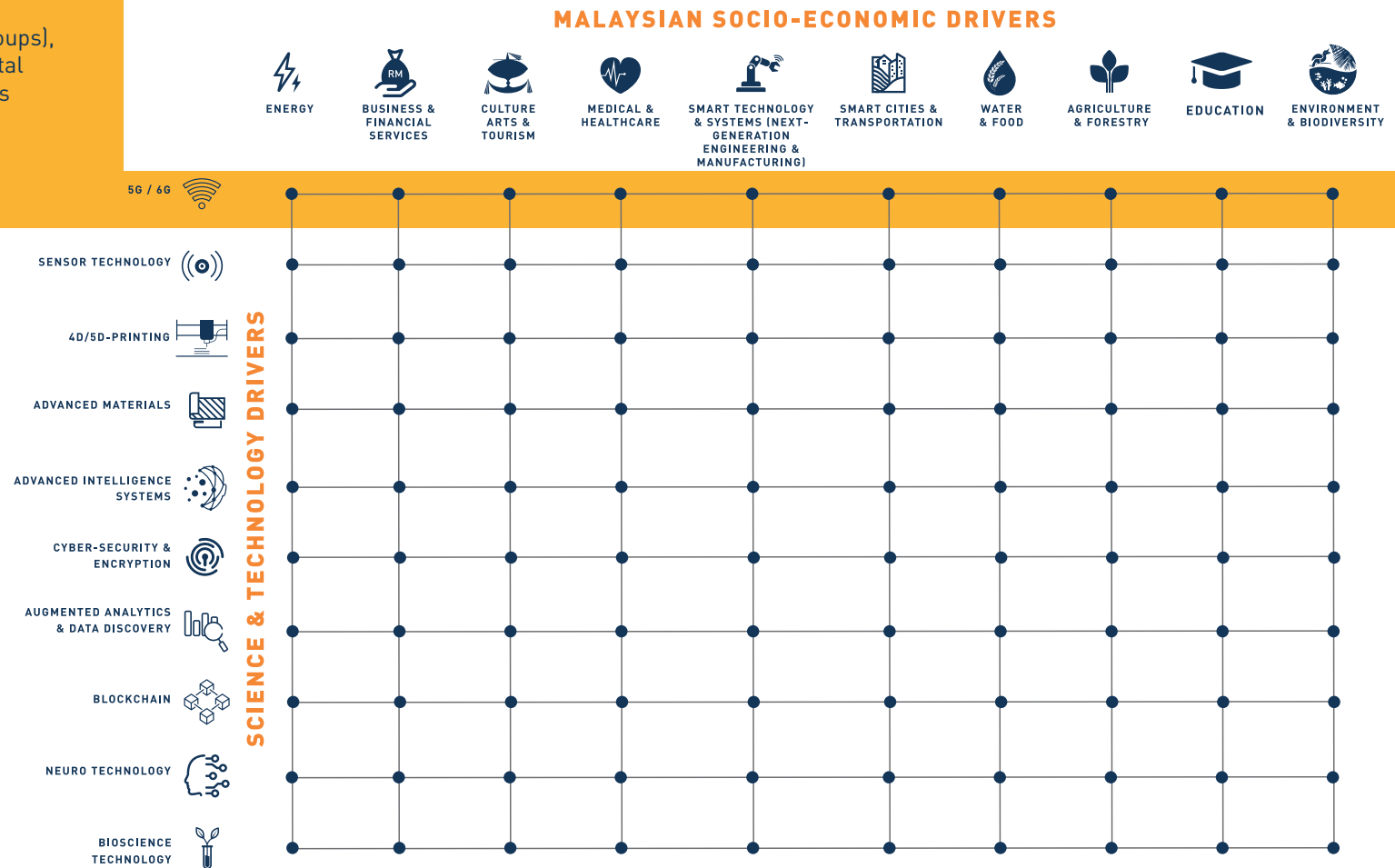
For S&T drivers to create value, it is imperative that they are linked to the socio-economic drivers. The 10-10 *MySTIE* framework will enable Malaysia to couple S&T and socio-economic drivers to spur national development. This framework consists of 10 key Malaysian socio-economic drivers and 10 global S&T drivers.

It is envisaged that the framework will identify fundamental, applied and experimental R&D in the 10 global S&T drivers needed to transform the 10 Malaysian socio-economic drivers in moving up the global innovation value chain, enhance economic competitiveness, reduce inequalities and raise the *rakyat's* quality of life. This will transform Malaysia to become a united, prosperous and environment-friendly nation by 2030.

Multi-stakeholder partnership model:

Establish a Center of Excellence (CoE) to lead R&D in 5G/6G. The CoE should be constituted by multiple stakeholders. As part of the CoE, research universities are to undertake fundamental research that complements the work of other institutions (e.g. other universities, GLCs, industries and community groups), undertaking applied and experimental research and translational outcomes in the 10 socio-economic areas.

Technology View of the World Mapped against Malaysian Socio-economic Drivers: Horizontal Perspective of 10-10 MySTIE Framework



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10-10 MySTIE Framework: An Example of Transforming The Agriculture & Forestry Socio-economic Driver

An example of the 10-10 MySTIE Framework application is the transitioning of the Agriculture & Forestry sector to be more knowledge- and technology-intensive. While the Agriculture & Forestry sector remains an important generator of economic wealth and employment for the nation, it has remained labour-intensive rather than driven by technology. As a consequence, this sector has remained dependent on foreign countries to meet its agro-food needs.

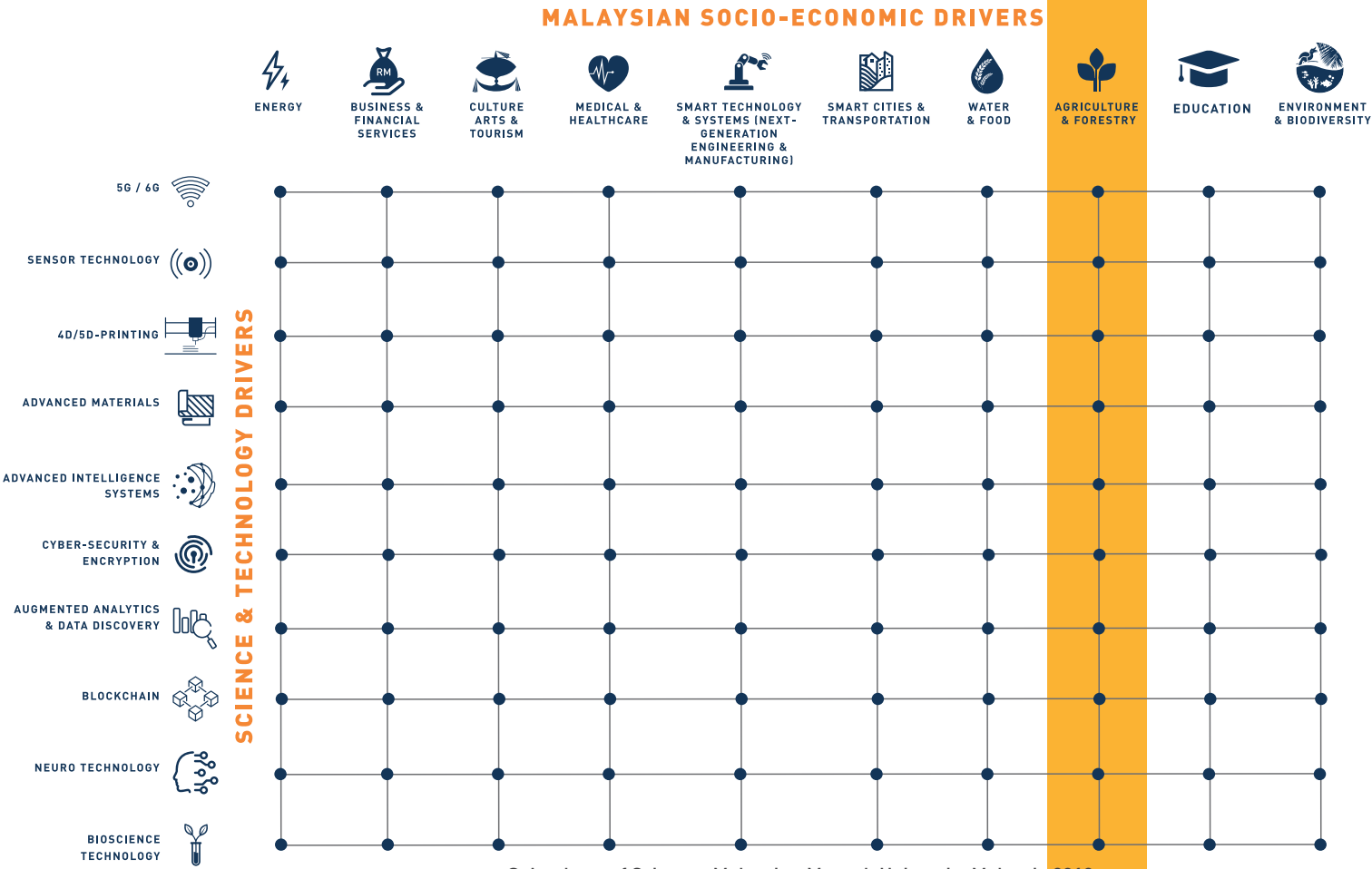
Technologies such as 5G/6G, Advanced Intelligence Systems and Augmented Analytics and Data Discovery can be deployed to create drone-enabled precision farming. Alternatively, technologies such as Sensor Technology, Neuro Technology and Bioscience Technology can be utilised to develop real-time multimodal data collection and discovery via advanced drone / bio sensors.

Hence, to enhance the competitiveness of the Agriculture & Forestry sector, multiple S&T drivers should be utilised to create core innovations to raise the Return on Value (ROV*) of the sector.

** Return on Value (ROV) is the value gain as a result of continuous improvement using new S&T drivers, systems, processes and new business models. In the context of STI, managing our resources effectively and efficiently will enhance the value proposition of the STI initiatives for all stakeholders, which in turn will increase its ability to raise the return on investment (ROI). The ROI is hence a function of ROV.*

Technology View of the World Mapped against Malaysian Socio-economic Drivers: Vertical Perspective of 10-10 MySTIE Framework

A national agriculture strategic plan should focus on investing in the ecosystem such that it develops and applies the 10 S&T drivers to enhance the Return on Value (ROV) of the sector. This will not only increase the quality and global competitiveness of the sector, but will also spawn new economic sub-sectors like agribusiness, agritech and agri-green financing / sukuk. A strong S&T-driven agriculture sector will also have positive multiplier effect on other socio-economic drivers. This in turn can further boost Malaysia’s food industry and the Halal economy.

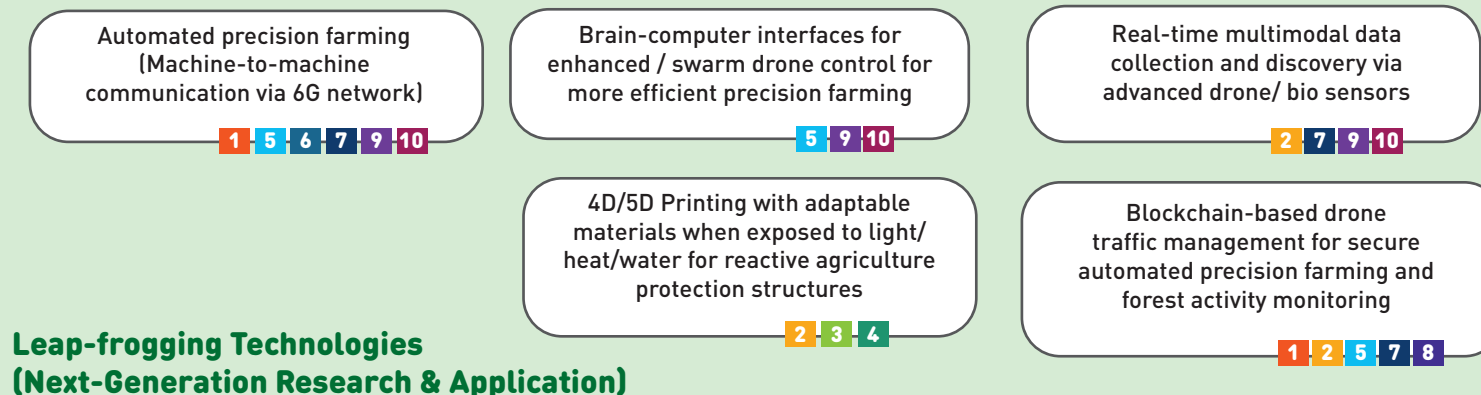
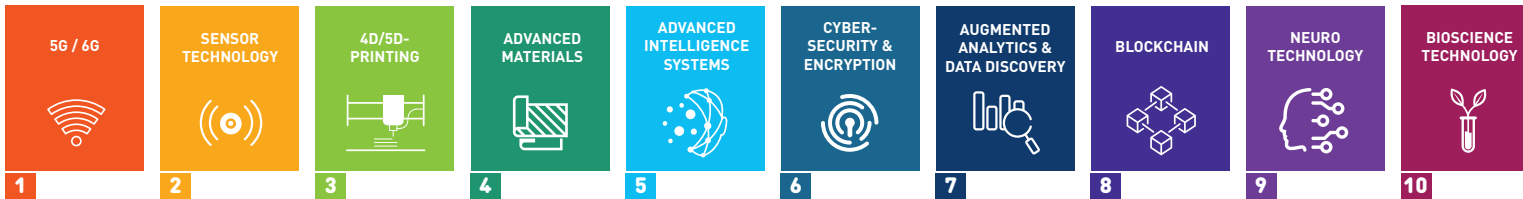
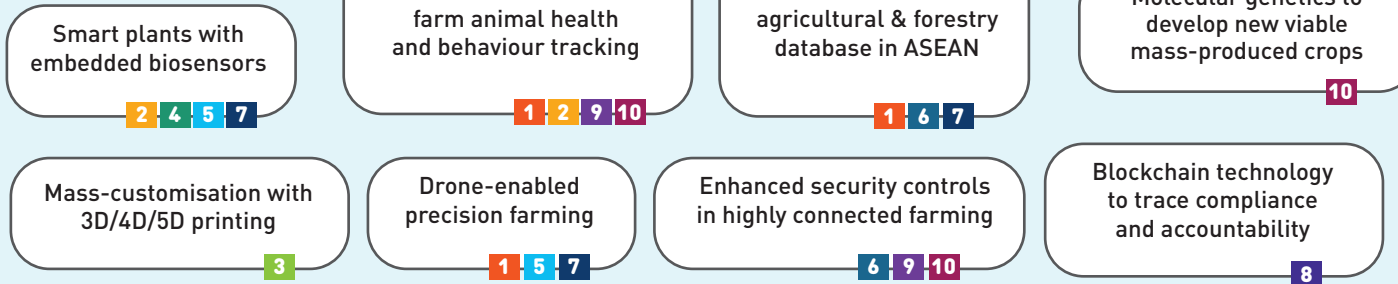


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Application of the 10-10 MySTIE Framework to the Agriculture & Forestry Socio-economic Driver

Case study of how the 10-10 MySTIE can be utilised to develop the next generation technologies for raising the return of value and competitiveness of the agriculture and forestry sector.


Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **agriculture and forestry innovations** be integrated with **other sectors**?


 **Smart Technology & Systems (Next-Generation Engineering and Manufacturing)**

 **Environment & Biodiversity**

 **Energy**
(2, 5)

Integration of gene-edited algae farms with industrial plants to automate carbon capture systems for biofuel production

 **Smart Cities & Transportation**

 **Water & Food**
(2, 5)

Vertical farms with automated solar-powered hydroponic systems within citiesto shorten supply chains

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Multiplier Effect of Modernising Agriculture and Forestry to other Socio-Economic Drivers



AGRICULTURE & FORESTRY

SMART AGRICULTURE

Modernising the Agriculture Sector

The 10-10 MySTIE Framework encourages the convergence of technologies that facilitates the transformation of each sector. This, in turn, creates a multiplier effect on other socio-economic drivers. For instance, modernising the agriculture sector can give rise to a vibrant agrotourism industry, and thereby providing a lucrative revenue stream.

Leveraging value creation opportunities requires careful curation of an ecosystem and its constituent systems and processes. This will continuously drive the multiplier effect and positive market externalities to create greater socio-economic impact for all stakeholders.



ENERGY

- Generation of feedstock and renewable energy from biofuels



BUSINESS & FINANCIAL SERVICES

- Smart Integrated Supply Chain
- Global Halal Services



CULTURE, ARTS & TOURISM

- Development of agrotourism



MEDICAL & HEALTHCARE

- Exploration of alternative ingredients, bioactive compounds and biomaterials
- Development of functional food and herbal product



SMART TECHNOLOGY & SYSTEMS (NEXT GENERATION ENGINEERING AND MANUFACTURING)

- Farm mechanisation and automation
- Development of smart farm monitoring



SMART CITIES & TRANSPORTATION

- Smart Integrated Transportation of agriculture products
- Normalised urban farming
- Connected rural and remote agriculture and fishing communities



WATER & FOOD

- Effective water irrigation and drainage systems



EDUCATION

- Personalised and experiential learning through a curriculum designed for tropical agriculture
- Development of a global centre with expertise in tropical agriculture

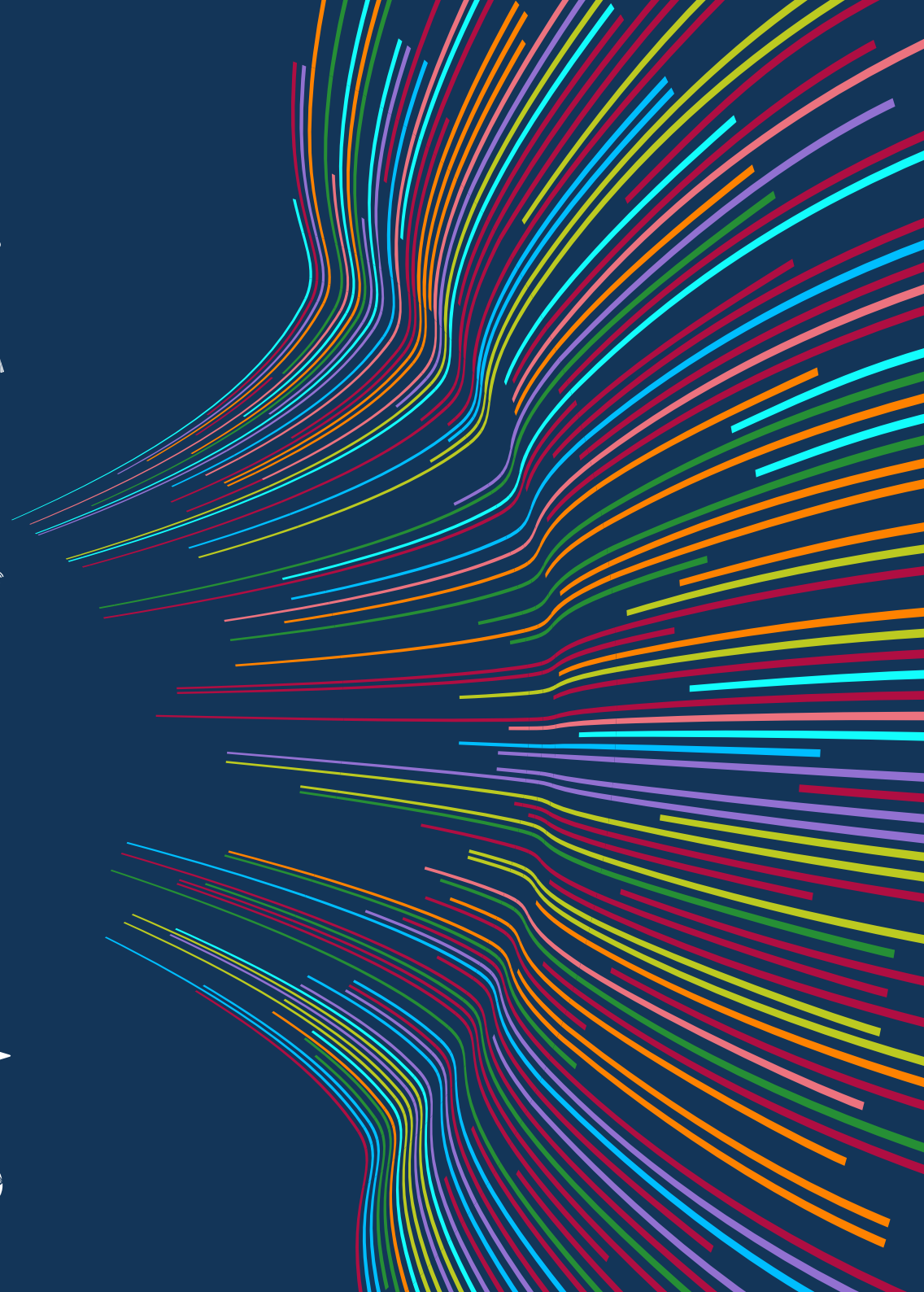


ENVIRONMENT & BIODIVERSITY

- Effective natural resources and environmental management (e.g. soil, flood, air quality)
- Modernised sustainable replanting programme
- Effective management of the marine and coastal communities
- Conservation of flora, fauna, indigenous animals, plants and insects

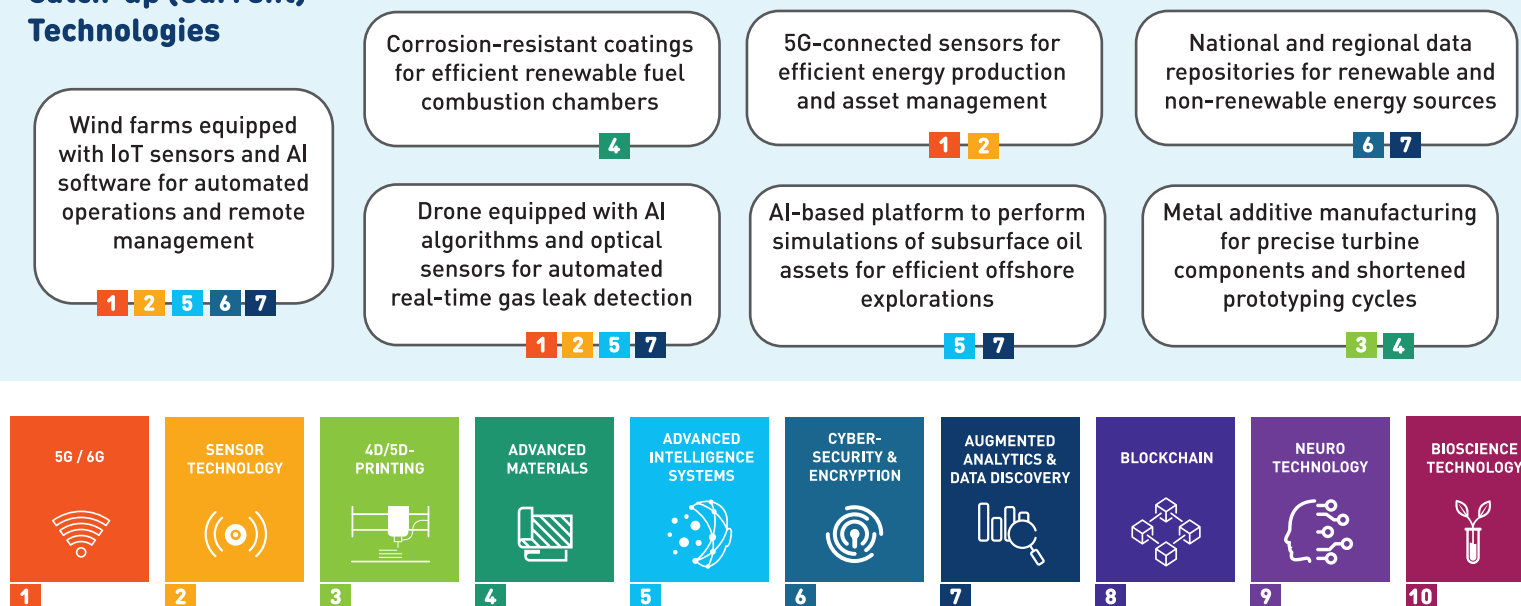
Source: ASM Analytics, 2020

Science & Technology Application Maps

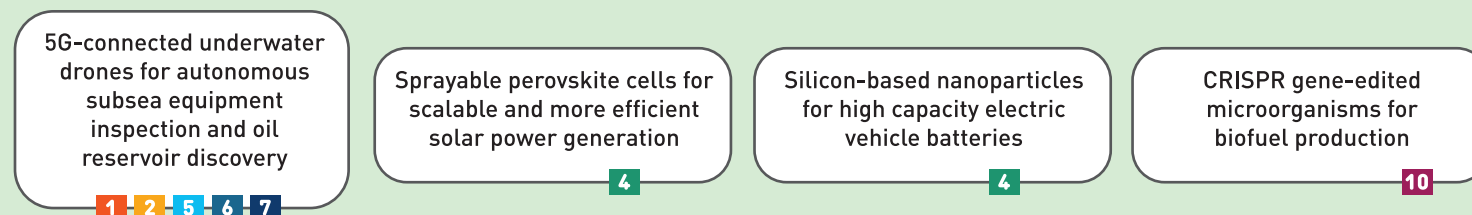


Application of the 10-10 MySTIE Framework to the Energy Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)



How can **energy innovations** be integrated with **other sectors**?

Agriculture & Forestry
Automated sun tracking solar panels for electricity independent hydroponic systems

Smart Technology & Systems (Next-Generation Engineering & Manufacturing)

Environment & Biodiversity

Automated industrial waste heat recovery systems to reduce energy costs and carbon dioxide emissions

Smart Cities & Transportation

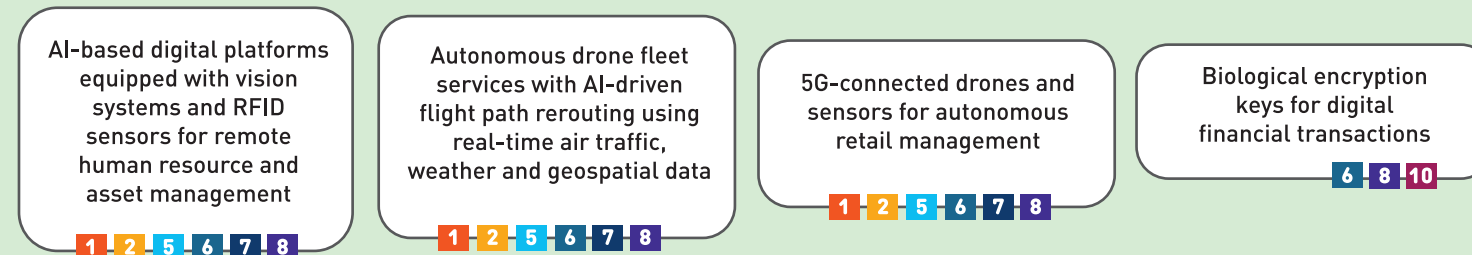
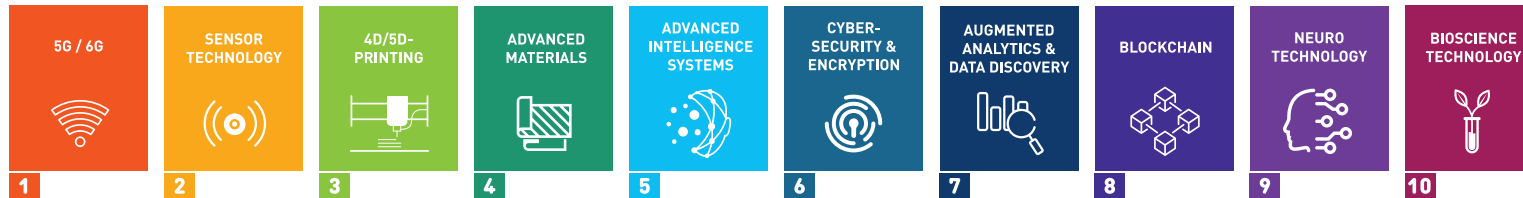
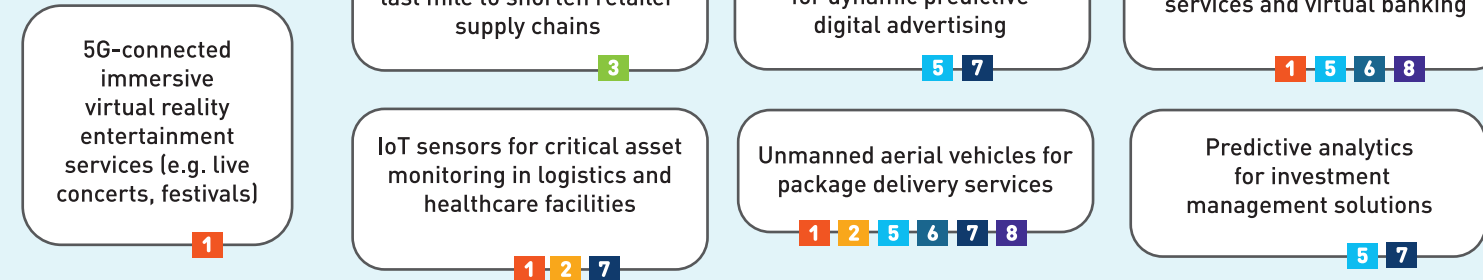
Business & Financial Services

Decentralised electricity grid with peer-to-peer trading via blockchain-enabled smart contracts

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Business and Financial Services Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **business and financial services innovations** be integrated with **other sectors**?



Culture, Arts & Tourism

Facial recognition payment systems at tourist destinations using visions systems linked to 5G-connected tourist database



Smart Technology & Systems (Next-Generation Engineering & Manufacturing)

Seamless end-to-end supply chain connectivity through automated secure blockchain payments and real-time logistics tracking



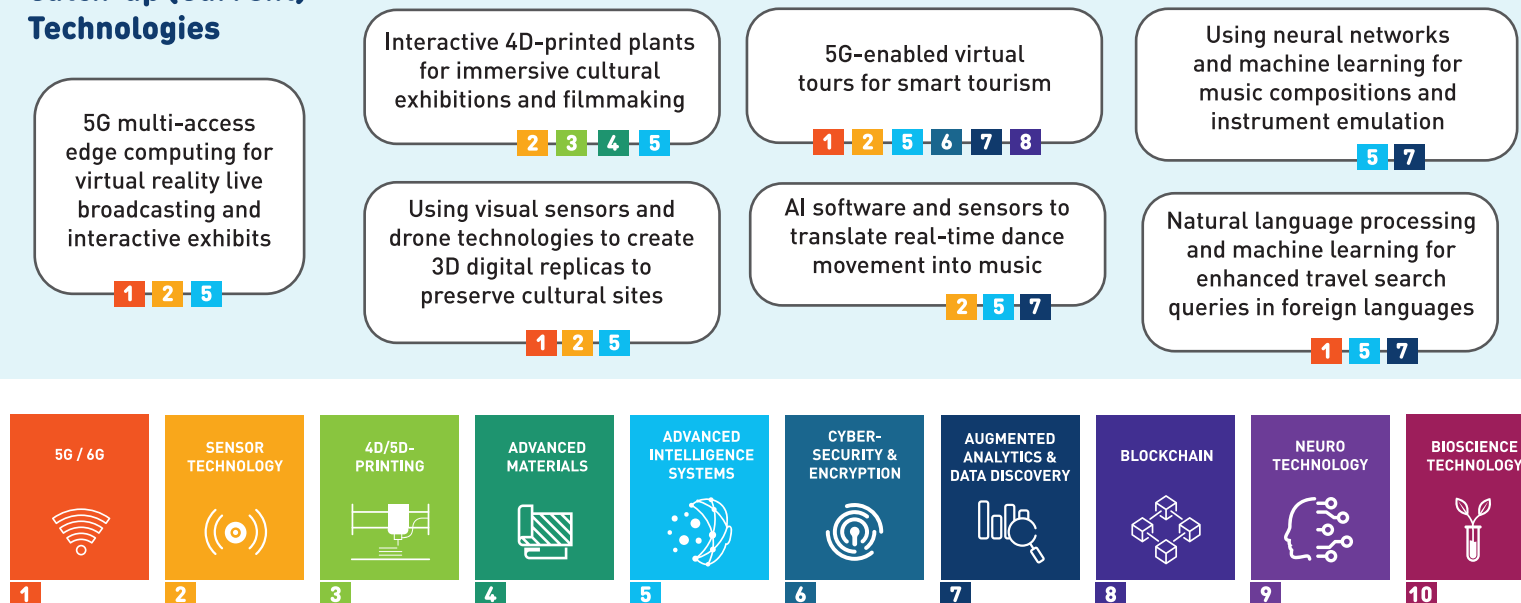
Medical & Healthcare

AI-driven health insurance services to identify claims eligibility based on pattern recognition and offer insurance packages using information shared in cloud healthcare database

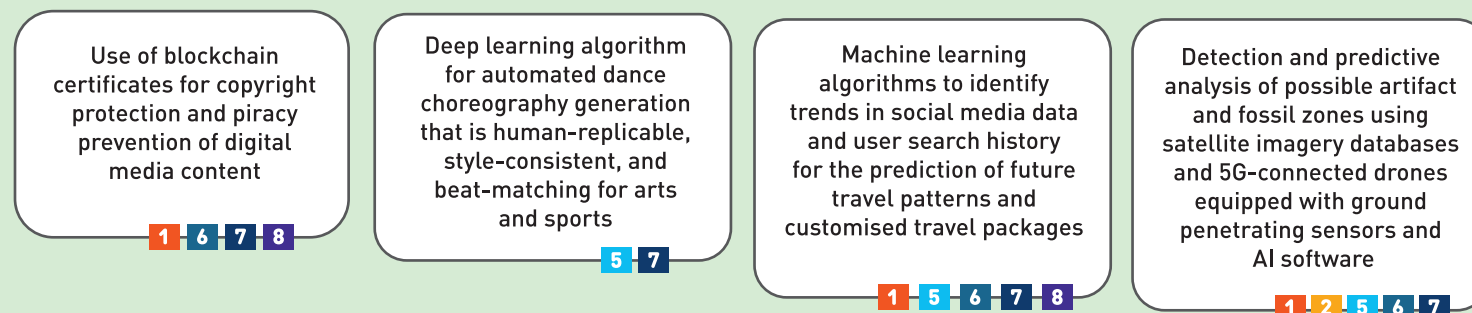
Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Culture, Arts and Tourism Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)



How can **culture, arts and tourism innovations** be integrated with **other sectors**?



Business & Financial Services

Blockchain technology for tracking and tracing high-value artwork sales through smart contracts and distributed ledger



Medical & Healthcare

Brain computer music interfacing to enable music compositions by brain impaired patients to restore brain functionality



Environment & Biodiversity

+



Smart Cities & Transportation

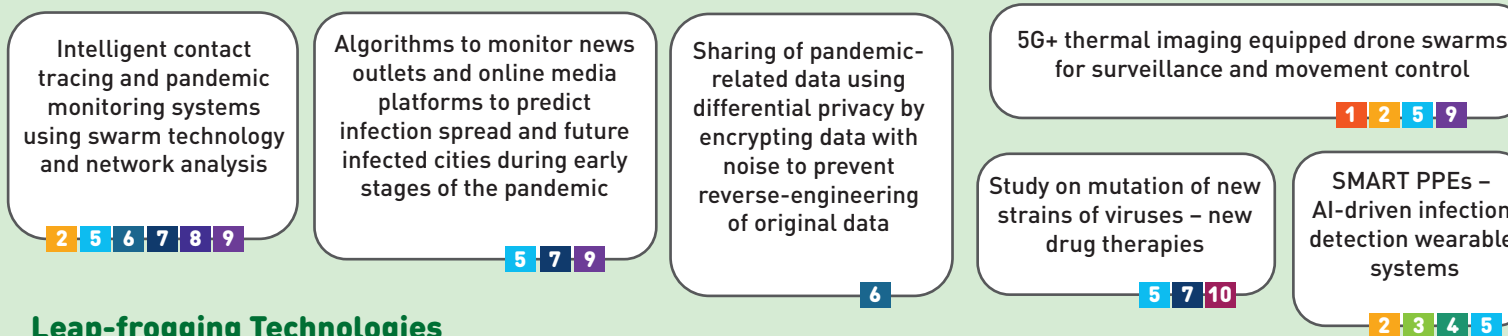
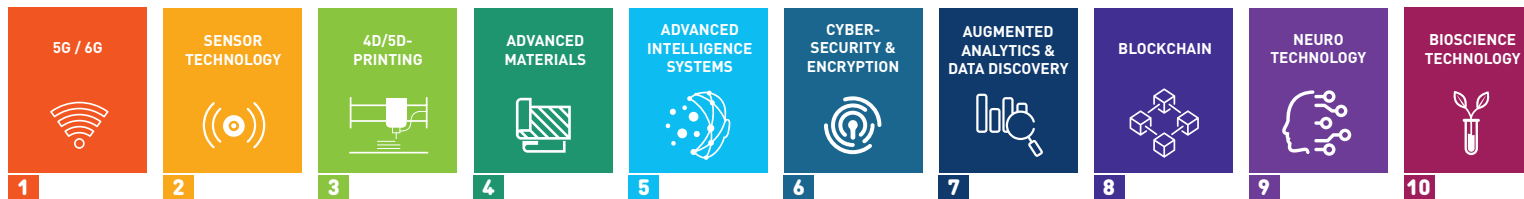
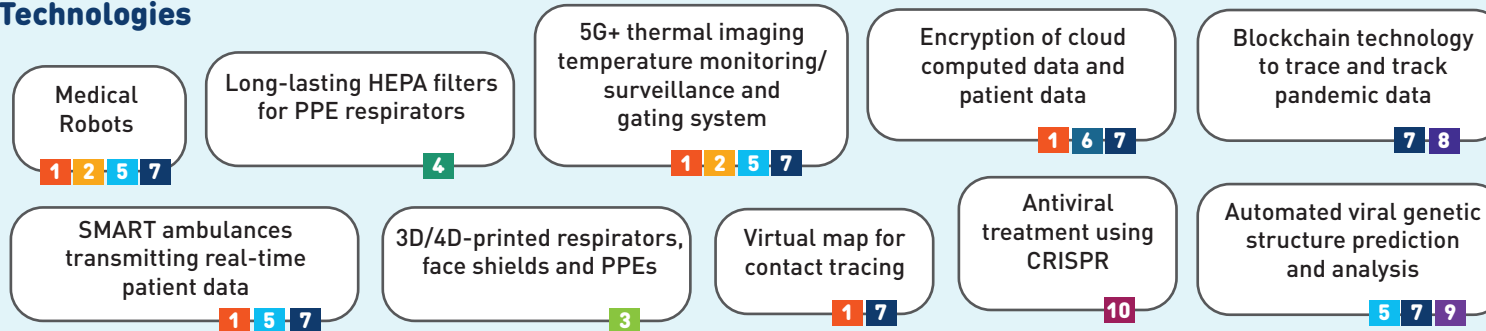
1 2

Smart cities with eco-friendly initiatives, cultural vibrancy and heritage preservation are important factors for attracting tourists to the country

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Medical and Healthcare Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **medical and healthcare innovations** be integrated with **other sectors**?



Smart Cities & Transportation
Pre-fabricated, modular and temporary buildings equipped with medical robots to cope with patient spikes



Water & Food
Machine learning algorithms to predict future disease outbreaks for early mobilisation of resource supply security measures



Smart Cities & Transportation

+



Business & Financial Services

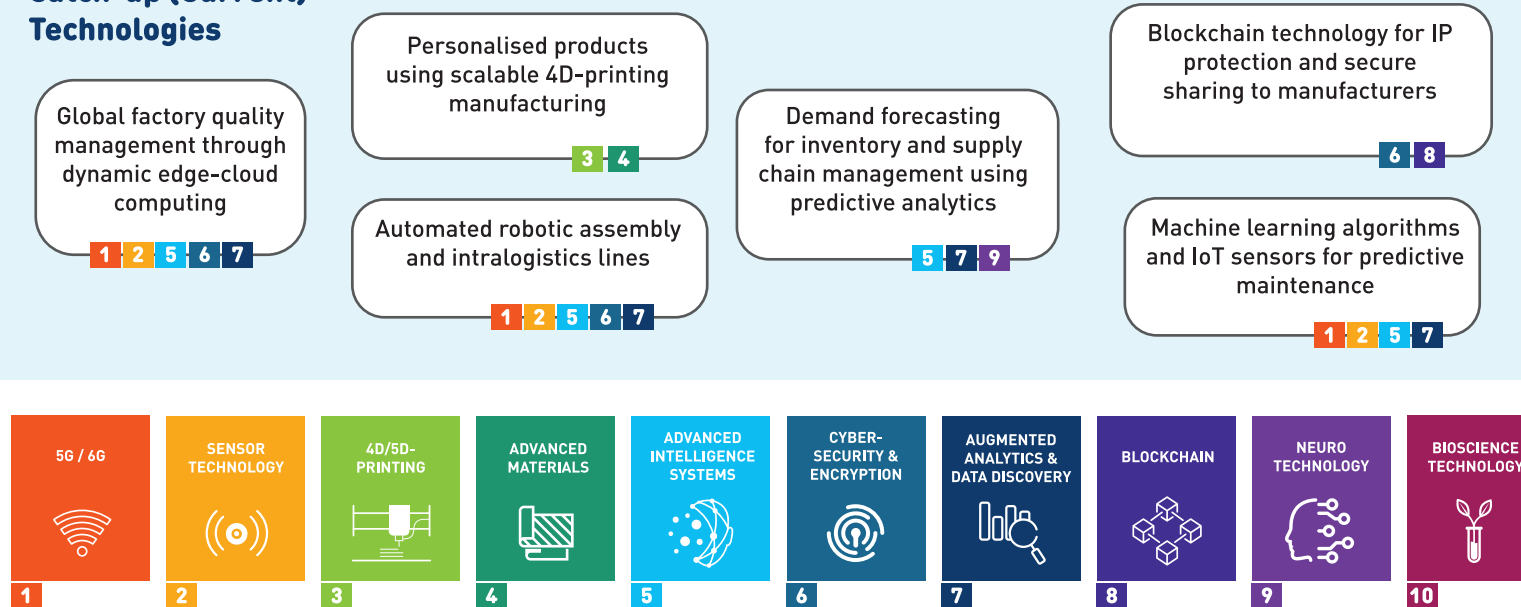
1 2 7

Contactless screening booths and facial recognition payment systems at high-density areas and transport hubs to minimise physical contact

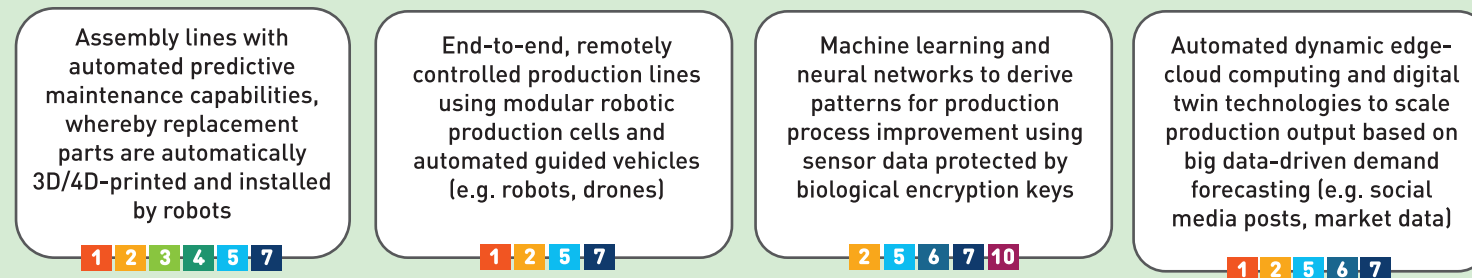
Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Smart Technology and Systems (Next-Generation Engineering & Manufacturing) Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)



How can **smart technology and systems innovations** be integrated with **other sectors**?



Medical & Healthcare

Production output based on demand forecasting using digital media data to predict undersupply of critical medical equipment during initial stages of disease outbreaks such as COVID-19



Business & Financial Services

Direct manufacturer to consumer transactions using drone delivery services and facial recognition payment



Environment & Biodiversity



Agriculture & Forestry

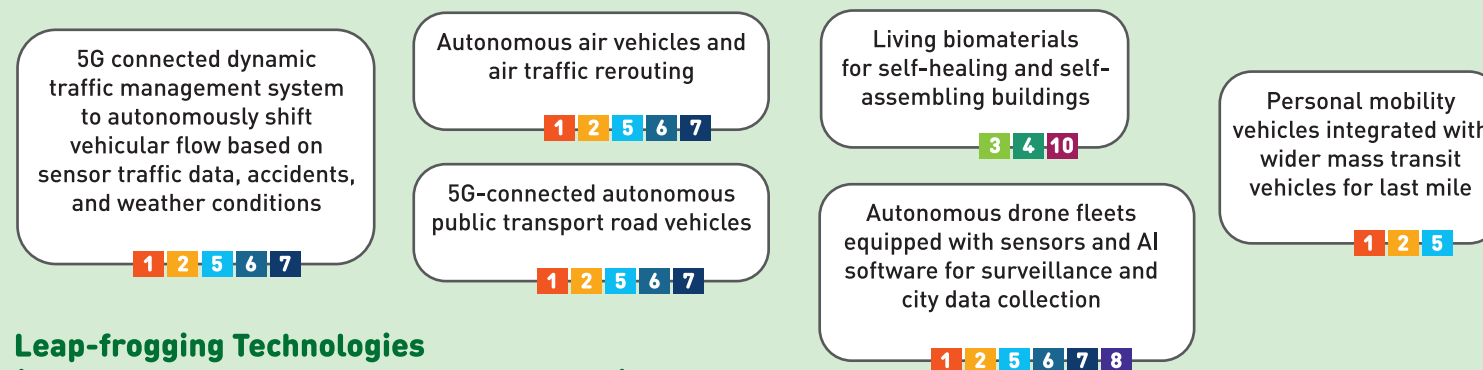
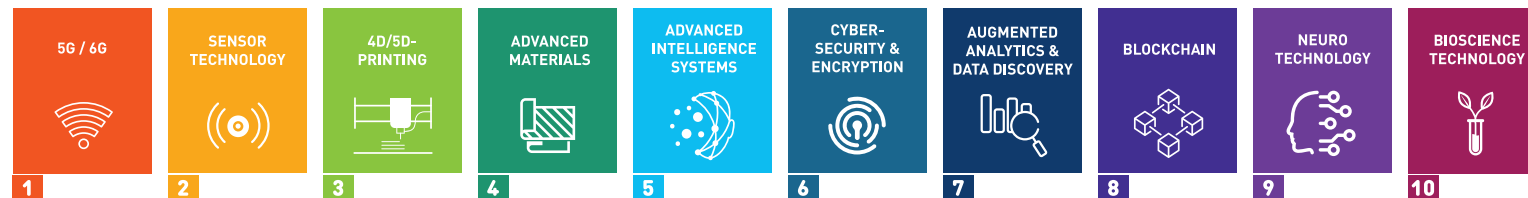
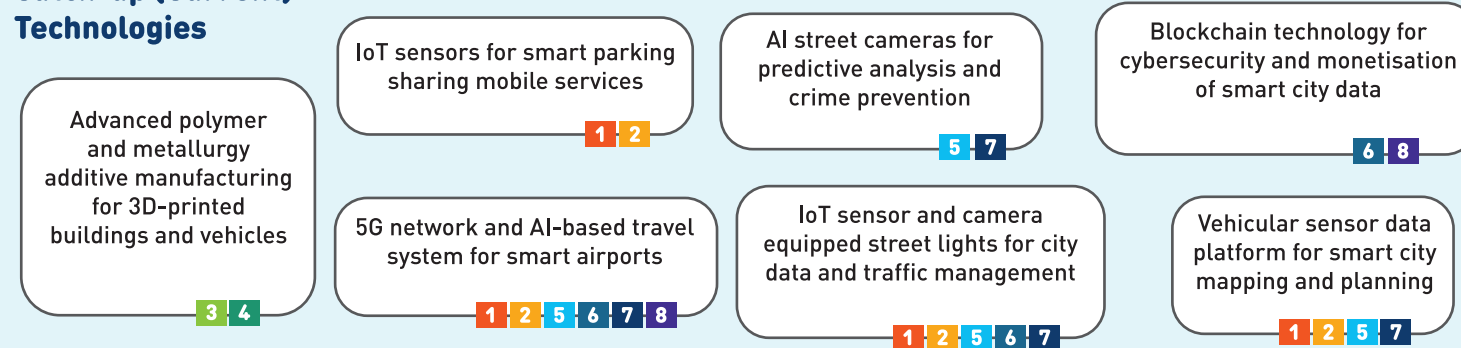
6 8

Blockchain technology to ensure sustainable manufacturing through use of smart contracts to determine certification and regulatory compliance of raw materials

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Smart Cities and Transportation Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **smart cities and transportation innovations** be integrated with **other sectors**?

Agriculture & Forestry
Automated vertical farming production based on big data driven demand forecasting

1 2 5 7

Energy
Decentralised electricity grid through blockchain-based monetisation of electricity generated by buildings equipped with solar window panes

1 2 5 6 7 8

Medical & Healthcare

Business & Financial Services

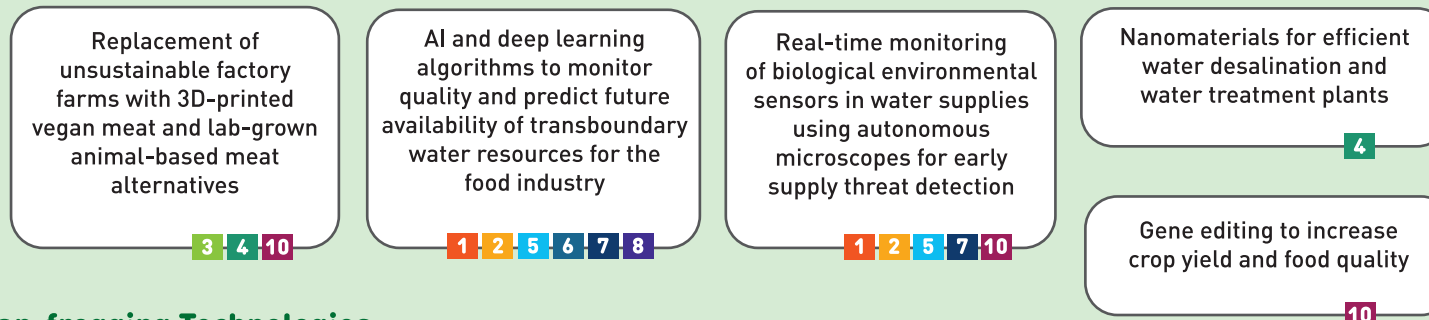
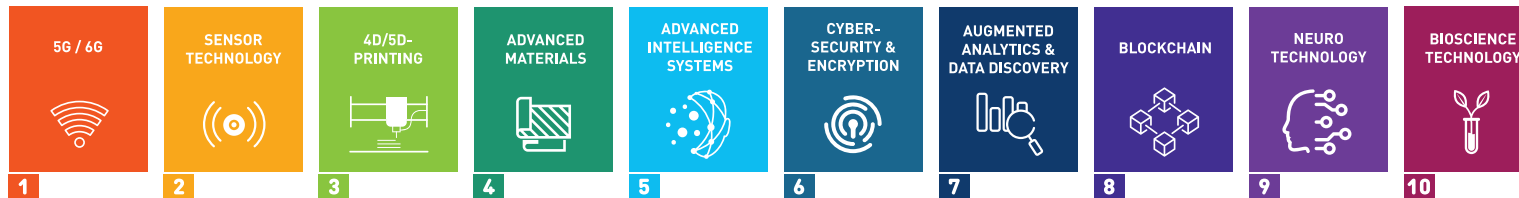
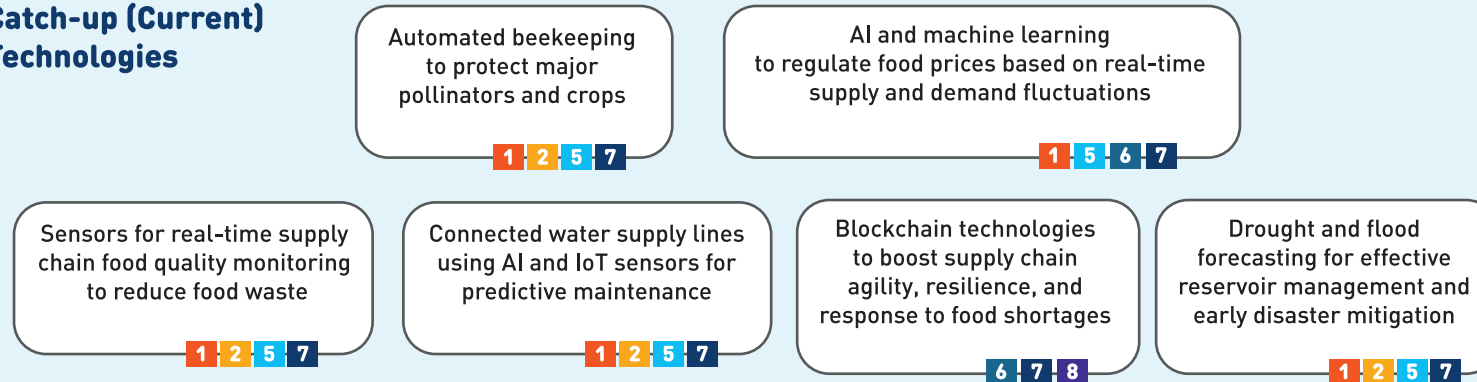
1 2 5 6 7 8

Public transportation equipped with facial recognition payment systems and 5G thermal body temperature monitoring system to identify potential COVID-19 infected passengers

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Water and Food Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **water and food innovations** be integrated with **other sectors**?



Smart Cities & Transportation
Integration of stormwater capture and purification systems with city infrastructure as additional water supply source
4



Smart Technology & Systems (Next-Generation Engineering and Manufacturing)
Cloud-based sensors for early detection of industrial waste and leakage in rivers and water sources
1 5
2 7



Agriculture & Forestry

+



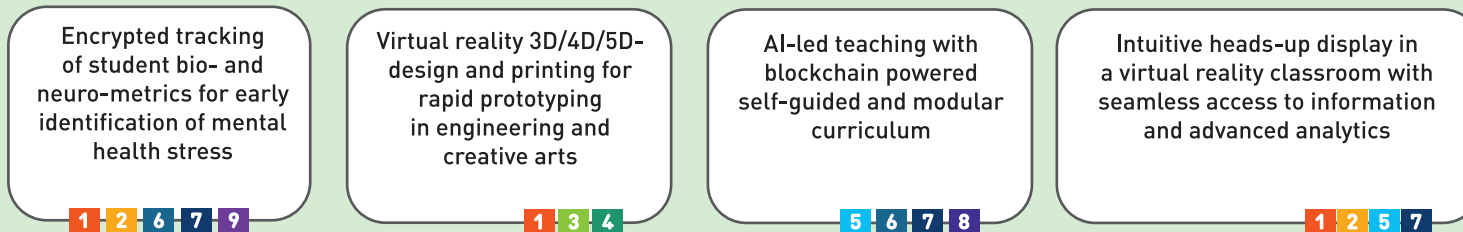
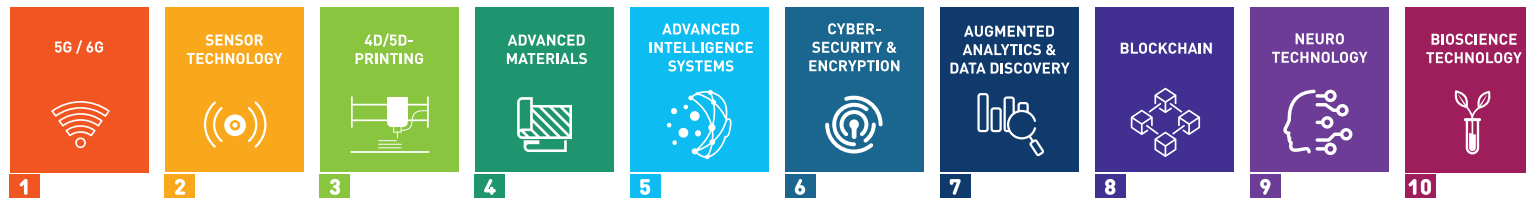
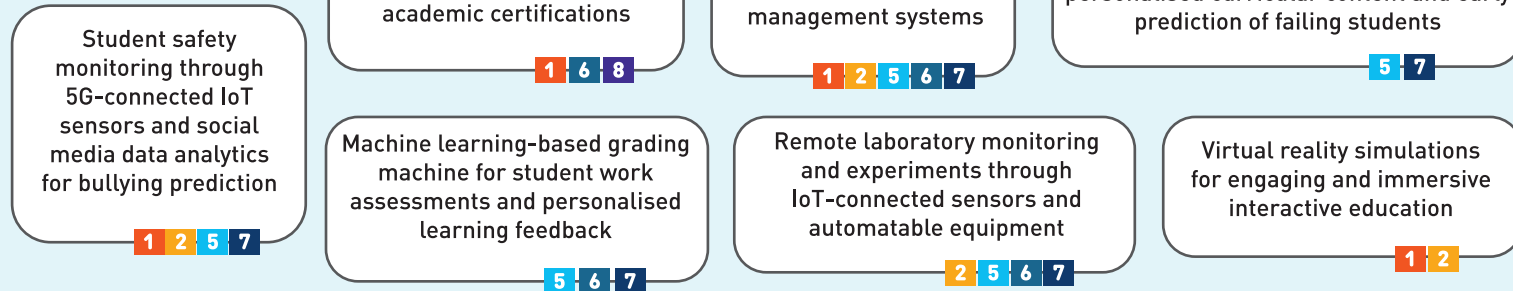
Business & Financial Services

Demand forecasted food supply chains with end-to-end optimization and transparency to prevent supply shocks
1 2
5 6
7 8

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework to the Education Socio-economic Driver

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can **education innovations** be integrated with **other sectors**?



Smart Cities & Transportation

City-wide enabled learning environments via augmented realities to balance in-classroom VR only experience



Multiple Sectors

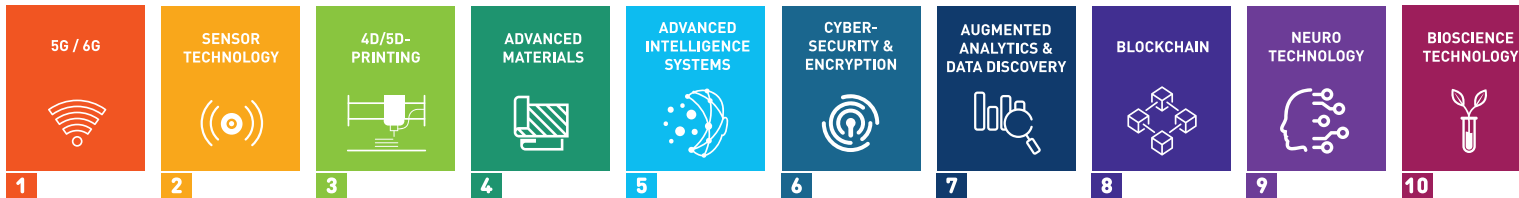
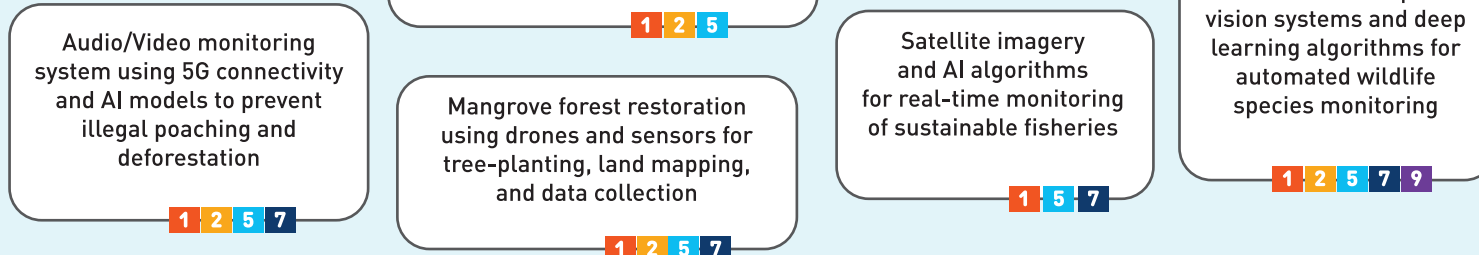
1 2

Interactive virtual classrooms for remote experiential learning beyond school locations (e.g. factory, forest, enterprise, museum) to cultivate strong talent pipelines

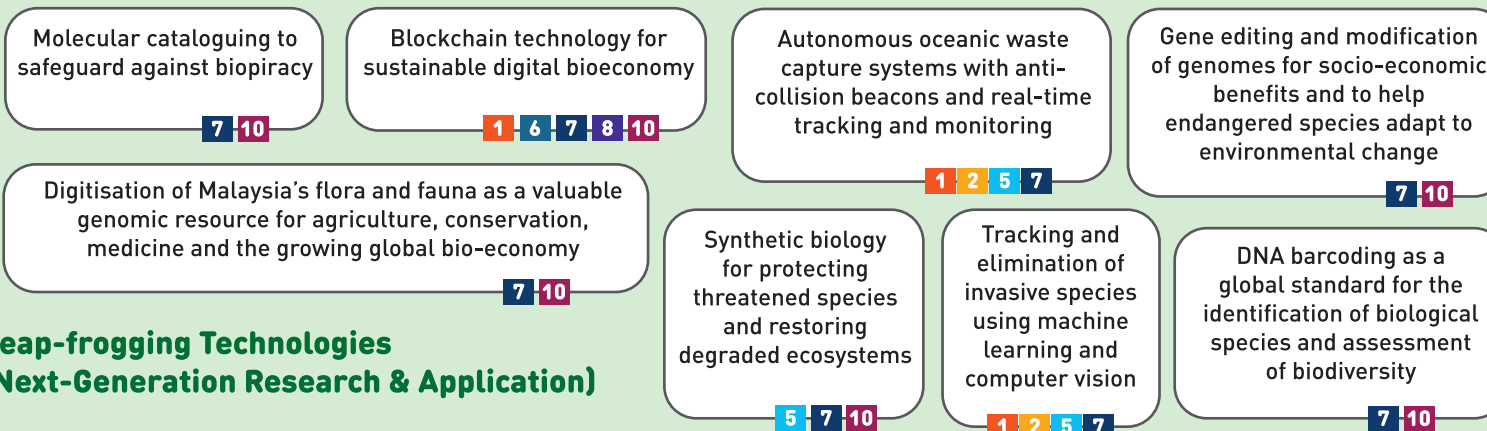
Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Application of the 10-10 MySTIE Framework for Precision Biodiversity (Environment and Biodiversity Socio-economic Driver)

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)



How can **precision biodiversity** be integrated with **other sectors**?



Water & Food

Blockchain to verify legal food sources and combat illegal fishing



Culture, Arts & Tourism

Evaluating the environmental impact of ecotourism using machine learning algorithms



Smart Cities & Transportation

Active air pollution forecasting and solution provision using AI algorithms for pattern recognition using meteorological, satellite, traffic, and social network data

Application of the 10-10 MySTIE Framework: An Example for the National Defence Systems

Catch-up (Current) Technologies

Shorten supply chains by integrating additive manufacturing in munitions, chip systems, and textile production for on-site production

3 4

Autonomous robots for mines & explosive detection clearance

1 2 5 6

Data analytics for detection of malicious cyber activities and network systems cyber security integrity

2 5 6 7

Autonomous unmanned ground vehicles for last mile resupply

1 2 5 6

Low observable material for high stealth, low radar detection of military aircraft

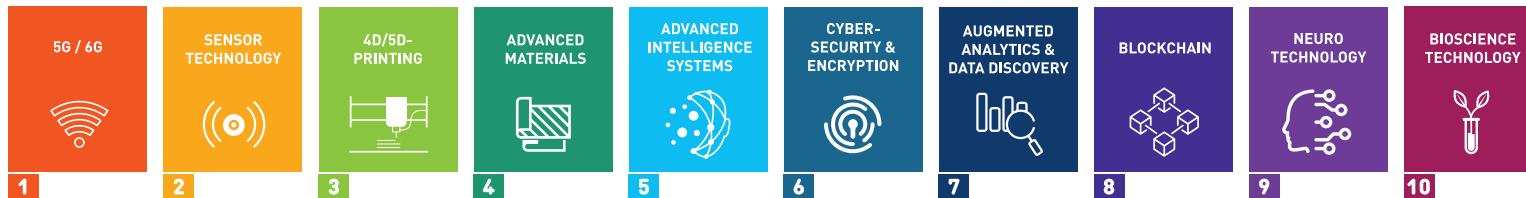
3 4

Network-enabled swarming drone squadron for unmanned air combat support

1 2 5 6 8

Autonomous robot submarines for marine patrolling, reconnaissance, and payload deployment

1 2 5 6 7



Leap-frogging Technologies (Next-Generation Research & Application)

Secure communication system with constant cryptographic protection for fighter jets

5 6

Conversational AI for hands-off verbal command and control of ground robots

2 5 6 7

Modification of skin microbiome to reduce mosquito feeding of military troops

10

Brain-computer interface controlled swarm drones for high level & complex military tasks

1 2 5 6 9

Next-generation antidotes for neuro-toxins (biological & chemical warfare)

9 10

UAVs with blockchain architecture for IoT security

1 2 5 6 8

Next-generation wearable materials to detect and withstand chemical, biological & nuclear warfare

2 3 4

How can other sectors leverage on **national defence systems innovations**?



Smart Cities & Transportation

Smart drone surveillance for homeland security

1 6
2 7
5 8



Energy

Solar power satellite space energy harvesting for terrestrial remote installation usage

1 4
2 5
6



Smart Technology & Systems (Next-Generation Engineering & Manufacturing)



Business & Financial Services

1 6 8

Blockchain technology to streamline military supply chains

1 4
2 5
3 7



Medical & Healthcare

Discoveries of new medical therapies, vaccines and Personal Protective Equipment (PPEs)

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

02

The Journey to Identify National STIE Niche Areas (2021-2025) using the 10-10 *MySTIE* Framework

10-10 *MySTIE* Framework Engagements

Inclusive input from policy makers, the scientific community, academia, industry captains and STI professional bodies

Series of engagements since March 2020

80 Stakeholder Engagements

Workshops, Focus Group Discussions & Presentations

300+ People Engaged

75 Ministries/ Agencies/ Industry Players

4 International Entities

604 Industry Captains

Provided inputs through Business Sentiment Survey 2019/2020

9 Position Papers

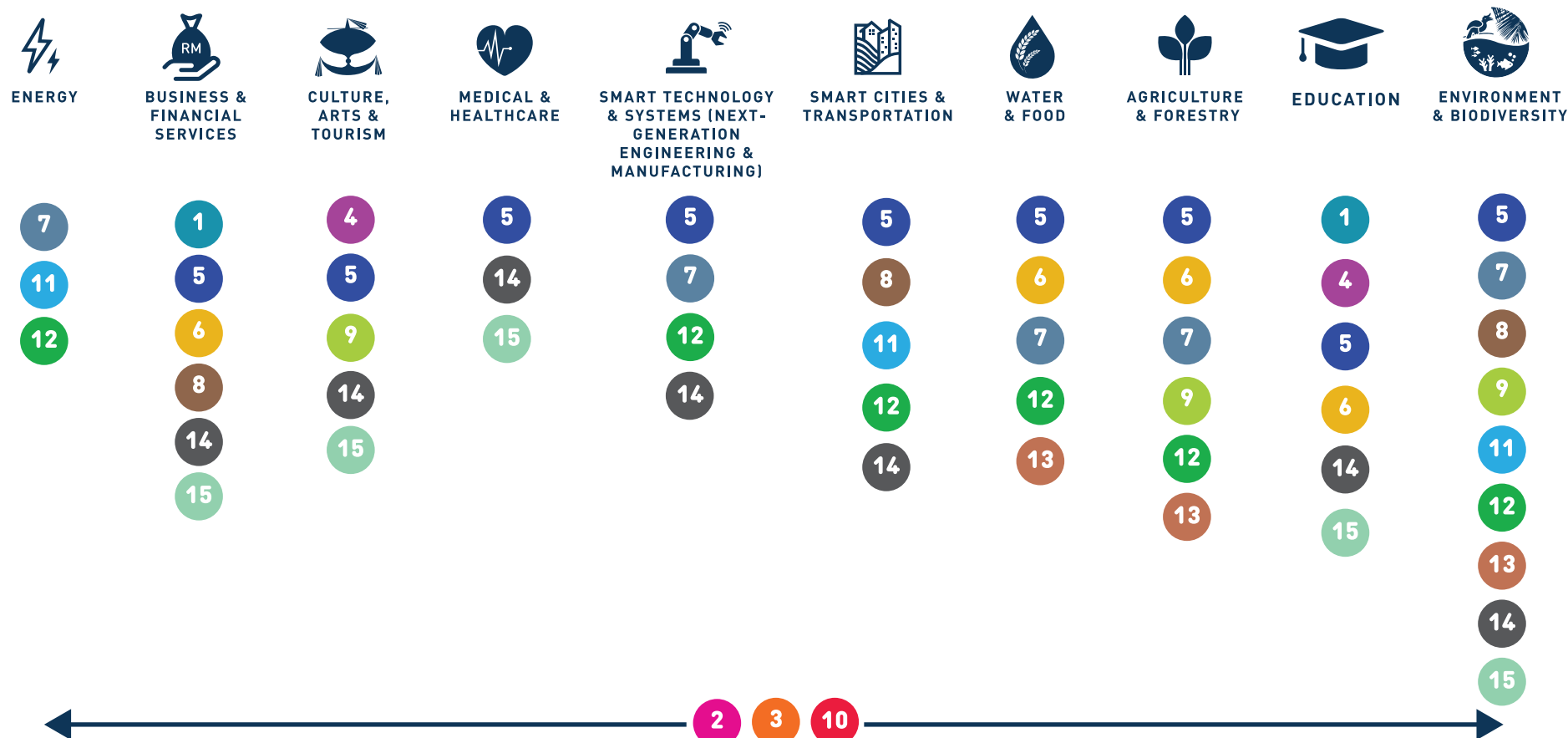
4 Joint Task Force

6 Strategic Studies for New Policy Formulation & National Plans

Linking the 10-10 MySTIE Framework to National Plans

Shared Prosperity Vision 2030 (SPV2030) is a national pledge to achieve an inclusive knowledge-based economy across the Key Economic Growth Activities (KEGA).

MALAYSIAN SOCIO-ECONOMIC DRIVERS



* Centres of Excellence along with Digital Economy and Fourth Industrial Revolution are innovation and business growth enablers across the 10 socio-economic areas.

- | | | | | | | | |
|---------------------------|---------------------------------|--------------------|--|----------------------------|---------------------|-----------------------------------|------------------------|
| 1 Islamic Finance Hub 2.0 | 3 Fourth Industrial Revolution* | 5 ASEAN Hub | 7 Commodity Malaysia 2.0 | 9 Coastal & Marine Economy | 11 Renewable Energy | 13 Smart & High Value Agriculture | 15 Malaysia Truly Asia |
| 2 Digital Economy* | 4 Content Industry | 6 Halal & Food Hub | 8 Logistics, Transportation & Sustainable Mobility | 10 Centres of Excellence* | 12 Green Economy | 14 Advanced & Modern Services | |

Source: ASM Analytics, 2020; MEA, 2019

Ecosystem Analysis

An analysis was carried out using two tools (i.e. 8i STI ecosystem enablers and SWOT analysis) to evaluate the current ecosystem for each of the socio-economic drivers. This included horizon scanning of the national landscape (i.e. national policies and plans) and stakeholder engagements to ensure careful selection of S&T drivers to enhance the ROV of the socio-economic drivers.



**8i STI
Ecosystem
Enablers**

01 / INFRASTRUCTURE

PHYSICAL & NATURAL

Quality and sophistication of the infrastructure that supports the growth and development of the industry and the broader economy.

02 / INFOSTRUCTURE

DIGITAL INFRASTRUCTURE

Digital infrastructure that provides seamless integration of multiple value chains within and across the industries and communities. These systems provide seamless flow of information for market intelligence and strategic decision making.

03 / INTELLECTUAL CAPITAL

TALENT STOCK

Skills (technical, entrepreneurial and leadership) and knowledge (general and specialised) of the talent stock.

04 / INTEGRITY

GOOD GOVERNANCE

Governance systems to manage processes and ensure commitment to continuous improvements and adherence to best practices.

05 / INCENTIVES

FISCAL AND NON-FISCAL

Incentives to encourage R&D, adoption of new technologies, innovation, commercialisation of local technology, and market expansion, including globalisation of local technology.

06 / INSTITUTIONS

GOVERNANCE BODIES

Quality of the institutions of governance (e.g. regulatory bodies, industry associations, institutions of learning / research institutes etc.) that support systematic development of markets, industries and communities.

07 / INTERACTION

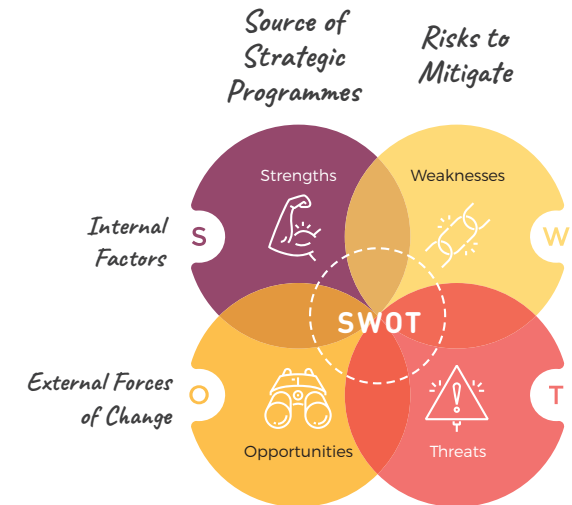
STRATEGIC PARTNERSHIPS

Level and quality of collaboration, co-creation and knowledge sharing among stakeholders.

08 / INTERNATIONALISATION

GLOBAL BEST PRACTICES & STANDARDS

Depth and breadth of engagement with global knowledge and innovation networks, institutions of governance and global supply chains.



Cross-cutting Challenges of the 10 Malaysian Socio-economic Drivers



INFRASTRUCTURE : Enhanced investment in infrastructure not in tandem with resources for maintenance

Infrastructure investment is expected to increase ~9% per annum between 2013 and 2025, but “limited maintenance due to inadequate financial resources has affected the quality of infrastructure.”

Source: EPU, 2016; 11th MP Mid-Term Review (2018)



INFOSTRUCTURE : Low connectivity and lack of integrated data management

- Gaps in deployment of high-speed broadband infrastructure in key industrial and training locations to support Industry 4.0 needs
- Need for data integration platforms for data-driven decision making
- Rural connectivity remains weak. “Malaysian users in thinly-populated rural areas have the connection to 4G just 44% of the time.

Source: Identification of National STIE Niche Areas using 10-10 Framework Workshop, 12 March 2020; OpenSignal, 2019



INTELLECTUAL CAPITAL : Low innovative capability

Knowledge content is mostly at absorptive and adaptive levels and rarely transcend to innovative capability. This is reflected in Malaysia’s rank of 53 out of 131 in ‘Knowledge Workers’ of Global Innovation Index 2020.

Source: EPU, 2016; Global Innovation Index 2020

Talent shortages and skill gaps to face Industry 4.0

High skilled workers make up only 24.4% of workforce in 2019. The 11th Malaysia Plan targeted the percentage of high skilled workers to increase from 25% in 2019 to 35% by year 2020.

Source: DOSM (2019), 11th MP (2015)

Over-reliance on foreign workers

Over-reliance on low-skilled foreign workers, particularly in construction (28.3%), agriculture (25.8%) and manufacturing (25.7%). The target under 11 MP is 15% of foreign workers from total workforce by 2020.

Source: 11th MP (2015); 11th MP Mid-Term Review (2018)



INTEGRITY : Need for governance systems and commitment to comply with global standards

Inability to conform to international standards due to lack of knowledge, resources and coordination resulting in goods and services not being able to penetrate global market.

Source: Identification of National STIE Niche Areas using 10-10 Framework Workshop, 12 March 2020



INCENTIVES : Fragmentation of incentive landscape

There are more than 100 incentives administered by 32 agencies. There is a need to streamline and re-engineer incentives to be more outcome-driven and impact-driven

Source: Bank Negara Malaysia, 2017



INSTITUTION : Need for agile and adaptable regulation and legislation

Institutional and legislative frameworks are incongruent with current trends and needs, thus requiring a review.

Source: Identification of National STIE Niche Areas using 10-10 Framework Workshop, 12 March 2020



INTERACTION : Lack of knowledge-based efforts, collaborative strategies and championing of change

- Poor communication and linkages within the value chains causing disconnect among players
- Lack of interaction and commitment among authorities, NGOs and community representatives to resolve critical issues on the ground

Source: Identification of National STIE Niche Areas using 10-10 Framework Workshop, 12 March 2020



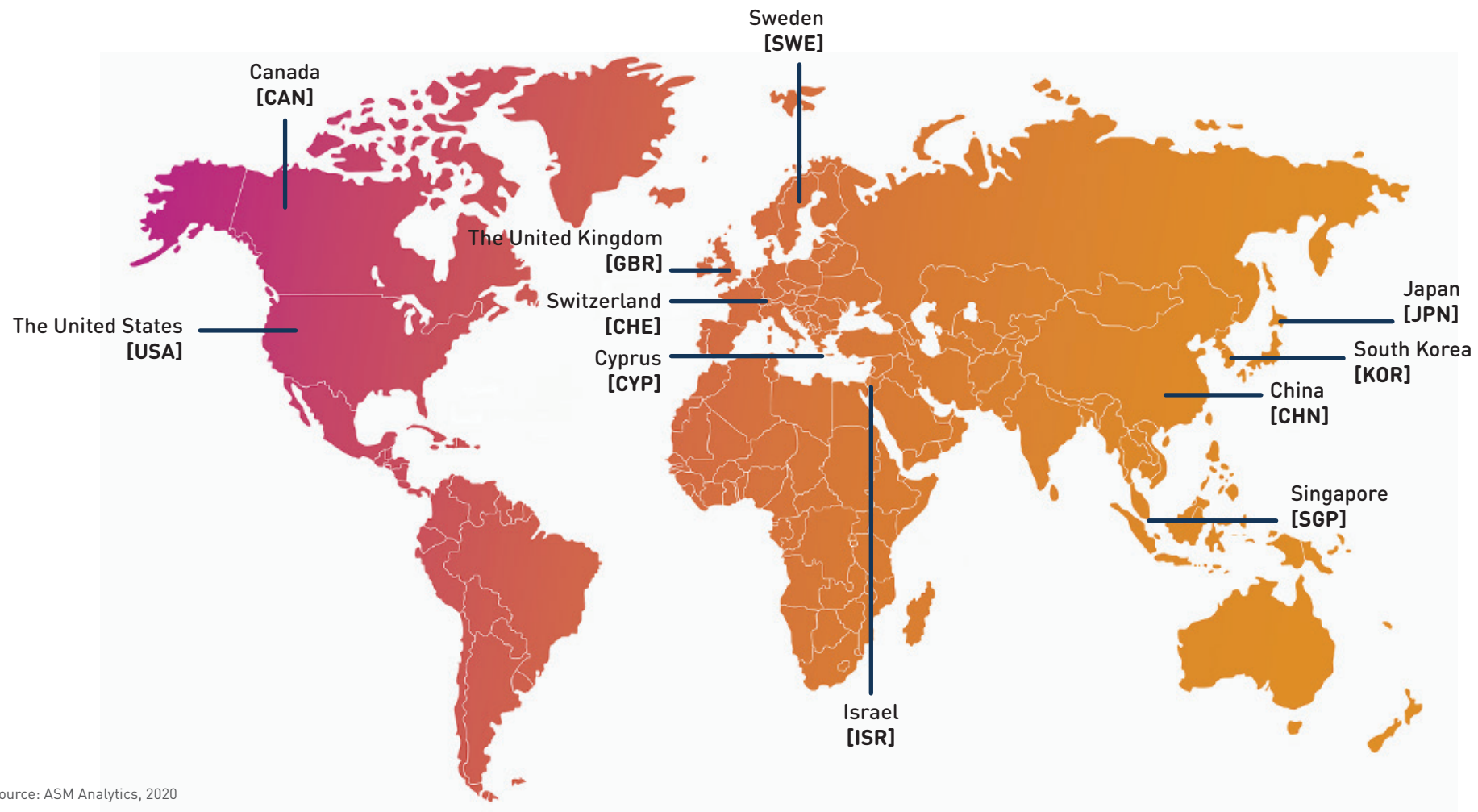
INTERNATIONALISATION : Need for effective market positioning and strong branding in international markets

Malaysia has many competitive advantages, such as rich biodiversity and unique culture that can be leveraged to improve Malaysia’s standing in the international arena. However, there needs to be greater understanding and adherence to international standards.

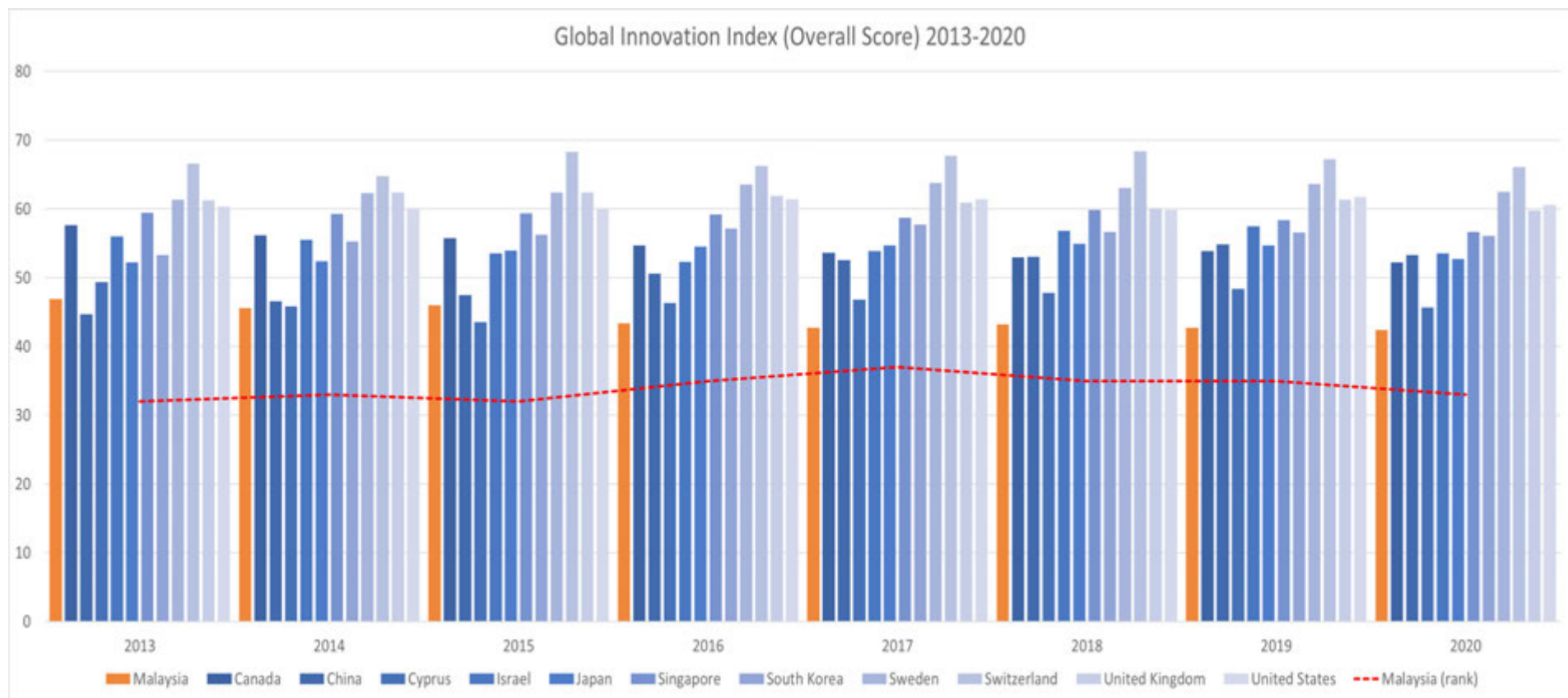
Source: Identification of National STIE Niche Areas using 10-10 Framework Workshop, 12 March 2020; EPU, 2016

Global Scanning and Benchmarking Analysis

Disruptive technologies and rapid innovations in the era of Industry 4.0 are changing the way we think and work. Scanning of policies, plans and practices in building a competitive innovation ecosystem across 11 countries provided valuable insights to emulate best practices. As progressive nations are fundamentally supported by strong STI ecosystems, it is important for Malaysia to identify our own competitive advantage to position Malaysia strategically in the international arena. A total of 11 countries were selected based on their higher ranks in the Global Innovation Index 2020 in comparison to Malaysia. Also, these are the top performing countries in their respective regions. Key strategies of the benchmarked countries are mapped with the 8i parameters to give an overview of best practices in building an innovative ecosystem.



Source: ASM Analytics, 2020



Analysed by ASM, Source: Global Innovation Index 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020

Malaysia's progress in STI development is reflected in the overall ranking in the Global Innovation Index (GII) from 2013 to 2020. Malaysia's highest rank over the last 7 years was at 32 in 2013. Since then, both Malaysia's overall rank and score have been declining, with the lowest performance in 2017 (ranked 37th out of 127 countries). While Malaysia's performance in the GII has stagnated, other innovative countries, such as Sweden and the UK, remained at the top of the rankings due to their strong STI ecosystems. Additionally, China has taken a great leap in climbing the rank. Best practices from the countries who have consistently performed well in the ranking should be taken into consideration in drafting strategies to improve Malaysia's STI ecosystems.

Global Scanning and Benchmarking 8i Analysis



INFRASTRUCTURE

Establishment of Technology and Innovation Hub as technology testing beds

[CYP] Cyprus Digital Innovation Hub (CyDi-Hub) was established as the regional network hub for researchers and businesses, as well as an incubator for industry players. They provide access to infrastructure and technical services that include product 3D design & prototyping, robotics, mechatronics, electronics & communication, IoT and software solutions etc.

[CHE] 5 innovation parks under Switzerland Innovation provide opportunity for business to access knowledge and infrastructure in the research institutes, bridging the gap between basic science and industry. The Swiss Business Incubation Centre (BIC) of CERN Technologies in Park Innovaare provides industry players the access to technology coaching on CERN's unique technologies, know-how, IP and seed fund.

[CAN] Canada established the 'Innovation Superclusters' initiative to develop superclusters in 5 key national industries: 1) Next Generation Manufacturing; 2) Digital Technology; 3) Protein Industries; 4) Ocean; and 5) Scale AI Supercluster. The superclusters aim to bring industries, SMEs and post-secondary institutions to develop high-potential technologies.

Integrate IoT in smart city planning

[KOR] A few cities in South Korea have integrated various technologies for smart city development. Songdo's central pneumatic waste disposal system automatically collects rubbish to recycle, bury, incinerate or convert to energy. Cheonggyecheon Stream Restoration adopts ICT and sensors to control the water level and water quality; Seoul's Bus Management System is an integrated control center that monitors operations in real-time, communicates directly with bus drivers and gathers information on vehicle positioning, location and speed.



INTEGRITY

Establish platform for stakeholders to discuss integrity-related issues

[GBR] The UK Chief Acquisition Officers Council (CAOC) created an online platform to allow stakeholders to discuss federal acquisition process, particularly on reporting and compliance requirements, updated innovative solutions for procurement & contracting practices. SMEs and non-traditional government contractors are also involved to improve the existing technical or strategic assistance programmes.

Strengthen patent policies to enable technology transfer

[CHN] Law of the People's Republic of China on Promoting the Transformation of Scientific and Technological Achievements (2015 Amendments) allows independent transfer of scientific and technological outputs to other parties, as well as authorising others to utilise the scientific and technological outputs for practical transformation.

Deploy highly secured and transparent system

[SWE] Swedish land registry authority, Lantmäteriet, tested a way to record property transactions and mortgage deed processes on blockchain. The system operates on a private blockchain which has land authority and banks holding copies of the records. When the land title changes, each step of the process is verified and recorded on blockchain.

Source: ASM Analytics, 2020



INFOSTRUCTURE

Pushing forward 5G internet and its next-generation technologies

[CHN] The Internet Plus Initiative (2015-2020) is a 5-year plan to integrate Internet, cloud computing, IoT, big data and other digital technologies across all economic sectors. The initiative commits to increase percentage of GERD/GDP on research in digitilising economic sectors, reduce dependency on foreign technology innovation, increase investments in home-grown solutions, enable access to 100 MBps internet connections across large cities and expand broadband connectivity to 98% of population.

[CAN] The Canadian federal government and the provincial governments of Quebec and Ontario invested in the Evolution of Networked Services through a Corridor in Quebec and Ontario for Research and Innovation (ENCQOR) project, a five-year (2018-2023) initiative that supports R&D of 5G technologies by establishing a pre-commercialisation corridor equipped with an open digital test bed that allows companies and researchers to test innovative ideas and solutions.

Build a trusted digital environment that enable more value-added services

[SGP] Singapore's National Digital Identity (NDI) platform provides a secure digital credential, as well as a platform for authentication, authorisation and consent that provide citizens a single digital identity to do transactions. The NDI will enable private and public sectors to develop value-added services on a common and universal trusted framework. It also allows seamless interactions across domains and services where users can log in using their fingerprint, facial recognition or a 6-digit password.



INTELLECTUAL CAPITAL

Provide funding to encourage young talents entering aging industry

[GBR] The UK Government is encouraging the younger generation to enter industries with an aging workforce through a funding programme. The "UK-Young Entrance Support Schemes" is an example in the agriculture industry, whereby grants are given to applicants as young as 16 years old to start farming business.

Reskill talent for job security

[SWE] EU practices the concept of flexicurity. For instance, Sweden has established a job security council, Trygghetsrådet (TRR) that provides help to laid-off workers. Employers pay into these job-security councils (operated as private organisations) and if they lay employees off, these workers will receive financial support and job counselling from the council to help get them back into the workforce as soon as possible.

Provide future-proof education

[SGP] Singtel Optus invests in six to 20 months internship programme across all five polytechnics in Singapore, providing opportunities for 300 students annually to learn skills in IoT, cyber security, cloud and other digital skills.

Global Scanning and Benchmarking 8i Analysis



INCENTIVES

Provide tax incentives and subsidy for foreign and domestic technology transfers programmes

[JPN] The Japan External Trade Organisation (JETRO) has a 'Subsidy Program for Global Innovation Centers' which subsidises the cost of foreign companies in establishing innovation centers and conducting research on IoT in collaboration with Japanese firms.

[KOR] Tax credit is given to SMEs for income derived from the leasing of patents or utility model rights where the company has file registration of such rights. Tax credit is also granted for transfer or lease, merger or acquisition of technology innovative companies.

Encourage commercialisation of innovations through patent box system

[CHN] China established a national patent box system, which provides tax breaks for revenues earned from patents, giving a favorable tax rate to firms that invest at least 3-6% of gross revenue in R&D, generate 60% of their revenue from IP, or have a substantial percentage of skilled workers or high-tech occupations.

[CAN] Quebec and Ontario have employed a patent box system that allows corporate income related to the sale of patented products to be taxed at rates which are significantly lower than those applied to ordinary business income. The patent box system provides firms with a strong incentives to innovate and commercialise the innovations in the local jurisdiction.



INTERACTIONS

Establishment of industrial alliance among key players to provide solutions

[SGP] A*STAR formed industrial alliances with 13 companies to develop IoT solutions for manufacturing industries, particularly in aerospace, offshore and marine, and land transport.

[CAN] The National Research Council of Canada's Industrial Research Assistance Program (NRC IRAP) helps SMEs to build innovation capacity and take ideas to market through a network of over 250 Industrial Technology Advisors (ITAs). ITAs focuses on assisting SMEs with technology and new product development, as well as connect universities and national laboratories with SMEs.

[USA] Manufacturing USA is a public-private partnership that brings together industry, academia, and government partners to leverage existing resources and co-invest in manufacturing innovation and accelerate commercialization. It consists of 14 innovation intermediaries that focus on advanced functional fabrics, photonics, additive manufacturing (3D printing), robotics, biofabrication, clean-energy smart manufacturing, advanced lightweight composite materials, digital manufacturing, flexible hybrid electronics, biopharmaceutical manufacturing, advanced semiconductor components, chemical and material processing, and remanufacturing of materials.

Source: ASM Analytics, 2020



INSTITUTIONS

Establish central coordinating and planning body for R&D funding of research

[GBR] The UK Research and Innovation (UKRI) is a central body that coordinates with the seven research councils, Innovate UK and Research England, as well as works with the UK government in effectively directing funding to research areas that are strategic for the UK.

[ISR] The Israel Innovation Authority is a public funded independent agency. Through collaborations, it provides a variety of practical tools and funding platforms for early stage start-up, growing high-tech companies, funding for R&D infrastructure, international collaboration, advanced manufacturing and innovation programs for societal challenges.

Establish innovation intermediaries and collaborative networks for market-driven R&D

[GBR] Catapult Centres are a network of independent technology centres located nation-wide and globally that provide support to translate R&D products into commercial products and services in specialist sectors (i.e. Cell & Gene Therapy, Future Cities, Satellite Applications etc.) for future growth, trade and productivity.



INTERNATIONALISATION

Introduce international matching funds to encourage collaborative research with innovative countries

[GBR] EUREKA has established a £4 million competition fund that connects researchers and businesses to 41 “EUREKA” countries to fund international collaborative research. Some of the investments by EUREKA include £1 million fund for medical technology and smart mobility through GlobalStars fund, £2 million for smart manufacturing, and £1 million for artificial intelligence and quantum.

Provide tax deduction for innovative companies to internationalise

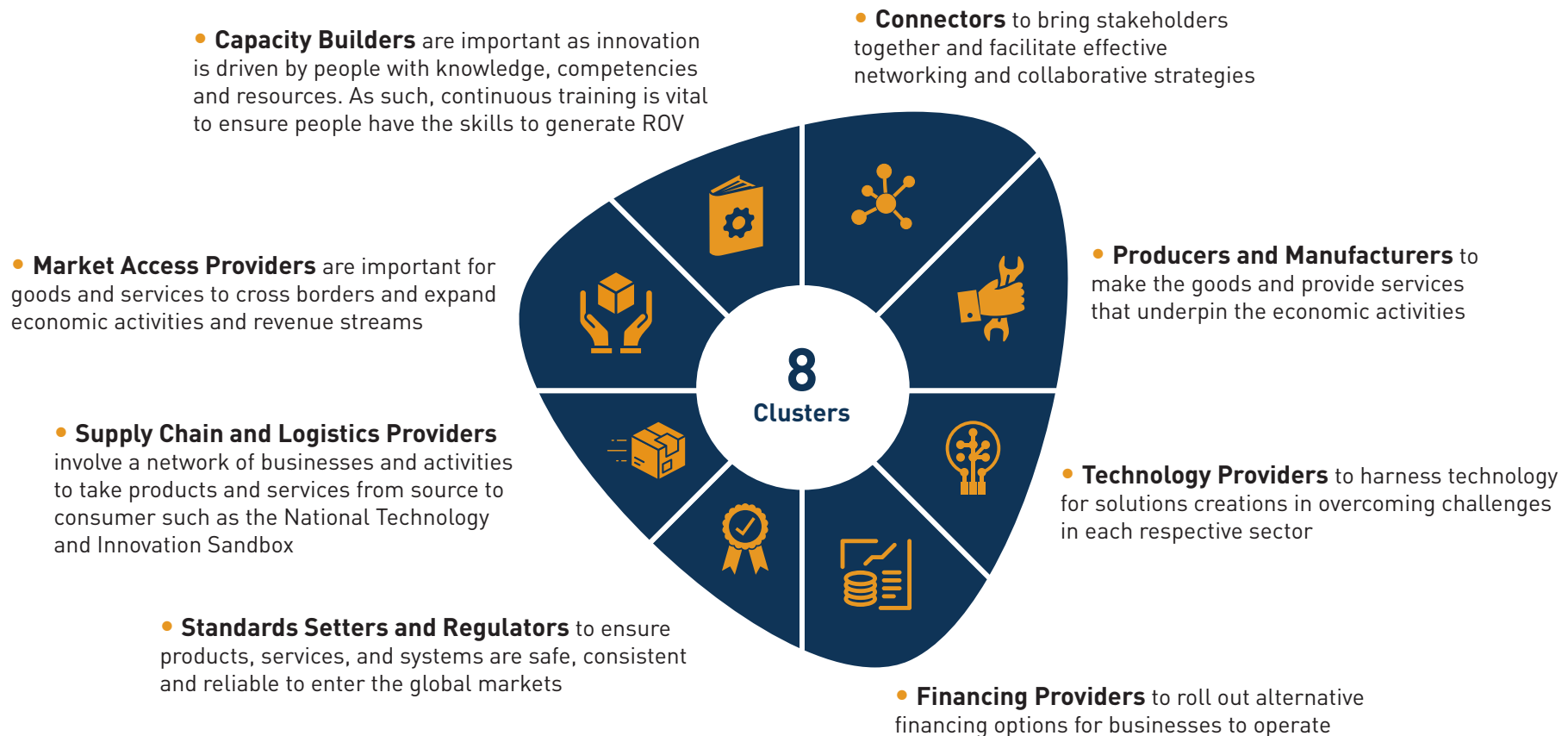
[SGP] Double Tax Deduction for Internationalisation (DTD_i) initiative encourages local businesses to embark on international expansion and internationalisation. The DTD_i is aimed at small-business ventures to create market presence in other countries, such as marketing, trade shows, networking and sourcing for local partners, which provides additional time and effort to these businesses who are often lean in operations. Under the DTD_i initiative, local businesses carrying out select overseas business activities are entitled to a 200% tax deduction of up to \$150,000 on expenses for these activities.

Strengthen position in international market through collaboration

[JPN] “Partnership for Quality Infrastructure” promotes Japan’s safe and high-performance technology to the rest of the world through providing attractive loan assistance systems for infrastructure development in the partnering countries. For example, Japan collaborated with India to use Japan’s Shinkansen train system to build the high-speed railway project between Mumbai and Ahmedabad.

Collaborative Platform

While the National STIE Niche Areas provide strategic focus, the translation on the ground cannot happen effectively unless there is a collaborative platform that brings together key players to spearhead concerted action. The collaborative platform provides a more holistic solution and effective implementation of strategies, policies and programmes. In order to develop a conducive ecosystem to support and sustain key economic growth activities and societal well-being at localities across Malaysia, we need 8 clusters:



Source: ASM Analytics, 2020, Adapted from European Commission, 2014

A functional collaborative platform comprising of the 8 clusters working together can give rise to a knowledge-based economy. Effective collaboration between stakeholders is needed to help address economic disparities by implementing high impact projects across localities in Malaysia.

The collaborative platform is critical for translating research into transformative outcomes for the community.

The platform also enables multichannel communication and feedback between the stakeholders. This facilitates effective decision-making and implementation of strategies.





Harnessing Multiple STIE Ecosystems Across Malaysia



Northern Corridor Potential STIE Ecosystems

*non-exhaustive



Manufacturing Projects: Top 5 areas in Perlis

1. Plastic Products
2. Electronics & Electrical Products, Food Manufacturing
3. Rubber Products
4. Textile & Textile Products
5. Transport Equipment



Manufacturing Projects: Top 5 areas in Kedah

1. Electronics & Electrical Products
2. Transport Equipment
3. Fabricated Metal Products
4. Plastic Products
5. Rubber Products

PULAU PINANG

Manufacturing (electrical & electronics, medical devices, high tech manufacturing hub, R&D and commercial & industrial activities), Medical & Healthcare Tourism, Digital Economy (global business services, e-commerce), Financial Services, Logistics Hub, Agriculture (seed centre-aquaculture), Education Hub, Agrotourism, Halal Port

KUALA PERLIS

Fisheries, Transportation & Logistics, Renewable Energy (solar), Ecotourism

KANGAR

Halal Industries, Green Manufacturing, Agrobusiness (superfruits valley), Service & Administration Centre

LANGKAWI

Tourism, Handicraft, Agriculture (urban precision farming)

BUKIT KAYU HITAM

Logistics & Border Economy Activities, Aerospace Industry, Composite Industry

ALOR SETAR

Agriculture (paddy), Heritage tourism

PENDANG

Modern Agriculture & Livestock

KULIM

E&E Manufacturing, Rubber-based Products, Kulim High Tech Park, Medical and Wellness, Biopolymer

IPOH

ICT, Mining, Sustainable Mining & Downstream Activities, Eco & Heritage Tourism, Agriculture, Digital Economy, Financial Administrative Centre, Urban Revitalisation, Education, Manufacturing, Renewable Energy Generation

PANGKOR

Ecotourism, Duty Free Zone, Fisheries & Aquaculture, Seafood Processing

KINTA

High Tech Manufacturing, ICT

BAGAN DATOH

Heavy Industries, Maritime, Logistics

TANJUNG MALIM

Automotive Industry, Education Hub, Ecotourism



Manufacturing Projects: Top 5 areas in Pulau Pinang

1. Electronics & Electrical Products
2. Machinery & Equipment
3. Fabricated Metal Products
4. Plastic Products
5. Basic Metal Products, Food Manufacturing



Manufacturing Projects: Top 5 areas in Perak

1. Electronics & Electrical Products
2. Non-metallic Mineral Products
3. Rubber Products
4. Food Manufacturing
5. Plastic Products



- Local Ecosystem
- ▲ Public HLIs 8
- TVET Institutions 35

East Coast Region Potential STIE Ecosystems

*non-exhaustive



Manufacturing Projects: Top 5 areas in Kelantan

1. Electronics & Electrical Products;
Wood & Wood Products
2. Textile & Textile Products
3. Chemical & Chemical Products;
Non-metallic Mineral Products;
Rubber Products
4. Basic Metal Products;
Furniture & Fixtures
5. Food Manufacturing;
Leather & Leather Products

JELI

Wood Industries, Minerals, Herbs, Automobile,
Gold & Quartz Mining, Ecotourism

CAMERON HIGHLANDS

Agriculture Biotechnology, Flower Industry,
Halal Food Production, Food Industry, Tourism

TEMERLOH

Agriculture, Aquaculture (patin fish),
Transportation & Logistics



Manufacturing Projects: Top 5 areas in Pahang

1. Wood & Wood Products
2. Chemical & Chemical Products
3. Petroleum Products
(including Petrochemicals)
4. Electronics & Electrical Products
5. Food Manufacturing

KOTA BHARU

Handicraft, Tourism (historical
heritage), Transportation &
Logistics, Education &
Trainings, Halal Hub,
Textile, Automobile,
Biotechnology

PASIR MAS

Halal Industry (high-value downstream
Halal food products), Tourism, Duty Free
Zone (retail), Aquaculture

KUALA KRAI

Agriculture (marketing &
trade center, herb & fruit
garden), Tourism (agro- &
ecotourism)

KUALA NERUS

Aquapolitan

KUALA TERENGGANU

Agriculture (coffee, rice, pepper, cotton goods),
Textile, Food Processing, Arts & Crafts, Timber,
Tourism (culture, heritage, history, beaches),
Education & Trainings, Business Services,
Transportation & Logistics

DUNGUN

Agriculture (nutraceutical,
medicinal herbs), Fisheries

KERTEH / KEMAMAN

Oil & Gas, Petrochemical, Tourism (Hutan Lipur
recreation), Transport & Logistics (support and
services to the petroleum industry), Heavy Industries

GEBENG

Polypropylene-based
Petrochemicals, Oil Palm
Biomass, Palm Oil-based
Products

PEKAN

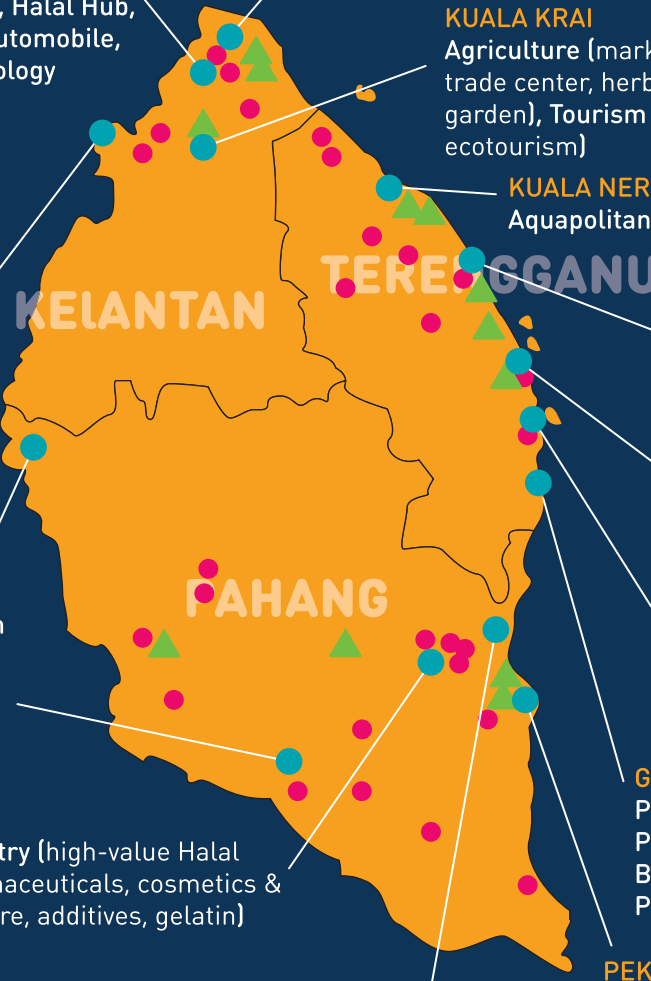
Automotive (manufacturing &
assembly hub), Maritime Industry

GAMBANG

Halal Industry (high-value Halal
food, pharmaceuticals, cosmetics &
personal care, additives, gelatin)

KUANTAN

Fishing, Aquaculture, Oil Palm, Petrochemical,
Food Manufacturing, Port & Logistics, High Technology
Industries (stainless steel, E&E, ICT, renewable energy),
Tourism (themeparks & family oriented resorts)



- Local Ecosystem
- ▲ Public HLIs 12
- TVET Institutions 28

Central Region Potential STIE Ecosystems

*non-exhaustive



Source: ASM Analytics, 2020; Nair, 2011; MIDA, 2020

Southern Region Potential STIE Ecosystems

*non-exhaustive



Manufacturing Projects: Top 5 areas in Negeri Sembilan

1. Electronics & Electrical Products
2. Machinery & Equipment
3. Chemical & Chemical Products
4. Fabricated Metal Products
5. Non-Metallic Mineral Products



Manufacturing Projects: Top 5 areas in Johor

1. Electronics & Electrical Products
2. Fabricated Metal Products
3. Textiles & Textile Products
4. Furniture & Fixtures
5. Plastic Products



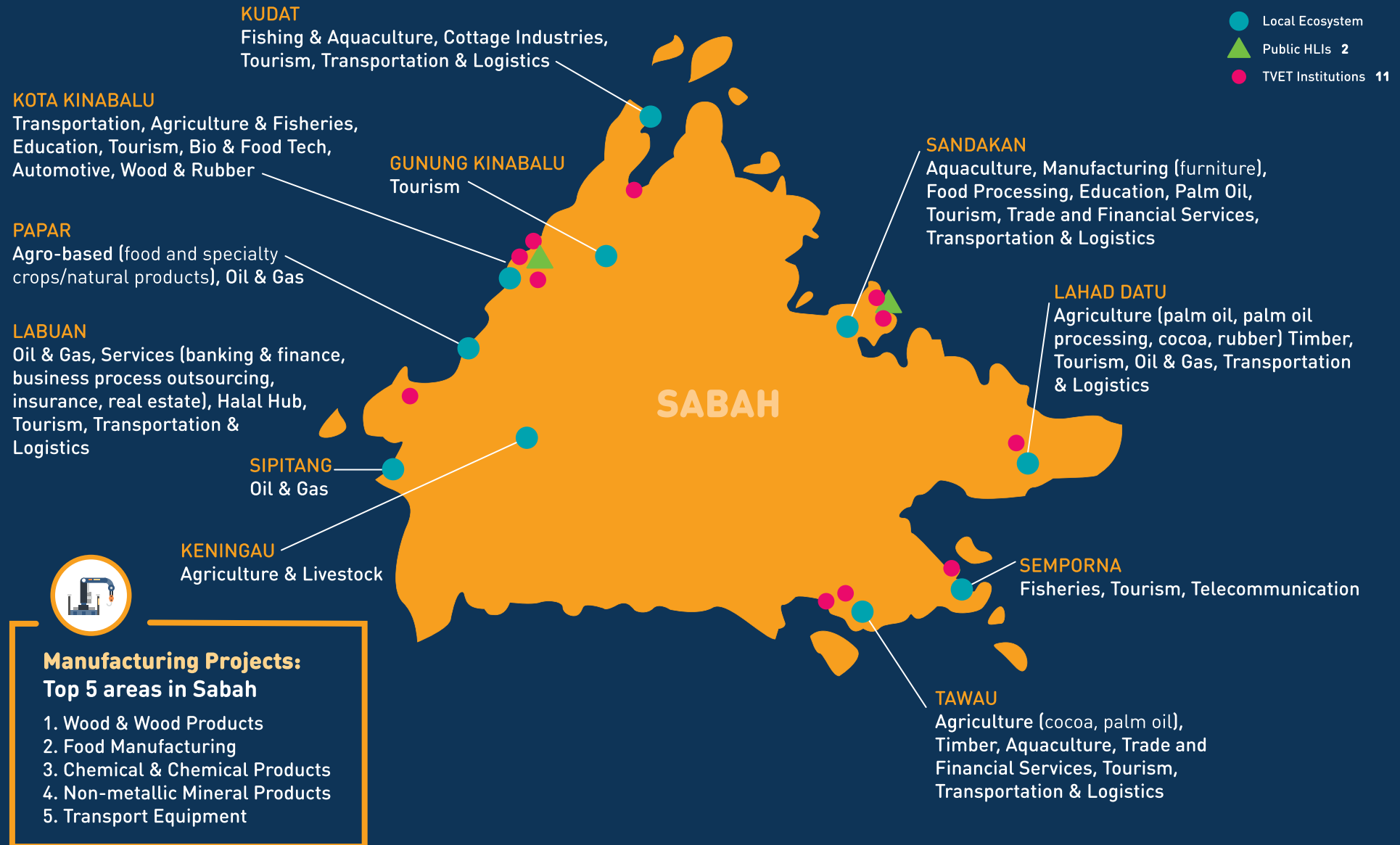
Manufacturing Projects: Top 5 areas in Melaka

1. Electronics & Electrical Products
2. Fabricated Metal Products
3. Machinery & Equipment
4. Plastic Products
5. Transport Equipment

Source: ASM Analytics, 2020; Nair, 2011; MIDA, 2020

Sabah Potential STIE Ecosystems

*non-exhaustive



Source: ASM Analytics, 2020; Nair, 2011; MIDA, 2020

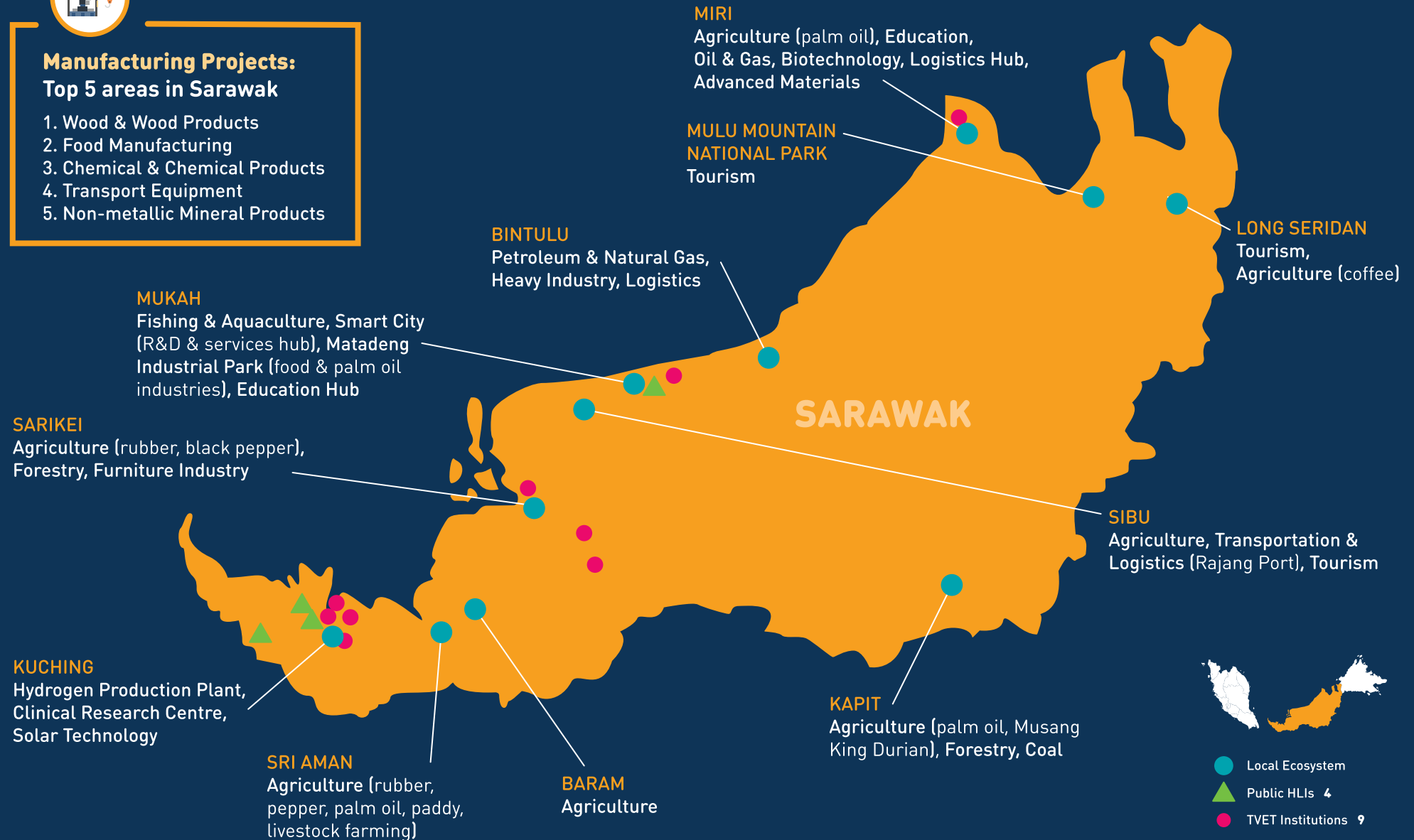
Sarawak Potential STIE Ecosystems

*non-exhaustive



Manufacturing Projects: Top 5 areas in Sarawak

1. Wood & Wood Products
2. Food Manufacturing
3. Chemical & Chemical Products
4. Transport Equipment
5. Non-metallic Mineral Products



Source: ASM Analytics, 2020; Nair, 2011; MIDA, 2020

Basis for National STIE Niche Areas

The National STIE Niche Areas are identified based on 4 key criteria:



03

30 National STIE Niche Areas for 10 Socio-economic Drivers

The 30 National STIE Niche Areas were identified through a series of stakeholder engagements to ensure that they are aligned with national aspirations. These niche areas were endorsed by the National Science Council on 14 July 2020 and will be reviewed every 2-3 years to ensure relevance to changing times.



Energy



Business &
Financial Services



Culture, Arts
& Tourism



Medical &
Healthcare



Smart Technology
& Systems (Next-
Generation Engineering
and Manufacturing)



Smart Cities &
Transportation



Diversified
Renewable Energy



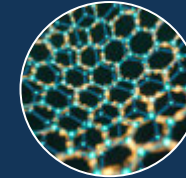
Subscription Business Models
& Sharing Platforms



Creative Content
& Heritage



Digital Health



Advanced Materials for
Circular Economy &
Sustainable Society



Integrated Urban
Infrastructure &
Infostructure
Management



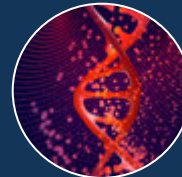
Energy Storage
System



Digitalised &
Autonomous Services



Digitalised
Tourism



Precision
Medicine



Next-Gen
Smart Factories



Smart Systems
for Connected Rural-
Urban Communities



Microgrid



Fintech in Islamic Finance



High-Value Tourism



Clinical Trials Hub for
Developing Countries



Manufacturing of Smart
Devices & Technology
Development



Human-Centred
Design & Analytics



Water &
Food



Agriculture
& Forestry



Education



Environment &
Biodiversity

30

National STIE Niche Areas for 10 Socio-economic Drivers



Premium
Halal Food



High-Value
Seafood



Personalised &
Experiential Learning



Precision
Biodiversity



Local
Superfood



Premium
Tropical Fruits



Micro-credentials



Innovative
Eco-Products
from Waste



Integrated Water
Resources Management



Local Agricultural Input



Global Online Learning:
Promoting Local Content



Smart Supply Chain Management for
Sustainable Forest Products

Impact of the National STIE Niche Areas

The 30 National STIE Niche Areas have been classified in terms of their weightage of contribution as follows:

12 niche areas are identified as
ECONOMIC BOOSTERS

11 niche areas are classified as
(combination of economic and social impact)
DUAL-IMPACT ENABLERS

07 niche areas are identified as
SOCIETAL WELL-BEING CATALYST

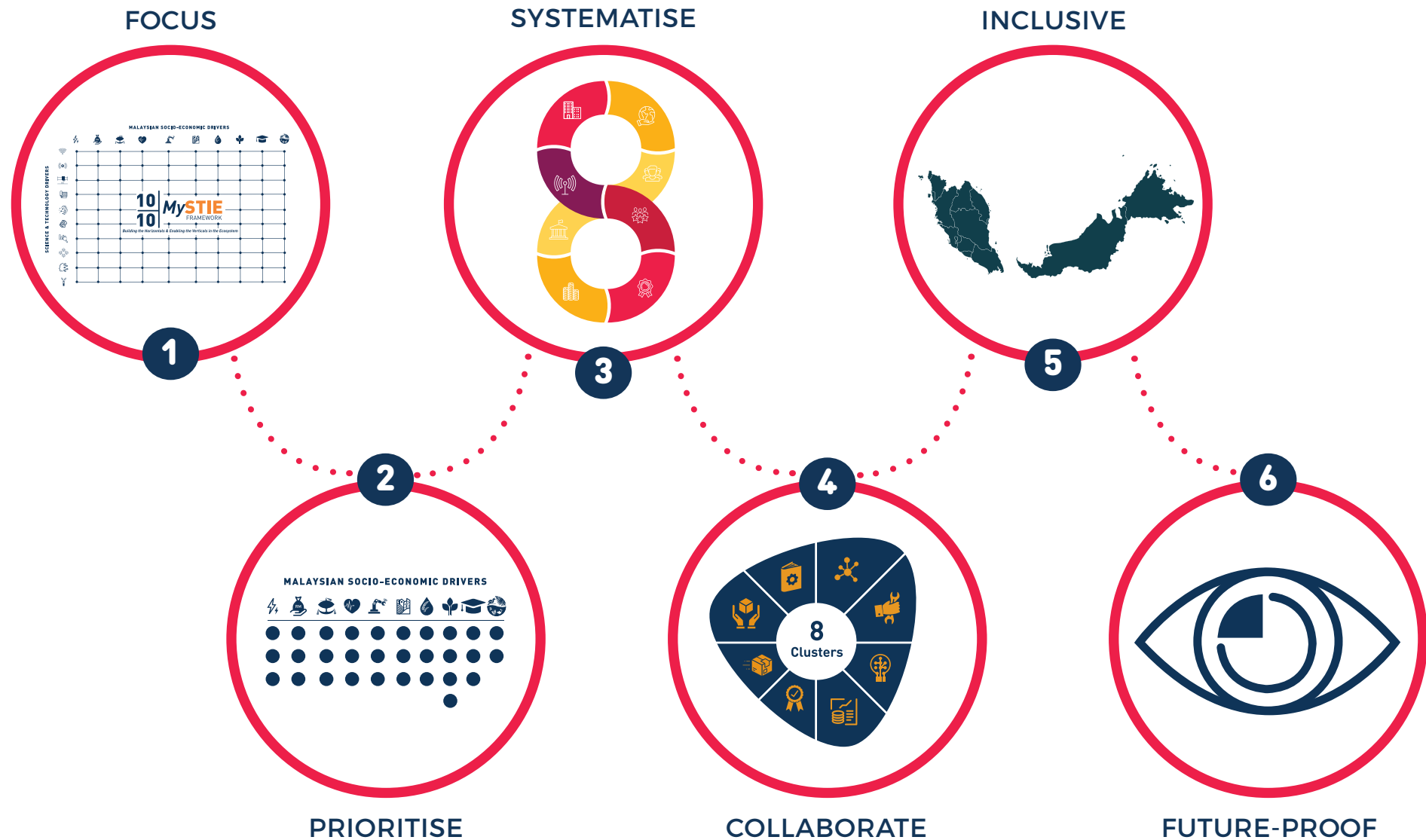


Part II

Implementing the 10-10 *MySTIE* Framework

Part II of this transformation book aims to provide a step-by-step guide on the use of the 10-10 *MySTIE* Framework to develop vibrant and agile STIE ecosystems.

10-10 MySTIE: Implementation Steps



Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020

Malaysia is an open and small economy with scarce resources. To move up the global innovation and competitive value chain, Malaysia must **focus** its efforts in developing key S&T and socio-economic drivers that ensure sustainable economic development. In this context, Malaysia must invest in key S&T drivers that deepen the impact of socio-economic drivers and target key **priority** niche areas to establish global leadership. To ensure the 10-10 MySTIE Framework contributes to nation building, a **systematic** ecosystem approach needs to be taken. It must incorporate strategic **collaborative** partnership approach among players such that they create a multiplier effect for **inclusive** development. This is to ensure no community is left behind in the transition to a developed nation and **future-proof** sustainable development.

The 10-10 MySTIE Framework will enable the deployment of high impact projects to address needs of communities as well as quality of life at specific localities across Malaysia. The mechanism comprises 6 steps, premised upon an ecosystem approach (8i STI ecosystem enablers) as follows :

1

FOCUS

Build an understanding of the emerging global technologies (10 S&T Drivers) and how they impact your core operations and influence key socio-economic areas.

2

PRIORITISE

Identify niche areas for priority investments to build positions of global leadership based on strengths and needs in your core business, in relation to the emerging global technologies.

3

SYSTEMATISE

Define a holistic approach (8i STI ecosystem enablers) to ensure systematic development that deepens the impact of S&T drivers on socio-economic development.

4

COLLABORATE

Foster an ecosystem-wide collaboration with key players for the deployment of high-impact projects at identified localities to create multiplier effect for shared prosperity.

5

INCLUSIVE

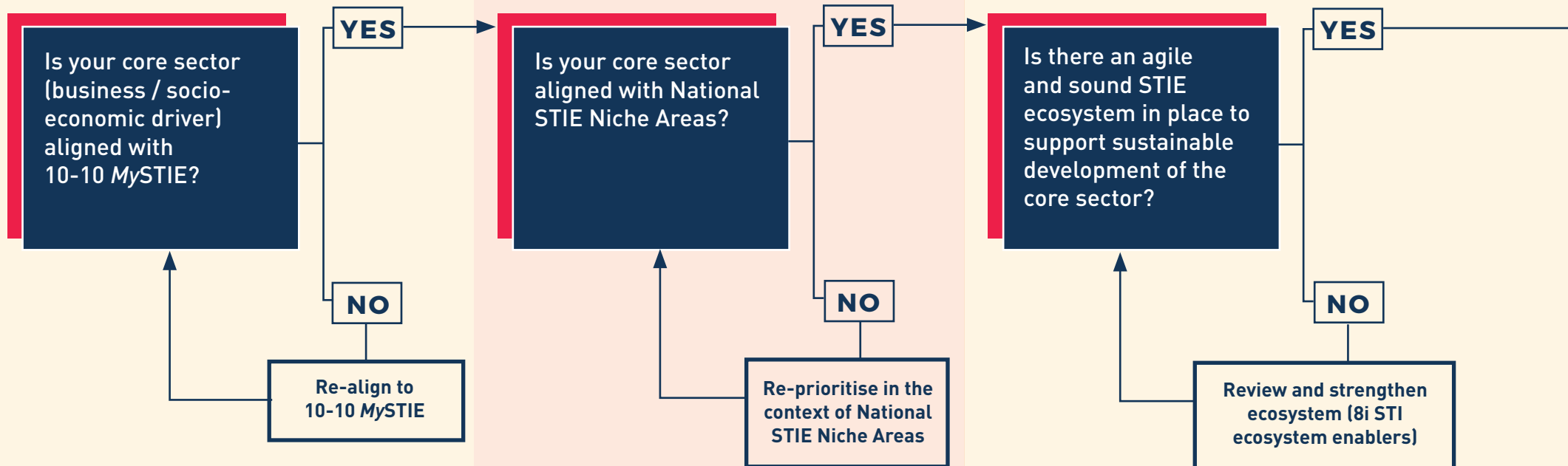
Initiate locality-specific STIE ecosystems to inclusively harness resources and talent to enhance return on value and improve the quality of life of the *rakyat*.

6

FUTURE-PROOF

Conduct regular foresighting to ensure the STIE ecosystem is adapting to change and is able to mitigate risks associated with uncertainties and volatilities.

10-10 MySTIE Process Flow for Nurturing Vibrant and Agile STIE Ecosystems



Ecosystem Development Strategies

Step 1

FOCUS

Identify key subsectors and their stages of development as well as incorporate appropriate S&T drivers to raise the quality and ROV of these subsectors

Step 2

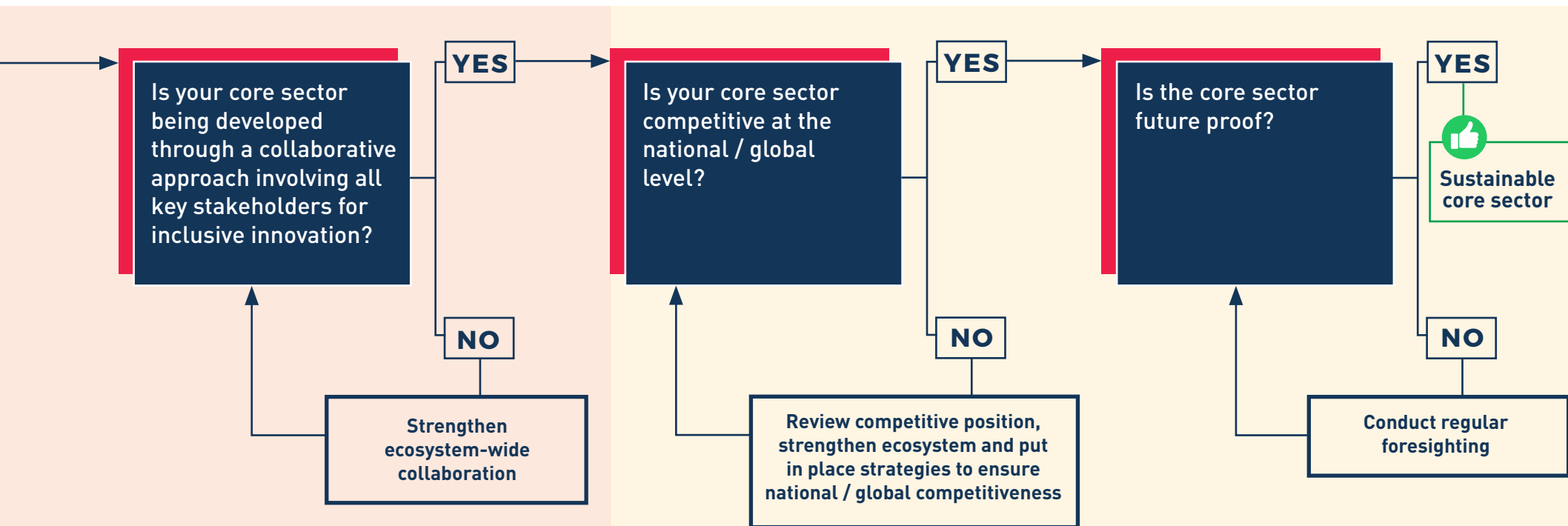
PRIORITISE

Identify niche areas within the key economic sectors to build positions of global leadership based on the emerging and frontier S&T drivers

Step 3

SYSTEMATISE

Define a holistic approach (8i STI ecosystem enablers) to ensure systematic development that deepens the impact of S&T drivers on socio-economic development



Step 4 & 5

COLLABORATE

Foster an ecosystem-wide collaboration with key players for the deployment of high-impact projects at identified localities to create multiplier effect for shared prosperity.

INCLUSIVE

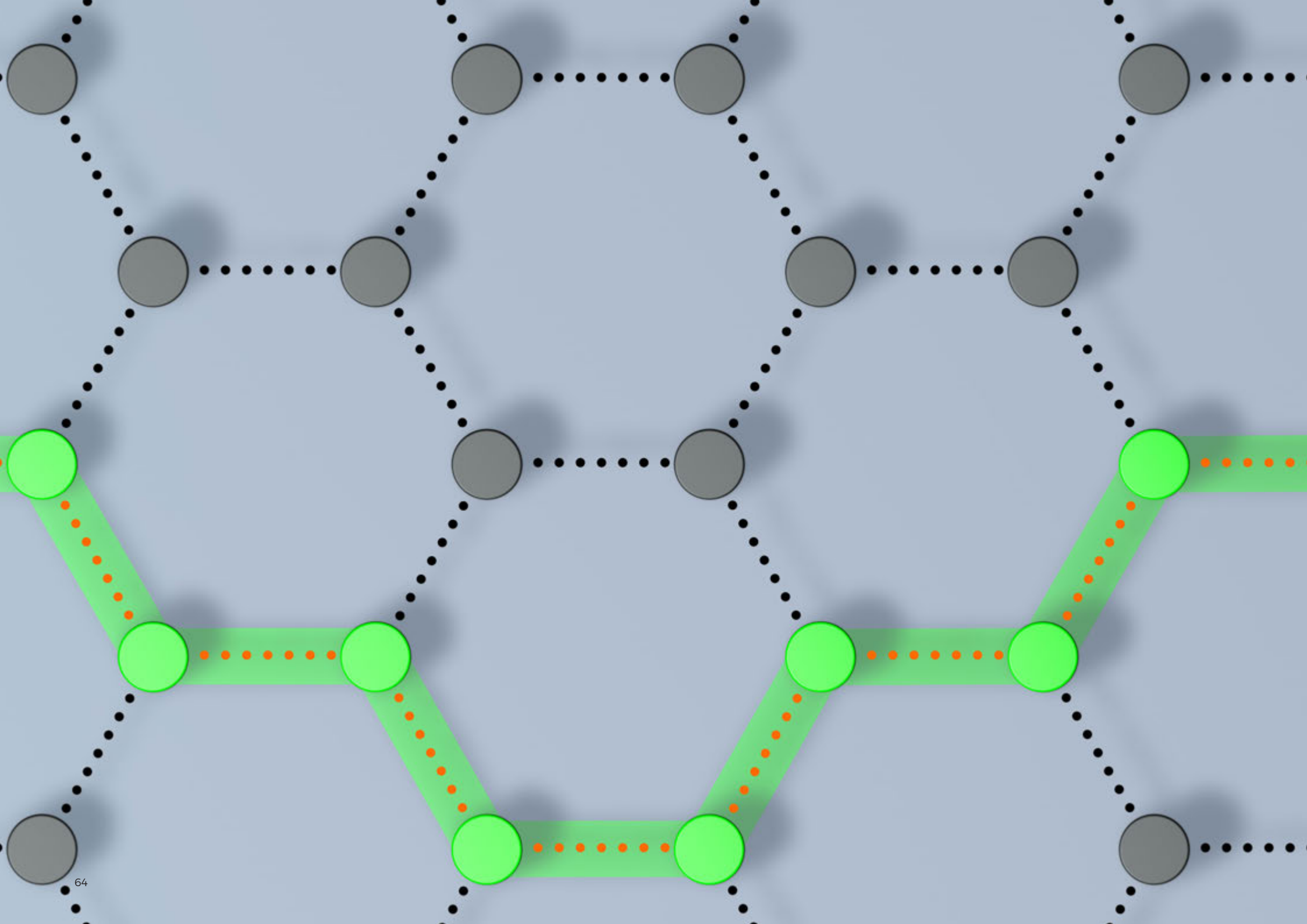
Initiate locality-specific STIE ecosystems to inclusively harness resources and talent to enhance return on value and improve the quality of life of the *rakyat*.

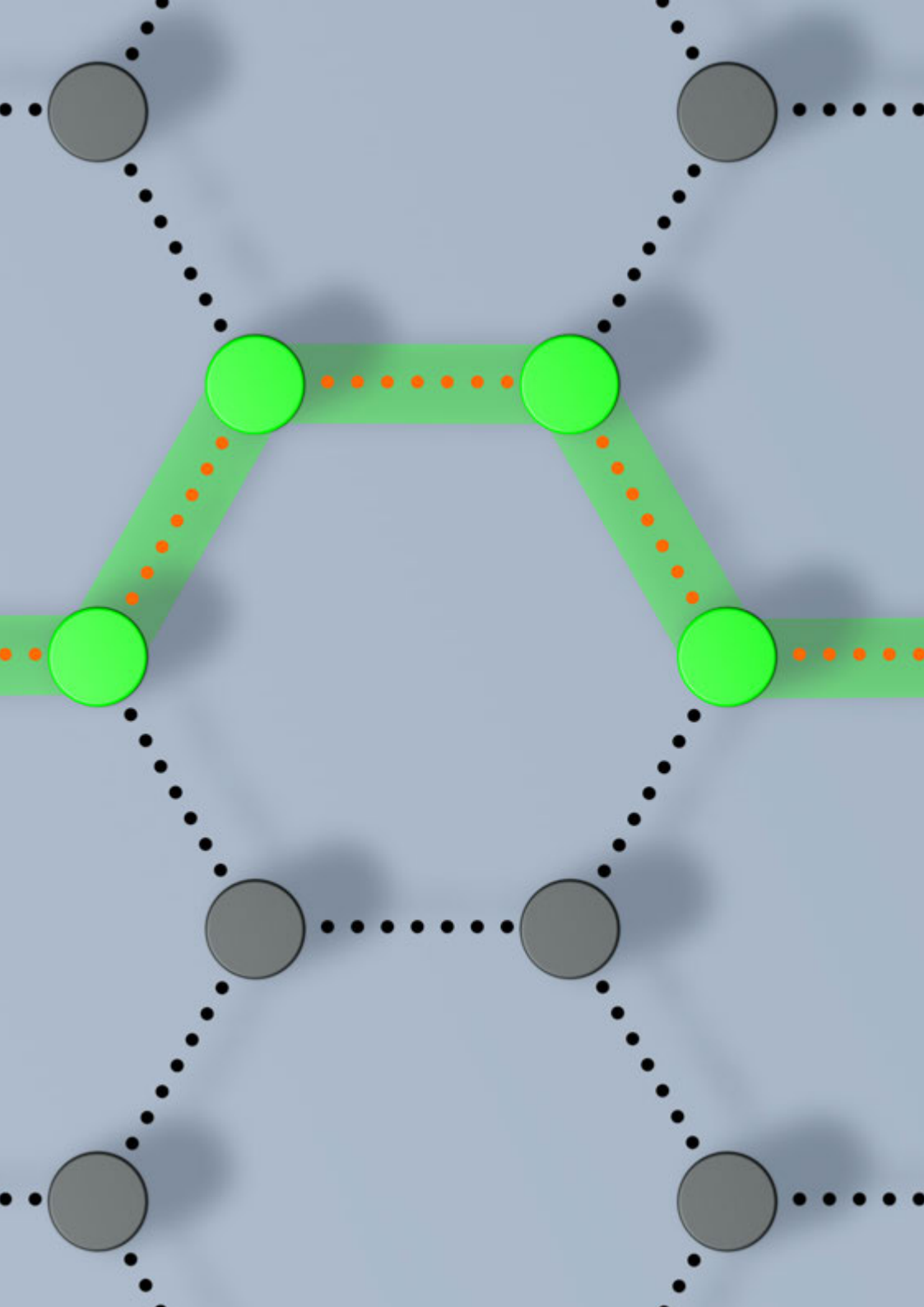
Step 6

FUTURE-PROOF

Conduct regular foresighting to ensure the STIE ecosystem is adapting to change and is able to mitigate risks associated with uncertainties and volatilities.

Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020





Potential High-Impact Initiative: Becoming A Pace-setter in the Global Halal Economy

A game-changer for Malaysia would be to position the Malaysian Halal ecosystem as a producer of premium products and services for the global market. This would require a strong collaborative platform constituted by Halal scientists, regulators and other key stakeholders for the holistic development of a robust Halal supply chain. An agile and sound Halal ecosystem underpinned by the 10-10 MySTIE Framework will translate into several multiplier effects on the socio-economic drivers of the country.

An STIE driven Halal ecosystem will not only meet domestic market needs but will extend its footprint globally. For example, if the Malaysian Halal Certification establishes and incorporates global environmental standards, it will build competitive advantage.

* **Halal Science** is a scientific research pursuit aimed at supporting, expanding and sustaining the Halal industry globally. This encompasses analysis and the use of new technology to create innovative products and services with great impact to society and environment.

Source: ASM, 2019

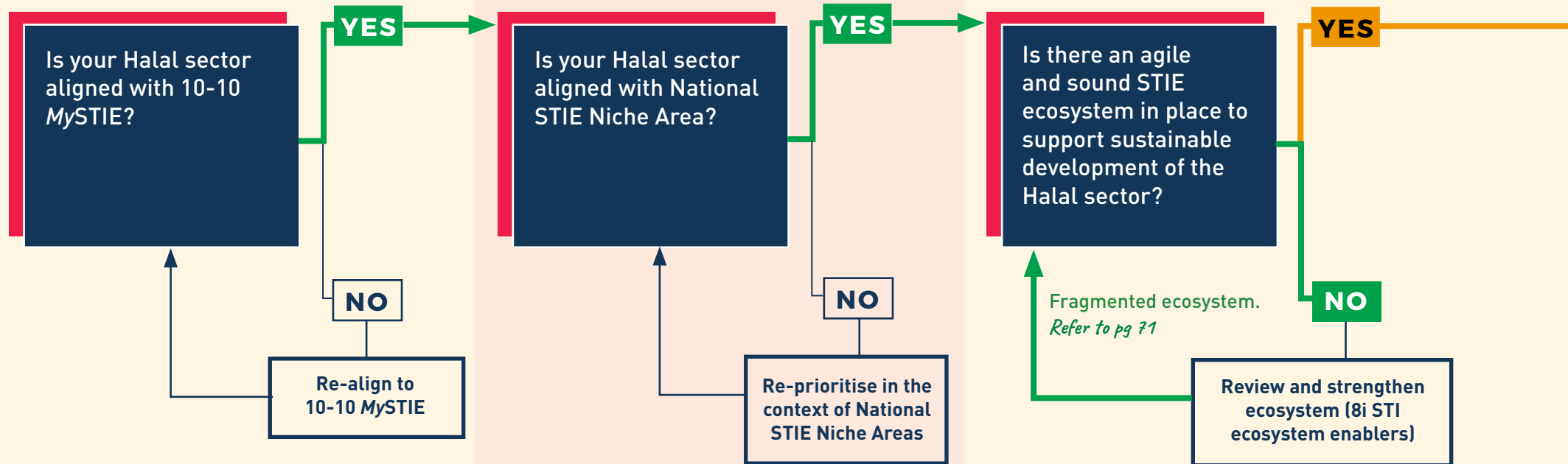
10-10 MySTIE Process Flow for Nurturing Vibrant & Agile STIE Ecosystems for Halal Economy:

Current Trajectory

An agile and strong Halal ecosystem can generate multiplier effects for all socio-economic drivers.
Refer to page 68-69

Aligned to 20 out of 30 National STIE Niche Areas.
Refer to page 70

10-10 MySTIE underpinning the Halal industry by operationalising *Maqasid al-Syari'ah*.
Refer to page 71



Ecosystem Development Strategies for Halal Economy

Step 1

FOCUS

Identify key Halal subsectors and their stages of development and incorporate appropriate S&T drivers to raise the quality and ROV of these subsectors.

Step 2

PRIORITISE

Identify niche areas within the Halal sector to build positions of global leadership based on the emerging and frontier S&T drivers.

Step 3

SYSTEMATISE

Define a holistic approach (8i STI ecosystem enablers) to ensure systematic development that deepens the impact of S&T drivers on the Halal sector.

If we ramp up our Halal Industry by underpinning it with 10-10 MySTIE, Malaysia has the potential to raise its global market share from 2.2% in 2018 (as cited in Halal Industry Master Plan, 2020) to 5% in 2030, estimated at RM1 trillion.

Future Trajectory

Develop a Halal collaborative platform that engages multiple players to harness the various Halal ecosystems across the country.

Refer to page 72-73

Halal STIE ecosystem is sound, robust and agile in meeting HACCP standards and garnering a larger share of the global Halal market.

Refer to page 74

Continuously undertaking foresighting and signposting to invest in the S&T drivers that will ensure that the Malaysian Halal industry becomes a pace-setter leading global development in the 10 socio-economic drivers.



Step 4 & 5

COLLABORATE

Foster ecosystem-wide collaboration with key players for the deployment of high-impact projects at identified localities to create multiplier effect for shared prosperity.

INCLUSIVE

Initiate locality-specific STIE ecosystems to inclusively harness the resources and talent to enhance return on value and improve the quality of life of the *rakyat*.

Step 6

FUTURE-PROOF

Conduct regular foresighting to ensure the STIE ecosystem is adapting to change and is able to mitigate risks associated with uncertainties and volatilities.

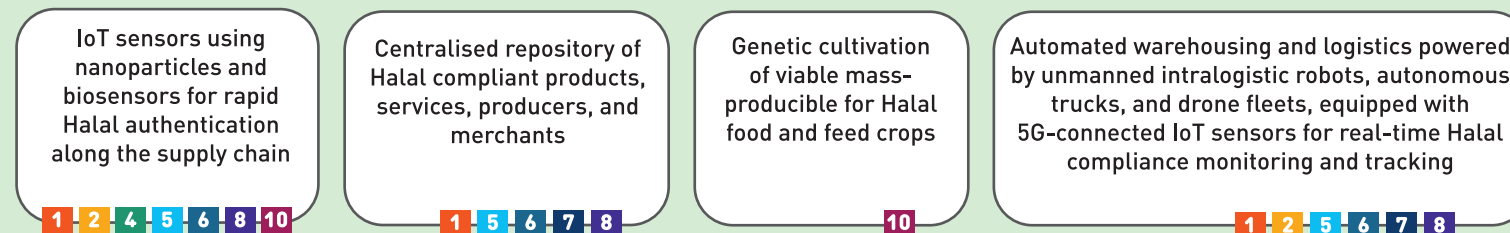
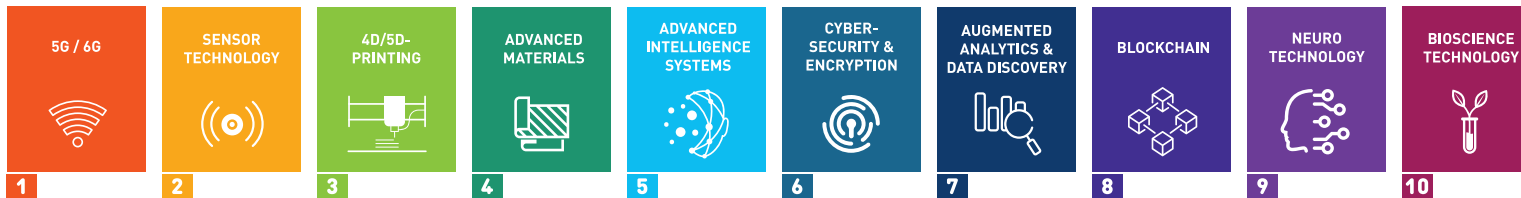
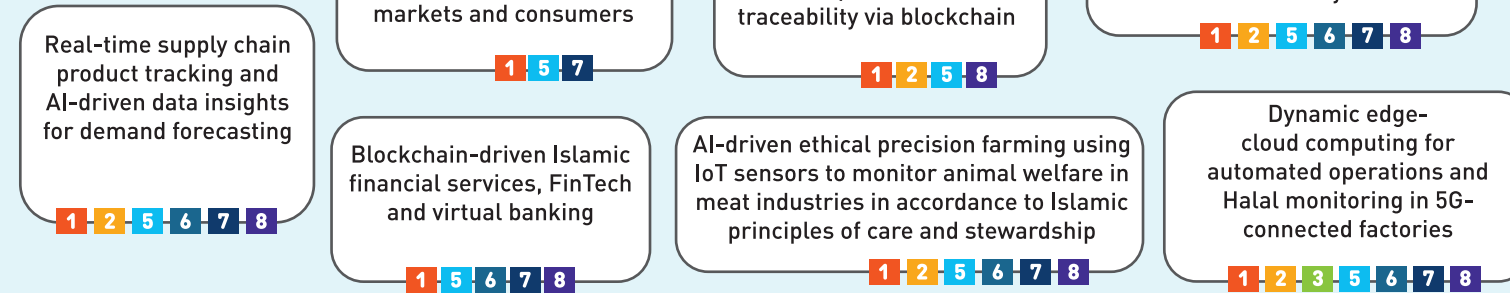
Future trajectory for Halal

Current trajectory for Halal

Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020

Application of the 10-10 MySTIE Framework: An Example for the Halal Supply Chain

Catch-up (Current) Technologies



Leap-frogging Technologies (Next-Generation Research & Application)

How can other sectors leverage on **Halal supply chain innovations**?

Agriculture & Forestry
5G-connected biosensors for real-time monitoring of farms and fisheries for adulteration detection at source
1 4
2 5

Culture, Arts & Tourism
Personalised Halal-friendly holiday packages derived from pattern recognition of online search history and purchase behaviour
1 6
5 7

Medical & Healthcare
+
Business & Financial Services

6 8
Blockchain ledger tracing systems track certification of pharmaceuticals and medical devices manufacture for Halal assured healthcare services

Source: Analytics by Nair, Ahmed, Vaithilingam and the Monash University Malaysia Research team, 2020

Multiplier Effects of a Vibrant Halal Ecosystem on the 10 Socio-economic Drivers



GLOBAL HALAL SUPER CORRIDOR GAME CHANGER FOR MALAYSIA

A strong Halal ecosystem in Malaysia will serve to create several multiplier effects on the socio-economic drivers. The strength in the ecosystem will spawn new sectors, increase revenue streams and enhance Return on Value (ROV) for the *rakyat*.



ENERGY

- Renewable Energy (ethical and clean energy)



BUSINESS & FINANCIAL SERVICES

- Halal Fintech for financial needs of Halal business
- Blockchain for green sukuk
- Traceability of financial transactions – ensure data privacy & protection, prevention of fraud and financial crimes



CULTURE, ARTS & TOURISM

- Islamic Culture & Arts
- Muslim friendly tourism – streaming of digital content of local culture and arts to the global community



MEDICAL & HEALTHCARE

- Halal vaccines, medical therapies and nutraceuticals clinical trials



SMART TECHNOLOGY & SYSTEMS (NEXT -GENERATION ENGINEERING & MANUFACTURING)

- Development of new smart-tech & devices to manage the Halal Industry
- Integrated system for Halal ingredient and product development



SMART CITIES & TRANSPORTATION

- Eco-friendly townships & transportation systems
- Halal supply chain (e.g. logistics, production, export and import) – seamless integration of multiple supply chains across multiple localities and jurisdictions



WATER & FOOD

- Food security and safe food systems
- Traceability of contamination in water and food sources



AGRICULTURE & FORESTRY

- Sustainable agriculture, fishery & forestry industries



EDUCATION

- Global Halal education industry covering STEM & non-STEM programmes / micro-credentials for the Halal economy

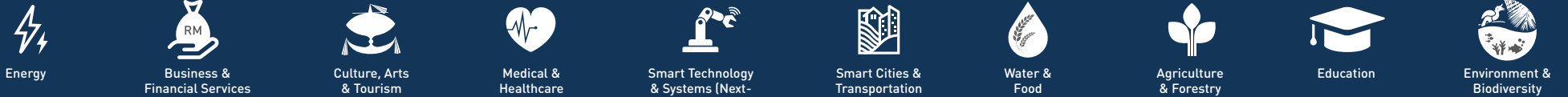


ENVIRONMENT & BIODIVERSITY

- Malaysia as a “Tropical Paradise” through the preservation and conservation of natural habitat in line with Islamic thought

Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020

National STIE Niche Areas for 10 Socio-economic Drivers Mapped to the Halal Economy



All 10 Socio-economic Drivers
20 National STIE Niche Areas } are directly or indirectly related to Halal

The 8i Halal Ecosystem Framework

(10-10 MySTIE operationalising *Maqasid al-Syari'ah*)

01 / INFRASTRUCTURE

High quality and sophisticated physical and natural infrastructure (farms, forests, rivers, oceans and environment) underpinned by a sound STI strategy that support the growth and development of the Halal ecosystem in a sustainable way.

02 / INFOSTRUCTURE

Digital infrastructure that provide seamless integration of multiple value chains within and across the Halal ecosystem - these systems provide seamless flow of information for strategic decision-making, market intelligence and goods & services.

03 / INTELLECTUAL CAPITAL

Talent stock in the Halal ecosystem - this covers general, specialized, technical, entrepreneurial and leadership skills to transform the Halal value chain (upstream to downstream) into a knowledge intensive global supply network.

04 / INTEGRITY

Governance systems to manage the ecosystem efficiently (good traceability and tracking of information, goods and services) - continuous improvement of the system to raise the Return on Value (ROV) for all stakeholders.

Drivers of Halal Ecosystem



A resilient Halal supply chain supported by a robust holistic ecosystem.

05 / INCENTIVES

Fiscal and non-fiscal incentives to encourage R&D, adoption of new technology, innovation, commercialisation of local technology and market expansion strategy, including globalisation of local technology and knowledge – driving process improvement and new product development.

06 / INSTITUTIONS

Quality of the institutions of governance (government agencies, regulatory, standard bodies, industry associations, community organisation, institutions of learning / research institutes) that support the systematic development of the Halal ecosystem – continuous institutional innovation and development. Continuous foresighting of the STI will ensure the resilience and agility of the ecosystem.

07 / INTERACTION

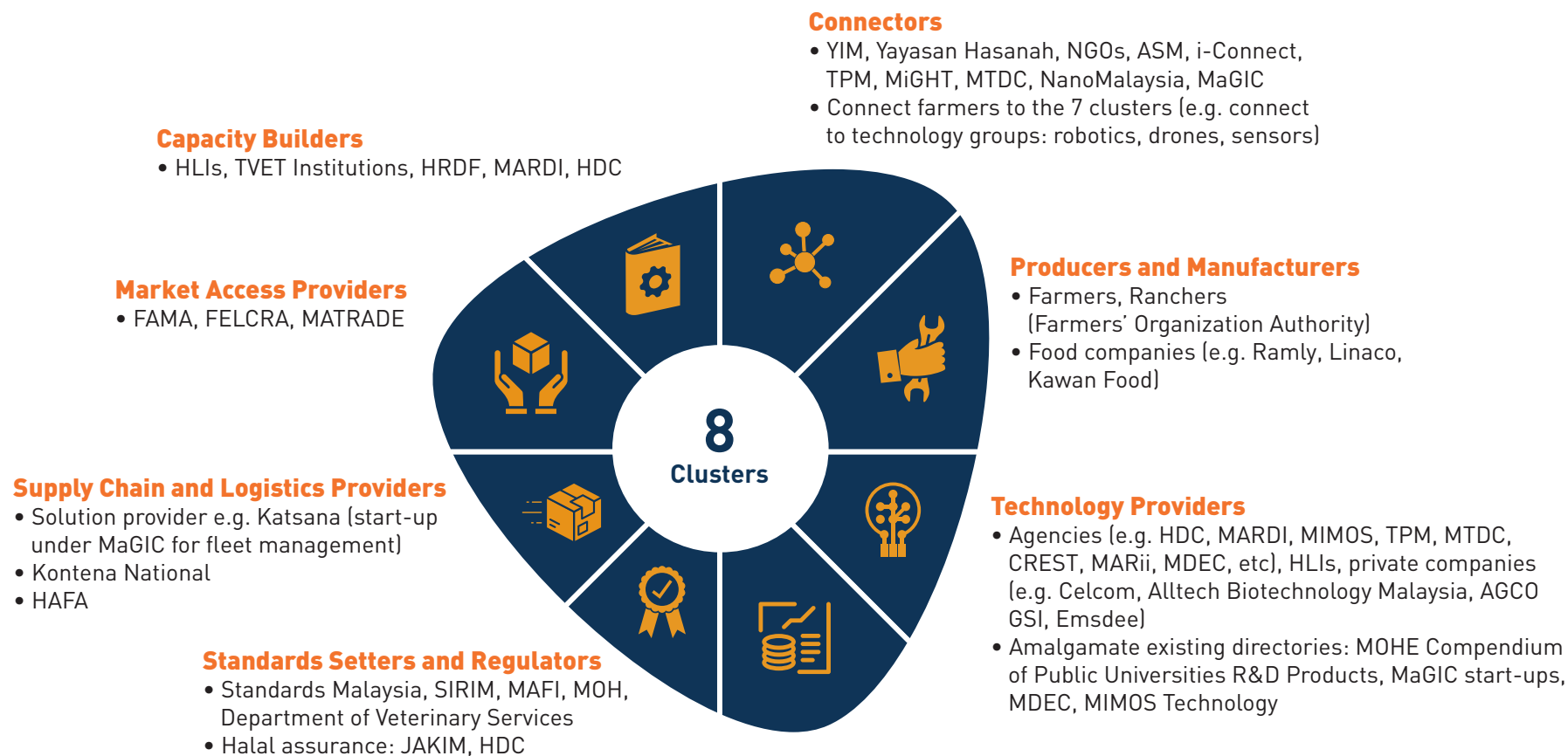
Strong collaboration and partnership among Halal stakeholders to ensure continuous transformation and development to improve productivity, efficiency and global competitiveness.

08 / INTERNATIONALISATION

Depth and breadth of engagement with global Halal-related knowledge & innovation networks, institutions of governance & standard boards and global value chains – expansion of global innovation footprints and market reach (adhere to OECD food, safety and environmental standards).

Source: Analytics by Nair, Ahmed, Vaithilingam and team from Monash University Malaysia, 2020

Collaborative Platform for Halal Industry

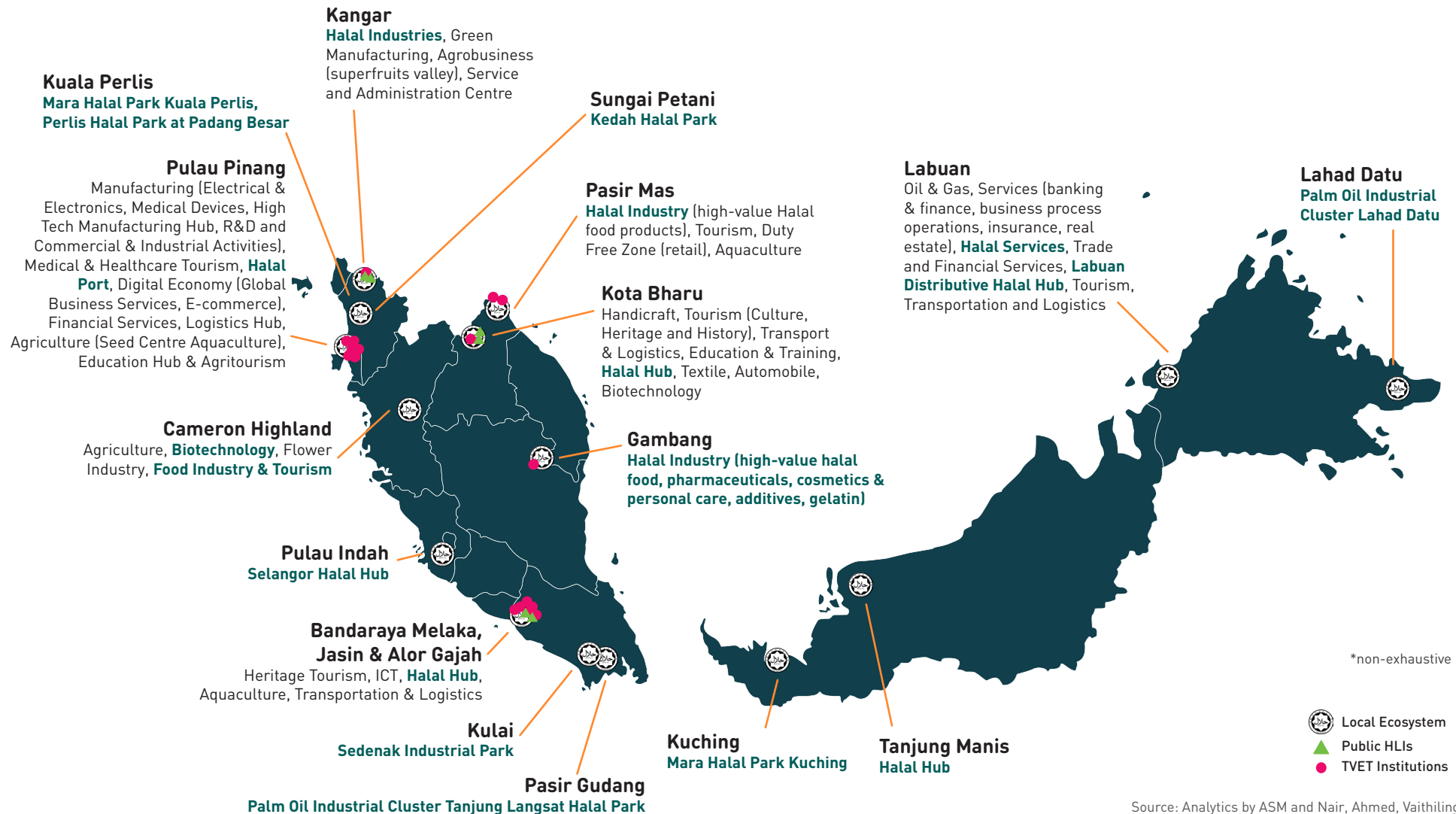


YIM (Yayasan Inovasi Malaysia); TPM (Technology Park Malaysia); MIGHT (Malaysian Industry-Government Group for High Technology); MTDC (Malaysian Technology Development Corporation); MaGIC (Malaysian Global Innovation & Creativity Centre); HDC (Halal Development Corporation Berhad); MARDI (Malaysian Agricultural Research & Development Institute); CREST (Collaborative Research in Engineering, Science & Technology); MARii (Malaysia Automotive Robotics & IoT Institute); MDEC (Malaysia Digital Economy Corporation); MOHE (Ministry of Higher Education); MAVCAP (Malaysia Venture Capital Management Berhad); MDV (Malaysia Debt Ventures); MIDA (Malaysian Investment Development Authority); MAFI (Ministry of Agriculture & Food Industries); MOH (Ministry of Health); JAKIM (Department of Islamic Development Malaysia); FAMA (Federal Agricultural Marketing Authority); FELCRA (Federal Land Consolidation & Rehabilitation Authority); MATRADE (Malaysia External Trade Development); HLIs (Higher Learning Institutions); HRDF (Human Resources Development Fund); TVET (Technical & Vocational Education and Training)

*non-exhaustive
































Source: ASM Analytics, 2020; Adapted from European Commission, 2014

Key Halal Related Socio-economic Activities at Localities Across Malaysia



Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020

Global Benchmarking on Halal Ecosystem

GOVERNANCE	Centralised Halal governance at national level	   
	Non-centralised Halal governance either state-based or coordinated by NGOs	    
CERTIFICATION	Centralised Halal certification	   
	Non-centralised Halal certification	    
	Internationally recognised certification	 
HALAL SCIENCE	Top-down government initiative, infrastructure support and funding	
	Consortium for Halal Science established	 
	Research activities confined to institutional level	 
INDUSTRY	Positive collaboration with Halal Scientist and key stakeholders for product development and innovation	
	Industry initiatives to develop Halal markets	    

Note:



Malaysia



Thailand



Indonesia



Japan



South Korea



United Arab Emirates



Brazil



New Zealand



Australia

Source: ASM, 2019

Bridging the Chasm Towards Impact Creation

Linking the gaps through:

- Forged trust between all stakeholders
- Effective governance systems, structures & processes
- Big picture synthesis of challenges & solutions at national level
- Collaborative data sharing followed with integrative & transformative synthesis

**Generators of
Knowledge**

10|10 **MySTIE**
FRAMEWORK



**Users of
Knowledge**

Collaborative Network

10-10 MySTIE Framework and holistic 8i STI ecosystem enablers together with neutral-entity intermediaries to bridge the chasm in translating the needs and goals of high impact initiatives

Source: ASM Analytics, 2020

Malaysia recognises the need in embracing STI to weather unprecedented crises while becoming a knowledge-based society. A wholesome fertile ecosystem would encourage knowledge to move across innovation actors to reach end-users. An effective knowledge transfer between generators and users will create an impact to the economy and society.

Current STI ecosystems in Malaysia face challenges in bridging the chasm between generators of knowledge and users of knowledge. Generators of knowledge are individuals or entities who are involved in the creation of new ideas, knowledge, products, services or initiatives with set goals. On the other hand, users of knowledge are the recipients of those creations who put them into practice.

This widening chasm exists due to lack of trust between stakeholders within the ecosystems which mainly stems from the different modes of communication that hinder effective delivery of targeted goals. Another issue that contributes to this chasm is the absence of “big picture synthesis”, which is required to inter-lace strategic thinking to solve national issues and challenges. This is because most stakeholders operate in silos within their own specialisation and are trained to analyse and not to synthesise.

To address these issues, a national-level framework is needed to bring people together and synergise the planning. The 10-10 MySTIE Framework acts as an intermediary in translating knowledge to solutions for national-level challenges. This Framework must be concurrently applied with an ecosystem approach (8i STI ecosystem enablers) to ensure maximum impact is achieved. Along with this Framework, neutral-entity intermediaries are needed to function as connectors between parties within the quadruple helix to achieve common goals. Some existing connectors in the Malaysian STI landscape are Collaborative Research in Engineering, Science and Technology Centre (CREST) and i-Connect by the Academy of Sciences Malaysia.

Preparing Malaysia Today for Tomorrow

State of
Development

Developed
Country

10/10 | **MySTIE**
FRAMEWORK

Malaysia Today

2020 Malaysia is a nation still grappling with widening socio-economic disparities across different social groups, ethnicities and regional localities, even after 63 years of independence. Despite having a RM1.42 trillion economy, Malaysia has yet to fully realise its economic growth potential. The economy is still dependent on low-skilled labour and is experiencing shortages in key skills relevant to a knowledge-intensive economy. The economy is caught in the “middle-income trap” and is vulnerable to global economic uncertainties. This could undermine environmental sustainability and the social fabric of the nation.

Caught in the
“Middle-Income Trap”

2020

Malaysia in 2030

2030 Malaysia powered by a vibrant and state-of-the-art STIE ecosystem will ensure inclusive socio-economic development and sustainable management of natural resources. The economy will be led by several Malaysian pace-setter institutions and industries that have strong knowledge networks and supply chains to build global competitive advantage. These are envisaged to generate positive spillover impacts on the quality of life and wealth of the nation. The economy will not leave any community behind as it transitions to become a **sustainable, progressive, prosperous and harmonious developed nation.**

2030

Source: Analytics by ASM and Nair, Ahmed, Vaithilingam and Monash University Malaysia Research Team, 2020.

References

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