MOSTI

Ministry of Science, Technology & Innovation

NATIONAL STRATEGIC ICT ROADMAP

TABLE OF CONTENTS

FOREWORD BY SECRETARY GENERAL OF MOSTI

Within the last two decades, Malaysia's focus in the field of the Information and Communications Technology (ICT) has been in the area of automation or computerisation of systems and the services i.e. using ICT as an enabler.

Recognising that ICT, in itself, can also play a role in economic transformation Malaysia acknowledges the need to identify niche areas of technology to focus on and excel in i.e. developing ICT as a sector.

The idea of developing a Strategic ICT Roadmap for Malaysia was mooted by the National Information Technology Council (NITC) and re-iterated in the Ninth Malaysia Plan. The *National Strategic ICT Roadmap* has identified three Technology Focus Areas that could advance Malaysia economically and technologically over the next ten years and beyond, and could help fulfil the tenets of Vision 2020: (i) Wireless Sensor Networks, (ii) Predictive Analytics; and (iii) 3-Dimensional Internet.

These technologies were evaluated based on their capability to leverage on the strengths and uniqueness of Malaysia vis-à-vis other economies globally, emerging technologies and global societal issues, as well as the current ICT plans that the country has produced in recent years.

As a start, five areas of greatest impact were identified namely smart agriculture, logistic systems, financial services, halal and manufacturing sectors.

To create a robust and sustainable ICT sector around the three identified focus areas, Malaysia needs a complete ecosystem which would translate into actionable programs in the areas of education, R&D and commercialisation, infrastructure and industry development, as well as attracting investments.

An effective, coordinated feedback and control mechanism is an equally critical building block in the ecosystem for the three Technology Focus Areas. Hence, the Roadmap is aided by a set of specific, easily recognisable signposts to indicate significant events that will influence the possibility for an envisioned future occurring. These actionable signposts are important stepping stones in enhancing the likelihood of raising the country's regional presence and global competitiveness in key economic sectors.

The *National Strategic ICT Roadmap* will provide a framework to enhance the productivity of key sectors of the economy and promote the development of new ICT-based and knowledge-intensive industries.

Y.Bhg. Dato' Abdul Hanan bin Alang Endut
Secretary General of MOSTI

INTRODUCTION : ROLE OF ICT IN NATIONAL DEVELOPMENT

Over the last two decades, three forces have shaped the global socio-economic landscape – forces of globalisation, liberalisation and digitisation. It is widely accepted that the latter force, digitisation of the global economy has increased the speed of globalisation and liberalisation. While the information revolution has resulted in several positive socio-economic impacts to mankind, the revolution has also intensified competition for resources globally. Traditional economic models and strategies are unable to meet the needs of people in a rapidly changing global environment. To keep pace with the information of the global economy, most countries are moving fast to transform into knowledge-intensive economies.

The general consensuses are that ICT is a key catalyst for emergence of the new economy, both as a sector and enabler for enhancing efficiency and productivity. The Malaysian Government has been proactive in promoting and developing ICT as a sector and enabler through various key strategic policies, programmes and plans. Supporting government policies, strong economic fundamentals, strategic location and a conducive living environment provide an excellent platform for Malaysia to leap-frog to a knowledge-based economy.

The Malaysian economy has undergone structural changes from agriculture and mining-based economy to manufacturing-based economy and is currently in the stage of a knowledge-based economy. Current plans such as the Ninth Malaysia Plan and Third Industrial Master Plan envisages that as Malaysia moves into the knowledge-based economy, the service sector will play a dominant role in the wealth creation of the nation. ICT is expected to play a key role in this wealth accumulation, both in terms of a sector and enabler.

For this reason, the *National Strategic ICT Roadmap* will provide a framework to enhance the productivity of key sectors of the economy and promote the development of new ICT-based and knowledge-intensive industries.

RATIONALE FOR THE NATIONAL STRATEGIC ICT ROADMAP
Challenges Ahead for an ICT-Driven Economy

As the march towards a knowledge society intensifies globally, there is an increasing recognition that technological development and innovations in ICT have increased the speed and intensity of globalisation and liberalisation; and, these changes have had significant economic and social impact on nations and communities across the globe. Countries that are embracing new technology and creating a vibrant innovative culture and ethos are in a better position to sustain socio-economic development in the new economy. While the information revolution provides opportunities for Malaysia to leapfrog to higher level of competitiveness and socio-economic development, there are a number of challenges that hinder Malaysia's progress towards a knowledge-based economy.

Convergence of technology in the last decade has posed challenges in managing ICT, which is pervasive across the economy. In Malaysia, there are a number of agencies, both public and private that manage ICT. There is an ambitious plan to increase the number of ICT workers in the country, enhance the ICT skill level of the population and improve the ICT infrastructure. The general ICT infrastructure access and quality have improved over the last five years. However, Malaysia still lags most developed countries and selected regional economies such as Singapore and South Korea. Malaysia also lags in the quality of ICT training, number of IT and skilled workers. This impedes Malaysia's innovative capacity and overall competitiveness.

The *National Strategic ICT Roadmap* identifies a set of development goals that will position Malaysia as a global leader in selected ICT focus areas and put Malaysia on a trajectory towards a knowledge-driven economy. The ICT Roadmap proposes that Malaysia adopt a focused approach in a few key ICT technology areas where Malaysia has the competency and capacity to lead globally. These key technology focus areas will be the 'trail-blazers' for Malaysia's transition towards a knowledge-based economy.
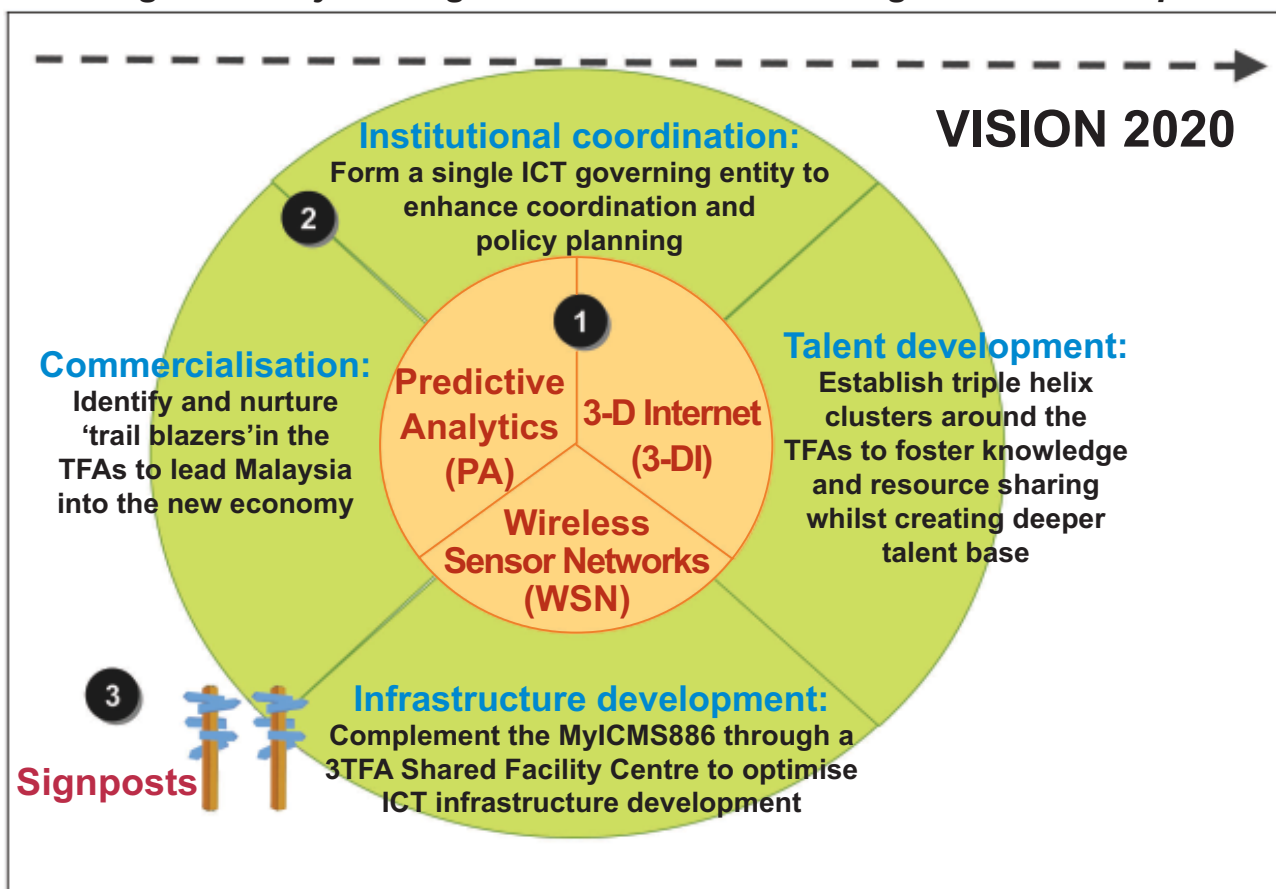
STRATEGIES OF THE ICT ROADMAP

The key recommendations of the *National Strategic ICT Roadmap* are inputs for the formulation of strategic policies, programmes and plans to intensify Malaysia's transformation to a knowledge-based economy. There are three strategies for Malaysia to pursue:

Strategy 1 : **Be a global leader in 3 Technology Focus Areas (3TFAs)**

Strategy 2 : **Rationalise institutional arrangement and accelerate K-Based Ecosystem**

Strategy 3 : **Use Signposts and Vision Areas to manage opportunities and risks**

Figure 1: Key Strategies of the National Strategic ICT Roadmap

VISION 2020

Institutional coordination: Form a single ICT governing entity to enhance coordination and policy planning

Commercialisation: Identify and nurture 'trail blazers'in the TFAs to lead Malaysia into the new economy

Talent development: Establish triple helix clusters around the TFAs to foster knowledge and resource sharing whilst creating deeper talent base

Predictive Analytics (PA)

3-D Internet (3-DI)

Wireless Sensor Networks (WSN)

Infrastructure development: Complement the MyICMS886 through a 3TFA Shared Facility Centre to optimise ICT infrastructure development

Signposts

Strategy 1: **Be a global leader in 3 Technology Focus Areas (3 TFAs)**

Malaysia has achieved reasonable success in promoting and developing ICT since the Sixth Malaysia Plan (1990-1995) but in order to lead in the next wave of ICT revolution, Malaysia needs to focus on 3 Technology Areas to optimise resources and achieve Vision2020.

(i) **Wireless Sensor Networks** (ICT infrastructure)

A wireless sensor networks (WSN) is the fundamental element to the concept of pervasive or ubiquitous computing, making surroundings "smart" by linking advanced sensors with computer networks, blending the physical with the virtual.

WSN consists of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.

Types of WSN Technology	Areas of application
• Acoustic	• Environmental monitoring
• Biochemical	• Security management
• Electromagnetic	• Industrial safety
• Mechanical	• Health / Medical applications
• Molecular	• Weather prediction
• Optical	• Energy applications
• Radiation	• Logistics monitoring
• Thermal	• Traffic control
	• Precision agriculture

Figure 2: WSN Applications in Intelligent Home

The Shadow robot hand system holding a lightbulb. Touch sensors in the fingertips allow it to apply gentle pressure.

(ii) **Predictive Analytics** (ICT info-structure)
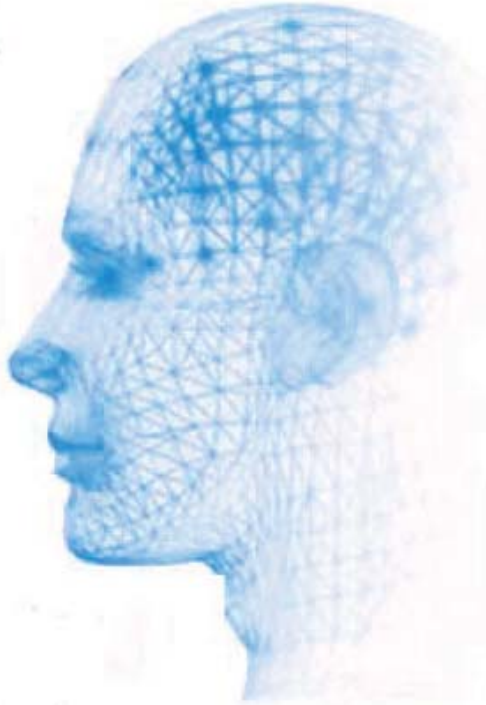
> *Predictive Analytics harnesses technologies and services to make predictions about future events from large amounts of structured and unstructured data using statistics and data mining techniques.*
>
> *Such predictions rarely take the form of absolute statements, and are more likely to be expressed as values that correspond to the odds of a particular event or behaviour taking place in the future.*

| Types of Technology	Areas of application
• Bio-medical • Weather and disaster prediction • Speech recognition and language translation • Prediction markets • Communications network pattern analysis	• Banking services • Financial forecasts • Consumer and retail research • Healthcare diagnostic • Logistics management • Weather and environmental prediction

(iii)   **3-Dimensional Internet** (Multimedia Digital Content)

> *3-D Internet is a set of emerging technologies for creating, distributing and rendering three dimensional scenes and animation in immersive, multi-user, online environments.*

Types of Technology	Areas of application
• Virtual worlds, virtual reality and metaverse • Image rendering & data visualisation • Online game architecture • Multimedia • Simulation • Wearable computing • Advanced data mining & artificially intelligent inference engines	• Education content • Industrial training • Marketing assistance • Exploration • Disaster simulation • Rehearsal of corporate initiatives • Entertainment • Tourism

Whilst building on Malaysia's strengths and uniqueness, the 3 TFAs also mutually reinforce the impact on the country's key engine of growth namely the manufacturing, services and agriculture sectors. Moreover, the proposed TFAs are driven by foreseeable wide market appeal with huge potential for local innovation and export.

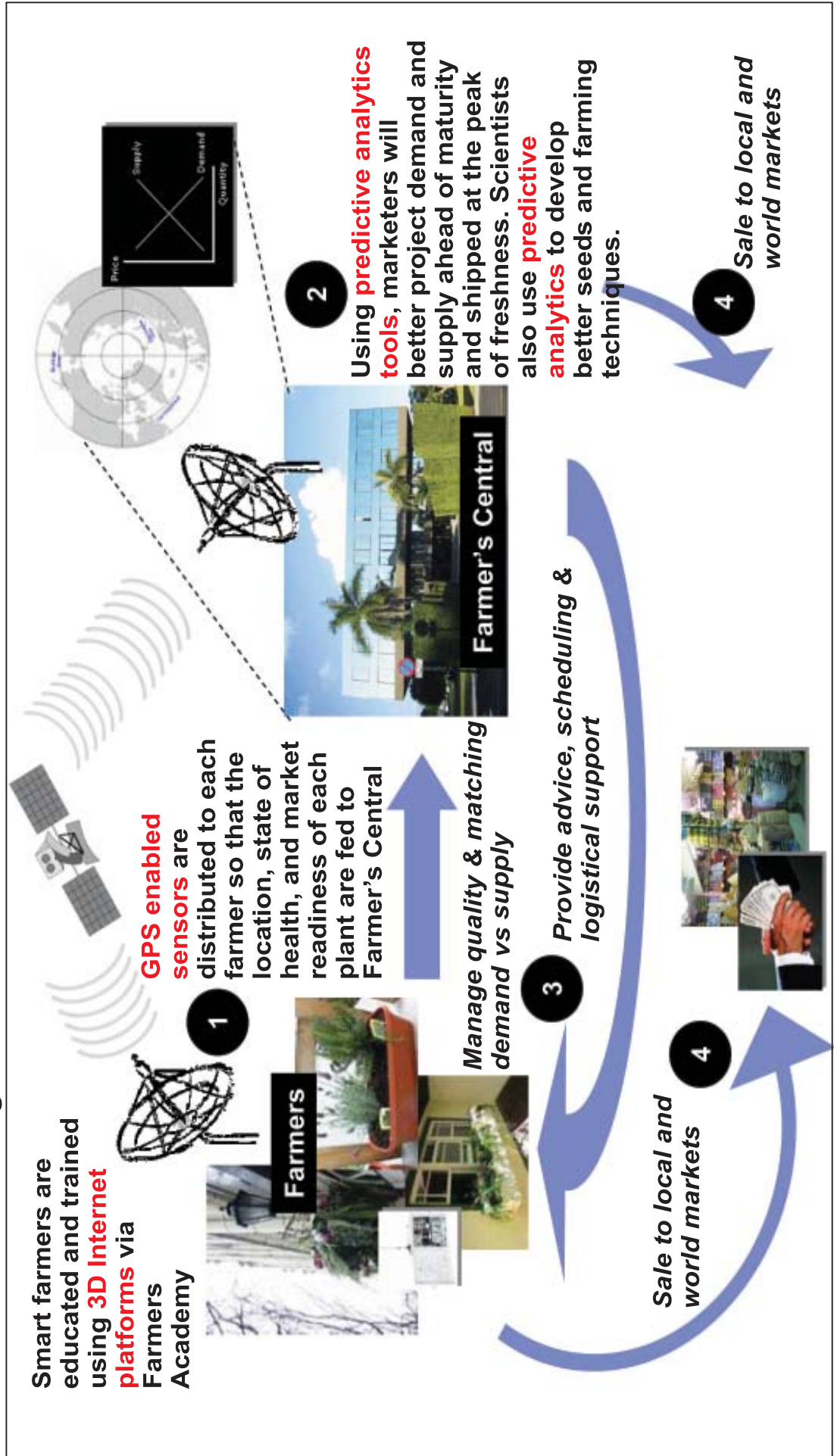*Figure 3: The 3 TFAs impacting Malaysia's key engines of growth*
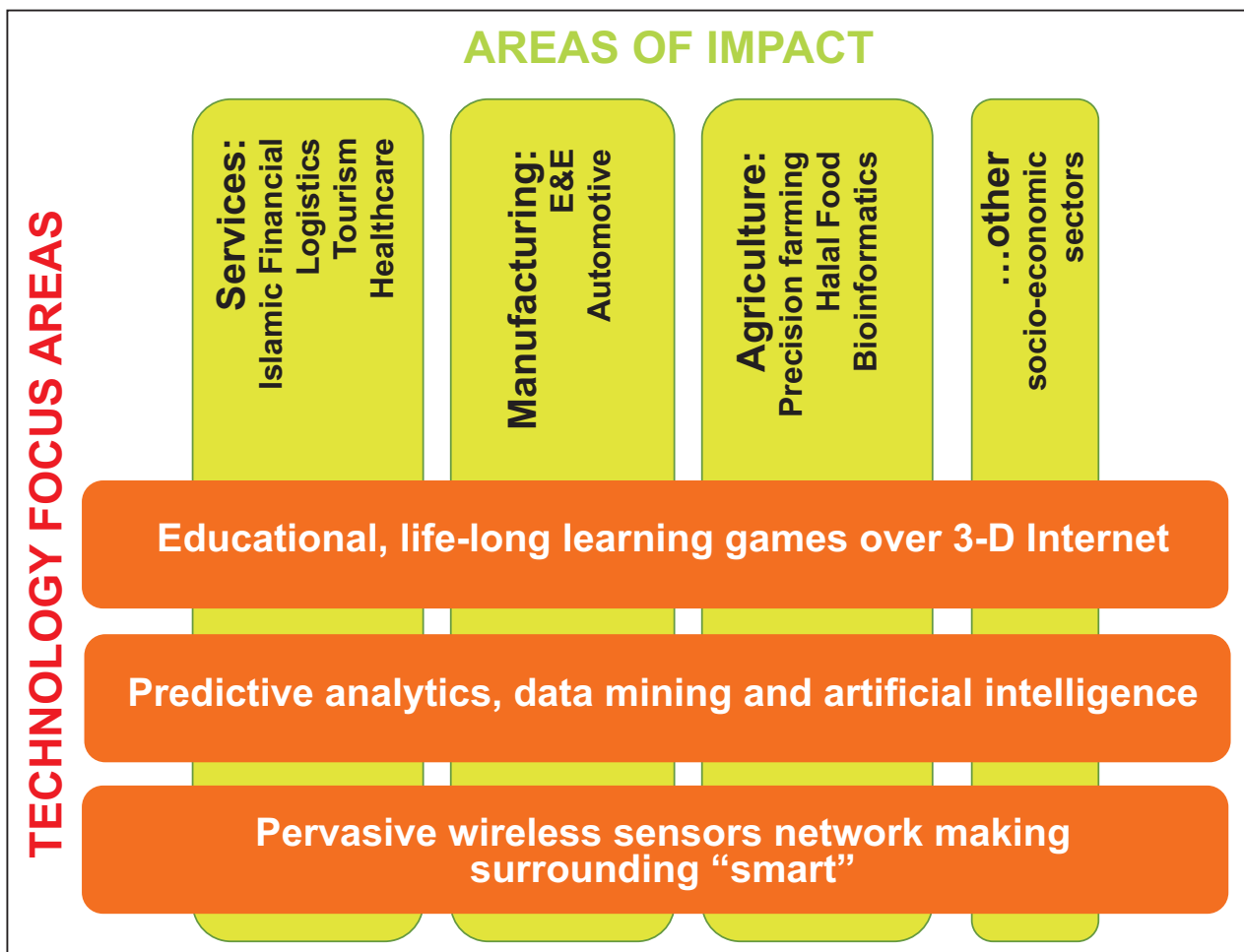
Henceforth, there should be a policy for realignment of the critical resources and investment into these 3 TFAs. Immediately, there is a need to accelerate broadband adoption along with the MyICMS 886 and the National Broadband Plan for a ubiquitous deployment of quality ICT infrastructure to spur the growth of content and applications creation around the 3 TFAs. Subsequently, the *National Strategic ICT Roadmap* and key recommendations have to be cascaded to the various federal and state agencies' ICT plans.

Potential Scenarios

Figure 4 below attempts to visualise the potential scenario where Wireless Sensors Networks, Predictive Analytics and 3-Dimensional Internet technologies play a significant role in the Malaysian farming industry.

**Figure 4: Potential Future Scenario for Smart Farmers**

Smart farmers are educated and trained using **3D Internet platforms** via Farmers Academy

1 **GPS enabled sensors** are distributed to each farmer so that the location, state of health, and market readiness of each plant are fed to Farmer's Central

Manage quality & matching demand vs supply

Farmers

Farmer's Central

2 Using **predictive analytics tools**, marketers will better project demand and supply ahead of maturity and shipped at the peak of freshness. Scientists also use **predictive analytics** to develop better seeds and farming techniques.

3 *Provide advice, scheduling & logistical support*

4 *Sale to local and world markets*

Sale to local and world markets

Strategy 2: **Rationalise institutional arrangement and accelerate K-Based Ecosystem**

To ensure a robust and sustainable ICT ecosystem, there is a need to rationalise the institutional arrangement and accelerate development of talent, infrastructure, innovation and commercialisation capacity. The ICT Roadmap identifies strategic action plans for creating a conducive Knowledge-based ecosystem required for the TFAs by integrating the proposed technologies into the key sectors of the economy and nurturing global winners.

Institutional Coordination

- Formation of a Pro-tem Committee to manage the *National Strategic ICT Roadmap* until an integrated ICT governing authority is established.
- Development and execution of the ICT Implementation Plan.
- Monitor and update recommended signposts.
- Participation in international bodies and/or events dictating standards in relation to the TFAs.

Figure 5: Action Plans for Institutional Coordination
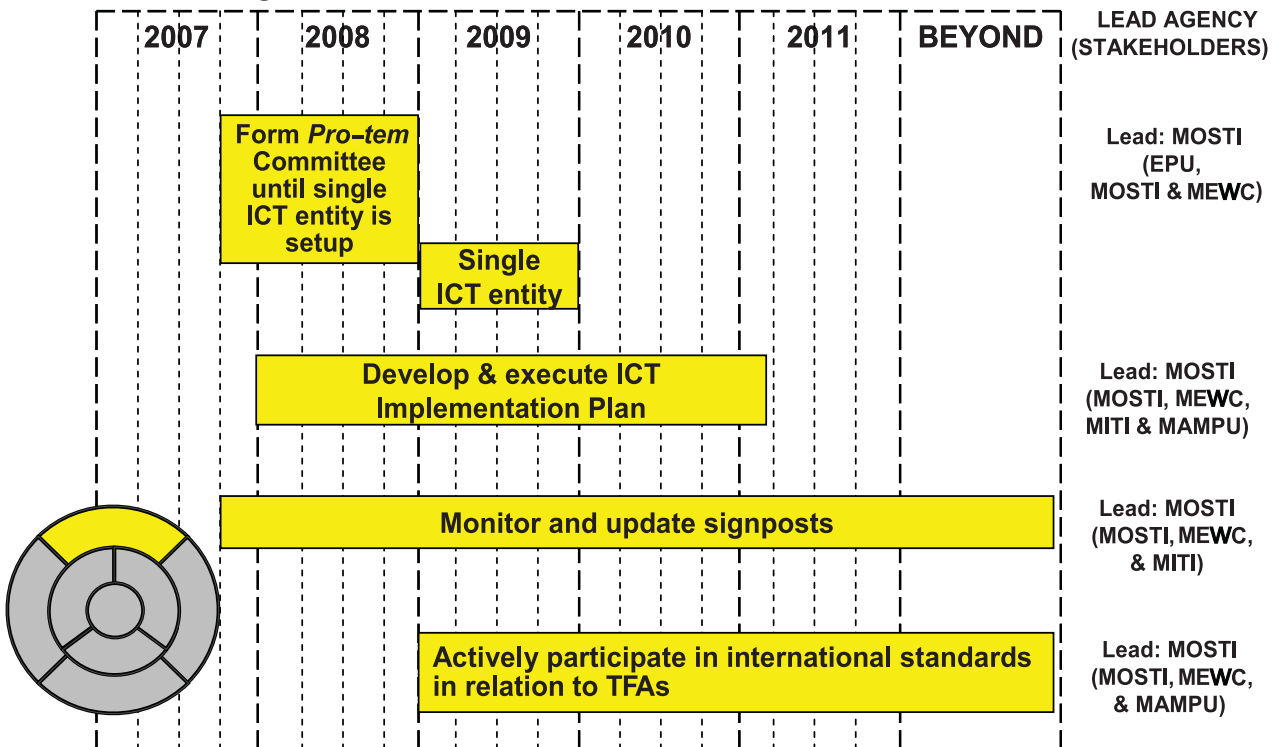
Talent Pool and Capability Development

- Create a "triple helix cluster" around the TFAs.

- Establish Academy for coordinated development of the TFAs among key stakeholders.

- Re-skill / Training of existing talents.

- Import Knowledge Workers to increase talent pool and support immediate development of the TFAs.
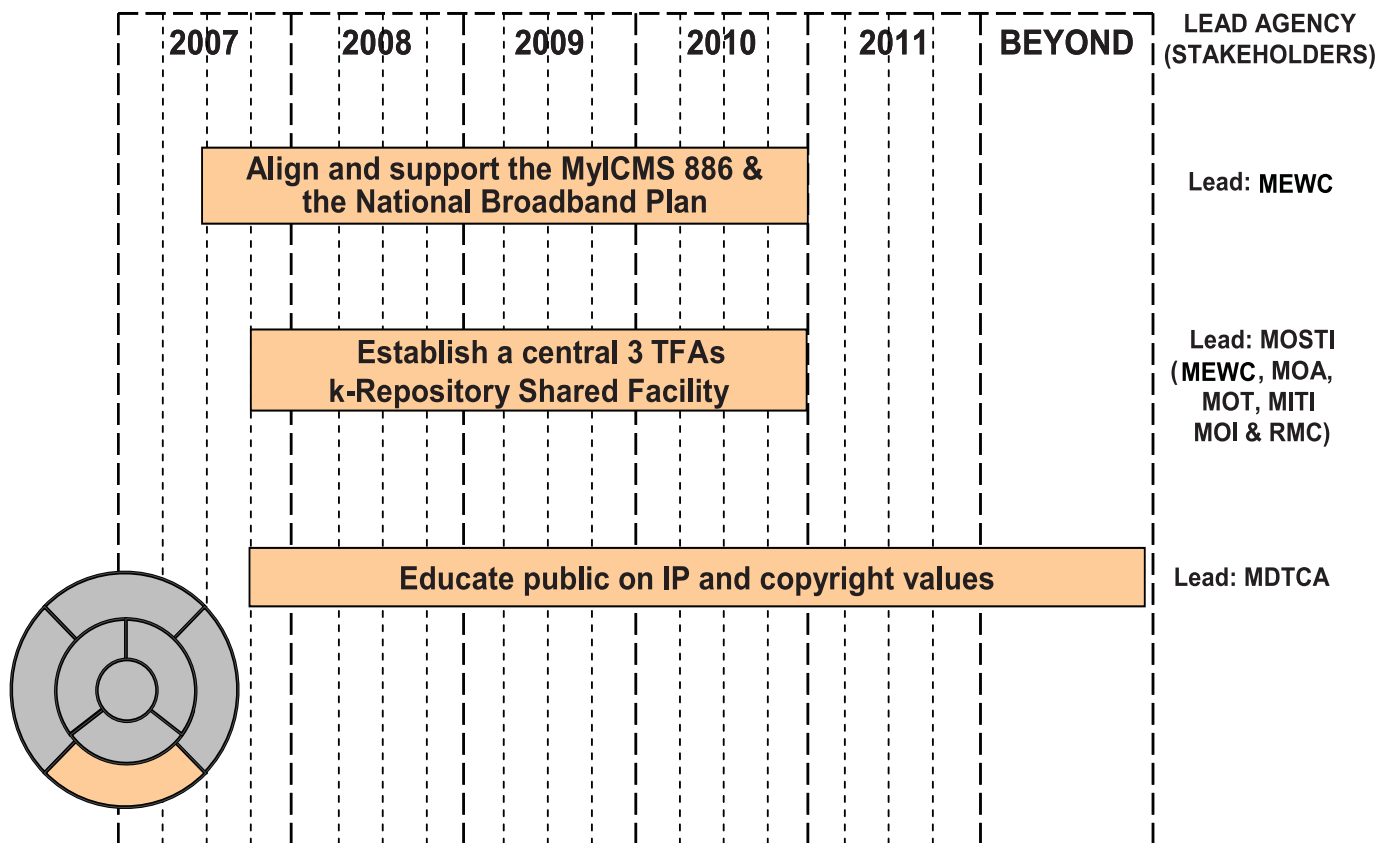
Figure 6: Action Plans for Talent Pool and Capability Development
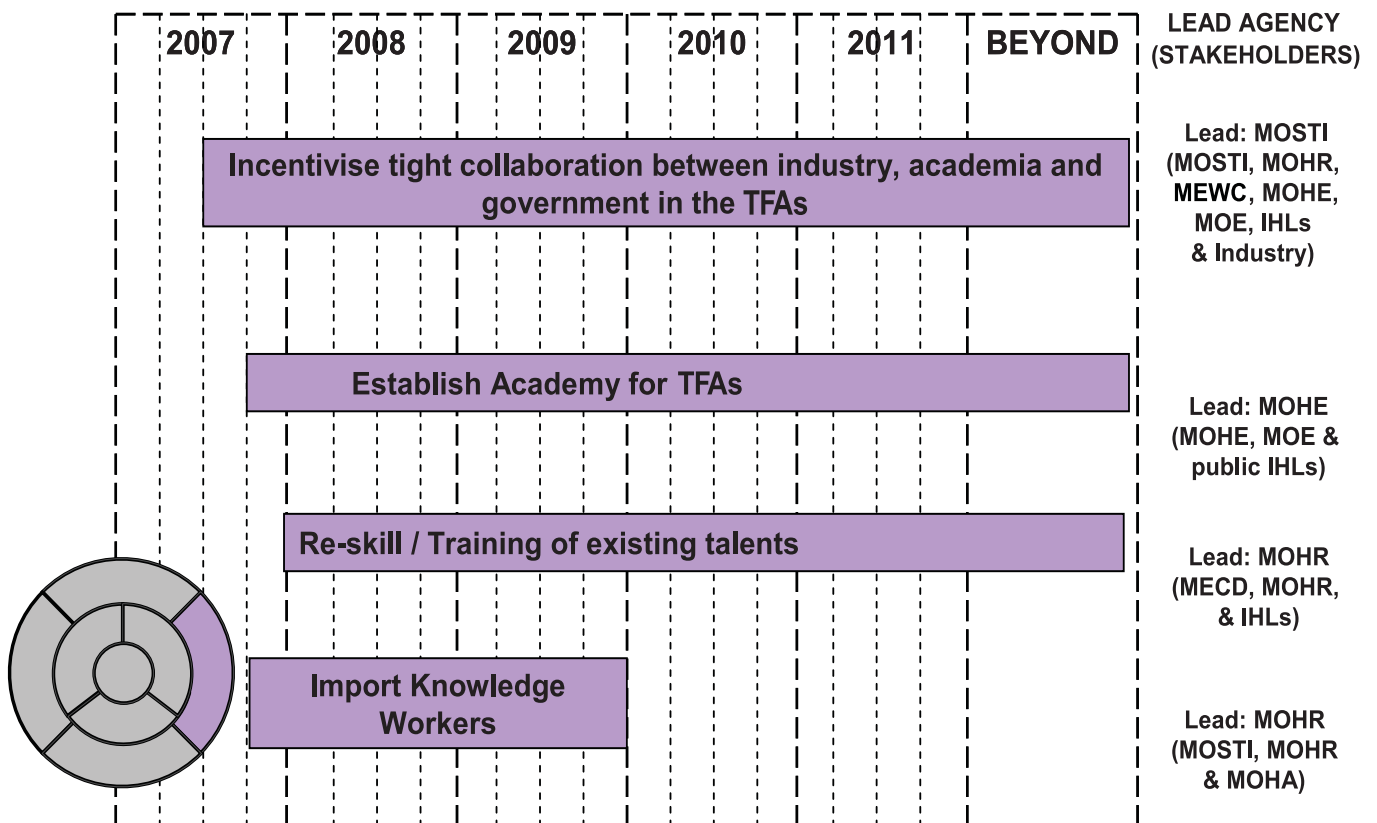
Infrastructure Development

- Align and support the MyICMS 886 and the National Broadband Plan.

- Establish a central 3 TFAs Knowledge Repository Shared Facility.

- Educate public on Intellectual Property (IP) and copyright values.

Figure 7: Action Plans for Infrastructure Development

Commercialisation and Growth Acceleration

- Communicate and educate industry on the *National Strategic ICT Roadmap.*

- Package R&D and commercialisation incentives of the TFAs.

- Facilitate global market penetration for Malaysian companies and match IP with Venture Capitals (VC) and global markets.

- Realign existing business incubations around the TFAs.

Figure 8: Action Plans for Commercialisation and Growth Acceleration
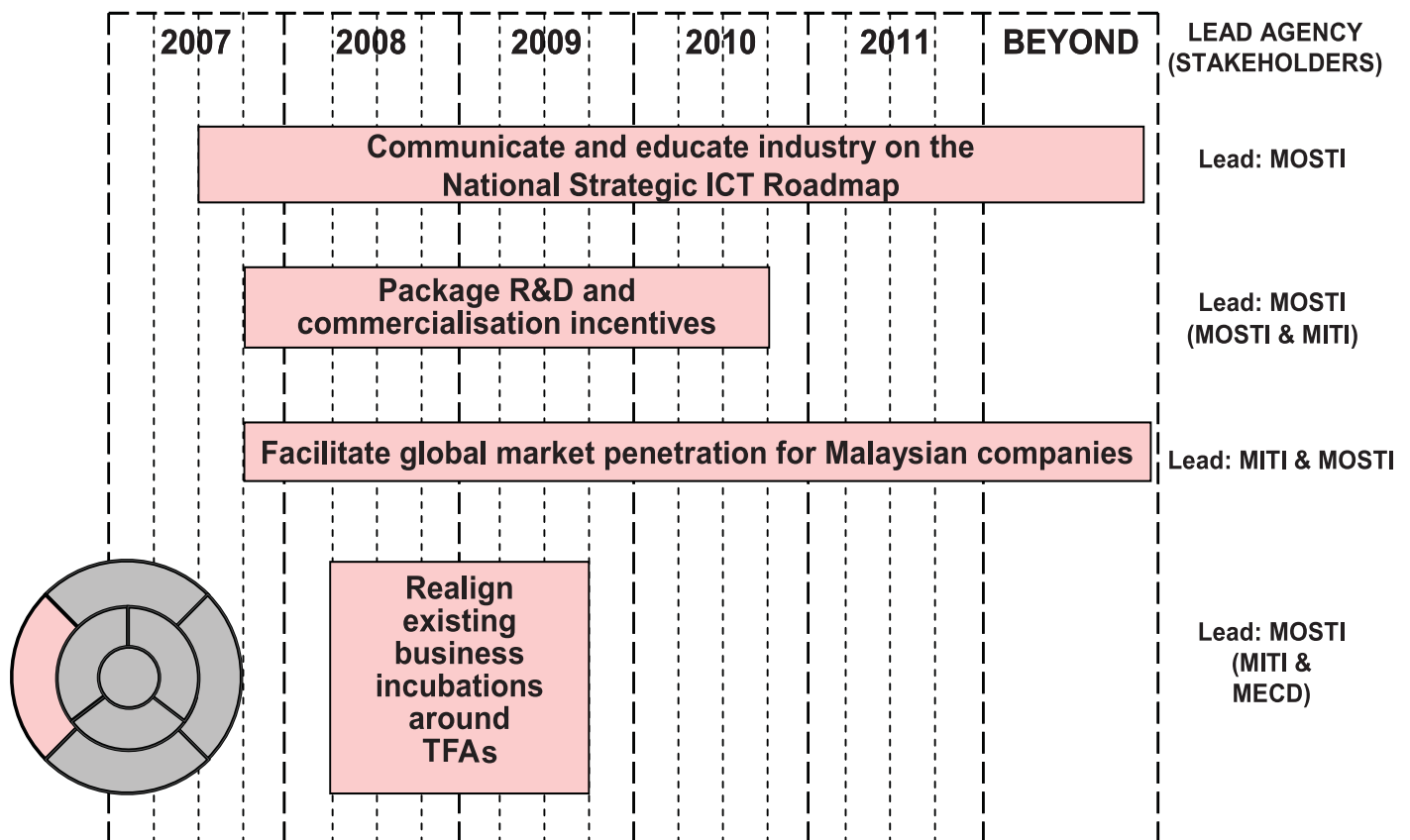
Rationalising the institutional arrangement will enhance coordination and policy planning for Malaysia's ICT sector while accelerating the development of Knowledge-based Economy infrastructure will optimise the ICT network, build the breadth and depth of knowledge workers as well as accelerate commercialisation and growth for global market penetration. A dynamic Knowledge-based Economy infrastructure will strengthen the overall capacity (institutional, talent, infrastructure and commercialisation) to support the 3 TFAs as well as to prepare for market re-construction in the face of globalisation.

It is important to note however, that these industry clusters have to be nurtured within an environment that provides world class infrastructure in an ecosystem that promotes knowledge collaboration such as the Multimedia Super Corridor. The maturity of MSC Malaysia and the timely nationwide expansion will serve as an effective platform for the recommended TFAs to flourish. The synergy between the MSC Malaysia initiative and the proposed TFAs as per the *National Strategic ICT Roadmap* can be seen complementing across the seven Flagship Applications, MSC Malaysia ICT Clusters as well as the MSC Malaysia Cybercities and Cybercentres.

However, the success and sustainability of the TFAs will require the full participation of the private sector. Whilst the Malaysian Government continues to play a major role in creating the right ecosystem by formulating economic diversification policies, promoting new sources of growth and creating a conducive environment for both domestic and foreign investors as propagated by the ITIC recommendation in the *National Strategic ICT Roadmap*, the private sector will continue to be a key driver in the expansion of the TFAs clusters through private funding initiatives and ingenious entrepreneurship skills.

Ultimately, the 3 TFAs would not only provide new employment opportunities and raise productivity; it will also initiate social change by transforming work practices, attitudes and life style. These TFAs will be important 'trail-blazers' for transforming Malaysia into a knowledge-based society.

Strategy 3: **Use Signposts and Vision Areas to manage opportunities and risks**

This *National Strategic ICT Roadmap* will provide a methodology for continuous monitoring with feedback signposts so as to better manage opportunities and risks associated with (disruptive) technology and its rapid impact on market. The technology landscape and key sectors are being transformed by rapid innovation and increased convergence in new technology. This is expected to intensify in the coming years and will continue to impact Malaysia's innovative capacity, competitiveness and socio-economic development. Using IBM's Impact of Future Technology (IoFT) method, the future global technology landscape was examined to develop vision areas around the TFAs in three time periods (near, intermediate and deep future). For each of the vision areas, consideration was given on the implications and applications might be on key sectors of the Malaysian economy.

The back-casting method was used to identify potential events (milestones) along the future timeline that will impact the TFAs and the key sectors of the Malaysian economy. These key signposts are important in increasing the likelihood of raising the regional and global presence and competitiveness of Malaysia in key sectors. A final, much smaller, subset of the seventy-one candidate signposts was selected. The final signposts are those that, if they occur, could have the largest impact on the 3 TFAs and for Malaysia.

Figure 9: The Vision Areas for the TFAs over the time continuum
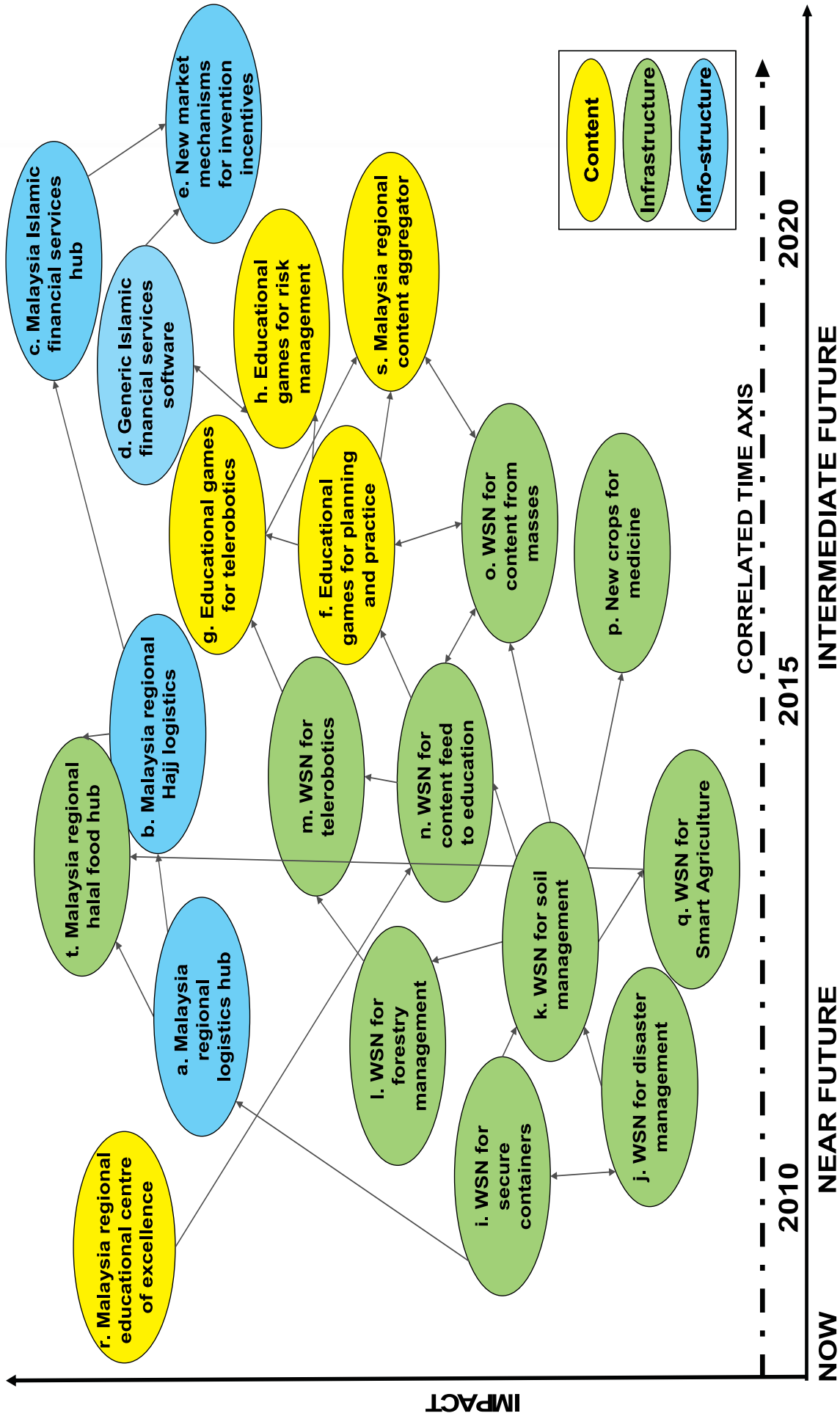
CONCLUSION

The *National Strategic ICT Roadmap* has charted an unprecedented plan by indicating the direction of the ICT industry in Malaysia, and the driver conditions that must be in place to capitalise on the opportunities in the new technology focus. The Roadmap is aided by signposts to detect recognisable future events that indicate significant changes that an envisioned future state will be realised. The seamless establishment of the feedback and control mechanism will be crucial for the accurate and timely update on the status of the recommended signposts.

Whilst leveraging on the wireless sensor networks, predictive analytics and 3-D Internet technologies to advance the economy, it is key for Malaysia to methodically focus on promoting mainly on downstream activities for the global demand. The downstream activities represent the much needed knowledge-based industry and will propel Malaysia further up the economic value chain ensuring the realisation of Vision 2020.

GLOSSARY

3-DI Three-dimensional Internet

E&E Electrical and Electronics

EPU Economic Planning Unit, Malaysia

GPS Global Positioning System

Hajj Arabic transliteration: Hagg, is the Pilgrimage to in Islam. Every able-bodied Muslim who can afford to do so is obliged to make the pilgrimage to Mecca at least once in his or her lifetime.

i.e. id est or that is

IBM International Business Machines

ICT Information and Communications Technology

IHL Institute of Higher Learning

IoFT Impact of Future Technology

IP Intellectual Property

ITIC Institutional Coordination, Talent, Infrastructure and Commercialisation

MAMPU Malaysian Administrative Modernisation and Management Planning Unit

MDTCA Ministry of Domestic Trade and Consumer Affairs

MECD Ministry of Entrepreneur and Co-operative Development

MEPS Malaysian Electronic Payment System

MESDAQ Malaysian Exchange of Securities Dealing and Automated Quotation

MEWC Ministry of Energy, Water and Communications

MITI Ministry of International Trade and Industry

MOA Ministry of Agriculture & Agro-based Industry

MOE Ministry of Education

MOHA Ministry of Home Affairs

MOHE Ministry of Higher Education

MOHR Ministry of Human Resources

MOI Ministry of Information

MOSTI Ministry of Science, Technology and Innovation

MSC Multimedia Super Corridor

MyICMS 886 Malaysian Information, Communications and Multimedia Services 886

NITC National Information Technology Council

PA Predictive Analytics

R&D Research and Development

RMC Royal Malaysian Customs

Signpost Recognisable future events that indicate a significant change in the likelihood that an envisioned future state will be realised. Signposts connect the dots between the deep future (as described in scenarios) and the present (technology landscapes). They can be such things as a technological breakthrough, an economic event, a policy change, or a social shift.

TFA Technology Focus Area

VC Venture Capital

WSN Wireless Sensor Networks