ICT STRATEGIC REVIEW 2012/13

INNOVATION FOR DIGITAL OPPORTUNITIES

MOSTI

PIKOM

Published by:

Ministry of Science, Technology and Innovation
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PIKOM, the National ICT Association of Malaysia, is a not-for-profit organisation. It is the largest association representing information and communications technology (ICT) players in Malaysia. Since its inception in 1986, PIKOM has come of its age as the voice of ICT industry. It has become an ICT referral centre for government and industry players, as well as international organisations. In this regard, PIKOM takes on the responsibility to publish ICT-relevant information in a periodic manner.

ISSN No:

Editor-in-Chief:
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Design, Production and Printing:
mjlaikc infoworks

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Release date
September, 2012

Foreword by The Minister of Science, Technology and Innovation

PIKOM's *ICT Strategic Review* is without question the most important annual series that tracks the progress and challenges facing the ICT industry in Malaysia. I would like to take this opportunity to commend PIKOM on successfully publishing the 4th edition of this series and state that the Ministry of Science, Technology and Innovation (MOSTI) is proud to be your partner in this endeavour.

The publication's focus on innovation for digital opportunities is timely given the fact that the Government recently embarked on the Digital Transformation Programme (DTP), otherwise known as Digital Malaysia. Innovation, specifically ICT-led innovation, is at the heart of efforts to transform our economy and society on the road to achieving fully-developed nation status by 2020. Indeed, pervasive innovation is critical to the creation of new wealth and this includes innovation in products, services, designs, processes, operations and others.

It is pertinent to note that by 2020, the DTP is expected to increase the contribution of the digital economy from the current 12.5% to 17% of Gross National Income (GNI) and in the process, create 160,000 new high-value jobs. To achieve this, I understand that the DTP is targeting investments worth RM31.1 billion via a public-private partnership model. Over and above these figures, the DTP is expected to raise the nation's competitiveness and comparative advantage in the global arena. In doing so, we hope the programme will expand our economy and at the same time improve the quality of life of our citizenry. These goals are central to the New Transformation Policy (NTP) espoused by our Honourable Prime Minister, YAB Dato' Sri Mohd Najib Abdul Razak.

Finally, I commend PIKOM's effort in making this publication a success. I would also like to take this opportunity to thank all contributing parties from industry and academia to the production of this *ICT Strategic Review 2012/13*.

YB. DATUK SERI PANGLIMA DR. MAXIMUS JOHNITY ONGKILI JP.

Message by the PIKOM Chairman

Malaysia has successfully weathered the Global Financial Crisis 2009 despite its persistent and continuing impact on the world economy as witnessed by the current debt crisis in the Eurozone. While others have been grappling to contain the Contagion, Malaysia has remained resilient throughout much of the ordeal and is instead, riding high on its transformation strategies.

In formulating these strategies, the Government understands that we cannot afford to rest on our laurels. Any delay in moving forward in the pursuit of fully-developed nation status would amount to being left behind. For standing still would mean losing out on opportunities arising from the new-age economy and society.

Today more than ever, competition is truly global. Emerging economies including previously impoverished nations have come to realise that innovation is the fastest and most efficient way to global competitiveness. The factor-driven prescription for economic development is fading fast for many nations which recognise that an economy reliant on natural resources and unskilled labour can only generate limited GDP and low wages for its people.

Likewise, Malaysia can no longer depend on efficiency-driven production and quality to attract foreign direct investment in the face of intense competition from other low-cost producing nations. Our nation has little choice but to embark on an innovation-led economy enabled and empowered by information and communications technology (ICT).

On this score, Malaysia has all the necessary ingredients and advantages such as a young and vibrant population. Invariably, it is our technologically-savvy Gen Y who will lead the way towards an innovative future. One can even argue that we are on a level playing field going forward given the fact that the comparatively aging populations in developed economies such as the US, Europe and Japan lack the agility and perhaps the receptivity to cope with the constant changes in technology.

That said, it is now imperative for Malaysia to harness the power of ICT and adopt a culture of innovation. After all, innovation is about generating new value.

As PIKOM Chairman, I acknowledge that we cannot change society, economy and institutions overnight. At the same time, we cannot allow events to dictate the course and direction we take in pursuit of creating new value through research and development, patent creation and commercialisation.

The country has to act. It is gratifying to note that the Government has stayed abreast of global trends over the past decades and introduced measures accordingly.

Despite this, Malaysia is still deficient in terms of globally-recognised brands that have the quality and reputation of a Samsung or an LG. We have yet to realise the return on investment on the huge resources dispensed so far on R&D and innovation.

It is time we review our flaws and weaknesses particularly in our education system and work culture. It is vital that we inculcate an innovation culture and environment consistent and compatible to our own values and systems.

As Chairman and Research Committee Chairman of PIKOM, I would like to register my deepest appreciation to all the contributors from industry, mainstream agencies and academia as well as individuals for turning the "ICT Strategic Review 2012/13: Innovation for Digital Opportunities" into a reality.

I value their diverse contributions from expressing their views to voicing their concerns on the innovation topic. I believe that the research findings would be beneficial to members of PIKOM and would bring about an enhancement of the ICT industry in the country.

Let me also take this opportunity to thank the Ministry of Science, Technology and Innovation (MOSTI), particularly the Minister, YB Datuk Seri Dr Maximus Johnity Ongkili for your unwavering support for this project.

WOON TAI HAI

EXECUTIVE SUMMARY

WOON TAI HAI
Research Committee Chairman

Prelude:

Disruptive Innovation the Way Forward for High Value-Adding Economy

In this prelude, PIKOM emphasises the importance of disruptive innovation as the primary source of value-add to an economy. The chapter cites as global examples of innovative ideas such household names as Google, iPad, Netflex, Amazon.com and many others.

Indeed, these applications, devices and technology platforms have resulted in the creation of new markets besides opening up access to new segments of consumers. Nevertheless, the chapter makes the contention that ICT is still a green field with plenty of opportunities available to countries like Malaysia. For this reason, PIKOM calls on the nation to aggressively pursue innovation strategies and inter-disciplinary approaches to reap the benefits they would bring.

Chapter One:

Essence of ICT Roadmap 2012 for Innovation Driven Growth

In this chapter, the Ministry of Science, Technology and Innovation (MOSTI) outlines the essential features of the new ICT Roadmap 2012. The latest propositions come after a review of the ICT Roadmap 2008, the earlier Technology Roadmap and emerging megatrends in ICT as well as through consultation with various stakeholders in the public and private sectors.

In the latest edition of the Roadmap, the initial three technology focus areas of sensor wireless networks, predictive analytics and 3-D Internet have been expanded to encompass six areas. These are e-services, ubiquitous connectivity, security and platforms, wireless intelligence, bid data / analytics and cloud computing.

To overcome past weaknesses at the implementation level, the 2012 Roadmap underscores the need for policy and programme ownership from the onset of planning. It also points out the need for effective functioning of the strategic-level steering committee under the purview of the National Information Technology Council (NITC), private sector engagement in research, development and commercialisation, inculcating patent culture among the research community, adequate funding including for foreign patent acquisition, maturity in work processes, aligning to globally-renowned best practices and work culture, competent human capital and elements of good governance such as mechanisms for regular monitoring, measuring and evaluating.

Chapter Two:

The Malaysian Economic and ICT Outlook

This chapter by KPMG supports the contention by PIKOM and other public sector agencies that Malaysia's economic growth rate in 2012 will remain robust despite the uncertainty of external factors such as the evolving sovereign debt crisis in the Eurozone. The chapter forecasts a growth rate above 5% in contrast to the 3-4% projected by many private sector investment research bodies.

Reasons given for this positive outlook include the limited trade exposure to Europe, in particular, the hardest hit economies of Greece and Spain. On the other hand, Malaysia's resilience is expected to be bolstered by strong trade with booming economies such as China, India and Southeast Asia. After all, China and India are projected to register 8.3% and 7.5% growth in the first quarter of 2012. That said, the chapter cautions that Malaysia may suffer from reduced investment from Europe, which has typically accounted for one-fifth of total FDI in the country.

Despite a challenging external environment, the positive economic outlook for 2012 is underpinned by strong domestic demand attributed to investments in the Government's various transformation initiatives and supported by the continuing low inflation rate, a strengthening Ringgit that boosts trade, and low base lending rates that spur public and private consumption. As it was in the past, the positive outlook should stimulate ICT sector growth through increased ICT spending in new mega-projects like the Kajang-Sungai Buloh Massive Rapid Transit, besides the on-going corridor projects and small and medium businesses moving up the value chain through improving operational efficiencies and business efficacies.

Chapter Three:

PIKOM Moving up the Value Chain: Advocacy to Value Creation

This chapter zeroes in on PIKOM (The National ICT Association of Malaysia) as the model to highlight institutional innovation as a natural and necessary evolutionary process. From its inception in the late '80s, PIKOM has evolved from its initial advocacy role for computer wholesaling and retailing businesses to organising cash-and-carry exhibitions and other events for the ICT industry in the mid-90s. In charting its maturation, the chapter

notes that PIKOM today is recognised by mainstream policy institutions as the voice of the industry as well as an active participant in national interest projects. On this score, PIKOM has been involved in developing the Digital Economy Satellite Account (DESA) system, spearheading the e-Waste Disposal for Malaysian household sectors for the Digital Malaysia Programme, and assessing the capabilities of ICT services companies in Malaysia for the Malaysian Services Provider Association (MSPC).

Chapter Four:

The Nexus of Forces: Social, Mobile, Cloud and Information

Gartner Research, the contributor of this chapter, has over the past years identified the independent evolution of four powerful forces in ICT sector: social, mobile, cloud and information. As a result of consumerisation and the ubiquity of connected smart devices, people's behaviour has led to a convergence and reinforcing of these forces, thus creating a plethora of new business opportunities. The paper raises a warning to senior IT leaders that they have to embrace new changes as their existing architectures are becoming obsolete, and take advantage of the nexus of forces so they can respond effectively.

Chapter Five:

Creating Value Through Frontier Technologies: MIMOS Innovation Inroads

MIMOS is contributing to the ICT Strategic Review series for the first time. Its chapter describes MIMOS' current role and functions in research and development pertaining to micro-electronics and ICT. The paper points out that while MIMOS was involved in policy and engaged in business in the past, today it is focusing its resources and efforts on research and development that can be patented and commercialised. In the research and development value chain, MIMOS is primarily involved in applied research, in particular, development and customisation of products, solutions, applications and content relevant to k-industries and k-SMEs. In pursuit of quality, global branding and recognition, MIMOS has also adopted Capability Maturity Model Integration (CMMI) and Six Sigma best practices to attain maturity in software development.

Chapter Six:

Internet Security Threat Report: Volume 17

Prepared by Symantec, the latest Internet Security Threat Report sends a warning that malware attacks are on the rise. The report notes that malicious attacks increased by 81% in 2011 despite the 20% reduction in the number of vulnerabilities. It also warns that advanced targeted attacks are spreading to organisations of all sizes and variety of personnel. It points out that data breaches are increasing and that attackers are focusing on mobile threats. This report provides an overview and analysis of the year in global threat activity, offering enterprises and consumers the essential information they need to secure their systems effectively now and into the future. It is based on data from the Global Intelligence Network, which Symantec's analysts use to identify, analyse and provide commentary on emerging trends in attacks, malicious code activity, phishing, and spam.

Chapter Seven

Essence of Personal Data Protection Act 2010 Malaysia: Challenges for Businesses

This is the first time that the ICT Strategic Review series features as article on the legal aspects of ICT development. It is timely, coming on the heels of the Personal Data Protection Act (PDPA), which has finally been enacted after more than a decade of deliberation. The chapter examines the various challenges in implementing the Act. It highlights personal data protection as a basic right of the individual that deserves the full protection of the law.

In a fully-connected world where huge amounts of information are collected, manipulated, used and shared, this is of paramount importance and has prompted many countries including Malaysia to regulate such processing. Data protection in Malaysia, thus far, has been piecemeal and generally self-regulated. However, in keeping with international practice, the Government has decided to regulate the processing of personal data via the PDPA 2010.

Chapter Eight:

Embracing the Consumerization of IT to Enable Workplace Transformation

This chapter by Microsoft discusses the essential elements in the consumerisation of IT. This is a fast growing trend changing the expectations, aspirations, processes, procedures, roles, rights, rules and regulations in a work environment. The chapter contends that IT users are increasingly making the ultimate choice in what devices, applications and services they use to get work done.

Many contemporary workers are spending time working away from the office, perhaps working at home for part of the week and increasingly blurring work-life boundaries. Not only that, consumer devices such as smartphones and slates are now becoming powerful enough to be able to run the types of applications traditionally restricted to desktop and portable computers.

Devices also provide seamless and ubiquitous access to big data, social computing and popular cloud computing applications such as Facebook, Twitter, Hotmail and others. Like employees in advanced societies, Malaysian employees today expect and demand the freedom to use their own devices (BYOD) as well as familiar subscribed services anytime and anywhere in order to be productive. Hence, one of the challenges faced by CIOs in Malaysia today is the need to address the needs and expectations of the modern workforce, while meeting the security and manageability requirements of the organisation.

Chapter Nine:

Social Business: Advent of a New Age

In this article, IBM differentiates between social business and social networking. It is one thing to create networks of customers, employees or partners. It is quite another to change the processes that run businesses and to make them truly "social." It is about applying "social" technologies to business processes in order to radically improve the way organisations operate. Forward-looking organisations are using social networking and finding out that integrating social networking tools with current business processes can help create new business models, encourage consumer sales and enhance employee communications, especially within large organisations. It is also indicated in the article that businesses that fail to transform themselves into social businesses will be left behind by competitors that embrace social business techniques.

Chapter Ten:

State of Mobility Report 2012: Malaysia Findings

It seems like just a few years ago that the Internet completely changed the way we do business. And now we are seeing it again with mobile devices as the catalyst. Smartphones are now being used by hundreds of millions of employees throughout the world to access corporate information to keep up with today's 24/7 business world. Symantec commissioned the 2012 State of Mobility survey to gauge how organisations globally are coping with this trend. This report provides insights into the mobility trends in Malaysia.

The report shows that Malaysia has reached a tipping point in the business use of mobile devices. But there is a price. Organisations are aware of the potential dangers mobility can pose, rating it highest among IT initiatives in terms of risk. They are worried about losing devices, data loss and malware infecting the corporate network through smartphones and tablets. But in the face of these challenges, organisations feel the risks are worth the benefits and they are working to implement security measures to rein in these costs and keep their corporate information safe.

Chapter Eleven:

Making a Livable and Friendly Environment: ICT strategies

In this chapter, HP raises the spectre of an increasing global population posing a threat to long-term environmental sustainability. The global population passed seven billion in 2011 and is on its way to a projected 9.3 billion by 2050. This poses many challenges to attempts in balancing the demands of economic growth with the need for environmental conservation and protection. Global energy consumption is projected to increase by nearly 50% by 2035.

It is obvious that the world needs solutions that improve energy efficiency and help keep pace with demand while reducing the emissions that contribute to climate change. In support of this move, the paper expounds on the need for an effective green governance structure. Such a structure would help customers, deliver energy-efficient IT, rethink the data centre through virtualisation strategy that can mitigate over-provision or under-usage, and position green business as smart business in all spheres of life. The paper also applauds the Government of Malaysia for identifying green technology as a major growth area under the National Green Technology Policy and its commitment to reducing emissions by up to 40% by 2020.

Chapter Twelve:

Green Jobs for a Low Carbon Economy: Nurturing the Next-Gen Green Collar IT Professionals

This chapter is a response to the high

rate of energy consumption within the ICT industry. In addressing these challenges, the paper recommends that the ICT industry play a significant role in generating green jobs as the nation moves towards a low carbon economy. Green jobs help to protect and restore ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency and avoidance strategies; decarbonises the economy; and minimises or altogether avoids generation of all forms of waste and pollution.

A low carbon economy is one where all waste must be minimised, energy must be produced using low carbon energy sources and methods, all energy resources must be used efficiently, and where possible, local needs should be served by local production with a high awareness and compliance with environmental and social responsibility initiatives. In this endeavour, the Green Computing Initiative (GCI), in collaboration with industry, academia and the government, has launched the Green Collar IT Professional (GCITP) programme aimed at producing green computing human talent in all sectors of the economy.

Chapter Thirteen:

Innovative Use of ICT among Urban Poor: Issues and Challenges

This chapter is about the innovative use of ICT among the urban poor. The article underscores the fact that the information economy is becoming increasingly important in determining the success of marginalised communities in achieving sustainable development in a knowledge economy. While ICT connectivity over the last two decades has improved significantly in Malaysia, the use of the technology among marginalised communities has not been fully realised. Based on actual ground probing, this paper examines the patterns of ICT adoption among the 'urban-poor', in particular how the innovative use of technology can make a difference in their well-being in the social, economic and political spheres.

Chapter Fourteen:

Broadband for Science and Innovation: Imperative for Business Growth

Broadband and effective connectivity being an integral component to business growth, PIKOM in this chapter deliberates the significance and impact of quality broadband on science and innovation networking and interaction, a phenomenon that is increasingly cross-border in nature irrespective of geography and time. In tandem with this development, the chapter notes that science is becoming global in terms of collaborative research including the joint publishing of research papers as well as sharing of advanced equipment, knowledge, expertise and skills. Additionally, the established scientific community in the developed world is accepting new members from developing economies much more readily. Given this scenario, the chapter highlights the need for Malaysia to take the necessary steps with regards to broadband connectivity that is critical for global networking. To facilitate this move, the country has to address various issues affecting broadband quality including the need to improve policy strategies; the scope, coverage, speed and cost of broadband service as well as digital divide concerns.

Acknowledgements

PIKOM is extremely grateful to all Executive Council members for their wise counsel, judicious guidance and unflagging support towards the publication of the ICT Strategic Review 2012/13 edition. PIKOM would also like to acknowledge the invaluable contribution of all the authors for this series. Specifically, we would like to thank the Ministry of Science, Technology and Innovation (MOSTI), KPMG, Academy of Science Malaysia (ASM), MIMOS Berhad, Symantec Corporation (Malaysia) Sdn Bhd, IBM Malaysia Sdn Bhd, HP Malaysia, First Principles Sdn Bhd, Microsoft Malaysia, IBM Institute for Business Value, Gartner, Green Computing Initiative (GCI), and Monash University (Malaysia Campus) as well as many others who have spared the time and resources for the publication. We hope these key players in government, industry and academia will continue to lend their support for the future. Lastly, PIKOM would like to register its sincere appreciation to the entire team in the PIKOM Secretariat for their individual support in the course of preparing this publication.

Contents

PRELUDE:
Disruptive Innovation the Way Forward for High Value Adding Economy 01

CHAPTER 1
Essence of ICT Roadmap 2012 for Innovation Driven Growth 21

CHAPTER 2
Malaysian Economic and Information Communications Technology Outlook 55

CHAPTER 3
PIKOM Moving up in the Value Chain: Advocacy to Value Creation 67

CHAPTER 4
The Nexus of Forces: Social, Mobile, Cloud and Information 79

CHAPTER 5
Creating Value through Frontier Technologies: MIMOS Innovation Inroads 87

CHAPTER 6
Internet Security Threat Report: Volume 17 97

CHAPTER 7
Essence of Personal Data Protection (PDPA) Act 2010 Malaysia: Challenges for Businesses 123

CHAPTER 8
Embracing the Consumerization of IT to Enable Workplace Transformation 129

CHAPTER 9
Social Business: Advent of a New Age 147

CHAPTER 10
2012 State of Mobility Survey: Malaysia Findings 159

CHAPTER 11
Making a Livable and Friendly Environment: ICT Strategies 165

CHAPTER 12
Green Jobs for a Low Carbon Economy: Nurturing the Next-Gen Green Collar IT Professionals 171

CHAPTER 13
Innovative Use of ICT among Urban Poor Communities: Challenges and Opportunities 181

CHAPTER 14
Broadband for Science and Innovation: Imperative for Business Growth 193

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PRELUDE:
DISRUPTIVE INNOVATION THE WAY FORWARD FOR HIGH VALUE ADDING ECONOMY

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Introduction

Harvard Business School professor Clayton Christensen is known for popularising the term "disruptive innovation" in his book *The Innovator's Dilemma*. The Professor differentiated between "disruptive technology" and "disruptive innovation". He cites: "Disruptive technology brings to a market a very different value proposition than had been available previously."

The term is used in business and technology literature to describe innovations that improve a product or service in ways that the market does not expect – typically, by first designing for a different set of consumers in the new market and later by lowering prices in the existing market. On the contrary, **disruptive innovation** is one that "helps create a new market and value, and eventually goes on to disrupt an existing entire market and value network". Disruptive innovation is the introduction of new technologies, products or services in an effort to promote change and gain advantage over the competition.

In this context, the word disruptive does not mean to interrupt or cause disorder - it means to replace. For example, the automobile was a revolutionary technological innovation, but it was not a disruptive innovation because early automobiles were luxury items that did not disrupt the market for horse-drawn vehicles. The market for transportation remained essentially intact until the debut of the lower-priced Ford Model T in 1908. The mass-produced automobile was a disruptive innovation because it changed the transportation market. The automobile, by itself, was not.

For illustration, the top 10 disruptive innovations that have killed existing businesses and given rise to new markets are outlined in Box 2. One pertinent characteristic observed in all these disruptive innovations is that the innovators attempted to solve problems that the people or businesses face in their routines such as limited storage capacity in a Walkman, lack of speed in postal services, lack of versatility in documentation, physical shopping requiring longer time etc. In other words, ICT-led disruptive innovation could possibly be realised by solving day-to-day problems.

Box 1: **Peter Drucker quotes from 'The Future of the Corporations and the Way Ahead'**

"Thus, having attained maturity in its applications, the Internet technology is truly bringing about the real revolution, some called it "digital Darwinism" as illustrated in Figure 1. In its contemporary form the Internet technology is daily changing the way one works, learns, plays, does transactions and builds relationships and networking. The phenomenal changes that we are experiencing today are acknowledged in particular, the pace, the phase, the speed, the form, the shape and the shades are unprecedented in human history."

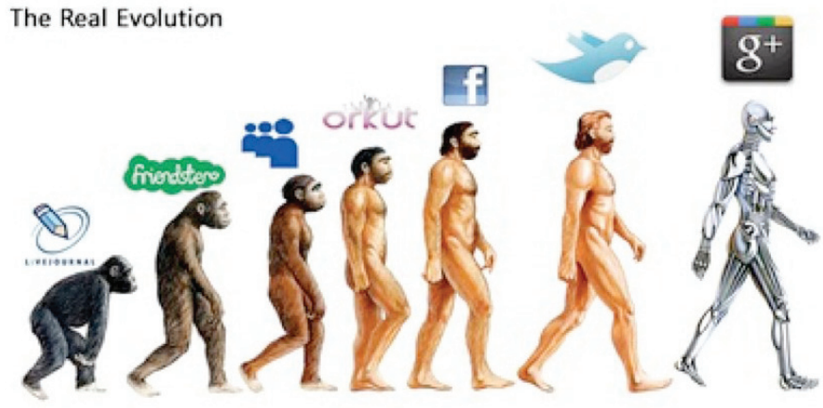

Figure 1: Digital Darwinism
Source: 'The Business as Usual' by Brian Solis (http://www.briansolis.com/2012/04/disruptive-technology-and-how-to-compete-for-the-future/)

"The first industrial revolution, triggered by James Watt's improved steam engine in the mid-1770s, immediately has an enormous impact on the West's imagination, but did not produce many social and economic changes, until the invention of railroad, in 1829. The railway system changed the mental geography! Similarly, the invention of the computer in the mid-1940s, the information revolution's equivalent of the steam engine, stimulated people's imagination, but it was not until forty years later, with the advent and proliferation of Internet at un unprecedented rate in the 1990s, that the information revolution began to bring about big economic and social changes" – 'The Future of the Corporation and the Way Ahead' by Drucker, F. Peter.

IT Application / Device	Disruptive Innovations	Killed which business?
Apple iPod	The idea of being able to carry all your favourite songs in your pocket was revolutionary.	Before iPods, Walkman by Sony and related MP3 players were the rage and dominated the markets. The iPod irrevocably altered the landscape for portable audio players and captured the market because of two shortcomings of the Walkman – inability to store a good amount of music and its bulky size. Moreover, carrying cassettes was an additional headache.
Email	Email is the rage among people, especially the youth as it makes connecting with their friends easy. Email has become such an integral part of our lives that almost all GPRS and 3G-enabled mobile phones offer this service. Even corporates find the email option as a way for official communication.	Email has indeed hit the postal service system across the globe. As the next gen does not find the postal service appealing anymore, this sector has been hit to a great extent. The drawbacks of the postal system are too many and the youth prefer convenience and speed.
Smart phones /Apple iPhone	Apple iPhone is the most revered mobile phone in the market. There is no greater status symbol than an iPhone. People had even lined up at Apple outlets just to be among the first people to own iPhones. This is something regular phones were never able to achieve. iPhones are mini personal computers, user-friendly and stylish.	With the advent of high-end mobile phones, landlines and cordless phones have literally been pushed to the back. Landlines are still used by the population but mostly because they are needed for router connections.
Netflex	Netflix has altered the face of online video viewing. Its subscription-based services, offering ease, convenience and the capacity to rent movies for as long as one wanted without any extra charges, have no precedents.	Netflix's entrance into the market led to Blockbuster filing for bankruptcy in September 2010.
Digital word processing	As the 70s dawned upon us, inventions like Microsoft Word started the ball rolling for the next wave in maintaining documents. As MS Word is a user-friendly software and still dominates the market, other digital word processors - even Apple iWorks – have struggled to capture a decent market share. In 2009, Microsoft said that its Microsoft Office suite, including MS Word, is used by more than half a billion people worldwide.	It took Microsoft a while to gain a foothold in the market but it did a tremendous job at it. It was preferred over typewriters so much that eventually typewriters were consigned to obsolescence.
Computer Generated Imagery (CGI)	Computer Generated Imagery or CGI has witnessed an incredible upsurge in the past few decades. Famous CGI movies include Ice Age, Monsters Inc, Avatar, Toy Story, Shrek and many others. Although other forms of special effects are used in movies, they are now being employed sparingly. CGI has captured their share in movie making.	Although hand-made drawings are still used in storyboards, they are not utilised in mainstream cinema. They act more like the skeletal framework of animation but do not form the end-product entirely. Popular art forms like stop motion animation, use of prosthetics and props, clay model animation and others are still being used but are not in the forefront as is CGI.
e-Commerce	With the boom in online shopping these days, customers are more than happy to browse for their preferred items without leaving the comfort of their homes. They can inspect the products first and then pay. They don't have to pay for home deliveries and also have the option of paying in instalments.	More and more businesses are offering the option of shopping online against visiting physical stores. Gone are the days when we used to be unsure of products we had bought online. Sites like HomeShop18 and Jabong offer such facilities. This is increasingly affecting the bottom line for physical stores these days.
Apple items	An advantage of having an online portal for Apple iTunes is that iPod users have to purchase songs exclusively from this site. As iPod is compatible with songs downloaded only from iTunes, iPod users will not go to any other music website. This is the reason why some people are dead against Apple products due to the restriction on sharing music, photos and videos with other cellphone users. As such, Apple users can only go to Apple websites and nowhere else.	As the number of Apple product users is huge, the music industry has faced a tough challenge in the past few years. Various physical music stores in the US, like Virgin Megastores, Sam Goody and Tower Records had to be shut down in 2009 because of the monopoly enjoyed by Apple products.
Online travel agencies	There has been a huge surge in online travel agencies in the past few years - from Redbus.Com to Expedia.Com in India, AirAsia in Malaysia, Groupon etc. And from bus to air tickets, these online travel agencies cover all areas. Traditional travel agents are not able to compete against such convenience along with value for money.	As a result, many travel booking agents have gone out of business.
Amazon Kindle	E-readers like Amazon Kindle by Amazon are all the rage these days with tech freaks. E-readers are so popular that Amazon.com sold more e-books than physical books in the last quarter of 2010. E-readers come with the ability to store more than 3,000 books and are also lightweight.	Amazon Kindle has many merits. Still, only time can tell if it will oust physical books from competition, although the more traditional person would prefer reading articles on paper. Although the majority of the population still prefers solid books, the increase in e-book sales suggests that this trend is gradually changing.

Box 2: Top 10 Disruptive Innovations in the Internet World

Essence of Malaysian Innovation Strategies

This is a time to take a step back, recognise where we are and where we need to be, examine our strategies and current initiatives, review our investments and innovation opportunities, and consider new areas for change or new pursuits. Otherwise, we will become outmoded and worse still, become irrelevant with the progression of time.

Scope of Innovation

Innovation is not a phenomenon confined to product and technology despite the fact that the word is commonly associated with these two categories. The scope includes services and processes encompassing the supply chain, recruitment, human resource management, process improvement, quality management, marketing and sales. For example within the financial sector, the advent of Islamic financial services is considered an innovative service. Similarly, a number of innovative services have been introduced in the delivery of government services such as passport renewal within 24 hours, approval for construction development permits within six months, reduced time taken to process new Halal Certificate applications from 90 to 30 days, implementation of Digital Industrial Court Proceedings, e-filing tax system, expansion of e-payment facilities to 236 agencies offering 449 online services, and the elimination and simplification of business licences from 395 of 761. Such process efficiencies in the delivery of public services have became possible through process innovation strategies.

Approaches to Innovation

There are many shades of innovation approaches. They can be classified broadly under four categories - bottom-up innovation, top-down formal innovation, organisational innovation and lately, globalised innovation.

• Bottom-up Innovation

Innovation does not necessarily originate from engineers and scientists. Indeed, many innovations are driven by entrepreneurs and inventors. For example, Bugs Tan Yeow Kiang, who by profession is an inventor and author, has invented numerous items as shown in Figure 3. For these efforts, he has won eight national and two international awards, namely Switzerland 2001 and Indira Institutes India 2009. Entrepreneur and inventor Sir James Dyson faced rejection in his home country United Kingdom, but his invention of the vacuum cleaner was accepted in Japan where the business subsequently grew into a billion-dollar venture. To his credit, he has also patented a number of inventions and innovations.

During the early years however, he faced patent infringement challenges, which he eventually won after lengthy legal battles. After rising to fame, Sir James Dyson received numerous awards in Japan and in his home country while his inventions are exhibited in design museums in Europe.

• Top-down Formal Innovations

Unlike entrepreneurs, engineers and scientists who work in universities and research bodies adhere to strict disciplines and institutionalised processes in carrying out research and innovation activities. To date, there are 20 public universities in Malaysia. Of these, four universities - University

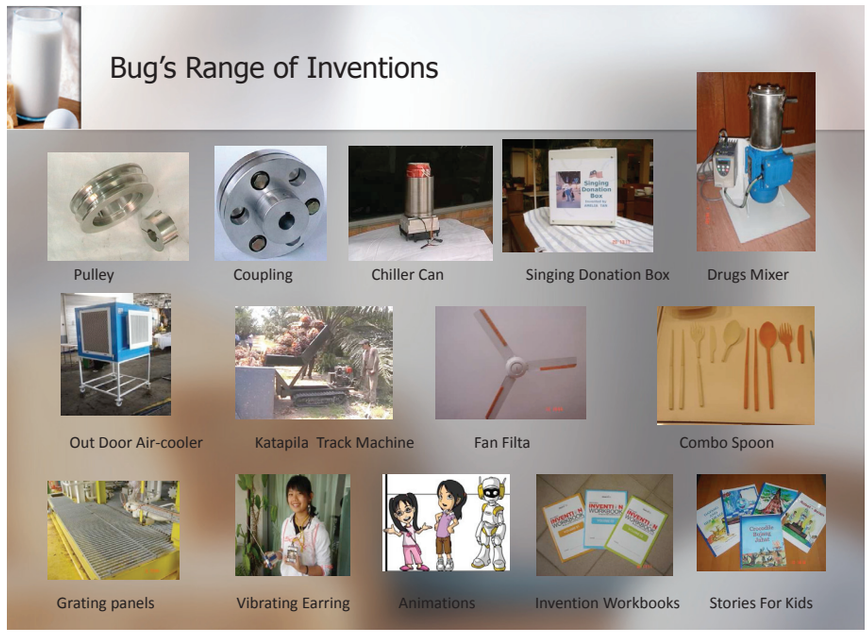

Figure 3: Bug's Tan Bottom-up Innovations: Malaysian Achievements
Source: http://www.nina.com.my/phocadownload/Innovative%20Inventions_Bugs%20Tan.pdf

Technology Focus Areas	Patent Applications over 11 years	Patents Granted over 20 years	Commercialised Products from Public Institutions (2009-2011)	Potential Commercialised Products from Public Institutions
e-Services	34	4	10	13
Artificial Intelligence				5
Wireless Intelligence	99	13		
Ubiquitous Connectivity	30	106	2	
Big Data/Analytics	26	2	4	5
Security and Platforms	102	22	1	5
Cloud Computing	4			
Smart Transport	11	4	1	
Smart Buildings	6			
Point-of-Care Technologies	5			
Smart Agriculture		1		
Smart Grid			1	4
Genome Sequencing				
Bio-Sensing		2	5	6
Sensors				3
Predictive Bio-simulation				
ICT Services			14	21
Communications			13	14
MEMS			1	1
Nanotechnology			1	4
Renewable Energy			7	5
Total			**60**	**86**

Table 1: Patent applications, patents granted and commercialised products including potential by areas of research
Source: MYIPO, Frost & Sullivan

of Malaya, University of Science Malaysia, Putra University Malaysia and National University of Malaysia – have been accorded research university status. Typically, public universities are granted research and innovation funds. In addition, there are 32 local private universities including corporate universities like Multimedia University, Petronas University and so on. There are also four foreign universities with branch campuses in Malaysia - Monash University, Nottingham University, Curtin University and Swinburne University. Additionally, there are 485 private colleges, 27 polytechnics, 28 teacher education institutes and 64 public community colleges. Only selected private universities are granted research grants. There are also many public research institutions involved in the various fields of research. Of these, those involved in ICT research activities directly or indirectly include MIMOS, SIRIM, Malaysia Nuclear Agency and Malaysia Remote Sensing Agency. Key areas of research include e-services, wireless intelligence, ubiquitous connectivity, big data/analytics, security and platforms, cloud computing, point-of-care technologies, smart grid, bio-sensing, smart transport and smart building. Table 1 shows the number of patent applications, patents granted and commercialised products from public universities including those with commercial potential. In other words, patenting and commercialisation are critical to any research, development and innovation activities undertaken by formal institutions.

• Organisational Innovation

Some innovations are driven by organisational leaders in cases such as transforming a mediocre organisation into a profitable one. Essentially, such organisations successfully re-engineer their customers' loyalty and satisfaction towards their products and services rendered, or re-engineer processes that can bring about significant cost reduction. For example in the early 90s, IBM returned to profitability from the verge of collapse due to heavy losses in the mainframe business. In Malaysia, Air Asia partly leveraged contemporary ICT to reduce its costs. In such transformation, the leaders practise an open innovation policy which allows organisations to tap into internal and external

sources for ideas. In this approach, it is assumed that knowledge resides in employees, suppliers, customers and competitors. Some organisations that have adequate resources embark on process re-engineering programmes such as CMMI, PCMM, ITIL, Six Sigma, Lean Sig Sigma etc. to bring about the desired outcomes. For instance, globally-renowned Indian software companies like Wipro, TATA Consultancy or Satyam were able to enter lucrative markets in the US after adopting the CMMI / PCMM and Six Sigma best practices in their software development activities. These companies responded well to the emerging demands of the market - for instance, the US market has explicit conditions that require companies seeking contracts to be CMMI-certified by Software Engineering Institute of Carnegie Mellon University. George Welch adopted the Six Sigma practices that demand data-driven methodology in problem solving to realising process improvements in terms of cost and cycle time reduction as well as mitigation of wastes.

• Globalised Innovation

With the advancements in new information, communications and networking media innovation has become global. For instance, companies like Innocentive tapped into global networks when it was looking for a new imaging approach to identify the oil and water emulsions in the Gulf of Mexico that arose from the infamous Deepwater Horizon oil well incident. This process simply connects problem solvers with individuals or organisations that have the means to solve the problem. Tapping the global intellectual capacities and capabilities from different backgrounds and fields as well as traditions and cultures is indeed a fast-growing innovative business. Even in Malaysia, YTL Communications Sdn Bhd launched "mY prize Global Developer challenge" with a tag of US$1 million in search of global entrepreneurs and innovators to develop the 4G mobile Internet products and services. YTL believes that the next wave in the provision of telecommunication and Internet services would come in the wireless mode with anytime, anywhere and anyone mobile convenience that contemporary customers desire for. When the rest of the telecommunications companies were busy pursuing 3G market opportunities, YTL instead adopted aggressive and innovative strategies to capture a share of telecommunications market via new products and services.

Public Policy and Services Sector Innovation

It is not entirely accurate to say that countries like Malaysia are poor in innovation. After all, companies like Air Asia, MIMOS and YTL Communications Sdn Bhd are several examples of innovative Malaysian companies among the many in the market. In fact, Malaysia has a long track record in planning and implementing innovation policy strategies. Indeed, the country excels in this field even when compared to many developed nations in the West.

Specifically, Malaysia's migration from its resourced-based economy in the 50s and 60s to a factor-driven economy in the 70s and 80s and subsequently to a knowledge and innovation-based economy is in itself considered innovation in public policy development. Between 1950 and 1970, the Government launched many FELDA land schemes, which converted virgin jungle into large rubber and oil palm plantations which in turn, boosted the agro-based economy. The agriculture sector, together with mining and timber, accounted for 40 per cent of GDP. However, this strategy could not withstand the test of time due to fluctuations in global commodity prices. The Government then embarked on an economic diversification programme to ensure growth and sustainable development.

In the 80s, the Government took a big leap in industrialising the nation by attracting export-led foreign direct investments that registered significant growth in the manufacturing sector, which alone accounted for 24 per cent of GDP in 1990. Again, the industrialisation strategy had to be replaced once Malaysia began losing its competitive edge to emerging economies that could offer a lower cost of production. Following the fall of the Berlin Wall in the early 90s, a number of newly-liberalised economies such as Vietnam, China, Cambodia etc. emerged as direct competitors for FDI, which had been instrumental in generating annual growth rates as high as 9.0 per cent at one time for Malaysia.

Following the country's Vision 2020 goal of becoming a developed nation of its own mould, the Government once again embarked on a major policy shift of migrating to a knowledge-based economy. Central to this strategy was the Government's intention to reduce vulnerable foreign dependencies while at the same time bolstering direct domestic investment (DDI) that could transform Malaysia from a trading and consumption nation to a production economy. Becoming a productive nation like Japan and South Korea requires research, development, innovation, patenting, commercialisation, and global branding policy strategies and practices. It is truly a formidable challenge. However, it is possible to be on par with Japan or South Korea in Asia, provided a concerted effort is made to surmount obstacles to innovation.

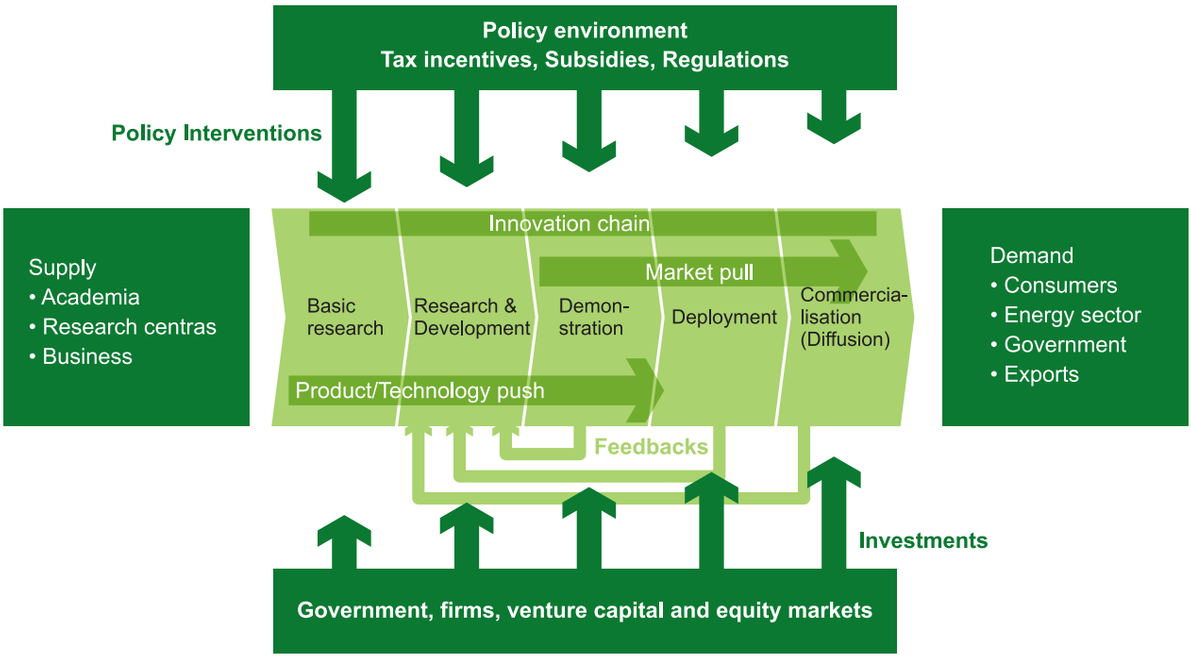

Figure 4: A Generic Innovation Framework
Source: http://awsassets.panda.org/downloads/coming_clean_2012.pdf (Coming Clean: The Global Cleantech Innovation Index Report 2012

Generic Innovation Framework

There are many variations of innovation strategies. However, the strategy that entails research, development, innovation, patent, commercialisation and global branding elements has the potential to ignite a nation into becoming a productive economy. There are many innovation frameworks in the world today. However, as shown in Figure 4, a typical innovation framework entails core research processes – basic research, research and development, demonstration (pilot models), deployment (mini roll-out) and commercialisation (mass diffusion). These processes are flanked by academia, research centres and private research centres from the supply side; consumers, industries, businesses, governments and export markets from the demand side; and supported by policy institutions that facilitate rights, roles, rules and regulations and in some cases, provide tax incentives and subsidies.

Investments for activities such as research, development, innovation, patenting, commercialisation, trade promotion and branding come from both government and private sectors. The government's assistance typically comes in the form of grants, loans and public venture funds. Private investments come in the form of private equity, angel and venture funds.

Malaysian Framework

In response to the growing importance of innovation, the government has set up the Ministry of Science, Technology and Innovation (MOSTI) to be responsible for the formulation and implementation of innovation policies and strategies. The Malaysian Innovation Agency has been set up as a statutory body under the Malaysian Innovation Agency Act 2010 - popularly known as AIM Act 2010 - with the primary purpose of being the driving force behind Malaysia's push towards establishing an "innovation economy" and the country's aspirations of achieving high-income nation status.

AIM has two clear objectives that provide the foundation for the innovation blueprint: to bring about holistic societal well-being through the cultivation of the innovation eco-system and to drive the national innovation agenda to generate new-wave wealth. These two goals can be achieved by using the Quadruple Helix approach, where the four parties of Government, Citizenry, Academia and Industry work in synergy to encourage a culture of innovation among the population and to ensure ideas are taken through from creation to commercialisation.

To promote innovation at the grassroots level, the government

has also set up Yayasan innovasi Malasia (Malaysia Innovation Foundation) as an implementing agency. In other words, the country has institutionally geared up at policy and programme level to ensure the successful implementation of all innovation activities in the country, be it from top-down or bottom-up, be it driven by public or private sector. Indeed, such policy support is critical for successful programme implementation.

Government Funding

A number of sources of funding are available for research and innovation activities. See Table 2.

As outlined above, in the case of Malaysia, there is no missing link, shortfall or gap as far as the innovation framework is concerned.

Innovation means breakthroughs, different ways of doing things, creating new technologies, bringing business to market and generating new revenue sources.

In the process, innovation is to connect people not only within national boundaries but across the globe. Indeed, global institutions like the World Economic Forum and Royal Science Society of United Kingdom views innovation as a global

Funding Agency	Fund Name	Funding essence
Ministry of Higher Education (MOHE)	Fundamental Research Grant Scheme (FRGS)	FRGS scheme is a grant for funding research activities at the nascent stage that involve exploring theories and concept of new ideas. The ceiling amount is RM250,000 for a maximum period of three years.
	Exploratory Research Grant Scheme (ERGS)	ERGS is also a grant targeted at bridging the gap between fundamental research and the applied research. The sum allotted is a maximum RM300,000 for a period of not exceeding three years.
	Long-term Research Grant Scheme (LRGS)	LRGS is a grant offered for research work requiring an inter-disciplinary approach involving multiple research institutions at a sum not exceeding RM3 million per project.
	Prototype Research Grant Scheme (PRGS)	PRGS funds the development of protoypes at pre-commercialisation stage and is subject to a ceiling of RM500,000 per project.
Multimedia Development Corporation (MDeC)	MSC R&D Grant Scheme	This grant scheme was introduced in 1997 to stimulate R&D and innovation capabilities among local companies and Malaysian workers as well as producing products that have commercial and IP rights potential. This grant is subject to a maximum sum of RM1.2 million.
	MSC Pre-seed Fund	This fund focuses on idea generation and facilitation of local start-ups, technopreneurs or K-SME's with ICT products for growth into MSC Malaysia status companies. The Pre-Seed Fund is limited to RM150,000 and is valid for 12 months.
	MAC3 Co-Pro Fund	MAC3 Co-Pro Fund was introduced in 2009 to assist local companies in producing animation and game development, and enhancing the local creative content industry.
	MSC Malaysia Innovation Handbook	This fund is intended to increase the number of collaborations between MSC Malaysia companies and service providers to produce more innovative proof-of-concepts, products, services and solutions, thus supporting the development of triple helix model fundamentals.
	MSC Intellectual Property (IP) Grant Scheme	This scheme was started in 2007 to develop Intellectual Property Rights (IPR) in view of protecting and capitalising intellectual assets of MSC Malaysia-status companies.
Ministry of Science, Technology and Innovation (MOSTI)	Science Fund	The Science Fund scheme provides financial support for basic research aimed at developing novel products, processes or services that can enhance knowledge skills and expertise among researchers in Institutes of Higher Learning (IHL) and Research Institutions (RI).
	Techno Fund	The Techno Fund is essentially intended to foster innovation and collaboration between technology-based enterprises, RI and IHL and to improve the state of R&D and commercialisation through intellectual property (IP) registration, leading to spin-offs or licensing.
	Inno Fund	The Inno Fund is targeted at small businesses and individuals aimed at developing technology innovation that can give rise to new products, services and processes including IP rights and patent registration.
	eContent Fund	The eContent Fund is aimed at spurring the growth of high quality creative content for both local and global markets.
	Industry R&D Grant Scheme	This scheme was started to stimulate research & development as well as innovation activities among Malaysian companies towards creating globally-competitive new technologies, products and processes. A total of 27 ICT-related projects has been funded at a cost of RM28 million.

Funding Agency	Fund Name	Funding Essence
Malaysian Technology Development Corporation (MTDC)	Commercialisation of R&D Fund (CRDF)	CRDF was introduced by MTDC in 1996 with the aim of generating greater commercialisation through R&D. A total of 155 projects were funded between 2006 and 2010.
	Business Growth Fund	This grant was introduced in 2010 to provide business funding to accelerate the growth of local technology-based companies towards building value for the company so as to attract venture capitalists and financial institutions.
	Business Start Up Fund	MTDC started this fund in 1996 towards encouraging entrepreneurship to start up a company.
	Technology Acquisition Fund (TAF)	The main purpose of TAF is to promote technology upgrading including acquisition of foreign technology in view of enhancing company-level competitiveness.
SME Corp	New Entrepreneur Funds	This Fund was introduced by SME Corp in 2001 to propel the growth of small and medium-sized Bumiputera enterprises, subject to a ceiling amount of RM5 million per enterprise.
	Fund for Small and Medium-sized Industries	Introduced by SME in 2000, this Fund is targeted at eligible SMEs in both export and domestic-oriented sectors and offers a maximum funding of RM3 million.
	Business Accelerator Program	Started in 2011 by SME Corp as an integrated program, it is aimed at developing and nurturing dynamic, competitive and resilient SMEs.
	Enrichment and Enhancement Program	This programme was established in 2011 to provide assistance to micro enterprises in enhancing their capability and sustainability by providing advisory, technical and financial support.
Ministry of Finance (MOF)	Cradle Fund	Initiated for the purpose of idea generation, it is geared to create an innovative business-building environment for technology entrepreneurs and technology start-ups.
	Malaysian Venture capital (MAVCAP)	MAVCAP provides an alternative source of high-risk financing for start-ups, seed capital and early stage ventures in ICT sector and high-growth industries. Since 2001, RM82.6 million have been disbursed to 258 entrepreneurs.
	Soft Loan Scheme for SME	This scheme was established in 2001 to promote the development of SMEs and comes with a ceiling loan limited to RM3 million.
National Information Technology Council (NITC)	Demonstrator Application Grant Scheme (DAGS)	DAGS was started in 2006 to acculturate Malaysians to ICT applications at work and home as well as nurturing web shapers or web developers and networked entrepreneurial communities. Public, private and third sector participation was the essence of this scheme.
	Creative Industry Fund	Established in 2009, the Fund provides funding in the form of loans needed for publication, purchase of assets or other related activities for the commercialisation of local creative industries. The funding amount is limited to RM5 million.
	MSC Malaysia ICON 2	Started in 2009, it aims to develop compelling local content that can spur demand for broadband.
Malaysia External Trade Development Corporation (MATRADE)	Services Export Fund	Established in 2009, the Fund is to assist Malaysian service providers in exploiting global opportunities. The ceiling amount for this grant is limited to RM100,000.
	Market Development Grant	This grant is aimed at assisting SMEs in the development of export markets and is subject to a RM100,000 limit.
	Brand Promotion Grant	This Grant is targeted at developing and promoting indigenous brand names for local products and services in the global market.
Prime Minister's Department	Facilitation fund	Introduced in 2011 by the Public-Private Partnership unit of the PM's Department, the Fund is to bridge the viability gap in private sector investment in the implementation of high value projects that have huge spill-over effects and high strategic impact on socioeconomic development.

Table 2: Sources of Public Funding for Research and Development, Innovation and Globalisation

phenomenon requiring breakthroughs in collaboration through forming linkages among different types of companies, industries and public institutions within and without national boundaries.

Such collaborations help innovators to leverage on global resources - specifically information and knowledge sharing, expert and specialisation services and sophisticated scientific equipment and laboratories that are considered beyond the reach of many scientists in the developing world, as well as global funding.

Premising upon such a broad notion of innovation, a country like Malaysia is yet to make a mark in creating or innovating a product or service that can turn around the economy. Indeed, such a breakthrough is necessary and critical to bolster the domestic investment environment and the export market towards the goal of attaining a high income nation status.

Malaysia's Position in the Global Innovation Race

There are numerous reports that measure the global position of a nation – the UN's Human Development Report provides human development ranking; IMD's Global Competitiveness Report provides factor and efficiency-driven economic positions; Digital Divide Index by the International Telecommunication Union (ITU); Broadband Service Quality Index by Said Business School of Oxford University and so on. Each of these reports has specific institutional motivation and aspirations, scope and coverage as well as target audience and data users.

In this series, the Global Innovation Index (GII) produced by the World Economic Forum (WEF) in collaboration with INSEAD provides the closest and specific measure on innovation.

The top 25 countries out of 141 countries covered in the GII 2012 innovation rankings by the WEF/ INSEAD are shown in Figure 3. It can be seen that only four Asian economies appear on this list, namely Singapore (3), Hong Kong (8), South Korea (21) and Japan (25). Malaysia ranked 32nd position in this ladder. Another interesting feature in this global ranking is that some of the countries that are small in size or population like Singapore, Switzerland, Finland, Hong Kong and Israel are classified as innovative nations. In other words, size does not matter and what matter are a quality population, conducive environment and culture.

The parameters that INSEAD used in the compilation of the Global Innovation Index (GII) 2012 are shown in Table 4. The parameters are categorised under innovation inputs and outputs. The input parameters include institutions (political, regulatory and business), human capital and research, infrastructure including ICT, market and business parameters while the output parameters entail knowledge, technology and creative outputs.

Country	Score	Rank
Switzerland	68.2	1
Sweden	64.8	2
Singapore	63.5	3
Finland	61.8	4
United Kingdom	61.2	5
Netherlands	60.5	6
Denmark	59.9	7
Hong Kong (China)	58.7	8
Ireland	58.7	9
United States of America	57.7	10
Luxembourg	57.7	11
Canada	56.9	12
New Zealand	56.6	13
Norway	56.4	14
Germany	56.2	15
Malta	56.1	16
Israel	56.0	17
Iceland	55.7	18
Estonia	55.3	19
Belgium	54.3	20
Korea Republic	53.9	21
Austria	53.1	22
Australia	51.9	23
France	51.8	24
Japan	51.7	25

Table 3: Top 25 Innovative Nations in the Global Innovation Index 2011
Source: Global Information Technology Report 2012 , World Economic Forum / INSEAD

Drivers of Innovation	GII Score	Drivers of Innovation	GII Score
Institutions	**55**	**Business Sophistication**	**11**
» Political	52	» Knowledge workers	28
» Regulatory	70	» Innovation linkages	45
» Business	44	» Knowledge absorption	6
Human Capital & Research	**42**	**Knowledge and Technology Outputs**	**36**
» Education	74	» Knowledge creation	65
» Tertiary	10	» Knowledge impact	39
» Research & Development	48	» Knowledge diffusion	24
Infrastructure	**41**	**Creative Outputs**	**42**
» ICT	38	» Creative intangibles	26
» General infrastructure	40	» Online creativity	62
» Ecological sustainability	46	» Ecological sustainability	56
Market sophistication	**14**		
» Credit	31		
» Investment	14		
» Trade & Competition	4		

Table 4: Malaysian Scores in the GII 2012
Source: Global Information Technology Report 2012, World Economic Forum / INSEAD

A total of 84 indicators were used. Although the list of indicators may not be comprehensive enough in depicting innovation elements, nevertheless, the data throws light on the status of innovation in Malaysia. The scores that Malaysia has secured are also shown in Table 4.

Strengths and Weaknesses in Malaysian Innovation

The scores shown in Table 5 indicate that in certain parameters, Malaysia has significant strength and in some areas, the country is still weak. For instance, in business sophistication, Malaysia is ranked 11th out of 141 countries. Further analysis of Table 5 shows that the country is number one in the following areas: R&D performed by business; R&D financed by business; high tech imports less re-imports, and ease of getting credit.

The study also shows the Malaysia is among the top 10 economies for: state of cluster development; graduates in science and engineering; ICT business and organisational model creation, and FDI net outflows. Additionally, the areas that show great potential for improvement in the near feature are: government effectiveness; ease of paying taxes; tertiary inbound mobility; quality of scientific research institutions; firms offering formal training; joint venture (JV)–strategic alliance deals, growth rate of PPP$ GDP/worker; ISO 9001 quality certificates; quality of trade and infrastructure; venture capital deals; intensity to local competition; and domestic credit to private sector.

The nation placed within the top 20 per cent for these variables. In other words, while Malaysia is ranked 32nd in the Global Innovation Index, the data reveals that the country is already strong in a number of areas and has great potential to improve in those areas currently considered weak, as revealed in this benchmarking study. Sometimes the benchmarks secured in such global studies need to be carefully evaluated before they can be fully accepted. For instance, Malaysia is ranked 56th for political stability, 90th for ease of starting a business, 70th for current expenditure on education, 68th for micro-finance gross loans, 52nd for venture capital deals, and 49th for knowledge intensity employment. The country's relatively low overall rank may be due to sampling flaws and a lack of adequate knowledge and exposure on the part of selected respondents who participated in the INSEAD primary survey. Malaysia's spectacular growth over the past two decades has been attributed to political stability supported by a diverse population in terms of language, culture and lifestyle.

Similarly, budget allocation for education has always been as high as the 20.4 per cent of total expenditure in 2010, which is consistent with the policy of producing high quality graduates and workforce. To eradicate poverty and uplift the poor, the country has introduced dedicated rural and urban poor programmes as well as micro-financing schemes like Amanah Ikthiar Malaysia, TUKAR etc.

Malaysia is not short of both private and public venture capital funds. In addition, the Government provides finance in the form of grants, loans and subsidies for research, development, patenting, commercialisation, branding, communication and trade promotion. As in the developed countries, Malaysia also has ivy-league type universities to produce top-notch graduates demanded by industry, academia and research institutions.

In fact, Malaysian institutions have secured a number of global awards in the field of research in recent years. Malaysian companies have also been the recipients of internationally-recognised awards like APICTA for innovative ideas in the ICT sector.

Innovation Drivers	Score	Rank
BUSINESS SOPHISTICATION	**58.2**	**11**
Knowledge Workers	*68.4*	*28*
Knowledge-intensive employment, %	26.8	49
Firms offering formal training, % firms	50.1	30
R&D performed by business, %	84.9	1
R&D financed by business, %	84.5	1
GMAT mean score	545.9	41
GMAT test takers/mn pop. 20 – 34	65.1	69
Innovation linkages	*42.4*	*45*
University/industry research collaboration	65.1	20
State of cluster development	65.4	4
R&D financed from abroad, %	0.2	91
JV-strategic alliance deals/tr PPP$ GDP	78.4	18
PCT patent filings with foreign inventor, %	33.2	62
Knowledge absorption	*63.7*	*6*
Royalty & licence fee payments/th GDP	5.9	11
High-tech imports less re-imports, %	32.7	1
Computer & comm service imports, %	38.3	41
FDI net inflows, % GDP	4.0	47
MARKET SOPHISTICATION	**60.8**	**14**
Credit	*46.8*	*31*
Ease of getting credit	100.0	1
Domestic credit to private sector, % GDP	114.9	25
Microfinance gross loans, % GDP	0.1	68
Investment	*54.7*	*14*
Ease of protecting investors	97.8	4
Market capitalization, % GDP	172.6	5
Total value of stocks traded, % GDP	37.9	27
Venture capital deals/tr PPP$ GDP	6.7	52
Trade & competition	*81.0*	*4*
Applied tariff rate, weighted mean, %	4.0	68
Non-agricultural market access weighted tariff, %	0.5	54
Imports of goods & services, % GDP	79.5	12
Exports of goods & services, % GDP	97.3	5
Intensity of local competition	74.1	24

Table 5: Selected Innovation Scores for Malaysia in Global Innovation Index Measurement
Source: Global Information Technology Report 2012, World Economic Forum / INSEAD

However, the issue of effective and efficient implementation of certain public policies and programmes remains. At times, this has slowed down due to political interference, institutional turf wars and weak mechanisms for monitoring, measuring and evaluation.

Thus, innovation inhibitors in the local scenario can be surmised as a weak culture; ineffective implementation of policies and programmes; highly-skewed broadband quality in terms of capacity, speed and cost; exhaustive procedures in securing government-aided finance; and lack of knowledge seeking, innovation culture and bottom-up / grassroots entrepreneurial spirit among the Malaysian workforce.

In 2009, the Wall Street Journal conducted a 'Most Admired Company in Asia' exercise. The top 10 most innovative companies identified in Malaysia included DiGi, Nestle, Public Bank, Astro All Asia Networks, UMW Holdings, Genting, Malayan Banking, Parkson Holdings, Malaysian Airlines and YTL Corporation. The exercise was applauded and revealed that all these Malaysian-based companies were leaders in the services industry and not in technology invention or product innovation. In comparison, Nintendo and Panasonic of Japan, Samsung Electronics in South Korea, Asustek and ACER in Taiwan, were among companies that had been voted the top-performing innovation companies by achieving excellence in product and technology innovation.

Even countries like Singapore and India only excel in services innovation. Growing innovation in the services sector is critically important for Malaysia's desire to uplift its services sector contribution to 70 per cent of GDP.

Obstacles and Challenges to Innovation

As far as Malaysia is concerned, the country is institutionally well-equipped with all the requisites of an innovation ecosystem in terms of political will and support, policy and programme strategies, funding mechanisms from ideation to globalisation stage, regulatory mechanisms, administrative and institutional arrangements, and more importantly, a defined role for research and innovation in the institutes of higher learning and research institutes. As acknowledged, the country has registered only limited success despite having come a long way in research and innovation. Malaysia is yet to make waves in research and innovation activities on a global scale. There could be numerous obstacles and challenges facing the nation in its aspiration to become an innovation nation. It may not be feasible to detail all of them in this paper. However, the main inhibitors to Malaysian innovation can be surmised as follows:-

• Visionary and Missionary Leadership

If there is an opportunity, every company would want to innovate with a view to increase their revenue, profits and margins. However, not all companies have the capacity or capability to do so especially in the case of small and medium-sized enterprises. Even for usual business expansion, SMEs lack the funding and as such, they may not even have an innovation strategy from the onset of business planning. Some SMEs may not have the requisite knowledgeable workforce to develop innovative products or services. Not all big companies including multinationals based in Malaysia are involved in research, development

Application	Description
Google Blogger	Blogger made lots of first-time artists, writers and thinkers as the website made it possible for users to publish works, ideas and literally anything on their own. Google acquired the Pyra Labs company and in 2003, made the platform entirely free which encouraged people to become bloggers. The bloggers can publish in Blogger which can now support more than 20 languages.
Google Translate	Google Translate helps millions of people worldwide to interact with each other by circumventing the language barrier. This free translation tool supports up to 64 languages. It can literally translate anything from web pages to sentences to words in an instant. Users can get the translation from any language to another within the available 64 languages.
Google Docs	Millions of people around the world collaborate, store and work on their documents with Google Docs, the free online productivity tool from Google. While other companies, including Microsoft (Microsoft Office), provide these kinds of productivity tools and services at a price tag, Google however offers this service absolutely free.
Google Advertising	Google advertising is one of the best options for people who want to advertise on the web. Unlike other advertisers who place irreverent ads everywhere on the screen, Google Ads has turned out to be highly useful. When you search for a particular product in Google, advertisers can serve you a related ad. Google makes most of its revenue from this.
Google Chrome	Google Chrome made its first appearance with Microsoft Windows in 2008. Because of its simplicity and ease of use, the browser gained a 33-per cent share of the market in less than four years and is now the most widely-used Web Browser. This free web browser is the backbone of Google, which integrates many Google products including Gmail and Google+. It allows users to sign in using their Google account, offering consistent performance and feel over multiple systems.
YouTube	YouTube can be considered the most fruitful acquisition Google has ever made. Google transformed YouTube, once a video-sharing site facing thousands of lawsuits, into one of the most preferred entertainment destinations on the internet. According to a Reuters report earlier this year, "YouTube, Google Inc's video website is streaming four billion online videos every day, a 25 per cent increase in the past eight months, according to the company."
Android	Well, nobody needs an explanation about Android. Google acquired the company and released the Linux-based operating system for mobiles in 2007. Nobody expected it to be a rival to iPhones or BlackBerrys. But five years later, Android is now way ahead of its competitors, at least in market possession. It also has a presence literally in all fields - Mobile to tablet to household equipment. About 400 million Android devices are present in the world today and roughly one million devices are activated each day.
Google Maps	Google Maps defined our destinations and routes from the day it was born - February 8, 2005. Over the years, it has grown as the most popular app in all platforms, whether it's a computer, mobile or tablet. It directs millions of people worldwide and with the introduction of advanced features like the street view, you can simply walk along the famous streets of Paris or explore the Amazon forest without leaving the comfort of your home.
Gmail	People never knew about free storage until Gmail was launched in April 2004, as a beta status. It was made available to the public two years later in 2007. Since then, it has changed the way we view emails. It offers unlimited storage so that you never have to delete your emails. Five years later and after many facelifts, Gmail as at June 2012 has 425 million users and is available in 54 languages.
Google Search	Search is the best product Google has ever made. It has become an unavoidable part of every online human being. Until today, no one has been able to question Google's monopoly in search. It was launched in 2007 and since then, it provides access to an unlimited amount of information about any and every thing at your finger tips. The service is available in 124 languages and processes hundreds of millions of queries a day. It is integrated into millions of other websites using the APIs and the best thing about Google search is that it never lets you down.

Box 3: Google Innovations in Content Applications
Source: Silicon India

and innovation activities for their own reasons. However, ad hoc local studies in the past have revealed that lack of funding is not the biggest hindrance for companies, small or large, to be involved in innovation. As shown in Table 2, the Government provides various sources of funding for research and innovation and as such, there is no excuse for Malaysian companies not to be involved in such activities from ideation to globalisation. Yet, the country has not attained the desired outcome of creating commercial patents and global brands. The top two barriers to innovation - even in large organisations - are lack of clear visionary and missionary direction to innovate, and the prevalence of risk-averse leaders in industries.

ICT-led innovation makes the economy grow faster. It can be seen in the illustration shown in Box 3 how Google as an individual company has leveraged well on the copious opportunities in the Internet era. Google expanded its businesses not purely from the technological perspective, but instead, leveraged on the content and applications market. As Malaysia is a multi-cultural country with a world-class infrastructure in place, its companies should explore emerging opportunities, not mimicking what others have but innovating something new.

Motivational Elements in Workforce Talents

The availability of innovative local talents for research and innovation activities could be a major challenge. The problem is being addressed either by importing foreign talents, or re-migrating Malaysian talents from overseas where they are doing well in their careers, or expanding the local talent pool. Indeed, on January 1, 2011, the Government set up the Talent Corporation to formulate and facilitate initiatives to address the availability of talent in line with the needs of the country's economic transformation. Collaborating closely with relevant Government agencies and employers in priority economic sectors, TalentCorp develops demand-driven initiatives focused on three strategic thrusts:

- Optimise Malaysian talent;
- Attract and facilitate global talent; and
- Build networks of top talent.

However, it must be noted that not every learned person can become a researcher or innovator. Would an academic qualification alone, for example a doctorate degree or first class degree, suffice for a person to become a bona-fide researcher or innovator? The answer is no. Very often we cite people like Bill Gates, who was a college dropout, or Steve Jobs, who did not have a PhD. These two had eschewed traditional wisdom and had reshaped industry direction through their innovative ideas and traditions.

Very often, research organisations tend to overlook or assess certain traits and qualities that are imperative for a person who aspires to become a researcher or an innovator. When organisations fail to have stringent conditions or a full-proof recruitment system, it would be a formidable task to achieve the desired outcomes in their research or innovation endeavours. It would only result in sheer waste of organisational resources, or public funds if it is owned by the Government. Now the question is: what are the traits and qualities a potential innovator or researcher should have prior to appointment? Some critical traits and characteristics that warrant attention include a knowledge-seeking culture, a can-do or go-getter attitude, research affinity, technical aptitude, a results-oriented customer advocacy focus, effective communication skills as well as the attitude to have fun at work.

Lack of Great Ideas and Inter-disciplinary Approach

The lack of great ideas is also a plausible reason for the low level of innovation in Malaysia. It may have been true to some extent in the past but with the advent of contemporary global networking and ready access to global ideas as well as interdisciplinary approach, new ideas can be generated. It may not be wise for countries like Malaysia to compete in inventing new technologies. Advanced countries like the US, the UK, France, Germany and Japan are way in front on this score and it would not be easy to penetrate into their respective markets. That said, it is not impossible if Malaysians are willing to invest their resources in areas like nanotechnology, MEMS and biotechnology where the research field is still green and a great deal of research and innovation opportunities are still available. Likewise, opportunities and the market for content development and application research in the ICT field is very much alive.

The other major shortfall in ideation is the lack of inter-disciplinary approach. Gone are the days when subject matter was confined to specific domains. Pervasiveness and ubiquity of ICT demands an inter-disciplinary approach. Indeed, the top 10 examples cited in Box 4 indicate the growing importance of an inter-disciplinary approach and how the world is being revolutionised through disruptive technology and disruptive innovations.

Technology	Description	Disruption
DVR + Entertainment on demand	Recording TV shows using VCR was once difficult and time consuming. Time-shifting programmes and fast-forwarding through commercials became as easy as pressing a couple of buttons with the introduction of TiVo and Replay TV digital video recorders. As such, people were no longer shackled to the arbitrary schedules of TV programmers and the obnoxious pandering of advertisers. Like the best disruptive tech, DVRs returned control to users and made consumers hungry for even more control over what they watched, when, and where.	The whatever / wherever / whenever model of media consumption is turning both Hollywood and the consumer electronics industry on their heads and forcing advertisers to rethink ways to capture our attention.
YouTube + Cheap Digital Cameras and Camcorders	When the candid video of former Senator George Allen calling someone a macaca (a monkey) appeared on YouTube, it not only cost him a Senate seat and altered the balance of power in the United States Congress, but it also demonstrated how far viral video had come. The Web is now the first stop for many political candidates and companies trying to spread the word about themselves or their products. YouTube accounts for more than 60 per cent of all video traffic sites. YouTube wouldn't have reached such heights without cheap digital cameras, camcorders, and cellphone cameras.	Digital video has made mini-Hitchcocks of everyone. YouTube and its many cousins give the masses a place to place their masterpieces. Journalism, politics, and entertainment will never be the same again.
Open Source + Web Tools	Open source solutions have allowed massive innovation and spectacular growth. Specifically, Linux and other open-source operating systems have allowed manufacturers to build simpler, cheaper machines, such as the One Laptop Per Child project's XO Machine and Asus' Eee PC. Such thin systems play a key role in enabling cloud computing and desktop software. Offerings, such as the Open Office suite and Mozilla's Firefox and Thunderbird, are free (and often superior) alternatives to Microsoft's products. And Sun's Java has enabled the development of rich applications for both the Web and handheld devices. When open source meets Web development, less expensive tools such as Apache, JBoss, MySQL, and Ruby have emerged for developing new products and services and delivering them across the Internet. That means start-ups can afford to take longer to develop and refine their products without the pressure and risk of filing an IPO. Even Microsoft appears to have succumbed to the irresistible lure of open source.	The Net is seeing a new boom in Web 2.0 companies that are more stable and more interesting than their dot-com-era predecessors. And with phones using Google's Linux-based Android operating system slated to appear this year, open source could disrupt the wireless market as well.
MP3+ Napster	Initially, the audio engineers at the Fraunhofer Institute for Integrated Circuits worked on MP3 research primarily on audio compression aimed at delivering high quality music over the phone. But MP3 files' small size in 1997 offered the first portable players that allowed music fans to listen to them without a computer. In 1999, Napster arrived, giving users an easy way to find new MP3s and share them - much to the chagrin of the Recording Industry Association of America. Nonetheless, it paved the way for peer-to-peer networking to develop as a legitimate distribution medium.	The idea that media should be portable and free is disruptive.
Blogs and Google Ads	Not long ago, if you wanted to be a publisher, you had to be either born into a rich family or an HTML geek. Now, thanks to simple tools such as Blogger, TypePad, and WordPress, anyone can be a publisher or producer - no technical expertise (or talent) required.	Blogs give everyone a public voice, while Google gives bloggers a way to fund and market themselves - and the economy of the 21st century is born.
Cheap storage and portable memory	When IBM invented the RAMAC hard drive in 1956, it stored only 5 megabytes of data at a cost of US$50,000. In 2005, Toshiba introduced the first 1.8-inch 40GB drive using perpendicular magnetic recording, which stacks magnetic charges on the disk's surface vertically instead of horizontally. Since then, density rates for hard-drive platters have increased 40 per cent annually. Today, densities have risen with cost reduction of 30 to 40 cents per gigabyte - cheap enough that companies such as Google and Yahoo can give storage away, enabling free Webmail, online photo and video sharing, and other cloud computing services. At the same time, improvements in flash memory allow people to carry vast amounts of music and video on iPods and cell phones, freeing everyone from the bonds of their TVs and stereos, and gradually turning wireless telecoms into broadband entertainment providers. In this endeavour, new nanotechnology called programmable metallisation cell (PMC) could produce drives that are a thousand times more efficient than flash at a tenth of the cost and as such, a thumb drive could store a terabyte of information.	Where would we be today without cheap, capacious, portable storage? No iPods. No YouTube. No Gmail. No cloud computing.

Technology	Description	Disruption
Cloud computing + always on devices	The profusion of cheap storage, software that can run a single massive application across thousands of low-cost servers, and near-ubiquitous Net access have created a virtual supercomputer accessible from your pocket. That's why companies such as Amazon, Google and IBM and Microsoft are jostling to offer cloud computing - applications that run on vast server farms instead of on local networks or desktop PCs and delivered across an Internet connection to corporations and consumers. If you've ever used Google Docs, Salesforce.com, Yahoo Mail, or Zoho Writer, you've experienced cloud computing. When machines across the Net do most of the heavy lifting, we can use devices that are smaller, cheaper and more portable than laptops or desktops without sacrificing computing power	For enterprises, cloud computing provides the benefits of a data centre without the cost and hassle of maintaining one. For consumers, it offers the promise of cheaper, simpler devices that let them access their data and their applications from anywhere.
Broadband and Wireless Networks	At the end of the preceding century, less than 1 per cent of US households had a broadband connection. Within the following decade, telecom and cable companies went about creating broadband infrastructure and raised the broadband penetration rate to 55 per cent by also offering affordable rates. This has allowed for rich media, video, and audio to dominate the Internet.	Broadband has created an explosion of video and music Websites and VoIP services, while Wi-Fi is bringing the Net to everyday household appliances such as stereos, TVs, and home control systems. Together, they're making the connected home a reality.
Web and the Graphic browser	Before 1993, however, the Internet as we think of it today was a loose collection of protocols, networks, and tools built by university geeks. The introduction of the World Wide Web in 1991 gave people a way to connect information online, but it was still just another (albeit critical) piece in the puzzle. The graphical browser, invented in 1993 by Marc Andreessen and Eric Bina at the University of Illinois at Urbana-Champaign, gave the Web wings, ultimately turning it into a delivery vehicle for just about everything. It changed virtually every aspect of the economy and created an entirely new class of major global corporations that did not exist prior to then.	Media firms, publishing companies, and advertisers now think Web first, and broadcast or print second.
Cell phones + wireless Internet access	Cellphones have changed the way we communicate, blurring the lines separating work, play, and the commute between the two. Wireless e-mail, messaging, and Web access will change communications even more. Data, not voice, is driving this disruption. The biggest news from Apple's recent announcement of its iPhone software development kit is that it lets business users access their work e-mail from their Apple handsets. New Internet-friendly cellphones such as the iPhone and G-Phone [phones built on Google's Android operating system] will lower the entry barrier for mobile Internet services, improve mobile Internet experiences, and introduce new business models. More importantly, it is beginning to see mass-market adoption and form factors diversify to include embedded portable devices such as portable media players and game consoles. Mobile Internet-capable phones are poised to become a major advertising platform as well.	The ability to be reachable 24/7 is morphing into the ability to surf the Net from any location. And it's forcing monopolistic wireless to open up their networks to new devices and services.

Box 4: Inter-disciplinary Approach in Innovation
Source: Silicon India

Grassroot Innovation Culture

By and large, the country lacks grassroot innovators. It may be attributed to our culture and behaviour as well as lack of industry maturity and a conducive environment. First of all, we must move away from the mentality as followers of best practices that have been developed elsewhere especially from the developed blocs. The western countries have developed products and services that meet their needs and are compatible with their culture, values and tradition. However, the spirit of innovation and pioneering entrepreneurship are something that we have to learn and adopt. Box 5 provides a list of eight such contemporary pioneers who emerged in the Internet world. They have created disruptive innovations. Most of these innovations were bottom-up; some of them started their ventures from a garage; some initially failed but bounced back to great success in creating global companies; and more importantly, they had the knowledge-seeking culture, passion, commitment, discipline and perseverance.

They are not "government-made initiatives" as typically used to be the case in Malaysia. In Malaysia, even though the innovation initiatives are very much government-guided or spearheaded as top-down initiatives stipulated in the various technology roadmaps and funding guidelines, Malaysian industry leaders generally

lack confidence in bringing their innovative products and services to the market successfully. They fear that the customer may not be ready to accept new ideas, solutions, products or services.

They tend to adopt a safe mode by becoming followers rather than to take risks in research, innovation and commercialization. Moreover, Asians including Malaysians have a subservient and hierarchical mentality, in particular showing respect to those in power. Asians focus on maintaining harmony in their relationships and as such, these traits pose challenges to an innovation culture! Besides that, Asians find it difficult to digest failures. At times, religious and belief systems also shape innovation behaviour.

The simplistic and non-materialistic lifestyle propagated by many Asian cultures, hinder innovation thinking. This is unlike the West where the people are more outspoken, express their views freely, are willing to take risks and positively pursue higher inspirations including a materialistic lifestyle. This motivates them to create or innovate new things that can take them to a higher point in life.

Innovation Personality	Vision	Achievement
Bill Gates	Microsoft : World run by computers	The founder of the pioneer computer product manufacturing company Microsoft, Gates is one of the most recognisable faces in the world. He started his entrepreneurial career by founding the company with partner Paul Allen. He dropped out of Harvard before Microsoft because he could not bring himself to go to class.
Niklas Zennstrom	Skype: Internet Telephony Service	The Swedish creator of Skype had envisioned seamless and easy file transferring over internet. To accomplish his goal, he co-founded KaZaA Media Desktop which became one of the most popular ways of trading multimedia files over the web. After facing a lot of controversy and lawsuits, Niklas went on to design Skype which was based on a similar technology to KaZaA.
Steve Jobs	Apple Inc: World's First Personal Computer	After a few days in college, Jobs soon realised that it was in no way going to fulfil his dreams. Working for many firms and designing calligraphy, Jobs teamed up with a pro engineer, Steve Wozniak, to produce the world's first personal computer. Jobs had this flair about him to never get into market research and achieve greatness just by following his gut feeling.
Steve Wozniak	Macintosh: Advent of Personal Computing	Teamed up with Steve Jobs, Wozniak compromised many things in his life to build the first personal computer. To raise the first funds for designing the prototypes of the Mac, Wozniak had to sacrifice his HP scientific calculator. Although Steve Jobs would forever remain the face of Apple Inc, Wozniak's contribution to build the Apple empire cannot be forgotten.
Mark Zuckerberg	Facebook : Know what your friends are up to	The Harvard dropout had barely any experience in business and hardly any money to start his entrepreneurial venture. In those times, he relied completely on his gut and believed in the people around him. Now with a multi-billion tech IPO, Zuckerberg stands to be one of the youngest successful entrepreneurs ever. Shot with many controversies all the time, the leader of Facebook never gives up on the fighting spirit and keeps going forward.
William Hewlett and David Packard	Hewlett-Packard: To make electronics a household item	In 1939, a toss of a coin started the company with a mere US$538 right in the middle of garbage. The duo then moved on from designing electric appliances to semiconductor-based products and now their company is one of the biggest tech companies in the world. What was once envisioned by William and David, electronics and allied appliances are now household items.
Larry Page and Sergey Brin	Google: The whole web at the fingertips	Larry's dream to have the whole web saved on a hard drive pushed the duo of Stanford PhDs to build what is now the greatest search engine in the world. Started in a garage with nothing more than ideas and passion, the team faced lots of issues in the early days. Google is now one of the most successful tech companies and has produced many products with a goal of changing the face of the world.
Jerry Yang and David Filo	Yahoo!: The ultimate web portal	Built for personal use by the two Stanford University alumni, Yahoo is now one of the most popular search engines around. When they came up with the idea of developing the product, they were merely college pass outs and had barely any experience to build the tech empire that Yahoo is today, although the company is today hampered by management problems and controversies.

Box 5: Top 10 Grassroot Innovations in the Internet World
Source: Wed 20 Jun, Silicon India

Voice of Customer (VOC)

One of the major shortfalls in the local research and innovation activity scenario is failure to include voice of customer (VOC) from the onset of the planning stage. VOC is a process of soliciting qualitative and quantitative data from customers.

VOC is a vital component of research, innovation, designing product or service, development into a prototype, commercialisation involving start-ups or mini-roll out or entering the mass market and branding strategy. It gives the research organisations the vehicle to listen, learn, and more importantly, to take action to meet customer demands. The VOC process not only helps to solicit feedback, but it also helps to build stronger relationships and business ties with the customers, which are critical for customer loyalty and retention.

For instance, designing a new product, formulating a new service strategy or initiating a start-up company usually come with concerns to lower bootstrapping costs, mitigate risks and ensure higher potential return on investments. Usually, new innovators and entrepreneurs ought to manage limited budgets but high expectations from investors and stakeholders. New innovators and entrepreneurs may have excellent ideas at the product development stage. At the beta and actual product development stage, however, they need real customers and real features that fulfil customer aspirations and desires.

What do customers typically look for? They look for quality featuring attributes, reliability, availability, defects-free and minimised maintenance; affordable cost of purchase, repairs and maintenance;

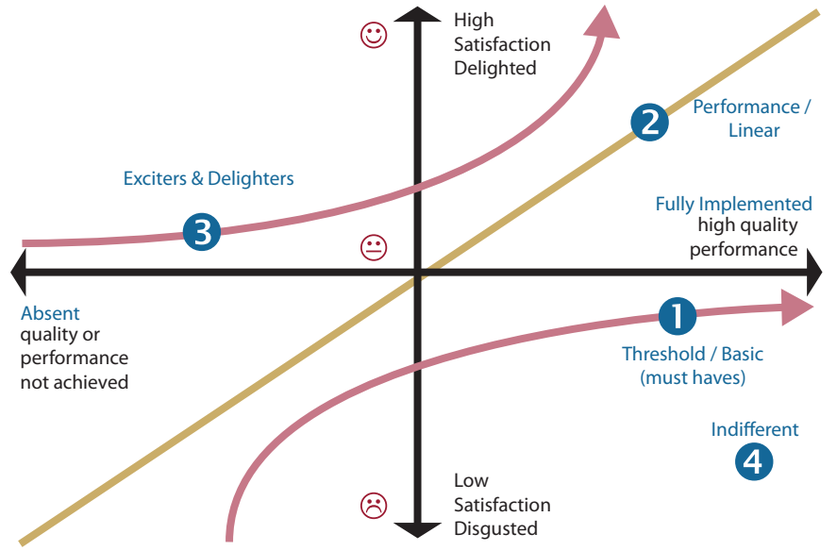

Figure 5: Kano Model for Soliciting VOC

reduced cycle time in delivery and avoidance of delays; service and safety such as sales services, parts availability as well as warranties and safety standards. Contemporary customers nowadays demand ethical business conduct, greener products and services as well as regulatory and legal compliance and conformance.

Figure 5 shows the Kano Model typically used in soliciting VOC. The first and most important element in a product or service innovation are the must-be elements, which are required and expected to be there (e.g. factory fitted air-conditioner in a car). The second important aspect is the satisfier elements or linear performance elements (e.g. storage capacity of a thumb-drive being increased progressively 1GB, 2GB, 5GB et cetera).

The third aspect is "delighters" which are unexpected elements as far as customers are concerned (e.g. car dashboard indicator showing fuel capacity matching against mileage). Over the time, some items can move from the "delighters" stage to the "must-be" category. For example, the car air conditioner was once considered an accessory but today it is a standard feature especially when every customer desires for it and more importantly, is willing to pay. In other words, the Kano Model strategy is crucial for any research and innovation exercise so that the investments gone in producing or developing a product meet the customer and market requirements.

Traditionally, the quality teams within an organisation are empowered to solve problems. The assumption is that they know about the product or service better than the customers do. They decide on design or re-design specifications, features and standards of a product and expect customers to buy-in once designed. This notion is challenged today after realising a number of products and services delivered to the market do not meet customer aspirations. To overcome such market failures, the culture and practices of VOC gathering set in a number of industries pave the way for customer-driven products and services.

The sources of customer information can be obtained from internal sources or via setting up a listening post or through research methods. The internal sources include existing

company information, administrative records, logistics and operational log records, industry experts, secondary data, suppliers and competitors. Customer-based research methods entail ethnography approach, survey interviews, focus groups discussions, in-depth interviews, customer-brain storming sessions, community of enthusiasts and observations. In some approaches, inputs or feedback are obtained from community of enthusiasts who have explicit interests in such products, for example sports equipment, computer software, or where customers are likely to band together into enthusiast groups or clubs. For soliciting quality ideas, in some instances, organisations use a customer advisory panel or industry associations who can provide better insights about a new product or regarding a proposed re-design.

However, Steve Jobs once said, "It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them." That quote came from an interview in Business Week on May 25, 1998. True, not all focus groups will produce results, and not all VOC data gathering techniques will bear fruit. Regardless, it is less about the gathering techniques themselves, and more about the information they provide.

Voice of Business and Voice of Employee (VOE)

Viewing from the business and employment perspective, the salaried employee may ask why create or innovate a new product. "What is it in for me?" is a typically question. Lack of self-motivation can be a major obstacle to instil an innovation culture in an organisation. Such employees are less likely to challenge the existing boundaries.

Moreover, in the Asian context, the hierarchy-based structure is unlikely to invite innovative ideas from employees, who out of awe, respect and fear may not offer their ideas. Employees also fear rejection of ideas from their superiors. Such hierarchy, rigidity and the poor communicative and interactive work culture can only be overcome provided the company instils open strategies.

Indeed, in contemporary times, e-mails, social networks and online suggestion boxes can be instituted to invite ideas from employees who understand the day-to-day problems much better than some in the managerial category. More importantly, good ideas must be recognised with awards and accolades as well as share ownership of newly-formed companies. Organisational leaders placing trust and empowering their staff is critical for implementing a voice of employee (VOE) culture in an organisation. However, the VOE also has to be

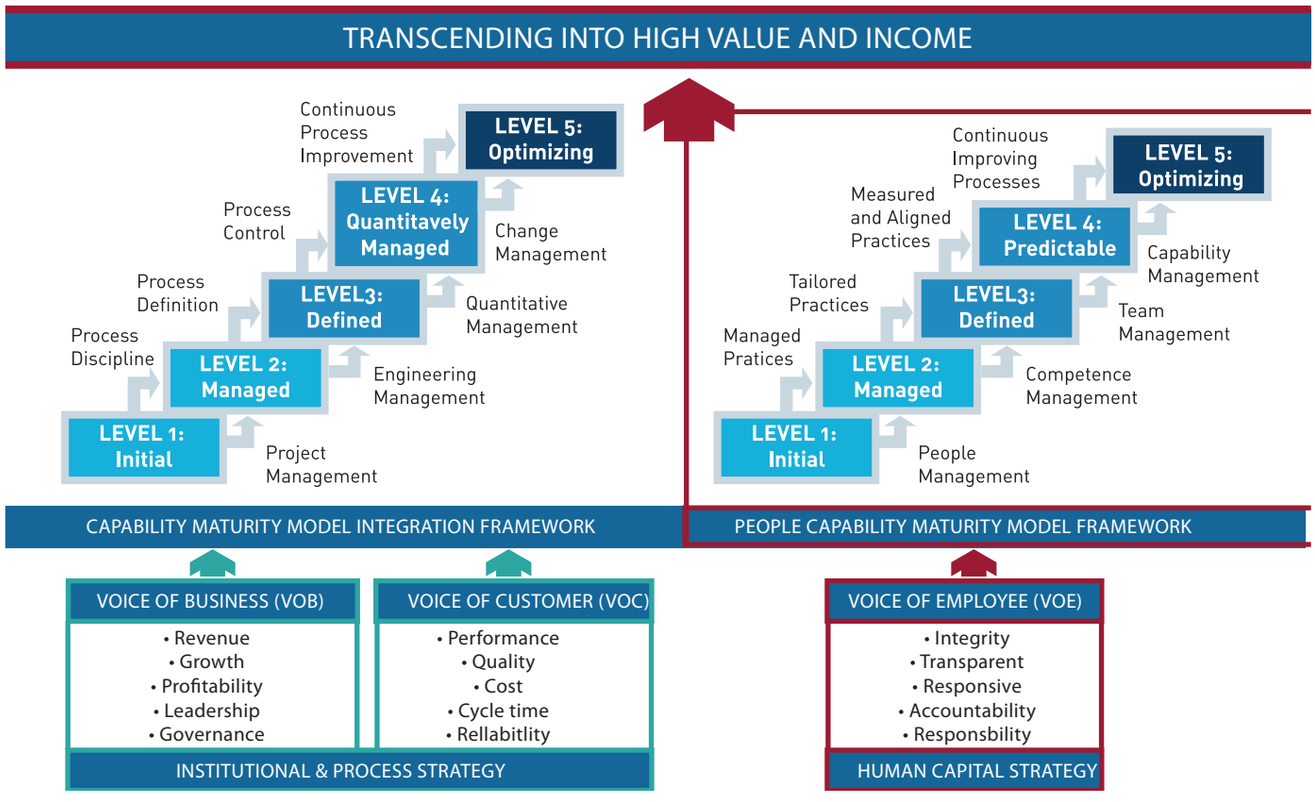

Figure 6: Capacity and Capability Process Building in Software Development Environment

balanced and synchronised with the voice of business (VOB) that the organisational leaders have been entrusted with responsibility to ensure profitability and growth. Thus, in order to institute an appropriate work culture and practices as well as creating a competent workforce, it is imperative for organisations to put in place not only work practices such as a capability maturity model that aims to develop institutional and organisational capacity but also the people capability maturity model. An example of such a framework is shown in Figure 6 that is being widely used in developing a matured software development environment. In other words, a matured organisation not only provides a safety net for its employees, but also instils the requisite sense of ownership and motivation among the employees.

ADVANCING MALAYSIA INTO A DIGITAL ECONOMY

Digital Malaysia is the nation's programme to advance the country towards a developed digital economy by 2020. It will create an ecosystem that promotes the pervasive use of digital technology in all aspects of the economy to connect communities globally and interact in real time resulting in increased GNI, enhanced productivity and an improved standard of living.

The programme will leverage on new and existing infrastructure to drive Malaysia towards a digital economy. By effectively combining existing ICT and digital initiatives, Digital Malaysia will foster a cohesive digital ecosystem that will ensure Malaysia becomes a developed digital economy.

THE DIGITAL MALAYSIA STRATEGY

Digital Malaysia is underpinned by three (3) strategic thrusts that have been identified as critical game changers:

- **Supply to demand -** initiate more demand-focused activities to leverage existing infrastructure, economic activity, market trends and consumer behaviour;
- **Consumption to production -** encourage and enable internet users to produce as much as they consume from digital technologies;
- **Low knowledge-add to high knowledge-add -** enhance competitiveness by focusing on knowledge-added activities such as automation and innovative digital tools.

These strategic thrusts aim to harness the opportunities and further the enhancement of the digital economy by delivering the following targeted goals:

- Catalyse digital entrepreneurs to tap demand initiatives
- Nurture a new generation of IT-savvy youth through the use of digital learning, who will form the bulk of Malaysia's workforce in 2020
- Drive automation and technology adoption amongst SMEs to boost productivity

MEASURING DIGITAL MALAYSIA'S SUCCESS

A **vibrant digital ecosystem** leading to increased wealth and productivity

17% ICT contribution, representing RM294 billion to Malaysia's GNI by 2020

Creation of **160,000 high value jobs** by 2020

Better standard of living for all through the maximisation of ICT in work, life and play

Be part of Digital Malaysia

See what others are thinking at **www.facebook.com/DigitalMalaysia**

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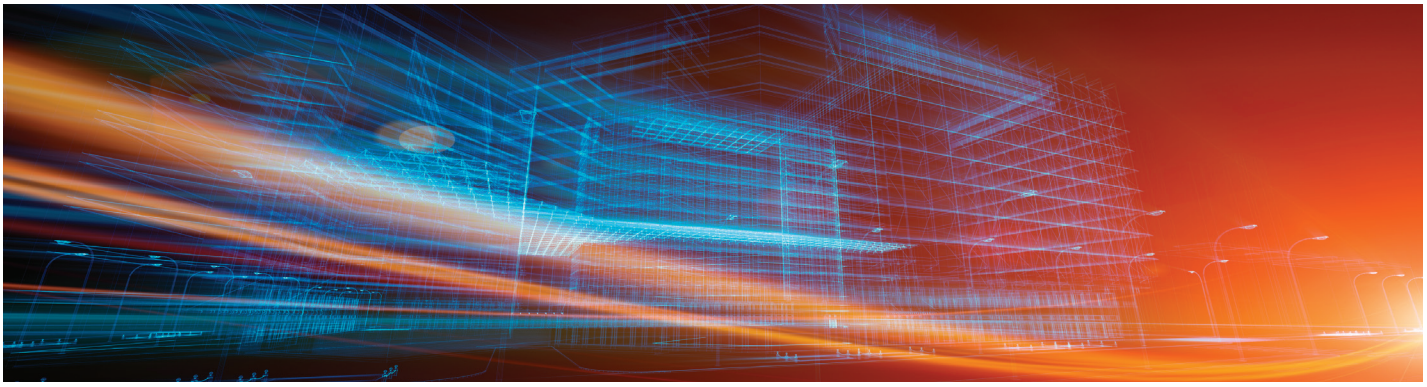
UNDERSTANDING DIGITAL MALAYSIA

Digital Malaysia is the nation's programme to advance the country towards a developed digital economy by 2020. It will create an ecosystem that promotes the pervasive use of digital technology in all aspects of the economy to connect communities globally and interact in real time resulting in increased GNI, enhanced productivity and an improved standard of living.



Your Questions Answered

Why do we need Digital Malaysia? Why is embracing the digital economy so important?

While Malaysia has already built a strong ICT foundation, Digital Malaysia intends to go beyond adoption numbers to focus on driving value-added services through the utilisation of digital technologies. The resultant digital ecosystem aims to create new sources of income and revenue, enhance productivity of government, business and citizens, create participatory opportunities, encourage innovation in domestic companies and enable global market expansion. Digital Malaysia will complement existing initiatives and programmes by maximising all existing resources from a demand-driven perspective and leveraging on the existing opportunities to drive the country towards an even stronger digital position.

Is the speed of change in technology really that fast?

The last decade has seen the advent of internet and digital technology, creating both great change and upheaval. The internet today connects about 2.1 billion people worldwide and has changed every facet of life, causing substantial economic impact. Digital technology has accelerated the speed of most business activities, from product development to customer response. Speed has become a key determinant for economic success. The social space has seen the biggest impact as it has built new platforms for communication, collaboration and dissent, shaping how we interact with each other and presenting countless new opportunities for business and the individual.

How will Digital Malaysia improve my standard of living?

Malaysians are no strangers to the internet. We consume information and use the internet extensively for social networking, news and research, but Malaysians have yet to fully capitalise on the internet for revenue generation. Digital Malaysia intends to create platforms and programmes to nurture and grow netizens to become producer-consumers or prosumers. The programme will create new income generation opportunities via new digital business models.

One example of these opportunities is micro sourcing, which is the distribution of well-defined discrete tasks to a large group of networked users through the internet. These tasks can be completed under flexible circumstances and only require basic internet-connected devices such as application-capable phones, tablets, netbooks and PCs. Although anyone can participate as a task worker, it especially offers opportunities to people outside the traditional workforce, including the bottom 40% (B40) of the population who want to increase their income.

Will Digital Malaysia bring new job opportunities?

One of Digital Malaysia's targets is the creation of 160,000 high value jobs by year 2020. Areas that the programme will explore for job opportunities include cloud enterprise applications, gamification, micro sourcing, internet of things, data analytics, mobility, social media, eCommerce, green technology and embedded systems.

What opportunities will the digital economy bring to small and medium enterprises in Malaysia?

The Small and Medium Enterprises (SMEs) will benefit from the three strategic thrusts of Digital Malaysia especially in addressing the areas of productivity and exports. By enabling enterprises to enhance productivity, Digital Malaysia will allow SMEs to raise productivity, through cost reduction and revenue enhancement. At the same time, e-commerce will allow SMEs to tackle the existing challenge of low SME exports by gaining a better footprint in global markets.

MDEC Driving Transformation

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01. ESSENCE OF ICT ROADMAP 2012 FOR INNOVATION DRIVEN GROWTH

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1. Introduction

The ICT roadmap development in Malaysia is not a new activity. In the past, the Ministry of Science, Technology and Innovation (MOSTI), with the support of various ministries, government-linked agencies and its associated research institutions, had developed a number of Technology Roadmaps. Until the creation of the ICT Roadmap 2008, ICT had been regarded as an integral component in the technology roadmap. However, such roadmaps need to stand the test of time as the ICT industry is arguably the most dynamic and prolific industry around. The ICT industry is highly susceptible to disruptive innovation and, more so, this takes place at a very fast pace while the industry faces rapidly-changing consumer behaviour as well as a very high degree of global competitiveness.

As such, it is imperative that the ICT Roadmap 2008 and the prior technology roadmaps be reviewed for context check, local capability perspective and implementable aspects. The three Technology Focus Areas (TFAs) stipulated in the ICT Roadmap 2008 were: Wireless Sensor Networks, Predictive Analytics and 3D Internet. The three TFAs are supported via a four pronged approach: *(i) competitive assessment of the identified TFAs covering country readiness, as-is situation across Industry, research development & commercialisation (RD&C) and human resources; (ii) alignment with global megatrends; (iii) ease of implementation and (iv) views of the various stakeholders.*

Specifically, the assessment requires realignment with Megatrends and national transformation programmes (NTPs) as well as benchmarking against competitive peer nations, i.e. Finland, India, Korea, Sweden, Taiwan and USA. Specific implementation factors that warrant due attention include factors such as efficacy of institutional arrangements and mechanisms, availability of adequate funding, human capital and capability development, setting appropriate targets/milestones and timelines and private sector participation in line with public-private partnership strategy that the Government has been promulgating.

2. Review of National ICT Roadmap 2008

Prior to 2008, the National ICT Strategic Roadmap, as outlined in Figure 1, was very much focused on production technology, in particular research and development as well as commercialisation targeted at nanotechnology and MEMS. This strategy was adopted during the preparation of the Malaysian Industrial Master Plan III as a way forward strategy to move up the micro-electronics sector in the value chain from employment-focused to high value-adding sector.

The low cost employment strategy that worked very well for Malaysia since the early seventies failed to sustain its rigour and flavour when a number of countries in the region such as China, Vietnam, Laos and Cambodia offered much lower labour costs following market liberalisation policies that were being pursued aggressively with the collapse of planned economies worldwide. Coupled with this market liberalisation was the global phenomena of the commercial Internet technology in the early nineties and its unprecedented impact on the ICT sector. This then led to the emergence of research and development pertaining to grid computing, semantic technology, wireless technology and biotechnology, as reflected in Figure 1. In parallel, the Government had also introduced cyber security, cyber laws and the open source concept in support of harnessing the new age technologies, in particular its profound and unprecedented impact on society, economy and government. The new age ICT has been changing the way individuals work, learn, play, interact and perform business transactions in cyberspace. During these developmental stages, ICT policy strategies were prepared in stages, and most of its components remained fragmented and independent of one another in the early drafts of the roadmap.

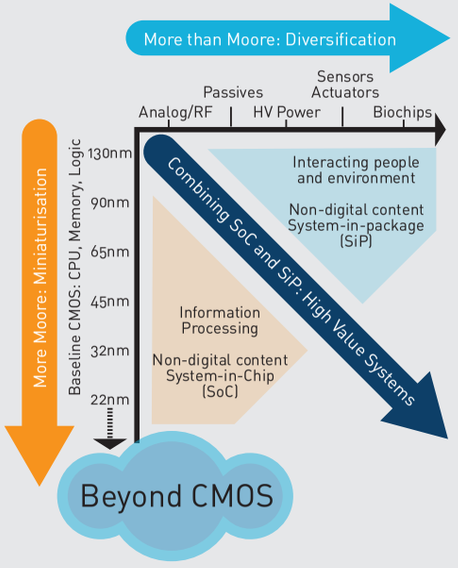
Recognising the need for coherence and linkages with one another, the ICT Strategic Roadmap 2008 (Figure 2) was initiated with a set of development goals, particularly aimed at positioning Malaysia as a global leader in selected ICT focus areas and to put Malaysia on a trajectory towards a knowledge-driven economy.

As mentioned earlier, the first explicit ICT Roadmap 2008 identified three key ICT technology focus areas (TFAs): Wireless Sensor Networks, 3D-Internet and Predictive Analytics. These areas were meant to advance Malaysia economically and technologically so as to meet the tenets of Vision 2020 – becoming a developed nation of its own mould economically, socially, politically and spiritually as well attaining high income status of not less than US$21,834 per capita. Like in any other roadmap, the ICT Roadmap 2008 was poised to provide strategic leadership, direction and thrust for ICT policy formulation and implementation as well as to rationalise institutional arrangements. It also identified administrative and logistics support required as well as signposts and vision areas to manage opportunities and risks. However in reality, such monitoring and evaluation as well as measurement tenets continue to

CYBER SECURITY

CYBER LAWS

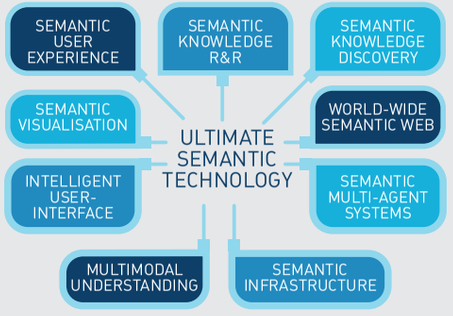
NANOTECHNOLOGY



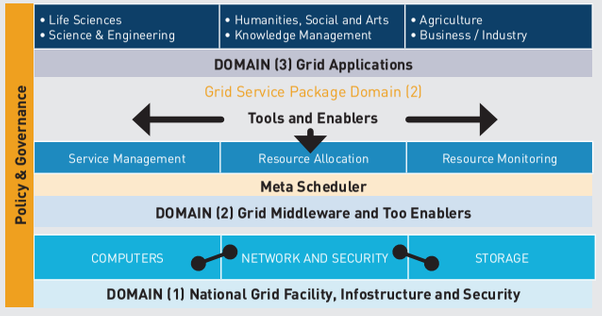
MEMS TECHNOLOGY

Market	Applications
Automotive	• Airbag systems • Vehicle security system • Inertial brake lights • Headlight leveling • Rollover detection • Automatic door locks • Active suspension
Biotechnology	• Diagnostics • Drug delivery • Drug recovery • Implantable devices
Consumer	• Appliances • Sports training devices • Computer peripherals • Car and personal navigation devices
Industrial	• Earthquake detection and gas shutoff • Machine health • Shock and tilt sensing
Military	• Weaponry • Equipment for soldiers • Embedded sensors
Communications	• Fibre-optics network components • RF relays, switches and filters • Tunable lasers

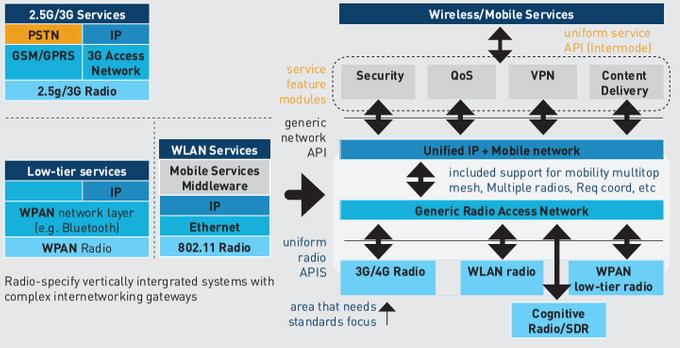
SEMANTIC TECHNOLOGY



GRID COMPUTING



WIRELESS TECHNOLOGY



BIOTECHNOLOGY

The implementation of the National Biotechnology Policy encompasses three main phase:

It is intended that by 2020 Malaysia will be a global player in biotechnology and will generate at least 20 global Malaysian companies.

OPEN SOURCE

Figure 1: ICT Road Map Prior to 2008: Technology Roadmap Focus
Source: MOSTI and ICT Strategic Review 2011/12, PIKOM

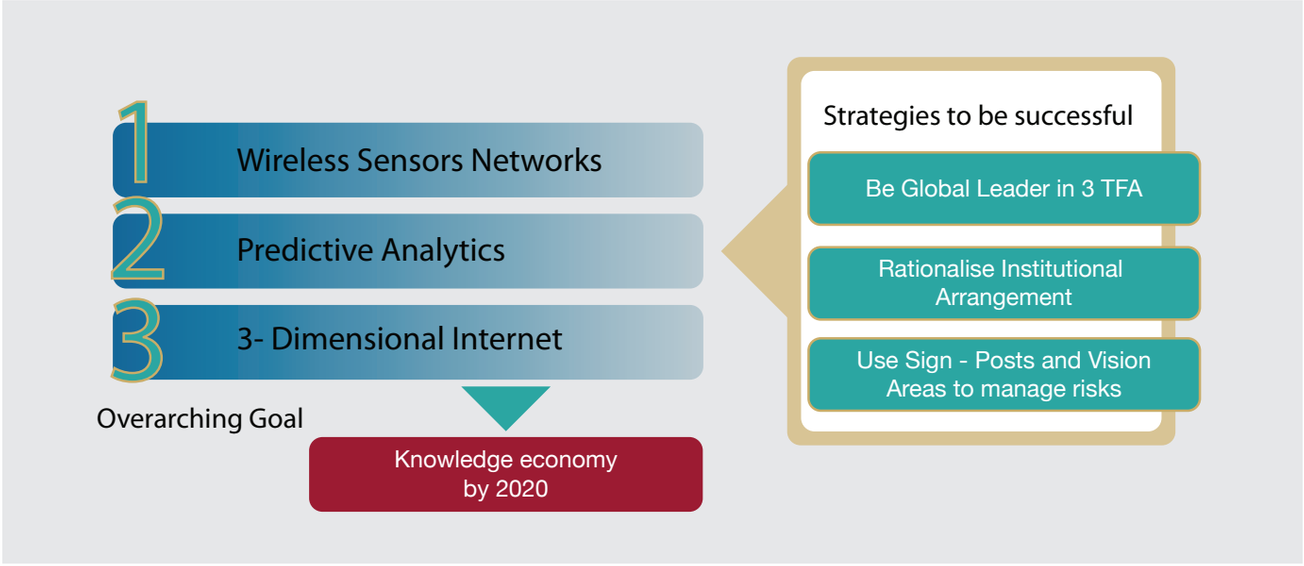


Figure 2: ICT Road Map 2008 Technology Focus Areas (TFA)
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

remain a challenge. Recognising the impending challenges in technology, economy and society arising from various internal and external forces, the Government was once again compelled to revisit, review and realign the ICT Roadmap 2008. Thus, for gauging the efficacy and success of the strategic ICT Roadmap 2008, a competitive assessment analytic framework, as shown in Figure 3, was considered. Essence of the evaluation framework included country readiness, assessments of the previous ICT roadmap using as-is-situation analysis, alignment with megatrends, implementation factors and stakeholder views. In particular, the assessment of the ICT Roadmap 2008 was poised to explore the relevance of the TFAs, future proof and ease of implementation aspects.

2.1 Country Readiness Assessment

Country readiness is viewed from three angles, namely ICT industry structure, R&D industry base and ICT human resource skills.

Industry Structure

The important parameters for assessing industry structure include key segments of the ICT industry, number of companies within each TFA, characteristics of the industry and the current market size of each TFA.

The number of companies in the TFAs of the ICT Roadmap 2008 was meagre. Specifically, four small companies (Ecosensa, RF-ident, CBSA Bhd and MemsTech) were categorised under the Wireless Sensor Networks TFA but most of them are skewed towards Radio Frequency Identification (RFID). Similarly, in the Predictive Analytics TFA, only three companies (Kbase, Statwks and Formis) were involved and they were all at a nascent stage. Despite being identified as one of the TFAs, the

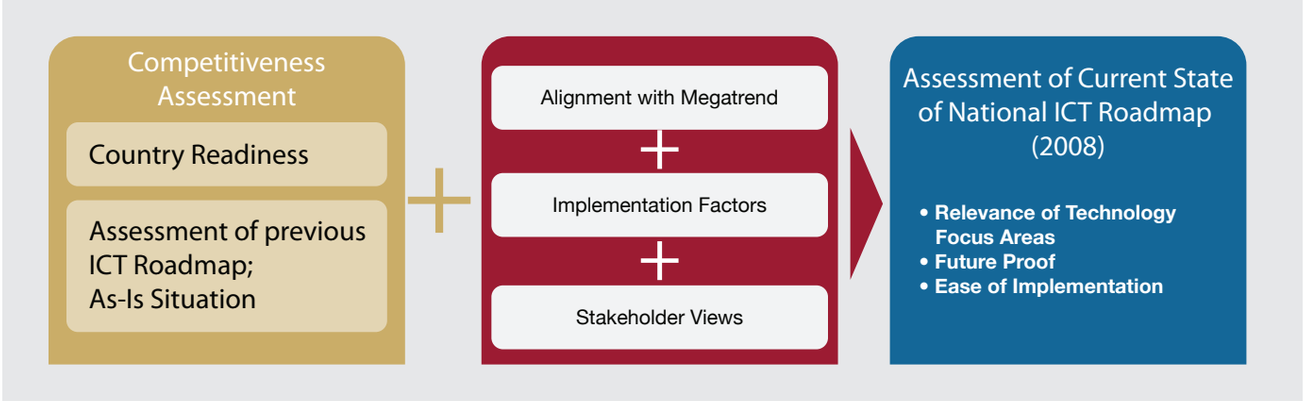


Figure 3: Framework for Reviewing ICT Roadmap 2008 / Technology Roadmap
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

3D-Internet had not taken off well in Malaysia except for a few multimedia companies involved in a limited way. In terms of market size, all the three TFAs were small even after going through four years of development under the ICT Roadmap 2008.

Research and Development Base

As evidenced by the research output by the top research institutions (Table 1), the R&D work in Malaysia was mainly attuned towards research in Medicine, Physics, Biochemistry and Agricultural Sciences during the 2000-2009 period. Specifically, only 4.4% was in computer science in comparison to medicine that had the highest share at 17.63%. These statistics indicate a dismal performance in ICT research despite promulgating ICT research activities through roadmap policy strategies. Within the ICT domain, the Predictive Analytics and Wireless Sensor Networks segments registered a reasonable level of research activity and there was none in the 3D Internet TFA, except in 3D Animation that is deemed to have some relevance (Figure 4).

Human Resource Skills

ICT employees' skill sets represent an important indicator for determining new technology take-up. As shown in Figure 5, most of the ICT employees in Malaysia in 2008 were employed in programming and operating systems (13%) followed by telecommunications (12%). The distribution of human capital based on the TFAs are: 11% in a combination of predictive analytics and big data; 10% in Internet of things; 5% in sensors; and 3% in 3D Animation. In other words, the employment numbers indicate that there is a mismatch between human resource skills sets present in the country and the recommended TFAs.

Subject	Research Output 2000-2009	Percentage Share
Medicine	5420	17.63%
Physics and Astronomy	4017	13.00%
Biochemistry	3800	12.30%
Agricultural Sciences	3437	11.12%
Engineering	3435	11.11%
Material Sciences	3232	10.46%
Chemistry	2902	9.39%
Environment Sciences	1638	5.30%
Chemical Engineering	1635	5.29%
Computer Sciences	1359	4.40%

Table 1: Share of Research Article Output by Subject Field, 2000-2009
Source: Malaysian Science and Technology Indicators, 2010

2.2 As-is- Situation Analysis

As-Is Situation Analysis on the previous roadmap provided details on ICT spending in the prior five years and the projections for the next five years as well as a comparison on value add of Malaysian ICT vis-a-vis selected countries. However, there was only a limited analysis of the industry in terms of key segments within ICT and key local and multi-national players in various segments with no analysis on industry structure done. Similarly, no analysis was done on the roadmap in relation to strengths of

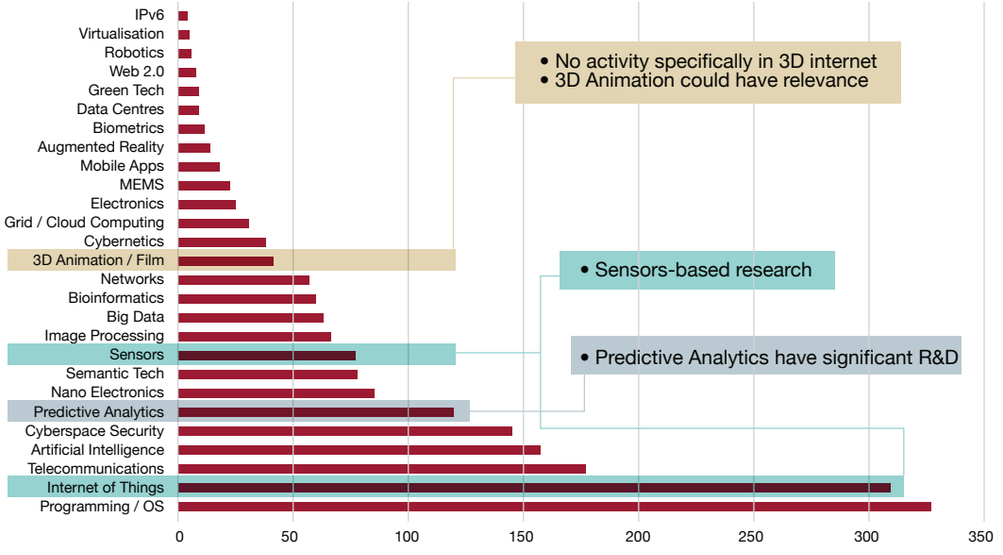


Figure 4: Number of Research Projects by Specific Research Areas
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

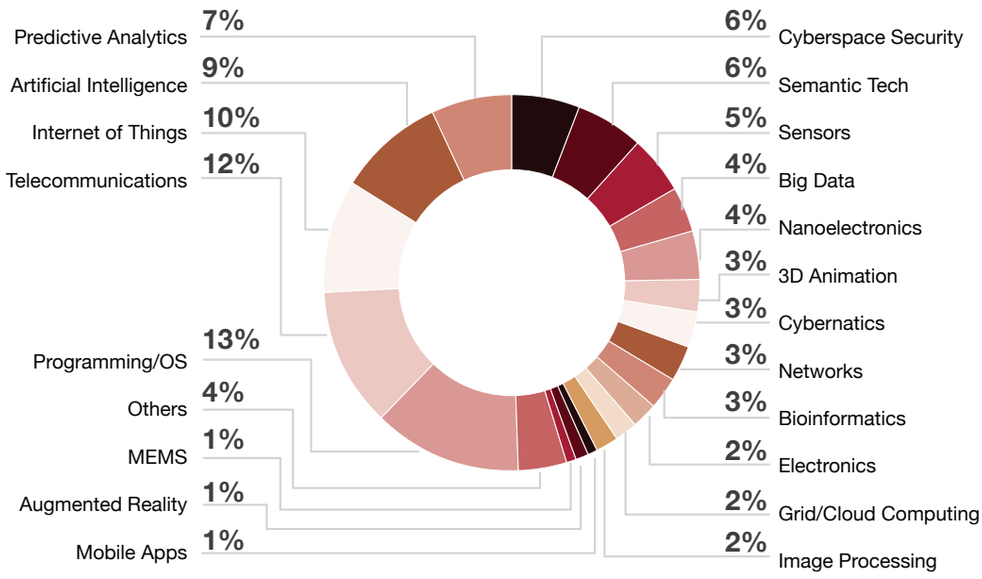


Figure 5: Distribution of Human Capital by ICT Segments
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

the R&D institutions, priority areas of research, profiles of researchers and funding allocation by various R&D entities.

In terms of human resources, no detailed analysis was presented on the distribution and concentration of human resources by R&D fields. There was no reference cited on the strengths and weaknesses of the ICT industry, RD&C and human resources within the country. The roadmap recommended private participation in the adoption of the TFAs but no action plan had been postulated. No details were provided on the size of the opportunity afforded by the TFAs and the key global markets or trade opportunities or the value chain in which Malaysian companies could play in.

Harmonisation of incentive systems by research institutions and by research focus areas was also not detailed out despite recommendations being made. In terms of human resources, the earlier roadmap also recommended re-skilling of existing workers and also importing foreign workers to augment the local talent pool but to what extent these are adhered to is unknown. Thus, the comparative analysis indicated that a number of shortfalls and gaps need to be duly addressed during the review of the previous roadmap prior to making any new recommendations. Pertinently, private participation in adoption of the roadmap, communicating the TFAs to the research community by the government, harmonisation of incentive schemes for RD&C, training and re-skilling the human resources and programme for inviting foreign workers to work in Malaysia warrant due attention. In addition, the preparation of action plans and implementation strategies, including inception of monitoring and evaluation mechanisms, are to be incorporated.

2.3 Alignment with Mega Trends Analysis

Future proofing of a TFA is essential to ensure that the country is investing its resources in the right technological direction. Specifically, it is imperative to gauge the alignment with any of the ICT-related megatrend technologies shown in Figure 6.

Essential features of the fast growing ICT enabling megatrends are as follows:

Megatrend 1: Pervasive Computing
Pervasive Computing refers to the presence of computing technologies and devices in all walks of life regardless of location and time. In other words, it denotes the various aspects of life in which computing is increasingly being used because of increased availability of devices, connectivity and online portals for easy access.

Under this megatrend, the associated technology trends identified were post-PC devices, ICT enabled-services and ubiquitous connectivity. Post-PC devices refer to devices that supersede and replace the PC, such as tablets and smart phones. ICT enabled e-services are services that can be accessed through electronic means, through a smart phone for instance. Ubiquitous connectivity is defined as the ability to connect to the Internet or other devices regardless of location.

Technologies impacted include

Figure 6: ICT Megatrend Overview by Frost & Sullivan
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

wearable computers, touch screens, LED displays, digital commerce, e-governance, telemedicine, social media, wireless broadband WiMax, LTE, NFC Chip, GP, GIS, online finance, virtual education and e-learning, digital pathology , payment processing software, proximity payments and location-based services.

Megatrend 2: Green/Innovating to zero

This trend revolves around green technologies and green IT, with the eventual goal of reducing emissions to zero. Within this megatrend, three major technology trends were identified – low power servers, green data centres and telepresence. However, under this identification, only the technological aspects were considered; other areas unrelated to ICT were not considered a part of this megatrend, such as alternate energy sources – solar energy, biofuels, etc. Low power servers refer to computer servers that have very low power consumptions, yet are fully capable of providing the computing power required for a particular application. Green data centres are facilities that house computer systems and are designed to reduce the extent of the environmental impact to a minimum, through means such as improving the energy efficiency of the computer and lighting systems, and the use of low emission building materials for construction.

Lastly, telepresence refers to the use of advanced video conferencing technologies and interior design in order to create the illusion of having a face-to-face meeting during a video conference. Technologies impacted include physicalisation, load balancing, 3D displays, waste cycling, broadband, virtualisation, VOIP, cameras and microphones.

Megatrend 3: Pay as you use

Pay as you use is defined as the transformation of capital expenses into operating costs or conversion of a product into a service. In the context of ICT, the major and most impactful 'pay as you use' model is seen in Cloud Computing. Cloud computing refers to the on-demand provision of IT capabilities, such as applications or computing power, as a service to multiple users with the use of Internet technologies.

Its impact has been pervasive, reaching out to various industries using ICT and also various ways in which ICT solutions are used. Various models such as Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS) are upcoming types of cloud offerings.

Cloud computing is attractive due to the reduced upfront costs that companies have to pay to adopt it as compared to traditional on-site computing. Also, due to

the on-demand nature of cloud computing, there will no longer be a situation whereby the computer system is under-utilised and thus it can contribute to cost savings. Furthermore, as the servers will be hosted in a central location, the hardware and software can be updated and controlled with ease. Technologies impacted include homorphic encryption, virtualisation and data centres.

Megatrend 4: Smart Infrastructure
Smart infrastructure is the embedding of ICT to improve efficiencies across various sectors, such as power, agriculture or transportation. The impact of ICT in transport comprises smart transport trend; in construction it gives rise to smart buildings; in agriculture it creates a variant called Smart Agriculture and so on.

Wireless intelligence refers to an array of devices, such as mobile phones and household appliances, connected by wireless technologies to form an integrated network. Smart grid is a network that connects the electricity providers, the power distribution system and the consumer with two-way communication capabilities for the control of appliances.

Smart agriculture is the use of technologies such as sensors and computer systems to control the variability of the environment so as to improve the amount of crop produced. Smart transport involves the incorporation of technologies to manage the flow of vehicles and ensure smooth traffic. Lastly, Smart Building is defined as the application of technologies to intelligently monitor and control the conditions within the buildings. Technologies impacted include wireless data encryption, gestural interface, 3-D displays, wireless sensors, database management, smart meters, M2M, grid management applications, telematics systems, precision agriculture, in-home displays, device interconnection, and controllers.

Megatrend 5: Preventive Healthcare
This megatrend refers to the shifting of health expenditures from diagnostic to preventive aspects of healthcare. With healthcare spending rising at a faster rate than the GDP for most countries, there is an urgent need to move away from the current trend. As the treatment cost makes up the bulk of healthcare expenditures currently, the shift towards preventive medicine will reduce the expenditure used on the treatment of patients, and is thus the future trend for healthcare. Four technology trends are associated with this megatrend. Point of care technologies refer to technologies involved in the monitoring, diagnosis and data access in the proximity of where the patient care is provided.

Predictive bio-simulation is the application of computer simulation to gain a better understanding of various physical and biochemical functions of the human body and the physiological response to different therapeutic methods. Bio-sensing is defined as the monitoring of biological parameters in the body, such as blood sugar levels, through the use of sensing devices. Genome sequencing, an upcoming technology, refers to the determination of the genetic structure of an organism, which can then be used to identify, for instance, the susceptibility of a person to certain diseases. Technologies impacted include in-vitro diagnostic, genomic and proteomic, micro and nanofabrication for sensor design, matrix-assisted laser desorption/ ionisation (MALDI), metabolic network construction and simulation and cyber doctors.

Megatrend 6: Rise of the machines
This megatrend covers intelligent and adaptive machines with increasingly higher computing powers and new technologies. Intelligent machines refer to devices capable of mimicking human behaviour. Augmented reality is the group of technologies that provides the user with a real-time view of the surroundings overlaid with computer generated information. Robotics is defined as the technology trend encompassing mechanical manipulators that can be programmed to perform various tasks. Advanced interfaces refer to new and innovative methods for the user to interact with the computer or electronic device.

Nanotechnology is the branch of technology involved in the manipulation of materials on the scale of atoms or molecules. Technologies impacted include speech recognition, natural language processing applications, neural networks, GPS, head-mounted displays, 3-D mobile displays, information overlay applications, microprocessors, wireless communications (NFC, WiFi) between robots and nano machines, smart sensors, lab-on-chip devices, hybrid imaging technologies, next generation displays, haptics brain machine interface (EEG) and swarm intelligence.

Megatrend 7: Real time, all the time
This megatrend encompasses the application of real time data analysis and advanced analytics to make data useful. This trend arises from the sheer volume of data being created and processed everywhere. Starting from the web to various personal databases to shared networks and so on, there is a plethora of information that can be intelligently mined and then used in an intelligent fashion for various applications such as better customer management, targeted sales, trend analysis, product development and so on.

Technologies impacted include biometrics, inline analytics, massively parallel processing databases (MPP), software based on frameworks like Map Reduce and advanced analytics applications based on ontology. The technology trends under it are Big Data/Analytics and Semantic Web.

Big data refers to the large amount of data generated by the company that would be too costly and time consuming to process using typical database management tools. Semantic web is the set of technologies that allows a mesh of information to be easily processed by the computer.

Megatrend 8: Flexibility/ Mass customisation
This refers to the catering of the product to each individual customer, creating many unique markets of one. This trend has been facilitated by increased innovation in technology and the availability of various new materials and advanced devices. Now it is possible to carry out manufacturing at a much smaller scale catering to individual customer needs. Flexible manufacturing is the technology trend that has been identified under this megatrend and its definition is the capability of the manufacturing process to create new and differentiated products easily and affordably. Technologies impacted include robotics programming logic controllers, advanced lasers, digital manufacturing, virtual manufacturing, and automated guided vehicle.

Megatrend 9: Cyber warfare
Cyber warfare refers to the spreading of the domain of conflict into the information domain, aided by the advancement in technology. With the increasing usage and importance of computers and Internet in our daily lives, cyber attacks from hackers have become much more frequent, bringing along serious consequences such as identity theft and leakage of confidential information. The possibility of getting into conflicts in cyberspace is getting closer to being a reality. Increasingly, nations are facing a security threat due to the extent of information on networks and the risk that is posed if their systems were to come under a malicious attack.

The next generation wars are predicted to be skewed towards information wars, making cyber security a very important aspect in any national agenda. Security platforms are the hardware and software required to provide data security, while access control is the technology that restricts the availability of resources to various users. Incident response management, on the other hand, deals with the agglomeration of security events into a central database for the conduct of analysis and to respond to these incidents in a timely manner. Technologies impacted include next generation firewalls, biometrics, antivirus software, intrusion detection system, intrusion prevention system, vulnerability assessment products, security information and event management, identity management, data encryption, remote control and video surveillance

As mentioned earlier, before the explicit introduction of ICT Roadmap 2008, ICT was considered an integral part of the technology roadmap. Table 2 shows the intersections of the global megatrends with the TFAs identified in the ICT Roadmap 2008. Further benchmarking TFAs of ICT Roadmap 2008 against the global ICT megatrends revealed that the Wireless Sensor Networks and Predictive Analytics TFAs were indeed in alignment with the global megatrends.

Specifically, wireless sensor networks formed part of the Smart Infrastructure megatrend that is considered as one of the enabling technologies. Similarly, Predictive Analytics was also in line with Real Time All The Time technologies that is critical for e-commerce activities requiring "anytime, anywhere and anyone" features. However, 3D Internet was not aligned with any megatrend even though it had been

Technology Roadmap	Mega-Trends								
	Pervasive Computing	Green Innovating to Zero	Smart Infrastructure	Pay As You Use	Preventive Health Care	Real time, All the time	Rise of the Machines	Flexibility / Mass Customisation	Cyber Warfare
Bio-informatics					×				
Nano electronics	×		×		×				
MEMS	×	×	×		×		×		
Bio-metrics	×		×						×
Cyber security				×		×			×
Grid Computing	×		×	×	×	×	×		×
Semantic	×		×		×	×	×	×	×
Wireless Communications	×		×						

Table 2: Alignment of Emerging Megatrends on Technology Roadmap
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

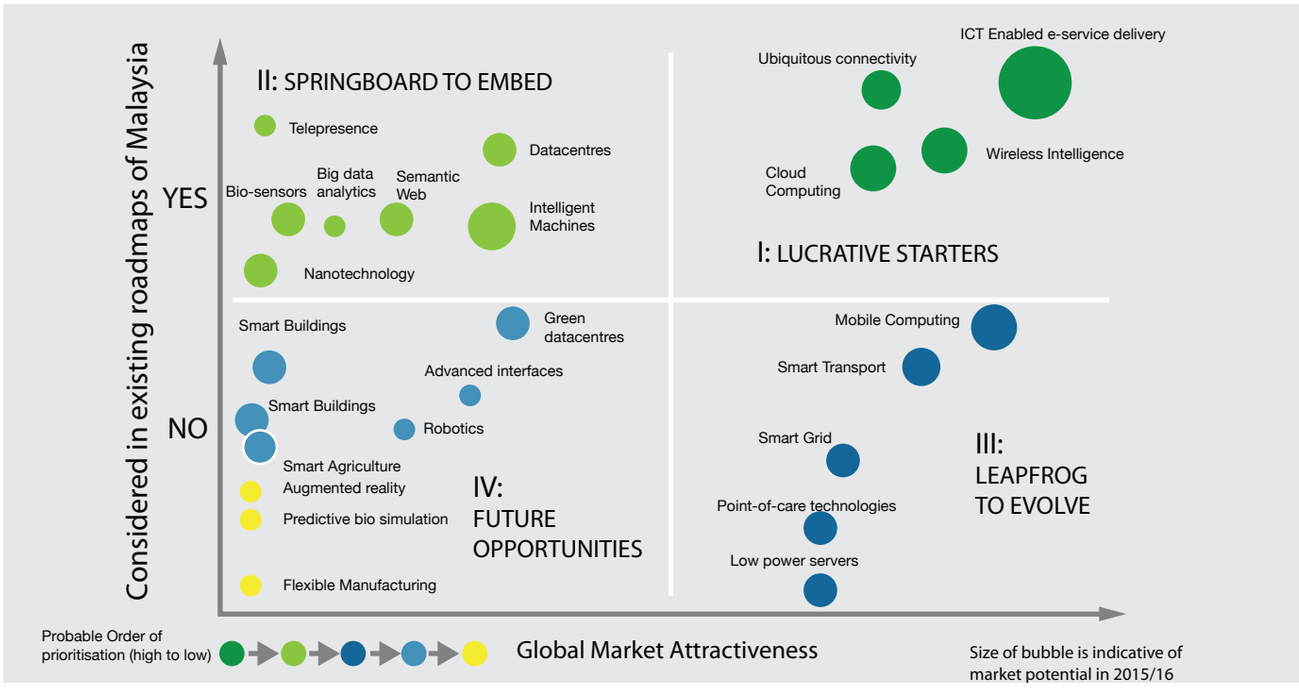


Figure 7: Opportunity Strategy Evaluation (OSE) Grid
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

explicitly identified in the ICT Roadmap.

Figure 7 provides an indication of the potential market size of each megatrend, measured and classified as either lucrative starters, springboard to embed, leapfrog to evolve, or future opportunities. For example, Mobile Computing has been forecast to reach a market size of around US$328 billion by 2015, while Near Field Communication (NFC) and Location-based Services, both under the technology trend of Ubiquitous Connectivity, are predicted to have a market size of US$34.5 billion in 2016 and US$10.3 billion in 2015 respectively. ICT-enabled e-service delivery is made of Digital Commerce, a US$963 billion market in 2013, presenting a huge market to be tapped.

2.4 Stakeholder Analysis

A stakeholder analysis involving industry, industry association and selected government agencies was conducted via interviews to ascertain their understanding of the previous national strategic ICT roadmap 2008 and its implementation status. The analysis explored market conditions, research and development support, human resources, industry linkages and government sponsorship and vision.

Market Conditions

The previous national ICT roadmap did not provide detailed information about the markets that it was addressing within Malaysia or across borders. The roadmap preparation did not take into account the inherent strengths of Malaysian companies that have competitive edge or comparative advantages in the three TFAs. This may be attributed to a lack of expertise, experience and exposure in business and marketing development skills especially as such capabilities are rare among the research community. Moreover, research communities in the research institutions of higher learning and universities are more concerned with publishing research findings in peer-reviewed journals and renowned publications. The career advancements of teaching staff in the universities are measured against the number of papers they publish or present at international conferences.

On the other hand, the private sector community lacks information on potential research findings that exhibit promising commercialisation possibilities that can be funded by the private sector. This gap is due to a lack of proper communication and branding strategy as well as a lack of private sector participation and direct involvement from the onset of research proposal initiation. Indeed, the private sector knows the market conditions and knowledge better that the research community who, in general, lack the requisite networking and interaction capabilities.

Research and Development Support

The ICT Roadmap 2008 failed to take into account the research and development base of the country before recommending the TFAs. Malaysia is considered to have a weak research base in terms of allocation - only 0.63% of the Gross Domestic

Product (GDP) is spent on R&D. The Malaysian R&D performance is low in comparison to newly-industrialised countries such as South Korea where 3% of GDP is spent on R&D. Prior to the Ninth Malaysia Plan (NMP), research work done lacked a commercialisation strategy; instead the strategies focused on building capacity and research capabilities. In other words, Malaysia, having gone through a five-year development plan after NMP, is still considered to be at its infancy stage as far as conducting market driven research is concerned.

Human Resources

Skill sets of ICT human resources present in the country did not match up with the recommended TFAs. The roadmap did not have analysis of human resources while recommending the TFAs, neither from an expertise point of view nor from a researcher base of the country.

Industry Linkages

Figure 8 shows university R&D and commercialisation linkages. No effort was made in communicating this roadmap to the private sector. Low awareness among the industry players led to lack of buy-in.

Government Sponsorship and Vision

As a vision document aimed to align with Government of Malaysia's aspirations, it failed to provide an appropriate implementation and monitoring mechanism.

2.5 Ease of Implementation Analysis

Strategy for Implementation and Detailed Implementation Guidelines

Most of the guidelines/ recommendations are prescriptive in nature. No short, medium and long-term implementation plans were identified. There were also no prioritisation framework or detailed implementation steps specified in the ICT Roadmap 2008. Instead, the implementation strategies were left to the programme owners of the TFAs and the ICT body at the strategic level.

Project Implementation Committees were identified. However their tasks, time frame for developing plans and how to develop the plans were not provided in the roadmap document. Monitoring of sign-posts, positioning of resources in terms of detailed financial resources and allocation procedures, manpower requirements as well as positioning at international events and seminars were not given due consideration. These missing factors have seriously impeded any further action and progress on the national strategic roadmap.

Accountability for Implementation

The roles and responsibilities of the lead agencies and stakeholders as well as detailed functional protocols had not been identified.

Funding to Support Research and Innovation

The expenditure on ICT R&D in the year 2008 stood at around 4.7% of the overall research expenditure. However, investigation revealed that no explicit funding had been identified for the TFAs within the strategic roadmap document. Moreover, the onus of seeking funding was left to the research institutions in the country, without providing any guidelines on which institutions to take the lead on which TFA as well as priority research areas. The earlier roadmap also did not spell out whether the funding should be borne entirely by the government or supported by private

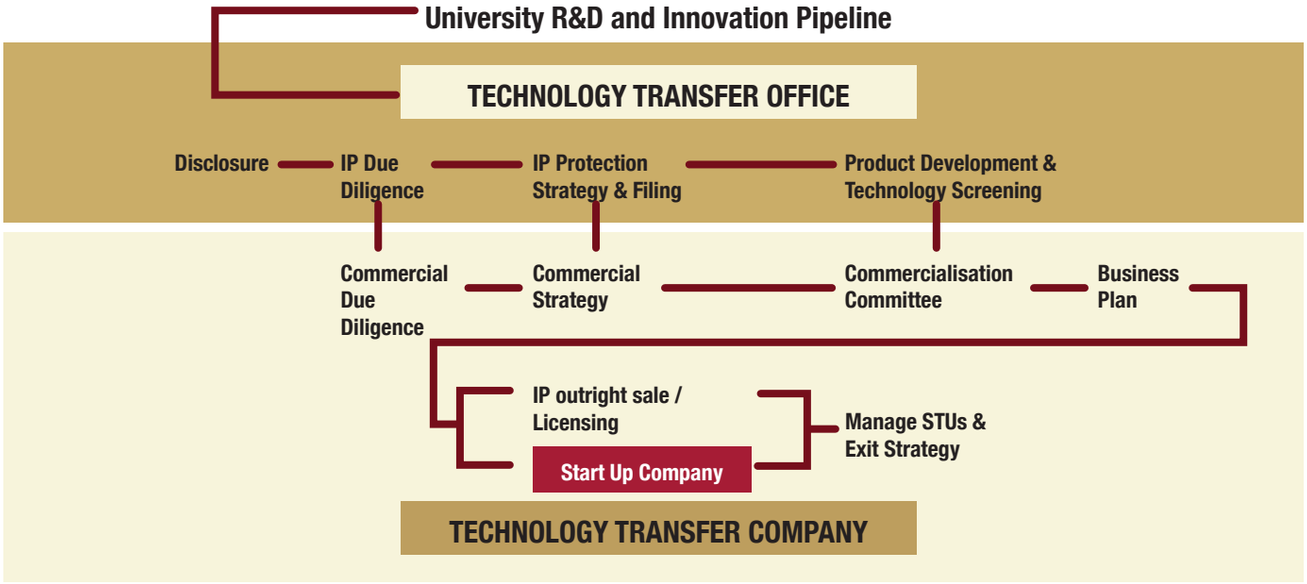


Figure 8: Generic R&D Linkages and Commercialisation Model Framework

sector participation or if there should be a possibility for public-private partnerships. Details on cost benefit analysis of investing in the proposed TFAs, in particular the quantum of funding required to turn the TFA into a significant contributor to the economy, was also not analysed in the previous roadmap. Also, capability and capacity assessments of local research institutions were also not included in the roadmap documentation.

Human Resource Capability Development Initiatives

The strategic roadmap document had provided a number of prescriptive guidelines on the human resource development, namely the establishment of an academy for the TFAs, re-skilling / training existing talents and importation of knowledge workers to increase the local talent pool. Though a number of lead agencies had been identified for implementing the proposed human resource development, there were no implementation guideline, process and procedures and, worse still, no explicit funding was allotted for the setting up of the academy. Analyses on the capability building curriculum, teacher requirements and qualifications were also absent. What was stated is a limited assessment of the workforce, which indicated that most of the ICT professionals are concentrated in the area of software/programming and only a limited number were involved in the areas of hardware design and sensors, analytics, and multimedia or 3-D Internet tools. Role of government-linked companies was also missing in the previous strategic roadmap plan.

Infrastructure Development Initiatives

The national ICT roadmap did not identify any new infrastructure that would enable faster adoption of the new TFAs. Rather, the roadmap advocated riding on existing infrastructure policy provisions and programme strategies like MYICMS 886 and the National Broadband Plan. However, no linkages and implementation guidelines were provided to the implementers of the research strategies. Nonetheless, the infrastructure section in the roadmap recommended formation of a centralised knowledge repository. Unfortunately there were no elucidation on fund allocation, human resource requirement and institutional arrangements and support for realising this proposition. .

Support for RD&C in the Specified Technology Focus Areas

One of the recommendations in improving commercialisation was to communicate and educate the industry on the national strategic ICT roadmap. However engagement plans, processes, procedures, rights, rules, roles and regulations guiding both the industry and research institutions were not articulated appropriately. The role of government in creating the engagement platform and incentive schemes for improving commercialisation status of the country as well as streamlining and harmonising the existing incentive schemes were not detailed out.

Private Sector Participation

Despite the Government promulgating public-private sector partnerships, the ICT Roadmap 2008 lacked explicit recommendation on the need for participation of the private sector. The private sector participation in government agencies or government-linked research institutions is critical to not only provide funding for commercialisation and its related activities, but also to provide the requisite market and business relevant intelligence. The need for market and business driven R&D strategy had been being promoted since the Ninth Malaysia Plan (2006-2010), which streamlined all research funds under the Fundamental Research Grant Scheme (FRGS) for basic research by the universities and research institutions with TechnoFund and InnoFund requiring private sector participation. Despite a macro strategy, involvement of the private sector in Government agency-led research is still at a dismal level. This may be partly attributed to the lack of communication between the two parties, especially on potentially-viable business ventures arising from research activities. The investigation also revealed that a number of university-led research have been patented, however they took a longer cycle time to get into the market space due to the lack of business and market development know-how. From the onset of developing a research proposal, planning and submission, there is no explicit condition attached to the funding mechanisms mandating the private sector's participation in the research endeavour.

Monitoring and Evaluation

One of the most important components that is typically missed out in public programme implementation is the process involved in monitoring, measuring and evaluating mechanisms. The ICT Roadmap 2008 was not an exception. Specifically, key performance indicators (KPI) at strategic, tactical and operational levels were missing. When such indicators are not spelt out from the onset of initiation of research projects, it will always be difficult for stakeholders and funders to gauge the efficiency and effectiveness as well as the accrued benefits. Absence of periodic monitoring and evaluation mechanisms will also pose a challenge in providing timely, informed decisions while addressing the issues, problems and challenges that arise in the course of implementing the research projects. Late decisions can be costly and can lead to unnecessary wastage and resource seepage.

Therefore, it is imperative to spell out measurable sign posts and vision areas in the implementation plan, distinctly targeted at the TFAs.

Milestones and Timelines

There are broad timelines given in the roadmap without any yearly milestones. This led to a situation where the lead agency is unable to prioritise its tasks for conducting effective research in the three TFAs. The lack of the following components further weakened the ICT Roadmap 2008: risk mitigation plans, an institutionalised project management component, inter-agency coordination process/mechanisms and discipline on strict adherence to the various timelines.

Market Size for the Three TFAs

There is no indication in the roadmap of the market size, contribution to GDP and the job creation capabilities for the each of the identified TFAs for the country. Information was also lacking on the market size at regional and global level that could have provided an effective guidance on the research direction and help to strategise the entry into markets outside the country. Indeed, market size and economy of scale are critical parameters for any R&D effort, given the fact that the Malaysian domestic market is a small one.

3. ICT Roadmap 2012: Technology Focus Areas

Figure 9 shows how the selection of the TFAs for ICT Roadmap 2012 was done in two stages. In the first stage, the nine ICT mega trends and 27 trends recommended by Frost and Sullivan as well as buzz technologies from other sources like Gartner and International Data Corporation (IDC) were considered. After taking into consideration Malaysia's strengths and capabilities, 14 technologies were shortlisted.

In the second stage, through engaging various stakeholders in the mainstream, industry players and academia, six TFAs, namely e-Services, Wireless Intelligence, Ubiquitous Connectivity, Big Data/ Analytics, Security & Platforms and Cloud Computing were finalised as areas of prioritisation for ICT Roadmap 2012. The consultative and consensus building as well as the 'buy-in' processes used economic impact and technology criteria in arriving at the six TFAs for the ICT Roadmap 2012. Specifically, the

27 MEGATRENDS AND TRENDS AUGMENTED TECHNOLOGY AREAS					
PERVASIVE COMPUTING	Post-PC Devices	ICT enabled e-Services	Ubiquitous Connectivity		
GREEN INN. TO ZERO	Low Power Services	Green Datacentres	Telepresence		
SMART INFRA	Wireless Intelligence	Smart Grid	Smart Agriculture	Smart Building	Smart Transport
PAY AS YOU USE	Cloud Computing				
PREVENTIVE HEALTHCARE	Point of care Health	Predictive Bio-simulation	Bio-sensing	Genome Sequence	
RISE OF MACHINES	Intelligence Machines	Augmented Reality	Robotics	Nanotech	Advanced Interfaces
REAL TIME, ALL TIME	Big Data / Analytics	Semantic Web	Advanced Interfaces		
FLEXIBILITY	Flexible Manufacturing				
CYBER WARFARE	Incident Response Management	Access Control	Security & Platforms		

	14 SHORT-LISTED TECHNOLOGY AREAS
1	e-Services
2	Wireless Intelligence - (IOT, M2M, sensors)
3	Ubiquitous Connectivity
4	Smart Agriculture
5	Smart Transport
6	Smart Building
7	Genome sequencing
8	Big Data / Analytics
9	Cloud Computing
10	Point of care Technology
11	Smart Grid
12	Predictive Biosimulaion
13	Security Platforms
14	Bio-sensing

	6 TECHNOLOGY FOCUS AREAS FOR ICT ROADMAP 2012
1	**Cloud Computing**
2	**e-Services**
3	**Ubiquitious Connectivity**
4	**Smart Agriculture**
5	**Wireless Intelligence and**
6	**Big Data / Analytics**
7	**Genome Sequencing**

Figure 9: ICT Roadmap 2012 Development Process
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

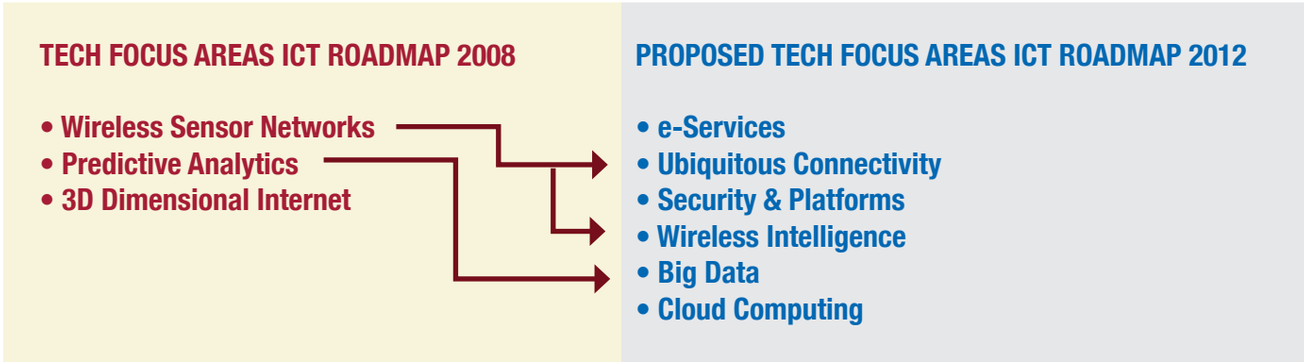


Figure 10: Mapping the Technology focus areas of ICT Roadmaps 2008 and 2012
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

economic impact measurements took into consideration market size and growth, its ability to create jobs in the economy, its potential to impact/ contribute to government's plan/ projects in key economic sectors and potential for participation by local private sector players. Similarly, technology capabilities considered human capital readiness, infrastructure availability, access to funding, maturity of current research being pursued and past track record of commercialisation in the respective technology area. In other words, the ICT Roadmap 2012 essentially used expert consensus and a data analytic approach.

Figure 10 shows the linkages and continuity between ICT Roadmap 2008 and ICT Roadmap 2012. Specifically, the on-going areas of research pertaining to 'Wireless Sensor Networks' that intended to develop the ICT infrastructure for the information society will be continued under 'Ubiquitous Connectivity' and 'Wireless Intelligence' domains in the ICT Roadmap 2012.

While this is relevant, another critical area deemed necessary to realise the ICT infrastructure for the information society is the need for 'Security & Platform' targeted at surveillance and security platform development. The 'Predictive Analytics' TFA is being mapped onto 'Big Data/ Analytics', which focuses on analysing the huge amount of unstructured data produced to uncover hidden patterns, unknown correlations and other useful information to enable better decision making. Despite being an explicit domain in the earlier ICT roadmap, the '3-D Internet' domain that is poised to spur the content industry in the country somehow did not warrant due attention in the new roadmap.

Malaysia has been at the forefront of using 'e-Services' as a pilot project under the Electronic Government Flagship within the MSC Malaysia initiative. 'e-Services' has already enabled the Government and its citizens to interface with each other in Malaysia. This has raised the quality and image of the public service in Malaysia. The existing development could be used as a launch pad to take the development and applications to the next level.

Last but not least, the strategic nature of 'cloud computing' technology, considering its impact on the overall ICT industry, criticality to enable 'pay-as-you-use' business model and relevance to small and medium-sized businesses, makes it a suitable technology area to focus and leverage on. Table 4 shows the point technologies associated with the recommended TFAs under the ICT Roadmap 2012.

Technology Focus Areas	Point Technologies
e-Services	Digital Commerce, e-governance, Online Finance, Virtual Education, Telemedicine, Digital Pathology
Wireless Intelligence	Wireless Data Encryption Technology, Wireless Sensors, M2M, Device Interconnection, Gestural interface, 3-D Displays, RFID, Image Recognition
Ubiquitous Connectivity	NFC, Social Media, Payment Processing Software, Location-based Services, Wireless Broadband, WiMax, LTE, GPS and GIS
Big Data/Analytics	Inline Analytics, MPP - massively parallel processing databases, Advanced Analytics Apps based on Ontology, Data Management Systems
Security and Platforms	Antivirus Software, Intrusion Detection System, intrusion Prevention System, Identity Management Software and Hardware, Biometrics, Video Surveillance, Next Generation Firewalls, Data Encryption
Cloud Computing	Datacentres, Homomorphic Encryption, Virtualisation

Table 4: TFA and Point Technologies
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

4. Essence of ICT Roadmap 2012

a. **Holistic national strategy:** There is a need to develop a holistic strategic roadmap that integrates ICT TFAs, technology roadmaps and national R&D roadmaps. For ensuing sustainability, it is also imperative to link all the policies relevant to roadmaps and to economic, education and R&D strategies. For streamlining the scarce resources in an efficient and effective way, it is also critical to link up the local ICT companies with the universities and research institutions that adopt national technology/innovation policy strategies;

b. **Alignment of ICT and other roadmaps:** As ICT is an integral part of the national transformation activities, it is vital to ensure synergy prevails among strategic ICT roadmaps, technology roadmaps, R&D and national transformation policy strategies;

c. **ICT technology focus areas (TFA):** After taking into consideration Malaysia's strengths in terms of expert capabilities and operational and institutional capacities, the ICT Roadmap 2012 targets six TFAs namely e-Services, Ubiquitous Connectivity, Security & Platforms, Wireless Intelligence, Big Data/ Analytics, Cloud Computing;

d. **Oversight institution for R&D:** An apex institution like the National Science Research Council (NSRC) or the National Information Technology Council (NITC) is to provide a holistic, periodic overview of policies, strategies and programmes as well as allocation on all R&D activities and processes. Such a monitoring, measuring and evaluation mechanism is crucial in not only ensuring quality deliverables in compliance with return on investment options but also to streamline all ICT happenings in a plethora of ministries, agencies and organisations;

e. **Streamlining R&D institutions with the TFAs:** In order to provide strategic focus and direction, it is essential for universities and research institutions to align their R&D endeavours in line with the TFAs, including setting up of centres of excellence (COE) to enhance the rate of technology development. This is to avoid resource wastefulness especially when research institutions are involved in areas that have no national interest or priorities;

f. **Human capital development:** The quantity and quality improvement in human capital in ICT research warrants due attention by initiating programmes such as cultivating a successful career outlook in science and technology; showcasing successful alumni; increasing post graduate enrolment; attracting talents from private sectors and foreign countries; establishing professional institutions and networks; fostering collaboration between private and public sector research institutions and researchers; and extending the government-supported fellowships and scholarships to private sector researchers as well. This well help to increase Malaysia's ratio of 367 scientists per million and 4,000 engineers per million in due time in order to be on par with top-notch countries in research;

g. **Intellectual property (IP) fund:** Create a Malaysian Intellectual Property Fund (MYIP) to lower hurdles and help finance IP filings at international level, which is currently very high due to the expensive legal and patent filings costs.

h. **Innovation and commercialisation centres:** Establish Innovation & Commercialisation Centres (ICC) in universities and equip the centres with staff who have adequate experience and professionalism so that the centre can provide timely advice and direction for researchers especially on market and business driven research demands. The ICC also can play the mediation role between the research community and the private sector, who are mainly concerned with market-driven research and viable business models for commercialisation. For branding the Malaysian innovation and inventions, the ICC can embark on capacity and capability programmes pertaining to process and quality improvement elements.

i. **Reducing cycle time:** The current technology transfer in institutes of higher learning facilitate the commercialisation process by advising researchers to align their research with market expectations; administering all activities and concerns related to IP protection and commercialisation; and undertaking activities pertaining to spin offs, joint ventures (JV) and partnerships. The availability of such services is a step in the right direction, however it is unable to create the intended impact due to a lack of focus, professional expertise and adequate funding. In the current practice, MOSTI requires six months, from the date of receipt, confirming in writing to the inventor whether to pursue the patenting process or not, verifying encumbrances and listing out obligations attached to the invention. Such a prolonged wait can lead to loss of technology

commercialisation opportunities, given that ICT is a fast evolving area. Recognising the impediments, the ICT Roadmap 2012 proposes that ICCs reduce the IP triage time to 90 days to tap the full potential of technologies in the ICT space;

j. **Linking GLCs and SMEs:** Towards enhancing capacity and capability, scaling up innovation and fostering greater market development and penetration for SMEs (including start-ups), GLCs need to form strategic partnerships with IHLs and ICCs for R&D and commercialisation endeavours;

k. **Technology clusters:** Spurring technology clusters in Malaysia is imperative to foster a closer collaboration between industries, universities and research institutions (RI), not only in view of increasing intra and inter technology clusters activities but also with external entities. Hi-tech start-ups leveraging on institutes of higher learning's research outputs are at a dismal level due to a low number of technology clusters and science parks, which currently stands at 10; in comparison, Taiwan has 70 tech clusters and three science parks

l. **External strategic alliances:** Flow of knowledge and human capital at a greater speed and pace as well as openness of the national innovation system can widen the scope and coverage of activities in R&D, in particular via two way or multiple way communications, interactions, networking and information sharing.

m. **Education and awareness programme:** The roadmap promotes industry mentorship programs, industry collaborations, and industry captaincy with universities as well as workshops and exchange forums towards ensuring more market-oriented output with special focus on local company participation. This strategy can help to enhance the level of awareness of IP protection and commercialisation as well as bridge gaps in market orientation through closer industry relationship;

n. **Technology evaluation:** The roadmap supports the creation of a dedicated agency, Technology Evaluation Agency (TEA), which will provide services such as end-to-end information on IP, technology evaluation nuances, determination of official standards for evaluating IP and managing IP fund targeted at helping patent filing.

5. Strategic Initiatives and Implementation Essence

Towards ensuring a successful implementation the ICT Roadmap 2012, 12 strategic initiatives have been formulated:

5.1 Strategic Initiative 1: TFAs and Multi-pronged Initiatives to Develop them

Table 5 shows the market size of the various TFAs proposed under the ICT Roadmap 2012. The data is shown for Malaysia and globally. All the proposed segments indicate great potential for growth. Besides the global and Malaysian market potential, the ICT Roadmap 2012 also assessed the current status of each TFA in the Malaysian market in terms of patents granted, patents applied and commercialisation aspects. This data is shown in Table 6.

Cloud Computing

Cloud computing is still at an infancy stage. Currently, most organisations are holding back due to their concerns over the security of their data once it goes outside their organisations and the low reliability of Internet connectivity in the country. However, with a large SME base, Malaysia has a great potential for cloud services that can drive down IT infrastructure cost. The factors that are poised to drive the cloud computing model include the fact that many companies are exploring cloud computing as an option to keeping the costs low especially in times of economic downturn when cost reduction strategy is imperative.

The government is also favouring cloud computing as a measure to increase the efficiency and efficacy of its internal operations. Cloud computing reduces dependencies on internal staff, whereby it is difficult to recruit and retain talented and highly skilled manpower under such a tight labour situation like in Malaysia. Low up-front capital costs and a growing SME base are also spurring the growth of cloud computing in the country. Thus, with such imperatives and impetus, the cloud computing industry in Malaysia is expected to grow at a CAGR of 39% until 2020. In terms of sub-segments, Software as a Service (SaaS) accounted for 84.3% and Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) both accounted for the remaining 15.7%. Leading research institution MIMOS has plans to develop a national cloud computing platform focusing on enabling services through software, security frameworks and mobile interactivity, as well as testing new cloud tools and methodologies.

Therefore, for an effective execution, it is imperative to institute a comprehensive and explicit cloud policy, namely First Cloud Policy like in the United States. On this premise, MOSTI is poised to take the lead role at policy level to promote cloud computing. For implementation in

Technology Focus Areas (TFA)	Malaysian Revenue (RM million)		CAGR (%)	Global Revenue (RM billion)		CAGR (%)
	2011	2020		2011	2020	
Cloud Computing	140	2801	39%	120	723	22%
Wireless Intelligence	180	1800	29%	50	450	22%
Big Data & Analytics	120	1563	33%	40	312	25.6%
Security & Platforms	745	2523	25%	158	326	9%
e-Services	830	3681	18%	300	767	11%
Ubiquitous Connectivity	9,900	16,584	5.9%	1,620	2,737	6%

Table 5: Market Size by Technology Focus Area (TFA)
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

Intellectual Property (IP) Number						
Segments	Cloud computing	Wireless Intelligence	Big Data & Analytics	Security & Platforms	e-Services	Ubiquity Connectivity
Patents granted	-	5	2	19	2	1
Patents applied	-	73	21	73	23	19
Commercialised products	2	11	15	7	51	7
Potentials commercialised, pre-commercialised and completed projects	30	117	6	45	76	27

Table 6: Intellectual Property Distribution by TFA
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

the Government sector, MAMPU is poised to take the lead.

Wireless Sensor Networks

Wireless intelligence comprising three major technology segments, namely wireless sensor, M2M and RFID, is poised to grow at a rate of 29% in Malaysia over the next decade. The key application areas that are poised to drive wireless sensor intelligence include adoption in agriculture, environmental monitoring, civil infrastructure monitoring and slope and landslides monitoring. RFID will be widely used in asset tracking and supply chain management, animal husbandry and livestock tracking, retail industry and wildlife conservation. M2M will be deployed in the development of smart cities, smart infrastructure, smart grids, telematics applications and wide rollout of 3G and LTE networks.

The area of RFID in Malaysia is quite well developed in terms of research, development of standards and policies. The market size for RFID in 2011 was US$13.6 million and is expected to touch US$33.8 million by 2016, with a CAGR of 19.8%. So far the country has 11 commercialised technologies, five patents granted, 73 patents applied for, 117 projects in pre-commercialisation stage and three projects under the Prototype Research Grant Scheme (PRGS).

To provide further impetus to the wireless intelligence segment, the following steps should be given due attention: commercialisation-related incentives for researchers; developing comprehensive standards and guidelines for adoption in the market; forums for information and knowledge sharing among the industry players and research community; developing partnerships with multinationals and centres of excellence around the world; and promoting more applications in key verticals like infrastructure development, environment management, energy and financial services.

Big Data and Analytics

"Big Data" has become increasingly quintessential in today's world of bits and bytes where a plethora of information is available in the digital world. Organisations today are facing a big problem with Big Data. Many ICT organisations cannot seem to comprehend what they can do with the vast amount of information that is floating across their channels on the Internet, mobile communication, media streaming, etc. The right use of big data and analytics can prove to be of significant benefit in identifying the right set of marketing efforts and revenue generation for organisations. In 2011, the worldwide Big Data and Analytics market is estimated at RM40 billion with a CAGR of 25.6%. Around 2.5 quintillion bytes of data is created everyday (Information source: IBM). Driven by this huge increase

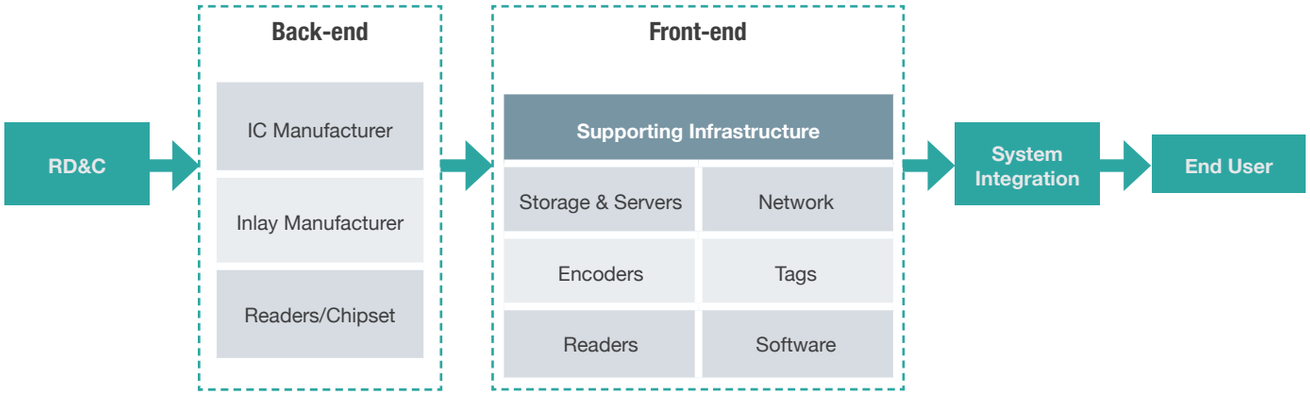


Figure 11: Wireless Intelligence Value Chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

in data creation, it is estimated that the Big Data & Analytics market will reach RM312 billion by 2020. So, in the next eight years, it could be eight times the current market size! On the other hand, Malaysia makes up a very small segment of the Big Data & Analytics market. It made up around 3% of the global Big Data & Analytics market in 2011, valued at around RM120 million.

Though CAGR wise it could see fast growth in the next eight years with an estimated market size of RM1.56 billion, it would be a meagre 0.5% of the global Big Data & Analytics market by 2020. So, the opportunity is immense for Malaysia to leapfrog and become a significant entity in the global market for Big Data and Analytics. Big Data & Analytics can be a technology enabler for various key industries and sectors in Malaysia such as oil & gas, healthcare, financial services, energy, etc. Massively Parallel Processing (MPP) databases and advanced analytics apps contribute towards enabling component across the industry sectors.

The current status of the Big Data and Analytics industry in Malaysia is 15 commercialised technologies, two patents granted, 21 applied patents for and six projects in either a potential or pre-commercialisation stage. About 14,000 people are estimated to be employed in the area of Database in 2012 in Malaysia.

In terms of IP, at present Malaysia does not have any strength in the area of Big Data and Analytics. However, the potential is there as a good number of patents have been applied for and there are several projects present in either a potential or pre-commercialised stage. Talent wise, there is a good number of Malaysians working in databases and data mining.

Big Data & Analytics value chain in Malaysia consists of several local companies supporting global vendors in the field of data storage, business performance, enterprise applications, etc. Typically, most of the Malaysian companies in the field of Big Data & Analytics are not directly linked to the end customer. Rather, they contribute to the value chain of global vendors having a base in Malaysia or overseas. Companies like Mesiniaga, Heitech Padu, Advanced Business Analytics, Statworks, etc. mostly operate in the role of system integration and process consultants. System Integrators and process consultants, in turn, interact directly with data storage and enterprise application vendors.

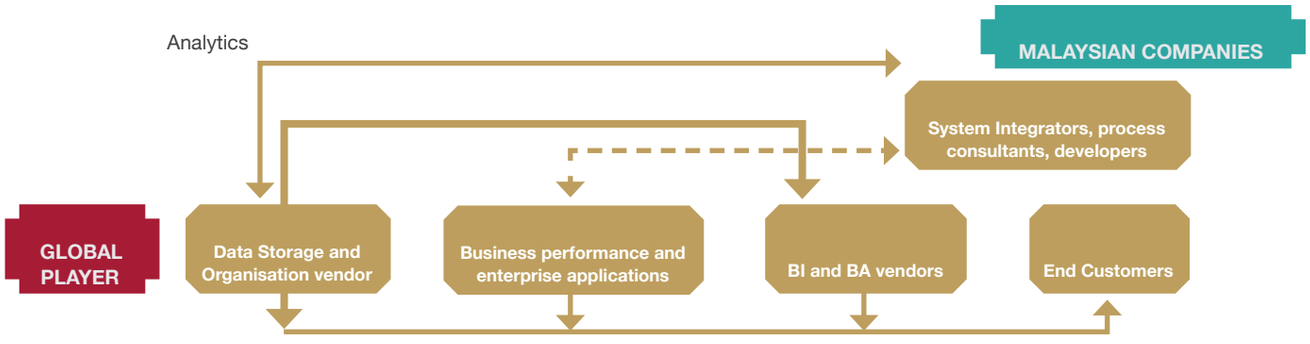


Figure 12: Big Data Analytics Value Chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

Figure 13: Security & Platforms Market Segments Constituents
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

To develop a sustainable industry for Big Data & Analytics, Malaysia needs to focus on R&D and localisation of the technologies. Awareness should be increased in the education curriculum at senior school and university levels. The curriculum should also be updated with the latest technological trends emerging in the Business Analytics / Business Intelligence and Big Data spaces.

Appropriate government funding can help build up a local talent pool well versed with technological prowess to develop complex algorithms and in-house Big Data technology. Suitable partnerships with foreign institutions of higher learning and R&D companies can also enhance the local talent pool development. Local companies, who mostly operate in the role of system integrators or vendors who secure contracts , should have KPIs that will get them more involved in strategic partnerships with MNCs who have interest in expansion in the field of Big Data & Analytics in Malaysia.

Working groups can also be formed which will focus on tracking technology trends and development in the various segments of Big Data & Analytics for the nation. On a medium term goal, demand for TFA should be created locally. Malaysian companies should be encouraged to use Business Analytics and Big Data as a business tool to improve market share and increase revenues. Appropriate investments in the infrastructure space for Big Data & Analytics should be dealt with in order to create demand for locally developed Big Data technologies.

Security Platforms

Market for security & platforms can be segmented into three industry areas: Cyber security, Video Surveillance and Biometrics, as shown in Figure 13.

The key market drivers for cyber security in Malaysia are the significant efforts in the various government departments to encourage the use of computers coupled with the thrust on cyber security, both network and end-point security. Key drivers of security and platforms market growth include the following:

Segment	Key Drivers	Industry Status
Cyber security	• Antivirus: High potential in public sector as well as large enterprise • Intrusion prevention system: Growing due to cloud adoption and as an add on to the firewall • Next Generation firewall: High potential due to increase in demand for application layer control and visibility features	• Local industry lacks potential to support the requirements of Critical National Information Infrastructure; • 10% of local IT revenue come from security products and services; • More than 30% of export IT revenue is derived from cyber security products and services
Surveillance	• Growing demand in govt. offices, private offices/ Organisations, Residential, Commercial/Retail, etc. • IP Video Surveillance, Integrated VS & Security, Wireless City Surveillance, Video Analytics • EACS/ Smart /Intelligent Buildings • Convergence of Applications	• Value chain analysis indicated that majority of the Malaysian firms are in the system integration field; • Nearly 6-8% of participants operate end to end in video surveillance; • The industry is moving away from product to service centric
Biometrics	• Growing applications in Identity card, travel documents Public office Access Control, Law Enforcement, etc.	• Multi Modal Biometric System, Biometrics for all geo-socialization tools /in everyday appliances • Lack of hardware manufacturers for integrated / multi-modal systems; • System integrators do not have the ability to integrate with AIDC/EACS technologies

Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

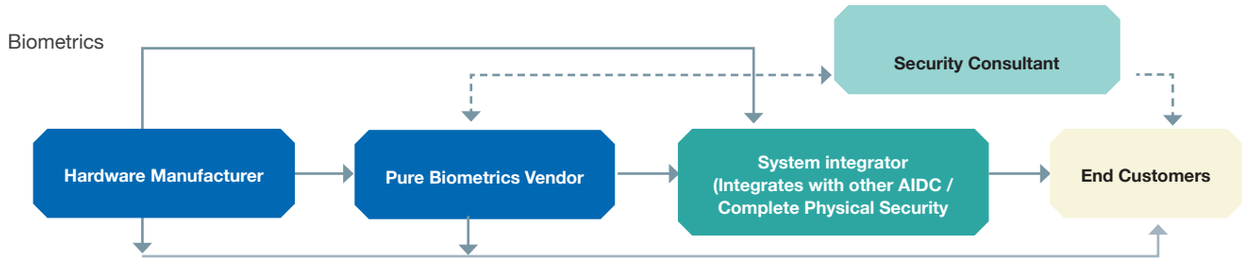


Figure 14: Biometric Market Value Chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

In terms of talent, close to 27,000 people are employed in the domain of networking and security in Malaysia in 2012, which represents a potential talent pool for security and platform implementation. Cyber Security Malaysia, an agency under MOSTI, was accepted as a Common Criteria Recognition Agreement (CCRA) authorising member, allowing it to evaluate and certify IT products as ISO standard 15408. Cyber Security Malaysia has also set up the Information Security Professional Association (ISPA), a certification body for information security professionals.

Figure 14 shows the Biometric Value Chain. In the Malaysian Biometrics industry, over 60% of the players are in the SI section. Approximately 8-10% of the market participants operate end to end. The industry lacks the presence of hardware manufacturers and the required experience in certain key segments such as integrated/multi modal systems. There is tremendous scope for new competency to be developed in this area.

Video Surveillance Value chain

As shown in Figure 15, over 80% of the players in the Malaysian Video Surveillance (VS) market are in the SI space. Approximately 8-10% of the total number of market participants operate end to end. Currently the Malaysian industry lacks hardware manufacturers and the expertise in cross-platform solutions. Cloud-based surveillance is still at an early stage of growth and many non-security participants are stepping up to provide such solutions. Most end-to-end providers are still nascent compared to APAC or other regional players. The current value chain is product-centric and the future will be very much service-centric; therefore the system integrators will move up the value chain and start offering services. VSaaS (Video Surveillance as a service)/RVM (Remote video monitoring) services over the cloud is where the opportunity is for Malaysian companies.

Therefore more focus, via awareness programmes and talent development, needs to be on the services front. Example of initiatives that can be taken are:

- Greater collaboration and cooperation with local and regional stakeholders
- Emphasis on R&D activities and developing local VS with integrated physical security
- Encourage foreign companies specialising in VS related

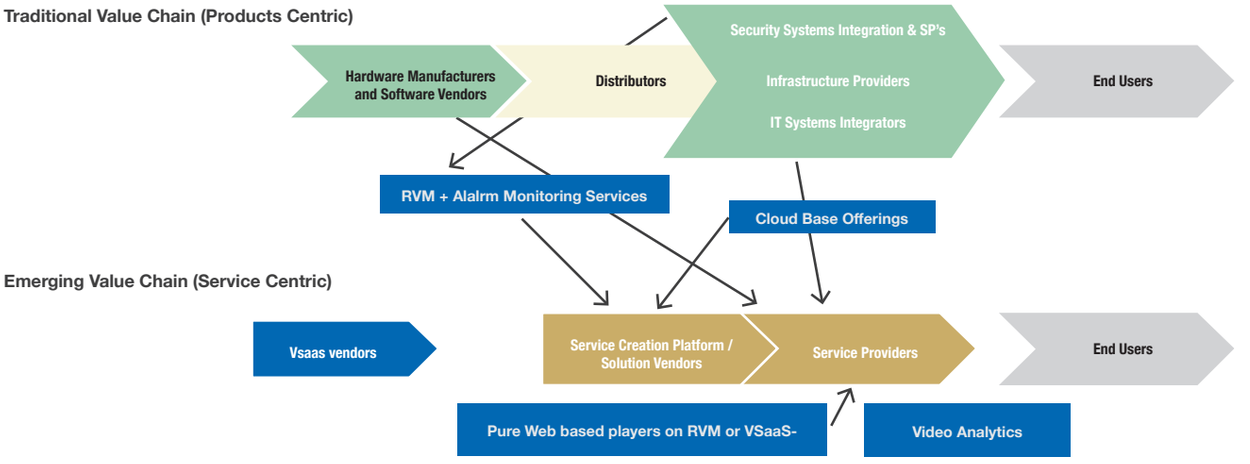


Figure 15: Video Surveillance Market Value Chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

Figure 16: Cyber Security Market Value chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

technologies to initiate R&D activities

- Development of human resources is key and with greater emphasis placed on universities to develop R&D

- Promote and educate (with both supply and demand) people on the possibilities of IPVS, VsaaS/RVM and Mobile VS by either funding their activities or possibly even pushing for mandates in critical areas to increase the adoption rate of this technology

- Identify economic impact and benefits of the technology for the nation

- To benchmark Malaysia against other leading nations as well as have joint research work with the VS industry based in North America, JAKOR (Japan and South Korea) & China

Cyber Security Value Chain

Figure 16 shows the cyber security value chain. Compared to other nations, Malaysia has a well-developed cyber security industry that has the potential to provide global solutions. Around 10% of local IT revenue and 30% of export IT revenues are derived from cyber security products and services. Malaysia already has a good international cyber security credibility, but is yet to fully capitalise on the lucrative business opportunities. Few of the initiatives that could be taken to boost the industry include:

- Ensure compliance to International standards of cyber security for Critical National Information Infrastructure (CNII)

- Develop capability for cyber security enforcement by agreeing on standards in various areas like e-commerce

- Strengthen key regulatory bodies by equipping them with necessary tools and talent

- Facilitate local industry development to support CNII
  - ◊ Develop talent pool for the industry
  - ◊ To catalyse the growth of local industry capability for sustained growth
  - ◊ Facilitate market access for local industry to go global

e-Services

The Global e-Services industry, comprising e-Government, e-Health and e-Learning services is expected to grow at a CAGR of 11% and reach revenues of RM767 billion by 2020 from about RM300 billion in 2011. In Malaysia, the e-Services industry is expected to grow at a much faster rate of 18% CAGR and is expected to reach a size of RM3.7 billion by 2020 from RM0.8 billion in 2011. The key drivers of e-services globally as well as in Malaysia are shown in Figure 17.

Figure 18 shows the value chain for e-services in Malaysia. Malaysia currently has competency in network infrastructure services and this includes existing players like Telekom Malaysia, TIME, Maxis, Celcom and many others. However broadband is still expensive for consumers and SMEs. In software development and system integration, there is scope for competency to be developed. A

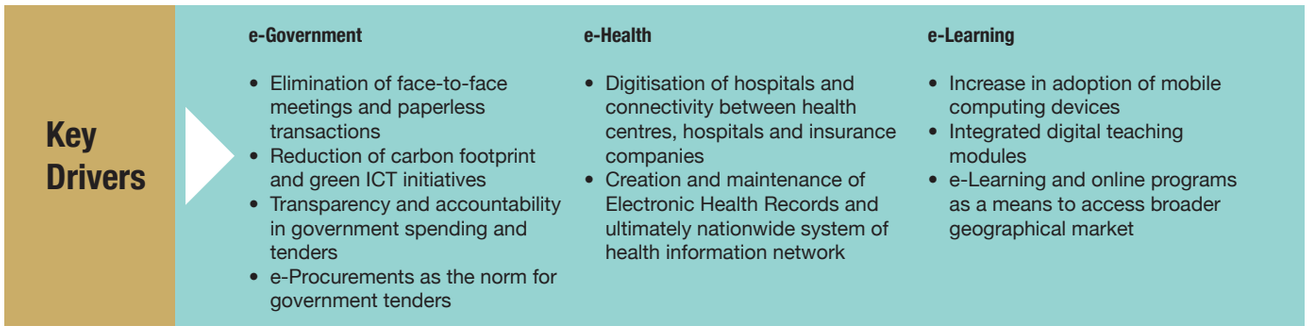


Figure 17: Key Vertical Industry Drivers of e-Commerce
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

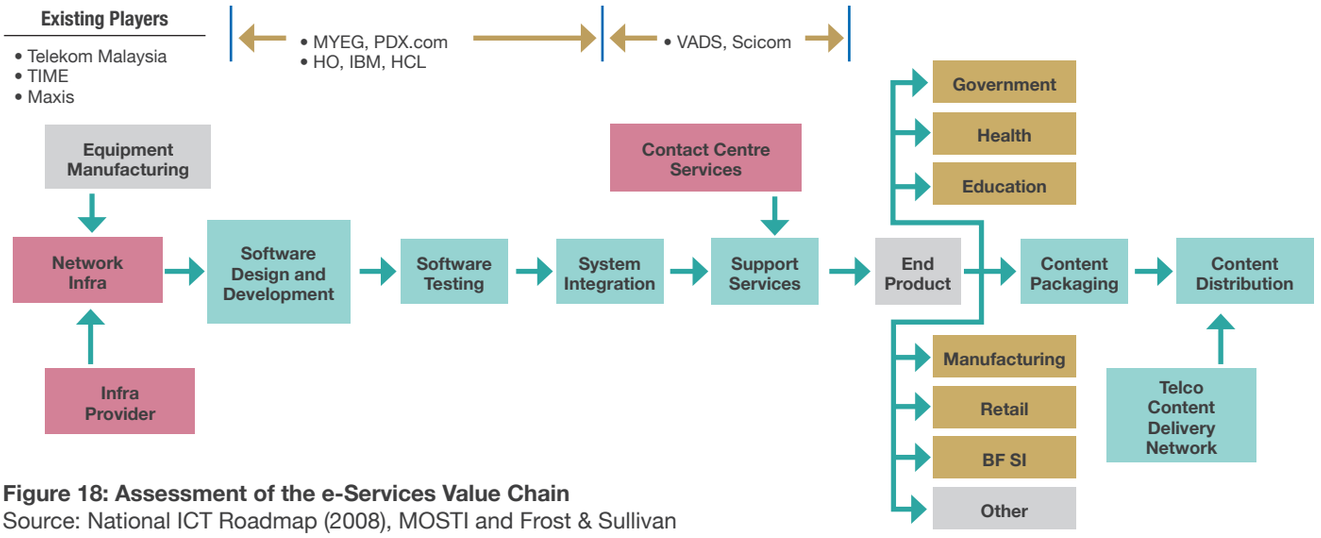


Figure 18: Assessment of the e-Services Value Chain
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

lack of highly-skilled local labour pool has meant that there are few local providers with the market dominated by the global IT service providers. In order to further increase the development and uptake of e-Services, the right regulatory framework, adequately trained human capital and good infrastructure are essential. Programmes to increase the awareness of existing and new e-Services are also necessary to increase adoption. Some of the initiatives for developing this key TFA include:

- Create standards and regulations for Health IT systems
- Financial incentives for local software providers creating content for e-Learning or e-Government services (R&D tax credits, grants and funds)
- Grants to hospitals and healthcare providers to adopt Health IT and electronic records
- Mandate the use of electronic health records in public and private hospitals
- Promote greater accountability of fund recipients and an audit of existing initiatives to look at resource efficiencies

There is a strong need to create demand among large enterprises, SMEs and consumers as e-Services is important to the growth of this industry. The strategic aim is to increase the participation of consumers and enterprises in the growth, to reduce service costs and also introduce a certain level of transparency and accountability.

This involves enabling SMEs to adopt eServices like e-Procurement and e-Commerce in order to improve the business processes, increase reach to a wider spectrum of potential customers while increasing efficiency and turnaround time. Initiatives to spur demand across the different segments include:

- Incentivise e-Transactions for greater adoption
- Increase adoption of e-perolehan by making it the norm for all government tenders
- Introduce e-Government services in different languages for greater adoption, improve user friendliness and comprehensiveness
- Target zero face-to-face services in the medium term to spur greater adoption among SMEs and consumers
- Increase attractiveness of e-Banking by enabling usage through different channels (i.e. social media)
- Greater promotion of MDEX as the preferred B2B platform among SMEs

Ubiquitous Connectivity

With the advent of mobile devices and increased mobile internet penetration, one has the option to be connected or be 'online' all the time from any location. This opportunity has been termed as ubiquitous connectivity. The ubiquitous connectivity considered here includes various enabling technologies like Near Field Communication (NFC), Long Term Evolution (LTE), WiMax, Global Positioning System (GPS), Geographic Information Systems (GIS), Location-based Services (LBS) and so on. Mobile internet adoption is expected to grow steadily in the future and existing mobile networks will be upgraded to offer greater capacity and data transfer speeds.

The purchase and usage of mobile apps have also been considerably increasing; in fact estimates suggest that smart phones will account for 23% of all new handsets sold by 2013 with almost 1-in-4 people already indicating that they used a smart

phone in Q1 of 2010. These are the primary drivers for the growth of this industry globally, along with increased adoption and usage in other sectors like retail and tourism. Global revenue for this area is expected to grow from RM1,620 billion in 2011 (estimated) to RM2,737 billion in 2020 (forecasted). However, to enable this growth, certain key aspects that need to be addressed will be collaboration and standardisation. Collaboration between key industry players is needed to provide end-to-end services seamlessly for NFC, GPS, GIS, LBS, etc.. Also, the setting up of standards for upcoming technologies like NFC and ensuring that latest technology developments are considered in regulations and policies will provide a needed boost to the opportunity. Upgrading of networks to provide higher data speed on all kinds of mobile devices will be essential for growth as well.

Figure 19 shows the ubiquity connectivity value chain analysis. Currently, the value chain has enough players and competence in the network provider space. However, towards the end of the value chain, i.e. content development and application orientation, there is still scope for a lot of development. In the space of GIS, there are some companies like Geosense and Geomatika which provide solutions, however in the upcoming NFC technology space, there is still scope for players to gain strength. Companies like Smartag are trying to establish their presence in this area, but are still at a stage of forming collaboration to gain technical support.

In terms of infrastructure requirement, LTE implementation and adoption is expected to pick up pace in the next 2-3 years and will lead to ready infrastructure for greater usage for application of ubiquitous connectivity. There is a talent pool as well which can be tapped for this area – there are a lot of people working in various Telcos and there is a R&D base in a number of local and MNC organisations. As far as demand creation is concerned, various national transformation initiatives provide the requisite impetus and a ready market for these technologies.

Some risks identified with this strategic implementation are:

- **Security concerns:** When connectivity all the time becomes a norm, huge amounts of information sharing will happen from various sources all the time, including private information. Thus, security issues could pose a major concern if not handled well in advance.

- **ICT literacy:** The adoption and usage of ubiquitous connectivity is quite dependent on ICT literacy among the people. This would essentially dictate the take-up rate of devices and technologies, confidence in using upcoming technologies and capabilities to utilise them to improve productivity across different sectors

- **Inter-agency collaboration:** Collaboration between various agencies is a major concern for any strategic implementation plan. There are differences in sharing information and resources and often this delays the implementation plan or leads to it being shelved

- **Different information systems across organisations:** Many agencies or organisations work on legacy systems, whereas some others may have advanced or moved to better systems. This poses a major threat to any data or information sharing or any kind of integration

Steps to mitigate risks:

- **Involvement of CyberSecurity Malaysia:** CyberSecurity Malaysia can be involved in the implementation steps at an early stage to mitigate the security concerns and make sure appropriate security norms are in place with the growth of connectivity

- Promotional campaigns and free workshops can be held to create awareness about new ICT

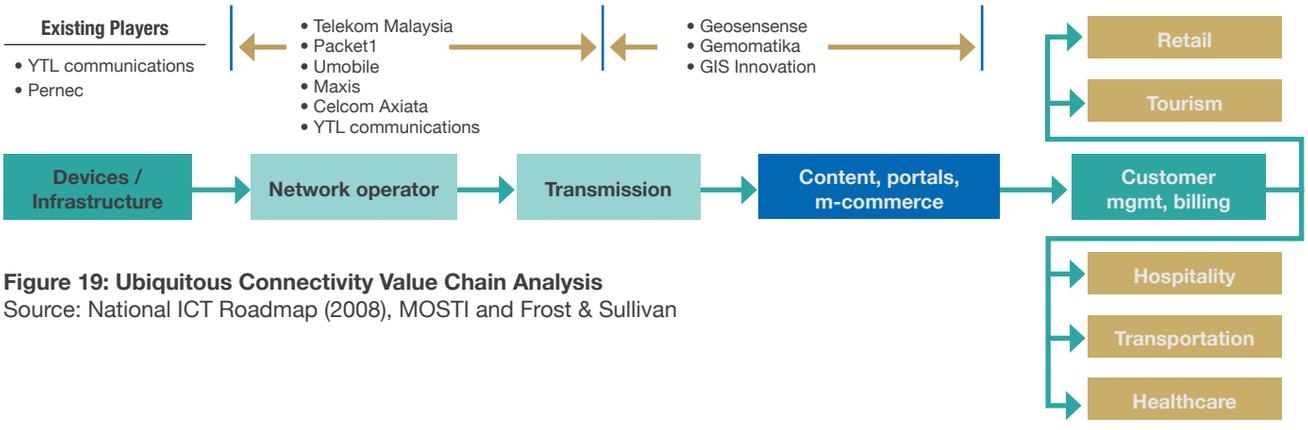


Figure 19: Ubiquitous Connectivity Value Chain Analysis
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

technologies and their usage. Mass usage can be encouraged by adopting these technologies at a public services touch point to generate the required confidence

- Careful change management process needs to be in place to ensure that systems, people and processes are in sync with the change

5.2 Enabling Local ICT Technology Available for ETP, GTP & DM

The ICT Roadmap 2012 study revealed that several key national transformation programs offer potential opportunities for ICT enablement and leveraging of local ICT technologies. However, inadequate awareness of opportunities in the Economic Transformation Programme (ETP), the Government Transformation Programme (GTP) & Digital Malaysia (DM) Masterplan along with the lack of understanding of local ICT technologies is inhibiting the potential of local supply meeting key local demand. Therefore, actions are needed to enhance the linkages between technologies, especially local ones, required for the ETP, GTP & DM. Recognising the imperative, a database of existing technologies was created and mapped with the existing opportunities in various national transformation programs.

In this exercise, more than 130 opportunities have been mapped onto more than 520 technologies and the outcome is shown in Figure 20. Thus, for enhancing the efficiency and efficacy of the linkages between the window of opportunities of various EPPs and NKEAs/ NKRAs, the ICT Roadmap 2012 has proposed that the Malaysia Industrial Research Institute of ICT (MiRICT) assume the leadership role and, at implementation level, work closely with Agency Innovation Malaysia (AIM) for commercialisation efforts. In addition to the opportunities for existing technologies, numerous other opportunities warrant attention such as electronic health records, centralised e-book database, online teacher training, smart grid for energy, tourism information on demand, etc..

5.3 A Channel for Research – Industry Linkage and Communication:

As in previous roadmaps, the ICT Roadmap 2012 also revealed that the relationship dynamics between the research community and industry needs improvement. One of the relevant and quick means could be enhancing the existing MOSTI KRSTE portal to be analogous to US Federal Government's data.gov. This will help to increase access to high value datasets of the Federal Government, unlocking data from individual silos and making it available to stakeholders. Such an initiative can enhance the outcome for innovation, collaboration and transparency. The current challenge plaguing the KRSTE portal is that the database is not comprehensive, lacks timely information and has only limited access coverage. Therefore, the ICT Roadmap 2012 has recommended that the KRSTE portal be upgraded

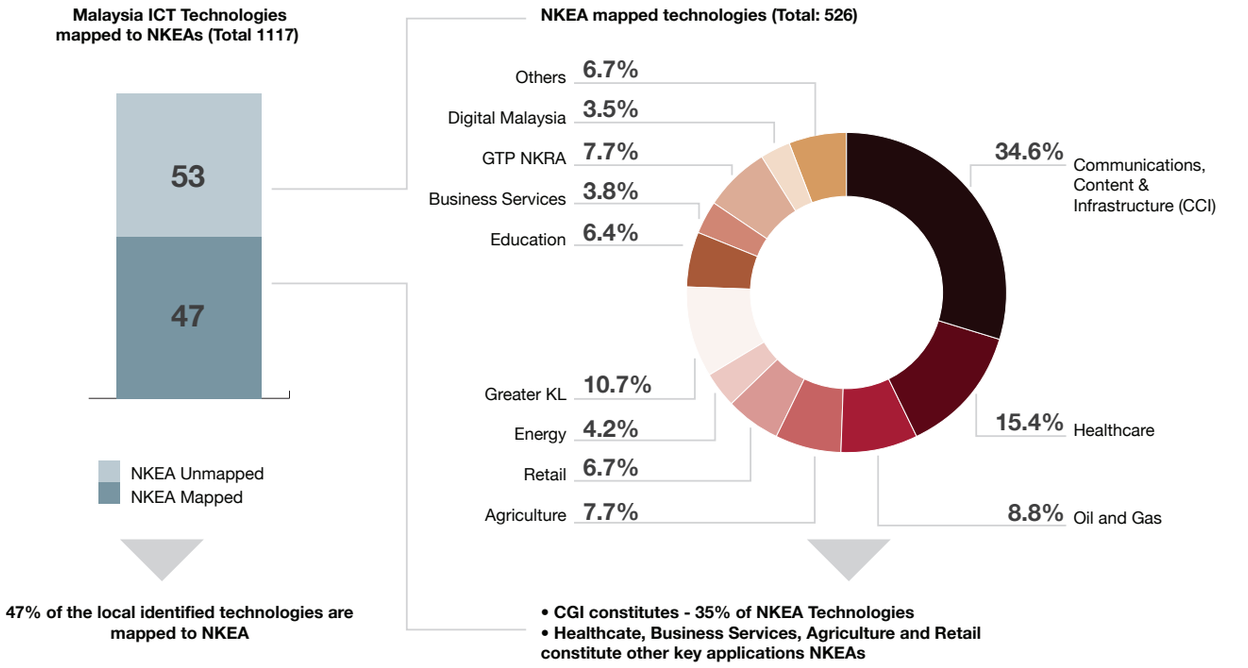


Figure 20: Local ICT Technology Mapping as per NKEA and Others
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

and to increase its access and visibility to industry and researchers. The upgraded site should also offer complete transparency on ICT project funding, progress status of ICT projects as well as capturing ICT industry's needs.

Once upgraded, it can be an effective channel of communications between various ecosystem participants. It will also gain ground for industry-driven research being undertaken at IHs/RIs, by providing visibility to researchers on industry's requirements. Being a lead agency for R&D in science and technology, MOSTI is recommended to continue assuming the role of enhancing the KRSTE portal, not only for its own internal purposes but also for wider industry use.

5.4 Central Technology Rating & Valuation Body - Key to Developing a New Funding Model

The study revealed that a significant gap exists in the innovation ecosystem in terms of assessment and evaluation of technology. Additionally, with the lack of quality professional services, technology evaluation and valuation remains a challenge. This has created significant hurdles for raising funds, especially for SMEs and start-ups that are required to show proof of their commercial viability, past track record, etc.

In addition to the above issue, it is also Malaysia's long-term strategic view that the funding model should gradually transition to enable private sources of funding. KOTEC is a Korean agency that supports technology funding based on ratings and guarantees. KOTEC (earlier KIBO) provides comprehensive assessment of technologies based on not just technology excellence but also its marketability and business applicability. KOTEC has developed its own patented technology rating system and uses it to provide technology ratings.

Recognising the gap, the ICT Roadmap 2012 proposed for a Techno-Commercial rating centre analogous to KOTEC (Figure 21). This independent body will give ratings to potential and developed IPs and technology from the technical as well as commercial standpoints.

5.5. Transitioning Existing Funding Model Towards Greater Efficiency

Various funds in the science and technology system have their own distinct funding features and characteristics, forms for filing funding application, approval process, monitoring mechanism and constitution of the funding committee. Also, each funding source has its own distinct commercialisation definition. For instance, Ministry of Higher Education's (MOHE) definition centres on research that already has an industry partner while MOSTI's and MTDC's definition looks at market presence of the research in terms of either licensing, assignment or spin-off venture.

Various cradle funding mechanisms consider actual revenue accrual as the key to commercialisation. The ICT Roadmap 2012 has recommended for a standardisation procedure which will not only ease the filling

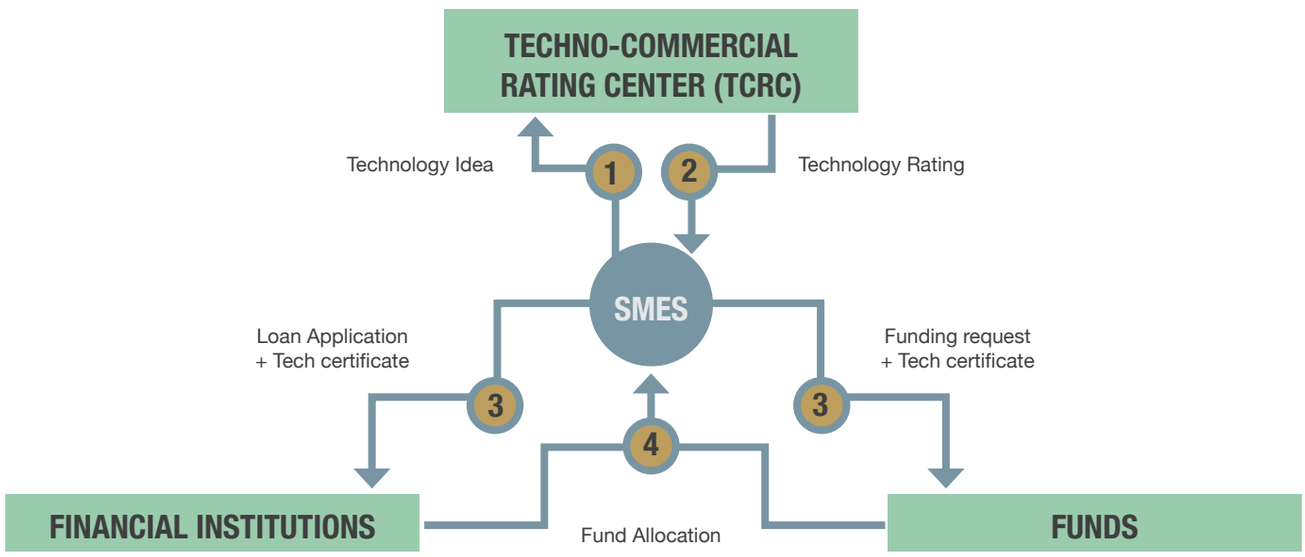


Figure 21 : Techno-Commercial Rating Generic Framework
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

of fund application for the research community, but will also lead to a more streamlined funding system with a possible standard of fund evaluation being applied to all funds. The roadmap recommended a number of possible areas of strengthening of fund approval and monitoring process:

- Fund approval panel to have adequate mix of industry participants and technical experts;
- Stress on funding projects with industry collaboration/ commercialisation partner to enable transitioning the research outcome for commercialisation with greater ease;
- Include commercialisation timeline as part of all project applications;
- Stringently pursue post-disbursement monitoring;
- Standardize commercialisation definition across funds;
- Assign unique identification codes for projects and link them to the KRSTE portal. This is to check publically funded R&D projects from soliciting funds from multiple sources;
- Transition entire model to leverage the central technology rating & valuation body

5.6. Bridging Gaps in Existing Institutions to Further the Commercialisation Agenda

An assessment of the innovation ecosystem indicates several key gaps in the existing science system with respect to further improving the commercialisation rate and IP creation. Investigations revealed that the Malaysian research community in institutes of higher learning (IHL) and research institutes (RI) has limited orientation and awareness towards commercialisation and IP management.

Of more than 2,000 research papers published based on R&D projects funded by MOSTI and MOHE, only about 60 projects have been commercialised, indicating a low level of commercialisation. This provides a reflection that the cultural and work practice orientations in universities are more towards academics rather than research commercialisation. Towards improving this situation, the ICT Roadmap 2012 recommended three key implementation strategies.

The first strategy is to educate and create awareness. Such efforts by a relevant body could be a simple step, yet a significant step towards transitioning the cultural orientation of research community towards a more market-oriented R&D. Secondly, strengthening the innovation and commercialisation centres (ICC) in the IHLs by advising researchers to align their research towards market expectations.

The ICCs should also administer and manage all activities and concerns related to IP protection and commercialisation while supporting the inventors in spin offs, joint ventures (JV) and partnerships. One of the recommendations is that strengthening of ICCs should be led by MOHE, in consultation and engagement of Agensi Inovasi Malaysia (AIM), NITC-Expert group and MOSTI. The third strategy is to foster and nurture community of practice (COP) to facilitate technology transfer among various ICT labs in the country. It is being widely acknowledged that Malaysia currently lacks the professional service providers required to support IP protection and commercialisation.

As illustrated in Figure 22, the entire process of IP disclosure, review and filing requires professional support from technology consultants. The setting up of a Community of Practice (COP) on technology transfer will help in the sharing of commercialisation know-how and skills while bridging the gaps in the existing professional services by supporting IP management and commercialisation. The proposed COP creates an environment that adds value and supports the technology transfer efforts of its

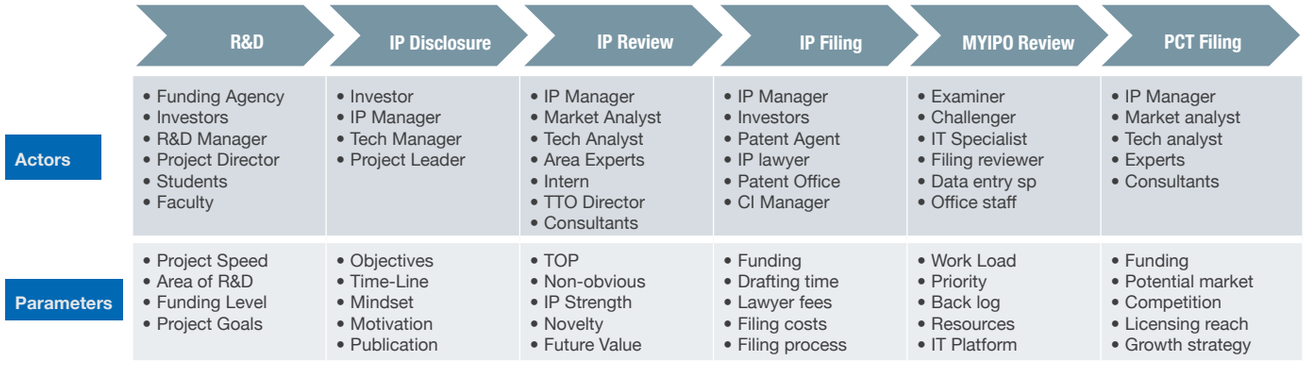


Figure 22: Typical IP Management Process, Actors and Parameters
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

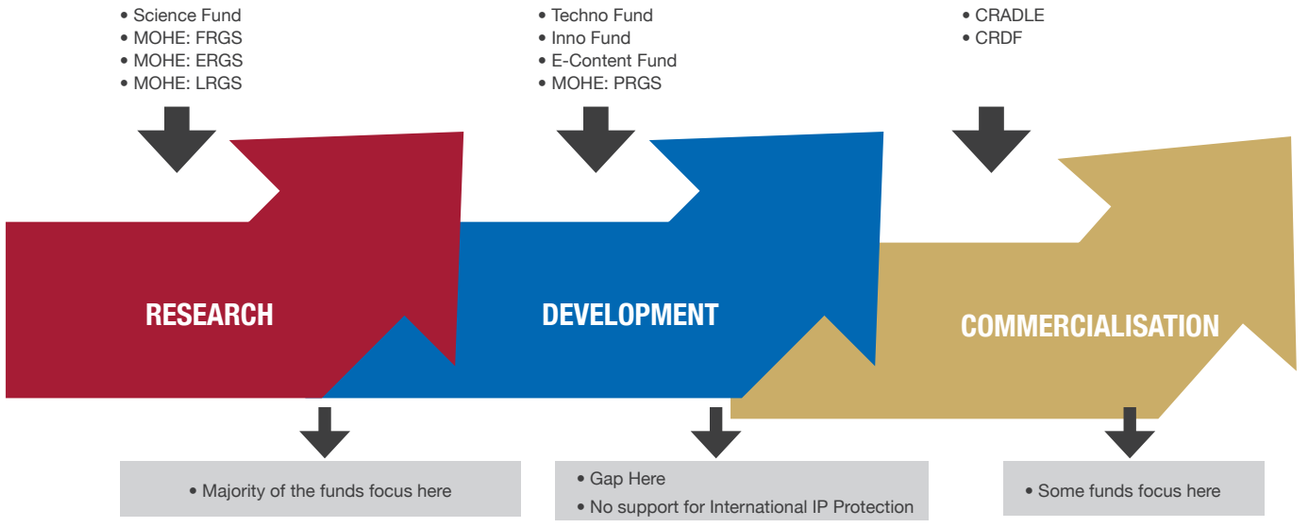


Figure 23: Fund Focus at R&D Stages in Malaysia
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

members and potential partners. Specific forums on key challenges can be created, such as legal issues, IP Protection, planning and policy, training, etc. It will help to form partnerships with industry, academia, and government to foster its technology transfer and outreach efforts. It can bridge gaps between the public and private sectors by bringing laboratories together with potential users.

5.7 Strengthening IP Management and Enabling Commercialisation

The ICT Roadmap 2012 has highlighted five key challenges faced in IP and commercialisation management. The first key issue is that of the inconsistency of IP Management standards across the RIs, IHLs and even local ICT companies. Such inconsistencies impact process issues like when to file, what to file, what patents to maintain, how to write and who should be involved among others. Lack of such knowledge and standardisation can either prolong the filing process, or increase the organisation's cost and, in the worst case scenario, even act as a disincentive to even embark on such an exercise.

Recognising this shortfall, the ICT Roadmap 2012 calls for defining best practices in IP Management and propagate the same to the IHLs (through the ICCs), RIs and the ICT industry. Institutions like MyIPO should be poised to play a more proactive role in disseminating information and knowledge as well as experience on IP management process and procedures to the research community.

The second issue that pertinently affects IP management and commercialisation is that current funds are highly skewed towards R&D (Science Fund, MOHE FRGS, LRGS and ERGS) and pre-commercialisation (Techno Fund, Inno Fund, E-content fund and PRGS) activities, as depicted in Figure 23. The only native commercialisation funds are the CRADLE and the MTDC CRDF funds. Towards ensuring that there is funding availability for commercialisation of locally-developed technologies, the ICT Roadmap 2012 calls for an alignment of R&D funding and commercial evaluation of the projects from the onset of R&D project initiation. The commercialisation funding should also be made available for management, administrative and logistics activities such as personnel costs of hiring industry experts, costs of engaging external business or technical advisors (including IP experts, legal experts), skill training, sales and marketing activities, and purchase or access to market information. This issue warrants the attention of three key mainstream agencies involved directly in the managing, approval and disbursement of research funds, namely MOSTI, MOHE and Ministry of Finance (MOF).

The third issue is the lack of effective key performance indicator (KPI) measurement and monitoring for IHLs, thus driving down the commercialisation rate. As such, it is imperative that the KPIs for IHLs to incorporate measurement parameters such as number of successful licensing, partnerships, spin offs, patent filing, disclosure, new projects commercialised, technology licensing agreements, collaborative research projects initiated and start-ups companies as well as percentage of grants that produce commercialised products and the organisation of inventor workshops. More importantly, there is a need for a stricter enforcement on KPI measures by the fund management institutions, including imposition of penalties

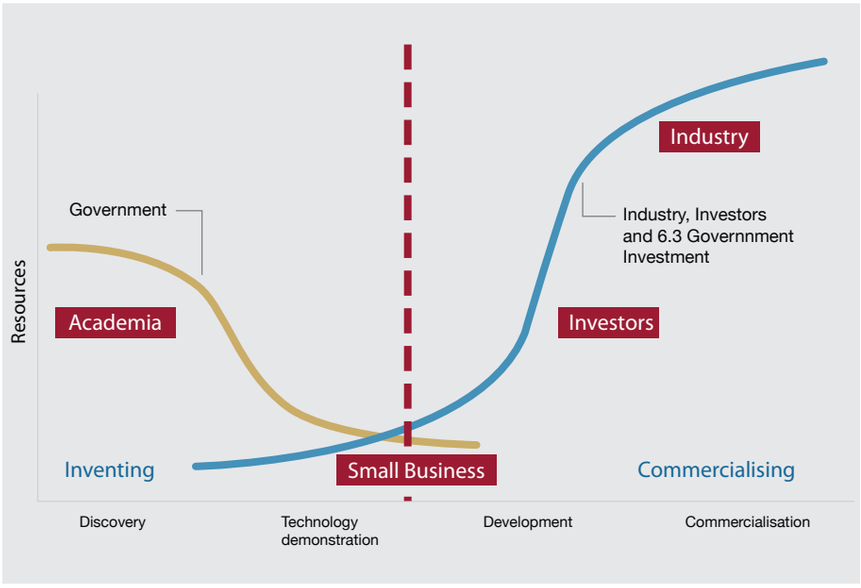


Figure 24: Moving from Technology Development to Commercialisation Framework
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

if IHLs and RIs fail to adhere to stipulated requirements, conditions, standards and targets.

The fourth issue is the lack of guidance and hand-holding of the IP creators and inventors to take their innovation from research to prototype and subsequently to the next level, or crossing the Valley of Death as it is sometimes called (Figure 24). At this stage, it is important to provide to the innovator access to capabilities like market research, business potential assessment, preparing business plans, structuring and negotiating the deals for technology transfer / commercialisation, etc. It would also be valuable to have these capabilities provided by a body of experienced industry, consulting, legal and investment experts who can act as informal mentors to the innovators. The fifth issue is termed as the "innovation graveyard" – denoting the number of R&D project failures. Realising that an idea may not have a commercial potential after a lot of effort has been taken to develop it wastes time and resources for any organisation and adversely impacts the ideas that may otherwise have a market potential. Thus, one of the ways to avoid this graveyard of bad ideas is to incorporate the concept of prototyping which is "testing the initial appeal and actual usage of a potential new product by simulating its core experience with the smallest possible investment of time and money."

5.8 Enabling SMEs and Start-ups to be Engines of Innovation and Commercialisation

While most IHLs and RIs in Malaysia do engage in significant R&D activity, there seems to be a lack of commercialisation enablers for SMEs. Specifically, small businesses looking to commercialise local R&D outcomes from the IHLs/ RIs or from their own efforts, lack a single window support to productise the research outcome or platform. While incubator services provided under MTDC do provide support in terms of real–estate and mentorship, they are inadequate in provisioning high-end labs and consultation support for developing pilots and prototypes for commercialisation.

It is to be applauded that high end tech incubators operated by Technology Park Malaysia and MDeC nurture start-up companies and technopreneurs from ideation to full commercialisation by offering offices,equipped with modern facilities and administration services as well as capacity building program with comprehensive and integrated coaching, mentoring, consultancy and training. However, a significant number of SMEs have not leveraged on these services offered (Figure 25). In beefing up this role, SME Corp could play an active role in linking SMEs with the agencies providing incubation services.

The other issue that warrants attention is that the current Income Tax rule 2005 (PU(A) 269/2005) provides deduction for investment

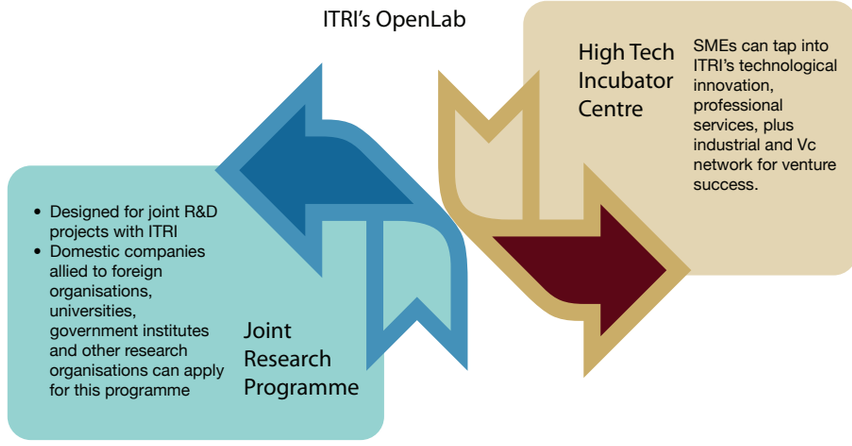


Figure 25: ITRI Best Practices on Open Lab Setup for SMEs and Start-ups
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

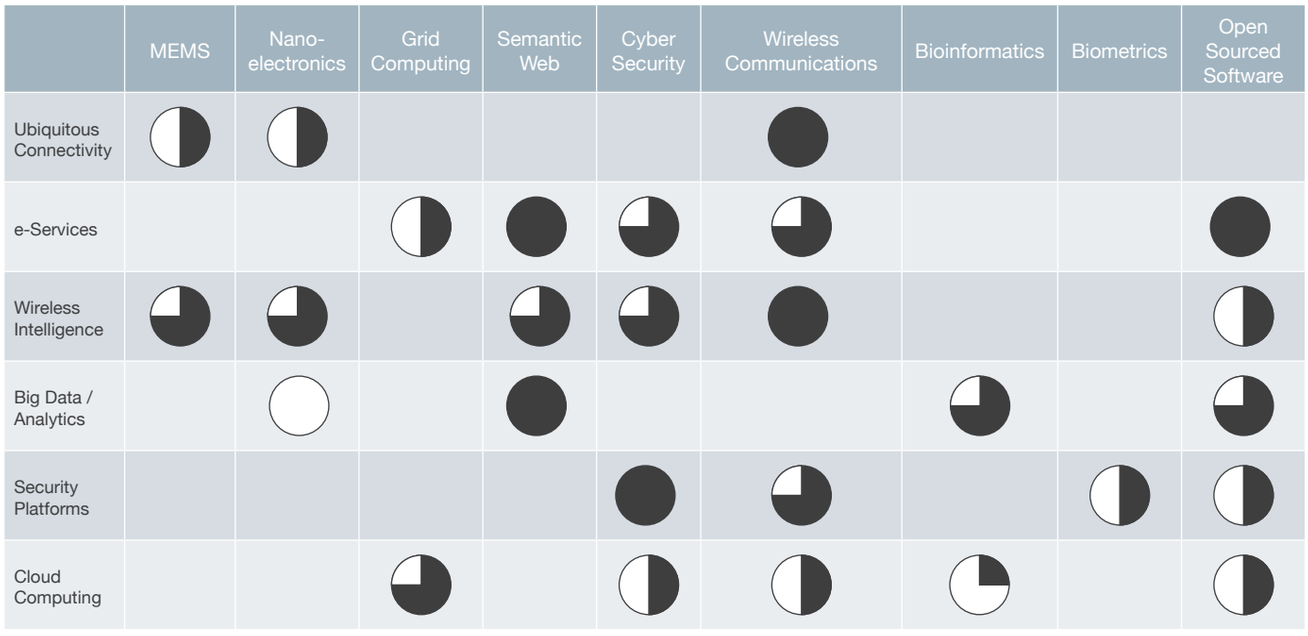


Figure 26 : Mapping of Technology Roadmap with TFAs
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

in commercialisation of a R&D outcome. This deduction is however limited to resource-based industries. Thus, the ICT Roadmap 2012 has explicitly recommended that the above incentive be extended to the ICT industry as well, considering its enabling role in improving efficiency across industries including resource-based industries.

Past studies have revealed that universities with clear and defined policies towards spin-off formations have more start-ups and spin offs. Currently, all IHLs do not have a standard and transparent policy for start-ups, thus it is timely for the Government, through MOHE, to initiate a transparent and structured policy for spin-off creation and development.

5.9 Aligning Technology Roadmaps with Technology Focus Areas

Certain gaps were identified in the current technology roadmap that need to be obviated. These issues include lack of milestones, inadequacy of human capital and expertise, funding challenges, low level of private sector participation, etc.. The technology roadmap is a vital cog in the overall establishment of a national strategic ICT roadmap. Figures 26 and 27 succinctly illustrates the linkages and continuity of essence of the Technology Roadmap and the proposed TFAs and their niche areas of focus respectively.

Equally important is that the TFAs integrate seamlessly with the Digital Malaysia Masterplan, which connects and empowers government, businesses and citizens through digital technology to drive innovation, creativity and productivity. For this to be realised, it is imperative that designated institutions be empowered in driving each of the technology roadmap programmes. For example, MDeC, with the support of the Institute of Micro Engineering and Nano Electronics, is to take the lead role in pushing the MEMS development in the private sector; Nano Malaysia Berhad to drive the nano-technology roadmap; MIMOS to spearhead the semantic technology development; MOSTI and MAMPU to jointly to drive grid computing; MCMC to spearhead the wireless communication roadmap; and Cyber Security Malaysia to drive the cyber security roadmap.

5.10 Attracting MNCs to Set Up R&D Centre in Malaysia

Despite the long established presence of multi-nationals like Agilent, Motorola, Altera, Intel and Seagate, Malaysia still has weak links in the global innovation network, which is a critical element for building a synergised ICT innovation ecosystem. The situation is projected to become critical as the involvement of multi-nationals have begun to ebb due to difficulties in getting qualified human resources for high value-add R&D. The problem is accentuated by the fact that manufacturing bases are increasingly moving to low cost countries like China, India and Vietnam.

In response to this challenge, the ICT Roadmap 2012 has called for an explicit incentive programme for

	MEMS	Nano-Electronics	Grid Computing	Semantic Web	Cyber Security	Wireless Communnications	Bioinformatics	Biometrics	Open Sourced Software
Ubiquitous Connectivity	• MEMS sensor • MEMS • Microphones • MEMS RFID tags	Nanosensors		• Social networks • Digital commerce	• Network Security • M2M security	• Social networks • Mobile applications • Digital commerce			Operating systems Mobile applications
e-services			• E-learning • E-payment	• Telemedicine • E-governance • E-learning • Digital commerce	• Network security • GPS-based security • Mobile security	• Telemedicine • E-governance • E-learning • Digital commerce			• Operating systems • Desktop appllications • Mobile applications
Wireless Intelligence	Wireless sensor networks	Nanosensors				Wireless intelligence			
Big Data / Analytics		Nano-enabled memories		Analytics based on semantic platform			Analysis of bioinformatics data		Analytics software
Security Platforms					• Internet traffic security • Data security • Secure access	• Network security • Secure integrated platform		Secure access	• Open security • Anti-spam systems
Cloud Computing			Underfying infrastructure		Cloud-based security	Enabling connectivity infrastructure	Storage of healthcare data		Virtualisation & Cloud enablement tools

Figure 27: TFA Niche Areas Mapped Against Technology Roadmaps
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

MNCs to set up R&D centres in the country. The incentive structure has to be best-in-class besides providing typical tax incentives, infrastructure subsidy, and operational cost subsidy. It is also equally imperative to remove the requirement for the R&D results to be used or carried out in Malaysia and to allow for double deduction under Section 34A of the ITA so as to encourage MNCs to localise their regional R&D centres in Malaysia even though the manufacturing can happen elsewhere. The abolition of the local shareholding requirement is also recommended so that even MNCs can avail certain R&D incentives which are otherwise reserved for majority Malaysian-owned businesses. At the implementation level, the Ministry of International Trade and Industry (MITI) has to work closely with Economic Planning Unit (EPU) and MOSTI, including its ICT-related agencies.

5.11 Shortlist of Local ICT Champions & Related Branding & Promotion Initiatives

Malaysia's ICT industry, though developed locally, has very little visibility abroad. There is very little awareness of the ICT segments in which Malaysian companies operate in and what their key strengths are. Local ICT companies are also very small and lack the financial wherewithal to market their products and services abroad in an effective manner. The organisation which is responsible for trade promotion, MATRADE, has limited resources and its responsibility is not only on the ICT sector but also other sectors in the economy that equally warrant attention for trade promotion.

Many countries around the world have dedicated organisations and government departments which actively promote the cause of the ICT industry. These institutions are well funded and resourced to carry out their tasks. It is high time that Malaysia considers either setting up a dedicated agency or beefing up the existing institutional functions and mechanism to actively brand and promote the local ICT industry abroad. Towards beefing up the Malaysian ICT branding, the ICT Roadmap 2012 recommended the following strategies:

- Enhance the ICT division within MATRADE and provide it more resources and funding to promote ICT in a dedicated manner;

- Showcasing of the Malaysian ICT industry prowess and success stories from around the world in key technology magazines and hosted on a dedicated page on MATRADE's website;

- Highlighting of key solutions developed for industries like Halal, Financial Services, Retail, Oil & Gas and Manufacturing to potential clients abroad;

- Highlight success stories in RD&C to showcase Malaysia's technology advancements in key ICT segments.

The promotion strategies recommended include the following:

- Enhance the amount of Market Development Funds (MDF) which is disbursed by MATRADE. Since most small businesses face problems with financing, it would be imperative for the government to enhance the amount of MDF from 50% to around 70% of total market development cost

- Fund overseas trade fair participation by Malaysian ICT companies and research paper presentations by ICT researchers

- Organise B2B match-making activities in Malaysia and abroad

- Develop marketing and promotional material which highlights the achievements of the Malaysian ICT industry. This material should be actively used by MATRADE offices abroad

- Industry associations like PIKOM, NEF and TEAM should be used actively to promote the Malaysian ICT industry abroad. Funding support should be provided to these organisations to actively carry out this role

Under the go-global and market acquisition strategy, Malaysia should have a tiered approach. In the immediate future, it should address emerging Asian nations like Vietnam, Myanmar and Cambodia. Countries in Africa and East Europe should also be addressed as part of the first wave of globalisation. This strategy would allow Malaysia to build up capabilities and not suffer from the same mistakes that Chinese firms made while going abroad.

The ICT division within MATRADE should be enhanced with more manpower and provided more funding so that it can actively support the ICT industry in its globalisation effort. PIKOM, TEAM and NEF should be roped in to lead the globalisation efforts of local ICT companies.

5.12 Human Resources as Key Enabler to the National Strategic ICT Roadmap

The availability and the quality of human resources is one of the most, if not the most, critical factor that can make or mar the implementation of any roadmap. The first issue has been the availability of ICT human resources, which has been a declining trend in terms of both new entrants and the graduate output. This is reflected in the ICT enrolment numbers in public and private universities in Malaysia (Figure 28).

In particular, ICT enrolments is down by almost half, from 96,090 in 2002 to 49,731 in 2011. Associated issues such as quality, competency and employability of ICT graduates to meet both the ICT producer and ICT user industry needs still prevail. Coupled with the low remuneration, rampant job hopping to seek better terms of employment, and a declining interest among young people in ICT

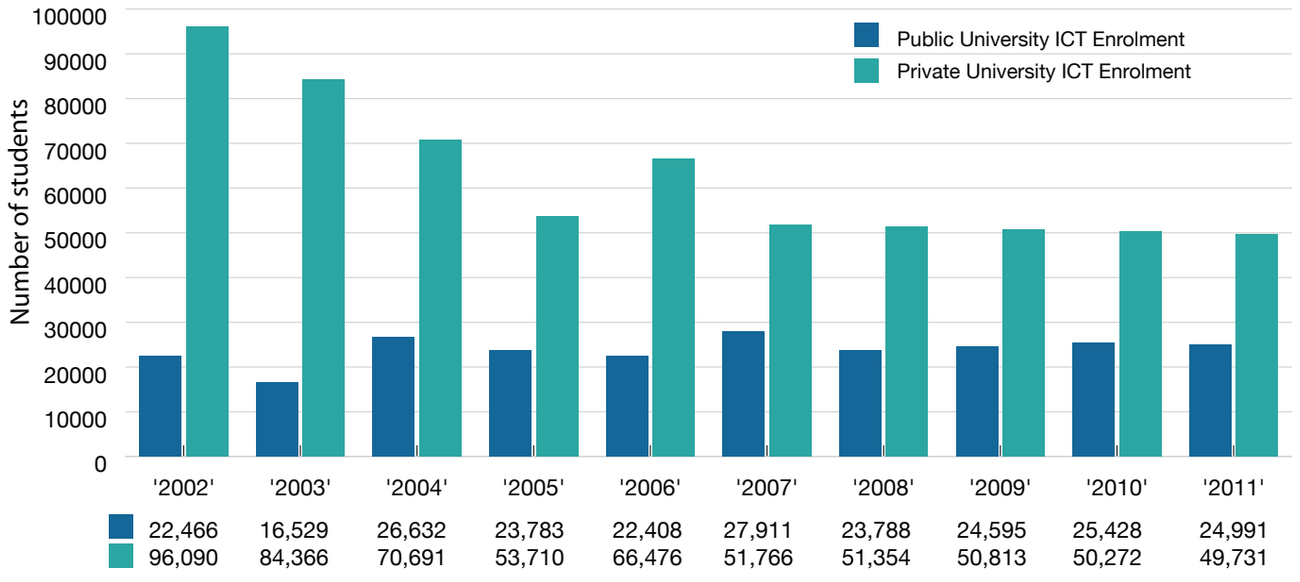


Figure 28: ICT Enrolment in Public and Private Universities 2002-2011.
Source: Department of Statistics and PIKOM Estimates

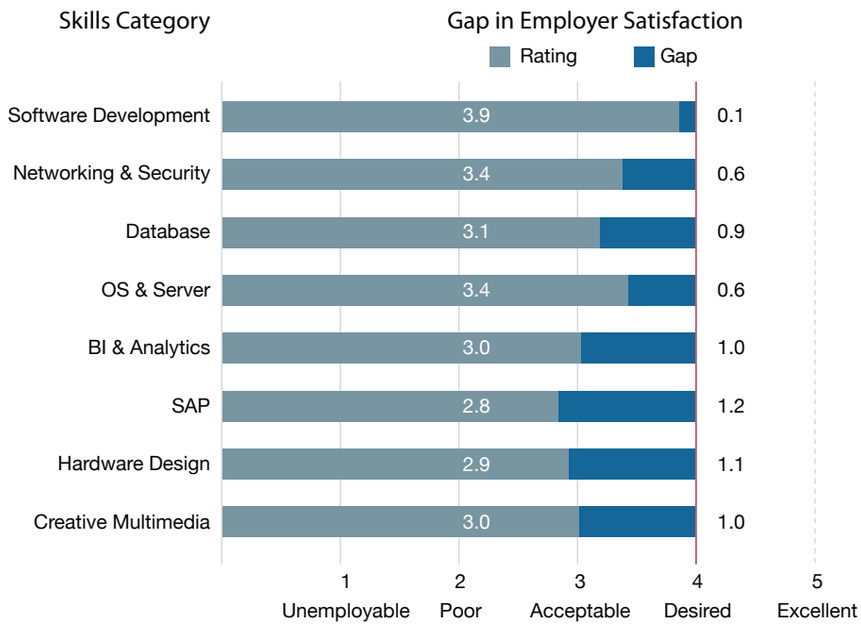


Figure 29: Employer Satisfaction Gap by ICT Skills Set Area
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

jobs that demand long working hours, continue to deluge the local ICT industry.

Malaysia also has a low number of researchers and engineers per million population (367 as per UNESCO, 2008). In addition, there is a visible quality gap between the output and the industry expectation, as shown in Figure 29.

The other discomforting note is the relatively long period of time to effect a ICT course curriculum review, which for a significant proportion happens once in more than two years, with some taking as long as five years. Such a duration is considered unacceptably long for courses in ICT, given the very dynamic nature of the industry and the need for ICT practitioners to constantly upgrade their skills sets. Of the institutes that have a regular review cycle of six months, most are private institutes such as private universities, colleges and university colleges. Towards addressing the human capital issue, the ICT Roadmap 2012 recommendations are in line with the National ICT Human Capital Development Framework, which has the objective of producing world-class ICT human resources to help Malaysia realise the national aspirations through three key thrusts (Figure 30). The first thrust is to raise the workforce competencies through strengthening the ICT curriculum, reinforcing the ICT foundation in the education system and expanding ICT enrolment.

The second thrust is to build greater R&D and innovative capacity through directing R&D and commercialisation resources towards strategic focus areas, establish a boutique university and increase tri-partite collaboration in R&D and commercialisation.

The third thrust is to institutionalise professional recognition and standards through the formation of a national ICT professional body, promoting professional development of practitioners and re-branding and promoting ICT as a career of choice.

6. Conclusion

The ICT Roadmap 2012 complements the weaknesses in the past ICT Roadmap 2008 and Technology Roadmaps. Essentially, the TFAs have been expanded from 3 to 6 after taking into consideration market potential, global megatrends, stakeholder inputs, ease of implementation, and more importantly, the country's inherent strength in research & development, innovation and commercialisation. The ICT Roadmap 2012 preparation process engaged stakeholders from

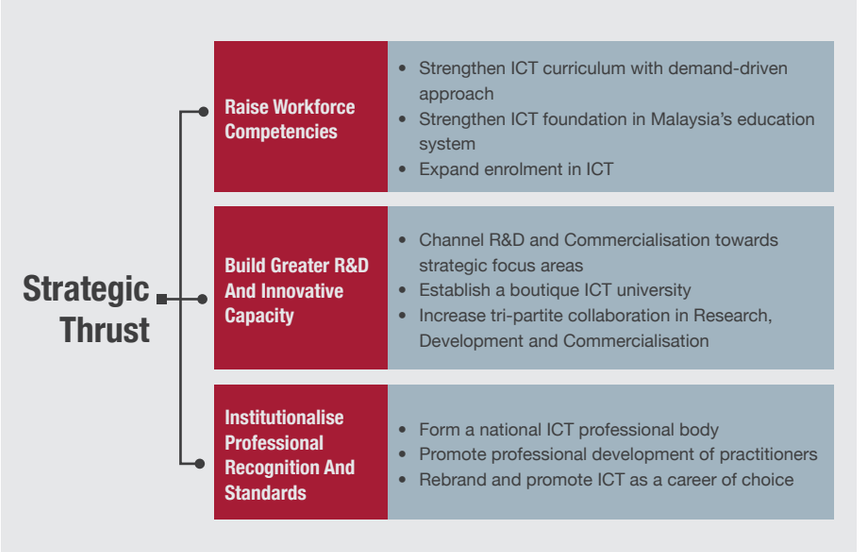


Figure 30: National ICT Human Capital Development Framework
Source: National ICT Roadmap (2008), MOSTI and Frost & Sullivan

mainstream policy institutions, development practitioners at the implementation level, the research community from academia and leading research institutions and industry representatives. The roadmap was finalised after going through rigrous methodologies and deliberations in three workshop series pertaining to technology prioritisation, commercialisation essence and implementation strategies.

From the onset, MOSTI had ensured that the right processes were being ensued in order to get the requisite buy-in from diverse industry players in the ICT sector, not only from public sector agencies but also the private sector. Unlike past ICT roadmaps, the ICT Roadmap 2012 has a distinct advantage of having the Malaysian Industrial Research on ICT Consortium (MiRICT) as a steering committee under the purview of NITC. The members of MiRICT include MOSTI, MOHE, MITI, MADICT, KPKK and the Economic Planning Unit. With such institutions in place, it is hoped that institutional turf-war, which posed one of the greatest challenges in the past, can be mitigated.

02. MALAYSIAN ECONOMIC AND INFORMATION COMMUNICATIONS TECHNOLOGY OUTLOOK

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Introduction

PIKOM is optimistic of sustained growth for the Malaysian economy despite the continuing fallout from the Global Financial Crisis of 2009. We expect the national economy to grow at an average of 5.0% in 2012 and to remain resilient against the global impact of the prolonged debt crisis in the Eurozone. Figure 1 outlines the performance of the Malaysian economy over the past three years, charting its recovery from GFC 2009 until Q1 of 2012.

The national economy expanded by 5.1% in 2011, down from 7.2% the previous year. In his 2012 Budget speech, Prime Minister Dato' Sri Mohd Najib Abdul Razak had forecasted a growth rate of between 5.0% and 6.0% for the year.

Bank Negara Malaysia (BNM) subsequently revised the estimates to 4.0% and 5.0% in response to the uncertain financial and economic climate in the Eurozone. The positive forecast is based on the strength of domestic demand in propping up the economy and mitigating the negative impact of external events.

Other estimates also paint a positive outlook for Malaysia in 2012, albeit at lower growth rates as shown in Table 1. Both Goldman Sachs and CIMB Investment Bank have forecasted a significantly lower growth rate of 3.8% for the Malaysian economy. International organisations like the International Monetary Fund (IMF), the World Bank (WB) and the Asian Development Bank (ADB), however, were more positive in their respective forecasts of between 4.0% and 4.6% for 2012. Going forward, these global institutions have all projected higher growth rates of not less than 4.7% for Malaysia in 2013.

Clearly, the predominant sentiment is that the national economy continues to be on track for sustained growth. The sustained economic outlook for Malaysia in 2012 depends on several external as well as domestic factors. They are as follows:

• External Environment: Trade Dependency

The Malaysian economy is largely dependent on trade. Any decline in the economic performance of its trading partners is likely to cause a contraction to the Malaysian economy due to the fall in external demand. It is for this reason that many private research houses have projected a much lower growth rate for Malaysia given the unfolding Eurozone debt crisis (As depicted in Table 1). The general opinion is that the Eurozone crisis could dampen the economic growth rates of both China and India. For instance, the IMF has lowered the GDP target for China from 9.0% in Q4 2011 to 8.3% in Q1 2012. Likewise for India, the IMF has revised downwards its GDP from 7.5% to 7.0% over these two quarters. Any downtrend in the economic performance of these two giant economies will inevitably spill over to countries like Malaysia. It is pertinent to note that China alone accounted for 12.5% of Malaysia's total exports and 14.4% of its total imports during

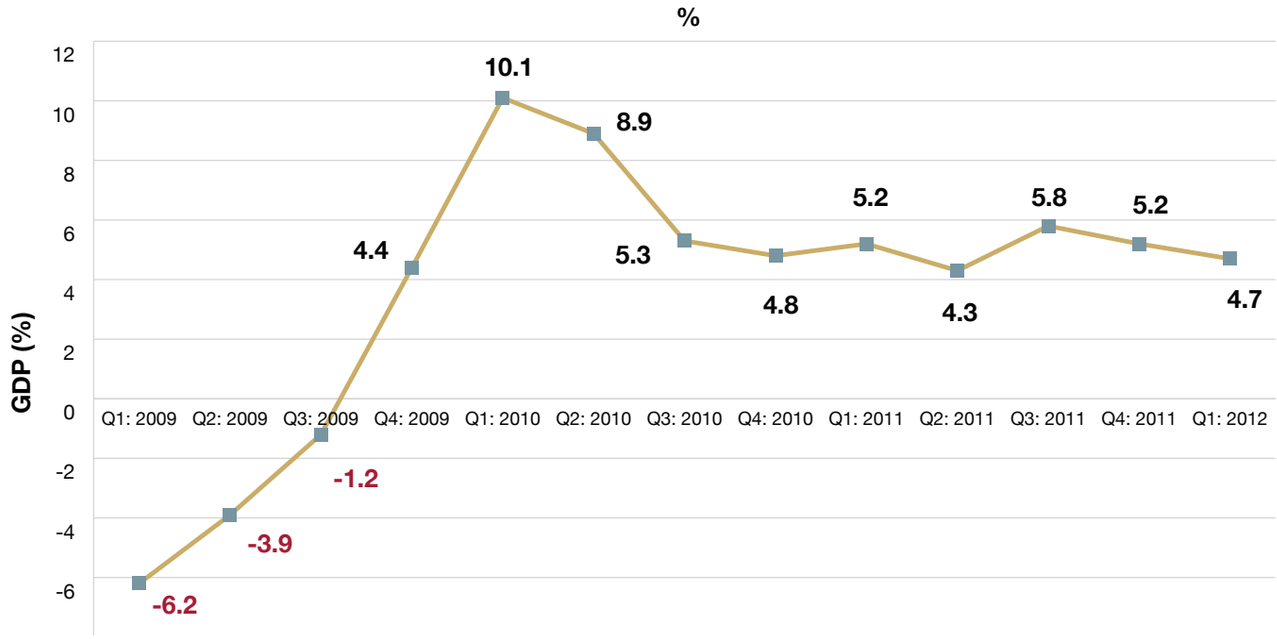

Figure 1: Quarterly Gross Domestic Product (GDP) Growth Rate of Malaysia: Q1: 2009 – Q1: 2012

Private Sector Agency	GDP 2012 Growth Rate (%)	GDP Forecast in 2013 (%)
Malaysian Institute of Economic Research (MIER)	4.2	5.0
Malaysian Rating Corporation Berhad (MRCB)	4.4	5.2
Alliance Research	4.2	
The Edge	4.4	
Merrill Lynch	4.2	4.5
Barclays	4.7	
Bank of America Global Research	4.2	
RHB Research	4.5	5.2
Kenanga Research	5.0	5.0
Maybank Investment Bank	3.5 – 4	
CIMB Investment Bank	3.8	
Goldman Sachs	3.8	
International Monetary Fund IMF)	4.4	4.7
World Bank (WB)	4.6	5.1
Asian Development Bank (ADB)	4.0	5.0

Table 1: Malaysian Economic Outlook for 2012 and 2013 by Private Sector and International Organisations

Q1 2012 (See Table 2). Meanwhile, India is gradually becoming a major trading partner for Malaysia, currently accounting for 3.6% of its exports and 2.0% of its imports. The question now is: To what extent would the economic performance of these two trading nations - in particular the impact of the Euro crisis on China - affect Malaysia's trade?

A close examination of the European Union's (EU) trade with China (As shown in Figure 2) reveals that its share of imports from China has been fluctuating between 2007 and 2011, with a peak of 18.7% in 2010 and a low of 16.2% in 2007. On the other hand, the EU's share of exports to China has been steadily increasing from 5.8% in 2007 to 8.9% in 2011. Interestingly, the share of the EU's imports from China remained at 17.7% in 2009, close to the five-year (2007-2011) average of 17.1%.

In the same vein, the share of the EU's exports to China stood at 7.5% despite the impact of the GFC 2009. Indeed, the presence of a strong trade relationship between these two economies is a positive factor for Malaysia's trade growth. Specifically, Malaysia has strong trade, diplomatic and cultural ties with China, the EU economies as well as India. On another note, Malaysia's trade with its Asian neighbours accounted for 64.9% of its total exports during Q1 2012 in comparison to only 9.1% to European nations. Similarly,

Country	January - April 2011				January - April 2012			
	Exports (RM million)	Percentage	Imports (RM million)	Percentage	Exports (RM million)	Percentage	Imports (RM million)	Percentage
Japan	25,964	11.6	21,356	11.8	28,911	12.5	20,820	10.7
Australia	7,844	3.5	3,859	2.1	9,983	4.3	4,224	2.2
Singapore	28,721	12.8	22,344	12.3	30,369	13.1	25,621	13.2
India	8,612	3.8	3,512	1.9	8,434	3.6	3,940	2.0
Hong Kong	10,432	4.6	4,072	2.2	9,308	4.0	5,072	2.6
USA	18,632	8.3	18,831	10.4	19,307	8.3	15,438	8.0
Phillipines	3,977	1.8	1,648	0.9	3,593	1.6	1,520	0.8
Thailand	11,833	5.3	10,893	6.0	13,401	5.8	11,753	6.1
South Korea	8,705	3.9	8,425	4.6	8,868	3.8	7,473	3.8
European Union	23,744	10.6	18,017	9.9	21,050	9.1	20,021	10.3
China	28,416	12.7	22,045	12.2	28,842	12.5	27,959	14.4
United Arab Emeriates	4,095	1.8	2,649	1.5	4,289	1.9	3,738	1.9
Vietnam	3,658	1.6	3,494	1.9	3,550	1.5	4,252	2.2
Taiwan	7,172	3.2	8,057	4.4	6,587	2.8	7,853	4.0
Indonesia	6,592	2.9	12,053	6.6	8,636	3.7	11,353	5.8
Other countries	26,029	11.6	20,129	11.1	26,331	11.4	23,151	11.9
Total	**224,426**	**100.0**	**181,384**	**100.0**	**231,459**	**100.0**	**194,188**	**100.0**

Table 2: Malaysian Exports and Imports by Country: January – April, 2012

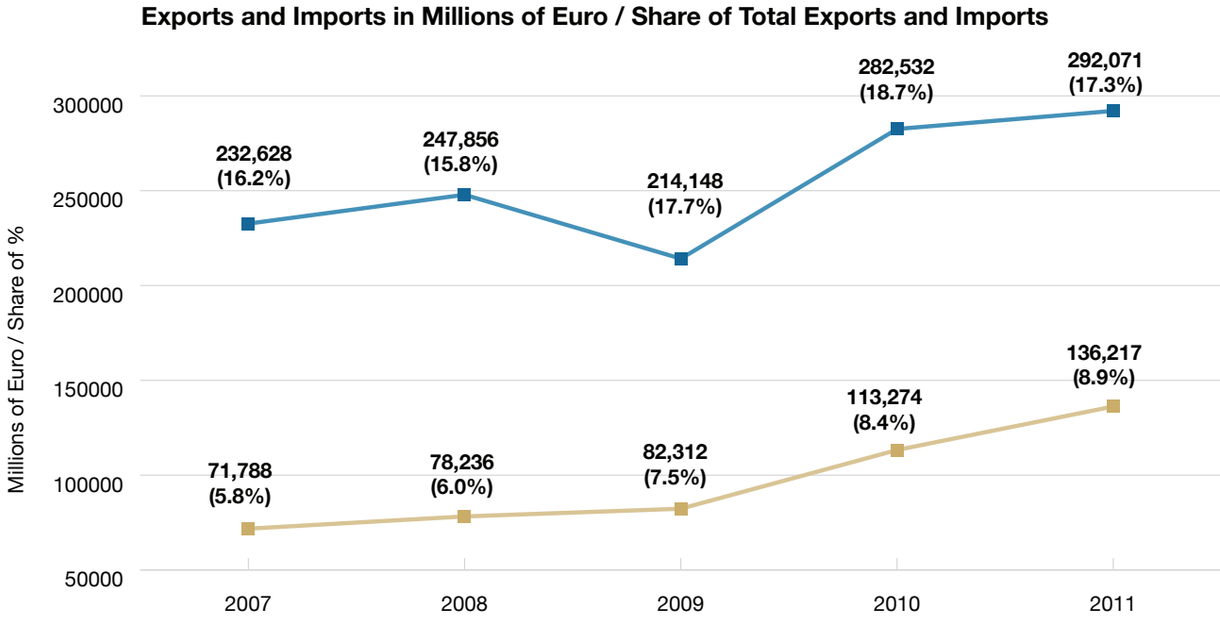

Figure 2: European Union Trade with China: 2007-2011

total imports from Asian countries accounted for 65.7% during the same period of January to April 2012, compared to 10.3% from EU economies. A closer look at the data shows that Malaysia has stronger trade ties with countries like the United Kingdom, Germany and Netherlands whereas it has only limited trade with economies like Greece, Spain and Italy, the epicenters of the current debt crisis. On this score, the financial turmoil in these nations is unlikely to have a direct impact on Malaysia's economic growth.

• External Environment: Investment Dependency

Although the Government has been aggressively encouraging domestic-driven growth as the way forward towards building a resilient economy, the country is still highly dependent on foreign direct investment (FDI). As shown in Table 3, roughy one-fifth of total FDI inflow into Malaysia comes from the EU - 19.7% in 2010 and 22.5% in 2011. During Q1 2012, FDI from Europe accounted for 21.5% of the total with 5.4% to 7.4% originating from Germany, France, the United Kingdom and Switzerland. Other smaller contributions came from the Netherlands, Denmark and Luxembourg. Again, it can be seen that there are hardly any FDI coming from countries currently afflicted by the deepening debt crisis. Based on this information, we can cautiously conjecture that Malaysia is poised to attract FDI from European nations that still enjoy a relatively healthy economic growth. From Asia, Japan and Hong Kong account for a significant portion of FDI inflow into Malaysia.

Domestic Demand

Despite a challenging external environment, the positive economic outlook for Malaysia in 2012 is underpinned by strong domestic demand attributed to a number of factors:

• Performance of Economic Sub-sector

Table 4 shows the sectorial performance of Malaysia's economy from Q1 2010 until Q1 2012. Except for mining and quarrying, all sectors posted a positive performance in 2011. Due to depleting natural resources, the mining and quarrying sector contracted as much as -9.3% in Q2 2011. The negative growth was mainly attributed to the reduction of output for tin concentrates, crude oil and condensates, and natural gas.

However, this sector rebounded with a 0.3% growth in Q1 2011 when the average price of crude oil increased from USD117 per barrel in Q4 2010 to USD125 per barrel in first quarter of 2012. The construction

Country	2010		2011		2011								2012	
					Q1		Q2		Q3		Q4		Q1	
	RM million	%	RM million	%	RM million	%	RM million	%	RM million	%	RM million	%	RM million	%
United States of America	8,031	27.4	3,527	9.6	1,453	12.9	1,564	16.0	1,111	12.2	- 601	- 9.3	- 2,837	- 38.0
Central & South America	2,954	10.1	- 3,503	- 9.6	- 82	- 0.7	1,157	11.9	- 1,509	- 16.5	- 3,070	- 47.4	1,109	14.8
Netherlands	6,125	20.9	3,522	9.6	994	8.8	424	4.3	562	6.2	1,543	23.8	- 111	- 1.5
Denmark	- 104	- 0.4	101	0.3	46	0.4	- 75	- 0.8	7	0.1	123	1.9	- 2	0.0
Luxembourg	132	0.5	- 558	-1.5	- 218	-1.9	- 34	- 0.3	- 403	- 4.4	96	1.5	554	7.4
Germany	- 476	- 1.6	3,091	8.4	1,545	13.7	180	1.8	763	8.4	603	9.3	551	7.4
France	607	2.1	391	1.1	- 21	-0.2	320	3.3	- 150	- 1.6	242	3.7	- 232	- 3.1
Switzerland	798	2.7	599	1.6	143	1.3	88	0.9	- 49	-0.5	416	6.4	440	5.9
United Kingdom	- 1,301	- 4.4	1,086	3.0	- 59	-0.5	347	3.6	284	3.1	513	7.9	406	5.4
China	- 3	- 0.01	- 44	-0.1	176	1.6	- 189	- 1.9	- 46	- 0.5	15	0.2	291	3.9
Hong Kong	- 761	- 2.6	- 378	-1.0	- 61	-0.5	- 126	- 1.3	- 817	- 8.9	627	9.7	862	11.5
Japan	2,876	9.8	9,591	26.2	2,112	18.8	4,847	49.7	1,455	15.9	1,177	18.2	1,531	20.5
Korea	4,576	15.6	423	1.2	334	3.0	325	3.3	- 12	-0.1	- 225	- 3.5	19	0.3
Chinese Taipei	- 412	- 1.4	- 134	-0.4	343	3.0	- 56	- 0.6	25	0.3	- 446	- 6.9	53	0.7
Thailand	- 398	- 1.4	1,169	3.2	- 83	-0.7	- 18	- 0.2	87	1.0	1,183	18.3	- 460	- 6.2
Singapore	1,405	4.8	6,314	17.2	2,662	23.7	288	3.0	1,570	17.2	1,794	27.7	301	4.0
Australia	15	0.1	493	1.3	- 44	-0.4	- 196	- 2.0	350	3.8	383	5.9	185	2.5
Other countries	5,258	17.9	10,925	29.8	2,013	17.9	907	9.3	5,906	64.7	2,100	32.4	4,809	64.4
Total	**29,322**	**100.0**	**36,615**	**100.0**	**11,253**	**100.0**	**9,753**	**100.0**	**9,134**	**100.0**	**6,473**	**100.0**	**7,469**	**100.0**
Europe		19.7		22.5		21.6		12.8		11.1		54.6		21.5
North Asia		21.4		25.8		25.8		49.2		6.6		17.7		36.9
South East Asia		3.4		20.4		22.9		2.8		18.1		46.0		- 2.1

Note: Negative number denotes outflow investment by Malaysians.

Source: The Malaysian Economy in Brief, Department of Statistics, May 2012.

Table 3: Foreign Direct Investment in Malaysia by Countries: 2010, 2011 and Q1 2012

Percentage (%)

Economic Activity	2011	2012	2010				2011				2012
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Agriculture	5.9	3.8	6.8	2.4	2.7	- 4.3	- 0.2	7.7	8.8	6.9	2.1
Mining & Quarrying	- 5.7	0.6	2.1	1.1	- 1.0	- 1.3	- 3.9	- 9.3	- 5.9	- 3.8	0.3
Construction	4.6	6.6	8.7	4.1	2.8	5.6	5.1	1.8	4.0	7.5	15.5
Manufacturing	4.7	3.9	17.0	16.0	7.5	6.2	5.7	2.6	5.4	5.2	4.2
Services	7.0	5.1	8.5	7.3	5.4	6.2	7.1	7.1	7.1	6.6	5.0
Type of Expenditure											
Government Final Expenditure	16.1	0.2	9.3	9.9	-7.7	2.5	11.1	6.0	21.1	22.9	5.9
Private Final Expenditure	7.1	6.2	5.2	7.9	6.7	6.4	6.9	6.6	7.6	7.3	7.4
Gross Fixed Capital Formation	6.5	11.7	6.2	12.5	11.6	11.1	9.8	2.7	5.4	8.4	16.1
Exports	4.2	1.4	21.2	15.6	8.1	2.6	1.9	4.6	4.8	5.5	2.8
Imports	6.2	1.6	28.5	23.2	11.6	3.9	9.3	4.0	3.9	7.8	6.8

Table 4: Gross Domestic Product by type of economic activity and expenditure at constant 2005 Prices
Source: National Accounts Gross Domestic Product First Quarter 2012, Department of Statistics

sector did remarkably well in Q1 2012, registering 15.5% growth. The positive performance of all economic sub-sectors is poised to continue into Q2 2012 in anticipation of sustained domestic demand. The growth of the sub-sectors is also likely to have spillover effects on information and communications technology (ICT). Both private and public sectors are increasingly adopting ICT as an enabling tool to improve operational efficiency, production effectiveness, innovation, and research and development methodologies. Contemporary ICT also enhances anytime and anywhere communication, interaction and networking among stakeholders and customers, especially with the increasing penetration of smartphones and tablet PCs that provide greater mobility and convenience, as well as being cost effective.

• Private Consumption: Inflation Rate

Private consumption is poised to rise following the upward salary revision for public sector employees, one-off financial assistance to low and middle-income groups, and the setting of a minimum wage (RM800 in Peninsular Malaysia and RM900 for Sabah and Sarawak). The ongoing low borrowing cost for businesses and households is expected to increase consumption and investments.

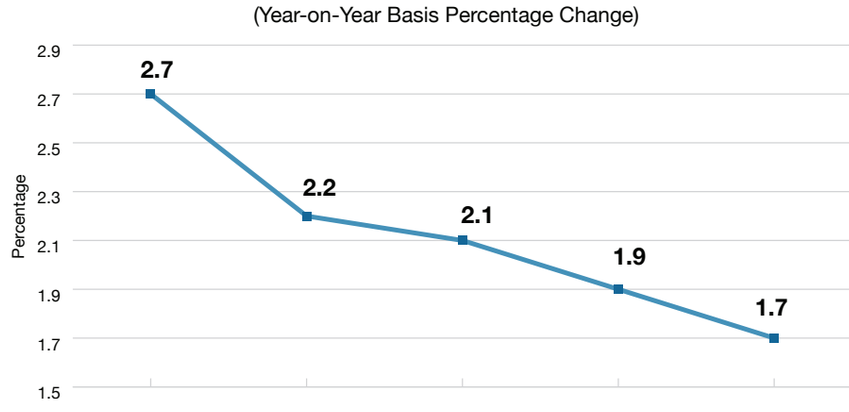

Figure 3: Malaysian Inflation Rate: Jan-May 2012

As shown in Figure 3, the inflation rate in Malaysia was only 1.7% in May of 2012, following a year-on-year change in consumer price index (CPI) from 102.9 in May 2011 to 104.7 in May 2012. During the period 2005 until 2012, Malaysia's inflation rate averaged at 2.8%. It peaked at 8.5% in July 2008 following the prolific rise in global oil prices. Bank Negara Malaysia has forecasted the inflation rate for the year at or below 2.5%. The declining inflation rate for Q1 2012 could well indicate a rising level of purchasing power.

• Private Consumption: Exchange Rate

The performance of the Malaysian currency against the US dollar for the period January 2011 to May 2012 is shown in Figure 4. Purchasing power, especially on foreign goods and services, is augmented in tandem with the increasing strength of the Malaysian Ringgit against the Greenback - from RM3.21 in 2010

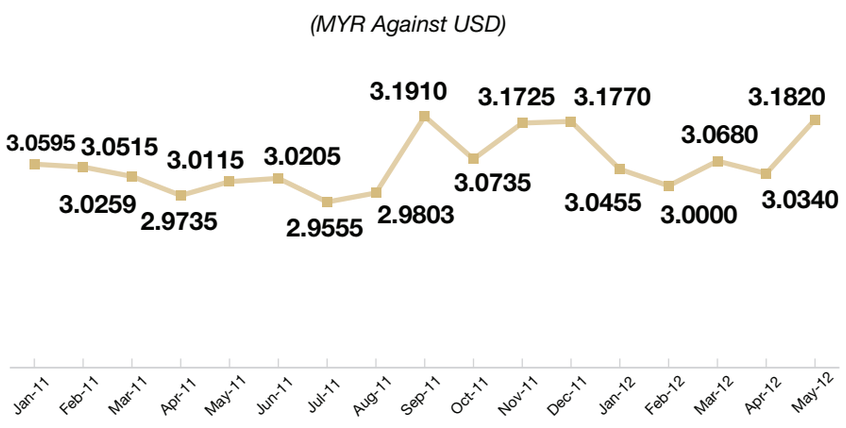

Figure 4: Performance of Malaysian Ringgit against USD: Jan. 2011- May 2012

to RM3.06 in 2011. The Malaysian currency is also strengthening against other regional currencies.

• Private Consumption: Base Lending Rate

The average base lending rate (BLR) of commercial banks dipped slightly from 6.54% in May 2011 to 6.53% in 2012, which provided a stable environment for consumption and business undertakings.

Private Sector Investments

Private sector investments are expected to increase through the implementation of a new mega project: the Kajang-Sg Buluh Massive Rapid Transit (MRT). Expansion in on-going corridor projects like Iskandar Malaysia, Northern Corridor Economic Region (NCER), East Coast Economic Region (ECER), Sabah Development Corridor (SDC) and Sarawak Corridor of Renewable Energy (SCORE) is poised to provide addition impetus to growth. In 2012 alone, Iskandar Malaysia is expected to attract RM64.38 billion worth of investments. The investments will be in the construction of new roads, road improvement, river cleaning, public housing, Legoland Malaysia Theme Park, Newcastle University of Medicine Malaysia, Malaysia Premium Outlet, an indoor theme park at Puteri Harbour, Pinewood Iskandar Malaysia Studio and the Netherlands Maritime Institute of Technology.

Private investments are also expected to pour into the implementation of national transformation programmes promoted by Dato' Sri Mohd Najib Abdul Razak's administration - namely 1Malaysia Programme, Economic Transformation Programme (ETP), Government Transformation Programme (GTP), Rural Transformation Programme (RTP), Political Transformation Programme (PTP) and Digital Transformation Programme (DTP).

Corporate Tax

With the reduction of corporate tax from 27% to 25% in 2009, Malaysia's corporate tax rate is one of the lowest in the region, as shown in Table 5. This enables Malaysia to remain as an attractive destination for FDI in the region. However, there is still room for improvement as the average global corporate tax rate stands at 22.96% in 2011 as cited by KPMG.

Small & Medium Enterprises

Small and medium-sized enterprises (SME) are poised to contribute significantly to the national economy in 2012. In 2011, SMEs accounted for 32.0% of the GDP, contributing 19% of total exports and accounting for 56% of employment. Of the total number of SMEs in the country, 87% are in the services sector.

The government has recognised that SMEs can play a significant role in bolstering the contribution of the services sector from 54.0% in 2011 to a targeted 65% of the GDP by 2020.

This can be only realised provided SMEs are receptive to new changes: do away with obsolete management skills and work processes and adopt contemporary ICT in enhancing operational efficiencies.

Towards this end, the Government has mooted a number of financial incentives in the 2012 Budget to stimulate consumption and investments by SMEs:

- Shariah-compliant SME funding totaling RM2 billion to strengthen SMEs;
- SME Revitalisation Fund totaling RM100 million, set up to provide up to RM1 million to genuine entrepreneurs to revive businesses affected by economic recession;

Brunei Darussalam	Indonesia	Laos PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
30%	30% (> 50 million Rupiah)	20%	25%	30%	32%	17%	30%	25%

Table 5: Corporate tax rate of selected countries, 2011
Source: Various sources compiled for ICT Strategic Review 2011/12, PIKOM

- SME Emergency Fund totaling RM10 million in the form of soft loans and grants to assist SMEs affected by natural disasters;

- RM500 million Shariah-compliant Commercialisation Innovation Fund, set up to finance SME products that have undergone the commercialisation verification process;

- RM30 million Market Validation Fund managed by Malaysia Technology Development Corporation together with Malaysia Innovation Agency (MIA) to ensure commercial viability through market validation process;

- RM 100 million allocated for Jejak Inovasi Programme, Cipta 1Malaysia Award . RM100 million soft loan managed by Bank Simpanan Nasional (BSN) to encourage professionals such as lawyers, doctors and accountants to set up firms in small towns; and

- Pioneer status with a tax exemption of 70% for 5 years for local designers in order to promote creativity, innovation and modern technology via Industrial Design.

Challenges to the Malaysian Economy

Despite the positive outlook, the Malaysian economy faces a number of key challenges:

- *External demand:* Risk aversion among potential investors - who are concerned about the shaky global economic performance - can reduce potential investment drastically;

- *Domestic demand:* Any slacking in the delivery of ETP, GTP, DTP, PTP and RTP can bring about a negative impact in achieving planned targets of becoming a developed nation by 2020;

- *Fiscal deficit:* The government's ambitious efforts to reduce its fiscal deficit from 5.4% of GDP in 2011 to 4.7% in 2012 may dampen public expenditure and investment unless it can achieve the target through revenue increasing measures or operational cost reduction strategies;

- *Consumption and Investment:* Fluctuation in oil and commodity prices in the global market is bound to lead to higher prices for consumers. This can then cause severe structural imbalances in market liquidity leading to higher inflation rates and higher lending rates. Massive capital outflow affecting foreign exchange rates can hurt export and import earnings;

- *Quality of the Malaysian workforce:* Over dependence on low skilled foreign workers may not be to the benefit of the Malaysian economy in the long term unless concerted efforts are made to increase the quality of the workforce pool via the infusion of the necessary technological capabilities.

- *Talent migration:* Talent migration is one of the challenges that the Malaysian economy has been facing for more than two decades. Specifically, the country loses talents to its neighbouring countries and English-speaking destinations where the average remuneration is higher.

  For example, Table 6 provides the average salary in terms of scaling numbers earned by typical ICT professionals in Malaysia compared to their counterparts in selected Asian and English-speaking countries that are considered popular destinations for Malaysian professionals. It

Country	Without Purchasing Power Parity Adjusted	With Purchasing Power Parity Adjusted
Hong Kong	3.10	2.63
United States of America	4.08	2.39
Singapore	2.52	1.98
Canada	3.50	1.83
New Zealand	3.06	1.74
Australia	3.18	1.65
United Kingdom	2.78	1.55
Thailand	1.02	1.18
India	0.66	1.03
Malaysia	1.00	1.00
China	0.95	1.00
Philippines	0.43	0.48
Indonesia	0.34	0.33

Footnote: For PPP adjustments, the World Bank methodology is used to obtain the ratio of GDP (in Atlas method) expressed in USD to international dollars, which takes into consideration the exchange rate fluctuation and international inflation rates. The ratio is used in the salary conversion for international comparison.

Table 6: Benchmarking average salaries earned by Malaysian ICT professionals against selected countries

can be noted that in 2011, the US paid the highest salaries for ICT professionals, which is 4.08 times higher than it is in Malaysia when the data is viewed without adjusting for purchasing power parity. This is followed by Canada (3.50 times), Australia (3.18 times), Hong Kong (3.10 times), New Zealand (3.08 times) and Singapore (2.52 times).

Other countries in Asia like India, China, Indonesia and Philippines offered lower comparable salaries than in Malaysia. Thailand, on the other hand, offered slightly higher salaries for ICT professionals. However, the PPP adjustment reveals that the US is not the highest paying country but Hong Kong, albeit only 2.63 times higher than their counterparts in Malaysia. Indeed, in the PPP-adjusted data, ICT professionals in all countries, except the Philippines and Indonesia, earned higher salaries than their counterparts in Malaysia.

ICT Industry Outlook

As shown in Table 7, global spending on IT products and services is expected to reach US$3.75 trillion in 2012, a 2.5% increase from US$3.66 trillion in 2011. The new forecast marks a decline from Gartner's previous estimate of a 3.7% growth in IT spending for 2012. The technology analyst firm attributed the lower growth rate to the recent strengthening of the US dollar against other currencies, rather than lower IT spending.

In fact, if the US currency exchange rate remains constant, IT spending is set to increase 5.2% in 2012, up from Gartner's earlier projection of 4.6% (IDC had predicted a 5.0% growth rate in global IT spending for 2012). In 2011, enterprise software spending registered the highest growth rate of 9.2% in 2011, followed by computing hardware at 7.7% and telecommunication equipment at 7.2%. In 2012, the telecommunication equipment sector is projected to be the top performer with a growth rate of 6.9% followed by enterprise software at 5.0%. Specifically, spending on telecommunication equipment, including applications, acceleration equipment, network security, WLANs and ethernet switches, is expected to reach US$472 billion in 2012.

IDC indicated that the strongest growth in 2011 came from smartphones (46%). This class of devices is poised to continue its growth as many organisations invest not only in network upgrades, but also in smart devices to cope with the continuing increase in digital information and digital-related activities such as mobile banking, e-commerce, entertainment applications, etc.

Gartner's research also cited that, despite on-going concerns about the global economic recovery (i.e., Eurozone sovereign debt problems, China's real estate 'bubble', rising oil prices), early signs in 2012 suggest that the global economic outlook has brightened a little. Due to the austerity measures taken in Europe, there have been calls for cuts in government spending, including IT spending, since the sovereign debt crisis emerged.

IT spending in Europe is projected to post a dismal performance of only 1.0% growth. However, countries like China and India are expected to register 15.0% and 16.0% growth in IT spending respectively. Despite the gloomy global outlook, IT spending in Brazil and Russia is projected to grow at a moderate growth rate of 9.0% and 11.0% respectively. The US and Japanese markets are also expected to rebound to at least 5.0% growth rate in IT spending. Since Malaysia's economy is highly dependent on trade, the improving economic situation in the US and Japan as well as the on-going high growth in BRIC (Brazil, Russia, India and China) nations is likely to boost the Malaysian ICT sector. Small and mid-sized businesses (SMB), being the bedrock of many economies, are projected to be a key driver in IT spending in 2012.

Although the foregoing statistics indicate a mixed global environment, the ICT industry in Malaysia is projected to register significant growth in 2012, supported by the right domestic driver conditions. PIKOM predicts that IT spending in Malaysia is poised to net a double-digit growth of at least 12.0% in 2012. IDC cited that Malaysia's economic growth is expected to remain cautiously optimistic, with IT spending forecasted to reach US$8.2 billion (RM24.6 billion) at the end of 2012. Demand for personal and business computing devices (i.e. smartphones, tablet PCs) coupled with the introduction of new technologies (i.e. Intel's Ultrabook

	2011 Spending	2011 Growth (%)	2012 Spending	2012 Growth (%)
Computer Hardware	404	7.7	421	4.3
Enterprise Software	267	9.2	280	5.0
IT Services	845	6.5	856	1.3
Telecom Equipment	442	7.2	472	6.9
Telecom Services	1,704	6.3	1,721	1.0
All IT	**3,661**	**6.8**	**3,751**	**2.5**

Table 7: Worldwide IT spending forecasts (in US$ Billion)

platform, the upcoming Windows 8 operating system) has resulted in a surge in emerging markets, especially in Malaysia where it is estimated that only 20% of SMEs leverage technology on a daily basis in their business.

The other factor that is poised to catalyse the growth of IT spending are the government's strategic programmes such as the ETP, GTP, DTP, RTP and PTP, which are very much ICT-driven or ICT-enabled. Specifically, of the total 131 Entry Point Projects (EPPs) under the ETP, 28 are ICT intensive and 57 are ICT enabled. Similarly, of the total 60 Business Opportunities in the ETP, eight are ICT intensive while 13 are ICT enabled. In the eight strategic reform initiatives positioned to drive the ETP (see below), contemporary ICT has an integral functional role in all of them.

- Re-energising the private sector
- Developing quality workforce
- Creating a competitive domestic economy
- Strengthening public sector
- Transparent and market friendly affirmative action
- Building knowledge base infrastructure
- Enhancing sources of growth
- Ensuring sustainability of growth

Similarly, in all the Government Transformation Programme (GTP) initiatives, contemporary ICT has a critical role in ensuring their efficient and effective implementation. Needless to say, the DTP programme initiatives are pure ICT-based projects aimed at providing transformational changes in five broadly categorised dimensions - technological, economic, social, governance and environmental.

The DTP targets RM31.2 billion worth of investments by 2020 based on a public-private partnership model. The Multimedia Development Corporation (MDeC), being the programme custodian, stated that the DTP is set to create 160,000 high-value jobs. The programme is also expected to push the contribution of the digital economy to the GDP from its current level of 12.5% to 17.0% while generating a Gross National Income of RM294 billion by 2020. In 2012, eight projects worth RM12.4 billion in GNI by 2020 have been identified for rollout. They are (investment amount shown in bracket):

- Asian e-fulfillment hub (RM620 million);
- e-Payment Services for small and medium-sized enterprises and micro enterprises (RM600 million);
- Shared cloud enterprises (RM300 million);
- Micro-sourcing for income generation (RM413 million);
- On-demand customised online education (RM39.8 million);
- Facilitating societal upliftment ((RM72 million)
- Embedded system industry (RM10.2 billion) and
- Mobile digital wallet (RM74 million).

The implementation of the DTP will hinge on three strategic thrusts. The first thrust is to move the country from ICT supply to demand-focused while leveraging on its existing infrastructure, economic activities, market trends and consumer behaviour. The second thrust is to shift from consumption to production-centric behaviour by leveraging opportunities available in digital technologies. The third and final thrust is to evolve from low knowledge-add to high knowledge-add by increasing the number local talents, innovators and knowledge workers. An increasing number of Malaysians are leveraging on e-commerce to tap into the growing global marketplace. This, in turn, has helped to push up IT spending in the country. In the recently-concluded McKinsey study, the results showed a high positive correlation between web spending and online sales generation in Malaysia, indicating growing potential for e-commerce.

Given its long history of ICT development, Malaysia has a number of distinct advantages such as 62.9% broadband penetration in 2011 (Source: www.skmm.gov.my), a large pool of Internet users across multiple geography and demography, proliferation in Internet and mobile banking, critical mass of technology-savvy Gen XY population as well as a paradigm shift in the mindset of the population.

The Netbook Programme launched by the Malaysian Communications and Multimedia Commission (MCMC) is set to come back strongly again in 2012. As reported by IDC, PC shipment increased from 684,333 units in Q3 2011 to 697,581 units in Q4, registering a marginal 2% increase. There are two inter-related factors attributed to this sluggish growth: first, severe floods in Thailand disrupted the supply of hard disks to the market and second, the MCMC did not undertake any supply of PCs under their much-heralded Netbooks Programme during Q3 and Q4. In Q1 and Q2 2011, MCMC delivered 280,000 and 123,000 units respectively, which abruptly shored up the PC supplies for the first half of 2011.

The portable PC accounted for 72% of the total market share in comparison to 28% for desktops, which is in any case on a downward trend. The decline of desktops is presumably accentuated by the higher affinity of Gen XY for mobile devices for work and play owing to their convenience and despite their higher prices. However, it should be cautioned that there may be a slight drop in global demand for PCs due to two broad reasons: firstly, consumers may have postponed their purchase in anticipation of the new release of the Windows 8 operating system

and secondly, the demand for PCs is declining due to the market shift towards lighter and more convenient mobile devices like the iPad and smartphones that are functionally compatible with traditional computer devices.

Broadband and cloud computing is projected to have a sustained impact on SMEs that are under-capitalised, under-developed and under-served with respect to technology tools. However, technology tools alone would not suffice as human expertise is needed to run or turn around their businesses – a factor that technology vendors tend to overlook. As acknowledged, most SMEs do not have IT departments as they cannot afford IT specialists. Any technological item that they introduce into their business or operations is seen as a cost that presumably reduces their margin if they do not gain a return on the investment. However, with the advent of cloud computing, the SME's business is changing. SMEs now have the opportunity to leverage enterprise-level applications and development platforms without the associated upfront capital expenditure pinch or complex IT roll-out. In particular, cloud-based customer relationship management (CRM), resource management, cash flow management, finance and budget administration, inventory control, human resource applications and performing business transactions over seamless networks drive SMEs to become more efficient and productive at an affordable cost. Moreover, applications hosted in the cloud can help to ensure business continuity and prevent massive data loss in the event of disasters. Nonetheless, the issue of privacy of data hosted in the cloud servers managed and administered by external parties still remains.

Despite a positive ICT outlook, the country is still facing the challenge of having a supply of quality and employable graduates in adequate numbers from both public and private institutions. As discussed above, remuneration for ICT professionals working in Malaysia is still considered low compared to competing nations in the region and globally.

Although the Government is promulgating the creation of indigenous and commercially-viable ICT products and services, R&D and innovation activities in the country have yet to rise to the occasion. Both public and private universities and industries still lack ingenious R&D and a patenting culture. ICT industries generally lack interest in pursuing process and quality improvement certifications such as Capability Maturity Model Integration (CMMI), People Capability Maturity Model (PCMM), Information Technology Infrastructure Library (ITIL), Six Sigma and Lean Six Sigma, which are crucial for globalising Malaysian ICT products and services or soliciting ICT contracts from developed economies.

Conclusion

Like many other developing nations, Malaysia remains a trading nation that is subject to the economic performance of developed nations who represent Malaysia's export market and source of high value FDIs. Fortunately, Malaysia's trade with countries that are severely affected by the sovereign debt crisis in Europe is limited. However, the spillover effects from this crisis still pose a major challenge, especially arising from any downfall in trade between Europe and China, who in the recent years have become Malaysia's major trading partners.

Domestically, the Malaysian economy has to be on its toes by ensuring prudent fiscal policies that stimulate local investments are in place and an efficient budgetary management is practiced via mitigating resource wastefulness and cost reduction measures. Also, an effective implementation of the targeted socio-economic and political transformation programmes has to be carried through coupled with an implementable monitoring and evaluation mechanism. More importantly, to transform the nation into a globally competitive nation, the country cannot afford to overlook the need for producing quality graduates via the education system and maintaining a pool of quality and branding-conscious workforce. In working towards building a resilient economy, investments in research and development as well commercialisation activities has to be stepped up.

03. PIKOM MOVING UP IN THE VALUE CHAIN: ADVOCACY TO VALUE CREATION

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Introduction: PIKOM Membership

The National ICT Association of Malaysia or PIKOM has 1,501 members as of July 31, 2012. The membership comprises four categories - Ordinary, Associate, Affiliate and Overseas members. Ordinary members have voting rights to elect Council Members, who are nominated from within this group. There are 344 Ordinary members, constituting 22 per cent of total membership as of July 2012. Ordinary members pay a joining fee of RM1,000 and annual membership fee of RM1,000. Ordinary members are eligible for all the benefits and privileges offered, mainly participation in PC Fair, which is PIKOM's annual cash and carry event held nationwide. The Affiliate membership base is the largest, accounting for 74 per cent of membership with 1,101 members. Associate members, making up only 3 per cent (52 members) pay a joining fee of RM500 and annual subscription of RM500. Both Associate and Affiliate members do not have voting rights. However, Associate members - who are mostly hardware and software vendors, retailers and dealers - are also eligible to apply for participation in the PC Fair. Affiliate members are mostly from information and communications technology (ICT) industries who have keen interest to keep track of industry events and happenings.

PIKOM 5X5 Strategy (2008-2012)

PIKOM members account for 80 per cent of the total ICT industry revenue estimated to be worth over RM50 billion today. PIKOM had boldly envisioned an RM80-billion industry by 2015 based on an annual growth rate of 10-11 per cent per annum over the period.

However, due to the global financial crisis and other yet-to-be-seen economic problems, this target has been shifted from 2012 to 2015 and its growth target lowered from 15 per cent, which was typical during the industry's heyday. To achieve these goals, PIKOM has developed a 5x5 strategy – five key thrusts in five years. Each of the thrusts will be a key pillar in moving the industry forward. With the mission, "To champion the ICT industry to enrich society", PIKOM will play the role as the driver and enabler of the ICT industry.

Essentially, the five key thrusts include enabling ICT for all, globalising the Malaysian ICT industry, enhancing partnership with industry and government, increasing the competitiveness of the industry, and strengthening PIKOM for successful implementation. PIKOM is working closely with industry groups with the goal of bridging the digital divide by ensuring ICT adoption in all segments of society.

By forming strategic alliances and partnerships with global institutions like the World Information Technology and Services Alliance (WITSA), the Asian-Oceanian Computing Industry Organisation (ASOCIO) and the Asia and Pacific Internet Association (APIA), PIKOM is continually identifying potential overseas markets for local industries. In this endeavour, PIKOM maintains strong working relationships with federal and state governments, and with all ICT-relevant government-linked corporations and agencies such as Multimedia Development Corporation (MDeC), Malaysian Communications and Multimedia Commission (MCMC), MIMOS and CyberSecurity Malaysia as well as Malaysian External Trade Development Corporation (MATRADE).

Towards building a competitive ICT industry, PIKOM facilitates the development of competent human capital and work force; undertakes policy, market and industry research; provides assistance in getting access to training schemes and financial incentives available in the mainstream. To undertake these monumental tasks, continuous efforts are made to strengthen PIKOM in terms of expanding the membership base, providing adequate resources for the secretariat operations and equipping the council members.

PIKOM Emerging as a Third Sector Force

As mentioned earlier, PIKOM had initially focused on advocating the needs of the hardware and software industry players before the Internet era. With the emergence of this new age, PIKOM has expanded its role by promoting ICT products and services through the staging of cash and carry events, starting with the famous PC Fair events and of late, the Digital Lifestyle Exposition. However, the demands of the ICT industry have increased with its changing landscape, which has compelled PIKOM to assume an expanded role and take on new functions. Specifically, the ICT industry has begun to embrace and harness new changes arising from the advent of Internet technology that is providing global connectivity irrespective of geography, time and culture.

This technology has also resulted in the convergence of computing, telecommunication and broadcasting technologies that once functioned

independently of one another. In tandem, digital content has overtaken its analogue counterpart, as evidenced by the unprecedented rate by which online media is replacing the print version. In fact today, most newspapers are providing content in its traditional printed form as well as web-based format, which is made available anytime, anywhere and for anyone.

More importantly, convergence of people, institutions and technology is taking place at a faster phase and pace, giving rise to the knowledge society and economy. On the technological front, simplified devices like smart phones and tablet personal computers such as the iPad are accelerating the process of creating the innovation-cum-knowledge society and economy.

The XY generation, especially those who were born after 1980s, is more technologically-savvy than their predecessors who belong to the 'baby boomer' generations. Members of the new generation are now entering institutes of higher learning and the workforce. Demographically, these new members are exerting demand that pose challenges to many of the traditional practices in lifestyle, home living, and work culture and practices.

Consequently, the way individuals work, learn, play, communicate, network and perform transactions are constantly undergoing drastic changes, that at times businesses, industries, institutions and people find difficult to cope with. Even more difficult is coping with the changing rights, roles, rules and regulations of governments, the private sector and non-governmental organisations.

PIKOM is not oblivious of these new age changes. Instead, PIKOM has moved in tandem with the times, having upgraded its role and functions to suit prevailing conditions and market demands. It is only natural bearing in mind that 40 per cent of PIKOM members are not from the hardware and software vendor segments that used to form the bulk of the association. Recognising the emerging expectations, PIKOM in 2008 formulated the 5X5 strategy that entails an expanded role and more functions. This paper attempts to elaborate on some of the experiences that PIKOM has undergone as a third sector force. One of the areas that the paper explores is moving up in the value chain from policy advocacy to value creation.

Policy Advocacy and Intervention Role

Besides organising events and forums for members, PIKOM has since inception been involved in policy advocacy and intervention in a bid to develop government relations. The commercial advent of Internet technology in Malaysia gave rise to a number of policy, legal and regulatory institutions in the mainstream. In the process, some old institutions were replaced while others were realigned or integrated with various ministerial functions. The new institutions included the National Information Technology Council (NITC), set up in 1994 as a think tank for the Government of Malaysia in all matters relating to ICT development in the country (Mahathir, 1996; Maniam, Hazman, 2006). Subsequently, the Malaysian Communications and Multimedia Commission (MCMC) was formed in 1998 as an ICT regulatory body.

Towards promoting a knowledge-based economy (KBE), the Government initiated the Multimedia Super Corridor programme (now abbreviated as MSC Malaysia) in 1995 under the purview of the Multimedia Development Corporation (MDeC), which has been tasked to undertake flagship applications such as an electronic government, multi-purpose card and smart schools.

Over the span of two decades, the Government also created three Ministries - Ministry of Information, Communications and Culture (MICC) to oversee the provision of ICT infrastructure, broadband and a Netbook Programme intended to narrow the digital divide; the Ministry of Science, Technology and Innovation (MOSTI) which assumed the role and responsibility for ICT policy and content development; and the Ministry of Energy, Green Technology and Water to promote Green ICT programmes. Despite fragmented institutional arrangements, ICT has been pushed to the forefront.

Other government-linked institutions were also established or were already in existence to provide the requisite support for ICT development. These included the Malaysian Technology Development Corporation (MTDC) for commercialisation of indigenous technologies, the Standards and Industrial Research Institute of Malaysia (SIRIM) to safeguard standards and quality, the Malaysia External Trade Development Corporation (MATRADE) to promote trade, the SME Corp to provide financial and advisory services for small and medium-sized enterprises (SMEs) and MIMOS to undertake research and development in micro-electronics.

No segment of the Malaysian population and organisations could claim that they are unaware of the promulgation of national ICT initiatives. The new institutions and institutional realignment processes also impacted private institutions and PIKOM was no exception. The public-private sector partnership programme that was initiated during the Mahathir era in 1982 became more

pronounced not only in implementing projects - especially infrastructure projects - but also in soliciting policy input from industry players.

Indeed, engagement of private sector in public policy dialogues became more apparent in the information era that demands global tri-sectoral partnerships (public, private and not-for profit-sectors) in decision-making processes. Given the fast-growing governance dynamics, the Government is beginning to give due recognition to industry associations like PIKOM as the voice of the ICT industry.

Gone are the days when the Government assumed to be all-knowing! The Government needed the support of PIKOM to embrace and harness the impact of ubiquitous and pervasive ICT on society and economy. As such, PIKOM is today represented in 38 Government-chaired committees for consultations, including the compilation of official statistics on ICT and the digital economy (PIKOM, 2011). Indeed, for the amelioration of the ICT industry, such recognition accorded to PIKOM is critical for the healthy growth of the industry for the simple reason that industry associations know their members and aspirations of industry players much better than the Government.

In response, PIKOM did not shy away from getting involved in public policy and programme formulation matters despite its limited resources. Indeed, networking with Government agencies opened up many opportunities for PIKOM and its members. With the growing confidence between the two parties, the Government has begun to engage PIKOM. Beyond merely soliciting input, the Government roped in PIKOM with programme and project assignments. One of the areas where PIKOM is involved is the collation of official statistics.

PIKOM Expanded Role in the Compilation of Official Statistics on ICT

Before discussing the role of PIKOM in official statistical collation, let us try to understand the definition and tenets of "official statistics" especially as per definition provided by the International Statistical Institute (ISI) / International Association of Official Statistics (IAOS) and United Nations Statistical Division (UNSD). As stipulated in the Fundamental Principles of Official Statistics by the United Nations Statistical Division (UNSD) "Official statistics, by definition, are produced by government agencies and can facilitate better debate and decision making both by governments and by the wider community (ISI, 1986; UNSD, 2006). Objective, reliable and accessible official statistics give people and organisations, nationally and internationally, confidence in the integrity of government and public decision making on the economic, social and environmental situation within a country. They should therefore meet the needs of a range of users and be made widely available".

In other words, "produced by government agencies" presumably relates not only to national statistical offices worldwide, but also government-linked agencies and ministries that undertake statistical collation activities for public policy needs. What about the data compiled by private sector associations like PIKOM in Malaysia? Can such data be considered as "official statistics"? The question is not so much 'why' but 'why not?' since the private sector can assure conformity to official statistics as stipulated in Principle 2 of the UNSD's Fundamental Principles of Official Statistics, as outlined below:

"To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data".

If yes, how and who can ascertain the quality, validity, reliability and statistical integrity that are critical:

- To safeguard the professionalism and standards of the practice;
- To ensure accurancy and consistency across geography and over time;
- To guarantee statistics that are free from political interference, biasness and skewed interpretation; and
- Towards quality management inclusive of the sound application of methodology to achieve the desired quality (Principle 2 of Fundamental Principles of Official Statistics of UNSD).

In answering these concerns, the paper attempts to relate the experience of PIKOM in harnessing and leveraging on statistics to provide consultative input, share research findings and develop technology capabilities as well as perform its customary policy advocacy role.

Malaysia's ICT sector has been a mainstay of the economy since the

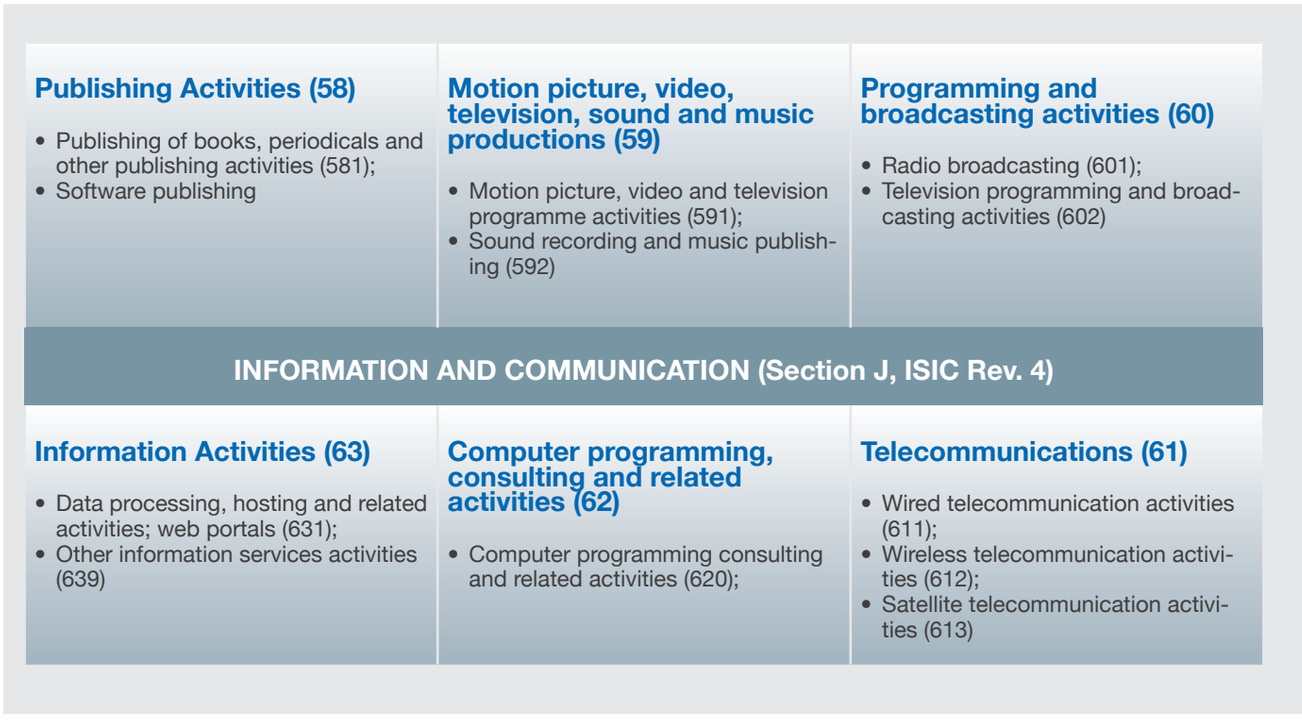

Figure 1: Structure of Malaysian ICT Sector under MSIC 2008

establishment of the Free Trade Zone (FTZ) Act of 1971, which led to significant inflow of foreign direct investment (FDI) particularly in micro-electronics. In its early stages, only production data pertaining to the micro-electronics sector was compiled as guided by the Malaysian Industrial Classification 1972 (MIC, 1972).

With the introduction of the Malaysian Standard Industrial Classification 2000 (MSIC, 2000), the scope was expanded to include the measurement of production, wholesaling and retailing of hardware, software and telecommunication items.

Subsequently in 2004, data on ICT services such as computer consultancy, data processing, radio broadcasting and television programming were added to the scope and emerged as a distinct sector with its performance monitored and published in the "Services Statistics: Information Communications Technology" series. Beginning 2010, the MSIC 2008 - which is based on International Standard Industrial Classifications (ISIC Rev.4) of the United Nations Statistical Division (UNSD) - has replaced the earlier classifications with inclusion of new items under codes 58, 59, 60 and 63, as shown in Figure 1.

The compilation of ICT data has been ambit of the DOSM as the official statistical authority and this status quo will undoubtedly remain in the years ahead. In recent years, PIKOM has been approached by DOSM to consulted on the organisation's sampling of export and import of ICT services.

Unlike merchandised trade that is easily monitored and measured through the customs and excise system, netting intangible export and import of services has always been a formidable challenge. Compounding the problem is that export and import of ICT services occur not only at formal corporation levels, but also at informal individual and household levels especially those involved in some form of online retailing or e-commerce business. The system may net the financial transaction via the Central Bank system, but may not be able to provide a breakdown by type of services. Besides that, PIKOM's membership database - consisting of up-to date contact details – can be used to increase the survey response rate. This has always been a challenge for many national statistical offices worldwide.

In its consultative engagement, PIKOM has pointed out a number of gaps and shortcomings in the new ICT definition which fails to take into account 'digital content development', 'e-commerce', 'e-learning', 'e-government', 'e-public services' or 'ICT-associated R&D, patents and intellectual property' as ICT services. It also must be acknowledged that in the absence of official data, user agencies including PIKOM relied on data provided by private agencies. The private sector data are not only costly, but also heavily market-driven, with the result being that the quality remains questionable (Wyckoff,

2001). This is notwithstanding the fact that eminent statisticians like W. Edwards Deming have drawn up ethical guidelines for private practices in statistical consulting. To reduce the duration of the cycle so as to produce timely statistics, PIKOM has offered to undertake data collection activities including data processing. The offer was made on the understanding that data collection in the future will most likely be outsourced to industry associations with their ready databases of members.

Engagement in Statistical Collation for Digital Economy Satellite Account (DESA)

In 2012, the Government initiated the Digital Economy Satellite Account (DESA) programme under the direct purview of the Prime Minister of Malaysia. The programme is placed under the supervision of the Ministry of Finance (MOF), which is also helmed by the Premier. As such, DESA is given the requisite policy direction and allocation support as well as institutional and administrative clout. At the implementation level, MDeC - being the custodian of the Digital Malaysia Programme (DMP) - has been tasked to provide the necessary stewardship.

Indeed, DESA was initiated primarily for monitoring, measuring and evaluating the performance of DMP, whose goal is to generate an innovative digital economy (IDE) alongside other strategic programmes such as the Economic Transformation Programme (ETP), Government Transformation Programme (GTP), Rural Transformation Programme (RTP) and Political Transformation Programme (PTP). Through the national strategic transformational programmes, the Government is also poised to increase the contribution of the ICT sector from its current level of 9.8 per cent of the Gross National Income (GNI) to 17 per cent by 2020.

For monitoring, measuring and evaluating these targets, the MOF under the advice of MDeC, has mobilised a number of key ICT-relevant ministries and mainstream agencies, namely DOSM, MOSTI, MICC, EPU, Central Bank of Malaysia Securities Commission of Malaysia (SCM) and Companies Commission of Malaysia (CCM). In this endeavour, PIKOM is the only private sector association that has been accorded equal standing with the others in the DESA initiative. PIKOM is not only being consulted in the formulation and implementation of DESA initiatives aimed at pooling and collating the supply and demand indicators, but has also been assigned to provide ICT statistics that have been compiled by the association.

Specifically, PIKOM has been tasked to provide data on the average salary of ICT professionals. This is compiled annually and published in the ICT Job Market Outlook in Malaysia. This series started five years ago and has since then been successfully produced every year with the ardent support of industry partners, in particular Jobstreet.com and KPMG. In this endeavour, PIKOM assumes the overall responsibility of collating and publishing data. PIKOM is also responsible for the quality and timely production of data.

The largest recruitment service provider, Jobstreet.com provides the latest salary information on ICT professionals by industry, job markets, and survey-based economic perception of job seekers and industry players. Meanwhile, KPMG, one of the big four international audit, tax and advisory firms, presents the country's current economic outlook. When it was first published five years ago, it was a simple publication providing only basic information on the average monthly salaries of ICT professionals in the country. Today, it offers detailed information on the average monthly salaries of ICT professionals by industry, job category, job function, employment size and geographical locations. Also showcased are the top salary-paying industries for the ICT workforce, hot ICT jobs in demand, perception of jobseekers and potential employers on the economy and job market as well as regional data on selected Asian and English-speaking countries. Besides average salary, the report has also incorporated an industry feature article, starting with "ICT Graduates and Employment Prospect" in the 2012 edition. Besides the ICT Job Market Outlook series, PIKOM also publishes the annual ICT Strategic Review series.

The first publication provides a platform for government agencies, especially policy makers and development practitioners, private sector leaders and academia as well as individual contributors, to present their thought leadership, industry relevant concerns, issues and challenges, research findings and statistical information. Over the past three years, the ICT Strategic Review has been managed successfully by promulgating themes pertaining to "Innovation the Way Forward", "e-Commerce for Global Reach" and "Transcending into High Value". On all accounts, both publication series provides a better understanding of the overall ICT job market and its dynamics in the country. The significant aspect of this whole episode is that mainstream agencies regard data produced and published by PIKOM as official statistics.

Engaging PIKOM for Technical Assignments in DESA Programme

In collaboration with MIMOS Berhad, PIKOM has been engaged to drive the DESA System as an integral component of the DESA Programme. MIMOS Berhad is the government-linked corporation that undertakes strategic research and development activities in micro-electronics and ICT domains. By virtue of its vast technical capabilities, MIMOS has been tasked to undertake the development of the DESA system. In this arrangement, PIKOM is to provide content consulting and project management services for the implementation of DESA Framework, as shown in Figure 2. Essentially, the Digital Economy Satellite Account (DESA) system entails an automated aggregation and knowledge management system. The system is used to extract data from various secondary sources and collate them into statistical data via typical statistical processes. By using analytics methodology such as trend analysis, projections and probabilistic estimation procedures as well as taking into consideration policy and business strategies, DESA can help to generate policy, market and business intelligence information. At the user level, DESA also provides a knowledge management system comprising a dashboard system for decision-making processes; for branding and communication; as a knowledge repository; and can be referred to for research.

The DESA System is implemented for monitoring, measuring and evaluating the impact of the Digital Malaysia programme that the Government is currently promulgating as an integral activity of an Innovative Digital Economy (IDE). The system at macro level is aimed at pooling indicators from various agencies and the private sector that produce, publish and disseminate statistical information on a regular basis. Currently ICT data and information are fragmented and exist in various data formats residing at various sources and systems.

In the absence of the DESA system, policy makers find difficulties in measuring the contribution made by the ICT sector in the economy. The proposed system is essentially a knowledge management system which will entail data collection, processing and dissemination using a dashboard system. The DESA System is aimed at providing online and real time interactive capabilities by linking all external ICT data sources, as listed below:

- Department of Statistics Malaysia (DOSM)
- Economic Planning Unit (EPU)
- Malaysian Multimedia and Communications Commission (MCMC)
- Ministry of Science, Technology and Innovation (MOSTI)

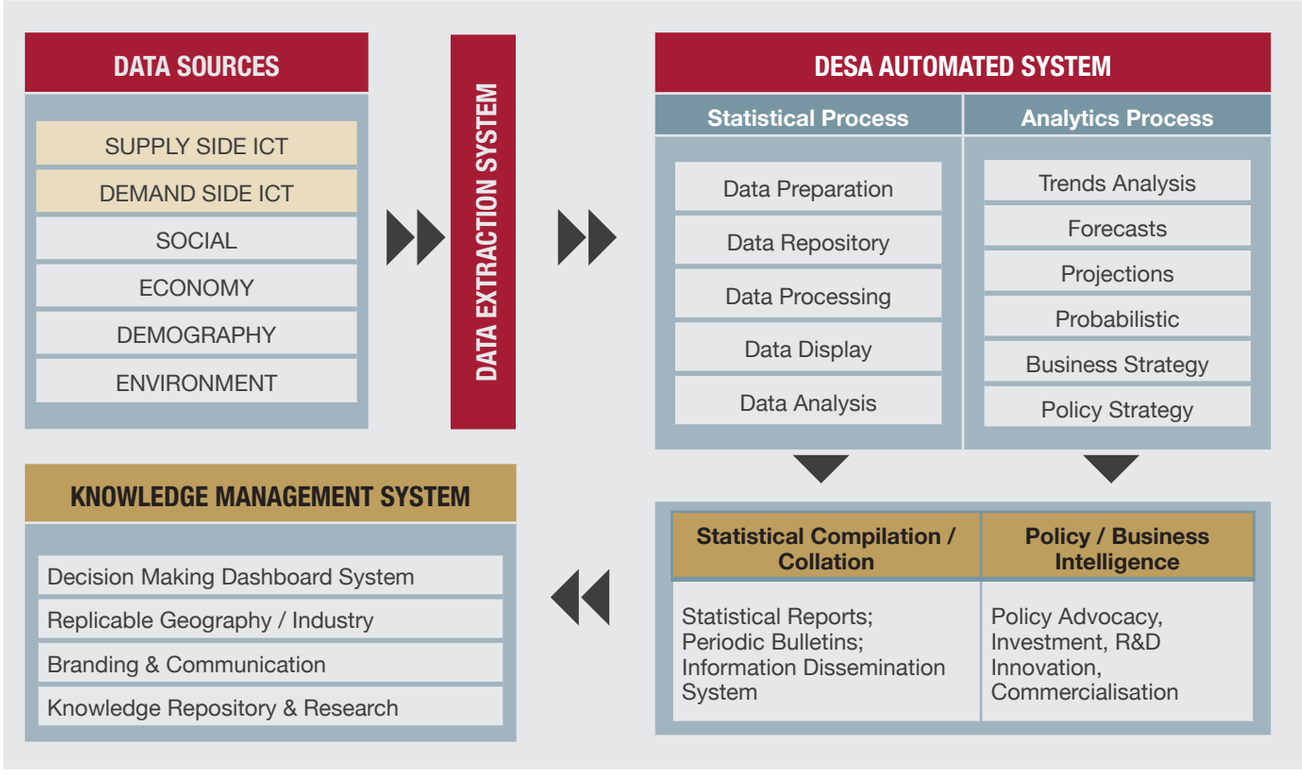

Figure 2: DESA Framework

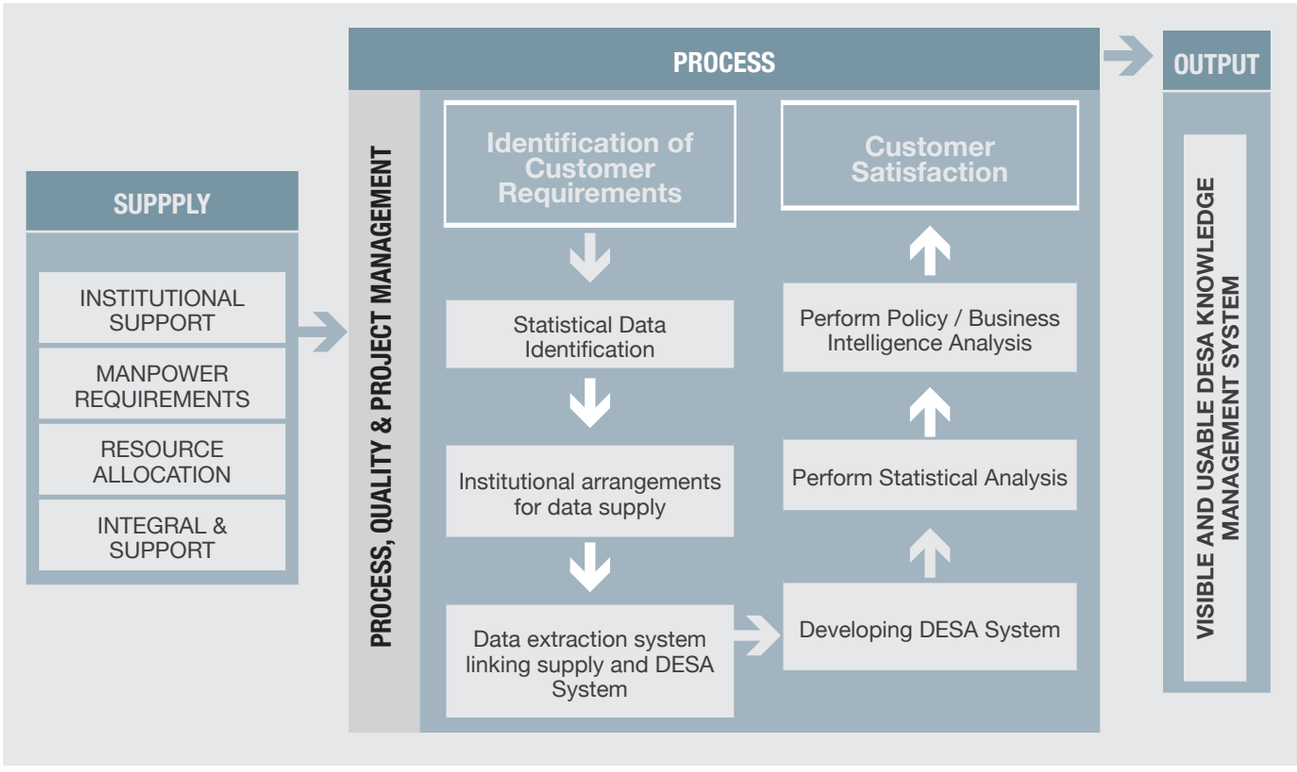

Figure 3: DESA Process

- Multimedia Development Corporation (MDeC)
- Ministry of Information, Communications and Culture (MICC)
- Ministry of Education (MOE)
- Ministry of Human Resources (MOHR)
- Ministry of International Trade and Industry (MITI)
- Ministry of Higher Education (MOE)
- Ministry of Energy, Green Technology and Water
- National ICT Association of Malaysia (PIKOM)

The share of ICT sector is currently at 9.8 per cent and the government plans to expand this share to 17 per cent by 2020. To gauge progress, periodic monitoring, measuring and evaluation as well as timely policy and programme prescriptions are imperative. In support of this analysis, the DESA system also offers a centralised database, a single source for data reference, segmented dashboard to meet the needs of policy makers and development practitioners at various levels and across industries.

Essentially, the DESA system should automatically extract data from the various data formats and data sources to a common repository. It should be able to tally the data as per requirement put forth by stakeholders who are the owners of the processed data; export the aggregated data to external analysis application for detail analysis and import the analysed data for further review; and create and publish reports for the consumption of the public and relevant agencies.

As shown in Figure 3, realising the DESA process is a monumental task requiring huge amount of resources in terms of allocation, time and more importantly, expert services. Indeed PIKOM is honoured to be engaged as a consultant to the DESA System project, indicating the confidence and trust that the association has garnered from mainstream industry players over the years.

PIKOM Involvement in Digital Malaysia Programme

Arising from its active participation in the Digital Malaysia Programme (DMP), PIKOM has been tasked to champion the e-waste disposal project. Rapid advancements in technology and the high rate of technological obsolescence has created the rapid growth of e-waste, not only in Malaysia but also globally. Sources of e-waste include all kinds of electrical and electronic (E&E) equipment such as refrigerators, washing machines, TVs, PCs, monitors, printers, batteries, scanners, mobile phones etc. The E&E items contain highly toxic elements and heavy metals like mercury, lead and cadmium. When disposed randomly and irresponsibly in landfills, the toxic elements can leach into the

earth, affecting the quality of water, rate of vaporisation and rainfall pattern and climate. When the E&E items are treated irresponsibly in the incinerator, heavy metals like mercury, lead and cadmium can be released in the air, thus polluting the environment. Detrimental effects on the quality of air, water and soil result in ecological and environmental degradation as well as posing a huge threat to our health.

It is estimated that the ICT sector accounts for 3 per cent of total carbon emissions in the world and 4 per cent of municipal wastes. On the other hand, governments worldwide are addressing the challenges associated with environmental degradation. Malaysia made a commitment at the Copenhagen Summit 2009 to bring down its carbon footprint by 40 per cent by the first quarter of this century. Recognising the growing dangers of e-waste especially with the prolific increase in ICT penetration, PIKOM has volunteered to own and drive the e-waste disposal programme.

Currently, multinationals like Hewlett Packard have their own take-back programme which provides an avenue especially for business and large industry users to return HP products for re-use or recycle after use. However, HP is managing this programme as a corporate social responsibility (CSR) initiative, which adds a cost to their operations. Like HP, other big corporations have similar arrangements to collect back E&E items after use. But, such CSR driven programmes can only bring limited success and its scope and coverage are not comprehensive enough to address environmental degradation challenges effectively.

For example in Malaysia, the take-back programme does not cover the household sector where there is an increase in ICT items and which is projected to increase even more with a technology-savvy population. The programme is vendor driven and not holistically addressed from a national interest point of view. No system or mechanism or agencies are in place to collect orphan brands. Moreover, of the total 151 E&E waste collection centres, only 21 are full-fledged recovery centres and 130 are partial recovery centres. There are no full recovery centres in Sabah and Sarawak. Thus, PIKOM is holistically exploring the issue using the life cycle product approach, entailing proactive and reactive strategies as shown in Figure 4. The e-waste disposal system is considered a reactive or post-effect strategy, which is poised to manage the disposal of E&E items that are currently in use.

The proactive strategies include reduction of travel and reducing destruction of forests by promoting the paperless office where texts and messages are increasingly sent through SMS, via e-mail and softcopy publications and by performing online business transactions using e-commerce modes; institutionalising teleworking and distance learning practices; and more importantly, deploying green ICT technology that consumes reduced electricity and energy. Although the programme is still in its infancy, PIKOM is committed to ensuring its successful implementation not so much from a business perspective, but from the quality of life perspective, which the Government, businesses and society as well as individuals cannot afford to ignore.

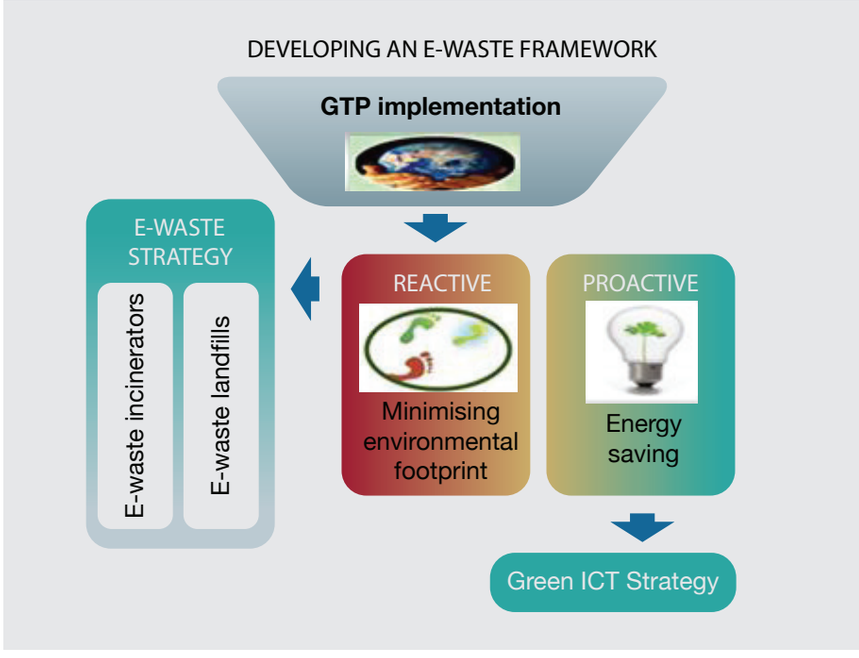

Figure 4: ICT Life Cycle Product Conceptual Framework: Proactive and Reactive Strategy

PIKOM's Predictive Analytics Model System (PAMS)

Besides involvement in public policy areas, PIKOM is developing tasks that are deemed important for the industry while also beefing up the secretariat functional efficiencies. Technological change is inevitable. If the statistical community does not change with it, technology may bring about disruptive changes, perhaps even in detrimental ways. (Straf, 2003, Esterhuysen, 2005).

Recognising the growing demand, PIKOM is in the process of developing the Predictive Analytics Model System (PAMS) as shown in Figure 5. The PAMS is being developed for the PIKOM PC Fair. As indicated earlier, this cash and carry fair is currently held nationwide in 32 locations with a turnout of 2.2 million visitors in 2011. In the past, PIKOM had concentrated only on the creation of a database via the registration of visitors and vendors.

No effort had been taken to study the profile of the visitors and vendors as well as the features and characteristics of ICT products marketed including consumer behaviour revolving around product/service satisfaction, preferences and aspirations. PIKOM is of the opinion that a significant amount of information is available at the PC Fair. Recognising its importance for competitive analysis, PIKOM is developing an online and interactive system for culling timely business intelligence and market insights, as shown in Figure 5.

Thus, the knowledge management system entailing statistical and predictive analytics outputs will be used not only for decision making, branding and communication and replication exercises, but also for developing the knowledge repository and research that official statistics are equally concerned with.

When PAMS has been implemented over a number of years, the system can help to generate demographics of event visitors and vendor profiles, products and services, as well as the detailed characteristics of ICT users in the country that are relevant to official statistics.

Besides the statistical dimension, the model also provides a basis for adopting a similar system in other trade fairs, including those organised by the Government. Indeed, the PAMS pilot model has been developed with the financial support provided by the Manpower and Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) of the Prime Minister's Department.

PIKOM Involvement in Primary Research

Being a membership-driven organisation, PIKOM lacks adequate resources especially funding for undertaking any primary research, especially those involving its members. As an industry association, PIKOM know its members better than anyone else in the market. As indicated earlier, the landscape of

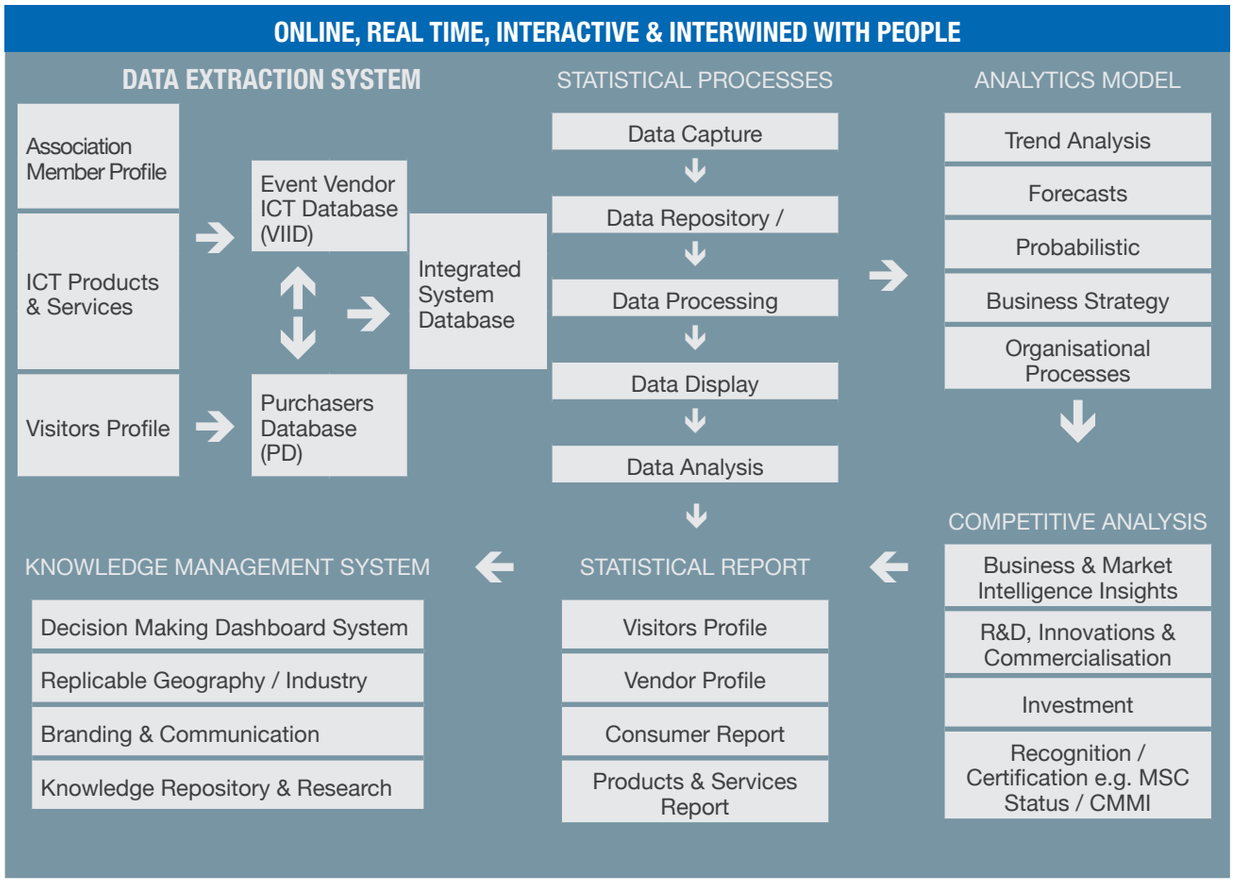

Figure 5: Predictive Analytics Model System Overview

PIKOM membership has drastically changed from 100 per cent retailers and wholesalers to the current mixed membership that has 40 per cent of non-vendor types. The membership concentration is spread nationwide, no longer confined to Klang Valley which used to be the case a decade ago. The five regional chapters, namely Northern, Southern, Eastern, Sabah and Sarawak, provide the requisite network, administrative and logistics support for any PIKOM event including research. PIKOM is also flanked by high calibre members in the Chief Information Officer (CIO) chapter, whose knowledge, expertise and experience can be leveraged for research activities.

Acknowledging the inherent strengths of PIKOM, institutions like the Malaysian Services Provider Association (MSPC) under the purview of the Ministry of International Trade & Industry (MITI) has commissioned an undertaking of a primary survey on "Assessing Capabilities of Information Communications Technology (ICT) Services Companies in Malaysia", for the first time. The study is funded by Performance Management & Delivery Unit (PEMANDU) that was formally established in September 2009 as a unit under the Prime Minister's Department. PEMANDU's main role and objective is to oversee implementation and assess progress of all the economic, social and political transformation programmes that the Najib administration currently pursues. In other words, although the fund is channelled through MSPC, the mainstream agency like PEMANDU has accorded recognition on PIKOM's capability in research.

The study is aimed at providing situation analysis on the performance of ICT services sector; profiling knowledge and innovation services provision of ICT services companies; benchmarking against selected ICT best practices; gauging issues, problems and challenges; and providing recommendations on elevating capabilities of Malaysian ICT services companies especially Small and Medium Enterprises (SME).

The SMEs need institutional support to become more receptive to changes in the business environment; to enhance competitive edge and comparative advantage to make their businesses go global; and to transform their business practices, processes, work culture and management skills so that their businesses can move up the value chain. PIKOM's aspirations to help its members augur and align well with MITI /PEMANDU's strategies for SMEs.

Conclusion

Since its humble beginnings in August 1986, PIKOM has come of its age. Today, not only does it serve its members, but also the entire ICT industry. When it was first formed, PIKOM merely addressed issues and challenges affecting their members' businesses. Later on, it organised events like PC Fair to help its members grow their enterprises.

When its membership grew in diversity in tandem with the emergence of Internet technologies, the convergence phenomenon as well as the impacts of virtual realities on society and economy, PIKOM redefined its position as the voice of industry. PIKOM actively engages in government relations to address various issues and challenges posing the industry. In line with this public-private partnership, the Government gave PIKOM recognition, representation and participation in various dialogues and forums as well as sought the association's input on budget and other industry development activities. Based on its excellent track record, PIKOM is now undertaking ICT research for the Government apart from pursuing its own agenda of industry development.

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04. THE NEXUS OF FORCES: SOCIAL, MOBILE, CLOUD AND INFORMATION

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The Nexus of Forces is the convergence and mutual reinforcement of social, mobility, cloud and information patterns that drive new business scenarios.

Gartner research over the past several years has identified the independent evolution of four powerful forces: social, mobile, cloud and information. As a result of consumerization and the ubiquity of connected smart devices, people's behaviour has caused a convergence of these forces. It raises a warning to senior IT leaders: Their existing architectures are becoming obsolete.

In the Nexus of Forces, information is the context for delivering enhanced social and mobile experiences. Mobile devices are a platform for effective social networking and new ways of work. Social links people to their work and each other in new and unexpected ways. Cloud enables delivery of information and functionality to users and systems. The forces of the Nexus are intertwined to create a user-driven ecosystem of modern computing.

The Nexus is the technology-immersed environment, and that environment drives business at an increasingly accelerated pace. Using multiple devices and applications of their choosing, people connect with one another and interact with a wealth of information. Whether they realize it or not, the seamlessness of their experiences and access to data relies more and more on an underlying cloud infrastructure. When these people are also employees, they carry expectations of this prolific interactivity and information access with them into the workplace.

Leading companies are taking advantage of Nexus dynamics to create innovative products and services, reaching new customers in new contexts. These companies understand the subtle relationships between behaviour, sentiment, history, location and intention and are able to adjust to the prevailing winds without uprooting business models and system architectures. Traditional companies struggle with this adaptivity, both from a business and IT perspective (indeed, IT is often part of the problem because it may keep an organization from capitalizing on new opportunities). Whether it be vendors, end users, private companies, governments, hospitals or universities, all organizations that produce or consume IT are affected by the Nexus of Forces, and they need to choose how they will respond.

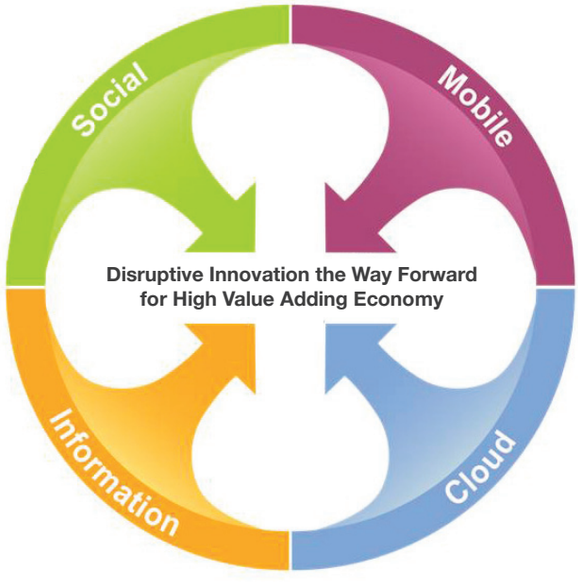

Figure 1. The Nexus of Forces
Source: Gartner (June 2012)

What We Predict

Tools will continue to improve, and access to information will grow wider and deeper. Technocentrism gives way to human-centered design. People will become even more sophisticated consumers and co-creators of technology and content. They will share their experiences and preferences, leading to broad adoption at an accelerating pace. To support the fluid dynamics of the Nexus of Forces, providers of technology will have to get comfortable with a new complexion of control, one where autonomy is provided against a nonintrusive foundation of revitalized infrastructure and operational systems and processes.

These advances don't come without increased complexity: That's just the nature of technology evolution. For users, however, things get simpler and more aligned with their intentions. Donald Norman captured this paradox in "The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution":
Most technology goes through cycles of development and change in both internal and external complexity. Often, the very first device is simple, but crude. As the device undergoes the early stages of development, its power and efficiency improve, but so does its complexity. As the technology matures, however, simpler, more effective ways of doing things are developed, and the device becomes easier to use, although usually by becoming more complex inside.

The management of this complexity falls on the ecosystem of technology providers — from enterprise IT shops to cloud service providers to device manufacturers — and the ease with

which pieces fit together and flex around unforeseen scenarios. The task of enterprise leaders is to hide complexity under a layer of simplicity.

At the Core: Social, Mobile, Cloud and Information Converge and Reinforce

Not that long ago, people's most sophisticated computing experience was at work, and computing was limited at home. Now, in most cases, the opposite is true. The consumerization of IT is a result of the availability of excellent devices, interfaces and applications with minimal learning curves. These devices — especially smartphones and tablets — and their application ecosystems are what the philosopher Martin Heidegger might have called "ready-to-hand," meaning that they fit the tasks and intentions of the user without getting in the way.

The key to design lies in understanding the readiness-to-hand of the tools being built. We can create tools that are designed to make the maximal use of human perception and understanding without projecting human capacities onto the computer.[1]

As a result of using these well-designed devices, people have become more sophisticated users of technology: The individual is empowered. People expect access to similar functionality across all their roles and make fewer distinctions between work and nonwork activities. People have come to expect and make use of presence and location services, contextual search results, and spontaneous interaction with their social networks to enhance everyday experiences. And they spread those experiences across multiple devices, often at the same time.

To preserve this highly interactive experience, several dependencies act together:

- Access to relevant, stateful information requires access to ubiquitous cloud services where that information is made available.
- People are mobile, and they require devices and applications in their hands as opposed to only machines tethered to a desk.
- Location data (for example, from a device) shapes the enormous amount of potential data into information that is most relevant.
- Access to social networks implies a personally relevant transactional experience that is integrated into, and initiated from, a social platform (for example, Facebook).

Business Scenarios and Opportunities

Consider the evolution of Amazon. In the mid-1990s, Jeff Bezos spotted an opportunity to create a mail order store on the emerging Internet that would make use of a searchable database. Books were a natural product for such a database because of the vast number of available titles and the reliance on the combination of information and physical form. Over time, Amazon enlarged its portfolio of merchandise and extended its reach through partner relationships. The Kindle ushered in a new paradigm for readers and closed the gap between idea ("I should read that!") and delivery (quick transaction using my "1-Click" settings and immediate download to my handheld device). New self-publishing models at Amazon now make it much easier for authors to deliver their work into the hands of new readers without the overhead of provisioning physical merchandise or the logistics of traditional delivery. In this mobile, contextualized, cloud-driven, information-centric scenario, all parties benefit more immediately: reader, author, provider (publisher) and proxy (retailer). The dark side of this accelerated delivery model is the shuttering of traditional bookstores that, while providing an important tactile and personal experience, cannot keep up with the pace of demand.

How are you enabling consumers to get their results more quickly? How are you empowering your knowledge workers to share their ideas? How long until your business closes its doors because it can't keep up with new delivery models?

In many of our homes, we have theatre-quality entertainment experiences. Increasingly, those experiences involve streaming high-quality video and audio across fast Internet connections for delivery on devices throughout the home. Again, the time gap has closed from idea ("We should watch that!") to delivery (log onto Netflix, BBC iPlayer, iTunes or other providers and press "Play"). Who has patience to wait for the mail or drive to the corner video store? Oh, and by the way, the corner video store isn't there anymore. Providers of these services use the cloud to achieve scale and reach, while your collection of devices use the cloud to enable seamless playback experience from room to room and from wall to hand.

What could your business deliver to paying users if your systems and business models allowed? What delivery methods are you clinging to that are holding you back? Are your customers going somewhere else?

At my local outdoor farmers market set up in a grassy field, the seller of heirloom tomatoes is cashless — well, she keeps cash on hand (just in case), but keeps it quiet. When I buy a bag of perfect purple beefsteaks, she swipes my debit card on her mobile card reader and I sign with my finger. My receipt is in my inbox, and her cash is in the bank the next day. Once more, the gap has closed from idea ("Those tomatoes would be great for dinner!") to delivery (on the scale, in the bag, on my way), especially in a day when the "idea" is more likely: "Those tomatoes would be great for dinner, but I don't have any cash on me, and the closest ATM is five miles away."

What is keeping your customers from acting on your services? How can you enable instant transactions — not only transactions of money, but also ideas?

The choices available for information, entertainment and purchasing are overwhelming. Consumers cannot browse every blog, headline or newspaper available to them to decide what to read. They cannot sample every movie or song that comes out every week to decide what is worthwhile. Increasingly, they rely on their friends or trusted others to recommend where they should spend their attention. RSS readers sit unused because people rely on retweets or Facebook "Likes" to decide what to read. Professional movie and music reviewers become less relevant as consumers depend on the friends they trust for recommendations. Professional analysts (potentially even those at Gartner) could lose some of their influence because social techniques make it easier for people to reach their peers for advice.

Are you relying on increasingly obsolete promotional channels to let people hear about your product? Do you know who the real influencers are?

These are examples of well-known scenarios that harness the Nexus of Forces, but every day, entrepreneurs test new ideas that push the boundaries of traditional business models and the IT that supports those models. Ideas that make the technology transparent while enhancing human behaviour will gain a foothold in this fast-paced ecosystem. End-user organizations and technology providers that are slow to move will be left far behind.

The Four Forces

Each of the four forces of the Nexus provides a starting point for research. Depending where your particular interest or experience lies, you can begin from any force and work your way toward the middle, building an understanding of the dependencies that hold the Nexus of Forces together.

Social

"The creative tension generated by the mingling of people from different fields, different backgrounds, and different expectations makes a critical contribution [to collective experience]. Among other things, such experience helps provide not only knowledge and information that people don't know they need, but also the skill to judge the worthwhile from the worthless — an increasingly important skill in an age of ubiquitous and often unreliable information." [2]

Social is one of the most compelling examples of how consumerization drives enterprise IT practices. It's hard to think of an activity that is more personal than sharing comments, links and recommendations with friends. Nonetheless, enterprises were quick to see the potential benefits. Comments and recommendations don't have to be among friends about last night's game or which shoes to buy; they can also be among colleagues about progress of a project or which supplier provides good value. Consumer vendors were even quicker to see the influence — for good or ill — of friends sharing recommendations on what to buy.

Social technologies both drive and depend on the other three Nexus forces:

- **Social provides an important need for mobility:** Accessing social networks is one of the primary uses of mobile devices. Indeed, it is the main reason that many people acquire more powerful smartphones instead of simple portable phones. Social interactions are transient, fleeting and spontaneous. They have much more value when they are possible wherever the user is located.

- **Social depends on cloud for scale and access:** Social networks benefit from scale, the kind of scale that is really only practical through cloud deployment.

- **Social feeds and depends on deep analysis:** Social interactions provide a rich source of information about connections, preferences and intentions. As social networks get larger, participants need better tools to be able to manage the growing numbers of interactions, which drives the need for deeper social analytics.

Mobile

"I'm a great believer that any tool that enhances communication has profound effects in terms of how people can learn from each other, and how they can achieve the kind of freedoms that they're interested in." [3]

Walk down the typical crowded street, and half the people you see will be looking at or talking on their mobile phones. Mobile devices are the constant gateway of attention. And it's personal: Many users would give up other essentials rather than give up their handheld companion. It is their constant point of interaction to their social world, where their most trusted personal and business relationships are maintained. Through the window in their palm, they are never alone, never lost, and never bored.

Mobile computing is forcing the biggest change to the way people live since the automobile. And like the automotive revolution, there are many secondary impacts. It changes where people can work. It changes how they spend their day. Mass adoption forces new infrastructure. It spawns new businesses. And it threatens the status quo.

For business, the opportunities — and the stakes — are high. To a retailer, the same device that navigates a customer into a store can redirect the final sale to the competition. To a bank, the mobile phone is a new wallet that could make the credit card obsolete.

To a sales organization, mobile computing keeps salespeople out in the field talking to customers. To a medical caregiver, a patient's vitals and behaviours may be constantly monitored, which increases the effectiveness and efficiency of treatment. Every industry is affected.

But mobile does not stand alone as an isolated phenomenon: Devices will come and go faster all the time. New form factors will emerge. People will interact with multiple screens working in concert. Sensor data will transparently enhance the experience, integrating the virtual and physical worlds contextually. The information gathered in this immersive world will have tremendous value.

Ultimately, the lasting relationship will be between a user and a cloud-based ecosystem.

Cloud

"The utility model of computing — computing resources delivered over the network in much the same way that electricity or telephone service reaches our homes and offices today — makes more sense than ever." [4]

This "utility model of computing" that Scott McNealy described in 2001 is at the heart of cloud computing now, more than a decade later. Cloud computing represents the glue for all the forces of the Nexus. It is the model for delivery of whatever computing resources are needed and for activities that grow out of such delivery. Without cloud computing, social interactions would have no place to happen at scale, mobile access would fail to be able to connect to a wide variety of data and functions, and information would be still stuck inside internal systems.

The model of cloud computing is what we call a "global-class" phenomenon because it focuses us on outcomes connected across the globe rather than technologies and outcomes centered on an internal enterprise strategy. There is no need to spend forever vetting technology acquisitions when we can sign up for a service and use it without having to care about the underlying technologies. No need to spend 80% of our IT budget just "keeping the lights on" when we can offload much of that to service providers who can deliver it more efficiently than we can and change the "light bulbs" for us.

In a global-class computing world, everything shifts to the culture of the consumer and the externalized view of computing. This plays nicely into the ideas of the Nexus because that externalization of computing is what allows the forces to converge and thrive. Mobile independent software vendors using cloud services have more options to access information and processes than ever before — without having to own it all.

Crowdsourcing can be done through mobile communities because the cloud allows them all to exist in the same "workspace" rather than being isolated in enterprise or single-PC environments. And, the cloud is the carrier ecosystem for a wide variety of data forms, both structured and unstructured. This data can be gathered from cloud-based communities, through cloud services, from mobile endpoints, and all in a consistent and globally available environment.

The cloud force is the glue of the Nexus and will drive the monetization of Nexus relationships as it drives the service enablement of IT across the world.

Information

"Information is not stored anywhere in particular. Rather, it is stored everywhere. Information is better thought of as 'evoked' rather than 'found.'" [5]

For years, technologists have discussed the ubiquity of information without realizing how to take full advantage of it. That time is here now. Social, mobile and cloud make information accessible, shareable and consumable by anyone, anywhere, at any time. Knowing how to capture the power of the ubiquity of information and utilize the smaller subsets applicable to your company, your product and your customers, at a specific point in time, will be critical to new opportunities and for avoiding risks.

Developing a discipline of innovation through information enables organizations to respond to environmental, customer, employee or product changes as they occur. It will enable companies to leap ahead of their competition in operational or business performance.
An enterprise can succeed or fail based on how it responds to trends such as:

- **Social media:** People are sharing detailed information about themselves, the products they use, and the companies they like (or don't like) in social media. Prior to social, getting specific data about customers/consumers was costly and aggregate in nature. Harnessing the information in social media allows organizations to understand the customer, or potential customer, in ways never before possible.

- **Cloud computing:** Cloud is both the underpinning of the massive amounts of information generated by social media and the primary model for elasticity in accessing and storing information in a cost-effective manner.

- **Mobile:** People are no longer tied to a specific location. The devices they use enable ubiquitous integration of work and nonwork tasks while providing easy access to application ecosystems, social networks and information.

Technology advances in the information space offer a chance to exploit these trends to meet a business's long-standing demand for better data with which to make fact-based decisions. Content analytics, social analytics, in-memory databases, Hadoop and other technologies can deliver better access/analysis of more varieties and volumes of information at lower costs.

Success requires an IT organization to understand the business requirements for new information and how it can affect measurable business outcomes and help drive innovation. At the same time, information demand can quickly outstrip the IT organization's ability to deliver. The increasing volume, variety and velocity of information will overwhelm familiar disciplines for accessing, storing, managing, analysing, governing, presenting, collaborating on and sharing information.

The IT organization must develop an iterative information strategy to guide its response to business requirements for information. Gartner's research will help CIOs, IT leaders and enterprise architects develop such an information strategy.

Challenges for Traditional IT

Traditional IT relies on engineering and prescription: I build a specific tool and teach you how to use it. Now, because of consumerization and democratization of IT, more control has shifted to the user, and the role of IT is to adapt and absorb, not just prescribe. Inflexibility of systems causes increased brittleness and divergence from their original use cases, thus making it difficult to address the fluid nature of human behaviour as described by neurophysiologist William H. Calvin:

Inconsistency is part of flexibility, of nature's strategy of keeping options open. Animals that cannot adapt to new environments will not survive the incessant fluctuations of climate. Judicial systems that cannot grow and change with our society's evolving problems will become rigid anachronisms that promote social earthquakes. Consistency and rationality are human virtues in dealing with certain potentially orderly situations; we make excellent use of them in engineering and legal systems, but we shouldn't expect living systems to have made them centrepiece of their operation in a changing, unpredictable world. [6]

Enter the IT executives and their staff. How prepared are they to deliver what the sophisticated, creative and sometimes circumventive user requires? IT departments are faced with legacy architectures, processes and skills designed for an increasingly obsolescent way of working. Along with those legacy architectures come legacy mind-sets and habits, all of which must be changed to deal with the Nexus of Forces.

Conclusion

Four independent forces — social, mobile, cloud and information — have converged as a result of human behaviour, which creates a technology-immersed environment. The forces interact and reinforce one another and are associated through complex dependencies. New business opportunities emerge from this Nexus of Forces, especially scenarios that extend reach and relationship to customers, citizens, patients, employees or any other participant in an ecosystem of humans and machines. The combination of pervasive mobility, near-ubiquitous connectivity, industrial compute services, and information access decreases the gap between idea and action. To take advantage of the Nexus of Forces and respond effectively, organizations must face the challenges of modernizing their systems, skills and mind-sets. Organizations that ignore the Nexus of Forces will be displaced by those that can move into the opportunity space more quickly — and the pace is accelerating.

Notes

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3. Bill Gates, Digital Dividends Conference, Seattle, 18 October 2000.
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About the author

Darryl Carlton is a research director at Gartner Research based in Singapore, where he is responsible for research in application strategy and governance in the Asia Pacific region. Mr. Carlton's personal research interests cover IT strategy, business and IT alignment, IT organization performance, application portfolio management, cloud computing and SaaS. Mr. Carlton is very interested in understanding how IT best practice will translate in the dynamic economies of Asia and what can be learned from Asian business practices. Before joining Gartner in 2011, Mr. Carlton was advising government agencies in Australia on IT strategy, organizational structure, and application portfolio management. Prior to this, Mr. Carlton was the founder and chief executive officer of one of the world's first SaaS providers - BizTone.com. At BizTone, Mr. Carlton was responsible for recruitment, capital raising and product architecture.

05. CREATING VALUE THROUGH FRONTIER TECHNOLOGIES: MIMOS INNOVATION INROADS

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Abstract

Some people may know MIMOS. Some may have worked with MIMOS. Some may have only vaguely heard about MIMOS. Some may even have developed wrong ideas about MIMOS. But how many really know who we are, what we stand for, what we do and where we are going? In this paper, we hope to shed some light on all these aspects. We will discuss the context we operate in, the R&D we conduct, and the mechanisms that enable them. We will also touch on some of our achievements to underscore why partnership and collaboration is key to winning in the innovation game.

1.0 Burying Old Ghosts

The business of MIMOS Berhad is to research and develop technologies of value towards industry transformation. The focus of our research and development (R&D) has been in ICT and microelectronics and will continue to be so in the future.

MIMOS began as an R&D institute but took on additional roles over the years. In the early '90s, it became the secretariat to the National IT Council (NITC) and took on the extra role of policy development in the area of ICT. When it was corporatised in the mid-90s, it had to also carry out business development. Entering the new millienium, we were wearing three hats - R&D, Policy Development and Business Development.

To ensure effectiveness, however, the government decided that we should only focus on R&D and the licensing of the fruits from this effort. As such, we now play only one role - the original role of R&D. We are back to our roots!

Nevertheless, the after effects of the other roles still linger and in the case of business development, quite strongly. A consequence of our business development activities then was the initiation of a number of business subsidiaries.

Of relevance here are JARING and MIMOS Smart Computing (now known as Mutiara Smart Computing). The former provides internet services and the latter assembles computers. Today, these two companies are separate entities and are not associated with MIMOS.

We would like to emphatically state here that we do not provide internet services nor do we assemble computers now. We are not in these 'businesses' anymore. We would like to bury this perception.

Our past business activities may have also given rise to the wrong perception in certain circles that we are competing with the local industry. This was never the case. We would like to bury this perception as well.

Since R&D is our bread-and-butter, we have a keen interest to work with universities and we are in for the long-haul. However, some people in academia seem to have the idea that we are after grant money that rightfully is theirs! This is completely not true. We would like to bury this perception also.

While we are at it (burying old ghosts), we would also like to point out that the word MIMOS is not an acronym anymore – it is just a name!

Before going further, we would like to stress that our mandate is to help the local ICT and electronics industries grow, and that is what we have been doing in the past, are doing currently, and will continue to do in the future.

2.0 Big Forest, Bald Patches and Stagnant Water

Key cryptic 'zen' - questions to chew on:

1. *How do we ensure that the big forest remains verdant green and abundant?*
2. *How do we green the existing bald patches and integrate them with the forest?*
   [Corollary: How do we prevent bald patches from occuring?]
3. *How do we ensure that water flows from the mountains to the seas, nurturing all that it touches along the way?*

MIMOS' idea of the big ICT forest and the role it wants to play in it is given in Figure 1.0. The upper right portion labelled K-Industries/K-SMEs depicts the profile of our domestic ICT industry. The bulk of the industry activities revolves around the development and customisation of products, solutions, applications and content. Less work is done in the area of architecting new technology platforms, the basis for spawning a range of related products and solutions rapidly. Going a step back, the scene is even sadder – little research is being undertaken by the local industry to create new technolgies and generate novel applications. R&D needs 'big bucks' and is inherently risky. Perhaps this is why our local industry does not indulge in it.

As mentioned earlier, MIMOS' charter is to help the local ICT industry grow and prosper. To do this, we want to complement the industry's activties - to achieve what the industry is not doing or is not able to do. As

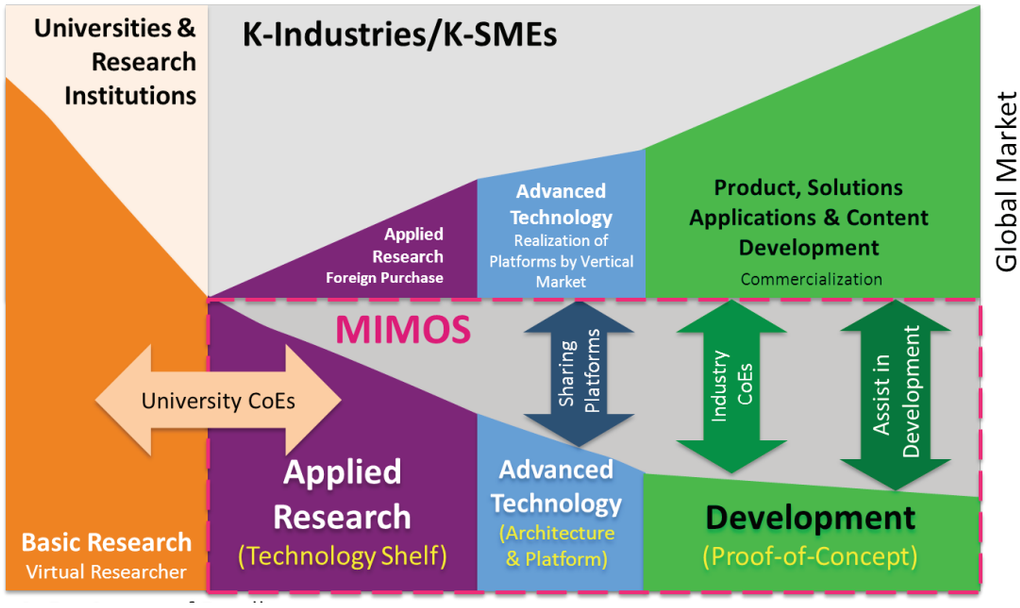

Figure 1.0: The domestic ICT landscape and MIMOS's role within this

you can see in Figure 1.0, MIMOS' portion (the 'triangle') is on the flip side of the industry's – our main focus is on applied research to create novel technologies, which would go into strategic technology platforms that in turn would form the basis for application development.

Notice that development is shown as limited to proof-of-concept. Ideally, we want to develop and transfer the technology platforms to the industry for the latter to take and develop the vertical applications. The proofs-of-concept are our way of testing the platforms as well as to provide 'sample' applications to the industry. We did not plan to develop commercial-class products or solutions.

Unfortunately, the practice did not quite ape the plan. In most instances, the industry was not ready to take the platforms. This is mainly due to a lack of product companies able to ride on the platforms to carry-out R&D to develop verticals. This is a critcal 'bald patch' that needs to be 'greened'. Preferably, we would like our technology recipients to have the right tools and talent for execution and implementation. Their lack of R&D roadmaps and 'domain' expertise are the associated 'bald patches' that need to be fixed.

The upshot of all these is that in many instances we had to go into developing full-fledged products and solutions to be able to expoit the technologies we had developed.

Take a look at the left portion of Figure 1.0. You will notice that there is a link between MIMOS and universities as well as research institutes (RIs). MIMOS does not do basic research. We want to work with the universities and RIs to tap their research outputs and knowledge relevant to us and turn them into useful technologies. In turn, the universities could look forward to having their findings going to the market eventually and creating real value.

The universities and RIs (including MIMOS) and industry to a large extent make up the local ICT 'big forest'. Now, it would be very fruitful if this whole ecosystem works harmoniously. Ideally, emerging science from research laboratories should flow into becoming emerging technologies that would in turn flow into becoming innovative products, solutions and applications and result in the creation of new industries. Sad to say however, this is not the case. The flow is a rivulet at best and stagnant at worst.

Collaboration is key to innovation but the link between universities, RIs and industry is still weak. The exchange of ideas, knowledge, IPs, technologies and people among them is far from satisfactory. The kinetic 'buzz' has not reached the critical threshold to trigger a vibrant and sustainable ecosystem for innovation.

We are trying very hard to energise the ICT innovation ecosystem by doing what we are doing as exemplified in Figure 1.0.

3.0 Buy Some, Make Some and Produce More

You have seen that our R&D process involves the stages of Applied Research, Advanced Technology and Development. The outputs of these

stages are essentially technologies, platforms and products respectively. In this section, we highlight some of these outputs and how they have been deployed.

3.1 Technology Basket

'Zen'-sense:
"Before you offer help to better, you had better be better!"

Common sense says that to help the industry stay ahead in the innovation game, MIMOS has to stay ahead in the technology game. Our current 10 technology research focus areas are illustrated in Figure 2.0.

While it may seem that 10 are too many, in reality these research areas are intimately related. This intimacy or 'connectedness' may be viewed from different perspectives. Here, we give you a 'data-centric' perspective that ties them together in a holistic fashion.

Let us briefly look at the various research areas, beginning with the **data collection** group. Research in the microelectronics area mainly revolves around the development of sophisticated techniques for integrating various circuits into monolithic pieces to bring down the chip footprint. In addition, design work is also carried out for in-house hardware products.

Our venture into nanoelectronics was a logical next step, considering the continuous drop in chip size and our expertise in microelectronics. Here, we are investigating material characteristics and nanostructures such as carbon nanotubes and graphene towards the development of various sensors. Microenergy is the term we use for research in the field of ambient energy harvesting and storage for use by micro-sized devices such as sensors.

In essence, this group forms the basis for our **sensor** technology thrust. Now, you know why we call this group **data collection** – sensors collect data!

The advanced analysis and modeling work **(data modeling)** is carried out by a group of mathematicians whose job is to develop mathematical models and algorithms for analysing data and solving problems. This mathematics group works with the various research groups wherever their expertise is required.

The area of work related to semantics technology is known as *knowledge technology* internally. The focus here is research into representing data and information in forms more amenable for manipulation to ease and enhance reasoning and meaning making. *Intelligent informatics* covers the area of video analytics where the research is on the analysis and understanding of images and videos. The last area in this **data analytics** and **visualisation** group is *psychometrics* which involves research in the development of people profiling instruments for various subject areas such as student intake, staff intake, etc.

Research in *advanced computing* (**data infrastructure** group) covers the areas of data computing and storage systems as well as data services, where we began with Grid Computing and graduated to Cloud Computing.

The above five research groups, to a large extent, form the basis for our second technology thrust - enterprise applications.

Wireless Communications, the other area in the **data infrastructure** group, concerns R&D in wireless technology, currently WiFi being the main focus to address last-mile solutions.

The work in the wireless space forms the basis for our third technology thrust - wireless communications.

You will notice from the 'concentric disc' (Figure 2.0) that data protection encircles all other data processing activities, irrespective of whether data is at rest, in use or in motion. Our work in information security covers cryptography, trusted systems and user authentication. Note that

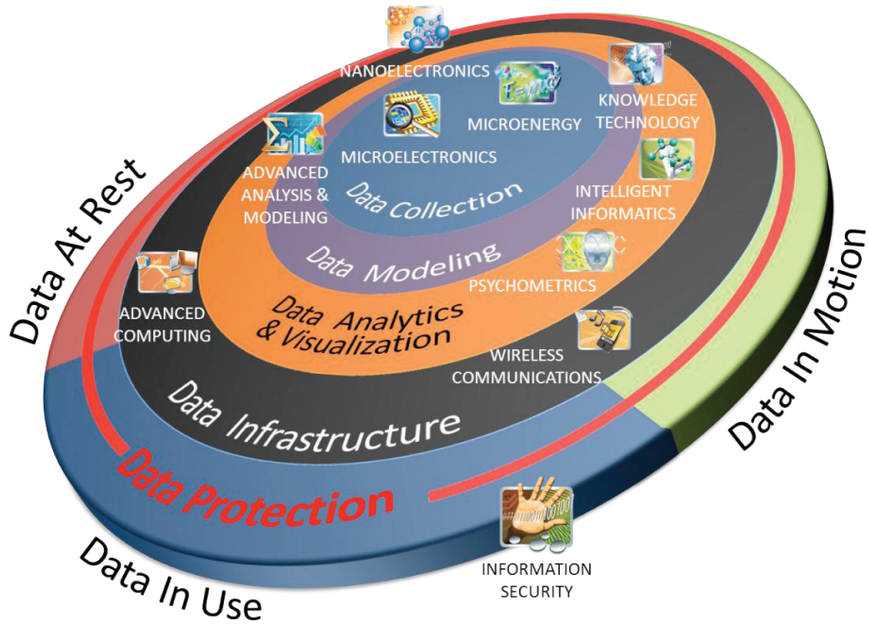

Figure 2.0: A data-centric perspective of MIMOS' technology focus

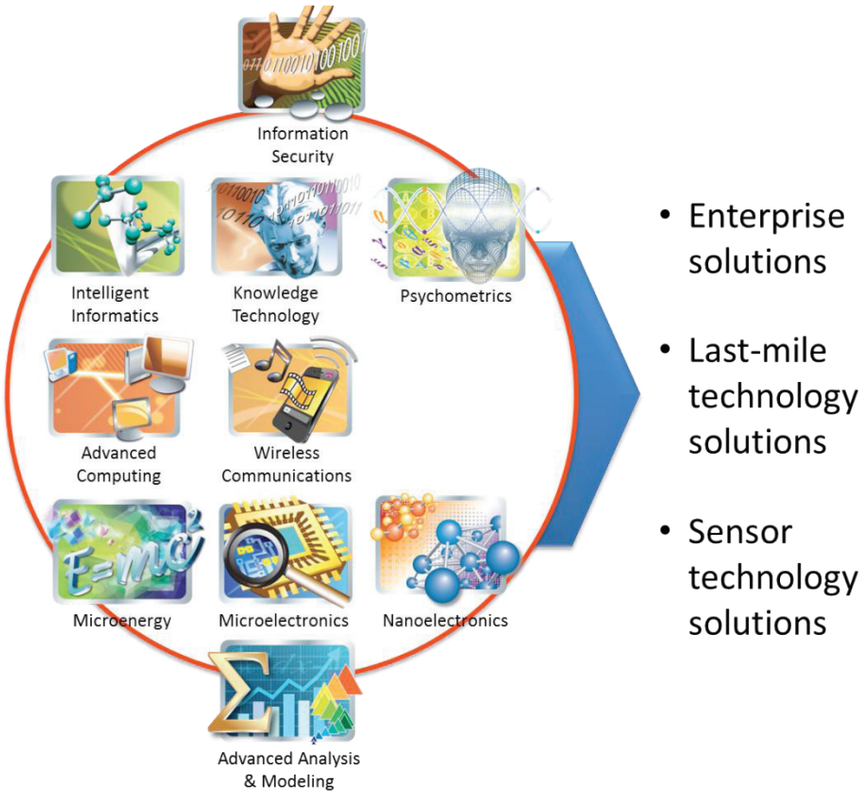

Figure 3.0: Research areas and technology thrusts

information security is a common thread and contributes to all three technology thrusts.

Figure 3.0 summarises our 10 technology research areas feeding into our three technology thrusts.

3.2 Thrust 1: Sensor Technology Solutions

Our current key platform is the Wireless Sensor Network (WSN). A WSN basically performs the tasks of data collection, communication and management. We view our WSN platform as a combination two sub-platforms, the front-end data collection and communication portion which is largely hardware-oriented and the back-end data management portion which is software-driven. The front-end essentially consists of sensor tips, data reading and communication electronics as well as associated software. Our portfolio of sensors, at present, can measure temperature, humidity, electrical conductivity, moisture and pH (nitrate [N], Phosphate [P] and potassium [K]). The back-end software features 24/7 viewing of field sensor data such as environmental, thresholds, alerts, network health as well as the generation of charts and reports. The configuration and customisation of the front-end and back-end will yield different 'verticals' or applications.

At the moment, we have developed two vertical applications on this WSN platform - Intelligent Pollination Management System (IPMS) and Intelligent Green House Management System (IGHMS).

The IPMS can be used to alert when pollination is due and monitor plant health. A version of this application has been field tested by Felda Agricultural Services Sdn Bhd at a site in Sungai Tekam for improving oil-palm yield. The results have been very encouraging.

A version of the IGHMS is being field tested by our technology recipient, Mutiara.com, at a site in Bumbung Lima, Kepala Batas where more than 5,000 chilli plants are being monitored. The system helps to measure the temperature, sunlight, the soil composition, the moisture, etc. to allow the automated supply of the right amount of water, compost and fertilizers at the right time.

3.3 Thrust 2: Last-mile Technology Solutions

Our flagship platform here is the WiWi – an access point (AP) having WiFi for the front-end and wireless or wired protocols (e.g., WiMAX, HSPDA or ADSL) for the back-end. The modular design of the platform enables the development of a range of products catering to different needs relatively easily.

The WiWi technology has progressed through three generations. The first generation had WiFi for the front-end and WiMAX for the back-end and was an indoor model. The second generation was an outdoor version of the earlier one – rugged and robust. The third generation is re-configurable allowing the development of multiple products. For example, by having WiFi for both front-end and back-end, we could have a relay - another product.

Quantum Intellicode, one of the technology recipients of WiWi, is currently installing WiWi APs under the Kampung WiFi or Wireless Village project (a NKEA initiative). To date, about 200 units of WiWi APs have been installed nationwide.

WiFi coverage is normally impacted in rural areas with hills and tall trees. Instead of having more APs, a solution combining a single AP with several relays is more cost effective. This has been proven correct at a field trial currently underway at Kampung Kerangai (Jelebu, Negeri Sembilan)

where a solution comprising a single WiWi AP in combination with two WiWi relays has given good coverage for a scattered group of about 30 houses.

3.4 Thrust 3: Enterprise Solutions

We have developed several platforms in this area and some of the key ones include Intelligent Informatics Platform (I²P), Semantic Technology Platform (STP), and Intelligent Surveillance Platform (ISP).

• 3.4.1 I2P – Products and Deployment

The I2P is composed of several integrated modules that together enable the development of 'intelligent' vertical applications.

One vertical is an *iLogistics* solution that enables fleet management, whereby goods from source to destination can be tracked. This is being marketed by our technology recipient, Biforst Logistics Sdn. Bhd.

A second vertical is our Intelligent Mining & Matching application that augments the JobsMalaysia portal of the Ministry of Human Resource (MOHR). The portal serves as an automated one-stop shop for matching job seekers with available vacancies.

Another interesting I²P vertical in the human resource domain is our TalentXChange portal which essentially matches competencies (based on resumes and transcripts) of student interns with industry needs.

The mining of the data could also reveal discrepancies in the supply and demand of talent, so that appropriate intervention measures could be taken. This initiative is driven by TalentCorp and the E&E Sectorial Group. Currently, the portal is in the prototype stage and is being tested.

• 3.4.2 STP – Products and Deployment

The STP is a W3C and SOA compliant platform, comprising modular web-enabled components for the development of either standalone knowledge systems or integration with existing knowledge systems. Several products have been developed on this platform, some key ones being Intelligent Learning Management Solution (iLMS), Knowledge Resource for Science and Technology Excellence, Malaysia (KRSTE.my) and UN-FAO Workbenches.

iLMS, a personalised and adaptive learning environment with features for performance monitoring by parents and educational bodies, is being tested at three MARA lower secondary science schools (Maktab Rendah Sains Mara [MRSM]) by our technology recipient Perfisio Sdn. Bhd.

KRSTE.my is a one-stop portal for information on research, development and commercialisation activities related to science, technology and innovation. It is championed by MASTIC of MOSTI.

The UN-FAO is using our STP platform to host several of their ontologies and thesaurus to provide knowledge exchange services to knowledge management projects conducted by UN-FAO partners. The ontologies and thesaurus and the corresponding workbench that are hosted on STP are:

- AGROVOC – agriculture, forestry and aquaculture terminologies;
- JAD – Metadata on Journals and Articles on Agriculture; and
- Biotech – thesaurus for biotechnology.

•3.4.3 ISP – Products and Deployment

The ISP is the basis for developing sophisticated surveillance systems. Typically, a surveillance system would consist of cameras to capture images or videos which are communicated to a central system for processing and displaying the captured images or videos. The strength of our system lies in using patented algorithms to analyse images and videos for a number of events such as intrusion, loitering, unattended object, object counting, suspicious path detection, etc.

The platform is flexible enough to support development of standalone products or products for incorporating into existing systems. Currently, a version of a surveillance product is being deployed by a technology recipient for a chain store in the country.

4.0 Best Practices to Next Practices

As you saw in the previous section, we have been able to take research ideas all the way to product development and deployment. To continuously improve our 'innovation productivity', we need to keep our 'innovation engine' well-oiled and fine-tuned. There are two dimensions to this - internal and external.

Internally, what have we done to improve innovation?

The root to flourishing innovation is the 'innovation culture' or the 'innovation mindset'. To cultivate and nurture this, we have introduced (and are continuously embedding) a set of common values (called SATRIA 1 Values) that all 'MIMOSians' must internalise,

practice and promote. We hold annual competitions to gauge the extent to which the practice of SATRIA 1 Values has contributed to innovation.

You would have heard this phrase umpteen times. Nonetheless, it is a fact and so we will repeat it here: "People are our most important asset!" That said, people with no talent are not going to be very useful. To improve skills, knowledge and competency, we have instituted M*STAR (MIMOS Strategic Training, Advancement and Recognition Program), a four-pronged talent development program for all R&D personnel, which covers:

- Professional Qualification (certification from professional bodies e.g., IEM, IEEE);
- Academic Qualification (Masters and PhD);
- Proficiency Certification (globally-recognised certification e.g. in Six-Sigma (Capability Maturity Model Integration [CMMI], TRIZ, etc.); and
- Personal Competency Development (subject matter expertise and specialisation via IP generation, publications, etc.).

We also have a scheme to place our research staff at renowned universities and industry laboratories for short training stints. Examples of past attachments include:

- University of Royal Holloway, London (Cryptography and Information Security);
- Intel Laboratory, Carnegie Mellon University, USA (Cloud Computing);
- Assessment Systems Corporation, USA (*Psychometrics*); and
- Leibniz Information Centre of Economics, Kiel, Germany (Knowledge Engineering).

Having inventive and innovation minds is not enough. You need to also have an innovation-enabling mechanism. To this end, we have put in a robust end-to-end pipeline process for moving ideas, through research and development to commercialisation. This is essentially a stage-gate process with customisation for front-end invention and back-end innovation. It incorporates industry best practices in testing and quality. We also practice six-sigma and CMMI.

As ideas flow through our innovation pipeline, more ideas spring forth and more intellectual properties are created. To promote and inculcate this 'ideate and disclose' culture further, we have put in an end-to-end process to manage IPs, covering disclosure, protection and exploitation. In concert, we have also developed an in-house IP Management System to make the process more efficient and effective.

Let us now examine the external dimension. Innovation cannot be done in a vacuum, especially if you do not have all the resources. Thus, collaboration is a fundamental aspect of how we innovate. As alluded to earlier, our starting point for innovation is applied research. We do not do basic research. We expect the universities to do this. Our collaborations with universities revolve around working in areas where we lack competency and where the research takes a longer time.

Apart from working with universities, we also collaborate with industry. For example, through our engagement with Microsoft R&D Laboratory, we had the privilege of early access to their pre-release cutting-edge technologies. An outcome of this has been the development of our Enterprise Knowledge Management System (EKMS), an icon-based drag-and-drop reconfigurable dashboard software platform. We have used the EKMS to develop several dashboards, especially for some government ministries. The EKMS system has also been taken up by Mindteck (India) Ltd., to be bundled with their 'life-sciences' offerings for the global market.

We are also collaborative partners in the Open Cirrus™ initiative, an open cloud computing research test-bed. Through the help of the founding members, HP, Intel and Yahoo, we gained a better understanding of the intricate interplay between the computing hardware, storage systems and associated software. This enables us to rapidly design and develop our cloud solutions. Our cloud solutions have been taken up by Telekom Malaysia (via VADS) and the Election Commission.

With NVIDIA, we are setting up an industry Centre of Excellence (CoE) to enable us to understand and build accelerative technologies for enhancing the applications and solutions we are developing.

The above is only a sample of our industry collaboration initiatives. Note that these collaborations are usually with the R&D laboratories of the companies concerned since we have a vested interest in learning about emerging technologies and carrying out research in relevant areas.

5.0 When Rubber Meets the Road …

All things said and done, at the end of the day, one wants to know what value our R&D has created or is creating.

Figure 4.0 shows our version of the innovation value chain where applied technology research feeds

Figure 4.0: Innovation Value Chain and Associated R&D Outputs.

into platforms, which in turn serve as the basis for products and solutions. These applications can be configured or bundled with other products to create bigger systems (normally done by system integrators). Service providers then step into the game to roll out these applications or systems for the various market segments.

The numbers in Figure 4.0 indicate the quantitative outputs from 9th Malaysia Plan activities onwards. A flavour of the platforms, products and solutions as well as their deployment by associated technology recipients was given in Section 4.0 earlier. The '4 + 1' segments refer to the sectors we are currently targeting: government, health, education, agriculture and communications.

You would notice that the above-mentioned market segments are also some of the National Key Economic Areas (NKEA) that the government is targeting in its Economic Transformation Programme (ETP). The government market segment is obviously covered in the Government Transformation Programme (GTP).

Thus, MIMOS R&D efforts are starting to bear fruits and creating economic value for the country.

Since, we are in the mode of 'chest-thumping' here, permit us to tune you in to several of our other achievements attained along the way.

Beginning 2006, we have placed added emphasis on IP generation and over the years been able to grow into becoming the top patent filer in the country. Notwithstanding this, as shown in Table 1.0, WIPO has ranked MIMOS 7th among PCT applicants from government and research institutions worldwide (2012 PCT Yearly Review: The International Patent System, page 38).

Further, MIMOS is the 7th WiMAX Forum IOT Testing Centre in the world and the only one in South Asia. It has also been appointed by STI International as the Asia Pacific Certification body for Semantics Technology.

For the discerning software practitioners, you may want to know that we have attained CMMI Level 5. In addition, we also practice 6-Sigma to ensure quality in design and development.

All these augurs well for MIMOS as a growing R&D organisation of international repute.

6.0 The Road Ahead to Trudge

In this paper, we have highlighted our take on the local ICT ecosystem,

Rank	Applicant's Name	Origin	Published PCT Applications		
			2009	2010	2011
1	COMMISSARIAST A L'ENERGIE ET AUX ENERGIES ALTERNATIVES	France	238	318	371
2	FRAUNHOFER-GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG E.V	Germany	265	297	294
3	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS)	France	149	207	196
4	AGENCY OF SCIENCE, TECHNOLOGY AND RESEARCH	Singapore	148	154	180
5	CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)	Spain	89	126	120
6	CHINA ACADEMY OF TELECOMMUNICATIONS TECHNOLOGY	China			119
7	MIMOS BERHAD	Malaysia	90	67	108
8	ELECTRONICS & TELECOMMUNICATIONS RESEARCH INSTITUTE OF KOREA	Republic of Korea	452	174	104
9	NATIONAL INSTITUTE OF AADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY	Japan	109	91	100
10	UNITED STATES OF AMERICA, REPRESENTED BY SECRETARY, DEPARTMENT OF HEALTH AND HUMAN SERVICES	United States of America	107	113	98

Table 1.0: Top 10 PCT Applicants: Government and Research Institutions

our aspirations for the growth of the local ICT industry, and how we are going about making it happen – through collaboration with all relevant players especially the universities and companies.

What can the industry and universities expect from MIMOS?

We have developed (and will continue to develop) strategic technology platforms to serve as foundations for product and solution development. Our aim is to reduce the risk associated with technology development. These platforms could be used by the industry to rapidly build innovative vertical applications. We also develop prototype applications on these platforms to validate functionality and test robustness. The industry could also take these prototype applications and develop them further. Our technologies and platforms are strongly backed by patents and copyrights. As you are aware, Intellectual Property (IP) is fundamental for competing in the global market and demanding premium prices for products.

Universities, on the other hand, could use our platforms to test their research proofs-of-concept by turning them into appropriate technology components. Universities could also send their interns for training with us. Ideally, we would like MIMOS to be 'overrun' by postgraduate students.

Both the industry and academia could also collaborate with us on joint projects and share our R&D facilities.

One thing we do not offer, though, is money or grants for projects!

We would like to reiterate that we have never put our hands in anybody's rice-pot nor do we intend to. When universities work with us and the results/IPs are incorporated into products, they will get their fair share of royalty when the products are commercialised. When the industry uses our patented technologies and platforms, their gain is speed-to-market of globally-competitive products. Thus, our objective has always been to help grow the 'rice-pot' so that everyone has more to partake in.

Whither now?

It is futile to do R&D if it cannot be taken to the logical end of commercialisation to realise real value. The greatest challenge we face is the lack of good product companies that could exploit the potential of our technologies and platforms to the brim. We are working very hard on various models to address this challenge.

One way is to work on large projects with potentially big economic impact. Large projects give us an opportunity to involve and collaborate with as many industry players as possible, both big and small. By providing a suitable Foundational Framework (comprising several integrated technologies and platforms), vendors could develop the necessary verticals of their specialisation towards creating integrated products or solutions of high impact. The Framework sets the standards for the various vendor verticals to co-exist and inter-operate harmoniously. The coming together of the various industry players could pave the way for the formation of an entity of formidable technology might to take on the global big boys! This is the win-win model that we have put in place for the PERKESO ICT Project (Ministry of Human Resource), which is aimed at revamping the current service delivery system for greater efficiency.

We must say that MIMOS has come of age and is going places. We are making inroads with our R&D products and solutions, both domestically and globally. But we are not doing it alone nor are we claiming so. In fact, we cannot go it alone nor we intend to do so. What we want to do, in abiding with our mandate, is enable the local industry to grow and go global.

'Zen'-end:
'Being King is good; being Kingmaker is better!'

06. INTERNET SECURITY THREAT REPORT: VOLUME 17

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Introduction

Symantec has established some of the most comprehensive sources of Internet threat data in the world through the Symantec™ Global Intelligence Network, which is made up of more than 64.6 million attack sensors and records thousands of events per second. This network monitors attack activity in more than 200 countries and territories through a combination of Symantec products and services such as Symantec DeepSight™ Threat Management System, Symantec™ Managed Security Services and Norton™ consumer products, and other third-party data sources.

In addition, Symantec maintains one of the world's most comprehensive vulnerability databases, currently consisting of more than 47,662 recorded vulnerabilities (spanning more than two decades) from over 15,967 vendors representing over 40,006 products.

Spam, phishing and malware data is captured through a variety of sources, including the Symantec Probe Network, a system of more than 5 million decoy accounts; Symantec.cloud and a number of other Symantec security technologies. Skeptic™, the Symantec.cloud proprietary heuristic technology is able to detect new and sophisticated targeted threats before reaching customers' networks.

Over 8 billion email messages and more than 1.4 billion Web requests are processed each day across 15 data centers. Symantec also gathers phishing information through an extensive antifraud community of enterprises, security vendors, and more than 50 million consumers. These resources give Symantec's analysts unparalleled sources of data with which to identify, analyze, and provide informed commentary on emerging trends in attacks, malicious code activity, phishing, and spam. The result is the annual Symantec Internet Security Threat Report, which gives enterprises and consumers the essential information to secure their systems effectively now and into the future.

Executive Summary

Symantec blocked more than 5.5 billion malicious attacks in 20111; an increase of more than 81% from the previous year. This increase was in large part a result of a surge in polymorphic malware attacks, particularly from those found in Web attack kits and socially engineered attacks using email-borne malware. Targeted attacks exploiting zero-day vulnerabilities were potentially the most insidious of these attacks.

With a targeted attack, it is almost impossible to know when you are being targeted, as by their very nature they are designed to slip under the radar and evade detection. Unlike these chronic problems, targeted attacks, politically-motivated hacktivist attacks, data breaches and attacks on Certificate Authorities made the headlines in 2011. Looking back at the year, we saw a number of broad trends, including (in roughly the order they are covered in the main report):

Malicious Attacks Skyrocket By 81%

In addition to the 81% surge in attacks, the number of unique malware variants also increased by 41% and the number of Web attacks blocked per day also increased dramatically, by 36%. Greater numbers of more widespread attacks employed advanced techniques, such as server-side polymorphism to colossal effect. This technique enables attackers to generate an almost unique version of their malware for each potential victim. At the same time, Spam levels fell considerably and the report shows a decrease in total new vulnerabilities discovered (-20%).

These statistics compared to the continued growth in malware paint an interesting picture. Attacks are rising, but the number of new vulnerabilities is decreasing. Unfortunately, helped by toolkits, cyber criminals are able to efficiently use existing vulnerabilities. The decrease in Spam - another popular and well known attack vector did not impact the number of attacks.

One reason is likely the vast adoption of social networks as a propagation vector. Today these sites attract millions of users and provide fertile ground for cyber criminals. The very nature of social networks make users feel that they are amongst friends and perhaps not at risk.

Unfortunately, it's exactly the opposite and attackers are turning to these sites to target new victims. Also, due to social engineering techniques and the viral nature social networks, it's much easier for threats to spread from one person to the next.

Cyber Espionage And Business: Targeted Attacks Target Everyone

We saw a rising tide of advanced targeted attacks in 2011 (94 per day on average at the end of November 2011). The report data also showed that targeted threats are not limited to the Enterprises and executive level personnel. 50% of attacks focused on companies with less than 2500 employees, and 18% of attacks were focused on organizations with less than 250 employees.

It's possible that smaller companies are now being targeted as a stepping stone to a larger organization because

they may be in the partner ecosystem and less well-defended. Targeted attacks are a risk for businesses of all sizes – no one is immune to these attacks.

In terms of people who are being targeted, it's no longer only the CEOs and senior level staff. 58% of the attacks are going to people in other job functions such as Sales, HR, Executives Assistants, and Media/ Public Relations.

This could represent a trend in attackers focusing their attention on lower hanging fruit. If they cannot get to the CEOs and senior staff, they can get to other links inside the organizations. It is also interesting to note that these roles are highly public and also likely to receive a lot of attachments from outside sources. For example, an HR or recruiter staff member would regularly receive and open CVs and other attachments from strangers.

Mobile Phones Under Attack

Growth of mobile malware requires a large installed base to attack and a profit motive to drive it. The analyst firm, Gartner, predicts sales of smartphones to end users will reach 461.5 million in 2011 and rise to 645 million in 2012. In 2011, sales of smartphones will overtake shipments of PCs (364 million)2. And while profits remain lucrative in the PC space, mobile offers new opportunities to cybercriminals that potentially are more profitable.

A stolen credit card may go for as little as USD 40-80 cents. Malware that sends premium SMS text messages can pay the author USD $9.99 for each text and for victims not watching their phone bill could pay off the cybercriminal countless times. With the number of vulnerabilities in the mobile space rising (a 93.3% increase over 2010) and malware authors not only reinventing existing malware for mobile devices but creating mobile specific malware geared to the unique opportunities mobile present, 2011 was the first year that mobile malware presented a tangible threat to enterprises and consumers.

Mobile also creates an urgent concern to organizations around the possibility of breaches. Given the intertwining of work and personal information on mobile devices the loss of confidential information presents a real risk to businesses. And unlike a desktop computer, or even a laptop, mobile devices are easily lost. Recent research by Symantec shows that 50% of lost phones will not be returned. And that for unprotected phones, 96% of lost phones will have the data on that phone breached.

Certificate Authorities And Transport Layer Security (TLS) V1.0 Are Targeted As SSL Use Increases

High-profile hacks of Certificate Authorities, providers of Secure Sockets layer (SSL) Certificates, threatened the systems that underpin trust in the internet itself. However, SSL technology wasn't the weak link in the DigiNotar breach and other similar hacks; instead, these attacks highlighted the need for organizations in the Certificate Authority supply chain to harden their infrastructures and adopt stronger security procedures and policies.

A malware dependent exploit concept against TLS 1.0 highlighted the need for the SSL ecosystem to upgrade to newer versions of TLS, such as TLS 1.2 or higher. Website owners recognized the need to adopt SSL more broadly to combat Man-In-The-Middle (MITM) attacks, notably for securing non-transactional pages, as exemplified by Facebook, Google, Microsoft, and Twitter adoption of Always On SSL[3].

232 Million Identities Stolen

More than 232.4 million identities were exposed overall during 2011. Although not the most frequent cause of data breaches, breaches caused by hacking attacks had the greatest impact and exposed more than 187.2 million identities, the greatest number for any type of breach in 2011, according to analysis from the Norton Cybercrime Index4. The most frequent cause of data breaches (across all sectors) was theft or loss of a computer or other medium on which data is stored or transmitted, such as a USB key or a back-up medium. Theft or loss accounted for 34.3% of breaches that could lead to identities exposed.

Botnet Takedowns Reduce Spam

Volumes It isn't all bad news; the overall number of spam fell considerably in the year from 88.5% of all email in 2010 to 75.1% in 2011. This was largely thanks to law enforcement action which shut down Rustock, a massive, worldwide botnet that was responsible for sending out large amounts of spam. In 2010, Rustock was the largest spam-sending botnet in the world, and with its demise, rival botnets were seemingly unable or unwilling to take its place. At the same time, spammers are increasing their focus on social networking, URL shorteners and other technology to make spam-blocking harder.

Taken together, these changes suggest that a growing number of untargeted but high-volume malware and spam attacks is matched by an increasingly sophisticated hard core of targeted attacks, advanced persistent threats and attacks on the infrastructure of the Internet itself. Organizations should take this message to heart. They need to be successful every time against criminals, hackers and spies. The bad guys only need to be lucky once.

Safeguarding Secrets: Industrial Espionage In Cyberspace

Targeted attacks use customized malware and refined targeted social engineering to gain unauthorized access to sensitive information. This is the next evolution of social engineering, where victims are researched in advance and specifically targeted.

Cyber-Espionage In 2011

The number of targeted attacks increased dramatically during 2011 from an average of 77 per day in 2010 to 82 per day in 2011. And advanced persistent threats (APTs) attracted more public attention as the result of some well publicized incidents.

Targeted attacks use customized malware and refined targeted social engineering to gain unauthorized access to sensitive information. This is the next evolution of social engineering, where victims are researched in advance and specifically targeted. Typically, criminals use targeted attacks to steal valuable information such as customer data for financial gain. Advanced persistent threats use targeted attacks as part of a longer-term campaign of espionage, typically targeting highvalue information or systems in government and industry.

In 2010, Stuxnet grabbed headlines. It is a worm that spreads widely but carried a specialized payload designed to target systems that control and monitor industrial processes, creating suspicion that it was being used to target nuclear facilities in Iran. It showed that targeted attacks could be used to cause physical damage in the real world, making real the specter of cyber-sabotage.

In October 2011, Duqu came to light5. This is a descendent of Stuxnet. It used a zero-day exploit to install spyware that recorded keystrokes and other system information. It presages a resurgence of Stuxnet-like attacks but we have yet to see any version of Duqu built to cause cyber-sabotage.

Various long term attacks against the petroleum industry, NGOs and the chemical industry[6] also came to light in 2011. And hactivism by Anonymous, LulzSec and others dominated security news in 2011.

Advanced Persistent Threats

Advanced persistent threats (APTs) have become a buzzword used and misused by the media but they do represent a real danger. For example, a reported attack in March 2011 resulted in the theft of 24,000 files from a US defense contractor. The files related to a weapons system under development for the US Department of Defense (DOD).

Government agencies take this type of threat very seriously. For example, the US DOD has committed at least $500 (USD) million to cyber security research and development and the UK Government recently released its

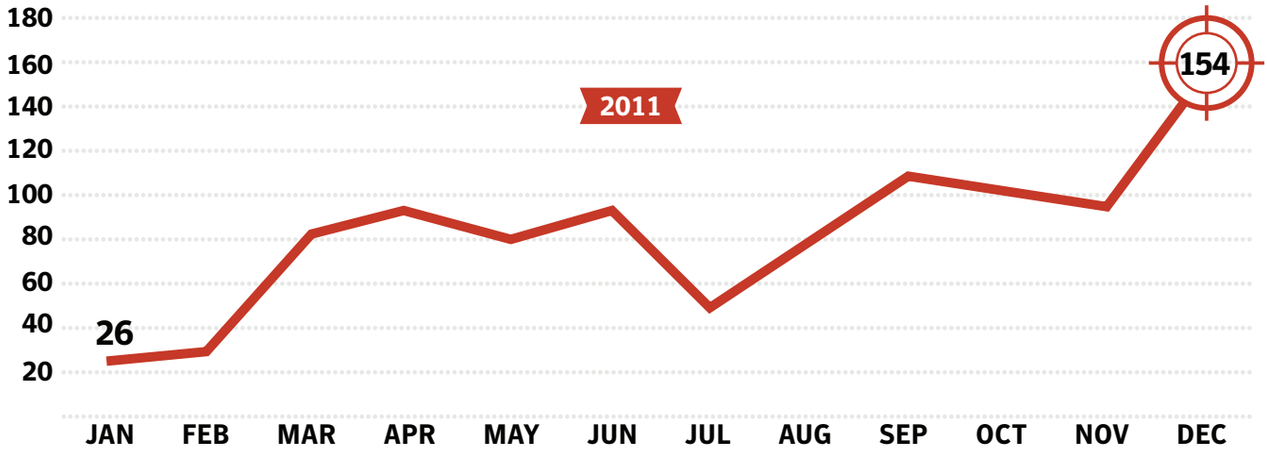


Figure 1: Targeted Attacks Trend Showing Average Number Of Attacks Identified Each Month, 2011
Source: Symantec.cloud

Cyber Security Strategy, outlining a National Cyber Security Programme of work funded by the GBP £650 million investments made to address the continuously evolving cyber risks, such as e-crime as well as threats to national security[7]. All advanced persistent threats rely on targeted attacks as their main delivery vehicle, using a variety of vectors such as drive-by-downloads, SQL injection, malware, phishing and spam.

APTs differ from conventional targeted attacks in significant ways:

1. They use highly customized tools and intrusion techniques.

2. They use stealthy, patient, persistent methods to reduce the risk of detection.

3. They aim to gather high-value, national objectives such as military, political or economic intelligence.

4. They are well-funded and well-staffed, perhaps operating with the support of military or state intelligence organizations.

5. They are more likely to target organizations of strategic importance, such as government agencies, defense contractors, high profile manufacturers, critical infrastructure operators and their partner ecosystem.

The hype surrounding APTs masks an underlying reality—these threats are, in fact, a special case within the much broader category of attacks targeted at specific organizations of all kinds. As APTs continue to appear on the threat landscape, we expect to see other cybercriminals learn new techniques from these attacks.

For example, we're already seeing polymorphic code used in mass malware attacks and we see spammers exploit social engineering on social networks. Moreover, the fact that APTs are often aimed at stealing intellectual property suggests new roles for cybercriminals as information brokers in industrial espionage schemes. While the odds of an APT affecting most organizations may be relatively low, the chances that you may be the victim of a targeted attack are, unfortunately, quite high. The best way to prepare for an APT is to ensure you are well defended against targeted attacks in general.

Targeted Attacks

Targeted attacks affect all sectors of the economy. However, two-thirds of attack campaigns focus on a single or a very limited number of organizations in a given sector and more than half focus on the defense and aerospace sector, sometimes attacking the same company in different countries at the same time. On average they used two different exploits in each campaign, sometimes using zeroday exploits to make them especially potent.

It is, however, a mistake to assume that only large companies suffer from targeted attacks. In fact, while many small business owners believe that they would never be the victim of a targeted attack, more than half were

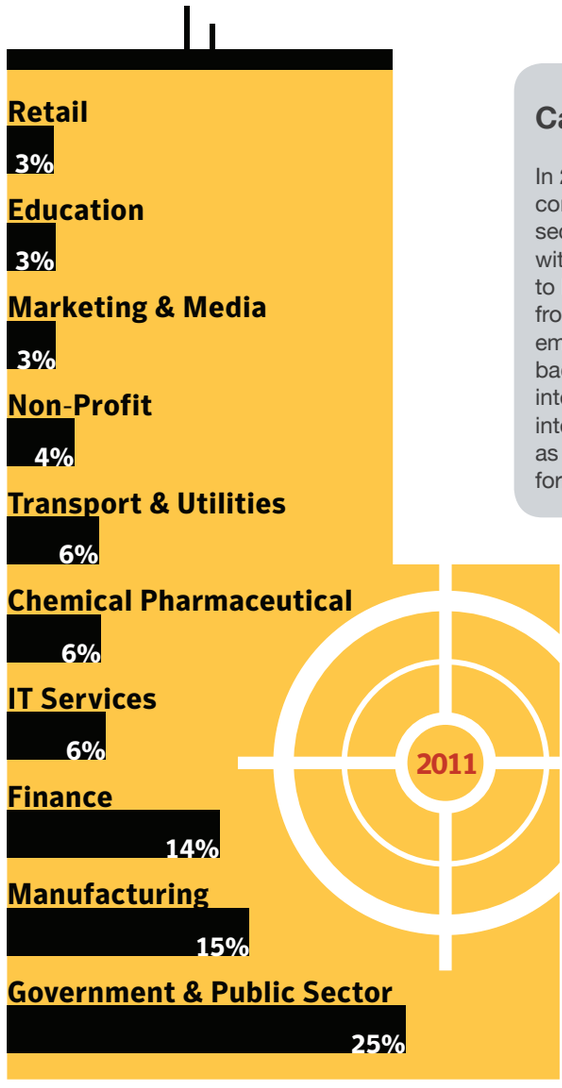


Figure 2: Targeted Email Attacks, By Top-Ten Industry Sectors, 2011
Source: Symantec.cloud

Case Study

In 2011, we saw 29 companies in the chemical sector (among others) targeted with emails that appeared to be meeting invitations from known suppliers. These emails installed a wellknown backdoor trojan with the intention of stealing valuable intellectual property such as design documents and formulas.

directed at organizations with fewer than 2,500 employees; in addition, 17.8% were directed at companies with fewer than 250 employees. It is possible that smaller companies are targeted as a stepping-stone to a larger organization because they may be in the supply chain or partner ecosystem of larger, but more well-defended companies. While 42% of the mailboxes targeted for attack are high-level executives, senior managers and people in R&D, the majority of targets were people without direct access to confidential information. For an attacker, this kind of indirect attack can be highly effective in getting a foot in the door of a well-protected organization. For example, people with HR and recruitment responsibilities are targeted 6% of the time, perhaps because they are used to getting email attachments such as CVs from strangers.

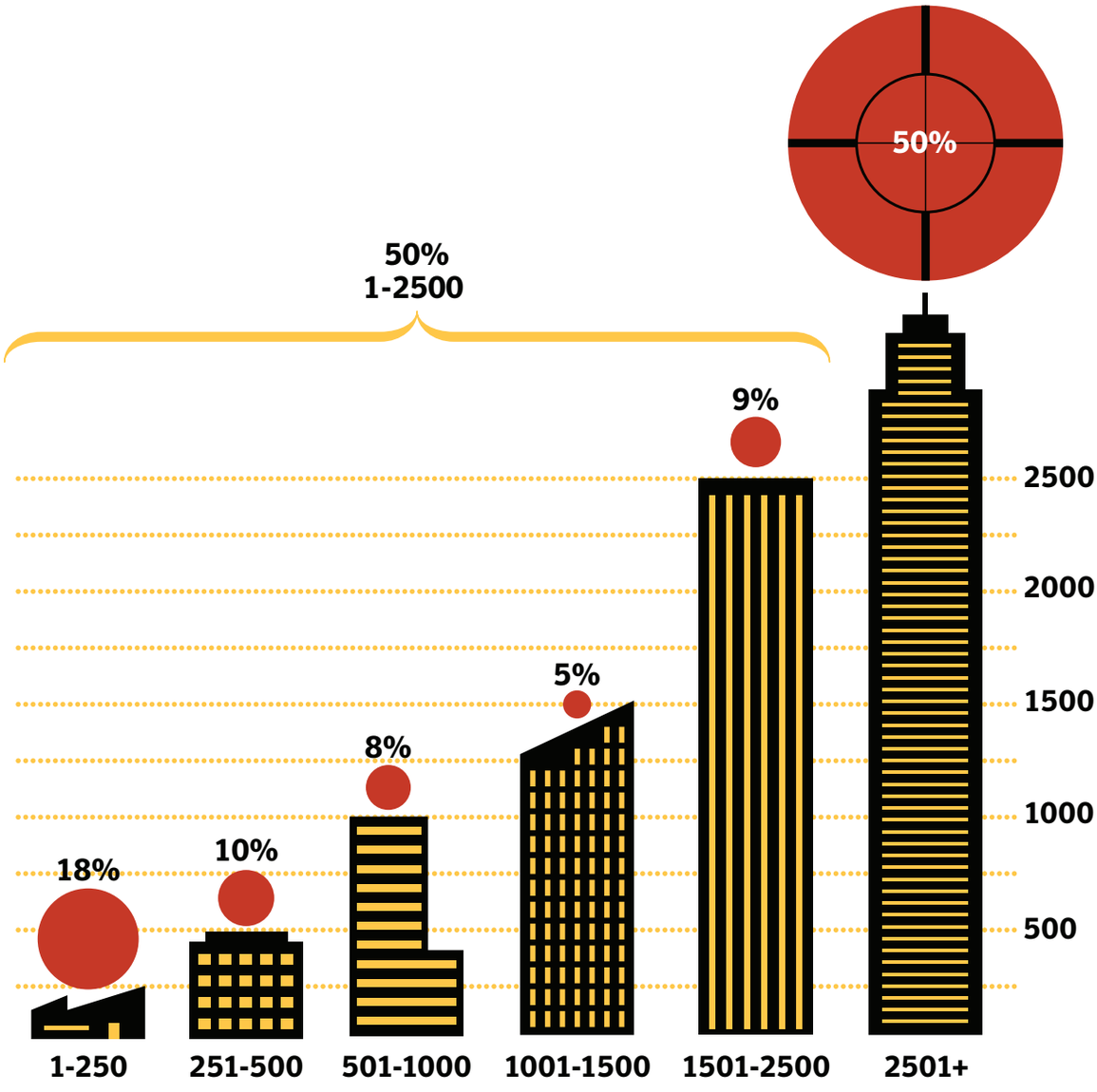


Figure 3: Attacks By Size Of Targeted Organization
Source: Symantec.cloud

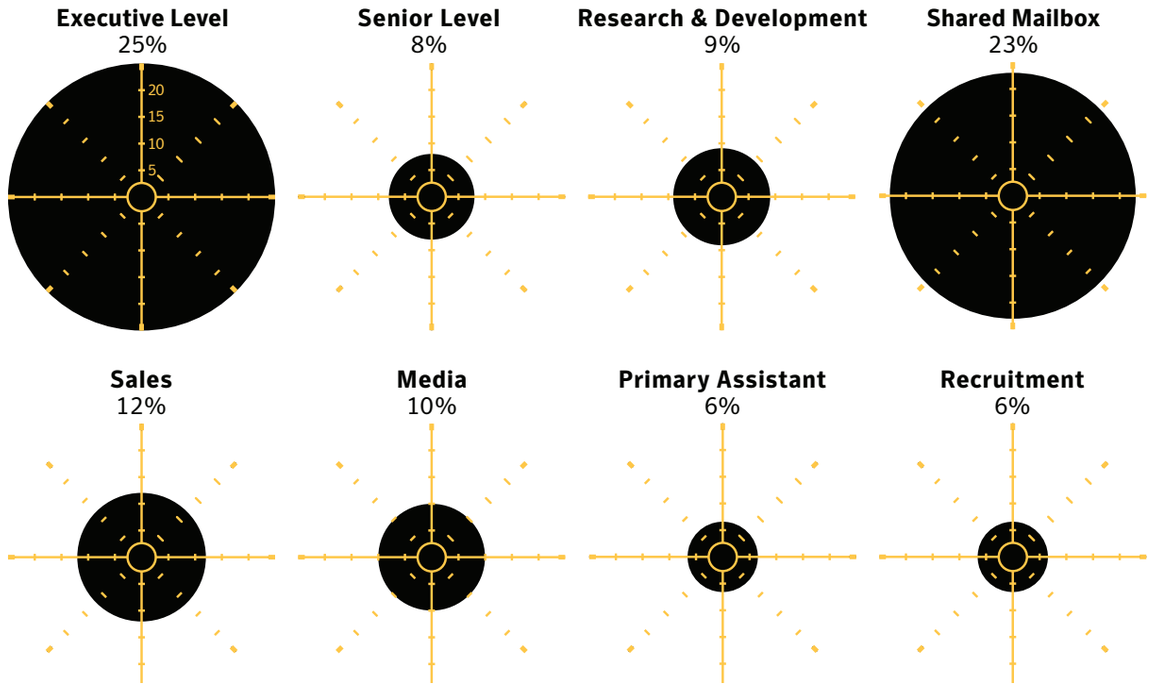


Figure 4: Analysis Of Job Functions Of Recipients Being Targeted
Source: Symantec.

Where Attacks Come From

Figure 5 represents the geographical distribution of attacking machines' IP addresses for all targeted attacks in 2011. It doesn't necessarily represent the location of the perpetrators.

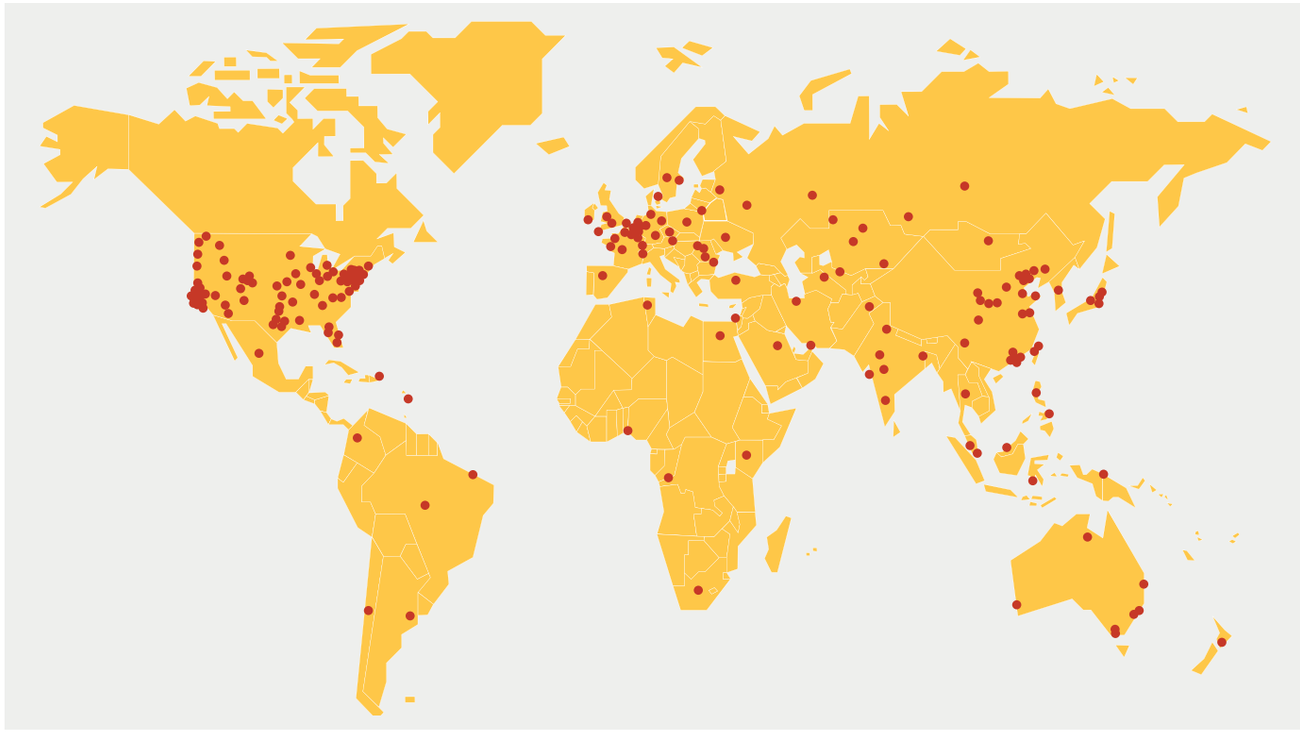


Figure 5: Geographical Locations Of Attackers' IP Addresses
Source: Symantec.

Against The Breach: Securing Trust And Data Protection

Despite the media interest around these breaches, old-fashioned theft was the most frequent cause of data breaches in 2011.

Political activism and hacking were two big themes in 2011; themes that are continuing into 2012. There were many attacks last year that received lots of media attention. Hacking can undermine institutional confidence in a company, and loss of personal data can result in damage to an organization's reputation.

Although not the most frequent cause of data breaches, hacking attacks had potentially the greatest impact and exposed more than 187.2 million identities, the greatest number for any type of breach in 2011, analysis from the Norton Cybercrime Index revealed. Despite the media interest around these breaches, old-fashioned theft was the most frequent cause of data breaches in 2011.

Data Breaches In 2011

2011 was the year of data breaches. Analysis of the industry sectors showed that companies in the Computer Software, IT and healthcare sectors accounted for 93.0% of the total number of identities stolen. It is likely that hackers perceived some of the victims as softer targets, focused on consumer markets and not information security. Theft or loss was the most frequent cause, across all sectors, accounting for 34.3%, or approximately 18.5 million identities exposed in 2011.

Worldwide, approximately 1.1 million identities were exposed per breach, mainly owing to the large number of identities breached though hacking attacks. More than 232.4 million identities were exposed overall during 2011. Deliberate breaches mainly targeted customer-related information, primarily because it can be used for fraud.

A recent study8 from the Ponemon Institute, commissioned by Symantec, looked at 36 data breaches in the UK9 and found the average per capita cost was GBP £79 and an average incident costs GBP £1.75 million in total. Similarly in the US, Ponemon examined 49 companies and found the per capita cost of a breach was USD $194 and an average incident costs USD $5.5 million in total. Echoing the Norton Cybercrime Index data above, the Ponemon study also found that negligence (36% of cases in the UK and 39% in the US) and malicious or criminal attacks (31% in the UK and 37% in the US) were the main causes. The study's findings revealed that more organizations were using data loss prevention technologies in 2011 and that fewer records were being lost, with lower levels of customer churn than in previous years. Taking steps to keep customers loyal and repair any damage to reputation and brand can help reduce the cost of a data breach.

Certificate uthorities Under Attack

Certificate Authorities (CAs), which issue SSL certificates that help encrypt and authenticate websites and other online services, saw an unprecedented number of attacks in 2011. Notable examples of attacks against CAs in 2011 included:

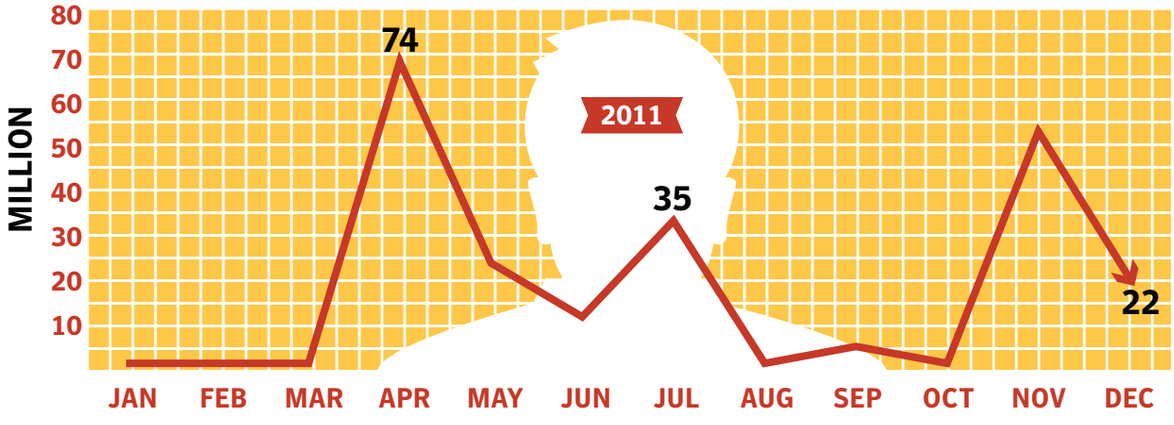


Figure 6: Timeline Of Data Breaches Showing Identities Breached In 2011
Source: Symantec

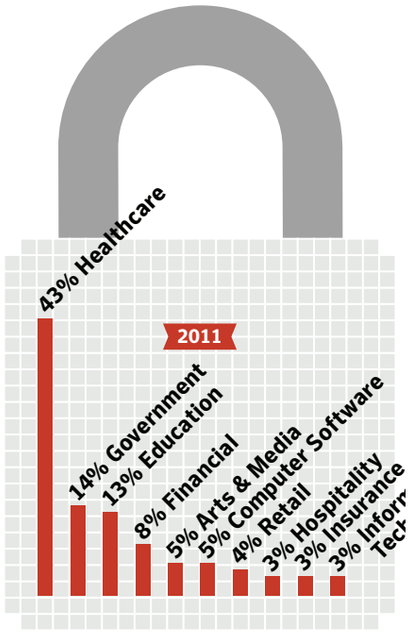


Figure 7: Top-Ten Sectors By Number Of Data Breaches, 2011
Source: Symantec

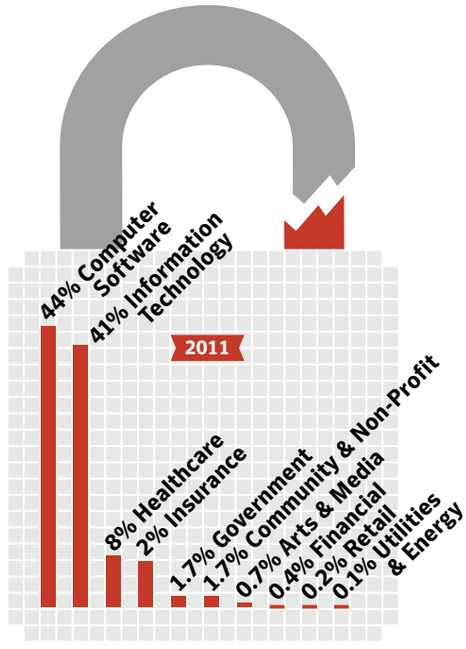


Figure 8: Top-Ten Sectors By Number Of Identities Exposed, 2011
Source: Symantec

MARCH

1. An attack compromised the access credentials of a Comodo partner in Italy and used the partner's privileges to generate fraudulent SSL certificates10.

MAY

2. It was reported that another Comodo partner was hacked: ComodoBR in Brazil11.

JUNE

3. StartCom, the CA operating StartSSL was attacked unsuccessfully in June12.

4. Diginotar was hacked in June. But no certificates were issued at first13.

JULY

5. An internal audit discovered an intrusion within DigiNotar's infrastructure indicating compromise of their cryptographic keys. Fraudulent certificates are issued as a result of the DigiNotar hack for Google, Mozilla add-ons, Microsoft Update and others14.

AUGUST

6. Fraudulent certificates from the DigiNotar compromise are discovered in the wild. Hacker (dubbed ComodoHacker) claims credit for Comodo and DigiNotar attacks and claims to have attacked other certificate authorities as well. Hacker claims to be from Iran.

SEPTEMBER

7. Security researchers demonstrate "Browser Exploit Against SSL/TLS" (BEAST for short)15, a technique to take advantage of a vulnerability in the encryption technology of TLS 1.0, a standard used by Browsers, Servers and Certificate Authorities.

8. GlobalSign attacked, although the Certificate Authority was not breached, their web server was compromised16, but nothing else17. ComodoHacker claims credit for this attack as well.

9. Dutch government and other Diginotar customers suddenly had to replace all Diginotar certificates as the major Web browser vendors removed Diginotar from their trusted root stores18.DigiNotar files for bankruptcy.

NOVEMBER

10. Digicert Sdn. Bhd. (Digicert Malaysia) an intermediate certificate authority that chained up to Entrust (and is no relation to the well-known CA, Digicert Inc.) issued certificates with weak private keys and without appropriate usage extensions or revocation information. As a result Microsoft, Google and Mozilla removed the Digicert Malaysia roots from their trusted root stores19. This was not as the result

of a hacking attack; this was a result of poor security practices by Digicert Sdn. Bhd.

These attacks have demonstrated that not all CAs are created equal. These attacks raise the stakes for Certificate Authorities and require a consistently high level of security across the industry. For business users, they underline the importance of choosing a trustworthy, well-secured Certificate Authority. Lastly, consumers should be using modern up-to-date browsers and become more diligent about checking to verify that sites they visit are using SSL issued by a major trusted CA and we have included some advice in the best practices section at the end of this report.

Building Trust And Securing The Weakest Links

Law-abiding users have a vested interest in building a secure, reliable, trustworthy Internet. The latest developments show that the battle for end-users' trust is still going on:

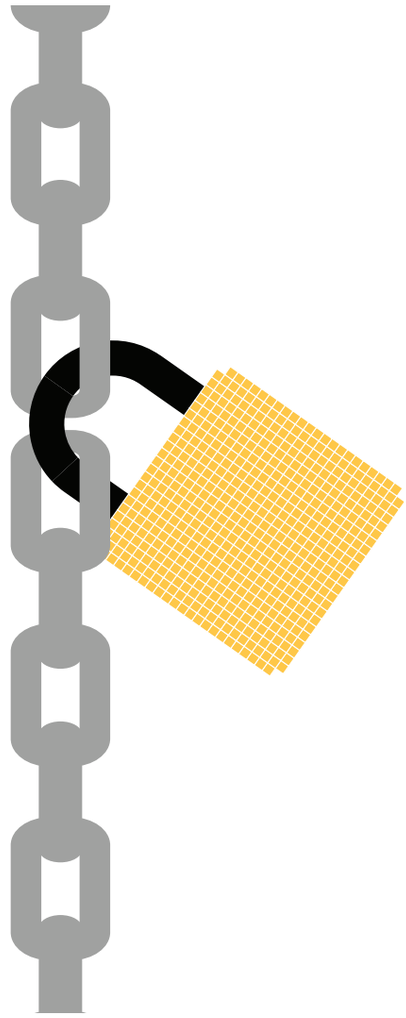
- **Always On SSL.** Online Trust Alliance20 endorses Always On SSL, a new approach to implementing SSL across a website. Companies like Facebook21, Google, PayPal, and Twitter22 are offering users the option of persistent SSL encryption and authentication across all the pages of their services (not just login pages). Not only does this mitigate man-in-themiddle attacks like Firesheep23, but it also offers end-to-end security that can help secure every Web page that visitors to the site use, not just the pages used for logging-in and for financial transactions.

- **Extended Validation SSL Certificates.** EV SSL Certificates offer the highest level of authentication and trigger browsers to give users a very visible indicator that the user is on a secured site by turning the address bar green. This is valuable protection against a range of online attacks. A Symantec sponsored consumer survey of internet shoppers in Europe, the US and Australia showed the SSL EV green bar increases the feeling of security for most (60%) shoppers24. Conversely, in a US online consumer study, 90% of respondents would not continue a transaction if they see a browser warning page, indicating the absence of a secure connection25.

- **Baseline Requirements for SSL/TLS Certificates.** The CA/Browser Forum released "Baseline Requirements for the Issuance and Management of Publicly-Trusted Certificates", the first international baseline standard for the operation of Certification Authorities (CAs) issuing SSL/TLS digital certificates natively trusted in browser software. The new baseline standard was announced in December 2011 and goes into effect July 1, 2012.

- **Code signing certificates and private key security.** High profile thefts of code signing private keys highlighted the need for companies to secure and protect their private keys if they hold digital certificates26. Stealing code signing keys enables hackers to use those certificates to digitally sign malware and that can help to make attacks using that malware much harder to recognize. That is exactly what happened with the Stuxnet and Duqu attacks.

- **DNSSEC.** This technology is gaining momentum as a method of preserving the integrity of the domain name system (DNS). However, it is not a panacea for all online security needs, it does not provide website identity authentication nor does it provide encryption. DNSSEC should be used in conjunction with Secure Sockets Layer (SSL) technology and other security mechanisms.



- **Legal requirements.** Many countries, including the EU Member States27 and the United States (46 states)28 have at least sectoral data breach notification legislation, which means that companies must notify authorities and, where appropriate, affected individuals if their data is affected by a data breach. As well as a spur to encourage other territories with less regulation, these requirements can reassure users that in the event of a breach they will be quickly notified and will be able take some action to mitigate against potential impact, including changing account passwords.

Consumerization And Mobile Computing: Balancing The Risks And Benefits In The Cloud

Over the past ten years we have seen a proliferation of mobile devices but there has not yet been a corresponding rise in mobile threats on the same level as we have seen in PC malware.

Risks With 'Bring Your Own Device'

Employees are increasingly bringing their own smartphones, tablets or laptops to work. In addition, many companies are giving employees an allowance or subsidy to buy their own computer equipment. These trends, known as 'bring your own device', present a major challenge to IT departments more used to having greater control over every device on the network. There is also the risk that a device owned by an employee might be used for non-work activity that may expose it to more malware than a device strictly used for business purposes only.

The proliferation in mobile devices in the home and in business has been fueled in large part by the growth in cloud-based services and applications, without access to the Internet many mobile devices lack a great deal of the functionality that has made them attractive in the first place.

Threats Against Mobile Devices

Over the past ten years we have seen a proliferation of mobile devices but there has not yet been a corresponding rise in mobile threats on the same level as we have seen in PC malware. If we look at how PC malware evolved, there are three factors needed before a major increase of mobile malware will occur: a widespread platform, readily accessible development tools, and sufficient attacker motivation (usually financial). The first has been fulfilled most recently with the advent of Android. Its growing market share parallels the rise in the number of mobile threats during 2011.

Unlike closed systems such as Apple's iPhone, Android is a relatively open platform. It is easier for developers, including malware writers, to write and distribute applications. In 2011, we saw malware families, such as Opfake; migrate from older platforms to Android. The latest strains of Opfake have used server-side polymorphism in order to evade traditional signature-based detection. Without a single Android marketplace for apps and central control over what is published, it is easy for malware authors to create trojans that are very similar to popular apps, although Android users must explicitly approve the set of permissions that is outlined for each app.

Currently, more than half of all Android threats collect device data or track users' activities. Almost a quarter of the mobile threats identified in 2011 were designed to send content and one of the most popular ways for phone malware authors to make money is by sending premium SMS messages from infected phones. This technique was used by 18% of mobile threats identified in 2011. Increasingly, phone malware does more than send SMS. For example, we see attacks that track the user's position with GPS and steal information.

The message that is coming through loud and clear is that the creators of these threats are getting more strategic and bolder in their efforts. People regard their phones as personal, private, intimate parts of their life and view phone attacks with alarm. The motivations for such attacks are not always monetary: in this example, it was about gathering intelligence and personal information.

Mobile threats are now employing server-side polymorphic techniques and the number of variants of mobile malware attacks is currently

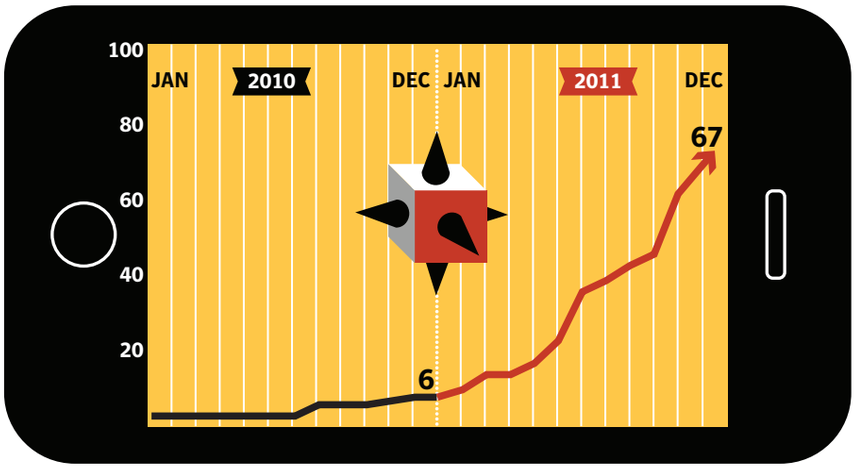


Figure 9: Total Mobile Malware Family Count 2010-2012
Source: Symantec

Quick Response (QR) Codes

QR codes have sprung up everywhere in the last couple of years. They are a way for people to convert a barcode into a Web site link using a camera app on their smartphone. It's fast, convenient and dangerous. Spammers are already using it to promote black-market pharmaceuticals and malware authors have used it to install a trojan on Android phones. In combination with link shortening, it can be very hard for users to tell in advance if a given QR code is safe or not, so consider a QR reader that can check a Web site's reputation before visiting it.

Once the bait has been taken the victim must be reeled in. The next step in these attacks fools the user into taking an action to propagate the threat, for example installing an app, downloading 'update' to your video software or clicking on a button to prove you're human. The attackers persuade their victims to infect themselves and spread the bait to everyone in their social circles.

It must be stated that this is not just a Facebook issue; variations of these threats run on all social media platforms. The number of threats on each of these platforms is directly proportional to the number of users on these sites. It is not indication of the "security" or safety of a site.

What Mobile Malware Does With Your Phone

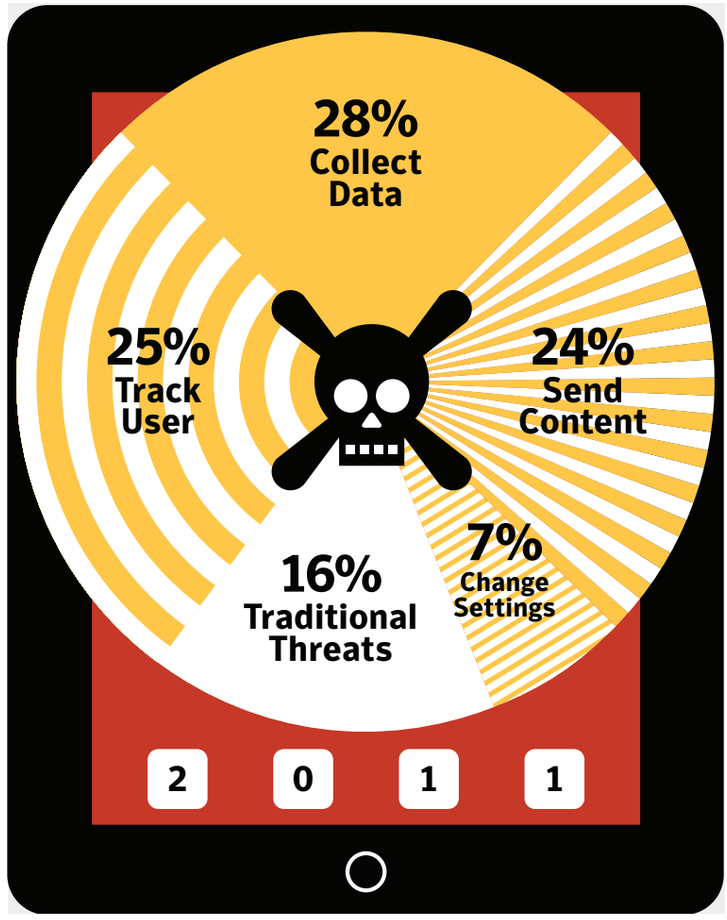


Figure 10: Key Functionality Of Mobile Risks
Source: Symantec

rising faster than the number of unique families of mobile malware. Monetization is still a key driver behind the growth in mobile malware and the current mobile technology landscape provides some malicious opportunities; however, there are none at the same revenue scale achievable in Windows, yet.

Consumerization Of IT And Cloud Computing

As more people are bringing their own devices to work, consumer technology is invading the office.. They're also using social networking sites for a variety of purposes, including marketing. And they're using cloud applications instead of company-managed software to store files or communicate.

In some cases, this is being done 'below the radar' by individual employees without the support of the company. In other cases, businesses are embracing the benefits of cloud computing, mobile working and the price/performance of consumer devices to reduce costs and improve productivity. For example, 37% of businesses globally are already adopting cloud solutions[29].

The risks of unmanaged employee adoption of cloud computing or the use of consumer devices and

consumer websites in business are clear. But even if companies deliberately choose consumerization, there are still security challenges. It makes it harder for companies to erect an impermeable boundary around the business and control exactly what is on employees' PCs and how data is stored, managed and transferred, especially when tracking how and where corporate data and information is being used.

Confidence In The Cloud: Balancing Risks

Many companies are keen to adopt cloud computing. However, it is not without its risks.

Many companies are keen to adopt cloud computing. It can reduce costs by outsourcing routine services, such as email or CRM, to third-party specialists and by swapping upfront capital expenditure with lower, more predictable per-user fees. It can also give companies access to newer and better technology without the difficulties of installing or upgrading in-house hardware. However, it is not without its risks. The first risk is unmanaged employee use of cloud services.

For example, an employee starts using a file sharing Web site to transfer large documents to clients or suppliers, or sets-up an unofficial company page or discussion forum on a popular social networking site. In fact, the tighter the IT department holds the reins, the more likely it is that employees will work around limitations using third party Web sites. The main risks involved in the use of ad-hoc cloud computing services include:

1. Security and compliance - the interfaces between users, endpoints and backend systems all need to be secure with appropriate levels of access control in place.
2. Is data encrypted as it is transferred over the internet?
3. Non-compliance with data protection regulations–for example, if the data is hosted overseas, from a European standpoint this could result in a breach of privacy legislation.
4. Lack of vendor validation – is the service reputable and secure? Can the users easily transfer their data to another vendor should the need arise?
5. Public and private cloud providers depend on system availability and strong service level agreements (SLAs) can help to promote high availability.
6. Secure access control over company data stored on third party systems. Does the service offer control over how the data is stored and how it can be accessed?
7. If the service is unavailable for any reason, the company may be unable to access its own data.
8. Are there legal risks and liabilities that may arise as a result of vendor terms and conditions? Always make sure the terms and conditions are clear and service level performance can be monitored against the agreed SLAs.

IT managers and CISOs can address these concerns by validating an approved list of cloud applications in the same way that they would authorize on-premise software. This needs to be backed-up with the appropriate acceptable usage policies, employee training and, if necessary, enforcement using Web site access control technology. In addition, where employees access consumer sites for business use, such as using social networking services for marketing, companies need to protect users against potential attacks from Web-hosted malware and spam.

Spam Activity Trends

The proportion of phishing emails varied considerably by company size with the smallest and largest companies attracting the most, but the proportion of spam was almost identical for all sizes of business.

Spam In 2011

Despite a significant drop in email spam in 2011 (dropping to an average of 75.1% of all email in 2011 compared with 88.5% in 2010), spam continues to be a chronic problem for many organizations and can be a silent-killer for smaller businesses, particularly if their email servers become overwhelmed by millions of spam emails each day.
With the power of botnets, robot networks of computers infected with malware and under the control of cybercriminals, spammers can pump out billions of spam emails every day, clogging-up company networks and slowing down communications. There were, on average, 42 billion spam messages a day in global circulation in 2011, compared with 61.6 billion in 2010.In 2011, we saw spam, phishing and 419 scams exploit political unrest (e.g. the Arab spring), the deaths of public figures (e.g. Muammar Gadhafi, Steve Jobs and Amy Winehouse) and natural disasters (e.g. the Japanese tsunami). They are the same topics that newspapers cover and for the same reasons: they attract readers' attention. Unlike spam, phishing activity continued to rise (up to 0.33% or 1 in 298.0 of all email in 2011, from 0.23% or 1 in 442.1 in 2010).

The proportion of phishing emails varied considerably by company size with the smallest and largest companies attracting the most, but the proportion of spam was almost identical for all sizes of business.

Impact Of Botnets On Spam

Overall in 2011, botnets produced approximately 81.2% of all spam in circulation, compared with 88.2% in 2010. Between March 16th and March 17th, 2011, many Rustock command and control (C&C) servers located in the US were seized and shut down by US federal law enforcement agents, resulting in an immediate drop in the global spam volume from 51 billion spam messages a day in the week before the shutdown to 31.7 billion a day in the week afterwards.

The Changing Face Of Spam

Between 2010 and 2011, pharmaceutical spam fell by 34%, in large part owing to the demise of the Rustock botnet, which was mainly used to pump-out pharmaceutical spam. In contrast, messages about watches and jewelry, and sex and dating both increased as a percentage. Not only were there fewer spam emails in circulation, but smaller message sizes were the most common and English remained the lingua franca of spam30, with Portuguese, Russian and Dutch the next most popular languages (albeit with a much smaller 'market share').

As the popularity of social networking and micro-blogging sites continues to grow, spammers increasingly target them as well as traditional email for their messages. Having your content go viral is not just the dream of legitimate marketers, but cybercriminals distributing malware and spam are also finding new ways to exploit the power of social media and are even tricking users into spreading their links for them.

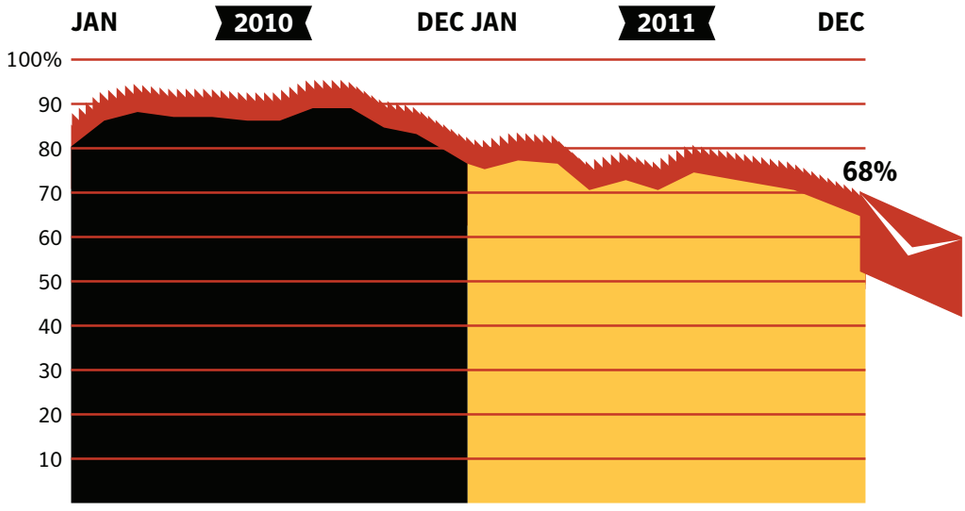


Figure 11: Percentage Of Email Identified As Spam, 2011
Source: Symantec

URL Shortening And Spam

Spammers are making greater use of URL shortening services, even establishing their own shortening services along the way. These sites take a long website address and shorten them, making them easier to share. This has many legitimate uses and is popular on social networking and micro-blogging sites. Spammers take advantage of these services to hide the true destination of links in their unwanted messages.

This makes it harder for users to know what they are clicking on and it increases the work needed for spam filtering software to check if a link in an email is legitimate or not. Spammers sometimes redirect a website address through many different shortened links. There are so many shortening services that if one gets shut down or improves security, spammers can move on to the next site.

In May 2011, the first evidence[31] of spammers using their own URL shortening services appeared, and spammers were hosting their own shortened Web sites redirecting visitors to spam Web sites. These shortened links first pass through bona fide URL shortening services, in a bid to hide the true nature of the spam URL from the legitimate shortening service.

Initially, spammer-operated link shorteners were rudimentary and based on freely-available open source tools. Spammers used these services to make it more difficult to detect and block spam activity based on the URLs involved, and further conceal the true location of the promoted sites. They generated different URLs for use in different environments, such as social networking, micro-blogging and email campaigns. Spammers also used fake profiles on Twitter to send messages containing the same shortened links, with each profile using different trending topics to promote their messages. As an added bonus, link shortening sites can give them feedback through a dashboard provided by the URL shortening service about the number of click-throughs on a given link so that they can use this information to target the messages better. In other words, they can find out what people like to click and send out more of that, increasing the effectiveness of their campaigns.

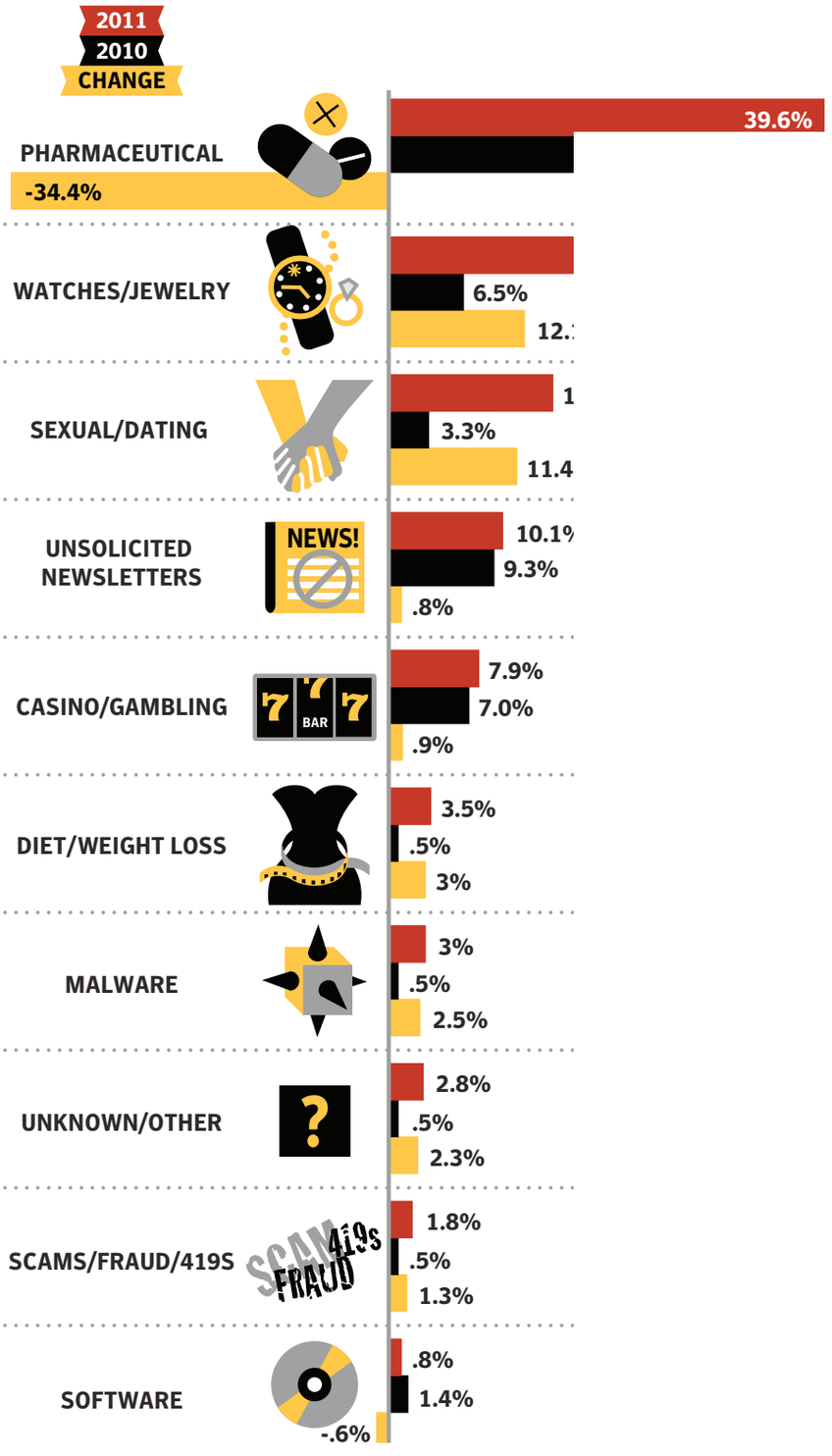


Figure 12: Top Ten Spam Email Categories, 2010-2011
Source: Symantec

Malicious Code Trends

Symantec's cloud-based technology and reputation systems can also help to identify and block new and emerging attacks that haven't been seen before, such as new targeted attacks employing previously unknown zero-day exploits.

Malware In 2011

By analyzing malicious code we can determine which threats types and attack vectors are being employed. The endpoint is often the last line of defense, but it can often be the first-line of defense against attacks that spread using USB storage devices, insecure network connections and compromised, infected websites. Symantec's cloud-based technology and reputation systems can also help to identify and block new and emerging attacks that haven't been seen before, such as new targeted attacks employing previously unknown zero-day exploits. Analysis of malware activity trends both in the cloud and at the endpoint can help to shed light on the wider nature of threats confronting businesses, especially from blended attacks and threats facing mobile workers.

Corresponding to their large internet

populations, the United States, China and India remained the top sources for overall malicious activity. The overall average proportion of attacks originating from the United States increased by one percentage point compared with 2010, while the same figure for China saw a decrease by approximately 10 percentage points compared with 2010.
The United States was the number one source of all activities, except for malicious code and spam zombies, where India took first place. Around 12.6% of bot activity originated in the USA as did 33.5% of web-based attacks, 16.7 % of network attacks and 48.5% of phishing websites.

Website Malware

Drive-by attacks continue to be a challenge for consumers and businesses. They are responsible for hundreds of millions of attempted infections every year. This happens when users visit a website that is host to malware. It can happen when they click on a link in an email or a link from social networking site or they can visit a legitimate website that has, itself, been infected.

Attackers keep changing their technique and they have become very sophisticated. Badly-spelled, implausible email has been replaced by techniques such as 'clickjacking' or 'likejacking' where a user visits a website to watch a tempting video and the attackers use that click to post a comment to all the user's friends on Facebook, thereby enticing them to click on the same malicious link.

As result, Facebook has implemented a 'Clickjacking Domain Reputation System' that has eliminated the bulk of clickjacking attacks by asking a user to confirm a Like before it posts, if the domain is considered untrusted.

Based on Norton Safe Web32 data – Symantec technology that scans the Web looking for websites hosting malware – we've determined that 61% of malicious sites are actually regular Web sites that have been compromised and infected with malicious code.

It is interesting to note that Web sites hosting adult/pornographic content are not in the top five, but ranked tenth. The full list can be seen in figure 16. Moreover, religious and ideological sites were found to have triple the average number of threats per infected site than adult/ pornographic sites. We hypothesize that this is because pornographic website owners already make money

By Category, The Top-5 Most Infected Websites Are:

1 **Blogs & Web communications**

2 **Hosting/Personal hosted sites**

3 **Business/Economy**

4 **Shopping**

5 **Education & Reference**

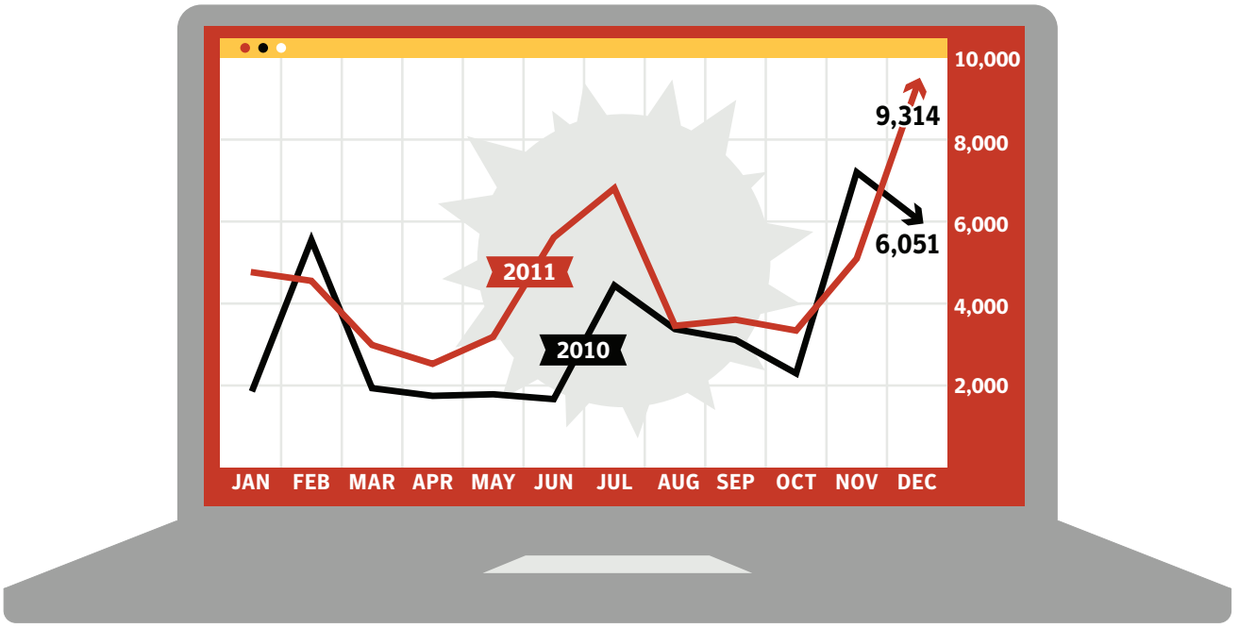


Figure 13: Average Number Of Malicious Web Sites Identified Per Day, 2011
Source: Symantec

from the internet and, as a result, have a vested interest in keeping their sites malware-free – it's not good for repeat business.

In 2011, the Symantec VeriSign website malware scanning service33 scanned over 8.2 Billion URLs for malware infection and approximately 1 in 156 unique websites were found to contain malware. Websites with vulnerabilities are more risk of malware infection and Symantec began offering its SSL customers a website vulnerability assessment scan from October 2011. Between October and the end of the year, Symantec identified that 35.8% of websites had at least one vulnerability and 25.3% had a least one critical vulnerability.

Email-Borne Malware

The number of malicious emails as a proportion of total email traffic increased in 2011. Large companies saw the greatest rise, with 1 in 205.1 emails being identified as malicious for large enterprises with more than 2,500 employees. For small to medium-sized businesses with up to 250 employees, 1 in 267.9 emails were identified as malicious.

Criminals disguise the malware hidden in many of these emails using a range of different attachment types, such as PDF files and Microsoft Office documents. Many of these data file attachments include malicious code that takes advantage of vulnerabilities in the parent applications, and at least two of these attacks have exploited zero-day vulnerabilities in Adobe Reader.

Malware authors rely on social engineering to make their infected attachments more clickable. For example, recent attacks appeared to be messages sent from well-known courier and parcel delivery companies regarding failed deliveries. In another example, emails purporting to contain attachments of scanned images sent from network-attached scanners and photocopiers. The old guidance about not clicking on unknown attachments is, unfortunately, still relevant.

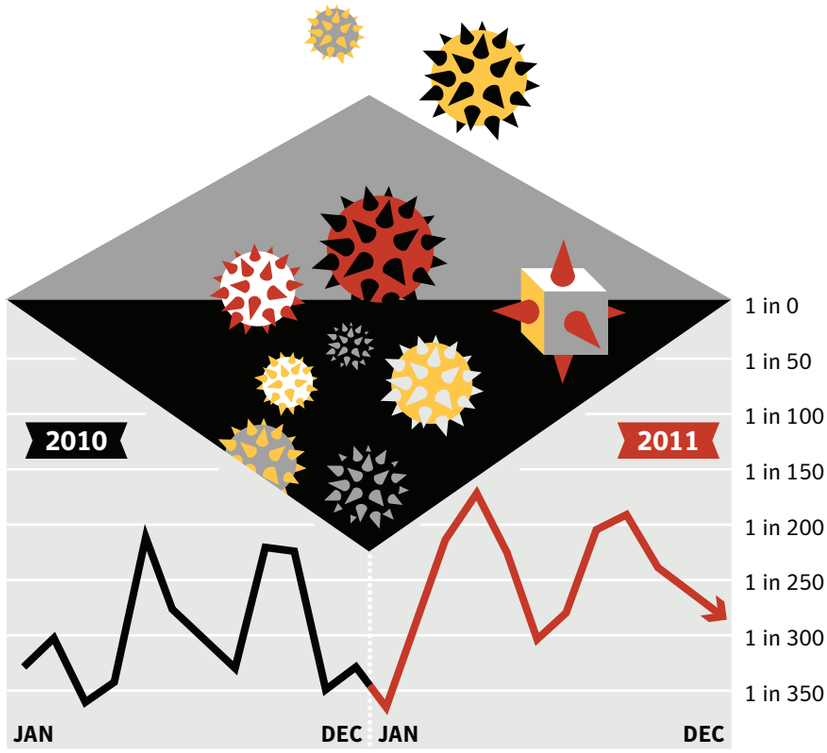


Figure 14: Ratio Of Malware In Email Traffic, 2011
Source: Symantec.clould

Moreover, further analysis revealed that 39.1% of email-borne malware comprised hyperlinks that referenced malicious code, rather than malware contained in an attachment. This is an escalation on the 23.7% figure in 2010, and a further indication that cybercriminals are attempting to circumvent security countermeasures by changing the vector of attacks from purely email-based, to using the Web.

Border Gateway Protocol (BGP) Hijacking

In 2011 we investigated34 a case where a Russian telecommunications company had had its network hijacked by a spammer. They were able to subvert a fundamental Internet technology - the Border Gateway Protocol - itself to send spam messages that appeared to come from a legitimate (but hijacked) source. Since spam filters rely, in part, on blacklists of known spam senders, this technique could allow a spammer to bypass them. Over the course of the year, we found a number of cases like this. Even though this phenomenon remains marginal at this time, compared to spam sent from large botnets, it is one to watch in the coming year.

Polymorphic Threats

Polymorphic malware or specifically, "server-side" polymorphism is the latest escalation in the arms race between malware authors and vendors of scanning software. The polymorphic technique works by constantly varying the internal structure or content of a piece of malware. This makes it much more challenging for traditional pattern-matching based antimalware to

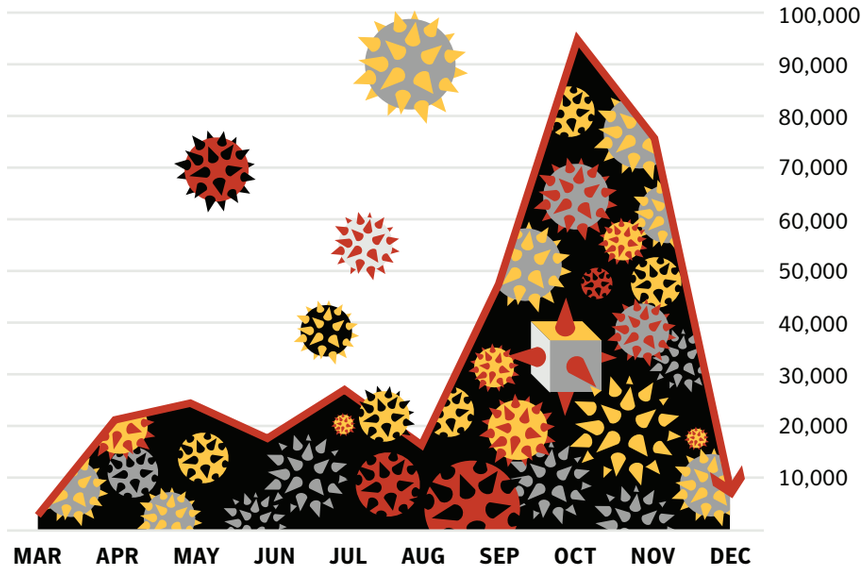


Figure 15: Rise In Email-Borne Bredolab Polymorphic Malware Attacks Per Month, 2011
Source: Symantec.clould

detect. For example, by performing this function on a Web server, or in the cloud, an attacker can generate a unique version of the malware for each attack.

In 2011, the Symantec.cloud email scanner frequently identified a polymorphic threat, Trojan.Bredolab, in large volumes. It accounted for 7.5% of all email malware blocked, equivalent to approximately 35 million potential attacks throughout the whole year. It used a range of techniques for stealth including server-side polymorphism, customized packers, and encrypted communications. Figure 15 below, illustrates this rise in Bredolab polymorphic malware threats being identified using cloud-based technology. This chart shows detection for emails that contained a document-style attachment purporting to be an invoice or a receipt, and prompting the user to open the attachment.

Exploiting The Web: Attack Toolkits, Rootkits And Social

Networking Threats Attack toolkits, which allow criminals to create new malware and assemble an entire attack without having to write the software from scratch, account for nearly two-thirds (61%) of all threat activity on malicious websites. As these kits become more widespread, robust and easier to use, this number is expected to climb. New exploits are quickly incorporated into attack kits. Each new toolkit version released during the year is accompanied with increased malicious Web attack activity. As a new version emerges that incorporates new exploit functionality, we see an increased use of it in the wild, making as much use of the new exploits until potential victims have patched their systems. For example, the number of attacks using the Blackhole toolkit, which was very active in 2010, dropped to a few hundred attacks per day in the middle of 2011, but re-emerged with newer versions generating hundreds of thousands of infection attempts per day towards the end of the year.

On average, attack toolkits contain around 10 different exploits, mostly focusing on browser independent plug-in vulnerabilities like Adobe Flash Player, Adobe Reader and Java. Popular kits can be updated every few days and each update may trigger a wave of new attacks.

They are relatively easy to find and sold on the underground black market and web forums. Prices range from $40 to $4,000.

Attackers Are Using Web Attack Toolkits In Two Main Ways:

1. **Targeted attacks.** The attacker selects a type of user he would like to target. The toolkit creates emails, IMs, blog posts to entice the target audience to the infected content. Typically, this will be a link to a malicious website that will install the malware on the victim's system.

2. **Broadcast attacks.** The attacker starts by targeting a broad range of websites using SQL injection, web software, or server exploitation. The objective is to insert a link from an infected website to a malicious site that will infect visitors. Once successful, each subsequent visitor will be attacked.

Rootkits

A rootkit is software that enables continued privileged access to a computer while actively hiding its presence from administrators by subverting standard operating system functionality. Rootkits have been around for some time—the Brain virus was the first identified rootkit to employ these techniques on the PC platform in 1986—and they have increased in sophistication and complexity since then.

Rootkits represent a small percentage of attacks but they are a growing problem and, because they are deeply hidden, they can be difficult to detect and remove. The current frontrunners in the rootkit arena are Tidserv, Mebratix, and Mebroot. These samples all modify the master boot

Dangerous Web Sites

Rank	Top-10 Most Frequently Exploited Categories Of Web Sites	% Of Total Number Of Infected Web Sites
1	Blogs/Web Communications	19.8%
2	Hosting/Personal hosted sites	15.6%
3	Business/ Economy	10.0%
4	Shopping	7.7%
5	Education/ Reference	6.9%
6	Technology Computer & Internet	6.9%
7	Entertainment & Music	3.8%
8	Automotive	3.8%
9	Health & Medicine	2.7%
10	Pornography	2.4%

Figure 16: Most Dangerous Web Site Categories, 2011
Source: Symantec

Macs Are Not Immune

The first known Mac-based bot network emerged in 2009 and 2011 saw a number of new threats emerge for Mac OS X, including trojans like MacDefender, a fake anti-virus program. It looks convincing and it installs without requiring admin permission first. Mac users are exposed to sites that push trojans by means of SEO poisoning and social networking. In May 2011, Symantec found a malware kit for Mac (Weyland-Yutani BOT) the first of its kind to attack the Mac OS X platform, and Web injections as a means of attack. While this type of crime kit is common on the Windows platform, this new Mac kit is being marketed as the first of its kind35. In addition, many attack tools have become cross-platform, exploiting Java exploits whether they are on Macs or Windows PCs. As a result of these trends, Mac users need to be more mindful of security risks and can't afford to assume that they are automatically immune from all threats.

Figure 17: Macdefender Trojan Screenshot
Source: Symantec

record (MBR) on Windows computers in order to gain control of the computer before the operating system is loaded. Variants of Downadup (aka Conficker), Zbot (aka ZeuS), as well as Stuxnet all use rootkit techniques to varying degrees.

As malicious code becomes more sophisticated it is likely that they will increasingly turn to rootkit techniques to evade detection and hinder removal. As users become more aware of malicious code that steals confidential information and competition among attackers increases, it is likely that more threats will incorporate rootkit techniques to thwart security software.

Social Media Threats

With hundreds of millions of people on social networking sites, it is inevitable that online criminals would attack them there. A social medium is perfect for social engineering: it's easier to fool someone when they think they're surrounded by friends. More than half of all attacks identified on social networking Web sites were related to malware hosted on compromised Blogs/Web Communications Web sites. This is where a hyperlink for a compromised Web site was shared on a social network. It is also increasingly used for sending spam messages for the same reasons.

All social media platforms are being exploited and in many different ways. But Facebook, as the most popular, provides some excellent examples on how social engineering flourishes in social media. Criminals take advantage of people's needs and expectations. For example, Facebook doesn't provide a 'dislike' button or the ability to see who has viewed your profile, so criminals have exploited both concepts.

Closing The Window Of Vulnerability: Exploits And Zero-Day Attacks

A vulnerability is a weakness, such as a coding error or design flaw that allows an attacker to compromise availability, confidentiality, or integrity of a computer system. Early detection and responsible reporting helps to reduce the risk that a vulnerability might be exploited before it is repaired.

Number Of Vulnerabilities

We identified 4,989 new vulnerabilities in 2011, compared to 6,253 the year before. (See Appendix D for more historical data and details on our methodology.) Despite this decline, the general trend over time is still upward and Symantec discovered approximately 95 new vulnerabilities per week.

Weaknesses in Critical Infrastructure Systems

SCADA systems (Supervisory Control and Data Acquisition) are widely used in industry and utilities such as power stations for monitoring and control. We saw a dramatic increase in the number of publicly-reported SCADA vulnerabilities from 15 in 2010 to 129 in 2011. Since the emergence of the Stuxnet worm in 201036, SCADA systems have attracted wider attention from security researchers. However, 93 of the 129 new published vulnerabilities were the product of just one security researcher.

Old Vulnerabilities Are Still Under Attack

On PCs, a four-year old vulnerability37 in many Microsoft operating systems was, by far, the most frequently attacked vulnerability in 2011, clocking in at over 61 million attacks against the Microsoft Windows RPC component38. It was more heavily attacked than the next four vulnerabilities put together[39].

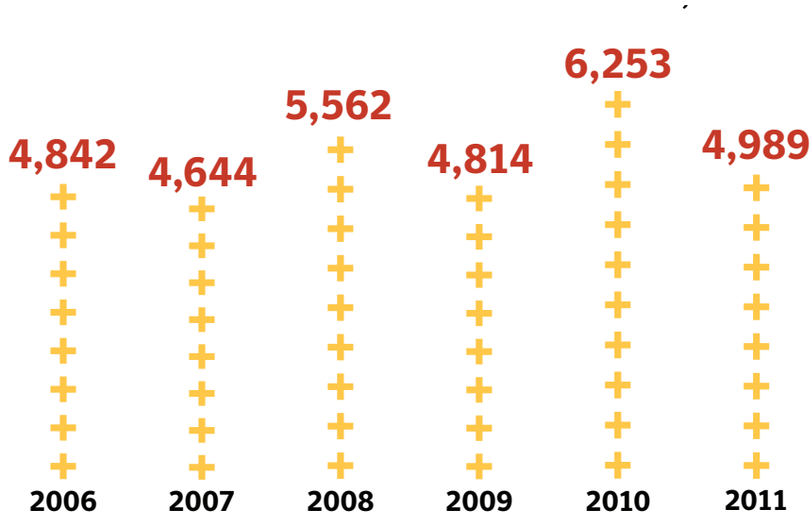


Figure 18: Total Number Of Vulnerabilities Identified, 2006-2011
Source: Symantec

The most commonly exploited data file format in 2011 was PDF. For example, one PDF-related vulnerability attracted more than a million attacks in 2011. Patches are available for all five of the most-attacked vulnerabilities, so why do criminals still target them? There are several explanations.

1. They are cheaper to attack. Criminals have to pay a premium on black market exchanges40 for information about newer vulnerabilities but they can buy malware off the shelf to target old ones.

2. Attacking newer vulnerabilities may attract more attention than going after older, well-known weaknesses. Some online criminals prefer a lower profile.

3. There is a still a large pool of potential victims because a proportion of the user base can't, won't or don't install patches or install a current and active endpoint security product.

Web Browser Vulnerabilities

Web browsers are a popular target for criminals and they exploit vulnerabilities in browsers such as Internet Explorer, Firefox or Chrome as well as plugins such as PDF readers. Criminals can buy toolkits for between USD $100 and USD $1,000 that will check up to 25 different vulnerabilities when someone visits an infected Web site.

In 2011, we saw a big drop off in reported vulnerabilities in all the popular browsers from a total of 500 in 2010 to a total of 351 in 2011. Much of this improvement was due to a big reduction in vulnerabilities in Google Chrome. Overall, the number of vulnerabilities affecting browser plugins dropped very slightly from 346 to 308.

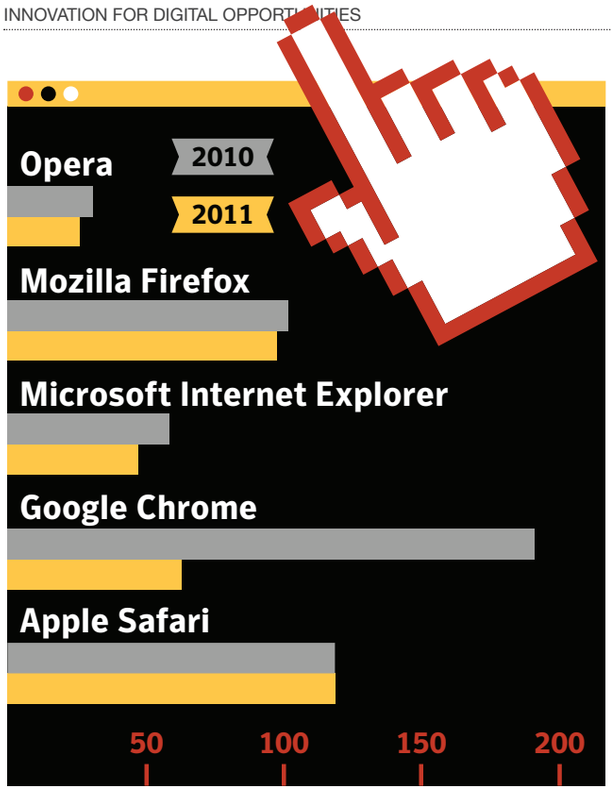


Figure 19: Browser Vulnerabilities In 2010 And 2011
Source: Symantec

New Zero-day Vulnerabilities Create Big Risks

A zero-day attack exploits an unreported vulnerability for which no vendor has released a patch. This makes them especially serious because they are much more infective. If a non-zero-day attack gets past security, it can still be thwarted by properly-patched software. Not so a zero-day attack. For example, in 2011 we saw vigorous attacks against a vulnerability41 in Adobe Reader and Adobe Acrobat that lasted for more than two weeks. It peaked at more than 500 attacks a day before Adobe released a patch on December 16, 2011. The good news is that 2011 had the lowest number of zero day vulnerabilities in the past 6 years. While the overall number of zero day vulnerabilities is down, attacks using these vulnerabilities continue to be successful which is why they are often used in targeted attacks, such as W32.Duqu.

Conclusion: What's Ahead In 2012

A wise man once said, 'Never make predictions, especially about the future'. Well, this report has looked back at 2011 but in the conclusion we'd like to take a hesitant peak into the future, projecting the trends we have seen into 2012 and beyond.

- Targeted attacks and APTs will continue to be a serious issue and the frequency and sophistication of these attacks will increase.
- Techniques and exploits developed for targeted attacks will trickle down to the broader underground economy and be used to make regular malware more dangerous.
- Malware authors and spammers will increase their use of social networking sites still further.
- The CA/Browser Forum42 will release additional security standards for companies issuing digital certificates to secure the internet trust model against possible future attacks.
- Consumerization and cloud computing will continue to

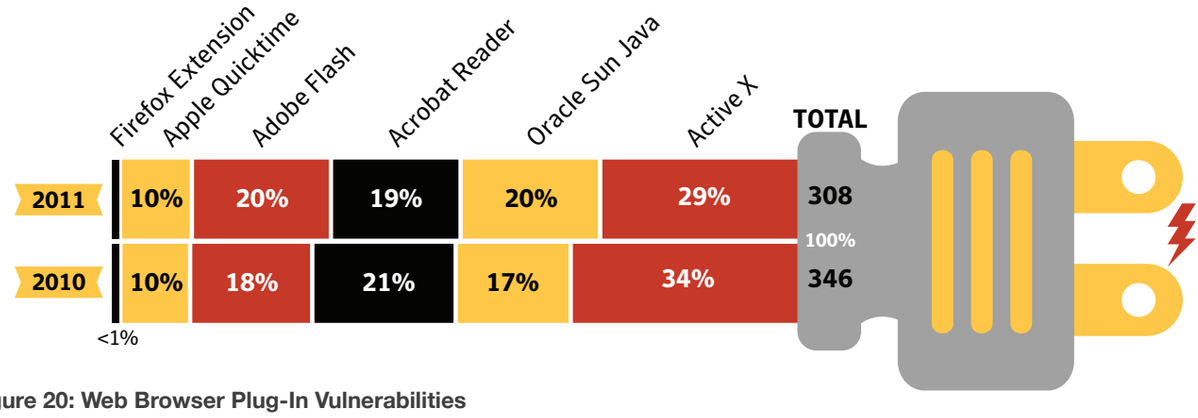


Figure 20: Web Browser Plug-In Vulnerabilities
Source: Symantec

evolve, perhaps changing the way we do business and forcing IT departments to adapt and find new ways to protect end users and corporate systems.

- Malware authors will continue to explore ways to attack mobile phones and tablets and, as they find something effective and money-making, they will exploit it ruthlessly.
- In 2011, malicious code targeting Macs was in wider circulation as Mac users were exposed to websites that were able to drop trojans. This trend is expected to continue through 2012 as attack code exploiting Macs becomes more integrated with the wider web-attack toolkits.
- While external threats will continue to multiply, the insider threat will also create headlines, as employees act intentionally – and unintentionally – to leak or steal valuable data.
- The foundation for the next Stuxnet-like APT attack may have already been laid. Indeed Duqu may have been the first tremors of a new earthquake, but it may take longer for the aftershock to reach the public domain.

Endnotes

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More Information

- **Symantec.cloud Global Threats:** *http://www.symanteccloud.com/en/gb/globalthreats/*
- **Symantec Security Response:** *http://www.symantec.com/security_response/*
- **Internet Security Threat Report Resource Page:** *http://www.symantec.com/threatreport/*
- **Norton Threat Explorer:** *http://us.norton.com/security_response/threatexplorer/*
- **Norton Cybercrime Index:** *http://us.norton.com/cybercrimeindex/*

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Symantec protects the world's information, and is the global leader in security, backup and availability solutions. Our innovative products and services protect people and information in any environment – from the smallest mobile device, to the enterprise data center, to cloud-based systems. Our industry-leading expertise in protecting data, identities and interactions gives our customers confidence in a connected world. More information is available at *www.symantec.com* or by connecting with Symantec at: *go.symantec.com/socialmedia.*

07. ESSENCE OF PERSONAL DATA PROTECTION (PDPA) ACT 2010 MALAYSIA: CHALLENGES FOR BUSINESSES

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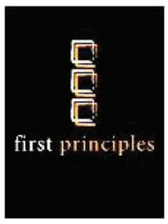

Background

The issue of data protection has been in deliberation for more than a decade in Malaysia. After a long wait, the Personal Data Protection Act 2010 (PDPA) was enacted. A similar Act is already in place in countries such as the United States, Canada, the United Kingdom, and in the rest of the European Union. In the Asia and Oceania region, countries like South Korea, Japan, Hong Kong, India, Australia and New Zealand have taken the lead in enacting a comparable Act; and countries such as Israel have also made efforts to enact such legislation, despite being a small country.

In the first quarter of 2012, the ASEAN region (Association of South East Asian Nations) has become the most active for new privacy developments. Malaysia had taken the lead in enacting the Act and should be lauded for her efforts as the Personal Data Protection Act 2010 (PDPA) was passed by the Malaysian Parliament on 5th April 2010 and has been gazetted into law on 10th June 2010.

However, implementation of the Act has yet to take place and it is expected that it will be implemented before the end of 2012. In countries like Singapore, Thailand, Indonesia and Philippines a similar Act is still a work in progress and not yet a law, but they could all be within 2012. All these acts have very different strengths and weaknesses in the protections they give to data subjects (DS), and present differing challenges for businesses.

This new legal direction is imperative not only for facilitating internal online and real time electronic activities but also across borders, both regionally and globally. The tenets of e-ASEAN Framework Agreement 2000 and the APEC Privacy Framework 2004, in which Malaysia is a signatory party, have indicated the need for developing a legal and regulatory framework for undertaking electronic transactions, interactions, communications and networking in a virtual space that knows no physical boundaries.

In essence, the e-Asean Framework entails promoting regional cooperation to develop, strengthen and enhance the competitiveness of the ICT sector; establishing an ASEAN Information Infrastructure; promoting e-commerce space including electronic payment systems; moving towards greater free flow of goods and services in cross border trade, investments and human resources; reducing digital divide within individual ASEAN Member States and amongst ASEAN Member States; and enhancing public and private sectors cooperation in realising e-ASEAN.

Similarly, APEC (Asia-Pacific Economic Cooperation) economies recognised the importance of protecting information privacy and maintaining information flow among economies in the Asia Pacific region and among their trading partners. Acknowledging the potential of electronic commerce cannot be realised without both the government's and business' cooperation, the APEC Ministers, including Malaysia, had endorsed the 1998 Blueprint for Action on Electronic Commerce. The blueprint covers details of actions for developing and implementing technologies and policies that build trust and confidence in safe, secure and reliable communication, information and delivery systems, as well as privacy.

Information and communications technologies, including mobile technologies, that link to the Internet and other information networks have made it possible to collect, store and access information from anywhere in the world. These technologies offer great opportunities for increased consumer choice, market expansion, productivity, education and product innovation, not only for business sectors but also for individuals and governments. While these technologies make it easier and cheaper to collect, link and use large quantities of information, they also often make these activities undetectable to individuals. Consequently, it can be more difficult for individuals to retain a measure of control over their personal information. As a result, individuals have become concerned about the harmful consequences that may arise from the misuse of their information.

There is a need to promote and enforce ethical and trustworthy information practices in both on- and off-line contexts to bolster the confidence of individuals and businesses. Thus, data protection is not only imperative for businesses and governments but also the individuals who are an integral part of the whole socio-economic and business systems. Before the data protection essence can be made regional or global it is crucial for individual countries to enact the personal data protection act.

As indicated earlier, at this stage many countries are at different stages of development and some countries are still grappling with the notion of personal data protection for its citizens. Malaysia, being one of early players, could provide global leadership in data protection dimensions by going ahead in implementing the Act by appointing a Personal Data Protection Commissioner. With this, Malaysian can lead the way in this arena as it is also in the process of amending the Evidence Act to strength the enforceability of abuse of personal data via the Internet.

In addition, ASEAN member countries have agreed to develop 'best practices/guidelines' on data protection by 2015, as part of their commitment to establish an integrated ASEAN Economic Community

(AEC) by 2015. As such, this is an area to watch out for. This article expounds the essence of Personal Data Protection Act 2010 as enacted in Malaysia.

Highlights of the PDPA

Personal data protection must be perceived as a basic right of the individual that deserves the full protection of the law. In a fully connected world where huge amounts of information is collected, manipulated, used and shared, this is of paramount importance and has prompted many countries, including Malaysia, to regulate such processing. Data protection in Malaysia, thus far, has been piecemeal and generally self-regulated. However, in keeping with international practice, the Government has decided to regulate the processing of personal data via the PDPA 2010.

The PDPA was passed by Malaysian Parliament on 5th April 2010 and was gazetted into law on 10th June 2010. It is expected to come into force by end of 2012. It applies to all sectors of the economy including healthcare, financial services, telecommunications, motoring, property, retail, including human resource departments and other organisations that are engaged in commercial transactions and that process personal data of individuals, but excludes the Federal and the State Governments.

The PDPA is a compliance statute and requires companies to be compliant within three (3) months of the Act coming into force. In this Act, non-compliance will attract criminal sanctions for the Company and also for Senior Management.

Under the PDPA, "Personal Data" ("PD") means any information in respect of commercial transactions, which:

a. is processed wholly or partly by means of equipment operating automatically in response to instructions given for that purpose;

b. is recorded with the intention that it should wholly or partly be processed by means of such equipment; or

c. Is recorded as part of a relevant filing system or with the intention that it should form part of a relevant filing system,

that relates directly or indirectly to a data subject (DS), who is identified or identifiable from that information or from that and other information in the possession of a data user. 'Sensitive personal data' ("SPD") means any PD consisting of information as to the physical or mental health or condition of a DS, his political opinions, his religious beliefs or other beliefs of a similar nature, the commission or alleged commission by him of any offence or any other PD as the Minister may determine by order published in the Gazette.

The key elements of the PDPA are:

- The Act will apply to any person who processes, has control or authorises the processing of PD (this includes all the companies that collect personal data)

- The purpose of information gathering is to ascertain the extent of the "processing" of PD by the companies from the time it is collected until it is destroyed.

- "Processing" in the PDPA means, "collecting, recording, holding, storing and carrying out any operation with that PD like organisation, adaptation, retrieval, use, disclosure, transmission, transfer, correction, erasure or destruction".

- The obligation towards the DS commences with the initial collection of PD and ends when the PD is finally destroyed. Everything that is done in between with the PD requires compliance with the Act in accordance with the 7 DP Principles (see next point).

- The Act sets out 7 Personal Data Protection Principles ("DP Principles") that essentially govern the conduct of Data Users ("DU") in the way they process PD of Data Subjects ("DS"). The principles acknowledge the reality that different businesses may process PD differently and each will have to adapt and comply with the principles accordingly.

- The 7 DP Principles are:

No	Data Protection Principles	What the Data Protection Principles cover.
1	General Principle	Consent of DS is required to process PD. SPD – explicit consent is required
2	Notice & Choice Principle	DU must give Notice to DS of the processing, description of PD, purpose for which PD is processed, source of PD and right to request access by DS, 3rd parties to whom DU will disclose PD, choices the DS has to limit the processing and whether it is obligatory or voluntary for the DS to supply the PD.
3	Disclosure Principle	DU shall not disclose PD without consent of DS for any purpose other than the purpose for which it was first collected or for a purpose related to the original purpose.
4	Security Principle	DU must take practical steps to protect PD (whether stored in IT Systems as a soft copy or stored elsewhere as a hard copy) from any loss, misuse, modification, unauthorised or accidental access or disclosure, alteration or destruction.
5	Retention Principle	PD should not be kept longer than necessary for the fulfilment of the purpose for which it was collected. DU must destroy the PD after purpose is met.
6	Data Integrity Principle	DU must ensure the PD processed is accurate, complete, not misleading and up-to-date having regard to the purpose for which it was collected and processed.
7	Access Principle	DS must be given access to own PD held by the DU and be able to correct his PD if it is inaccurate, incomplete, misleading or not up-to-date

- The Processing of PD is defined to encompass all activities dealing with PD from the time of first collection until it is finally destroyed.

- Data Subjects have been given extensive rights with respect to their PD under the PDPA (which includes access to their PD held by the DU, ability to correct their PD, requirement for consent before it is processed, right to notice, right to stop processing of PD, etc.)

A Personal Data Protection Commissioner, who has extensive powers to hear complaints, inspect, investigate and prosecute where necessary for any breaches of the PDPA, will administer the PDPA.

What will be the implications to companies?

Personal data falls under the ambit of the PDPA and so all concerned including but not limited to customers, employers and employees need to be equally aware of their rights and obligations under this important Act. Typically, Human Resource Departments (HRD) would have fairly detailed policies and procedures on processing employee personal data (PD) as employee data is usually treated with a certain amount of confidentiality. However customer data may not be equally treated with the same level of confidentiality. Thus, all these would have to be reviewed to ensure compliance with the PDPA. But its benefits extend to beyond mere compliance with legislation, as good data protection is good practice.

What needs to be done by respective companies?

A quick look at the key action areas will give a broad idea of the work involved, which will vary depending on the size and complexities of different companies and different business. Firstly, the companies must chart the flow of PD throughout the organisation to identify including:

- ways PD is the collected in the company
- what type of PD is collected
- how PD is recorded, used and stored
- who has access to the PD
- what are the current PD security policies
- transfer and use of the PD to group companies within and without Malaysia
- what kinds of disclosure is made to third parties e.g. insurance companies, regulatory authorities, the reasons for such disclosure and what safeguards are extracted from 3rd parties
- whether access to PD is provided to data subjects i.e. customers and/or employees
- how long is PD retained and how it is destroyed

This would only be the start of the compliance process to ascertain gaps and inconsistencies in the adequacy and existence of controls and procedures to align with the requirements of the PDPA. Changes would have been made to address these risks. Then, it would be ideal

to move on to the formulation of a PDP Policy, which should include the following areas:

- For companies - the points of collection, storage, security, access and correction, disclosure, retention and destruction.

- For the Human Resource Department - Recruitment and Selection (e.g. advertising, head-hunters, written and online applications, verification and vetting, referees, medical examination, short-listing and interview, contract of employment)

- In the course of Retention of customer and employee PD (e.g. security, access and correction, disclosure to third parties, insurance, medical records, performance evaluation, monitoring at work, disciplinary action)

- In the case of Employee PD - Dismissal or Cessation of Employment (e.g. legal action, tax authorities, retention/destruction of employee PD, information to potential employers)

Of course, training of all management and employees would then have to take place to ensure all in the company are on board with the new policy.

Why comply with PDPA?

Aside from legal compliance, good personal data protection practices will increase your customers' as well as employees' trust in the company, protect the company from legal action, bring awareness to employees to also treat customers data with equal respect, prevent misuse of personal data by employees, save costs and exposure from keeping unnecessary and out-of-date data and keep your company/organisation in par with international standards.

Organisational Training and Education

The PDPA is applicable to all sectors including but not limited to healthcare, banking, insurance, telecommunications, retail and education where huge amount of data is collected from individuals and their compliance with PDPA has become critical.

At the same time, it is also reckoned that different industries have different imperatives and issues, which require special focus and treatment to comply with the seven principles set out in the Act. As it is a new area of law that is not so much prescriptive but principles based, thus advice provided must be suitable and cost effective for a particular industry.

It is also crucial that employee data must be treated separately from customer/consumer data with the Human Resource Department (HRD) having its own assessment, reports and training as well as customer and human resource processes and operational issues involved.

Therefore, a modular approach which seeks to set in place a systematic process for PDPA compliance as well as educate the employees on their rights and obligations under the Act as well as the customers' rights and obligations is vital. The five recommended modules are:

Module I - Awareness Training
Module II - Initial Risk Assessment
Module III - Risk Assessment Workshops and Formulation of PDP Policy
Module IV - Implementation of PDP Policy and Compliance Training
Module V - Compliance Audit

Private sector consultants like First Principles Sdn Bhd have found the proposed approach practical and workable with various types of industry clients as the modules provide the requisite flexibility in tailoring the modules to the customer needs, timing and budget.

It is also very encouraging to see the positive response of industries in Malaysia as many companies have taken steps to carry out a compliance audit of their systems in anticipation of its implementation.

This may not only be due to the three (3) month period provided in the Act for compliance but the awareness that it is basically good business practise and hence good to implement regardless of the PDPA's implementation.

08. EMBRACING THE CONSUMERIZATION OF IT TO ENABLE WORKPLACE TRANSFORMATION

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Preamble

The definition of how Malaysians work is changing, and the boundaries between professional and personal lives are being redefined. Today's IT-savvy Malaysians no longer work only within their offices, but often check e-mail late at night and update personal Web sites during the day. The office computer is accompanied by portable computers, slates, and smartphones. These myriad of devices provide seamless and ubiquitous access to big data, social computing and popular cloud computing applications such as Facebook, Twitter, Hotmail and others. It is not surprising that employees today expect and demand the freedom to use their own devices (BYOD) as well as familiar subscribed services anytime and anywhere to be productive.

Consumerization of IT is an increasingly accepted term describing this growing tendency for the use of consumer devices and services in the workplace. For many, such consumer devices and services appear to represent the future of computing that empowers them to do their job more efficiently. For the younger Malaysians who grew up in this modern digital world, this provides them most natural environment for them to work in.

Hence, one of the challenges faced by CIOs in Malaysia today is the need to address the wide range of needs and expectations of the modern workforce, while meeting the security and manageability requirements of the organization. This article provides some ideas and insights on how technology innovation can help transform the workplace and meet these challenges.

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1. Executive Summary

The definition of how we work is changing, and the boundaries between professional and personal lives are being redefined. Users no longer work only within their offices, but often check e-mail late at night and update personal Web sites during the day. The office computer is accompanied by portable computers, slates, and smartphones. Computing power is now available across a wide range of devices. Consumer devices such as smartphones and slates are now becoming powerful enough to be able to run the types of applications that were traditionally restricted to desktop and portable computers. For many workers, such consumer devices appear to represent the future of computing and empower them to do their job more efficiently. The highly managed IT infrastructure within most enterprises can seem to be a cumbersome and restrictive environment, and does not provide much flexibility.

There are so many choices available to consumers that members of the workforce prefer to use their own device at work and pressure IT to support their growing need to stay productive and competitive. The challenge for IT is to be able to embrace consumerization where it is appropriate, while at the same time minimizing risks to the enterprise and to its data. Many newer devices were not initially designed for enterprise use, and careful planning is required to enable the level of management and control that most enterprises require.

As a leader in business and consumer technologies, Microsoft is in a unique position to understand and provide guidance on how best to embrace consumerization responsibly within enterprises.

2. What is the Consumerization Imperative?

Consumerization is the growing trend where users are making the ultimate choice in what devices, applications, and services they use to get their work done.

2.1 New Workplace Expectations

The workplace environment is changing, due in no small part to advances in mobile devices and remote working technologies. Many workers are spending time working away from the office, perhaps working at home for part of the week, increasingly blurring work-life boundaries.

Many workers are now using their own devices and have the flexibility to work "out of hours," so there is great potential to improve user productivity, such as during a commute. Technology enthusiasts can be demotivated if they are expected to use older devices that have restrictive software, applications, and network access policies, when they are at work.

Recent studies have confirmed this trend. For example, an IDC study that Unisys commissioned found that 40 percent of the time that users spend on their home computer is actually for work. In addition, 50 percent of the time that users spend on their smartphone is also related to work .

2.2 Opportunities and Challenges Ahead

Consumerization is the growing trend where users are making the ultimate choice in what devices, applications, and services they use to get their work done.

By embracing the workforce and empowering it with the latest and greatest technologies, IT can help businesses unleash productivity, reduce costs, and stay competitive. In fact, in a recent study, 83 percent of IT decision-makers characterized the effect of consumerization as mostly positive .

However, embracing consumerization is not an easy task and needs deliberate planning from IT. Companies should evaluate how to ensure productivity anywhere, while still protecting data, maintaining compliance, and enabling adequate PC and device management. This all puts pressure on IT to provide compelling solutions for end users while maintaining a secure and well-managed environment.

Examples of such opportunities and challenges can be found in hospitals. Hospitals are major consumers and creators of personal data, and medical staff need access to this data wherever they are on the hospital site. This data access is often provided by mobile data carts, and there is increasing pressure on IT to enable medical staff to use more mobile devices.

However, privacy and security requirements, such those contained in the Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health Act (HITECH), pose special challenges, particularly mobile devices may provide access to data about patients.

3. Factors for Success

There are several key factors that should be addressed so that unmanaged consumer devices can be successfully used within the workplace:

1. **Assess and understand your users.** The first phase involves assessing what consumer-grade applications and devices your employees are using at work today. It will also be helpful to create a profile of your end users and the typical scenarios that they encounter. Depending on the user impact on the business and the needs of users, you may have a different level of tolerance for their use of consumer technologies and a different pace and approach for how to embrace consumerization for different user types in your company.

   The recent Smart Workforce Segmentation Helps You Better Identify and Meet Worker Needs Study , which Microsoft commissioned and Forrester Consulting conducted, can be used as an example to evaluate how other midsize-to-large organizations are distributing technology, what drives these decisions, and how it affects the business.

2. **Assess and understand content and information sensitivity.** Users, and the content that they consume and generate, vary in their level of information sensitivity. For example, some users may deal with sensitive legal issues, whereas others may deal with information that is intended for a public readership. Similarly, some data, such as sales contracts, is highly sensitive and should be kept within securely managed storage. Alternatively, other data, such as marketing brochures, can be shared using consumer technologies such as Windows Live® SkyDrive® without presenting any risks to the organization. As with any technology, adopting consumer technologies for your business should be done responsibly, and that means assessing the risks and then, for your organization, deciding which risks are acceptable and which are not.

3. **Assess and understand your device types and application needs.** Devices are not necessarily good for all tasks:
   a. Devices that do not include keyboards, or other rich input mechanisms, may be appropriate for some types of data consumption, but can be poor for data creation.
   b. Rich user interfaces on desktop computers and portable computers, including full keyboard and mouse support, in addition to the use of touch or pens on touch-enabled computers and tablets, generally provide the best environment for data creation and manipulation tasks. Windows-based tablets and slates get the full Windows experience (including Adobe Flash and Microsoft® Silverlight®), customization options, and manageability.

4. **Define the criteria for a successful solution.** Consider what benefits there will be, and how these benefits will be measured.

5. **Use enabling technologies to implement your solution.** Plan on protecting sensitive data, enabling data access and sharing, providing tools for application delivery and access, and providing a centrally managed environment by using enabling technologies such as cloud-based applications and services, in addition to desktop virtualization.

6. **Update your organizational policies.** Your organizational policies should reflect your solution, requiring collaboration beyond IT to include legal, HR, and finance considerations.

7. **Pilot your solution.** Use volunteer users to pilot your solution. They should be highly motivated and keen to work and help create a consumerization strategy for your enterprise. Do not expect to pilot just a single device because such a device is unlikely to be right for all your users—one size does not fit all.

8. **Plan for continuous improvements.** It is unlikely that the first iteration of the program will be perfect.

9. **Ensure that the program drives business value.** The program should not just be a way for particular users to "get cool stuff." You should identify your user scenarios and productivity needs, and ensure that the program meets these requirements and supports your business objectives.

10. **Provide implementation and development resources.** One thing to consider is to provide sufficient resources to support and develop the delivery of applications and data across multiple platforms. The level of resources that can be allocated will affect the likely costs and timescales for successful implementation of a consumerization project.

11. **Adopt the program.** Roll it out to all employees or to those you have identified as most likely to benefit.

4. What are the Enabling Technologies?

IT needs to adapt to the new device landscape. Users will increasingly demand more choice in their work devices, which may be met by a

personal device or more choice from company hardware. Companies should evaluate new technologies that can enable productive and safe use of consumer devices in the workplace. Some of the capabilities that should be supported by these technologies include:

- Protect sensitive data.
- Enable data access and sharing.
- Provide tools for application delivery and access.
- Be capable of being centrally managed.

For most enterprises, consumerization initiatives are unlikely to be realistic options unless most or all of the above requirements can be met. For example, if a user brings his or her own personal portable computer to work, and mixes personal and business applications and data on the same desktop instance, there is a high risk of incompatibilities at best, and data loss and legal issues at worst (such as malicious software or illegal downloads being brought into the workplace).

4.1 Cloud-Based Applications and Services

Cloud computing includes Web-based applications or Web-hosted services, and centralized server farms and data centers, where data is accessed from any type of networked device. A common feature of cloud-based computing is that endpoints are theoretically device-independent; by using the browser on the device as a "universal client," there is no need for client software that is specific to a certain operating system for each type of device that may access the application. However, for consumer devices, there are several considerations for using cloud applications for corporate data access:

- **Browser requirements.** A key requirement is that browsers on users' devices support the applications. For example, there may be requirements that dictate a particular set of supporting browser versions.

- **Screen size.** There may be screen real-estate issues, particularly for smaller form-factor devices. This can be alleviated to some extent by good design, such as avoiding fixed page sizes.

Microsoft Office 365 and the Office Web Apps are good examples of cloud applications. Office 365 includes online versions of Microsoft Exchange, SharePoint®, and Lync™. Office Web Apps provides free versions of popular productivity software including Word, Excel, PowerPoint and OneNote. All these work with Windows-based PCs, Windows Phone 7, and Macintosh computers. Office 365 also includes some functionality that is supported by iPhone, BlackBerry, Nokia, and Android devices.

Some phones offer more complete support for Office 365. For example, using Windows Phone 7, you can synchronize SharePoint workspaces to your phone and work with corporate Office documents offline.

Other examples of cloud applications include Windows Live Mesh 2011 for synchronizing files across devices and for remote access to PCs, Windows Live SkyDrive for storing and sharing documents and other files, and Windows Intune™ for cloud-based PC management.

4.2 Desktop Virtualization

4.2.1 VDI

In a Virtual Desktop Infrastructure (VDI), Windows-based desktop environments are run and managed in virtual machines on a centralized server. The server then remotely presents the user's desktop to her client computer or other device by using a protocol such as Remote Desktop Protocol (RDP). VDI enables the central management and deployment of user desktops, but adds the capability for users to access their own personalized desktops, customize their own unique desktop settings, and have administrator rights if necessary (such as for developers).

In contrast to VDI, Session Virtualization enables users to share a single server-based desktop via sessions. You can use Session Virtualization to virtualize the presentation of entire desktops, or just specific applications. You can use Remote Desktop Services, part of Windows Server® 2008 R2, to deliver both VDI and session-based desktops.

4.2.2 Folder Redirection

Folder redirection is one component of a strategy, sometimes referred to as user state virtualization, where user data and settings are stored securely in a central location, and can be cached on the local desktop when users are offline. The primary copy of the data is on the network, so it is easily restored in the case of a lost or stolen PC and the user's settings can be reapplied automatically.

4.2.3 Application Virtualization

Virtualized applications run in a separate, protected, virtualized space, and are not installed in the traditional sense. When organizations deploy virtual applications, they reduce application-to-application conflicts.

The Microsoft implementation of application virtualization is Microsoft Application Virtualization (App-V), which is available as part of the Microsoft Desktop Optimization Pack (MDOP). You can stream App-V applications to users on demand through enterprise software distribution systems such as Microsoft System Center Configuration Manager or through the Microsoft Deployment Toolkit (MDT). Alternatively, you can deploy App-V applications by using stand-alone media.

You can manage and service App-V applications centrally, enabling enterprises to update once and assure compliance throughout the organization. Updates are delivered to users seamlessly. Citrix XenApp is a Microsoft Partner solution that extends support for traditional and App-V virtual applications to a wide range of devices, including smartphones and other non-Windows-based devices.

4.3 Choosing the Right Technology

When evaluating technologies, there are three principal questions to ask:

1. **What is the impact on the client device?** A low-impact technology requires no client installation at all, or a lite agent only. A high-impact technology requires one or more agents to be installed on the client.

2. **What level of IT investment is needed?** A low-investment solution uses or extends the current infrastructure, or makes use of cloud technologies. A high-investment solution requires new infrastructure.

3. **How much do you need to control?** You need a low level of control where there are only single applications, or where only baseline security is enabled. You need a high level of control where complete environments are supported.

For example, terminal server computing and VDI both have a low impact on the client, but VDI typically requires more substantial IT investment and control systems. Similarly, management technologies have a high impact on the client, but you can reduce costs by using cloud-based management tools (Figure 1). The amount of access that a device has to enterprise resources, including e-mail, documents, and business applications, should depend on the degree to which the device meets organizational criteria. The more the organization trusts the device, the greater the access. The level of access to information dictates how productive a user can be when working from the device. For example, even unmanaged devices may be permitted access to e-mail and calendar applications, but productivity will be limited unless users are also given access to documents and business applications (Figure 2).

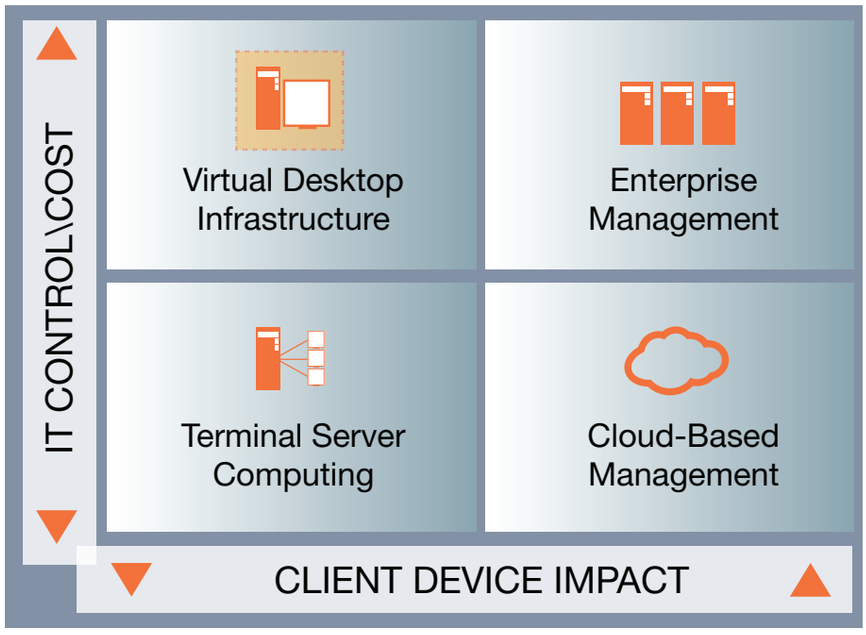


Figure 1. How technologies rate for cost, control and client impact.

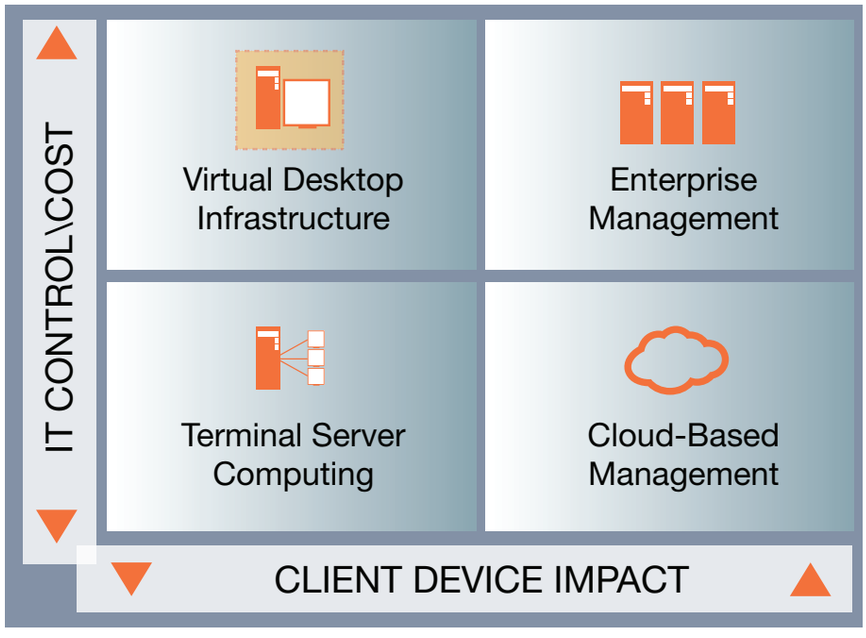


Figure 2. How application access affects productivity for managed and unmanaged devices.

5. Enabling a Diverse Set of Devices

The pressures on IT to enable a diverse set of devices come from several consumerization scenarios.

5.1 Work from Home PC or Bring Your Own Computer

Many organizations are now formalizing their support for home working, and enabling employees to use their home computer for work purposes. In a study of 150 companies, which Microsoft commissioned and Forrester Consulting conducted, 37 percent of IT decision-makers reported that they support some flavor of a Bring Your Own Computer (BYOC) program and an additional 26 percent had plans to do so . Such initiatives may also include financial support for purchasing the computer.

Bring Your Own (BYO) describes voluntary agreements whereby employees can use their own computers or other devices in the workplace. In some cases, users are financially supported through a stipend, whereby an employee is provided with a sum of money to purchase a device, and support for a period such as three years.

BYO can apply to any device such as any computer (BYOC) or any type of PC (BYOPC). IT should be concerned about the potential complexity of BYO. In the Forrester Consulting study , 56 percent of IT decision-makers responded that they are targeting 2011 and 33 percent are targeting 2012 for fully deploying a BYOC program.

However, most IT managers have significant work ahead to determine which lines of business or workforce segments should be allowed access to the BYOC program, how the stipend will be extended to users, how to determine corporate policies and the rules of the BYOC program, and how to lock down the security controls of corporate data, applications, and network access.

5.2 Slates and Tablets: Windows-Based or Non-Windows-Based Devices

The increasing choice of form factor for both Windows-based and non-Windows-based devices is also a significant consumerization driver, with a range of slates and tablets becoming available. Users are demanding wider choice, even if IT will be supplying the hardware.

Tablet computers typically include touch screens, in addition to more traditional keyboard and pointer interfaces, and the screen may swivel to hide the keyboard as required.

Specialist vendors may produce tablets for specific markets such as industrial, medical, hospitality, and outdoor applications. Slate computers are similar to tablets, but may not have a dedicated physical keyboard; slates may also have a smaller form factor than tablets or more traditional portable computers.

5.2.1 Windows-Based Laptops, Slates, and Tablets

Windows 7 includes a range of new touch features that support both finger gestures on touch screens, and stylus input for more accurate inputs such as handwriting recognition, signature capture, and data entry applications. In certain specialist devices, other Windows-based operating systems may be in use, such as Windows Embedded on point-of-sale (POS) devices and handheld line-of-business (LOB) devices for fleet and warehousing applications.

However, you can manage all Windows-based computers through technologies such as System Center Configuration Manager, and they can all be part of an Active Directory® domain.

5.2.2 Non-Windows-Based Slates and Tablets

Non-Windows-based slates and tablets run a range of operating systems such as Apple iOS, Android, Linux, and others. Although there may be a shared origin in Unix-like systems for some of these operating systems, they provide different user interfaces, and different levels of security and manageability.

There are multiple operating systems across this device sector, so it is essential that enterprises adopt a systematic approach to management, otherwise security may be compromised.

5.3 Smartphones

Smartphones are typically defined as mobile phones that provide sufficient computing power to run fairly powerful mini-applications (or apps), and a user-friendly interface to enable interaction with these apps and the phone functionality itself. Smartphones are available for Windows-based and non-Windows-based operating systems.

Windows Phone is the Windows-based smartphone operating system. It supports a rich touchscreen user interface, in addition to a range of enterprise features such as built-in SharePoint workspace support for managing Office files, and support for Exchange ActiveSync®. Non-Windows-based smartphones include devices running Apple iOS, Android, Symbian, and others. Most of these support touchscreen interfaces and, depending on the vendor, specific enterprise management features.

6. What are the Main Considerations if Enterprises are to Embrace Consumerization?

Enterprises that are considering their approach to consumerization should review their current and anticipated devices across several key technology and policy areas.

6.1 What Operating Systems and Hardware need to be Supported?

Given the wide range of devices that are now available, enterprises should consider whether they are going to be restrictive in their acceptance of consumer or BYO devices, and whether they should set guidelines or more prescriptive rules. Similar considerations will apply for company-owned hardware. In all scenarios, enterprises should look at their proposed support policy, how devices will be updated, and the likely costs for supporting these devices.

6.1.1 Support Policy

Considerations when planning a support policy include:

- How many platforms will be supported, and which versions of each platform will you use?
- Which browsers will you support?
- Will you enforce a standard image? Are there methods for applying standard images?
- Who will be responsible for device support?
- Will you enforce a hardware refresh cycle?
- What peripherals will you need to support?
- What happens when a device is lost or stolen?
- If the device breaks, will there be a backup machine?
- How do you decommission the device at the end of its life?
- What will the minimum device specifications be?

For example, if employees are part of a BYOPC program that stipulates that a purchased laptop must include onsite warranty, you will still need to consider what happens if that laptop has been sent back to the vendor for repair, and the user is temporarily without hardware.

6.1.2 Update Methods

Considerations when planning for update management include:

- How will you manage new versions of firmware or operating systems, or major updates?
- How will you manage security updates?
- Is updating likely to run into cross-vendor issues?
- In the case of phones, do carriers have a veto on operating system updates?
- What is the typical operating system update process for each platform?
- Who provides the updates: the vendor, the carrier, or someone else?
- What security models do they use?
- What is the commitment of the update supplier to timely updates?
- What is the mechanism for delivering the updates?
- What if the hardware vendor stops support (for example, parts are discontinued or back-ordered)?

For example, for Windows-based computers, Microsoft is responsible for all feature and security updates for the operating system and for Microsoft application software.

Microsoft maintains 24/7 security issue monitoring and research, issues regular security issue disclosures on blogs and through the Microsoft Security Response Center (MSRC) Web site, and releases security updates on the second Tuesday of each month. For non-Windows-based devices, it is important that you understand the update methods used by device vendors and suppliers.

6.1.3 Costs

Considerations when assessing support budgets include:

- What are the likely costs for maintaining the operating system and hardware?
- Do updates require payment or subscriptions?

For example, updates to supported Windows-based operating systems and applications are free, and this includes major updates through service packs.

6.2 How Will Regulatory Compliance be Achieved?

A major risk for any enterprise that permits the use of nonstandard devices in the workplace, or for work purposes out of the office, is how to ensure and demonstrate regulatory compliance. This is

a particular challenge for more regulated industries such as healthcare, pharmaceuticals, financial services, and government agencies. For example, in the United States, the Sarbanes-Oxley Act (SOX) for corporate governance can have significant compliance requirements.

In considering regulatory compliance, there are several key questions that should be asked:

- Where is the data? If data is ever stored on the local device (or copied locally), that data is at risk if the device is lost or stolen, or when employees leave the company. For Windows-based computers, tablets, and slates, you can use BitLocker® to create encrypted local data vaults.

  You can also use this approach together with policies to ensure that corporate data is only copied down to a local encrypted store, or cannot be copied down at all and is only accessible through remote access tools such as VDI.

- Are there local laws that need to be considered? For devices such as smartphones and non-Windows-based slates, it may be important to be able to remotely wipe settings and data on that device if it is lost or stolen. Remotely swiping employees' mobile devices may give rise to legal concerns in some jurisdictions, and enterprises should consult with their lawyers.

- Will you need to keep a hardware inventory for compliance? If you need to know exactly what devices are connecting to your network and consuming corporate data, you will need a higher level of management, logging, and inventory procedures. Not all types of device lend themselves to this approach.

6.3 What Applications Will be Used?

When considering how to provide users with the applications that they need, there are several key questions that should be asked:

- How will you handle line-of-business applications?

- Do all applications need to be available on all devices?

- Does the application vendor support the device?

There are three main approaches to providing applications where there are multiple platforms to support:

1. Use off-the-shelf applications for each type of device, and determine any application compatibility issues as soon as possible, because multiple devices and platforms mean that multiple testing is required.

2. Use custom development to create or port applications for each type of device, such as creating Microsoft XNA® or Silverlight 4 applications for Windows Phone 7.

3. Use device-agnostic technologies, such as VDI or the cloud, where it does not matter what type of endpoint device is being used to access the application, and there is no requirement for application support on multiple platforms.

For example, it may be possible to use common applications across all supported devices, as long as the application vendor has a broad device support. Popular applications such as Windows Live Messenger are available for Windows-based desktops, laptops, tablets, slates, and smartphones, and there are versions available for some other platforms. However, many common business applications are not available for all devices, or may have only limited support.

6.4 How Will Applications be Deployed and Managed?

When considering how to provide users with access to the applications that they need, there are several key deployment and management questions that should be asked:

- How will you deliver applications to users?

- Will you permit user-installed applications, or self-provisioning?

- How will you know what applications you have?

- Will you ensure version control?

- What is the update process and delivery mechanism for typical applications on each platform that you will support?

- How will you manage the application life cycle, including application updates?

- Who provides updates to your applications, and what security models do they use?

- What commitment do your application vendors have to timely updates?

- Is there a way to remove application access to users as roles change, or when users leave the company?

- How will you support audit and compliance reporting?

For example, user-installed applications are a potential problem area unless all Microsoft Software License Terms and licenses are thoroughly checked. Self-provisioning could be manageable if enterprises

run their own "app stores" that only offer approved applications, and with the list of available applications customized to specific users.

There are several models for deploying applications, and not all of them include management functionality:

- Public app stores and marketplaces. A major issue, especially for handheld devices, is the use of "consumer apps," which may be available through platform-specific application marketplaces such as the Windows Phone Marketplace. Some of these applications may actually be business focused, but for platform-specific reasons, may only be available through a public marketplace. Application marketplaces present several challenges for IT:
  - ◊ How will an employee buy applications?
  - ◊ What identity is used to buy applications: personal or corporate?
  - ◊ What is the currency and method of payments?
  - ◊ How will the application be updated?

- Corporate internal app stores. Increasingly, there are demands for marketplaces that corporate IT can manage. This could be through methods that enable IT to deploy and manage applications within an existing global app marketplace, such as a private marketplace within a public marketplace, or by using a more controlled internal-only marketplace.

- Push deployment tools. You can deploy software, including application updates and security hotfixes, over the network by using technologies such as System Center Configuration Manager 2007 R2.

- Application whitelists. Whitelists are lists of approved applications; if an application is not approved, it will not run. Being able to restrict the applications that can run on a device can help prevent the execution of potentially malicious software, and ensure that only tested and evaluated applications are available.

6.5 How Will Devices and Data be Secured?

When considering how to secure devices and data, key questions include:

- How do you control access to sensitive data?

- How do you manage data backup and restore?

- How do you protect data on your network?

- How do you secure data on the device?

For example, unless you can secure data on the device itself, all data should be protected in the corporate data center, or cloud, whatever device is being used. In this way, lost or stolen devices present minimal risk to the enterprise and its data. Therefore, users should be able to use online access to data centers as much as possible, but also be able to use offline access (using secured local data) when they are using roaming devices that cannot be always connected to the corporate network. Depending on where the data is, and how it is accessed, there are additional specific considerations.

6.5.1 Data on the Local Device

If there are operational or other reasons that dictate that some data may be cached or otherwise stored on the local device, it is essential that the full implications of this are critically assessed, and procedures put in place to mitigate any risk to the enterprise, such as in the event that the device is lost or stolen.

Key issues to consider for all devices that may store sensitive data are:

- Can local data be encrypted?

- Are there protected data storage areas on the device?

- Does the device support removable storage devices such as SD cards or USB drives?

- If removable storage is available, can access to this storage be disabled?

- What local data and settings should be backed up, and how?

- How do you protect against malicious software?

For example, using VDI for accessing corporate resources helps to keep a clear, protective barrier between potentially infected user devices, such as smartphones or slates, and the enterprise. The virtual desktop itself is kept within the firewall, and as long as the device's VDI client does not permit local data to be copied or transferred to the virtual desktop, any malicious software on the client cannot affect network resources. Effective strategies for dealing with malicious software are particularly important on devices that may hold local copies of sensitive data or be running local applications that access corporate resources. For example, there should be systems in place to deal with endpoint security, such as antivirus and rootkit protection. For newer devices, there can be an initial period when it appears that the device is not a target for malicious software.

However, as the number of such devices increases, the prevalence of

malicious software inevitably also rises. Antivirus vendors are reporting that mobile malicious software is becoming an increasing problem, due both to the numbers of smartphones and similar devices, and the fact that most are now connected to the Internet.

6.5.2 Data in the Cloud or Corporate Data Center Only

Wherever possible, data should reside within protected clouds or data centers. In this way, data should not be exposed on the local device.

Key issues to consider where data is stored in the cloud or data center are:

- How will reliable network access to this data be delivered?
- Are there specific network requirements such as requirements for firewalls?
- Do access technologies, such as Windows Media® Digital Rights Management, need to be supported?

For example, if the device is using a cloud-based application, such as an Office Web App, all data can be kept in the cloud storage. If the enterprise has implemented policies, such as rights management, to control who can access and edit documents, for example, these policies can be applied in the cloud application and will be enforced locally at the client. One way of doing this is by using Office Web Apps through a Web browser, which will automatically respect online rights management policies, regardless of the device being used.

6.5.3 Enabling Network Access

All BYO devices should be treated as untrusted devices when they are connected to corporate networks, in the same way as devices such as home computers that are using remote access. One approach is to configure your infrastructure so that such devices are not able to connect to trusted resources, even when they are used within the workplace. One way of doing this is by using switch-level protection to prevent untrusted devices from being physically plugged into the corporate local area network (LAN).

Key issues to consider when planning for enabling network access are:

- What technologies are in place for enabling network access?
- Can the network infrastructure be configured to permit untrusted devices?
- Are there any network access limitations on any proposed devices?

For example, for mobile devices, there are several common approaches for providing network access to corporate resources:

- Virtual private networks (VPNs). VPNs are one way to access corporate resources, through a secure, private channel from the endpoint. For Windows-based computers, and for other platforms such as Macintosh and Linux, the ability to support multiple VPNs is typically built in to the operating system. However, for smaller form-factor devices, there may be limited support for VPNs, or the ability to configure only a single VPN configuration.
- Reverse proxies. Reverse proxies are used as an alternative to direct connections to endpoints. They provide an extra protective layer between the corporate resources, such as Exchange servers, and external devices. Reverse proxies enable Secure Sockets Layer (SSL) encryption and acceleration services to be offloaded from the endpoint service, and also provide load balancing where the reverse proxy server can distribute all of the traffic that is targeted for a single URL to a group of endpoint servers.

6.5.4 Enforcing Network Security

There are various methods that can be used to restrict network access to compliant devices only. Without such controls, it is difficult to ensure that a compromised device, such as a smartphone, does not then also compromise the corporate network when it is connected.
Key issues to consider when planning for network security are:

- Does the device support any access protection technology?
- What mechanisms will there be for users to get their own devices into compliance?

For example, on Windows-based computers, you can use network access protection (NAP) to control access to network resources based on a client computer's identity and compliance with corporate governance policy. If a client is not compliant, NAP provides a mechanism to automatically bring the client back into compliance and then dynamically increase its level of network access. For BYO devices, it is important to consider whether tools, such as Web portals, can be provided so that users can deal with operating system and policy updates themselves if their device is identified as being out of compliance.

6.5.5 User Authentication

User authentication procedures first confirm the identity of any user who is trying to access protected resources, and then enable user access to permitted resources.

Key issues to consider when planning for user authentication are:

- On consumer devices, how will multiple identities be managed?
- Does the device support user names, personal identification numbers (PINs), and passwords?
- Does the device support smart cards or biometric authentication methods?
- Is multifactor authentication supported, such as user name and password plus certificates?

For example, a user's personal identity, such as his Windows Live ID, and his work identity, such as his domain logon and corporate e-mail address, may affect which applications can be run if a personal certificate is required. There is also the issue of personal and corporate data that may coexist on the same device, but be subject to separate identities for data access controls. Where VDI solutions are used to access server-hosted virtual desktops, you can use Active Directory to identify active users on the network, in the same way as for domain-joined regular computers.

Devices, such as non-Windows-based slates, do not support this unless using a VDI solution. On larger form-factor devices, such as Windows-based computers, you can use smart cards to verify user identity before any network connection can be made. Smaller devices may not have the necessary hardware support for smart cards or biometric scanners.

6.6 How Will Devices be Managed?

The range of devices that consumerization may introduce into the workplace presents IT with several management-related challenges. For corporately owned computers, a high level of device management can be achieved. In other cases, only limited management may be possible.

The key management issues include:

- What devices are in use, and who is using each device?
- What applications are on each device, and are these applications supported and licensed?
- Is each device up to date with updates, fixes, applications, and so on?
- In the event of security problems, are mechanisms available for rapidly closing such breaches?
- Can security policies, such as password complexity, be easily enforced?
- What support, or remote assistance, is required, and is this required 24/7?
- What tools are available for devices that rarely connect to the corporate LAN?

For example, there are several types of technology that you can use to impose some form of management on consumer devices:

- Cross-platform tools such as Exchange ActiveSync.
- Windows-based tools such as System Center Configuration Manager and Windows Intune.
- Non-Windows-based tools such as the Apple iPhone Configuration Utility and Mobile Device Management (MDM) application programming interfaces (APIs).

6.7 How Will User Responsibilities be Managed?

Successful management of consumerization is not just about technology; effective organizational and employment policies also have their place. For example, if BitLocker or other third-party encryption is required as part of a precondition for connecting a device to the corporate network, the legal implications of encrypting data on a personal system should first be fully investigated.

It may be useful to include clauses in employment policies on the use of employees' own devices, defining what rights the employee has and what rights the employer has. These policies could include:

- User agreement to accept device requirements such as password enforcement.
- Any rights the organization has to wipe devices remotely, such as if the device is lost or the user leaves the company.
- Any commitment the organization has to supply temporary loan devices if a user's BYO device is broken. Even if a warranty is required, there will often be a period of unavailability.

The enterprise should set out clear rules so that only when employees sign the relevant document or contract do they get access to corporate resources through their supported devices.

7. Solutions for Managing Consumerization in Enterprise

Consumerization in the Enterprise This section describes several example solutions for managing consumerization in the enterprise, within highly managed corporate environments and in more dispersed

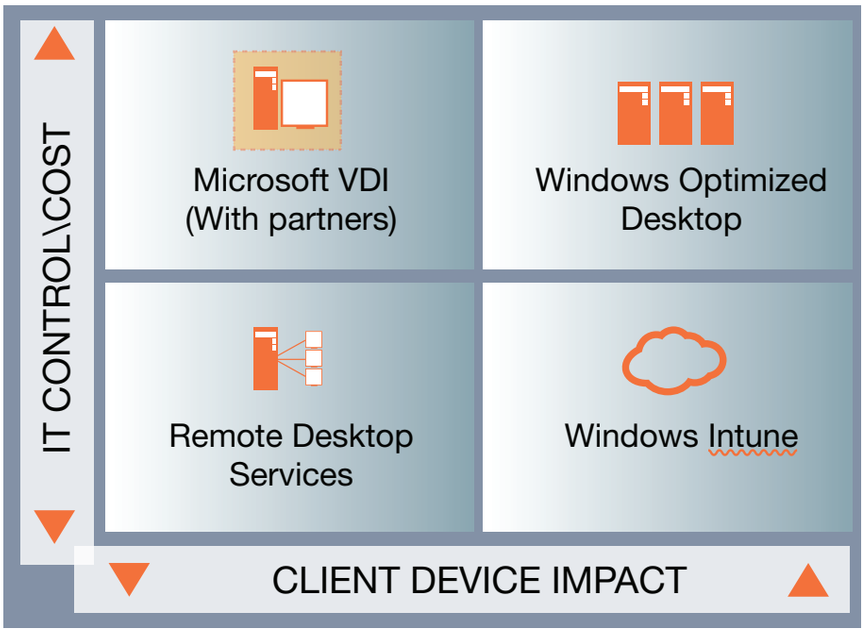


Figure 3. Key Microsoft enabling technologies rated for costs, control and client impact.

organizations, and for both Windows-based and non-Windows-based devices. Figure 3 shows how the key Microsoft technologies in these solutions rate in terms of typical costs, level of required control, and client impact.

7.1 PCs and Slates

The best approach for managing BYO PCs, Macintoshes, and slates in the enterprise depends on the types of device that IT is expected to manage.

7.1.1 Windows Optimized Desktop

The Windows Optimized Desktop combines Microsoft solutions for desktops through to data center management across physical and virtual environments. At the base level is client infrastructure, including Windows 7 as the desktop operating system, Windows Internet Explorer® 8 as the browser, and MDOP. The infrastructure for Windows 7 Enterprise and Windows Server 2008 R2 supports client features such as BranchCache™ and DirectAccess. In addition, through Hyper-V™, it supports VDI environments. Management tools in System Center and security technologies in Microsoft Forefront® support the client and server components. Management tools, such as System Center and MDOP, provide the security, access, and application optimization tools for locally deployed systems, and for systems and applications that are hosted on-premises in the data center:

- **Application management.** In Windows Optimized Desktop environments, you can use a managed deployment approach, using software such as System Center Configuration Manager or Microsoft System Center Essentials, to deploy Windows-based applications to Windows-based computers. Using this approach, you can deploy applications to large numbers of computers at the same time. For Windows-based PCs, slates, and tablets, the AppLocker™ feature in Windows 7 Enterprise enables administrators to create a whitelist of approved programs that can be selected individually by file hash, in groups by location, or in groups by publisher (signed by the publisher's certificate). After Windows 7 clients using Group Policy have downloaded AppLocker rules, only the whitelisted applications are permitted to execute.

- **Local data security.** For Windows-based computers, BitLocker Drive Encryption is a data protection feature that uses a protected storage area at the volume level. BitLocker is integrated with the operating system to address threats of data theft or unauthorized data access, primarily from lost or stolen portable computers. BitLocker is available in Windows 7 Ultimate and Windows 7 Enterprise. In more managed environments, you can use the Encrypting File System (EFS) to protect specific files and folders on portable computers, desktops, and servers. EFS encrypts the contents of protected documents and enables users to choose the documents that they want to encrypt.

- **Removable storage.** In Windows 7 Enterprise, BitLocker To Go™ extends BitLocker Drive Encryption protection to USB removable storage devices.

- **Backups.** Where data is stored and manipulated on the local device, it is essential for this data to be protected and backed up. For Windows-based tablets and slates, you can use the built-in Windows 7 backup tools to back up data to USB and other external devices. Where devices have regular access to corporate networks, you can use technologies such as Microsoft System Center Data Protection Manager 2010 for rapid backups where only block-level changes are copied. For mobile Windows-based computers, System Center Data Protection Manager 2010 can also take snapshot backups offline that are automatically synchronized to central backup servers when

they are next connected to the corporate LAN. However, where, for example, a portable computer is used for both work and non-work tasks, the challenge is how to back up just enterprise data and not to use corporate resources to back up non-work-related information.

- **Network access.** Microsoft Forefront User Access Gateway (Forefront UAG) can provide reverse proxy services for Exchange and Internet Information Services (IIS) servers, in addition to doing so for other corporate services. For Windows Phone 7, for example, data transmission is encrypted by using 128-bit or 256-bit SSL encryption, through reverse proxies that are hosted by Forefront UAG.

- **Network security.** On Windows-based computers, NAP provides a range of enforcement options:
  - ◊ **IPsec Enforcement.** Unless the computer is compliant, no IPsec communications with other computers are permitted.
  - ◊ **802.1X Enforcement.** Unless the computer is compliant, only limited communications across any 802.1X-authenticated network connection, such as to an authenticating Ethernet switch or an IEEE 802.11 wireless access point (AP), are permitted.
  - ◊ **VPN Enforcement.** Unless the computer is compliant, only limited communications over a VPN connection are permitted.
  - ◊ **DHCP Enforcement.** Unless the computer is compliant, only a restricted IPv4 address will be leased to the computer. Such an address only permits access to a restricted network.

For more information about NAP, see the Network Access Protection page at *http://technet.microsoft.com/en-us/network/bb545879*.

Other approaches to ensuring compliance include management tools such as System Center Configuration Manager, which you can use to identify devices that have no or limited encryption, no antivirus, or do not have up-to-date operating system or application updates.

- User authentication. All Windows-based computers use user names and passwords. For Windows-based computers, you can use local or domain policies to set required password complexity and password renewal periods.

7.1.2 Windows with Windows Intune

For organizations that do not have the resources or infrastructure to support the complete Windows Optimized Desktop strategy, Windows Intune can help deliver the management and security essentials. Windows Intune is a cloud-based management solution that brings together Microsoft cloud services for PC management and endpoint protection with upgrade rights to Windows 7 Enterprise and future versions of Windows. Using Windows Intune, IT can give workers the best Windows experience with the latest Windows-based operating systems and keep those PCs current and protected with the Windows Intune cloud service.

Windows Intune delivers management and protection through an easy-to-use, Web-based console. IT gets immediate insight into the user's PC environment and can view the status of updates and malicious software, alerts, security policies, hardware and software inventory, and more. All that is needed is an Internet connection and the Windows Intune client installed on each managed PC.

Windows Intune can help to deliver the essentials of management and protection—updates, endpoint protection, and asset inventory—to unmanaged and lightly managed devices. Windows Intune does not require Windows-based computers to be part of an Active Directory domain. For Windows-based portable computers, slates, or tablets, Windows Intune provides an effective, cloud-based management and protection solution. For users who are part of a BYOPC program, Windows Intune includes rights to deploy Windows 7 Enterprise on that PC in addition to managing and protecting that PC with the cloud service.

7.1.3 VDI

For devices that cannot provide the full Windows 7 experience and security environment, you can use a VDI-based strategy to enable secure access to a server-hosted, Windows-based desktop. This approach is the most effective one for non-Windows-based portable computers and slates, such as Macintoshes, iPads, and Linux-based netbooks. However, the VDI approach can also be useful where employees bring their own Windows-based portable computers into the workplace. In this case, VDI is used to deliver a secure enterprise desktop, with all personal data and software being kept out of the corporate network.

One example solution includes technologies from Microsoft and Citrix. Microsoft VDI suites provide the base platform for the desktop infrastructure and use:

- **Hyper-V** as the virtualization layer.

- **App-V** as the application virtualization platform.

- **Microsoft RemoteFX™** for a rich user experience.

- **System Center** technologies to manage the infrastructure.

Citrix XenDesktop manages desktop delivery, in addition to providing a rich user experience across the

wide area network (WAN). You can use Citrix Receiver to extend virtual desktops onto devices such as non-Windows-based tablets and smartphones; the screen is updated on the device, but corporate data is kept secure in the data center. You can use VDI technologies, such as Citrix Receiver, to touch-enable any Windows-based application so that it can be used on non-Windows-based devices. Considerations for using a VDI solution such as the Microsoft-Citrix solution are:

- **Storage optimizations.** When converting or preparing desktops to use as virtual desktops, it is important to look at what performance optimizations are available, such as configuring appropriate storage block sizes on the server to maximize server disk performance.

- **The number of images to support.** When streaming operating system images by using Citrix Provisioning Services, it is often most efficient to use one or two standard images, which are then streamed to multiple users.

- **E-mail configuration.** When using Microsoft Outlook®, do not use Cached Exchange Mode, because the desktop is in the data center and is never offline in a VDI-type scenario. (If the ICA connection is broken, you lose access to the desktop, but it is still online as far as Exchange is concerned.)

- **Bandwidth requirements.** A lot more bandwidth is required for full VDI (XenDesktop) solutions than for solutions that only use virtualized applications, such as Citrix XenApp, Microsoft App-V, or Microsoft RemoteApp. This is because there is typically a lot more idle time, and lot lower average utilization for virtual applications than for full virtual desktops.

For more information about using Hyper-V and XenDesktop, see TechNet Virtual Lab: Implementing Citrix XenDesktop 4 on Hyper-V R2 at *https://cmg.vlabcenter.com/default.aspx?moduleid=281742e3-2613-42da-bd58-2c3578f039b4*.

7.2 Smartphones

There are various ways to manage smartphones in the enterprise. For example, you can use Exchange ActiveSync to manage a wide range of Microsoft and non-Microsoft devices. Exchange ActiveSync is a Microsoft Exchange synchronization protocol that is optimized to work over high-latency and low-bandwidth networks. The protocol, which is based on HTTP and XML, enables devices to access information, such as e-mail, calendars, and contacts, on an Exchange server, in addition to providing management tools through Exchange ActiveSync mailbox policies and other tools.

For example, Windows Phone 7 supports Exchange ActiveSync management policies, such as requiring passwords and enforcing different levels of password strength, in addition to the ability to remotely wipe the device and restore its original factory settings after multiple failed attempts to unlock it. Management based on Exchange ActiveSync is an industry standard for smartphones and other small form-factor devices, and is supported by platforms such as Apple iPhones and iPads, Android, Symbian, and Palm.

Common smartphone management requirements in the enterprise include:

- **Remote device wipe.** Exchange Server 2010 enables you to send a command to a mobile phone that will perform a wipe of that phone. This process, which is known as a remote device wipe, clears all Exchange information that is stored on the mobile phone to clear data from a stolen phone or clear a phone before assigning it to another user.

For more information about remote wipe in an Exchange 2010 environment, see Perform a Remote Wipe on a Mobile Phone at *http://technet.microsoft.com/en-us/library/aa998614.aspx*.

- **Password locking.** This Exchange ActiveSync policy is used to require users to lock their mobile phones by using a password. You can also enforce a variety of policy settings that guide the usage of mobile phone passwords. As long as an Exchange ActiveSync mailbox policy has been created, the settings that you can configure include the following:
  - ◊ Enforcing an alphanumeric password.
  - ◊ Enabling password recovery.
  - ◊ Requiring encryption on the mobile phone.
  - ◊ Specifying a minimum password length.
  - ◊ Specifying a period of inactivity before you must re-enter a password on a mobile phone. This is known as device password locking.

For more information about password locking in an Exchange 2010 environment, see Configure Device Password Locking at *http://technet.microsoft.com/en-us/library/bb125004.aspx*.

- **Idle time-out value.** Direct Push Technology uses Exchange ActiveSync to keep data on a Windows-based phone, or other phone using Exchange ActiveSync, synchronized with data on an Exchange server. On firewalls, a network idle connection time-out indicates how long a connection is permitted to live without traffic after a Transmission Control Protocol (TCP) connection is fully established. You must correctly set this time-out value to allow the

Exchange ActiveSync heartbeat interval and the enterprise session interval to communicate effectively. If the firewall closes the session, mail would be undelivered until the client reconnects, and the user could be unsynchronized for long periods of time. Microsoft recommends that organizations set time-outs on their incoming firewalls to 30 minutes. For more information, see Understanding Direct Push and Exchange Server 2010 at *http://technet.microsoft.com/en-us/library/ff459598.aspx*.

- **Exchange ActiveSync Autodiscover settings.** You can use the Autodiscover service to provision mobile phones for users when the user's e-mail address and password are supplied. The ability to use the Autodiscover service depends on the mobile phone operating system. Not all mobile phone operating systems that support synchronization with Exchange 2010 support Autodiscover. For more information, see Configure Exchange ActiveSync Autodiscover Settings at *http://technet.microsoft.com/en-us/library/aa998277.aspx*.

- **Troubleshooting Exchange ActiveSync.** The online Exchange Remote Connectivity Analyzer is an essential tool for troubleshooting Exchange ActiveSync, and tests issues such as e-mail settings and synchronizations. For more information about the Exchange Remote Connectivity Analyzer, and to use the tool, go to *https://www.testexchangeconnectivity.com/*.

The best approach for managing smartphones in the enterprise depends on the types of phone that IT is expected to manage.

7.2.1 Windows-Based Phones

Windows-based phones are designed to support specific enterprise management features:

- **Local data security.** Some customers require smartphones to encrypt data at rest on the device. Windows Phone uses a least-privileged security model, including application certification and sandboxing with isolated storage to protect data. Application developers can make use of cryptographic APIs to encrypt application data if they want to. Windows Phone prevents users from transferring files from or to a PC by using a USB connection. Windows Phone does not support removable memory cards, preventing information from being transferred to or read on a PC. You can only use the Microsoft Zune® software to synchronize media files (such as music, picture, and video files) with a PC. When a Windows-based phone is lost, an administrator or the end user can wipe it remotely, or the phone will wipe automatically when a wrong PIN is entered multiple times.

- **Removable storage.** For Windows Phone, removable data storage cards are not supported. Windows Phone devices come with a minimum of 8 gigabytes (GB) of data storage. If an original design manufacturer (ODM) has designed a Windows Phone device with an SD card, Windows Phone protects the data by locking the card. To "lock" the card, a 128-bit key is used and stored in the built-in memory of the phone to uniquely pair the card with the phone. The result is that if the card is removed from the phone, the SD controller will prevent access to the card unless the correct 128-bit password is supplied. SD cards that are paired with a specific Windows Phone device can no longer be used in other phones or a PC.

For more information about Windows Phone security, see Windows phone capabilities security model at *http://blogs.msdn.com/b/jaimer/archive/2010/04/30/windows-phone-capabilities-security-model.aspx*.

- **Backups.** For Windows Phone, the Zune software is used to back up media files and SharePoint synchronization is used to ensure that Office documents and other documents are copied back to enterprise servers. On Android devices, personal data, such as phone contacts, is automatically backed up through synchronization to the user's Google account, but call records and application data are not. You can use third-party applications to back up this data. For devices using Apple iOS, you must manually back up all personal data to a computer by using iTunes software.

- **Protection against malicious software (also called malware).** Antimalware tools for smartphones are still not mainstream. However, Windows Phone uses a least-privileged security model, including application certification and sandboxing to prevent malicious software attacks.

- **User authentication.** All Windows-based computers use user names and passwords, and Windows Phone supports device security by using passwords and PINs. For smartphones, you can use Exchange ActiveSync policies to ensure that appropriate passwords or PINs are used.

- **Device management.** To manage Windows Phone devices, IT can make use of Exchange ActiveSync for policy support, and to manage e-mail and document access. It is important to note that at present, Windows Phone devices only support a subset of the Exchange

ActiveSync policies that are available with Exchange 2003 SP2, Exchange 2007, and Exchange 2010. Currently, Windows Phone supports the following Exchange ActiveSync policies:

- ◊ **Password Required.** (This is the only policy available on Exchange 2003 SP2.) Requires the user to set a device-locking PIN before the phone starts synchronizing e-mail, calendar, and contact information with an Exchange server.
- ◊ **Minimum Password Length.** Sets the minimal number of numeric characters in the PIN.
- ◊ **Idle Time-out Frequency Value.** Defines the time before a phone locks when not in use.
- ◊ **Device Wipe Threshold.** Defines the number of times that a wrong PIN can be used before the phone wipes and resets to factory settings. (In addition, remote device wipe can be initiated either by a user through Outlook Web App or by an Exchange administrator.)
- ◊ **Allow Simple Password.** Can be used to prevent the user from using a simple PIN such as 1111.
- ◊ **Password Expiration.** Sets the validity period of a PIN, after which the PIN has to be renewed.
- ◊ **Password History.** Prevents the user from reusing the same PIN repeatedly.

For more information about using Exchange ActiveSync policies with Windows Phone 7, see Exchange ActiveSync Considerations When Using Windows Phone 7 Clients at *http://social.technet.microsoft.com/wiki/contents/articles /exchange-activesync-considerations-when-using-windows-phone-7-clients.aspx*.

For more information about Exchange ActiveSync policies that are supported on Windows Phone 7, see Exchange ActiveSync Client Comparison Table at *http://social.technet.microsoft.com/wiki/contents/articles /exchange-activesync-client-comparison-table.aspx*.

Exchange 2010 includes a new Allow/Block/Quarantine (ABQ) feature. Where Exchange ActiveSync policies enable administrators to limit device access by capabilities, the ABQ list enables access to be controlled by device type. For more information about the ABQ list, see Controlling Exchange ActiveSync device access using the Allow/Block/Quarantine list at *http://msexchangeteam.com/archive/2010/11/15/456931.aspx and Understanding Mobile Device Management at http://technet.microsoft.com/en-us/library/ff959225.aspx*.

7.2.2 Non-Windows-Based Phones

The enterprise management features supported by non-Windows-based phones varies from vendor to vendor. For example, many devices support management based on Exchange ActiveSync policies, but not all non-Windows phones work with all Exchange ActiveSync features. In addition, the version of Microsoft Exchange is important, with more support for non-Windows-based phones being provided by Exchange ActiveSync 12.0 (Microsoft Exchange Server 2007) and earlier Exchange versions.

However, as long as your device/Exchange combination is supported, this means that you can use procedures such as the Exchange remote wipe procedure for any smartphone, not just Windows Phone devices.

For more information about Exchange ActiveSync policies that are supported on non-Windows-based phones, see Exchange ActiveSync Client Comparison Table at *http://social.technet.microsoft.com/wiki/contents/articles/exchange-activesync-client-comparison-table.aspx*.

If appropriate Exchange ActiveSync policies are not available for the smartphones that must be supported, you will need to consider vendor-specific or third-party tools:

- **Application management.** There are various approaches to the management of applications on Linux-based and Android slates and smartphones. For example, tools are available that can enable or disable application installations, provision applications and application updates, restrict network access for applications, and collect application inventory data. It is important that enterprises set out minimum requirements for application management before considering which tools and methods may be appropriate for enterprise needs. On Apple iOS devices, the use of custom or in-house applications can be controlled with a provisioning profile. Users must have the provisioning profile installed to execute the application. You can install or revoke provisioning profiles over the air by using MDM solutions. Administrators can also restrict the use of an application to specific devices.

- **Local data security.** Recent Apple iOS devices include encryption, and Android devices support encryption through third-party applications.

- **Device management.** Apple iOS devices support some, but not all, Exchange ActiveSync policies, depending on the version of Exchange. Apple also provides the iPhone Configuration Utility, which is used to create XML configuration profiles that can be distributed to phone users. These profiles include similar policy settings to Exchange ActiveSync, such as passcode requirements. Larger enterprises can also make use of MDM APIs to create their own management tools for

functions such as remote wipe and other policies that are similar to Exchange ActiveSync policies.

In addition, larger enterprises can use MDM for other functions such as alerting IT when the phone becomes liable for international roaming charges, turning off cameras, verifying strong passwords, and collecting detailed asset information. MDM tools require a client to be installed on the device, and there are now third parties that supply management tools based around MDM and Exchange ActiveSync functionality. For Apple iOS devices that do not use Exchange ActiveSync or other enterprise tools, you can use the consumer-focused iPhone MobileMe service to locate missing devices on a map, display a message on its screen, remotely set a passcode lock, and initiate a remote wipe to delete personal data.

On Android devices, the Google Apps Device Policy enables administrators to remotely wipe data on lost or stolen devices, lock idle devices, and manage passwords for devices running Android 2.2 or later. Administrators can also enforce data security policies such as:

- Requiring a device password on each phone.
- Setting minimum lengths for more secure passwords.
- Requiring passwords to include letters and numbers.

Device policy management APIs enable developers to create applications to control features, such as managing e-mail and VPN accounts, and installing certificates. However, this is also a potential problem area if important security features are dependent on each phone vendor and the API features that they support.

7.3 Microsoft Can Help

Microsoft has always been interested in delivering software that empowers people at work and at home. This commitment is deeply rooted in Microsoft's original mission statement: "A PC on every desktop and every home." With over a billion customers across the globe today, Microsoft delivers solutions that power the world's largest enterprises, schools, government offices, and small businesses, in addition to hundreds of millions of homes.

For enterprises that have fully managed infrastructures, the Windows Optimized Desktop, which includes Windows 7 Enterprise and the Microsoft Desktop Optimization Pack, delivers the key capabilities that enterprise customers have asked for. The Windows Optimized Desktop enables user productivity and gives users anytime, anywhere access to the information that they need to get their work done. In addition, it provides tools for IT to support its business securely, protect corporate data, achieve cost efficiencies, and take advantage of the virtualization trends in the client computing arena.

For businesses that have less managed infrastructures, Windows Intune provides cloud-based management and protection technologies for Windows-based desktops, portable computers, and slates. Windows Intune enables essential tasks including updates, endpoint protection, and asset inventory to be performed on any device that has an Internet connection.

8. Summary

Workers increasingly want to be able to use their own devices, such as slates and smartphones, at work, and many are also prepared to purchase their own portable computer or other device as part of a BYO program. IT must be able to embrace consumerization where it is appropriate, while at the same time minimizing risks to the enterprise and to its data. By assessing and understanding your users, in addition to the devices that they want to use, you can help ensure that consumerization benefits your business, and that these benefits can be measured and evaluated. Embracing consumerization enables businesses to deliver productivity gains and competitive advantage. Consumerization becomes a major opportunity when the strategies that are described in this paper are followed, ensuring that corporate assets are secure and establishing new roles for empowered employees and IT as partners. Microsoft has a range of enterprise-ready solutions that can help you address your users' needs around consumerization, from deployments of Windows Optimized Desktop, through cloud-based management using Windows Intune, to Windows-based and non-Windows-based smartphones.

09. SOCIAL BUSINESS: ADVENT OF A NEW AGE

IBM INSTITUTE OF BUSINESS VALUE
Website: www.ibm.com/iibv

Preamble

Becoming a social business goes beyond social networking and many organizations employ these tools to encourage consumer sales, employees in large enterprises also need to communicate rapidly within their organizations. Forward-looking organizations as our case studies below illustrate, are finding out that integrating social networking tools with current business processes can help create new business models.

Businesses that fail to transform themselves into social businesses will be left behind by competitors that embrace social business techniques. The situation is not unlike the challenges that businesses faced more than a decade ago when the dot.com boom fundamentally changed the way enterprise applications were built for the next decade.

What changed the most was the way enterprises transformed processes within their organizations.Today we're in the middle of a social craze. IDC predicts the emerging social platforms category, which includes enterprise social software products, will reach nearly $2 billion by 2014. Social networks and social media have helped to forge connections while providing new tools for collaboration and access to information. And these tools are finding their way into the workplace as well, with businesses adopting social technology at a rapid pace.

According to the 2011 Global Web Index Survey of over 51,000 web users, use of social tools is now mainstream in all countries (except Japan), having over 50 percent of their respective populations using the tools. Communities are the number one social tool with Facebook dominating, except in Russia, Netherlands, Japan and China where local brands lead.

But there's a big difference between social networking and social business. It's one thing to create networks of customers, employees or partners. It's quite another to change the processes that run businesses, to make them truly "social." It about applying "social" technologies to business processes in order to radically improve the way organizations operate.

Introduction

In 2008, IBM shared a vision for a smarter planet – an opportunity to infuse intelligence into every system through which the world works. Three broad trends made this opportunity possible:

1. everything is becoming instrumented with sensors and computational power;

2. the world is becoming interconnected via vast, ubiquitous networks; and

3. many things are becoming intelligent by applying analytics to the mountains of data they can collect.

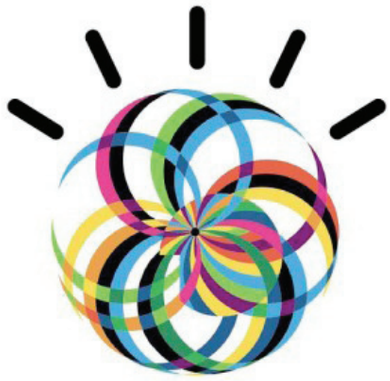
Since then, remarkable progress has taken place to make the complex systems that people rely on – cities, energy grids, food distribution chains, healthcare networks, banking systems, etc. – smarter. Perhaps most remarkable of all, however, has been the application of this vision to people themselves. Instrumentation, in the form of smartphones, has put unprecedented power literally in people's hands, anywhere they go. The meteoric rise of social networking, which now accounts for 22 percent of people's time spent online, has connected nearly every individual on earth.[1] And the emergence of social analytics means not only are individual people intelligent, but networks of people have become intelligent as well and are able to learn from interactions and associations to deliver recommendations and take action. As the global network of people becomes instrumented, interconnected and intelligent, dramatic shifts are taking place.

The ways individuals interact, relationships form, decisions are made, work is accomplished and goods are purchased are fundamentally changing. Consumers now wield unprecedented power over how brands are perceived. Crowdsourcing is changing industry landscapes by leveling the intelligence playing field at an extraordinary rate.

In addition, employees are demanding social tools in the workplace – and are actively sidestepping established hierarchies and IT processes to use them. As a result, the world finds itself at a transformative point with regard to how business is done. We believe it is the dawn of a new era – the era of the Social Business.

A similar tectonic shift in the marketplace occurred a little more than a decade ago when the Internet went through its first maturation phase. It changed from being a digital novelty for technologists to being a platform for doing business.

From e-commerce and peer-to-to peer file sharing to the emergence of IP-based solutions for financial, accounting and supply chain systems, the Web became a serious business tool for organizations and industries of -every kind.Just as the dawn of e-business changed business forever, ten years later organizations find themselves at another junction point in the evolution of business: the coming of age for Social Business as social computing and social media are integrated into enterprise design.



What does it Mean to be a Social Business?

A Social Business embraces networks of people to create business value.

Our definition of a Social Business has three underlying tenants:

1. **Engaged** - A Social Business connects people to expertise. It enable individuals – whether customers, partners or employees – to form networks to generate new sources of innovation, foster creativity, and establish greater reach and exposure to new business opportunities. It establishes a foundational level of trust across these business networks and, thus, a willingness to openly share information. It empowers these networks with the collaborative, gaming and analytical tools needed for members to engage each other and creatively solve business challenges

2. **Transparent** - A Social business strives to remove unnecessary boundaries between experts inside the company and experts in the marketplace. It embraces the tools and leadership models that support capturing knowledge and insight from many sources, allowing it to quickly sense changes in customer mood, employee sentiment or process efficiencies. It utilizes analytics and social connections inside and outside the company to solve business problems and capture new business opportunities

3. **Nimble** - A Social Business leverages these social networks to speed up business, gaining real-time insight to make quicker and better decisions. It gets information to customers and partners in new ways -- faster. Supported by ubiquitous access on mobile devices and new ways of connecting and working together in the Cloud and on open platforms, a Social Business turns time and location from constraints into advantages. Business is free to occur when and where it delivers the greatest value, allowing the organization to adapt quickly to the changing marketplace.

We believe the most effective approach to enabling a Social Business centers around helping people discover expertise, develop social networks and capitalize on relationships. A Social Business enables its employees – and customers – to more easily find the information and expertise they seek. It helps groups of people bind together into communities of shared interest and coordinate their efforts to deliver better business results faster. It encourages, supports and takes advantage of innovation and idea creation and builds on the intelligence of the crowd.

An effective Social Business embodies a culture characterized by sharing, transparency, innovation and improved decision making. Such a culture enables deeper relationships with customers and business partners. By allowing people (both inside and outside an organization) to document and share their knowledge and ideas and others to recognize, refine and promote the value of those ideas and content, a Social Business can reap great benefits. Among them:

1. the ability to leverage more expertise and a greater diversity of skills and experience,

2. better real-time use of current knowledge (contrasted with formalized, but less current knowledge) and

3. improved situational awareness and use of social intelligence in decision making.

Did you know?

- *Smartphone shipments will outpace PCs by 2012.[2].*
- *Online users in rapid-growth regions like Latin America, the Middle East and China are now spending more time on social-networking sites than on e-mail.[3]*
- *Gartner Research predicts that social networking services will replace e-mail as the primary communications vehicle for 20 percent of business users by 2014.[4]*
- *Globally, the total minutes spent on social networks monthly saw a more than 100 percent gain over the same time last year.*

A Social Business shifts the focus from documents, project plans and other temporary artifacts to the source of the energy, creativity and decision

How does my company start the journey?

Based on working with thousands of clients, here is a way to create your personalized Social Business Agenda.

A - Align your goals and culture to be ready to become more engaging and transparent. Do not underestimate the task ahead of you. Culture eats strategy for lunch. Take a look at IBM's Social Computing Guidelines as a way to get started.

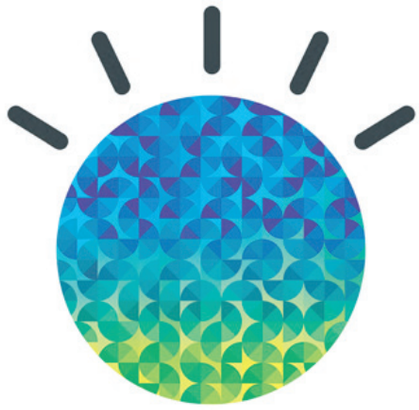
G – Gain Social Trust by focusing on finding your fans, friends and followers, and forming best friends from your tippers or most influential clients or outside parties. It dives into what social trust is all about and how you instill it.

E – Engage through experiences with your clients and employees — consider diving into gaming, virtual gifting, location based, mobile, or other stellar experiences to drive that engagement.

N – "Social" Network your processes. Since this is about business, figuring out how to add social techniques to your processes is critical. Think about customer service — adding in Twitter to address your customer's concerns. Or Crowdsourcing for product innovation, or Communities for incrementing your marketing processes around Loyalty.

D – Design for Reputation and Risk Management. This is the #1 area of focus for the C level — managing the risk of having your brand online, your employees being your brand advocates, and even your clients becoming your marketing department. The value typically outweighs the risk, but see how to develop a Disaster Recovery plan as you plan for the worst, and expect the best.

A – Analyze your data. Social analytics are the new black. You need to see the patterns of sentiment, who your tippers are, and listen daily



making that moves the business forward: people. A people-centric approach relies on four factors:

- **Networks:** Globally integrated networks of employees, partners and customers are the backbone of a Social Business. Rich online profiles of trusted experts enable collaboration and agility and allow for exploration of expertise, publications and networks of colleagues to quickly initiate action or fulfill a business need.

- **Social and realtime collaboration:** Connecting remote teams of people to improve and decision making and discover relevant expertise or related work empowers people and enables problem solving.

- **Mobility:** A social business benefits from enabling individuals to use the device best suited to their needs and keeping them connected whenever and where ever they are. The speed and relevance of information exchange are increasingly essential.

- **Integration:** Bringing social collaboration capabilities into the applications people use to do their jobs, without overwhelming them, allows for information sharing within the context of business processes.

A key element to the success of a Social Business is trust. First, an organization needs a certain level of trust to empower its employees to share their ideas and expertise – and it must demonstrate this trust by rewarding the behavior. By the same token, it must trust its customers to maintain an open dialogue with them.

At the same time, this trust must be balanced with an appropriate level of governance or discipline that sets the parameters of appropriate actions. This is a very delicate balance and one with which some companies struggle.

What is the Value of Social Business?

As the rapid growth of social networking and mobility has erased some of the boundaries that separated individuals in the past, people increasingly use their relationships with other people to discover and use information to accomplish innumerable tasks. New opportunities for growth, innovation and productivity exist for organizations that encourage people – employees, customers and partners – to engage and build trusted relationships.

Individuals are using social networking tools in their personal lives, and many are also incorporating it into their work lives – regardless of whether it's sanctioned by their employers. Astute organizations will embrace social software and find the most effective ways to utilize it to drive growth, improve client satisfaction and empower employees.

In fact, Social Business software has gained significant momentum in the enterprise, and this trend is expected to continue, with IDC forecasting a

Common industry terms

- *Enterprise 2.0: Mostly focused on collaboration behind the firewall between employees and partners. When applied effectively, it can enable large organizations to become more nimble and agile and, in many ways, act more like a "small" business in the best sense of the word.*
- *Social CRM: A strategy that allows an organization to make customers a focal point of how it does business, where the customers are actually a key force behind the development of the ideas, services and products that the organization produces.*
- *Social media: Social media is another channel composed of various social sites such as Twitter and Facebook. These channels have their own processes, guidelines, governance and forms of accountability. As an organization develops a social business strategy, social media might be one of the channels to pursue.*
- *Social software: The broader set of social tools (messaging, chats, blogs, wikis, activities, file sharing, profiles, forums, analytics, tagging, etc.) that enable all of the concepts above and include applications used within an enterprise behind a firewall as well as third-party services that extend beyond the firewall.*

compound annual growth rate of 38 percent through 2014.[5]

However, becoming a Social Business is not simply a matter of deploying some collaboration tools and hoping for the best. It is a long-term strategic approach to shaping a business culture and is highly dependent on executive leadership and effective corporate strategy, including business processes, risk management, leadership development, financial controls and business analytics. Realizing the potential value of Social Business is predicated on an organization's ability to recognize and design for this transformation.

Social Businesses can orchestrate and optimize new ways of generating value through innovation, creativity and utilizing the right skills and information at the right time. They become more flexible and agile in the face of the global market's competitive pressures and rapid rate of change.

We see three key business value opportunities arising from the Social Business transformation. Here are three case studies that illustrate the value of Social Business:

Case study one demonstrates how to deepen customer relationships

In today's fast-paced "always on" world, brands are getting strengthened and destroyed in a fraction of the time it once took due to the proliferation of instant, viral feedback via social media and social networking tools. The combination of social media and the growth of Internet use has essentially changed the way consumers interact with brands. Now, more than ever, organizations must understand and communicate with their customers.

Most business leaders understand this. In fact, 89 percent of all CEOs who participated in the 2012 IBM CEO study want to "understand individual customers better and respond faster" as the most important dimension to realize their strategy in the next five years. A Forrester study also found that the socially savvy CEOs will begin to dominate boardrooms by 2015.

Consumers are connecting with brands in fundamentally new ways. The ways individuals become aware of, research, purchase and obtain support for products have changed. Increasingly, customers rely on digital interactions, peer evaluations, social media and online after-purchase support to make their decisions about which brands to engage. While customers have historically interacted with trusted sources to help make purchasing decisions, technology is enabling them to do so, on a much larger and more organized scale using more resources.

Social marketing is becoming an increasingly effective and essential mechanism to engage customers. The benefits to brand building and engagement are obvious, but organizations are challenged with delivering a consistent, compelling brand experience across their channels and breaking through the "social clutter." To truly become customer centric, an organization needs to have the social media tools ingrained in its end-to-end business.

And it needs to listen to its customers when they volunteer information – because customer feedback obtained via social media is many times quite different from information gained through surveys and other market intelligence tools. Social Businesses are finding ways to mine this information while also creating a consistent, truly interactive and context-aware experience.

Instead of simply pushing messages and offers out to the market, marketing is engaging customers

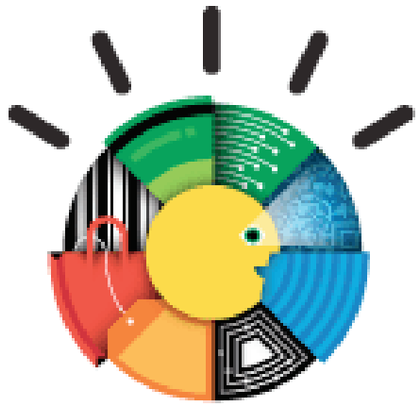
Three technologies to become a true social business:

1. Adopt social networking tools that enable employees to remain in contact with a network of their colleagues; respond quickly to business opportunities by calling upon the expertise in their network; and discuss and refine new ideas through the dialog among communities of coworkers, partners and customers.

2. Next-generation content management system that understands the rules of business as regulatory compliance still applies if a business is using a social network. Gartner said that by the end of 2013, half of all companies will be forced to produce material from their web sites for regulatory reasons.

3. Apply business analytics to unlock the potential of the information that emerges within a social network. Without analytics, the information is just more data. By using analytics, an organization can start to tag the web pages where the data resides, collect information on how it's being used. Then decisions can be made on how the systems will evolve, how the network should evolve, and how an organization can start to transform business processes.

Creating connections and enabling collaboration through social networking is a great first step, but the real business value comes when an organization can tap into the data generated by these connections and use it to develop new business insights. This is the mark of a true social business.



through open dialogue integrated with rich media capabilities that cater to customers' preferences, buying patterns and personal networks. From a marketing and sales perspective, a Social Business can create, manage and publish personalized content (text, pictures, audio, video, documents, etc.) based on profile data from the Web, optimized for customers' behavior patterns. In addition, it can provide consistent branding and user experiences across multiple sites and channels seamlessly through Web content management. Finally, a Social Business is better able to target the right content to the right customers based on personal attributes, patterns of behavior, segmentation and loyalty programs through personalization engines, Web analytics, and instant messaging and online meetings.

In terms of customer service, a Social Business can provide an online experience through "real people" showing personalized profile information via instant messaging, community blogging or Web conferences – turning customers into advocates. In addition, it can strive to deliver realtime information to online customers through multiple devices (mobile, smart-phone, tablet PCs, etc.) to help ensure effective communication anytime and anywhere. As part of all this, an effective Social Business can also implement a flexible model of customer self-service capabilities, such as chat forums and communities, to increase responsiveness and decrease costs. Essentially, Social Businesses are successfully building deeper customer relationships and impacting the traditional role of the Chief Marketing Officer by concentrating on some key actions:

- **Put customers at the center:** Embrace an open dialogue with customers through social tools to involve them in both internal processes, like product development, and external processes, such as promotion and customer service.

- **Address customer experiences comprehensively:** The best experiences are consistent and custom fitted to users' preferences, devices, locations, social networks and behavior patterns.

- **Utilize technology to build competitive advantage:** Analytically derived customer insights that leverage customer information from across internal and external data sources (Facebook, Twitter, etc.) feed marketing programs which, in turn, deliver the ultimate engaging customer experience

Case study 1: Deepening customer relationships to speed development

China Telecommunications Corp. (China Telecom) is the largest fixed-line service and third-largest mobile telecommunication provider in China. It offers a full range of integrated information, Internet connection and application services. With over 200,000 employees, it operates subsidiaries in 31 provinces and branches in the Americas, Europe, Hong Kong and Macao. To stay competitive, the Shanghai branch of China Telecom wanted a way to accelerate creation of new telecom services by optimizing use of its employee base in a unified innovation process. China Telecom developed an innovation platform with a Web portal

interface that enables collaboration among employees, partners and customers.

The portal accepts ideas from this enlarged community, expanding the sources of innovation and helping to filter the best quality ideas. More than 550 new "voices" joined the development process in the first six months of the portal launch, with publication of the first idea a mere ten minutes after launch. Marketing teams can analyze new intelligence gathered directly from consumers' Web 2.0 entries and introduce new services with the knowledge that subscriber demand exists. More product ideas of higher quality reduce opportunity costs and risks, and increase the chances of marketing success. And as Niu Gang, Associate Director of the Shanghai Research Institute for China Telecom observes, this solution enables the company to deliver exciting products to the marketplace at a faster pace than ever before.

Case study two shows how to drive operational efficiencies

Social Businesses can improve communication, as well as drive innovation, much faster than traditional organizations. Good ideas can be brought together. Complimentary expertise can be combined. Serendipitous connections can be made. Ideas can be discovered, stand on each others' shoulders and be refined, expanded on and turned into valuable goods and services much more quickly. This sharing of ideas and increased communication can lead to increased operational efficiency.

GGVSome leading services development organizations have begun to utilize social tools to drive product innovation and service improvement. Progressive development teams are using social capabilities to connect with new, broader perspectives, which are enriching the quality of their development efforts. As they extend their reach beyond conventional networks within an organization, their knowledge base and problem-solving capacities can grow exponentially. The Social Business model is changing the traditional roles of development managers by emphasizing the importance of their ability to:

- **Bring more diverse opinions together to form novel ideas.** Build focused communities that help improve the quality and speed of gathering business insights and generating improvement ideas.

- **Gather better requirements straight from the customer's voice.** Gather high-quality input and ideas, as well as frequent feedback, from motivated customers and partners who broadcast their product needs through daily commentary via external communities and blogs.

- **Bring break-through products to market faster while preserving quality and traceability by sharing product ideas and production processes across organizational boundaries.** Product developers can obtain early feedback on development prototypes and incorporate feedback on in-flight projects or prototypes via file sharing, forums, blogs, tweets and other social media to refine and perfect designs before committing to fixed production volumes and costly reworks.

- **Continue to connect developers with feedback from the field.** Improve quality and service by actively communicating externally to solicit quality concerns, offering appropriate expertise to solve problems and getting answers into the hands of those who may need it most at any given time.

- **Rapidly form small, focused teams to innovate. The best innovations often come from small teams.** A Social Business is not just about bringing together more opinions, it is about enabling the right people to come together to solve problems, unimpeded by organizational boundaries.

Case Study 2: Speeding innovation and time to market

CEMEX is the third largest building materials company in the world, with employees in 50 countries. To meet business challenges, it had to bring its global community closer together, so it created a social network initiative, called Shift, for open collaboration across its entire workforce. Within a year, over 20,000 employees were engaged, over 500 communities had formed, nine global innovation initiatives were underway -- and ideas started flowing around the world among specialists in all areas and levels of the company. Wikis, blogs and communities became links between operating units around the world, and the collaboration among employees led to impressive results -- for instance, the launch in under four months of the first global brand of CEMEX's Ready Mix special product. If the same level of collaboration now enabled by Shift were conducted today through traditional meetings by phone and travel, CEMEX would be spending an additional US$0.5 to US$1 million per year.

Case study three underlines the importance of optimizing the workforce

Social Businesses are utilizing social technologies to connect workers with each other, with experts both internal and external to the organization

Six steps to integrate social communications

Social communications involves the marriage of traditional communications tools such as telephony and video, with newer social networking and social media tools. This integrated approach is helping to take enterprise collaboration to the next level, and revolutionizing the ways that people and businesses communicate.

Here are six steps to easily integrate social communications into business strategy:

1. **Determine which social tools are being used.**
   Are people in your organization tweeting? Are they on Facebook? If so, then good news: You've already taken the first step. Look around and you'll see people traveling with their tablets, taking sales calls on their Blackberries and Tweeting with colleagues and friends.

2. **Determine how to best manage this interaction**.
   Ask yourself, "How can I help people actually get work done, better and more efficiently, across their social networks?" The key is real-time communication. Helping to conduct an expertise search based upon people in your social networks allows work to be done more quickly. The analytics tools in the social network helps identify people who should connect and work together on a particular project based upon their knowledge of a certain subject, whether it be legal matters or pricing issues. The real-time aspect allows users to see who's available right now. It eliminates the need for sharing conference call information and coordinating schedules. This can also be useful for bringing in external counsel. If you connect with someone via a social network, you can invite them to a meeting and use a tool with co-editing features to collaborate on a document -- a contract, for example. Something that would have taken hours, perhaps even days, is now completed in a matter of minutes.

3. **Ensure the social tools your organization uses provide seamless integration features.**
   When deciding which social tools your organization should use, keep in mind that the most important factors are seamlessness and integration. Make sure you choose social tools that will work with your telephony systems. Do you have video investments? It should integrate with those, too.

   Since the mobile workforce is expected to reach more than 1.19 billion by 2013, mobile support is especially critical. The various operating systems that support today's smart phones, tablets, and other devices need to integrate with your social communications strategy.

4. **Be aware of security and privacy of information.**
   Email and instant messaging come with their own risks – such as viruses, spam and phishing attacks. Similarly, social networking opens up its own risk of information leakage risks. Encourage adoption by educating people on how to properly use their social network. Not everything should be posted publicly, and employees must be shown what is and isn't okay to share in public domain. Many products offer control mechanisms that assist in compliance by allowing some posts to be blocked. And be sure you have archives so there is a historic record of what's been said.

5. **Hone in on the benefits of social.**
   If you want to measure the benefits, look at overall productivity and efficiency. If someone can more easily find another person via social connections, then they are more likely to ask for information. The net result is that the task at hand takes less time, but also that important materials are subject to additional review. A proposal, for example, can go out the door having undergone scrutiny by more sets of eyes.

6. **Understand the cost savings.**
   There are additional cost savings around managing communications cost. Everything adds up: desktop phones can sit unused if an employee is remote or travels often. The cost of international calls can get sky high. So can data plans for mobile devices. Eliminating these costs produces tangible savings that can be easily quantified. It's clear why social communications is critical for today's always open, always connected, organization. Communications challenges are no longer just about connecting people for a one-on-one conversation, but rather using the wide variety of social networking and analytics tools to determine the best way to reach a person and ensure faster access to information. With seamless access to new, social tools that make it even simpler to connect, it's now easier than ever to assemble a group, regardless of location, and make a decision almost immediately. Overall, organizations that realize the value of social communications as they evolve into a social business will outperform their peers.

and with context-relevant content. Workers can leverage these tools to coordinate activities such as completing projects or tasks, reporting status, keeping managers up to date, getting help and helping others.

There are two major trends driving the need for organizations to adopt these capabilities:

1. **Millennials are entering the workforce:** They are well versed in a social culture of sharing and transparency. It is second nature to them to communicate their status, update their superiors and get feedback on their activities – and technology is core to how they do it. Organizations that want to get the most out of these new people resources will need to give them the tools to best leverage their work habits and potential for idea generation.

2. **More and more teams are geographically distributed:** As firms continue their geographic expansion, find talent in far flung places, look to moderate their real estate costs or give their employees more work/life flexibility, they are considering options such as "hoteling" or telecommuting. These strategies make improved collaboration even more critical. Social, collaborative and rich communication technologies that are seamlessly deployed across all mobile devices, as well as integrated into existing applications and into the fabric of business culture, offer the potential to make a distributed workforce more productive.

Social Businesses are optimizing their workforces by enabling their employees to become more effective and by recognizing where which talents can be best utilized. Human resources professionals in a Social Business can expand their roles and help:

- **Encourage a culture of information sharing.** Social tools provide a gateway for current and relevant information exchanges across geographies and organizational silos. Building trust and encouraging social interactions are essential to driving a social change in the workforce.

- **Empower workers to foster innovation and growth.** Quick access to information and collaboration with an expanded professional network stimulates creativity, idea generation and problem solving.

- **Help employees find people and build relationships.** Social tools can support people's intrinsic sense of "belonging" by recognizing contributions and building stronger communities and relationships across the organization.

- **Improve leadership development.** Strive to retain top talent and develop the next generation of successful leaders through leadership development communities, expertise tracking and personal brand management.

- **Mobilize for speed and flexibility.** It's important to be able to rapidly respond to customer demands and changing market conditions through rich profiles, expertise tagging, file and bookmark sharing, team libraries and group broadcast tools.

- **Rapidly develop and deploy skills and capabilities.** Human resources professionals should serve as a repository to catalogue – and continue to develop – the vast talents and expertise that exist. They can utilize a number of methods to improve this process, including social learning, expertise tagging and folksonomies, social rewards and technical communities of interest. Such tools can enable HR to identify the right individuals for the right opportunities, benefitting employees, the company and, ultimately, the client.

- **Enhance skills transfer and new employee onboarding processes.** By creating shared repositories of social and business information, human resources professionals can enable new employees to more rapidly acclimate. Group chat rooms, social bookmarks and shared team repositories can also help shift teams rapidly transfer realtime information from one shift to the next, such as recent customer requests, special outcomes of note, etc.

Social Businesses recognize that employees need to be agile, informed and able to work beyond their specific job descriptions. As such, they provide tools and the cultural incentives that allow employees more access to the right information and the right people.

Social Businesses reduce both the cultural boundaries as well as the technical obstacles for people to connect with people and information, allowing unprecedented access. All this equates to an optimized workforce – one that is able to feel closer to its customers while driving operational efficiencies.

Case Study 3: Collaborating to improve productivity, decrease costs

Sogeti is one of the world's leading providers of IT consulting services and solution integration. As it expanded across 15 countries, information silos made locating and collaborating with the vast expertise in the company difficult. Sogeti needed new ways to foster teamwork and peer communication among its many business groups and locations. To tie together over 20,000 people across 200 locations, Sogeti deployed an enterprise-wide social networking and collaboration platform for finding and leveraging expertise, knowledge transfer, close teaming across distances and sharing of best practices. Now, integrated multiple active directories provide a unified approach to identifying expertise wherever it may be.

Easier access to the tacit knowledge of others helps co-workers develop their skills, and fast identification of people's skills supports efficient staffing with the right people for any project or mission. Together, accelerated knowledge transfer, better use of expertise and the ability to staff the right people quickly is preparing Sogeti to enter new markets. And being able to share rather than having to reinvent key processes is yielding significant savings in project startup costs.

Preparing for the Future

In conclusion, the challenge faced by virtually all enterprises in these turbulent times is how to build organizations that are more adaptive and agile, more creative and innovative, and more efficient and resilient. Increasingly, it is becoming clear that the traditional hierarchical enterprise, built on a structure of departments and a culture of compartmentalization, will give way to a socially synergistic enterprise built on continually evolving communities and a culture of sharing and innovation. As such, we predict the path to becoming a Social Business is inevitable. However, the differentiating factors – those which will separate the leaders from the masses – will stem from how effectively an organization embraces both a Social Business culture as well as the technology to deepen customer relationships, drive operational efficiencies and optimize the workforce.

And even the most successful organizations will encounter potholes along their paths. For example, in today's open world, disgruntled employees, partners and customers have a tremendous voice – something that must be considered as a business plots its Social Business strategy. In addition, issues relating to protection of intellectual property in the socially networked world, as well as an enterprise's potential legal risks associated with social media, must be considered. Finally, HR policies likely need to evolve to take into account the massive increase in public information about employees, candidates and alumni.

Creating connections and enabling collaboration through social networking is a great first step, but the real business value comes when an organization can tap into the data generated by these connections and use it to develop new business insights. This is the mark of a true social business.

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10. 2012 STATE OF MOBILITY SURVEY: MALAYSIA FINDINGS

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Executive Summary

It seems like just a few years ago that the Internet completely changed the way we do business. And now we are seeing it again, with mobile devices as the catalyst. Once mostly forbidden by IT, smartphones are now being used by hundreds of millions of employees throughout the world to access corporate information to keep up in today's 24/7 business world.

Symantec commissioned the 2012 State of Mobility survey to gauge how organizations are coping with this trend. Applied Research spoke with 6,275 organizations of all sizes in 43 countries from August to November of 2011. 150 of those responses came from organizations in Malaysia. Our survey shows that we have reached a tipping point in the business use of mobile devices. Most organizations are making line-of-business application available. They are also developing custom applications, and even making plans to create corporate app stores for employees to download approved software.

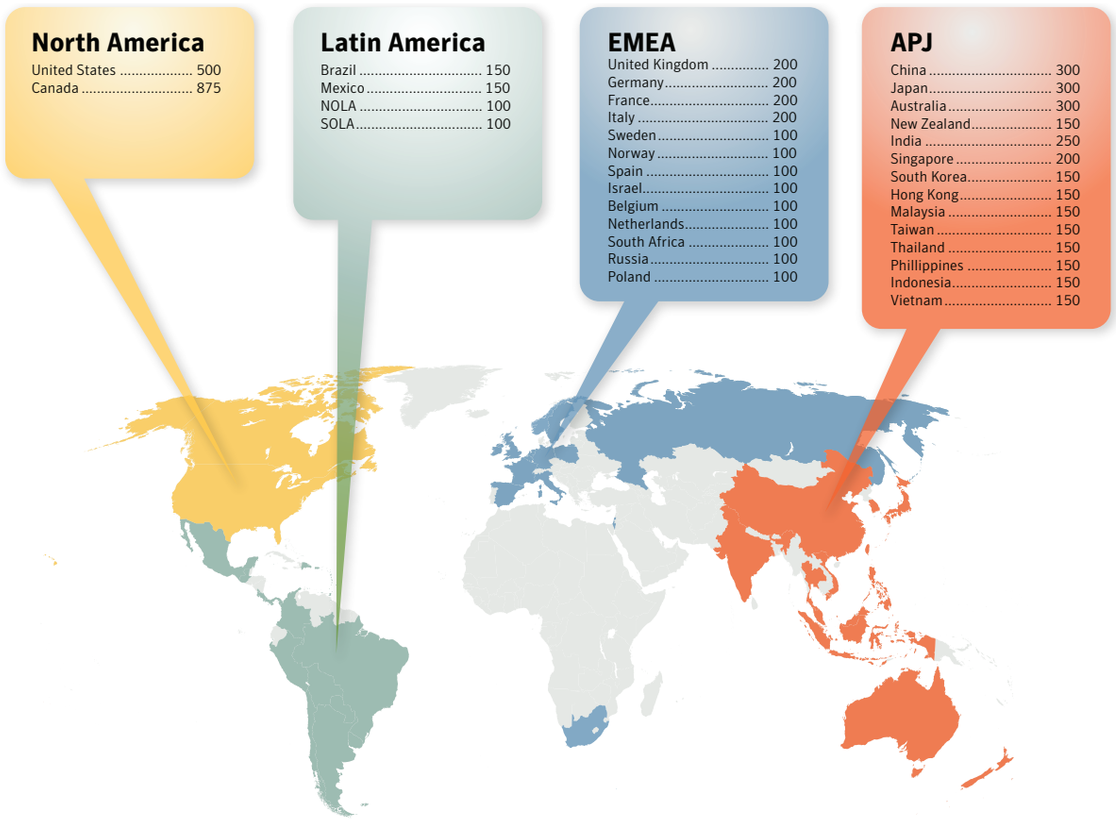
All this points to the goal of improving corporate agility. Businesses want to improve efficiency and increase workplace effectiveness, as well as get things done quicker, and mobility offers them the chance to do that. But there's a price. Organizations are aware of the potential dangers mobility can pose, rating it highest among IT initiatives in risk. They're worried about losing devices, data loss and malware infecting the corporate network through smartphones and tablets.

And there's good reason for these concerns. Globally, businesses are losing a significant amount of money to incidents relating to mobile devices – as much as USD$429,000 annually in the case of large enterprises. Despite these costs, however, organizations feel the risks are worth the benefits, and they are working to implement security measures to rein in these costs and keep their corporate information safe.

Methodology

Symantec commissioned Applied Research to field the State of Mobility Survey from August through November of 2011. They contacted a total of 6,275 businesses across the globe, 150 within Malaysia, with the number of employees ranging from 5 to more than 5,000. Among small businesses, the survey respondents were the person in charge of computers. Among enterprises, we contacted senior IT and C-level executives.

Within this report, all crosstabs based on company size and region are pulled from the global population. Globally, the poll has a reliability of 95 percent confidence with +/- 1.3 percent margin of error. Within Malaysia, the margin of error is +/- 8 percent.



Finding 1

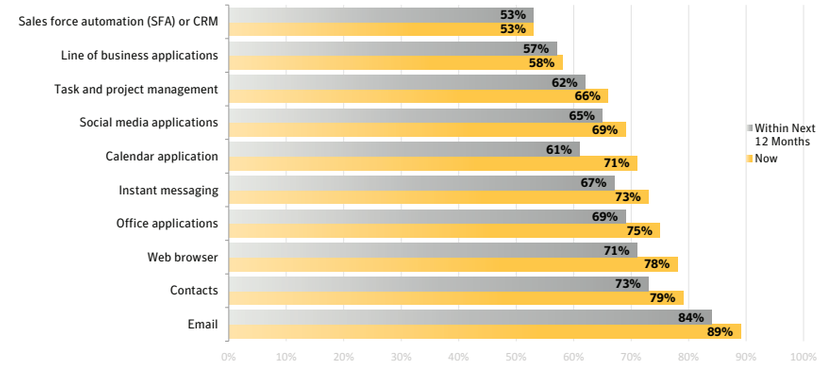
Tipping point in mobility adoption

Times are changing for businesses, and in no area is this more readily apparent than in mobility. These devices have become essential tools for conducting business. Employees are seeing significantly improved productivity by being able to access business resources from anywhere. Organizations are now commonly making line-of-business applications accessible from mobile devices – 58 percent of respondents reported this to be the case. In fact, now that mobile devices are commonplace, over two-thirds (70 percent) of businesses are now looking at implementing a corporate "store" for mobile applications.

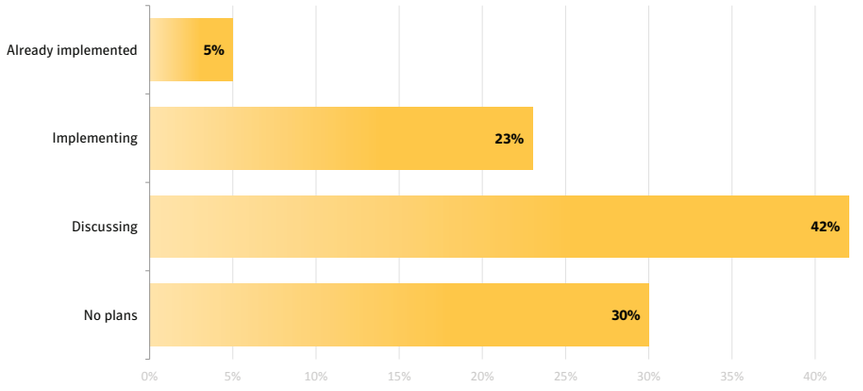
In order to better understand why organizations are adopting mobile computing, we asked them about the most important business benefits. They mentioned increased efficiency, increased sales, and reduced time required to accomplish tasks. Taken together, these all benefit their business agility. In many areas of IT, the expectations of implementing a new technology are not always matched by the results. In the case of mobile computing, however, expectations much more closely matched reality. The largest gap was in efficiency – 70 percent expected to increase efficiency through mobile computing and 60 percent actual achieved that gain. However, other areas, such as employee productivity and employee satisfaction (59 percent expected vs. 65 percent actual), actually exceeded expectations.

These results largely held true for small businesses and enterprises alike, with efficiency being their top goal. Enterprises were slightly more optimistic in the benefits they would realize, not quite doing as

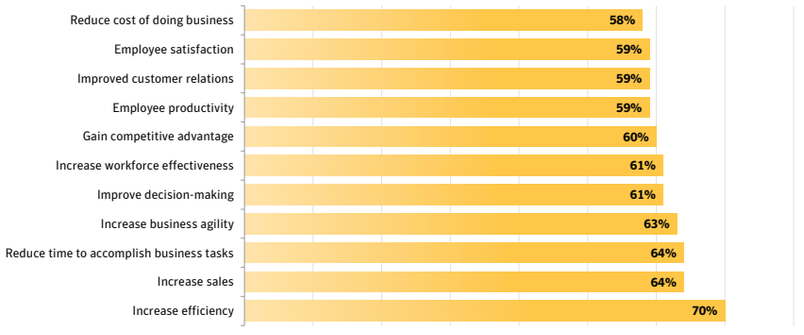
Which applications do your employees currently use for business purposes on their mobile devices?



Do you have plans to roll out a private 'app store' where employees can get officially supported applications for their mobile devices?



Please indicate how important each of the following business benefits are for mobile computing: (Somewhat/Extremely important)



well as they expected, while SMBs had slightly lower expectations that were exceeded. The main difference was that smaller businesses were less likely than enterprises to have plans regarding custom apps or corporate app stores.

North America is lagging somewhat behind the curve in mainstream business use of mobile computing, and Latin America is ahead in areas such as line-ofbusiness applications (67 percent compared to 53 percent for North America) and planning corporate app stores (70 percent compared to 52 percent).

Finding 2

Mobile initiatives significantly impacting IT resources

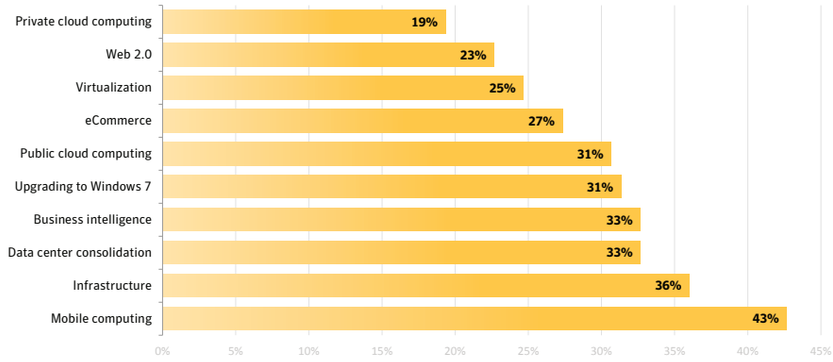
Mobility is providing useful benefits, but it's also creating challenges for IT as they balance it with other areas of focus. Nearly half of the organizations we surveyed (44 percent) see mobile computing as somewhat to extremely challenging, and it is requiring effort to manage. In fact, 30 percent of IT staff is involved in some way with mobile computing. They reported that their top priorities are reducing the cost and complexity of managing mobile computing, supporting as many of the devices employees want to use as possible, and security.

Mobility ranked as the leading IT risk among organizations, being cited as one of the top three risk areas by percent of respondents – more than any other initiative, including virtualization, Web 2.0 and even public cloud computing. They have a variety of concerns, including device loss, data leakage, unauthorized access to corporate resources and malware infection.

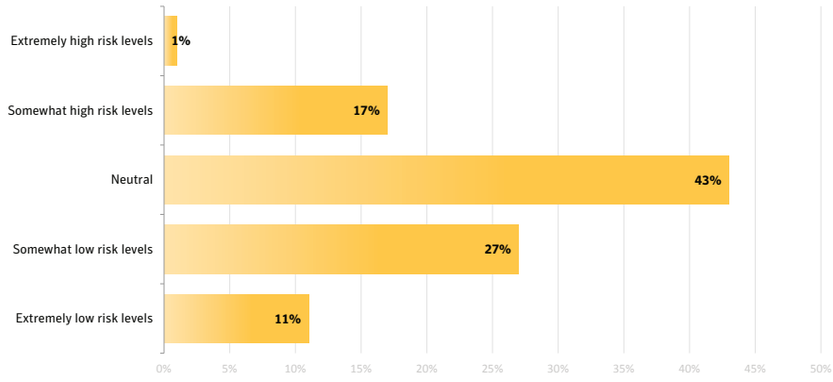
Nearly one-in-five respondents felt that the risks of mobile computing are somewhat to extremely high, and they identify the fastest growing risks as spam, phishing and malware. In response to these perceived risks, most organizations are at least discussing a range of security measures, from antivirus software to remote disabling of devices. When it comes to implementing measures, however, less than half have taken those steps.

Is this lack of security affecting businesses?

What are the top three computing initiative risks in terms of the level of risk they introduce for your organization? (In the top 3)



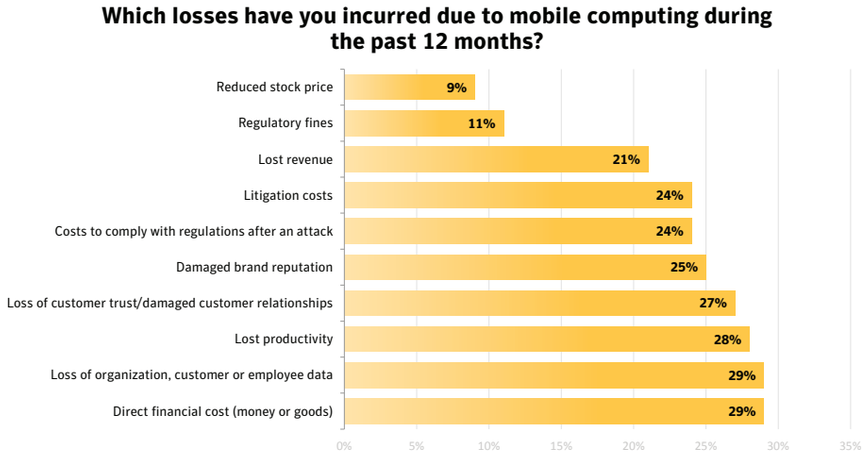
How would you characterize the level of risk your organization faces in conjunction with mobile computing?



Finding 3

Mobile risks impacting organizations

In a word, yes. Small and large businesses alike are seeing damages mount due to mobility-related security issues. They have suffered a variety of losses, measured by direct financial expenses, loss of data, and loss of productivity. Within the last 12 months, the average cost of these losses was a surprising US$247,000 overall, US$183,000 in Malaysia. Large enterprises and small businesses are largely experiencing the same kinds of loss, but to a very different



degree – globally, small businesses averaged US$126,000 of loss, while enterprises averaged US$429,000. The average losses also varied widely according to region, from a low in Asia (US$199,000) to a high in Latin America (US$385,000).

In the end, however, most organizations feel that mobility is worth the challenges. Two-thirds (66 percent) feel that they at least break even on the risks vs. rewards

Key Recommendations

As organizations work to realize the competitive advantage offered through the adoption of mobile computing, Symantec offers the following recommendations to improve the effectiveness of mobile initiatives:

- **Enable broadly.** Mobility offers tremendous opportunities for organizations of all sizes. Explore how you can take advantage of mobility and develop a phased approach to build an ecosystem that supports your plan. To get the most from mobile advances, plan for line-of-business mobile applications that have mainstream use. Employees will use mobile devices for business one way or another – make it on your terms.

- **Think strategically.** Build a realistic assessment of the ultimate scale of your mobile business plan and its impact on your infrastructure. Think beyond email. Explore all of the mobile opportunities that can be introduced and understand the risks and threats that need to be mitigated. As you plan, take a crossfunctional approach to securing sensitive data no matter where it might end up.

- **Manage efficiently.** Mobile devices are legitimate endpoints that require the same attention given to traditional PCs. Many of the processes, policies, education and technologies that are leveraged for desktops and laptops are also applicable to mobile platforms. So the management of mobile devices should be integrated into the overall IT management framework and administered in the same way – ideally using compatible solutions and unified policies. This creates operational efficiencies and lowers the total cost of ownership.

- **Enforce Appropriately.** As more employees connect their personal devices to the corporate network, organizations need to modify their acceptable usage policies to accommodate both corporate-owned and personally-owned devices. Management and security levers will need to differ based on ownership of the device and the associated controls that the organization requires. Employees will continue to add devices to the corporate network to make their jobs more efficient and enjoyable so organizations must plan for this legally, operationally and culturally.

- **Secure comprehensively.** Look beyond basic password, wipe and application blocking policies. Focus on the information and where it is viewed, transmitted and stored. Integrating with existing data loss prevention, encryption and authentication policies will ensure consistent corporate and regulatory compliance.

11. MAKING A LIVABLE AND FRIENDLY ENVIRONMENT: ICT STRATEGIES

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Green IT, Smart Business

As the world's largest provider of information technology (IT) infrastructure, software, services, and solutions, HP is taking a leadership position in innovating energy-efficiency solutions - for a healthy planet and productive business.

In this article, Narinder Kapoor, Vice President, HP Enterprise Group and Managing Director, HP Malaysia, shares his insights on how companies must view IT as an essential component of carbon reduction compliance. In 2011, the global population passed 7 billion on its way to a projected 9.3 billion by 2050—a rise that's creating many challenges. None may be more critical than balancing the demands of economic growth with the need for long-term environmental sustainability. As more people strive for greater prosperity, we're facing increasing pressure to do more with finite resources. With energy driving the global economy, as well as nearly every aspect of modern life, and consumption forecast to increase nearly 50% by 2035, the world needs solutions that improve energy efficiency and help to keep pace with demand while reducing the emissions that contribute to climate change. In 2009, the Government of Malaysia identified green technology as a major growth area under the National Green Technology Policy. Today, Malaysia is committed to reducing emissions intensity of its GDP by up to 40 per cent by 2020.

The Benefits of Energy Efficiency

According to The Climate Group, information and communications technologies (ICT) could save 7.8 billion metric tons of carbon dioxide equivalent (CO2e) by 2020, representing 15% of global emissions.

Further, investing in energy efficiency is sound business strategy. According to McKinsey & Co., the average internal rate of return on energy efficiency projects is 17%, which could yield energy savings of up to $900 billion USD annually by 2020 in the United States alone.

IT Key to Carbon Reduction

It is becoming increasingly apparent that information technology can act as the key driver to achieve carbon targets in two important ways. Firstly, as a major energy user, information technology is currently generating about two per cent of the world's carbon emissions equaling the air travel industry as one of the biggest global CO2 emitters. Adopting a structured methodology to IT policies, practices and investment to reduce power consumption and carbon emissions is the first step towards setting up a clever, green-economy ready business.

Equally significant, IT can be used to track, manage and account for carbon emissions throughout an enterprise. Today, every process, action and product can be measured so that management can identify inefficiencies and make fact-based decisions on the carbon cost of their business.

Accurate information is pivotal because what gets measured gets managed. It empowers organisations to demonstrate leadership in taking pro-active measures to reduce their carbon emissions, and plan safely for emission-trading and a more environmentally regulated future.

Moving towards Green Governance

For any program to have long-term benefit there needs to be an effective whole-of-organisation governance structure. Starting with IT, initiatives such as one-time virtualization and printer consolidation, or maintaining a carbon inventory for the business operations in Excel spreadsheets, may provide some reprieve, but the impact is only going to be temporary without green governance in place. This means sustainable management driven from the top as a business strategy.

It's about making strategic decisions and driving growth and efficiency through sustainable enterprise. This involves establishing accountability and responsibility for activities that generate carbon emissions, identifying where cost savings can be achieved and actively planning. Such a structured approach means carbon management and accounting becomes a discipline and a protection against potential business risk.

Whatever directions are taken by governments in terms of carbon caps, emissions trading and compliance – areas of considerable uncertainty around the globe – companies have a real competitive advantage if they have green governance for IT and business operations in place. Transparency of information means they can respond with certainty to regulators, strategically position their business for future challenges, and demonstrate green credentials and corporate responsibility to shareholders and customers.

Putting IT to Work to Help Customers

As the world's largest provider

of information technology (IT) infrastructure, software, services, and solutions, HP is in a unique position to respond to this challenge. We see unprecedented opportunities to transform the way the world lives and works—while advancing our business and helping our customers thrive. HP is in a position to help customers turn energy-consumption data into usable information—helping them develop more efficient and productive operations that use less energy and reduce associated greenhouse gas (GHG) emissions.

The company can help individuals and organizations of all sizes:

- **Individual users**: HP Power Assistant makes it easier to monitor and reduce PC energy consumption, operating costs, and CO2e impact, without affecting productivity.

- **Enterprises:** HP Energy and Sustainability Management (ESM) is designed to help enterprise customers measure and manage energy use and other resources across their facilities, IT, supply chain, and workforce.

- **Utilities and others:** HP Smart Grid Solutions help these partners to design and deploy dynamic pricing programs and energy-efficiency, conservation, and demand-response programs.

Delivering energy-efficient IT

One of the important ways in which HP helps customers is by improving energy efficiency across its portfolio of products—from desktop PCs and printers to data centers. In fact, HP's product portfolio is on average 50% more energy efficient today than it was in 2005.

The company is also delivering solutions that replace inefficient technologies with more productive and sustainable alternatives. For example, HP thin clients enable computing on a "virtual desktop" residing on a central server. These offer significant savings in power usage over traditional desktops - for lower energy costs and lower cooling costs than heat-generating PCs.

Replacing 2,000 desktop PCs and monitors made in 2005 with the same number of HP thin client solutions, including the required servers, would cut energy consumption by 74% and save an estimated 795,000 kilowatt hours (kWh) per year.

Rethinking the Data Center

As demand for computing resources increases, companies are relying more heavily on data centers, thereby increasing energy use.

To help slow this trend, HP is helping customers rethink the data center—from design through operational management. For example, HP Critical Facilities Services (CFS) provides consulting, design, and engineering services for new or retrofitted data centers.

One challenge customers face is that traditional data centers can be over-provisioned and under-used, resulting in wasted energy and money. Virtualization offers one solution: Consolidating many servers into a single machine can dramatically reduce the energy demands of a data center while increasing its capacity and performance. HP is also developing data centers based on a more efficient cloud-based infrastructure. This enables servers to use and share resources more efficiently, getting more work out of each kWh used.

Taking a Leadership Position

Green practice is a responsibility taken seriously by HP. For the second year in a row, HP ranked the highest among electronics companies and fifth overall on the 50 Best Global Green Brands 2012 list issued by Interbrand, a leading brand consultancy. In ranking HP, Interbrand highlighted how we are extending our leadership in energy efficiency by installing the HP EcoPOD—a self-contained, ultra-efficient data center in Georgia. The HP EcoPOD reduces power usage and costs compared with traditional data centers. In fact, HP's Adaptive Cooling technology helps the HP EcoPOD use 95 percent less facilities energy compared to legacy data center designs while still maintaining peak performance. In addition, Interbrand also noted several of the ways we are improving the efficiency of our portfolio, supply chain, and operations to help us conserve more than we as a company consume. These include:

- Ongoing commitment to reduce energy consumption, paper use, water consumption, waste, and greenhouse gas emissions across our enterprise

- Strong emphasis on green packaging initiatives, the sale of "green products," product certification, and lifecycle analysis

- Focus on making environmental improvements by partnering with transportation, logistics, and other suppliers

- Ability to apply our scale, portfolio, and ingenuity to reduce our environmental impact and enable customers to be more energy efficient

Transforming Energy Usage across HP's Business

HP is committed to making its own global operations more energy-efficient, seeking low-carbon energy sources where possible. For example:

- In 2011, the company implemented a software platform to automate energy and sustainability data collection across 770 HP sites worldwide
- It works to manage and decrease energy use and GHG emissions throughout the business—from manufacturing and operations, to product transport, use, and recycling
- HP collaborates with government agencies, nongovernmental organizations, universities, and peer technology companies to improve its own performance, and to develop standards to advance the industry, and contribute to advanced research in energy and sustainability
- HP is an official signatory of The 2°C Challenge Communiqué, a statement from more than 400 international businesses that calls on governments to take action at a national level to ensure a successful transition to green growth and a climate-resilient economy. HP technology, services, and solutions can help transform how the world lives and works. The company makes it possible for customers to grow responsibly and to be more productive, while being conscious of the environment and efficient with resources.

Product Reuse and Recycle

Reusing an electronic product extends its life and reselling refurbished equipment can generate additional revenue. But eventually, all IT equipment reaches the end of its useful life. Recycling programs for electronic equipment can reduce the need for raw materials and energy to manufacture new products and help ensure that returned electronic equipment is managed responsibly.

In 2011, HP reached a milestone of responsibly recycling 2 billion pounds of electronic prod¬ucts and supplies since 1987—equivalent to the weight of 36 Statue of Liberty monuments! HP demonstrates its commitment to environmental sustainability through voluntary and mandatory programs. HP provides product take-back solutions to our customers, many of whom require that we manage their returned IT equipment responsibly.

We work with a global network of vendors in 67 countries and territories worldwide to collect, process for resale, and/or recycle returned products. Our main programs include:

a. **Hardware reuse***
Available currently across 53 countries of the world, HP resells refurbished products from PCs to data center equipment at the end of leasing terms or as part of trade-in agreements. We offer remarketed equipment for many HP and non-HP products, and follow strict processes set out in our Hardware reuse standards to protect user data and meet environmental requirements.

In 2011, in the United States, HP launched a program allowing consumers to donate the cash value of returned items to one of 15 selected charities including United Way, World Vision, and World Wildlife Fund (WWF).

b. **Hardware recycling**
This program is available in 50 countries across the world where HP recycles returned products that are not suitable for reuse. Consumer recycling services vary by country, depending partly on local regulations and infrastructure. And in 2011, HP launched a new hardware recycling facility in Kenya. We make appropriate recycling arrangements with commercial customers on a case-by-case basis

c. **HP ink and toner cartridge recycling**
Customers can return used HP ink and LaserJet toner cartridges to authorized retail and other collection sites through the HP Planet Partners program. This program is currently available across 55 countries. HP's "closed loop" ink cartridge recycling process is the first of its kind. Recycled plastic from HP ink cartridges is combined with recycled plastic bottle materials to create new Original HP ink cartridges. The HP LaserJet cartridge "closed loop" recycling process uses recycled plastic from HP LaserJet cartridges to create new Original HP LaserJet cartridges. In 2011, we expanded our "closed loop" HP ink cartridge recycling capability to include Vietnam

Supporting Vendor Development

At HP, we continue to focus on increasing the volume of HP equipment that is reused or recycled.

These efforts include expanding our return and recycling programs in developing countries. A challenge is that capabilities in these counties vary widely and many lack adequate collection and recycling systems.

The bulk of electronic waste is often collected and treated informally with few or no controls to safeguard human health and safety and the environ¬ment. HP works to improve local capabilities where we are expanding our programs, and we contract a third party to audit our first-tier vendors and ensure they conform to our high standards.

We are working with governments and nongovernmental organiza¬tions (NGOs) to improve local recycling capabilities in new markets. We identify potential vendors, conduct audits to make sure they meet our stan¬dards and policies, and require them to provide plans on how they can address any gaps in their approach.

Green Business is Smart Business

Organisations today, of all sizes, must recognize that sustainability is vital to their future growth and core to their business. A broader, more strategic plan for sustainability will not only drive efficiency and innovation across the organization, but will also influence how suppliers operate to satisfy their customers.

By integrating IT solutions so thoroughly into everyday operational practices their ability to make sound environmental decisions is greatly advanced. IT becomes the foundation and driver for new efficiencies and cost cutting. A great advantage of this approach is that it can be implemented without huge investment. Armed with knowledge, the process of change can begin with baby steps. Individual departments are able to take responsibility for their own actions which helps reinforce a culture of efficiency and reduce climate impact.

In summary, companies must view IT as an essential component of carbon reduction compliance. It's the clever solution. The alternative involves substantial business risk.

** Availability of each reuse offering varies by location.*

12. GREEN JOBS FOR A LOW CARBON ECONOMY: NURTURING THE NEXT-GEN GREEN COLLAR IT PROFESSIONALS

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GCI™
Green Computing Initiative

1. Abstract

This paper presents information about the impact of the local IT industry on the environment and the industry's appetite for high rates of energy consumption. It discusses the role that the IT industry can play in generating green jobs as the nation moves towards a low carbon economy.

In 2011, the local IT industry spent some RM3.7 billion on its electricity bill while producing a staggering 8.4 million metric tonness of carbon dioxide (CO_2). By 2020, the electricity consumption and carbon footprint of the local IT industry will increase by 55% and electricity expenditure will skyrocket by some 400%.

Green Computing Initiative's Green Collar IT Professional (GCITP) program is seen as a key step in contributing towards the establishment of thousands of green jobs, decarbonizing the economy and increasing Gross National Income.

Green jobs help to protect and restore ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency and avoidance strategies; decarbonizes the economy; and minimize or altogether avoid generation of all forms of waste and pollution.

A low carbon economy is one where all waste must be minimized, energy must be produced using low carbon energy sources and methods, all energy resources must be used efficiently, and, wherever possible, local needs should be served by local production with a high awareness and compliance with environmental and social responsibility initiatives.

The IT industry plays a significant part in enabling a low carbon economy through sustainable computing efforts. These efforts are documented in the Sustainable Computing Framework by Green Computing Initiative (GCI) and are currently the world's most comprehensive framework for the IT industry.

The GCI in collaboration with industry, academia and the government launched the GCITP) program with the following objectives:

- Jumpstarting the nation's Green Jobs agenda by producing green computing talent from the industry, academia and government sectors.

- Laying a foundation for the nation's path towards a Low Carbon Economy by providing a pool of talent to spearhead the various sustainable computing initiatives to support:
  - ◊ An increase of RM2 billion to annual GNI through cost savings by 2020.
  - ◊ A 40% reduction in the IT industry's carbon footprint by 2020.
  - ◊ A 50% reduction in the IT industry's energy costs and consumption by 2020.

2. Introduction

In 2011, the Information Technology (IT) industry in Malaysia was responsible for consuming some 9.3 billion kilowatt hours (KWh) of electricity annually costing some RM3.7 billion while outputting some 8.4 million metric tonnes of carbon dioxide (CO_2)[3] (Figure 1).

Further findings from the same study by Green Computing Initiative found that of the total expenditure on electricity costs, the public sector's IT electricity bill amounted to RM750 million while the private sector's electricity bill totaled close to RM3 billion. The CO_2 emissions in 2011

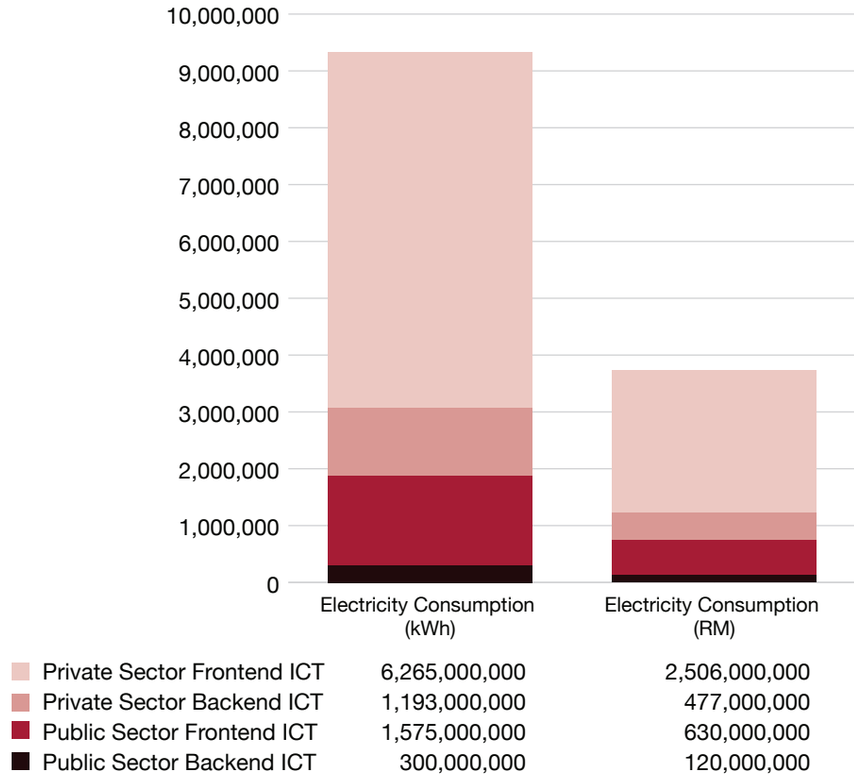

Figure 1: 2011 Malaysia ICT Electricity Costs & Consumption
(Source: Green Computing Initiative - Malaysia Study Q2, 2012)

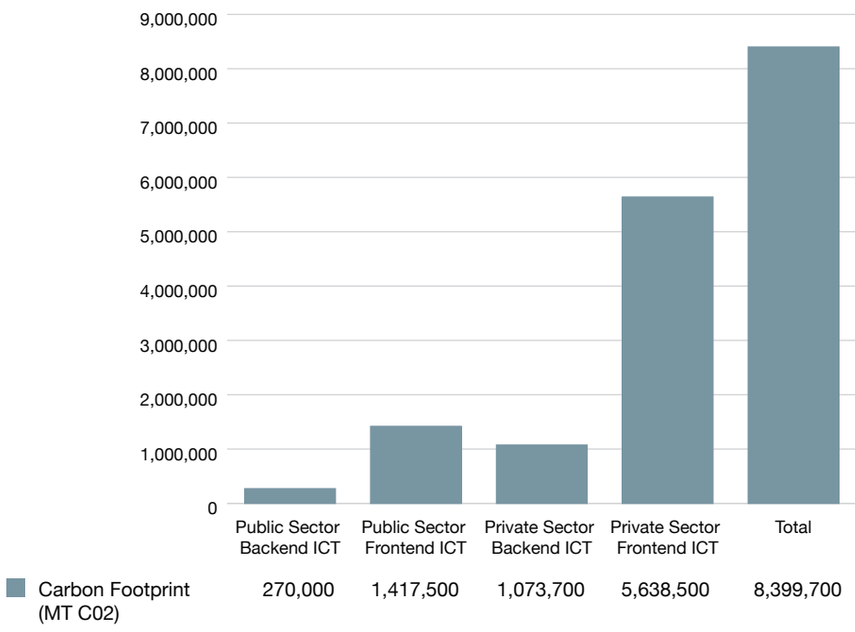

Figure 2: Carbon Foot Print (MT CO_2)
(Source: Green Computing Initiative)

from the public sector amounted to 1.7 million metric tonnes and the private sector was responsible for a staggering 6.7 million metric tonnes of CO_2 (Figure 2).

Based on a Business as Usual (BAU) scenario, the figures paint a sobering and stark picture of our nation's IT industry's costs to our pockets and the environment. The electricity consumption and carbon footprint of the local IT industry will increase by 55% and electricity expenditure will skyrocket by some 400%. The distinctive leap in electricity expenditure is attributed to the government's gradual rationalization of the fuel subsidy system, which is seen to be completely dismantled by December, 2015.

Efforts are currently underway to mitigate the negative effects of the local IT industry on the environment, the nation's energy security as well as the Gross National Income of Malaysia. Green Computing Initiative's Green Collar IT Professional (GCITP) program is seen as a major step in contributing towards the creation of thousands of green jobs, decarbonizing the economy and increasing Gross National Income.

3. Toward Creating Green Jobs and a Low Carbon Economy

The IT industry has tremendous potential and capacity for the creation of green jobs and enabling a low carbon economy. In order to understand how this can be accomplished, it is important to understand what the terms green jobs and low carbon economy mean.

3.1 Definition of Green Jobs

The International Labour Organisation (ILO) defines green jobs as positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency and avoidance strategies; decarbonizes the economy; and minimize or altogether avoid generation of all forms of waste and pollution .

3.1.1 FiveR Model

The IT industry's contribution to green jobs is geared towards IT professionals applying the FiveR Model (Figure 3), throughout the IT infrastructure lifecycle. GCI are the stewards of the industry standard Eco-Friendly Green Computing Definition (EFGCD). Eco-Friendly Green Computing is the study and practice of the design, development, implementation, utilization and disposal of sustainable information technology infrastructure efficiently and effectively with low or zero impact on the environment whilst reducing operating costs. The FiveR Model extends the traditional 3R concept of Reduce, Reuse and Recycle with two additional drivers namely Rethink and Reengineer. As an example, the diagram below depicts the Green Data Centre FiveR Model for the Ministry of Energy, Green Technology and Water (KeTTHA).

3.2 Definition of Low Carbon Economy

A low carbon economy is one where all waste must be minimised, energy must be produced using low carbon energy sources and methods, all energy resources must be used efficiently, and, wherever possible, local needs should be served by local production with a high awareness and compliance with environmental and social responsibility initiatives.

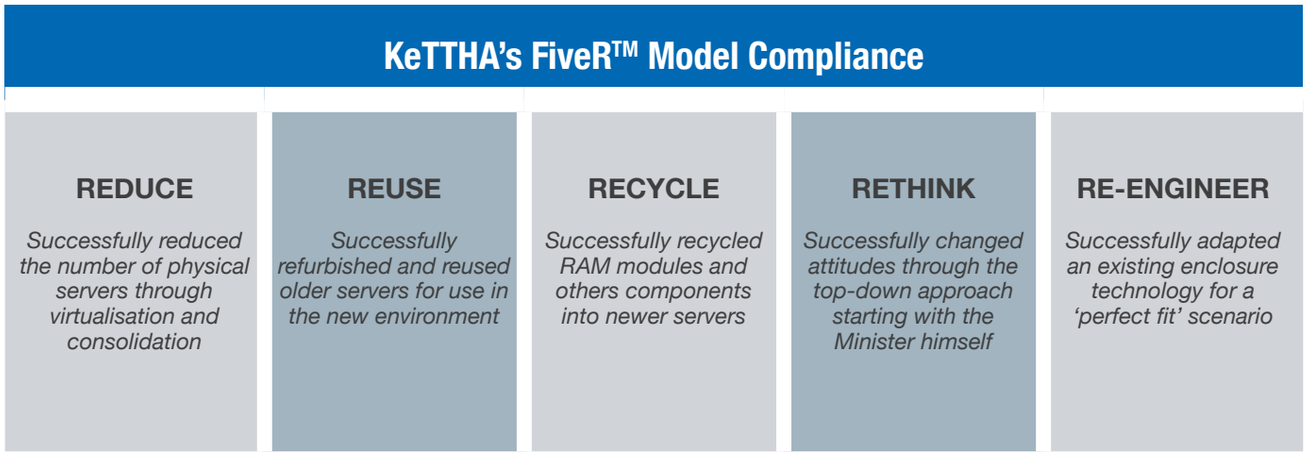

Figure 3: Ministry of Energy, Green Technology and Water's FiveR Model™ Compliance for Sustainable Computing Framework

The IT industry plays a significant part in enabling a low carbon economy through sustainable computing efforts. This effort is documented in the Sustainable Computing Framework (Figure 4) by GCI and is currently the world's most comprehensive framework for the IT industry.

3.2.1 Sustainable Computing Framework

The framework consists of five enabling horizontals: Attitude, Proficiency, Policy, Governance and Technology; thirteen drivers spread across two dimensions: Green of IT and Green by IT. It also outlines five engagements from various parties of the entire ecosystem.

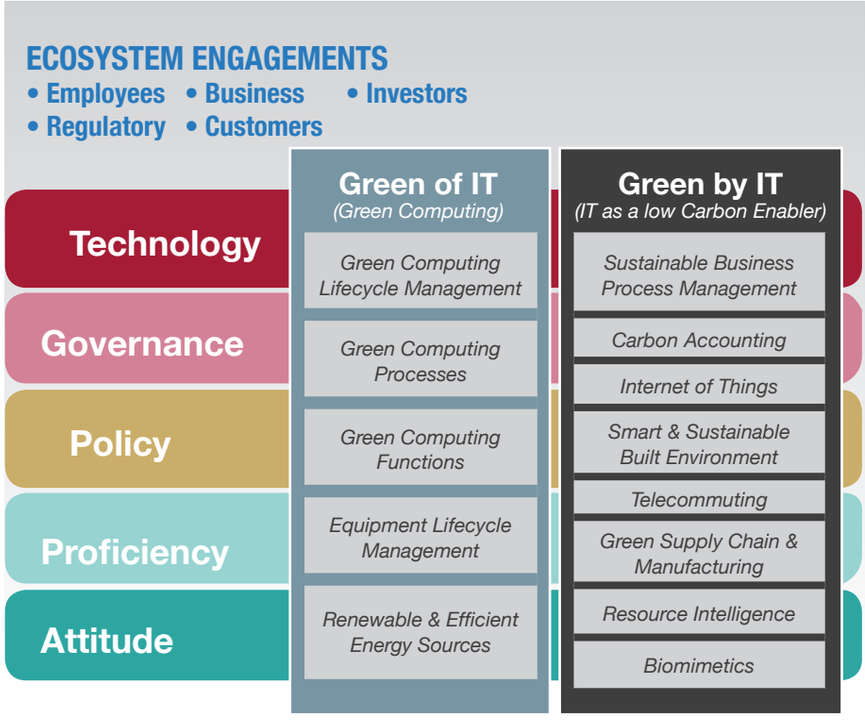

Figure 4: Sustainable Computing Framework by GCI, 2011

3.2.1.1 Enabling Horizontals

3.2.1.1.1 Attitude Enabler

The Attitude Enabler is based on the premise that people's attitudes are determined more by their immediate situation or surroundings. Some of the principles in this enabler include the 5th R in the Five R Model (Rethink), the Triple Bottom Line (People, Profit, Planet), Green Culture and Green Awareness.

3.2.1.1.2 Proficiency Enabler

The Proficiency Enabler is based on how IT professionals, business strategists & end-users need to be equipped with skills necessary to achieve & maintain successful sustainable computing outcomes. Principles include requirements for IT professionals to have technical expertise to strategize, design, implement and maintain green computing technologies. Business strategists with expertise are to work with IT as low carbon enablers and end-users with skills to utilize green computing.

3.2.1.1.3 Policy Enabler

The Policy Enabler is based on the need for policies to be in

place to guide decisions and to achieve rational outcomes in green computing initiatives. One of the principles embodied here is the Green Computing Policy which is the output of three processes: GC Portfolio Mgmt, GC Fiscal Mgmt and GC Request Management.

3.2.1.1.4 Government Enabler
The Governance Enabler is based on how it is essential to define governance models for all stakeholders to ensure Green ICT services are delivered in a functional, reliable, cost effective & sustainable way. Principles include metrics & Key Performance Indicators (KPIs), reporting to link business and technology teams and audit & certification to ensure compliance of standards.

3.2.1.1.5 Technology Enabler
The Technology Enabler is based on how green computing technologies are a critical enabling factor in Green ICT deployments. Principles include cloud computing, virtualization, green data centre, grid computing, power optimization, greenware and green networking.

3.2.1.2 Green of IT Dimension
The Green of IT Dimension, also referred to as Green Computing, consists of five drivers that strive to make the ICT industry more cost effective and eco-friendly.

i. The **Green Computing Lifecycle Driver** consists of a lifecycle made up of four stages namely
   - the Strategy stage that determine the needs, priorities, demands and relative importance for the desired green computing services;
   - the Design stage designs the infrastructure, processes and support mechanisms needed to meet the availability requirements of the customer;
   - the Implementation stage validates that the green computing service meets the functional and technical fitness criteria before deployment;
   - the Operations stage monitors the ongoing availability being provided; and
   - the continual improvements stage coordinates the collection of data, information and knowledge regarding the quality and performance of green computing services.

ii. The **Green Computing Processes Driver** consists of 17 processes which are structured sets of coordinated activities that produce an outcome and provide value to stakeholders. The processes include Portfolio, Fiscal, Request, Service Level, Capacity, Availability, Continuity, Security, Supplier, Service Catalog, Knowledge, Asset, Change, Testing & Release, Alerts, Issues and Improvements.

iii. The **Green Computing Functions Driver** consists of logical grouping of roles and automated measures that execute a defined process, an activity or a combination of both. The functions are needed to manage the 'steady state' operation of an IT environment.

iv. The **Equipment Lifecycle Management Driver** can be married to environmental stewardship to improve efficiency and reduce costs. This provides a more holistic approach to going green by focusing on all aspects of equipment lifecycle, including principles like asset acquisition, equipment operation and maintenance as well as asset disposal.

v. The **Renewable and Efficient Energy Source Driver** is based on the premise that energy efficiencies in an IT facility will no longer be the primary hallmark of a green facility in the near future. The source and generation efficiency of the energy being used by IT facilities will be the key criteria for benchmarking green facilities moving forward.

3.2.1.3 Green by IT Dimension
The Green by IT Dimension, also referred to as "IT as a Low Carbon Enabler", consists of eight drivers that strive to utilize Information Technology to make other industries more cost effective and eco friendly.

i. The **Sustainable Business Process Management Process Driver** is an overall approach to modeling, optimizing, consolidating, and executing business processes of an organization from a carbon perspective.

ii. The **Carbon Accounting Driver** measures, validates and reports on an organization's environmental impact. Principles include measuring current or baseline carbon emissions, set targets for reduction and set up systems to monitor emissions and conduct a periodic emissions audit report, internally and externally on reduction program and progress against targets.

iii. The **Internet of Things** (IoT) Driver are things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts. IoT's prerequisite is energy efficiency. This will lead to energy awareness in all electronics. Abundant sensory information from IoT is utilized to improve energy efficiencies and reduce carbon footprints.

iv. The **Smart & Sustainable Built Environment Driver** refers to an energy-efficient, low-emission

built environment of a high quality, where the measures required by climate change prevention have been taken. Principles include smart meters, smart grids, energy efficiency, smart buildings, smart cities, eco-districts and distributed energy generation.

v. The **Telecommuting Driver** refers to how ICT is the primary driver for telecommuting which includes unified messaging, gatekeeper, telephony endpoint and high speed connectivity. The Green Supply Chain & Manufacturing Driver refers to the process of using environmentally friendly inputs and transforming these inputs into outputs that can be reclaimed and re-used at the end of their lifecycle thus, creating a sustainable supply chain and manufacturing process.

vi. The **Green Supply Chain & Manufacturing**

vii. The **Resource Intelligence Driver** refers to how effective and efficient resource intelligence relies on IT as a key enabler for asset management to xxxxxx. Key principles include maximizing asset utilization and minimizing asset reacquisition. Asset management is intrinsically linked with the transformation and use of energy. The Biomimetics Driver refers to the art of taking natural adaptive strategies used by plants or animals and translating them into engineering designs that can be used to implement energy efficient products or tools.

viii. The Biomemtics

3.2.1.4 Demands on the ecosystem

The ecosystem is always subjected to various demands by stakeholders. Employees' demands include having an environmentally responsible employer, ease of use & knowledge. Business demands include Return On Investment (ROI), scalability and resilience. Investors' demands include sustainability reporting and ESG risks awareness. Regulatory demands include adhering to government policies and laws. Customers demand on green products and organizations are currently affecting brand loyalty rates. Industry players and governments are encouraged to contact Green Computing Initiative to learn more about the framework. Training and consultancy services are readily available on a worldwide basis.

4. The Green Collar IT Professional

The Green Computing Initiative in collaboration with industry, academia and the government launched the Green Collar IT Professional (GCITP) program with the following objectives:

- Jumpstarting the nation's Green Jobs agenda by producing green computing talent from the industry, academia and government sectors.
- Laying a foundation for the nation's path towards a Low Carbon Economy by providing a pool of talent to spearhead the various sustainable computing initiatives to support:
  - ◊ An increase of RM2 billion to annual GNI through cost savings by 2020.
  - ◊ A 40% reduction in the IT industry's carbon footprint by 2020.
  - ◊ A 50% reduction in the IT industry's energy costs and consumption by 2020.

The GCITP program is guided by the K2W (Knowledge To Wisdom) framework that builds upon the Proficiency Enabler of the Sustainable Computing Framework. The K2W Framework's basic premise is that by enabling new or existing knowledge workers with the right tools and skills, an explosive growth in innovation efforts will be realised. This is in line with the government's drive for performance through innovation.

To understand the K2W framework, a primer on the Data, Information, Knowledge and Wisdom (DIKW) model (Figure 5), is required:

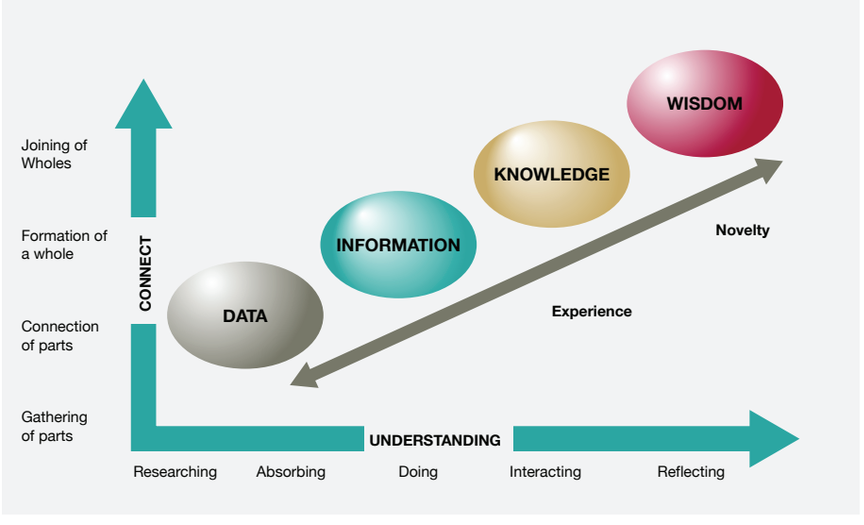

Figure 5: Data, Information, Knowledge (DIKW) Model

Data by itself has no meaning. It fills databases. This data must be studied in order to become significant. Producing more data does not accomplishes much. We have to interact with it.

Information arises when we scrutinise the data. This provides a framework for understanding what the data represents. This information can be implicit in the form of understanding or explicit, presented in a manner that all can see, like a chart or a graph.

Knowledge is the capability to take an action. It is formed when information is transformed through human social interactions. A person on his own cannot create knowledge and must interact with information created by others to arrive at an action such as a decision. This is key. Individuals and organizations must work with the implicit and explicit information generated by others in order to formulate a course of action. Frequently, this course of action is to generate more data, resulting in a new Data, Information, Knowledge (DIK) cycle. Knowledge leads to action. Wisdom consists of the best and most fitting action. It more often than not arises from several rounds of the DIK cycle. It requires experience. The DIK cycle often describes an analytical process, one in which simplification is key. Wisdom requires synthesis, often bringing together a wide range of knowledge created from a massive amount of information representing a remarkable load of data.

The objective of K2W frameworks (Figure 6) is to arm existing and new knowledge workers with the right tools and skills to move beyond the Knowledge domain to the Wisdom domain. The majority of knowledge workers in Malaysia are adept at generating data, information and knowledge but many lack the skills and tools to synthesis the existing knowledge into wisdom. Wisdom is an essential ingredient of innovation.

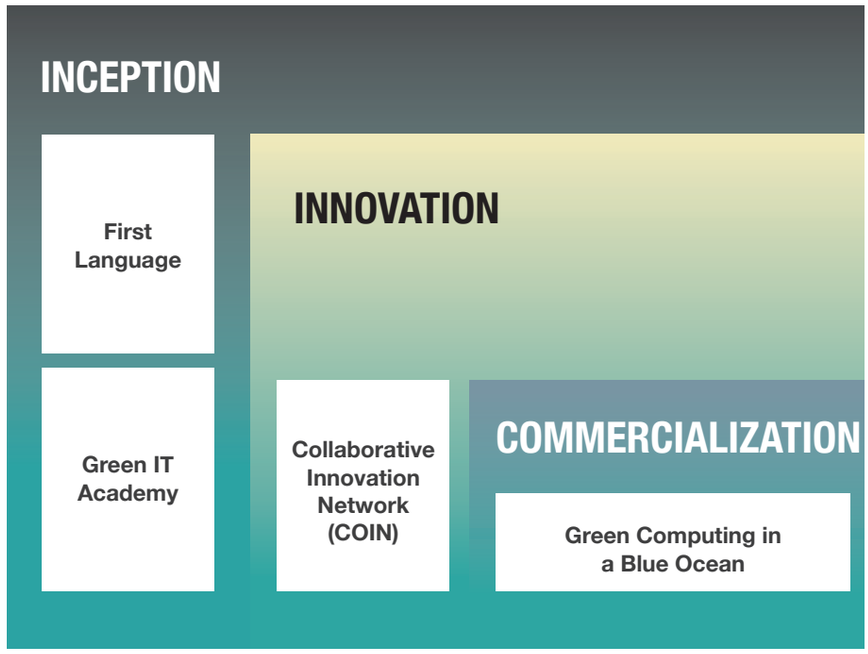

Figure 6: Knowledge to Wisdom (K2W) Framework

The three primary K2W enablers which support the GCITP program are inception, innovation and commercialisation. Inception deals with how green computing knowledge creation is initiated. Innovation acts as the key enabler to move beyond the Knowledge domain to the Wisdom domain. The commercialisation enabler provides the platform for product and service rollout.

Drivers within the inception enabler include first language and the Green IT Academy. A first language is the language a person speaks and comprehends the best. First languages are crucial to inception because intimate comprehension of the subject matter is paramount to establishing a solid base towards moving from knowledge to wisdom. The GCITP program delivers green computing knowledge in English as well as in Bahasa Melayu. The training content is provided to every participant in both languages. The language of instruction is also available in the choice of both languages. The Green IT Academy is a GCI program that assists educational institutions and non-profit organizations worldwide to deliver career enhancing courses and certifications. The curriculum covers a wide range of green computing technologies as well as management skills like problem solving and critical thinking. University Putra Malaysia is currently the appointed South East Asia Regional Green IT Academy overseeing all academies in the region. Green IT Academies are the primary delivery channel of the GCITP program on a nationwide basis.

The GCITP program delivers three instructor-led training modules namely "Understanding and Utilising Green Computing Technologies (UUGCT)", "Strategising, Designing and Optimising Green Computing Technologies (SDOGCT)" and "Implementing, Managing and Optimising Green Computing Technologies (IMOGCT)".

The UUGCT course helps students learn about the power their computer, peripherals, and other technology equipment are consuming right now, and puts it all in context so they can clearly see why that matters. This course leads to the Certified

Green Computing User Specialist certification. At the end of the course, students will have a sense of the impact they are making - called their carbon footprint and they will learn a variety of ways to reduce their power consumption by changing their practices, upgrading their system, buying green, and much more. Students will also learn how to dispose of old computer equipment in a way that is kind to the planet.

The SDOGCT course focuses on the Strategy, Design and Continual Improvement phases of the GCI Process Lifecycle. Students will be led step-by-step through all the processes and functions that lead to a properly designed green computing initiative. This course leads to the Certified Green Computing Architect certification. At the end of the course, students will have learned all the strategy and design issues needed to achieve their organizations' green computing objectives. Students will gain the knowledge on how to develop their Green IT Policy, put together an action list to identify their organizations Green IT requirements, and how to address them.

The IMOGCT course focuses on the Implementation, Operations and Continual Improvement phases of the GCI Process Life-cycle. Students will be formally introduced to the real-world concepts, principles and practices of Green Computing. This course leads to the Certified Green Computing Professional certification upon successful completion of the CGCP02 Exam. At the end of the course, students will have adequate knowledge and skills to implement, operate and optimize green computing technologies for small, medium and large IT infrastructures.

Collaborative Innovation Networks (COIN) is an imperative driver for the innovation enabler. myGreenCOIN is a consortium of green technologies research facilities based in universities nationwide. All Green IT Academies in Malaysia are members of the myGreenCOIN network. In myGreenCOIN, the dissemination of innovative and new ideas is very similar to the ripple when a pebble drops into water. myGreenCOIN is the interaction of like-minded, self-motivated individuals who are researchers and associates of member research facilities who share the same vision - 'minimizing the impact of the ICT industry on the world's environment'. An innovative idea is pushed forward by charismatic leaders, who assemble a group of highly motivated collaborators. The research ecosystem at myGreenCOIN is based on the following foundations:

- **Innovation:** We differentiate innovation from invention with the following principle - Invention is the conversion of cash into ideas. Innovation is the conversion of ideas into cash.

- **Collective Intelligence:** We act in a mass collaboration which relies on openness (sharing of ideas), peering (horizontal organization, not hierarchical) and acting globally (no boundaries and new markets).

- **Knowledge Engineering:** We integrate knowledge into advanced systems in order to solve complex problems normally requiring a high level of human expertise.

- **Knowledge Ecosystem:** We foster the dynamic evolution of knowledge interactions between entities to improve decision-making and innovation through improved evolutionary networks of collaboration.

The 'Green Computing in a Blue Ocean' driver converts ideas, research, or prototypes into viable products that retain the desired functionality, while designing them to be readily manufacturable at low cost and launched quickly with high quality designed in. These activities within this driver also involve formulating the manufacturing and supply chain strategies, devising implementation plans, and implementing such plans. The Blue Ocean strategy is adopted as part of this process because the majority of green computing technologies operate in an uncontested marketplace.

Blue Ocean Strategy is a business strategy book first published in 2005 and written by W. Chan Kim and Renée Mauborgne of The Blue Ocean Strategy Institute at INSEAD. The book illustrates what the authors believe is the high growth and profits an organization can generate by creating new demand in an uncontested market space, or a "Blue Ocean", rather than by competing head-to-head with other suppliers for known customers in an existing industry i.e. a "Red Ocean".

The metaphor of Red and Blue Oceans describes the market universe. Red Oceans are all the industries in existence today – the known market space. In the Red Oceans, industry boundaries are defined and accepted, and the competitive rules of the game are known. Here companies try to outperform their rivals to grab a greater share of product or service demand. As the market space gets crowded, prospects for profits and growth are reduced. Products become commodities or niche, and cutthroat competition turns the ocean bloody. Hence, the term red oceans is used.

Blue oceans, in contrast, denote all the industries not in existence today – the unknown market space, untainted by competition. In Blue Oceans, demand is created rather than fought over. There is ample opportunity for growth that is both profitable and rapid. In Blue Oceans, competition is irrelevant because the rules of the game are waiting to be set. Blue Ocean is an analogy to describe the

wider, deeper potential of market space that is not yet explored.

The cornerstone of Blue Ocean Strategy is 'Value Innovation'. A Blue Ocean is created when a company achieves value innovation that creates value simultaneously for both the buyer and the company. The innovation (in product, service, or delivery) must raise and create value for the market, while simultaneously reducing or eliminating features or services that are less valued by the current or future market.

5. Conclusion

In conclusion, Malaysia should seize the opportunity to become the global leader in green computing solutions as currently these solutions are sorely missing from the global energy reduction equation.

The Green Collar IT Professional program strives to empower future global leaders in green technologies by leveraging on the K2W Framework that stresses upon the importance of moving beyond the knowledge worker arena towards a wisdom warrior centric innovation ecosystem. By embarking on this much needed program, Malaysian IT professionals will possess skills to reduce the impact of the industry on the environment, generate billions in cost savings and produce world class innovations in the coming years. Commercial enterprise, learning institution or research centre are to leverage upon institutions like Green Computing Initiative in Malaysia that offer certifications and branding for Green ICT jobs.

13. INNOVATIVE USE OF ICT AMONG URBAN-POOR COMMUNITIES: CHALLENGES AND OPPORTUNITIES

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Abstract

Information and communication technology (ICT) is becoming increasingly important in determining the success of marginalized communities in achieving sustainable development in a knowledge economy. While ICT connectivity over the last two decades has improved in Malaysia significantly, the use of this technology among marginalized communities has not been fully realized. This paper will examine the patterns of ICT adoption among a particular type of marginalized community in the country, namely the 'urban-poor'. The study will examine the key factors that hinder ICT adoption in this community, and how it has improved the socioeconomic wellbeing of ICT users. Further, the study discusses key strategies to help connect this marginalized community to the information economy, which in turn will facilitate them to leapfrog to higher stages of socioeconomic development.

Keywords: ICT, Digital Divide, Sustainable Development, Poverty and Urban Poor.

1. Introduction

The role of ICT in wealth creation has been well documented. For example, Brynjolfsson and Hitt (1995 and 2000) have shown that countries that have embraced the information revolution have improved their Total Factor Productivity (TFP) and economic wealth. Other studies, i.e. Waverman et al. (2005), have shown that the adoption of telecommunication has increased the Gross Domestic Product (GDP) of developing countries by 0.6 per cent.

ICTs have reduced the cost of communication and increased access to information and knowledge for firms and communities across the globe. This has allowed firms and communities to expand their reach for resources such as new technologies, capital, markets and other valuable resources, thus improving their innovative capacity. ICT has also allowed firms and communities to leverage on new technologies and knowledge to increase economic and social capital.

ICT is seen as an important tool for reducing poverty (Kelle-Viitanen, 2003). It has been documented that low economic development and poverty are due to a range of factors. Among the key factors are low levels of access to capital (Friedman and Kuttner, 1993), low levels of skill (Gibson, 2005) and weak institutions (Bardhan, 1997, Mo, 2001 and Gymah-Brempong, 2002). These factors lead to the poor relying on various intermediaries for resources and markets. Many of them pay exorbitant transaction cost to access basic resources in order to ply their trade. This hinders their productivity and wealth creation opportunities. Prolong living in a depressed condition, reinforced by other negative externalities such as lack of confidence and motivation, instill a 'culture of poverty' (Lewis, 1965). The culture of poverty, in turn, prevents marginalized communities from breaking away from the clutches of poverty and, in many societies, it is passed on to future generations.

ICT is seen in many countries as an important enabler for breaking the cycle of poverty. It can provide the poor access to education via various e-education platforms. It also can be an important source of information on market conditions, suppliers and other market intelligence, which enables the poor to make informed choices pertaining to investment and marketing strategies. For example, Bhatnager (2000) show that ICT initiatives such as the Warana Wired Village program in the state of Maharastra in India had provided the poor in several villages access to information on education and medical facilities to support socioeconomic development. The study also shows that ICT has been used to enhance the efficiency and productivity of milk farmers in the state of Gujarat in India.

In many localities where the poor live, the transportation system is often inadequate to support a vibrant business environment. New communication technologies can overcome this constraint by facilitating a home-based tele-working environment (Mitter, 2000). An example of a major success of communication technologies creating new employment for the poor is the Grameen Village Phone program *(http://en.wikipedia.org/wiki/Grameen_Bank#Village_Phone_Program).*

In this program microfinance facilities were provided to the poor to establish wireless payphone service in Bangladesh. New entrepreneurs emerged under this program, mainly women who were at the bottom of the societal development pyramid due to a patriarchal society. was at the forefront of creating new employment via the Grameen Phone program Grameen-type communication initiatives have expanded to other developing countries, where there has been a proliferation of Subscriber Trunk Dialing (STD) booths that offer telecommunication services and employment opportunities for marginalized communities.

One of the major concerns among development and social workers is the lack of access to good medical services for the poor. Poor access to quality healthcare facilities leads to malnutrition and other diseases that reduce the quality of life of the poor. ICT has enabled tele-medicine where hospitals in the developed cities can provide valuable health care education and services to the poor using sophisticated communication technologies. Hospitals in the

developing world can also link with medical experts across the globe on diseases to collaborate and ascertain intervention strategies via mobile communication technologies (Vital Wave Consulting, 2009).

The digital medium has also been used by the poor to gain access to other public services such as electronic tax filing, smart card for financial transactions, micro-credit facilities and registration of land titles. Effective use of ICT can lead to "transparent smart e-governance with seamless access, secure and authentic flow of information crossing the inter-departmental barrier and providing a fair and unbiased service to the citizens" (Kalam, 2003). This in turn leads to an efficient delivery of public services to the poor which enables and empowers them to bypass intermediaries in order to access resources that improve their standard of living.

Malaysia, like all other developing countries, has put in place a number of strategies to reduce poverty. Since independence in 1957, medium term (the 5-year economic plans) and longer-term economic plans (the Outline Perspective Plans, OPPs) have given emphasis in transforming the ecology of the poor to ensure that they are able to improve their socioeconomic wellbeing and be globally competitive. These initiatives have systematically reduced absolute poverty from 49.3 per cent in 1970 to 3.6 per cent in 2007 (NEAC, 2009). Further, hardcore poverty has been reduced to 0.7 per cent in 2009 (EPU, 2010).

In spite of the rapid progress in reducing absolute poverty, relative poverty is still a major concern for Malaysia. The Gini coefficient, which measures income inequality, show that income disparity in Malaysia has not changed much from 1987 to 2007. The Gini coefficient for Malaysia in 1987, 1997 and 2007 were 0.456, 0.459 and 0.441 respectively (NEAC, 2009). The Gini coefficient in the urban areas for the same period was 0.449, 0.427 and 0.427 respectively. Slight improvement was noted in the coefficient in the 1980s and 1990s (NEAC, 2009). Compared to other countries in Asia, Malaysia is the second most unequally distributed country after China (PEMANDU, 2010a).

A recent report from PEMANDU showed that around 200,000 households earn a meager RM750 per month (PEMANDU, 2010a). A report from the National Economic Action Council (NEAC, 2009) show that the top 20 per cent of the income earners experienced the highest increase in income. On the other hand, the bottom 40 per cent of the population experienced the slowest growth in income, earning an average income of RM1,222 in 2008 (NEAC, 2009). The concerning trend was that households in urban areas earning RM2,000 to RM3,000 find it difficult to cope with the increasing cost of living (PEMANDU, 2010a).

Uncertainties, low income and cheap migrant workers from neighboring countries in the rural areas are forcing rural communities to migrate to urban areas. Migration of these low skilled workers to urban areas have resulted in the emergence of 'urban-ghettos' that cause a strain on various public facilities such as schools, police, sanitation and medical services. Many of the urban-poor lack the skills for a rapidly changing economy that is increasingly driven by ICT. The mismatch between an increasing number of low skilled workers and the types of jobs created by the economy in the urban areas have increased social problems such as unemployment, gangsterism, anti-establishment behavior and crime.

Primary objective of this paper is four-fold. First, the study will provide a review of ICT development policies to overcome poverty in Malaysia. Second, the study will examine ICT use among 'urban-poor' communities in Malaysia and the factors that hinder the use of ICT in daily activities. Third, the study will investigate if urban poor communities are getting socioeconomic benefits from the use of ICT. Finally the study will explore strategies that empower 'urban-poor' communities to become innovative and chart a path to self-improvement and self-sustenance.

This paper is organized as follows: A brief review of Malaysia's ICT strategies to improve socioeconomic status of the poor is discussed in Section 2. The patterns of ICT adoption among 'urban-poor' communities in Malaysia will be discussed in Section 3. Discussion of the results and key policy implications are provided in Section 4. Concluding remarks are given in Section 5.

2. A Brief Review of ICT Policies and Poverty Eradication Initiatives

The Malaysian government recognized that the information revolution can be an important catalyst for assisting marginalized communities improve their socioeconomic wellbeing. In the middle of 1995 the government established the National Information Technology Council (NITC) to develop a strategic framework for diffusion of ICT across all segments of the population. In the subsequent year, the National Information Technology Agenda (NITA) was launched. As part of the NITA, the Multimedia Super Corridor (MSC) plan was rolled-out to transform Malaysia into an information-driven

society and power Malaysia's vision of becoming a developed country by 2020.

One of the major development thrust of the MSC plan was to develop the relevant ICT architecture and applications to assist marginalized communities migrate to a knowledge-intensive society. Among the initiatives introduced include making computers more accessible to the poor via schemes such as: One Home One PC, PC Gemilang 2 and PC Mesti Beli programs. Sales tax on PCs and related ICT components were also reduced so as to ensure that they were affordable to the poor.

Under the 8th, 9th and 10th Malaysia Plans, large allocations were provided to improve ICT connectivity for marginalized communities, especially people living in rural areas (EPU, 2001, EPU, 2006 and EPU, 2010). Among the key initiatives include the National Broadband Plan (NBP) and the MyICMS-886. Due to the low income level among the poor, several public facilities such as tele-centres were established to provide marginalized communities access to high quality ICT services using broadband. These include the Gerakan Desa Wawasan, Medan InfoDesa and Pusat Internet Desa (EPU, 2001 and EPU, 2008).

To ensure future generations become citizens of the information age, ICT connectivity was intensified under the 9th Malaysian Plan. The use of ICT and multimedia in schools were boosted under the following programs: Smart School, MySchoolNet Portal and Program Pembestarian Sekolah. Under the 9th Malaysia Plan, broadband coverage was increased from 2 per cent in 2004 to 32 per cent in 2009 (EPU, 2010).

Under the 10th Malaysia Plan, strategies were outlined to ensure that ICT contributes to the national income, especially among the marginalized communities. Micro and small firms operated by the disadvantaged communities will be given fiscal and non-fiscal incentives in order to move them up the innovation value chain. The incentives include providing small and micro firms access to ICT services, including critical software, cloud computing services and systems that assist these firms to manage their financials, human capital, supply-chain and resources more effectively (EPU, 2010).

Leveraging on the 1Malaysia concept, ICT is seen as an important enabler for ensuring the poor have equitable and transparent access to high value-added services and opportunities to improve their socioeconomic status. The development of ICT infrastructure and content are classified as one of the National Key Economic Area (NKEA), with the objective of providing advanced communication services and networks for enabling a knowledge-based economy in localities where marginalized communities reside (PEMANDU, 2010b). This includes providing the poor access to high quality ICT services and relevant content that will enable them to acquire education, healthcare, financial services and other government services. Advanced ICT services are also critical for the successful implementation the National Key Result Areas (NKRA), which include reducing crime, fighting corruption, improving student outcomes, raising the standard of low-income households, improving the rural basic infrastructure and improving public transport (PEMANDU, 2010a).

Under the 10th Malaysia Plan, the 1Malaysia Tele-centres were introduced across the country in rural and poor neighborhoods. These tele-centres play a key role in providing the local population access to advanced ICT skills to nurture creativity and innovative endeavors that will improve their quality of life. It is envisaged that access to the above-mentioned resources will increase the median household income from RM1,440 per month in 2009 to RM2,300 per month by 2015 (EPU, 2010).

The above summary provides the initiatives undertaken by Malaysia to transform the country into an information and knowledge-driven economy. It is envisioned that these initiatives will set a strong foundation for Malaysia to become a high income and developed economy by 2020.

3. Patterns of ICT Use among Urban-Poor Communities

Urban-poor communities are defined as low-income communities residing in low-cost public housing in the urban areas. A sample size of 520 respondents was selected randomly from six urban poor localities around Klang Valley region in Malaysia, from July to November 2010. The localities included: Kampung Medan, Air-Panas, Pandamaran Jaya, Kapar – Taman Sentosa, Shah Alam – Seksyen 17 and Rimba Jaya. A total of 86 observations were dropped from the sample due to incomplete information. Thus, the number of usable sample for the study was 434.

The pattern of mobile phone, computer and Internet use among these marginalized communities is given in Figure 1. Mobile phone is the preferred choice of ICT of this community. Approximately 90.6 per cent of them use mobile phones. The percentages of urban-poor that use computer and the Internet were 46.6 per cent and 34.9 per cent respectively. This implies that around 9.4 per cent, 53.4 per cent and 65.1 per cent of these communities do not use mobile phones, computer

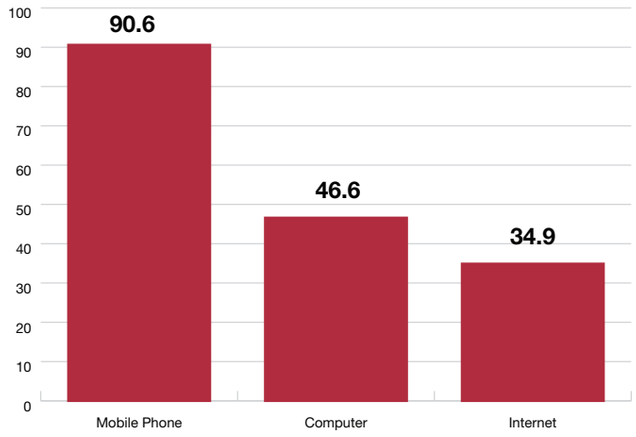

Figure 1: ICT usage among urban-poor communities (%)

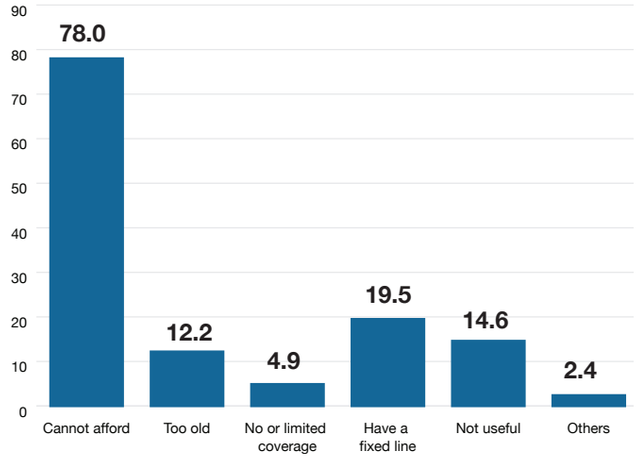

Figure 2: Reasons for not using mobile phone (%)

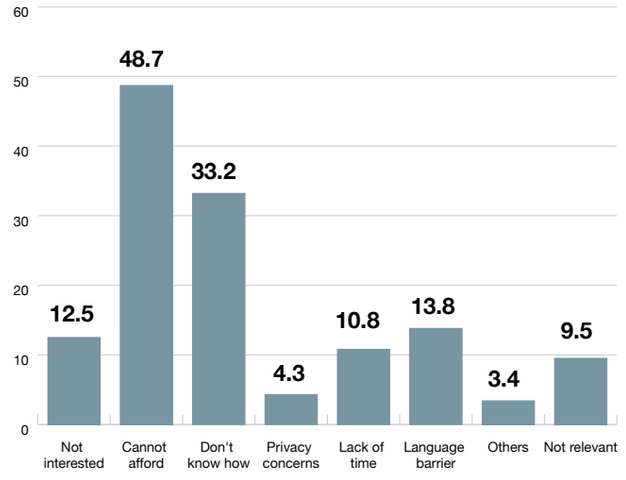

Figure 3: Reason for not using computer (%)

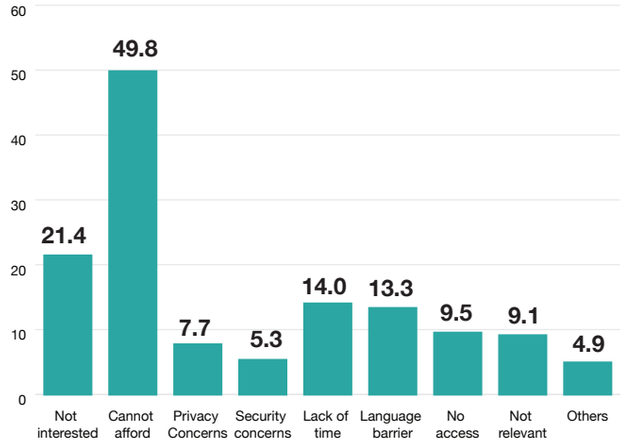

Figure 4: Reason for not using the Internet (%)

and the Internet respectively.

The reasons for not using mobile phones, computer and the Internet are given in Figures 2 to 4. Approximately 78 per cent of those surveyed cite cost as the main factor for not using a mobile phone. The main factors hindering the use of computer include affordability (48.7 per cent) and the lack of computer skills (33.2 per cent). In the case of the Internet, affordability (49.8 per cent) and lack of interest (21.4 per cent) are the main reasons cited for not using it.

In the study, the employability of the respondents was assessed based on whether they used any of the three ICTs. The results are summarized in Figure 5. Among the unemployed, 89.6 per cent used mobile phones; while 42.2 per cent and 31.8 per cent used computer and the Internet respectively. On the other hand,

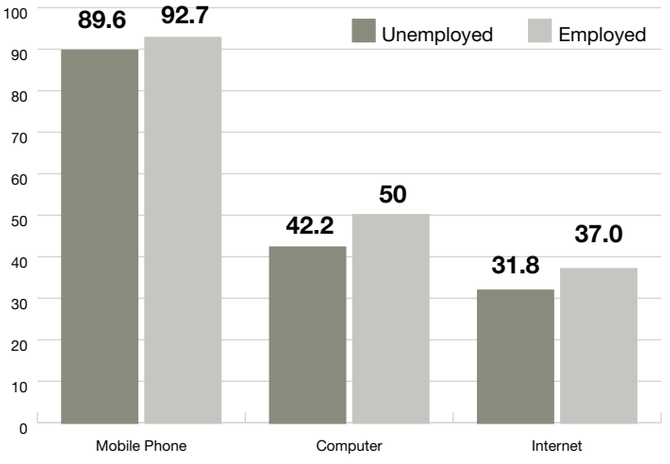

Figure 5: ICT usage & probability of employed versus unemployed (%)

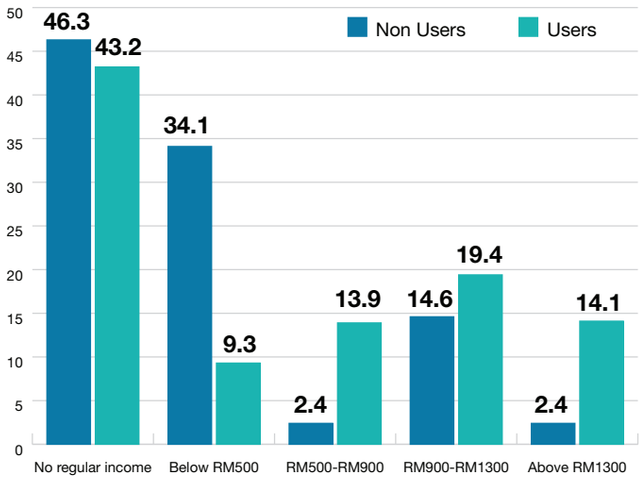

Figure 6: Income distribution of non-users & users of mobile phone (%)

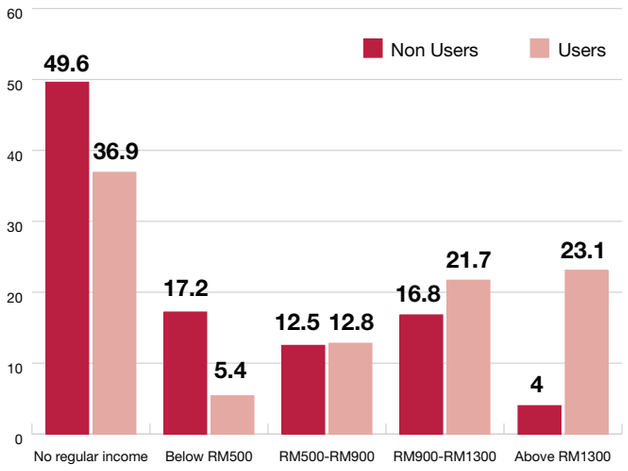

Figure 7: Income distribution of non-users & users of computers (%)

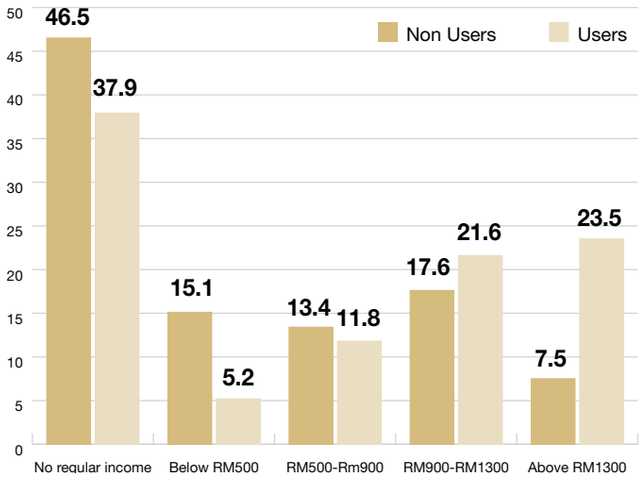

Figure 8: Income distribution of non-users & users of the Internet (%)

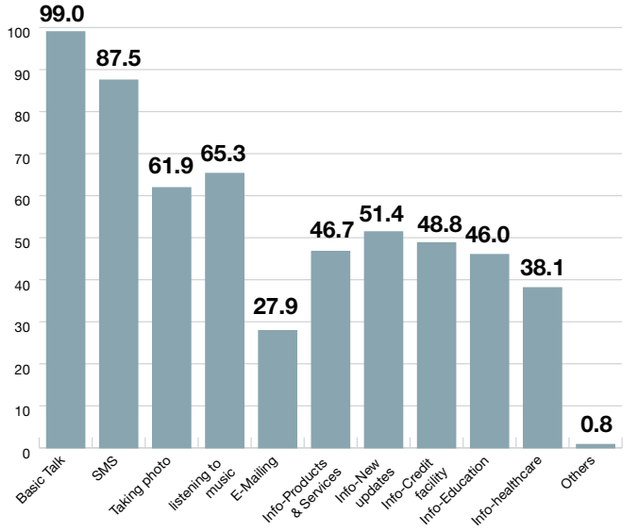

Figure 9: Socioeconomic benefits of mobile phones (%)

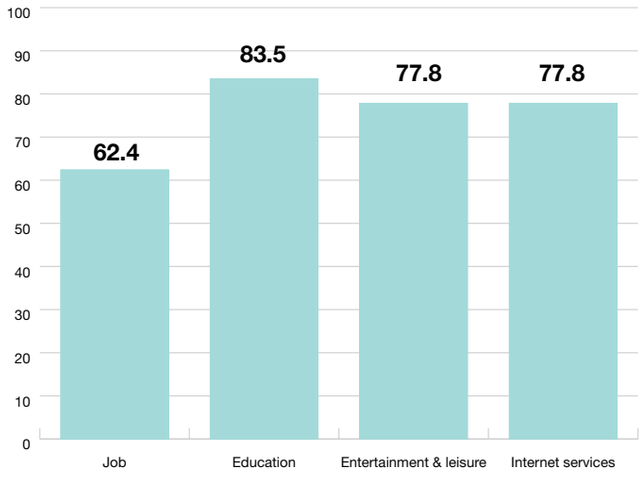

Figure 10: Socioeconomic benefits of computer (%)

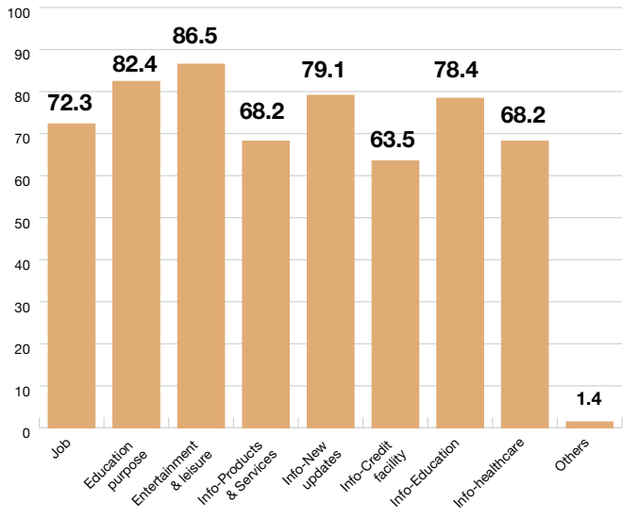

Figure 11: Socioeconomic benefits of the Internet (%)

among the employed, the following were obtained from the sample: 92.7 per cent used mobile phones, 50 per cent the computer and 37 per cent the Internet. The result shows that people who used the three ICTs have a higher probability of being employed than non-users of the ICTs.

Income distribution of non-users and users of the three ICTs are shown in Figures 6 to 8. The percentage ICT users without regular income were found to be lower than non-users of the three ICTs. Income levels of users of the three ICTs were found to be higher than those who do not use the ICTs. These results imply that users of ICT have better employment opportunities and higher income profiles than non-users of ICT.

The socioeconomic benefits of using the three ICT are given in Figures 9 to 11. A majority of the respondents using mobile phone use it for basic talk, short messaging service (SMS), taking photos and listening to music. However, the proportion of mobile phone users who used this medium of communication for higher order use such as for e-mail communication, education, healthcare, banking & finance services and seeking information for products & services were below 50 per cent.

In the case of computer, 83.5 per cent used it for education, 77.8 per cent for entertainment & leisure and internet services and 62.4 per cent for job related use. The empirical results for the Internet show that more than 80 per cent use it for education and entertainment & leisure while more than 70 per cent use it as part of their job and for information search (news and education). More than 60 per cent report that they use the Internet for seeking information on products & services and healthcare information.

The results suggests that the use of the three ICTs contribute positively to improving the socioeconomic status of the urban poor communities. Specifcially, computers and the Internet provides higher socioeconomic benefit than mobile phones.

4. Discussions and Policy Implication

The analysis above shows ICT use among urban poor communities in Malaysia can improve their socioeconomic well-being. In particular, it provides the poor an opportunity to enhance their human/intellectual capital by accessing new skills and knowledge via e-learning platforms. The medium of communication also provides them an opportunity to increase their financial capital via access to micro-finance facilities for business development and creating new income streams.

ICT is also a key catalyst for fostering social capital development that enables various community development programs and nurturing social networks. It can also be an important tool for the development of political capital that enables empowerment of the poor to take ownership in improving their quality of the life.

The Malaysian government has been pro-active in promoting the use of ICT among the poor through the various 5-year economic plans and, more recently, the government transformation programs. While these initiatives to some extent have increased the use of ICT among the poor and have improved their socioeconomic well being, there are segments of the population that have not fully benefited from the information revolution. The empirical analysis showed that a large proportion of the urban poor communities are not using ICT effectively to improve their quality of life. Strategies to connect the urban poor communities to the information society are discussed below.

Among the three ICTs, mobile phones are the preferred mode of communication due to its ubiquitous nature, affordability and its ability to personalize services. Though mobile phones are widely used by this segment of the population, its full potential has not been exploited via advanced applications that can add value to the urban poor's standard of living. To encourage greater connectivity of this segment of the population to the digital economy, greater efforts should be in place to encourage them to use mobile phones in a more sophisticated way that will improve their quality of life. The use of this communication technology will help the poor transcend the language barrier, which have prevented them from connecting to the information economy.

In this paper, we argue that developing the mobile communication ecology is critical for facilitating the poor to migrate to an information and knowledge driven economy. However, the transition to a higher socioeconomic trajectory will only be possible if the existing mobile communication ecosystem is strengthened. Four major challenges that hinder the use of this technology are outlined next.

First, the cost of mobile communication devices and broadband services are expensive for urban poor communities in Malaysia. Smart phones that connect to high speed broadband cost above RM500 in Malaysia. Further, the cost of fixed broadband with speeds of 20Mbps and 5Mbps cost RM249 and RM149 per month respectively (http://www.soyacincau.com). Mobile broadband with a speed of 7.2Mbps costs between RM58 and RM 248, with varying quality of service (http://www.soyacincau.com). The cost of

smartphones and broadband services are beyond the income levels of the urban poor, who earn below RM1300. A majority of them do not have permanent jobs and a stable income stream. Cost effective smart phones and affordable broadband service can change the way urban poor communities access advanced knowledge networks, which can enhance their productivity and wealth creation opportunities.

Second, the mobile Internet bandwidth is inadequate to support high quality audio and video streaming. The current mobile broadband speed of of up to 7.2Mbps is inadequate for powering the next generation mobile Internet applications such as visual networking, high-definition video streaming and high-definition IPTV. The new mobile applications require a download speed of at least 11.25 Mbps, upload speed of at least 5Mbps and a latency of not more than 60 milliseconds (California Broadband Taskforce 2008, cited in Vincente, Gil-de-Bernabe, 2010). Improved bandwidth will reduce intermittent disruptions in service that can frustrate users. Roll out of high speed mobile Internet services will be a key factor encouraging the poor to use mobile communication technologies for advanced services that will improve their socioeconomic wellbeing.

The third factor hindering the use of mobile devices for mobile commerce (m-commerce) and other online applications is security, especially in the context of transmission of financial and personal information across networks (Kao (2009) and Ajakaije and Krause (2011)). In a recent study by Vaithilingam et al. (2012), it was shows that trust among customers on the m-banking security system is an important consideration in the adoption of mobile banking (m-banking) and other online financial services among users in Malaysia. The use of digital biometric security features or mobile signatures can be an important direction for a more secured use of m-commerce and other mobile applications (Yi et al. (2009), Pandey and Geethanjali (2011) and Belkhede et al. (2012)). The biometric security features include smartphones with fingerprint, iris, voice and face recognition sensors.

A survey conducted by AuthenTec, a world leader in fingerprint security, showed that of the 500 respondents, 58 per cent would switch phones that allow them to access m-commerce services with biometric security features (AuthenTec, 2006). The same study showed that 73 per cent would use biometric finger sensors for their stored contact, music and photo files, while 61 per cent will use it for purchases in vending machines, 59 per cent to protect online book and music purchase and 53 per cent for m-banking services (AuthenTec, 2006).

Countries such as Japan and Finland have successfully promoted m-commerce by developing advanced mobile infrastructure, which have incorporated mobile signatures to provide more secured services (Law on Regulation of Transmission of Specified Electronic Mail, 2002: http://www.cas.go.jp/jp/seisaku/hourei/data/ACPT.pdf) and Finland (Act on the Protection of Privacy in Electronic Communications, 2004): http://www.cyberlawdb.com/docs/finland/privacy.pdf). In 2008, Tan Sri Dr. Zeti Akhtar Aziz, the Governor of the Malaysian Central Bank reiterated that the growth of the m-banking and m-commerce sectors will depend on the introduction of the mobile digital signature, which will ensure confidentiality, authenticity and integrity of payments via mobile devices (Aziz, 2008). To complement these efforts, a legal architecture must be in place for careful implementation and enforcement of standards pertaining to maintaining the integrity of data using mobile communication devices.

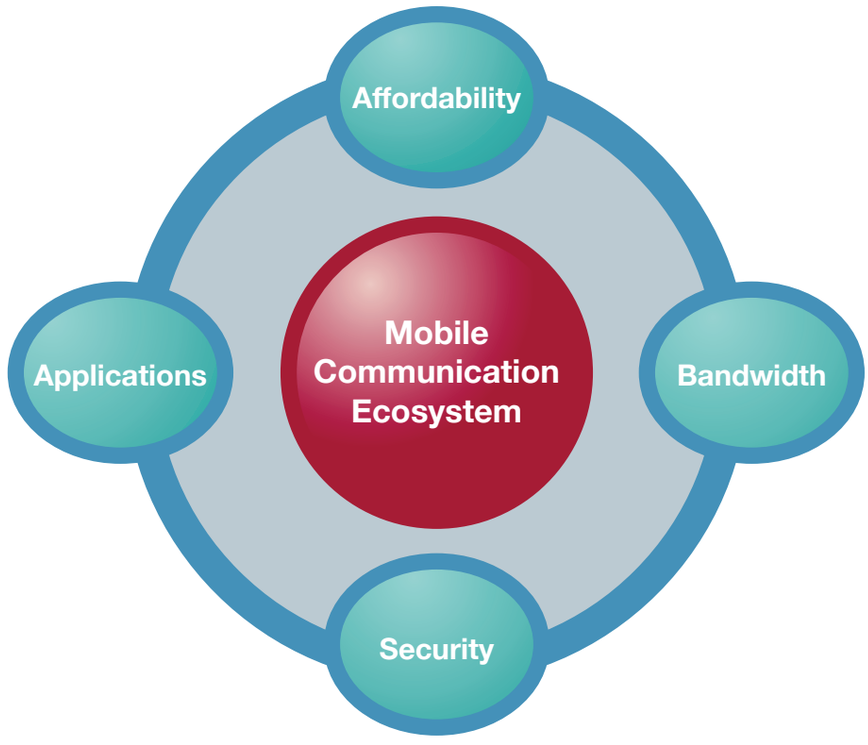

Figure 12: Mobile communication ecosystem for urban-poor communities

The fourth factor hindering the take-up of mobile communication technology is the lack of applications that are simple to use, not time consuming and relevant in adding value to the lives of urban poor communities. Income levels of the urban poor communities are low - a large proportion of them have household income levels below RM1300. Cost effective ICTs such as mobile communication technologies can be an important source of socioeconomic capital development if appropriate user-friendly applications are developed for this segment of the population. Vaithilingam et al. (2012) show that customer's perception of the extent to which m-banking services provide value add has an important influence on actual adoption of this service in Malaysia.

Other example applications that can assist urban poor communities improve their socioeconomic wellbeing are mobile health services, electronic education and skills development programs.

In summary, mobile communication technology provides tremendous opportunities for the urban poor communities to increase their reach for resources, knowledge and wealth creation opportunities. A prerequisite for them to leapfrog to a higher innovation and wealth trajectory is a viable mobile communication ecosystem that ensures the following (as shown in Figure 12): (i) affordability; (ii) adequate bandwidth for new generation applications; (iii) security of data transmission; and, (iv) applications that are relevant in improving the lives of urban poor communities.

5. Concluding Remarks

ICT is an important enabler for marginalized communities such as the urban poor communities to close the knowledge and income gaps with the more developed communities. The Malaysian government has been pro-active in promoting the development of a sustainable information ecology that will assist it to become a knowledge intensive, globally competitive and high-income country by 2020. While these initiatives have reduced absolute poverty, relative poverty remains a major concern, especially with the increasing urban poor communities in the country.

The empirical analysis presented in this study showed that a majority of the urban poor communities have not fully gained from the national ICT initiatives. Many of them are working in employment sectors that are labor intensive and have low-income levels. These sectors are vulnerable to global economic uncertainties, replaced by cheaper migrant workers and substituted by technology intensive sectors. The study also showed that those who used ICT have higher income levels. They also use ICT in a more sophisticated ways to create economic and social capital. Key strategies to improve the mobile communication ecosystem were discussed in this paper so that the poor in the urban areas have opportunities to access the relevant resources to improve their way of life.

In summary, rapid transformation is taking place in the global economic architecture, which is powered by the rapid innovation in ICT. Communities who do not keep pace with the changing global economic landscape, risk falling behind in terms of competitiveness and socioeconomic development. Strategies and policies to connect the urban poor communities must be in place so that these marginalized communities are able to leapfrog to higher stages of development and contribute to Malaysia's vision of becoming a developed and high-income economy.

Acknowledgements

The authors would also like to thank Mr. Eng Yeung Jiah, Mr. John Tan and Ms.Ewilly Liew for expert research assistantship. Any errors in the paper are the sole responsibility of the authors.

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14. BROADBAND FOR SCIENCE AND INNOVATION: IMPERATIVE FOR BUSINESS GROWTH

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Acknowledgements:

This article is produced following a series of discussions between Academy of Science Malaysia (ASM), Monash University Sunway Campus Malaysia and PIKOM. In this regard, the author would like to thank YM Tengku Datuk Dr. Azzman Shariffadeen (Fellow of ASM), Professor Mahendhiran Nair of Monash University and Mr. Loganathan of ASM for providing invaluable input towards this paper. I also would like to thank Mr. Tan Tze Meng of Multimedia Development Corporation (MDeC) for sharing the latest data on Internet tariffs. Similarly, permission was sought through ASM from McKinsey and Said Business School of Oxford University to publish their data and also for referencing their published materials.

1. Background

Science and innovation advancements are not exceptions to the impact of new age technology. Since its commercial advent in the early nineties, Internet technology has had a profound impact on science and innovation as well as business and the community. The way the scientific community works, learns and performs research and innovation have changed. In tandem, the rights, roles, rules and regulations of institutional governance and overall landscape of the scientific world have been undergoing a great upheaval. Virtual and global connectivity, interaction and networking irrespective of time, geography, demography, culture, values and traditions have heightened international collaboration among scientists. Use of cross-boundary data, information and knowledge in their research endeavours has widened the science and research perspectives. Broadband connectivity, being an integral of new-age information and communications technology (ICT), has been playing a significant role in stimulating these changes. Specifically, it has been a powerful tool in greatly accelerating the production, distribution and sharing of data, information and knowledge among researchers and user groups as well as other interest groups across the globe. Indeed, the pace of change is happening at an unprecedented rate that the world has never experienced before. It can be assuned that such phenomenal changes are occurring not only in the scientific world, but also in all spheres of life, thus the impact and effect of broadband on science and other disciplines are mutually reinforcing.

2. Broadband Connectivity for Global Science & Innovation

As appropriately highlighted by the Royal Society of United Kingdom's report, *Knowledge, Networks and Nations: Global Scientific Collaborations in the 21st Century*, science and innovation have increasingly become global. With the dawn of the 21st Century, global spending on research and development (R&D) has doubled from US$790.3 billion in 2002 to US$1.15 trillion in 2007. Similarly, publications have grown by one-third from 1.09 million to 1.58 million over the same period. The number of researchers has also been continually on the rise, increasing from 5.7 million in 2002 to 7.1 million in 2007. Such phenomenal growth is partly attributed to global networks.

Scientific advancements are geographically widespread, occurring in many countries. Traditional dominance in science is held by the USA, United Kingdom, Germany, France and Japan. Their dominance is measured in terms of production of innovative products and services as well as publication output. The Royal Society cited that these five countries alone have been responsible for 59% of all published works on science globally. Among them, the USA leads the world in research, contributing 20% of the total research papers published globally. Having a strong tradition in science and research as well as innovation, these nations command strong positions in producing high quality publications. They have put in place the requisite pull factors such as higher remuneration and perks, state-of-the-art research facilities, conducive work culture and environment, world class connectivity and connectedness, recognition and awards as well as freedom and democracy tp attract world-class talents and researchers to their universities and research institutes. In turn, the scientists and researchers from other parts of the world are highly motivated to be part of such universities and research institutions that have already gained global recognition as being world-class. Therefore, it will not be surprising that, with increasing global networks and connectedness, these countries are poised to command continued leadership in science, research and innovation in the global league. However, in the current information and knowledge era, new players are increasingly joining the global collaboration in research, science and innovation activities. Anytime and anywhere connectivity provided by the Internet, along with the political and market liberalisation sweeping the globe since the fall of the Berlin Wall in the early nineties as well as increasing human rights and freedom, is catalysing the globalisation phenomenon in the field of science.

Notably, the new entrants in the science and innovation race include

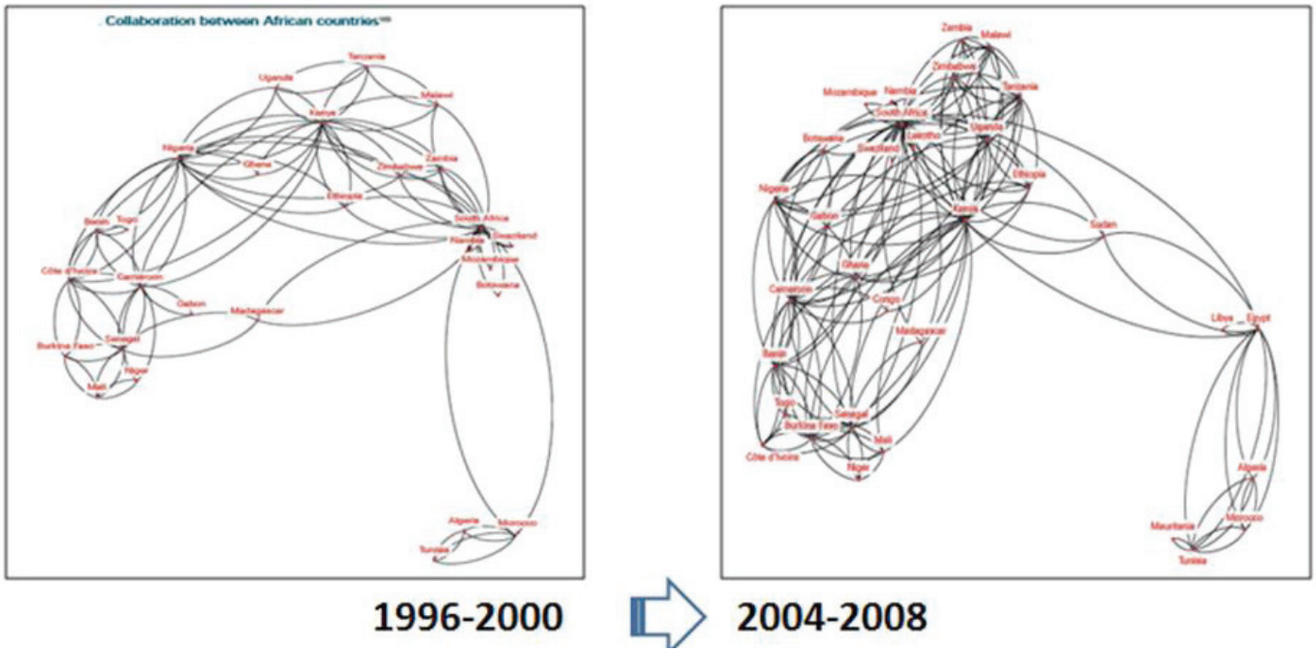

Figure 1 : Scientific Collaboration among African Nations. *Source: The Royal Society, 2011.*

China, India, South Korea and Brazil. Specifically, as reported in the Royal Society findings, China has increased its research publications significantly and it is now ranked the second highest producer of research output in the world. In parallel, India has improved its global position by climbing from 13th in 1996 to 10th position between 2004 and 2008. In this race, India has overtaken countries like the Russian Federation that were once considered a research powerhouse. South Korea has been known for producing global brands such as Samsung, LG, Hyundai and Kia arising from their own advancements in science, research, innovation and commercialisation. Other fast-emerging scientific nations that warrant due attention include Turkey, Austria, Greece and Portugal in Europe and Singapore, Thailand, and Malaysia in Southeast Asia. These nations have improved their standings in the global scientific league tables after their Governments had recognised that technology and innovation are key to long-term economic and social development, against the realisation that the alternative would be to remain an impoverished state in the global economy, as famously cited by Paul Kagame, President of Rwanda. Recognising that science and innovation are no longer a luxury or the sole preserve of developed economies, African nations have significantly stepped up regional collaboration (Figure 1) for the periods 1996-2000 to 2004-2008, as revealed in the increasing number of links. Although African presidents had in 1980 agreed to increase research spending to 1% of GDP as part of the Lagos Plan of Action, it was only recently that these nations were able to increase their science and research activities. As highlighted in the Report, South Africa has come close to the target of spending 0.92% of GDP in 2008 and 2009 for scientific advancements. More importantly, South Africa has become a key focal point in a continent that has been impoverished by economic backwardness and social ills for many centuries.

International collaboration is no longer driven solely by geographical proximity. There are numerous examples of regions that can be cited, indicating researchers coming together to share their resources and expertise. One such classic illustration is Vietnam, as shown in Figure 2. The Royal Society findings reported that countries like Vietnam have begun developing collaboration not only with its Southeast Asian neighbours, but also with distant economies, especially with those having well-advanced in science and innovation like the United States, Japan, United Kingdom. (The thickness of the links in Figure 2 indicates the volume of output.) Despite heterogeneity of the groups and vastly differing economics, natural resources and human capital wealth, Vietnam is making great strides in science collaboration regionally and globally. In these new developments, Vietnam is an exception in developing inner and outer global networks. Generally speaking, science collaboration between developing countries is still at a minimal level. Malaysia is one of them. Researchers and scientists in Malaysia are still inward-looking and their involvement in international collaboration is limited in scope and coverage. Unlike Vietnam, Malaysia lacks the requisite motivation, confidence and perhaps ability for intellectual discourse for international collaboration in science. The most Malaysian scientists and

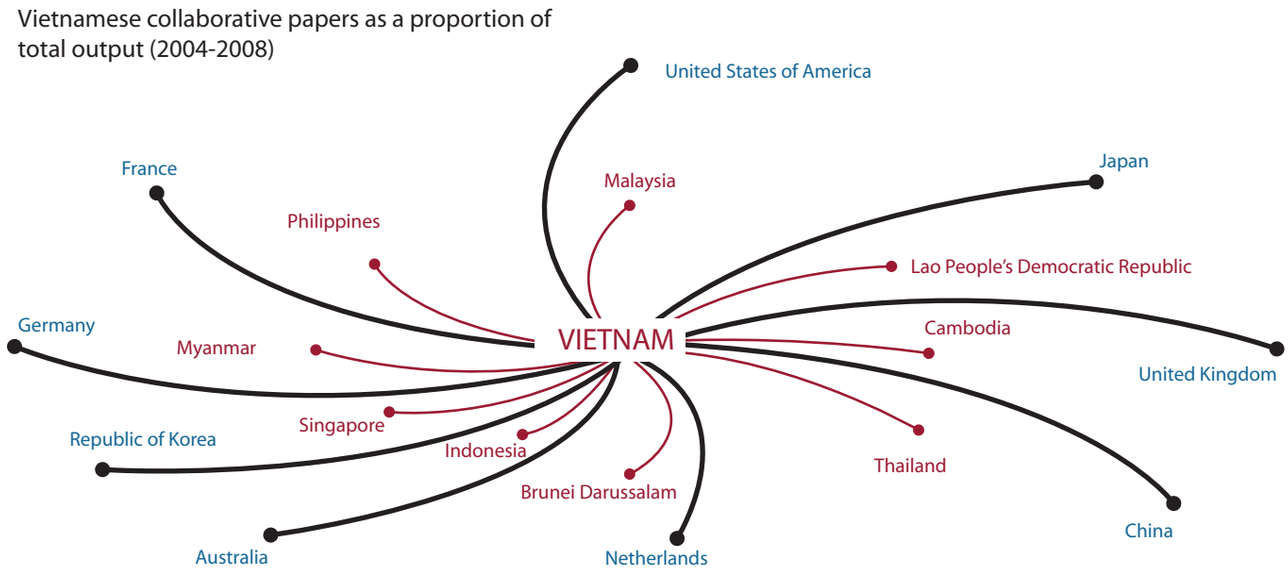

Figure 2: Vietnam's Scientific Collaboration

researchers may have is some level of international science and research collaboration with English-speaking countries like the United Kingdom, USA and Australia with which the country has long-established trade, diplomatic and cultural ties. The country has to emerge from such a closet and be compelled to reckon with the growing global opportunities due to global connectivity. It is also observed that traditionally non-English-speaking countries in Europe, Latin America or in French-speaking African nations, the learning of English has grown significantly especially among academics, thus paving the way for wider global opportunities.

Today, international collaboration addresses not only national problems but also global challenges. More importantly, the governments, irrespective of political settings, businesses, both small and large, and not-for-profit organisations including media, philanthropists and charities, are supporting global scientific work. With traditional centres of scientific excellence gaining new strength, entrants of new players and leaders are pointing to a multi-polar scientific world. They are engaged in international collaboration in driving economic development and addressing local and global challenges of sustainable development as well as discovering new innovative applications of scientific methods.

Much of the international science is largely conducted through bottom-up efforts and through informal connections as scientists become more mobile. Large and often complex data are shared at the click of a button. More importantly, scientists are able to organise themselves or are being organised in tackling shared concerns and research questions. The Royal Society reported that the proportion of articles published in international journals arising from international collaboration has increased from 25% to 35% over the past 15 years. This is only possible when researchers move away from confining themselves to national territories and participate in international collaboration. Cheaper travel makes it easier than ever before for international researchers to meet face-to-face and share equipment and facilities. Moreover, the scale of research questions demands researchers' mobility and timely responsiveness. Besides convenience in modern travel, developments in contemporary ICT, in particular the capacity, speed, latency and quality of broadband services, greatly assist in accelerating the speed, pace, scope and coverage in international collaboration involving science and innovation activities. Inter-disciplinary, cross cultures and traditions increases the quality of scientific research and improves the efficiency and efficacy of collaborative research. Although high-quality infrastructure is imperative, the primary drivers are the scientists themselves, especially the dedicated and committed ones constantly seeking to work with the best people, institutions and equipment across the globe.

Another pertinent characteristic of international collaboration, as reported by the Royal Society, is that of connections of people through formal and informal channels, diaspora communities and professional communities of shared interests. Dedicated virtual global networks spur such collaborations in science and innovation. The public global virtual networks such

as LinkedIn, Facebook and Twitter are also being added to the count for international science collaboration. In essence, global collaboration brings benefits in increased citations, access to new markets, broadening research horizons and positive impact on the science system itself in bringing prosperity or addressing specific challenges.

Thus, it can be surmised that contemporary ICT and broadband enable scientists to work with the most-outstanding scientists in their fields across the globe. It helps to build knowledge networks by providing access to complementary skills and knowledge, filling in knowledge gaps and resources, accessing high quality equipment and instruments and shaping research agendas. Collaboration brings with it the obvious benefit of scale. Notably, sharing the burden of research activity can play a significant role in breaking down complex tasks into manageable pieces. It facilitates joint authorship, capacity building, geopolitical linkages and global networks of science.

3. Essence of Broadband Performance

It is undeniable that broadband services are critical for the advancement of global science and its community as well as for society and the economy at large. From the economic perspective, it has been estimated that a broadband contribution of 4% to GDP can achieve a 50% population penetration in USA; 0.6% to GDP with 15% population penetration in UK; and 0.9% to GDP with 50% population penetration in New Zealand. In a similar vein, the Economic Planning Unit (EPU) of Malaysia has projected that a 50% household penetration would result in a tangible contribution of 1% to the country's GDP and would also possibly create 135,000 jobs.

3.1 Policy Strategies

Recognising its significance, the Government has been promoting the provision of broadband services through various policy strategies. Indeed, telecommunications reform in Malaysia began in 1983 when the government allowed the private sector to complement Jabatan Telekom Malaysia (JTM) in the supply of terminal equipment such as telephones and teleprinters. This set the stage for further liberalisation in other telecommunications markets such as Value-Added Networks (VANs) (1984), radio paging (1985), and mobile cellular (1988) when several locally-owned as well as foreign companies took advantage of the new market environment. After the full-fledged privatisation of Telekom Malaysia Berhad in 1987, the telecommunications sector further experienced liberalisation between 1993 and 1995 when the fixed line and cellular services market were opened to other private sector operators, namely TIME, Maxis, Digi, Celcom and Prismanet.

Indeed, in 1994, the Ministry of Energy, Telecommunications and Post issued a 28-page policy paper for the telecommunications sector entitled "The National Telecommunications Policy (NTP)". Another important telecommunications market that was liberalised was the Internet Service Provider (ISP) market. Before its commercial introduction in 1992, MIMOS, being a government-owned research institute, began providing Internet service in 1987, mainly to universities and research institutes. To harness the structural and institutional changes as well as convergence of computing, telecommunications, broadcasting and content industries, the Government established the Malaysian Communications and Multimedia Commission (MCMC) as an industry regulatory institution in 1998, supported with the enactment of the Communications and Multimedia Act (CMA) in 1998. The role of CMA 1998 is to undertake, firstly, economic regulation to ensure that the communications and multimedia industry is efficient vide licensing, competition policy and quality services; secondly, protection of consumer by ensuring access, affordability and service quality are met for businesses and citizens; thirdly, technical regulation to ensure technical inter-operability of networks, efficient allocation of resources and the safety, security and integrity of network services and applications services; and fourthly, social regulation towards ensuring that content applications and services reflect national cultural aspirations.

Since the launch of MSC Malaysia (formerly known as the Multimedia Super Corridor) in the mid-nineties, the Government has initiated a number of major policy strategies in the provision of high-quality broadband services. The major stages are shown in Figure 3. Specifically, the first National Broadband Plan was mooted in 2004, mainly to connect communities. The key objectives of broadband provision are: first, to move the economy up the value chain; second, enhance Malaysia's position as a global ICT and multimedia hub; third, expand the communication network to ensure more equitable access to information and services; fourth, enhance information security; and fifth, bridge the digital divide.

However, in propelling Malaysia into the advanced level of information, communication and multimedia services, the Government introduced the MyICMS886 strategy in 2005. This strategy has identified eight service areas, namely High-Speed Broadband, 3G & Beyond, Mobile TV, Digital Multimedia Broadcasting, Digital Home, Short Range Communications (e.g. RFID-based), VoIP/Internet Telephony

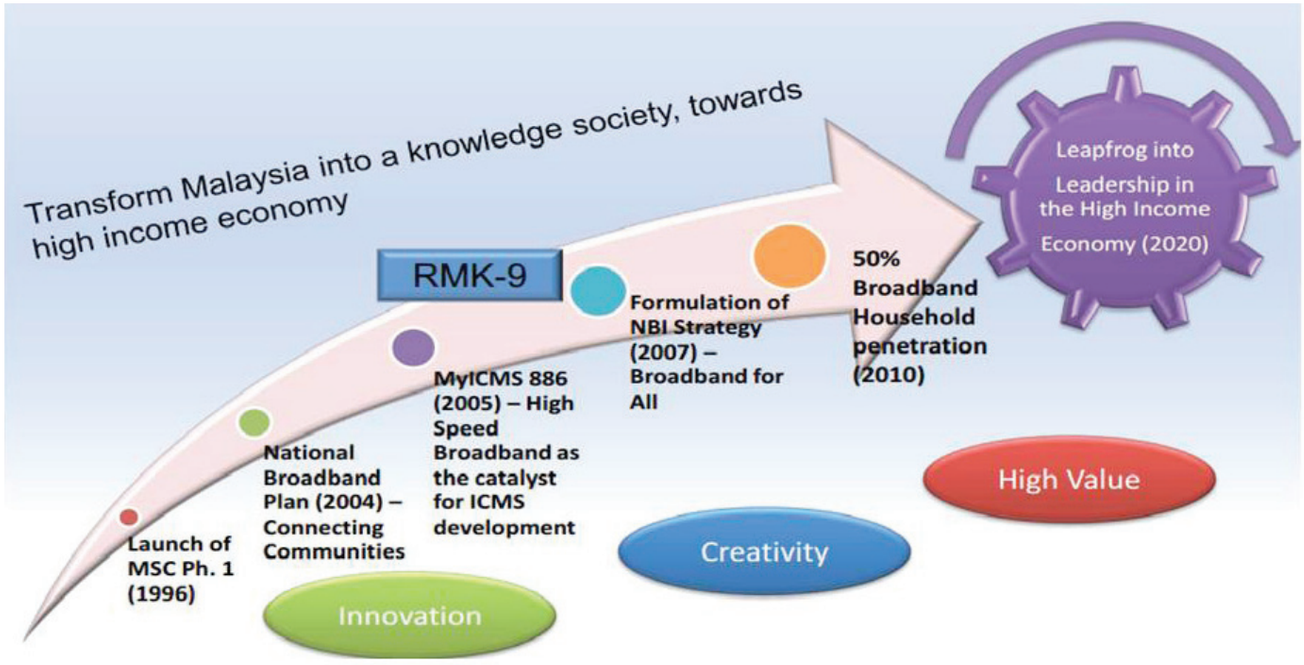

Figure 3: Major Broadband Policy Strategies in Malaysia
Source: Malaysian Communications and Multimedia Commission (MCMC) (Extracted from paper presented by Nor Akmar at ITU-MIC Forum on Wireless Broadband Network for Asia-Pacific, 23 – 25 March 2010 Tokyo, Japan.)

and Universal Service Provision. The next number 8 in the strategy's name denotes the eight focus areas in the provision of infrastructure, both hard and soft.

The hard infrastructure targeted includes Multiservice Convergence Networks, 3G Cellular Networks and Satellite Networks while the soft elements include Next Generation Internet Protocol (IPv6), Home Internet Adoption, Information & Network Security, Competence Development, Product Design & Manufacturing. The number 6 denotes six growth areas, namely Content Development (e.g. education, entertainment, games), ICT Education Hub, Digital Multimedia Receivers (set top box), Communication Devices (e.g. VoIP phones), Embedded Components, Devices (e.g. RFID) and Foreign Ventures. In support of the MyICMS886 strategy, the National Broadband Initiative (NBI) was formulated in 2007 to provide broadband services for all. As envisaged in the NBI, the target of achieving 50% broadband penetration in 2010 has been realised. Now the country is moving towards a 75% target by 2020 through the implementation of appropriate supply and demand initiatives.

From the supply side, the NBI promulgates a two-pronged broadband deployment strategy, namely Broadband for General Population (BBGP) and High Speed Broadband (HSBB). Specifically, the BBGP entails multiple technologies comprising 3G/HSDPA & WIMAX Services with network speeds of up to 2 Mbps. As shown in Figure 4, at 2 Mbps, only simple applications such as e-mail, browsing, e-school, Voice over Internet Protocol (VOIP), small file sharing, YouTube downloading, basic e-commerce and e-government services transactions can be executed. In other words, BBGP services is inadequate for applications such as Facebook, games, Internet Protocol TV (IPTV), telecommuting, e-health and High-Definition television (HDTV) type of applications. The BBGP also entails the Universal Service Programme (USP) targeted at providing last-mile connectivity to the rural population. The USP is managed using cess fund contributed by telecommunications industry players. The USP Fund is managed by the Malaysian Communications and Multimedia Commission (MCMC). Each telco service provider is mandated to contribute 6% of its annual revenue.

The High Speed Broadband (HSBB) is a premium broadband service with network speeds of up to 10 Mbps targeted at key economic and industrial zones. In order to achieve a household penetration of 70%, an emphasis on supply alone is insufficient. There must be an effective strategy to encourage demand for broadband. Therefore, emphasis will be given to three aspects of demand, that is awareness, attractiveness and affordability, as shown in the supply and demand framework postulated under NBI. The approach for creating awareness will be through continuous government and private

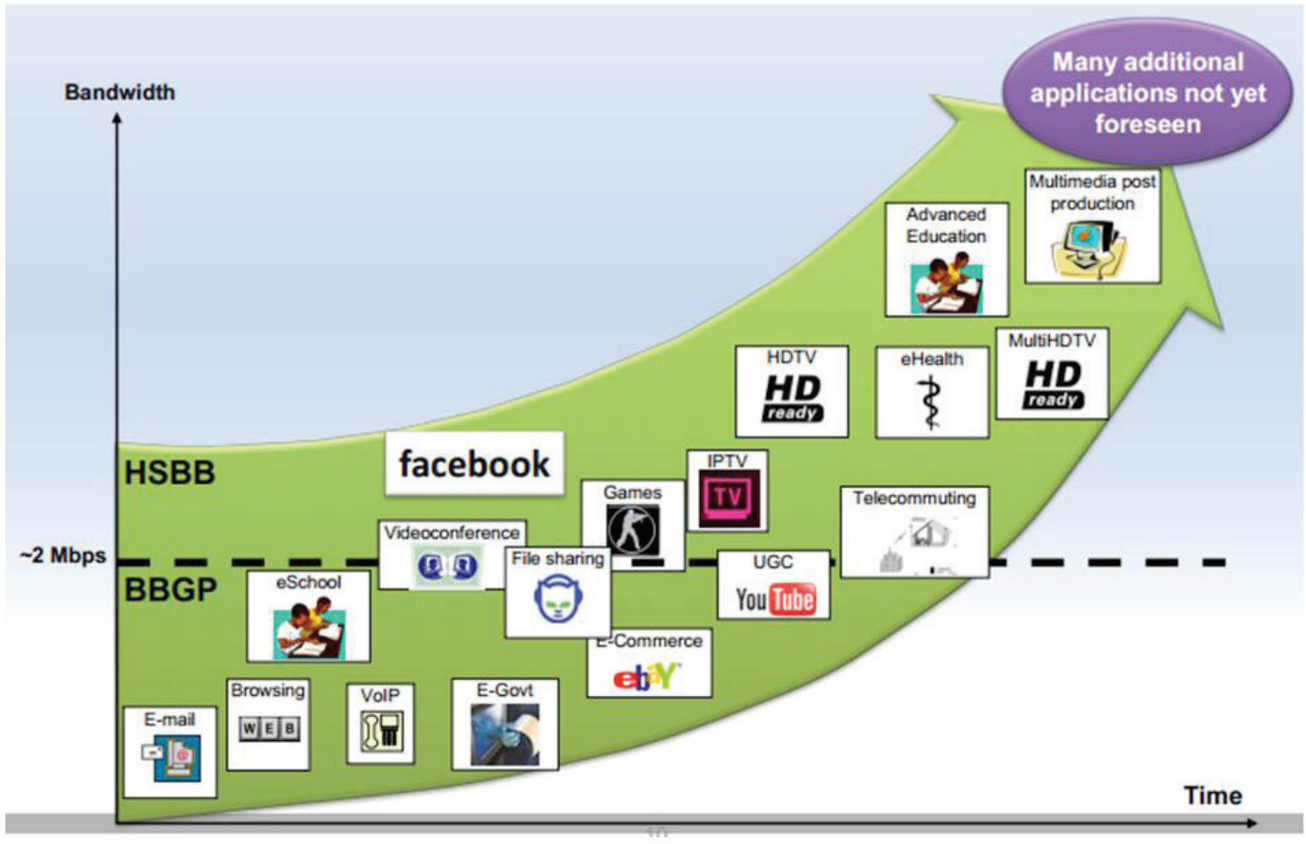

Figure 4 : Matching Applications with BBGP and BBHP Services
Source : Malaysian Communications and Multimedia Commission (MCMC) (Extracted from paper presented by Nor Akmar at ITU-MIC Forum on Wireless Broadband Network for Asia-Pacific, 23 – 25 March 2010 Tokyo, Japan.)

sector involvement in the awareness programmes and capacity building initiatives. In order to improve the attractiveness of the online content, efforts will be focused on enhancing and promoting e-Government, e-Education and e-Commerce. Efforts are also on the way to digitise the traditional information resources such as library, archive, etc. to be available online.

The affordability factor and bridging the digital divide are being improved by developing various incentives to reduce broadband access costs and widening community access. At the demand side, the NBI entails four major elements. They are broadband awareness and promotion; online content development for government and private sectors; affordable broadband package by government and service providers; and community access.

The benefits of broadband are:

- it will create a tangible impact on the country's Gross Domestic Product (GDP). Based on the statistics for the year 2008, the communications and multimedia industry contributed 6.1% in terms of revenue to the country's GDP;
- it will increase the national competitiveness and attract Foreign Direct Investment (FDI) into the country;
- is one of the enablers for a knowledge-based economy;
- it will create 135,000 new high-value jobs in the ICT sector with a 50% penetration rate.
- it will create a spin-off effect in other sectors such as engineering, local content development and broadcasting;
- However, the quality of broadband meeting user requirements in terms of capacity and speed compatible to contemporary Internet applications still remains a challenge.

3.2 Types of Broadband Services

Box 1 shows the type of broadband services licensed in the country. The list shows the type of services provided by various telecommunications industry players in the country. However, little is known on the actual items delivered in the market unless demand-based probes on consumers are carried out - where users can relate to what kind of services they are subscribing to and the service level quality they are receiving as well as their satisfaction.

Description of Broadband Services	Package Download Speed Range	Remarks
Cellular Broadband	384 Kbits/s to 42 Mbits/s	Celcom, Digi and Maxis confined to 384 Kbit/s to 7.2 Mbits/s range, while U Mobile provides up to 42 Mbit/s
Direct Single Loop (DSL)	384 Kbit/s – 20 Mbit/s	Internet Service Providers (ISPs) and their technologies include : Giga Broadband (VDSL 2-5 Mbit/s); Jaring Flite Wired (ADSL 1 Mbit/s); Maxis Wired (ADSL 256kbits/s – 9 Mbit/s); PersiaSYS Ultraband (Cable ETTH: 700kbit/s- 8 Mbit/s); TIME Business DSL (ADSL 2-50 Mbit/s) Time Business DSL (SDSL 2- 10); Time Broadband Consumer (ADSL 1.5 Mbit/s- 6 Mbit/s); TMNet Stremyx (ADSL / SDSL 384kbits – 4 Mbits) TM UniFi (VDSL 5-20 Mbit/s)
Fibre Optic	2 Mbit/s-50 Mbit/s	TM UniFi (FTTH: 5 -20 Mbit/s); TIME Fibre Broadband (FTTH : 2-50 Mbit/s); Maxis Home Broadband (FTTH : 4-30 Mbits) Service Providers: Cyberjaya Metro Fibre Network (CMFN) (FTTB and FTTB, mainly in Cyberjaya); Metrofon (FTTH; KL & Selangor); Penangfon (FTTH; Penang); Maxis High Speed Home Broadband (Subjected to TM UniFi); Time Fibre Broadband (50 Mbits available in Mt Kiara region); TM Unifi (Selangor currently; e-commerce, VOIP, IPTV) Note: FTTH – Fibre-To-The –Home; FTTB - Fibre-To-The –Building;
Wireless Broadband	WIMAX (384 Kbit/s- 15 Mbit/s)	ISPs: Airzed (1-2 Mbit/s); AsiaSpace WiMAX (AMAX) (1-1.5 Mbit/s); Redtone WiMAX (512 Kbit/s- 1.0 Mbit/s); Axis Broadband (512 Kbits); Izzi Broadband (IBurst technology) (1 Mbit/s); Hotgate Technology Inc (Various broadband technologies); JARING Flite Wireless (SOMA FlexMAX Mobile WiMAX System; 384 Kbit/s- 1 Mbit/s) Packet One (1-5 Mbit/s); YTL Communications (Uncapped up to 15 Mbit/s)
Hotspot	WiFi 802.11b(384 Kbit/s-512 Kbit/s)	ISPs: JARING Flite WiFi (60 hotspots); P1 Hot Zone (> 200 hot spots); Streamyx ZONE (> 1,000 hot spots)
Leased Line	Giga Speed Capacity	Service Providers: City Broadband (over fibre optic); TM METRO (4 Mbp/s-1 Gbp/s); TIME Ethernet Leased Line (point to multipoint connectivity); TIME International Leased Line (IPLC)
VSAT		Service Providers: H-Vision IPSTAR Satellite Broadband , 2-way satellite connection; Sabah.Net IP STAR Satellite Broadband, 2 way satellite connection; TIME Satellite Broadband (1.5 Mbit/s -4 Mbp/s), entire nation including rural areas
WiMAX	Not less than 1 Mbit/s	Service Providers Bizsurf (M) Sdn Bhd; MIB Comm Sdn Bhd; Asiapace Dotcom Sdn Bhd; Redtone-CNX Broadband Sdn Bhd

Box 1: Broadband Services in Malaysia

Source: Internet in Malaysia, Wikipedia, http://en.wikipedia.org/wiki/Internet_in_Malaysia, Last accessed: 26 August 2012

Type of Broadband Services	Capacity Quota (GB)		Monthly Fee (RM)		Download Speed (Mbps)		Unit Cost per GB (RM)		Unit Cost per Mbps (RM)	
	Geometric Average	Range	Geometric Average	Range	Geometric Average	Range	Geometric Average	Range	Geometric Average	Range
Fixed Broadband (FB)	34.1	5.0–120.0	133.6	49–249	4.4	0.4–20.0	3.9	2.1–11.8	30.6	12.5-122.5
Mobile Broadband (MB)	4.34	0.5–16.0	79.44	30–248	1.77	0.4–7.2	18.54	6.6 –60.0	44.7	6.7-225.7
Mobile Internet (MI)	2.1	0.1–20.0	63.2	18-198	2.8	0.4 –7.2	30.9	5.0–180.0	20.2	2.5-125.7

Table 1: Geometric averages of Malaysian Broadband service, based on Supplier Data
Source: Summary compiled from www.soyacincau.com/2011/07/17/broadband-in-Malaysia-2011-cost-comparison/

3.3 Broadband Quality

The type of broadband services provided in the country from the supply side can be well understood only by examining the provision of broadband quality in terms of speed, capacity and price as well as unit cost for capacity and speed. In the absence of demand-side data, as mentioned earlier, which only can be collected through primary surveys covering households and business establishments, the best effort information from the supplier side is used. A close examination of the type of broadband services listed showed great disparity in the type of services rendered. To minimise the variations, geometric averages were compiled instead of simple averages. The results are shown in Table 1. As reflected in the range measures, it can be seen that for each type of broadband service, capacity, speed and average cost vary greatly. Indeed, such wide disparity reveals the poor broadband business practices that prevail in the country from the viewpoint of creating healthy competition among service providers. The highly-skewed distribution also sends confusing signals and poses difficulties for consumers to make an informed decision on the best option. The performance of Malaysian broadband is benchmarked against the "today" and "tomorrow" applications scenario requirements, especially the speed as postulated by the Said Business School of Oxford University, in Figure 5.

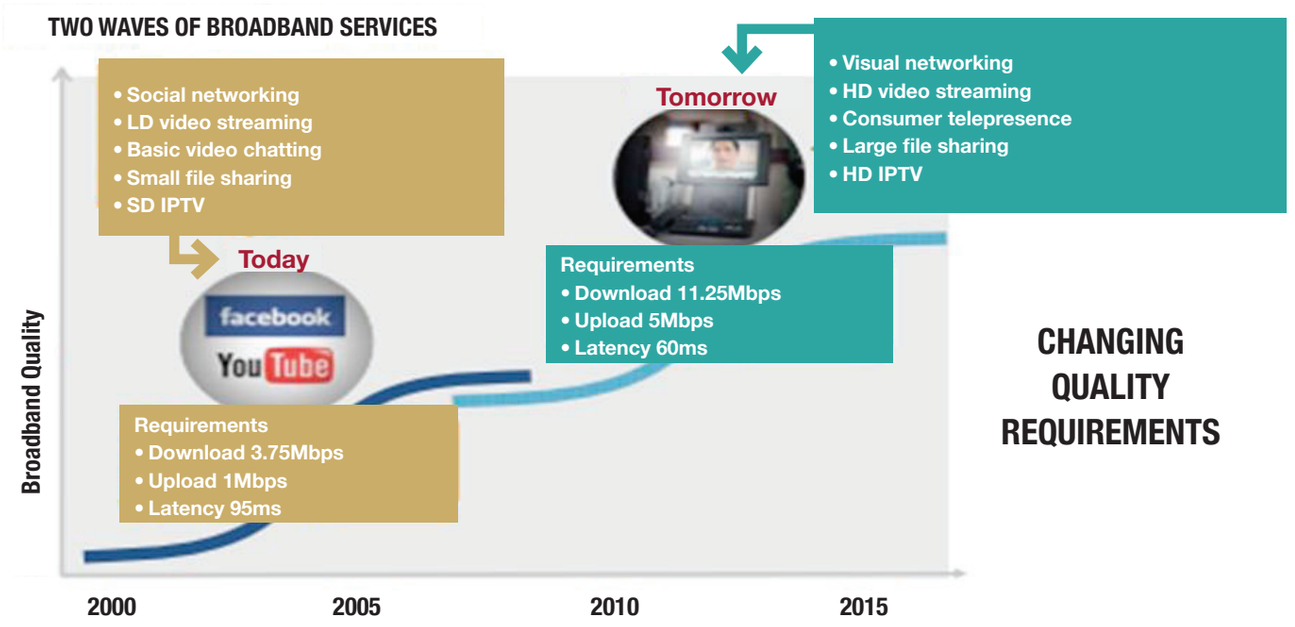

Figure 5: Broadband requirements for "today" and "tomorrow" applications
Note: Published with permission from Said Business School

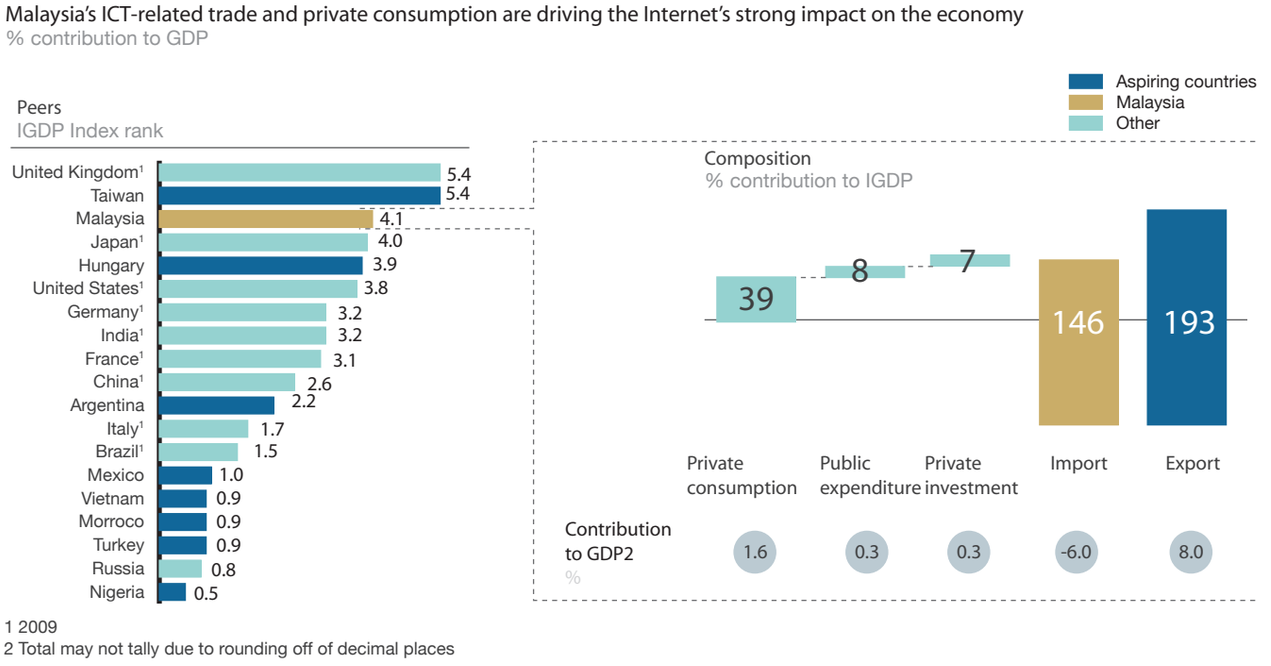

Figure 6: ICT's contribution to GDP
Source: McKinsey (2011); Published with permission

The comparison shows that only the average speed offered under the fixed broadband of 4.4 Mbps is able to meet the minimum criterion of 3.75 Mbps needed for downloading today's applications. Briefly, today's applications cover social networking, low density video streaming, basic video chatting, small file sharing and Standard Definition Internet Protocol TV (SD IPTV). The average speeds of mobile broadband of 1.77 Mbps and 2.8 Mbps for mobile Internet are far from adequate to meet today's application requirements. All the three types of broadband services are also inadequate to meet tomorrow's applications, which demands an average download speed of 11.25 Mbps and latency of 60 milliseconds. Tomorrow's applications include visual networking, high density video streaming, consumer tele-presence, large file sharing and High Definition Internet protocol TV (HDIPTV).

The McKinsey Report (2011) analysis showed that ICT-related trade and private consumption made a 4.1-% contribution to Malaysia's Gross Domestic Product (GDP). As shown in Figure 6, of this contribution, 8.0% was from export, 1.6% accounted for private consumption and 0.3% was from public expenditure. Private investment in ICT is only 0.3% of GDP, which is considered to be low.

3.4 Broadband Penetration in Malaysia: 2002-2015

With its introduction in 2002, broadband penetration in Malaysia grew significantly from 0.1 to 58.0 per 100 households in 2011. The marked increase in the provision of broadband from 31.6% in 2009 to 55.6% in 2010 is due to the inclusion of broadband-driven cellular phones following the revised definition by the International Telecommunication Union (ITU).

Prior to this, ITU defined broadband in the context of computer-mediated devices like desktops or laptops. ITU revised the broadband definition upon reckoning the 4G capability of cellular or tablet devices, which are on par with typical computing machines in terms of capacity, capability and performance. Taking into consideration the new definition and its expanded scope of devices, the broadband penetration rate in Malaysia is poised to reach 75% by 2015. This target is achievable when taking into consideration the increasing number of cellular phone users, which has already reached a penetration rate of 116.6 users per 100 inhabitants in 2011, and who will switch to 4G technology in the years ahead.

3.5 Broadband Usage Patterns

Figure 7 shows the current dynamics of Internet penetration in 2011 in Malaysia. Specifically, the data shown in Figure 7 shows that for every 100 inhabitants, 14 users subscribe to fixed line / dial-up Internet, 11 users are using fixed-line broadband and 33 users benefit from mobile broadband. All in all, there are a total of 58 Internet users per 100 inhabitants

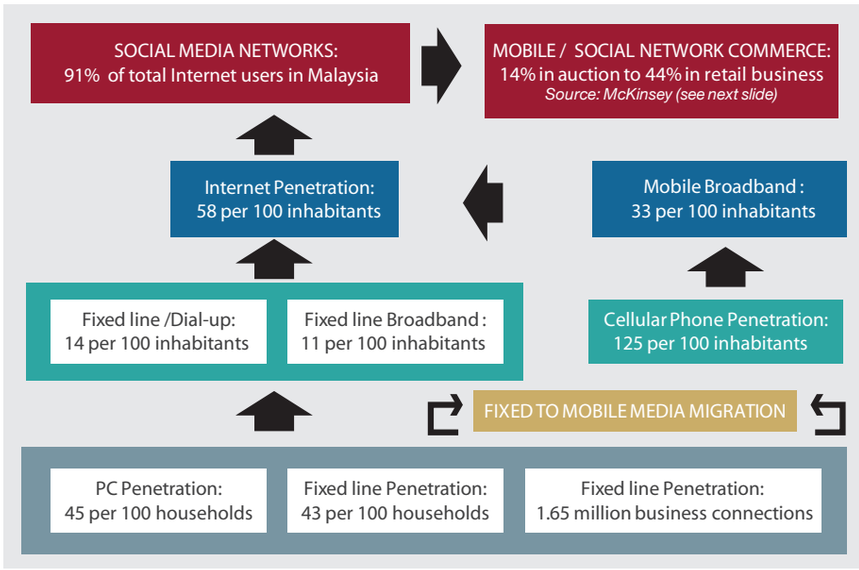

Figure 7: Dynamics of Internet Penetration in Malaysia
Source: Department of Statistics, Malaysia and PIKOM (2011)

in 2011. As highlighted earlier, the penetration rate is targeted to reach 75 users per 100 inhabitants by 2015 with an intermediate target of 61.5 users per 100 inhabitants by 2012.

McKinsey estimates 91% of Internet users in Malaysia are social media savvy. This proportion is well above the global average of 70% (See (Figure 8). Malaysians also outpace others in areas pertaining to search/ navigation, photos, multimedia and blogs. These activities are considered low-value add, reflecting a high consuming nation rather than a producing one. It can be seen from Figure 8 that the proportion of Malaysians involved in high-value add services, such as retail, business, sports, education and auction, did not exceed 45%.

3.6 Digital Divide

One of the development challenges that the policy makers and development practitioners are bound to address is bridging the gap in the digital divide, in particular between the urban and rural populations.

Like in any other technological introduction, broadband gained a foothold among the urban population first before permeating among the rural folk. Even among the urban folk, it is the more educated and affluent people who are considered to have the requisite affordability to embrace new technology. Typically, new technology tools and services start with high prices and with increasing demand - the prices tend to come down, especially once critical mass is reached in terms of market viability and profitability. Malaysia saw the introduction of broadband in 2002 and, over the past decade, broadband services have pervasively permeated into many corners of the country.

Malaysian users favour social networking over news and retail activities

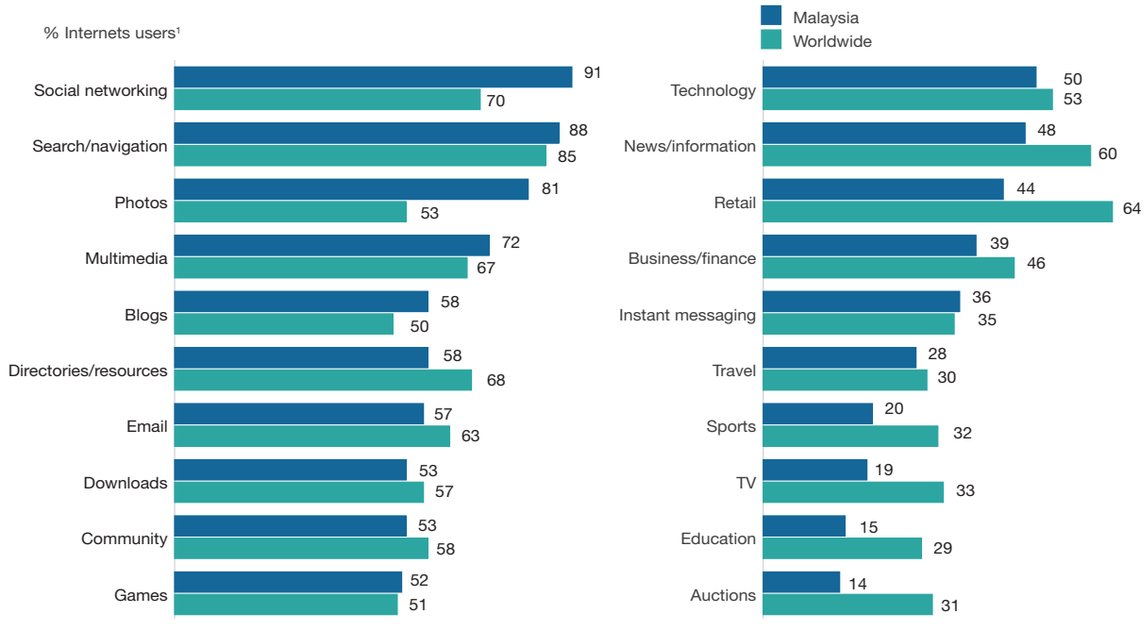

Figure 8: Internet Usage Distribution in Malaysia, 2011. *Source: McKinsey*

Despite great advancements, many of the rural locations in the country still lack quality infrastructure, such as roads, health amenities, education facilities, housing and sanitation.

The challenges in the rural areas are further accentuated by the lack of access to affordable information and communications technology services including quality broadband. Such shortfalls pose challenges in attracting skilled and knowledge workers to rural locations where much help is needed to upgrade the standard and quality of living. Due to poor connectivity, connectedness and networking of the poor rural folk is very low, thus handicapping them in terms of access to knowledge, skills, information, resources and markets (Nair, 2011).

The digital divide study conducted by the Monash University of Sunway Campus in Malaysia on communities living in government-assisted land schemes, privately-operated plantations, traditional agricultural communities, fishing villages and urban poor communities revealed a number of weaknesses in the driver conditions. These include low education skills, low proficiency in languages especially English, which is considered the lingua franca of the Internet world, poor creativity in rural education settings, poor technology uptake and weak alignment to national innovation strategies, as well as the lack of local champions and an effective local governance system (Nair, 2011).

The foundation conditions include infrastructure and infostructure where broadband is an integral component. Undeniably, the foundation conditions are critical for driving the driver conditions entailing intellectual capital development, interaction, integrity, incentives and institutions. The study succinctly revealed that the plantation communities, at the lowest level with only a 5% Internet penetration rate, have poor technology uptake due to the prohibitive cost, lack of usage knowledge and, more importantly, see no relevance to their daily routines. In comparison, the urban poor communities, on an average, experience 35% connectivity but the bulk of poor urban folks also cited the same reasons as their counterparts in the plantation sector for poor technology uptake.

3.7 Regional Benchmarking

Regionally, Malaysia is ahead of countries like China, Vietnam, Thailand, Indonesia and Cambodia in terms of the Internet penetration rate (Figure 9). However, in comparison to industrialised or newly industrialised countries, particularly Singapore, South Korea and Japan, Malaysia is lagging behind significantly. For instance, the broadband penetration in South Korea has reached 83.7% followed by 80.0% in Japan and 70% in Singapore.

The Said Business School of Oxford University, with the support of Cisco, has been assessing broadband leadership in the global arena since 2008. In the beginning, only broadband diffusion factor was considered a proxy measure for broadband leadership. However, recognising the growing significance and pervasiveness of bandwidth intensive applications, the Said Business School has widened its scope for assessing broadband quality. Specifically, for each country,

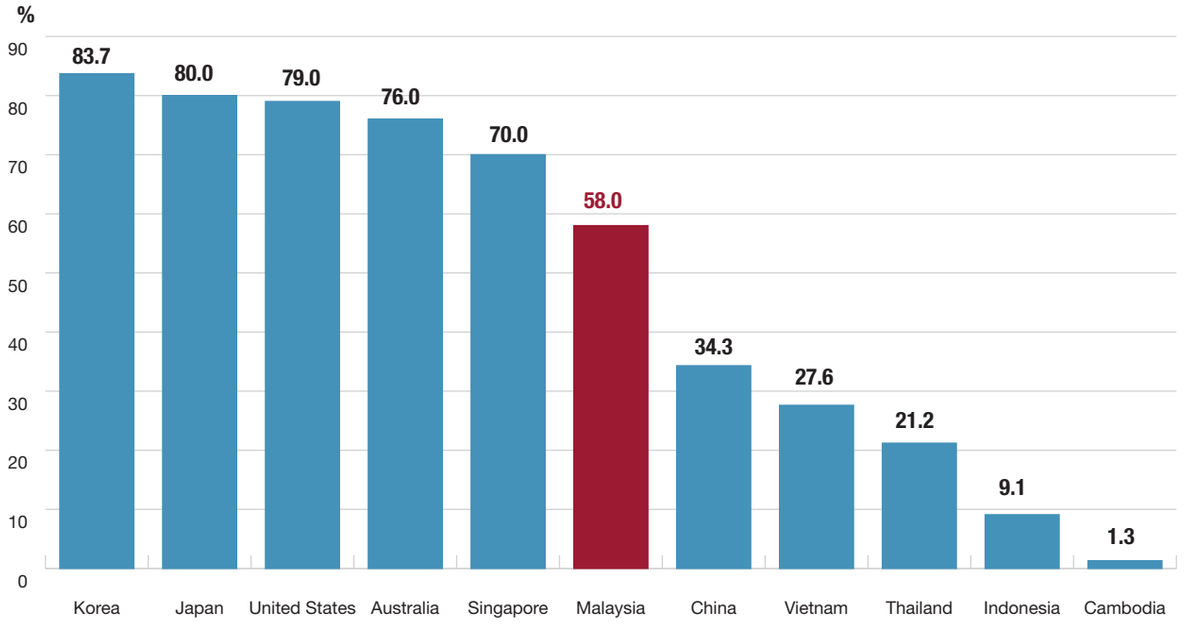

Figure 9: Internet Users Per 100 Inhabitants in 2011
Source: MCMC, International Telecommunication Union and PIKOM

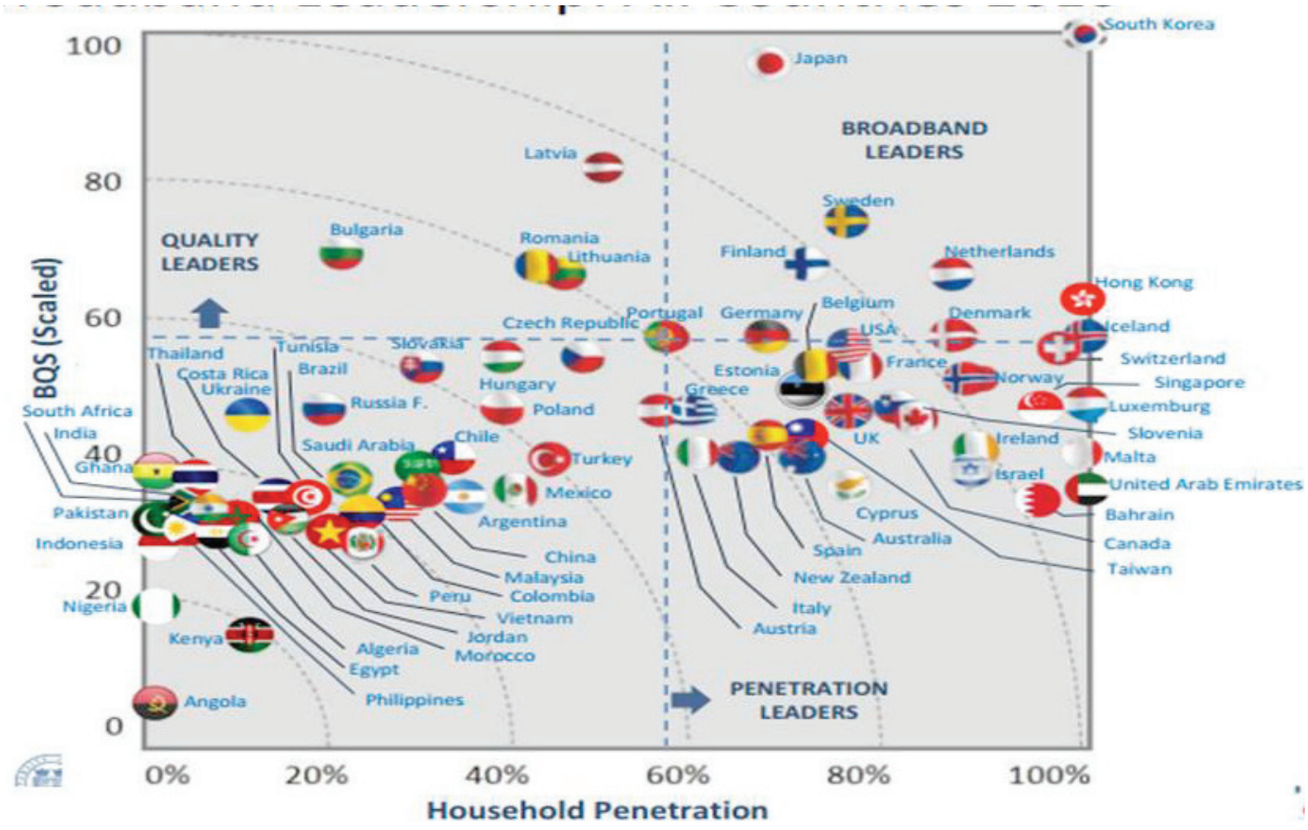

Figure 10: Broadband Leadership of 72 Countries in 2010
Source: Said Business School of Oxford University (Published with permission)

the Broadband Quality Score (BQS) index is plotted against the household penetration rate as shown in Figure 10. In 2010, the study covered 72 countries incorporating 40 socioeconomic variables as well as 40 million records sourced from Speedtest.net. The BQS is calculated for today's and tomorrow's applications via the following formulae:

BQS (today) = 55% Download + 23% Upload + 22% Latency, where download throughput is 3.75 Mbps, upload throughput is 1 Mbps and latency is 95ms.

BQS (tomorrow) = 45% Download + 32% Upload + 23% Latency, where download throughput is 11.25 Mbps, upload throughput is 5 Mbps and latency is 60ms.

An analysis of Malaysia's BQS Index showed that it is in the fourth band, that is, below quality leaders and penetration leaders as well as very

Ready for tomorrow	Comfortably enjoying today's applications	Meeting needs of today's applications	Below today's applications threshold	Basic applications
Korea	Switzerland	Taiwan	United arab emirates	Algeria
Japan	United States	Spain	Qatar	Peru
Latvia	Czech Republic	Australia	China	Nigeria
Sweden	Hungary	Ireland	Argentina	Kenya
Bulgaria	Belgium	Malta	Bahrain	Angola
Finland	France	New Zealand	Mexico	
Romania	Slovakia	Italy	Tunisia	
Lithuania	Norway	Turkey	Costa Rica	
Netherlands	Estonia	Chile	South Africa	
Hong Kong	Luxembourg	Israel	Malaysia	
Germany	Austria	Ghana	Pakistan	
Portugal	Singapore	Thailand	India	
Denmark	Poland	Saudi Arabia	Morocco	
Iceland	Slovenia	Cyprus	Colombia	
	Russia Federation	Brazil	Philippines	
	United kingdom		Indonesia	
	Greece		Jordan	
	Ukraine		Egypt	
	Canada		Vietnam	

14 countries have already prepared for the internet "applications of tomorrow" compared to only 1 country in 2008

Figure 11: Level of Preparedness for Today and Future Internet Applications by Country
Source: Said Business School of Oxford University (Published with permission)

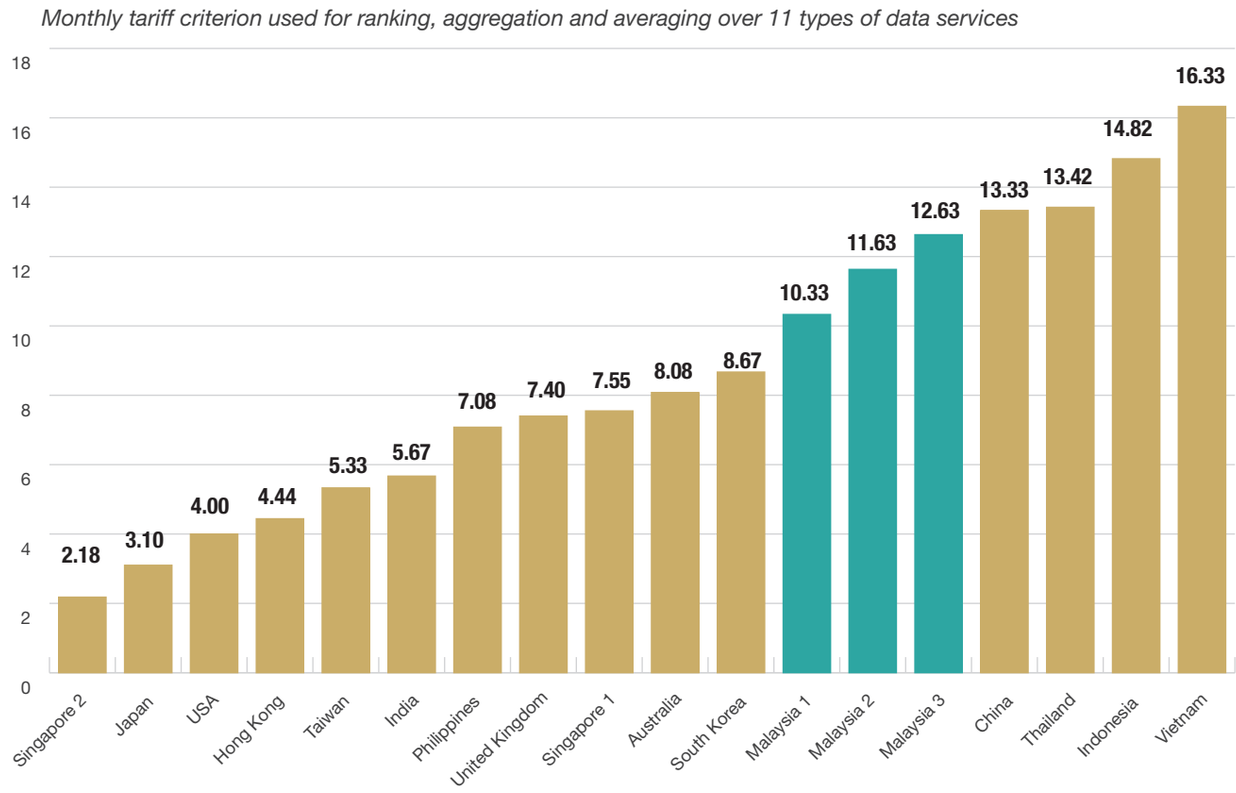

Figure 12: Average Ranking Based on Monthly Tariff on Data Services by Country
Source: Compiled from MDeC / Frost & Sullivan study on broadband services (2012)

far from the first band of broadband leaders. Of the 72 countries ranked (Figure 10), Malaysia occupied 58th position in the broadband leadership ladder.

Figure 11 shows the level of preparedness of selected countries for application readiness. Unexpectedly, Malaysia is placed under the "below today's application threshold". Interestingly, Figure 11 reveals that 14 countries are already prepared for the Internet's "applications of tomorrow", compared to only one in 2008. In this category, Korea ranked first and two other countries in Asia ready for tomorrow's applications are Japan and Hong Kong.

3.8 Average Monthly Tariff for Data

Competitive edge in broadband pricing is critical for the effective and efficient provision of data and Internet services as far as investment benchmarking considerations are concerned. Figure 12 shows the ranking of 18 nations based on the average monthly tariff incurred for data services. The data services considered in the compilation include domestic leased line over Ethernet, international private leased line and domestic and international IP-VPN.

To make a meaningful comparison, only data services of 50 Mbps were considered in the analysis. Data for 10 Mbps, 20 Mbps and 100 Mbps were not available for the countries considered in the study. It can be seen from the summarised data that Malaysia has been ranked 12th, 13th and 14th positions respectively for the three service providers, behind the Philippines and Singapore in this region. At the moment, Malaysia's position in the provision of data services is better off in comparison with China, Thailand, Vietnam, and Indonesia. Singapore ranked number one in data service.

Further analysis showed that average monthly tariff paid for data services in Singapore is only 65% of Malaysia's rate (Table 2) and similarly, the Philippines pays only 84% indicating that these two countries are more competitive in pricing for data services. The result also indicated that monthly tariff pricing in Thailand and Vietnam are 1.54 and 2.34 times higher respectively than in Malaysia.

3.9 Average Monthly Tariff for Internet Services

Similar analysis was also carried out on the average monthly tariff pricing for Internet services (Figure 13 and Table 3). Four types of Internet services, namely dedicated Internet access, shared broadband services, domestic and international transit and server collocation, were considered in the compilation of average monthly tariff and average rank score. The computation considered only 100 Mbps type of Internet services for

AVERAGE MONTHLY TARIFF FOR DATA SERVICES								
Type of Services (50Mbps)			**Singapore 1**	**Singapore 2**	**Philippines**	**Thailand**	**Vietnam**	**Malaysia 3**
Data Services	Domestic leased line over ethernet	Last Mile	9,100	8,000	7,800	12,600	30,400	13,200
		50Km end-to-end charge	12,600	10,000	12,900	17,600	76,300	15,400
	International private leased line to:	United Kingdom	71,500	50,000	82,800	157,800	166,000	87,200
		USA	58,700	45,000	81,000	146,000	182,300	71,200
		Hong Kong	26,700	20,000	30,400	88,200	111,400	42,000
		Japan	29,500	23,000	41,400	106,400	124,300	36,400
	Domestic and international IP-VPN	Port, Cloud and leased line charges	25,100	12,000	16,300	40,200	116,100	24,500
		United Kingdom (end-to-end)	82,800	75,000	75,600	118,600	151,600	88,500
		USA (end-to-end)	92,300	80,000	85,000	128,000	147,500	97,900
		Japan (end-to-end)	82,200	80,000	75,000	118,000	132,100	87,900
		Hong Kong (end-to-end)	85,000	75,000	81,000	124,000	125,500	105,400
Average Monthly Tariff (RM)			**40,703**	**31,979**	**40,932**	**75,093**	**113,894**	**48,867**
BENCHMARKING AVERAGE MONTHLY TARIFF AGAINST MALAYSIA								
Type of Services (50Mbps)			Singapore 1	Singapore 2	Philippines	Thailand	Vietnam	Malaysia 3
Data Services	Domestic leased line over ethernet	Last Mile	0.69	0.61	0.59	0.95	2.30	1.00
		50Km end-to-end charge	0.82	0.65	0.84	1.14	4.95	1.00
	International private leased line to:	United Kingdom	0.82	0.57	0.95	1.81	1.90	1.00
		USA	0.82	0.63	1.14	2.05	2.56	1.00
		Hong Kong	0.64	0.48	0.72	2.10	2.65	1.00
		Japan	0.81	0.63	1.14	2.92	3.41	1.00
	Domestic and international IP-VPN	Port, Cloud and leased line charges	1.02	0.49	0.67	1.64	4.74	1.00
		United Kingdom (end-to-end)	0.94	0.85	0.85	1.34	1.71	1.00
		USA (end-to-end)	0.94	0.82	0.87	1.31	1.51	1.00
		Japan (end-to-end)	0.94	0.91	0.85	1.34	1.50	1.00
		Hong Kong (end-to-end)	0.81	0.71	0.77	1.18	1.19	1.00
Overall Comparison			**0.83**	**0.65**	**0.84**	**1.54**	**2.33**	**1.00**

Table 2: Benchmarking Monthly Tariff for Data Services of Selected Countries
Source: Compiled from MDeC / Frost & Sullivan study on broadband services (2012)

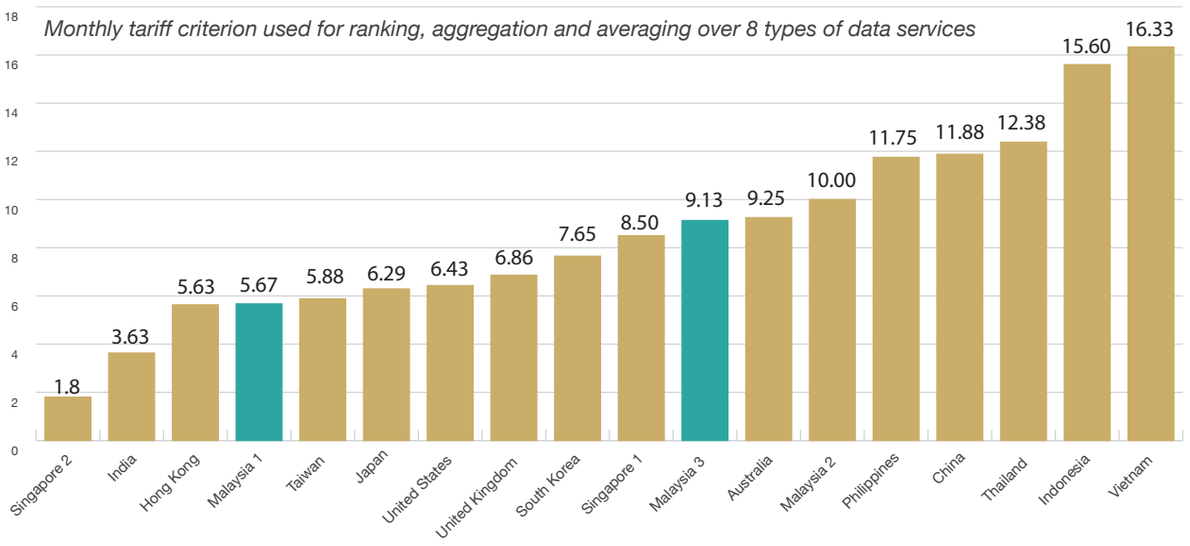

Figure 13: Average Ranking Based on Monthly Tariff on Internet Services by Country
Source: Compiled from MDeC / Frost & Sullivan study on broadband services (2012)

MONTHLY TARIFF FOR INTERNET SERVICES (RM)						
Type of Internet Services (100Mbps)		**Singapore 1**	**Singapore 2**	**Philippines**	**Thailand**	**Malaysia 3**
Dedicated Internet Access (100Mbps)	Port and dedicated charges	43,600	35,000	54,300	79,100	48,600
Shared broadband (100Mbps)	Shared broadband Internet	23,500	15,000	25,400	33,300	26,400
Domestic and International Transit (100Mbps)	Port, cloud and access charges	56,500	25,000	58,100	70,900	52,400
	UK Internet transit	25,100	20,000	28,200	37,700	27,300
	USA Internet transit	18,800	15,000	30,800	25,100	18,800
	Japan Internet transit	18,800	15,000	22,600	23,500	20,100
	Hong Kong Internet transit	18,800	15,000	19,100	25,700	20,400
Server collocation (100Mbps)	Server collocation	37,300	35,000	46,800	35,100	36,500
	Average	**27,833**	**20,485**	**32,999**	**37,299**	**29,116**
Type of Internet Services (100Mbps)		**Singapore 1**	**Singapore 2**	**Philippines**	**Thailand**	**Malaysia 3**
Dedicated Internet Access (100Mbps)	Port and dedicated charges	0.90	0.72	1.12	1.63	1.00
Shared broadband (100Mbps)	Shared broadband Internet	0.89	0.57	0.96	1.26	1.00
Domestic and International Transit (100Mbps)	Port, Cloud and access charges	1.08	0.48	1.11	1.35	1.00
	UK Internet transit	0.92	0.73	1.03	1.38	1.00
	USA Internet transit	1.00	0.80	1.64	1.34	1.00
	Japan Internet transit	0.94	0.75	1.12	1.17	1.00
	Hong Kong Internet transit	0.92	0.74	0.94	1.26	1.00
Server collocation (100Mbps)	Server collocation	1.02	0.96	1.28	0.96	1.00
	Overall	**0.96**	**0.70**	**1.13**	**1.28**	**1.00**

Table 3: Benchmarking Monthly Tariff for Data Services of Selected Countries
Source: Compiled from MDeC / Frost & Sullivan study on broadband services (2012)

which data were available for all the nations considered in the study.

Interestingly, Malaysia ranked 4th among the 18 competitive nations considered in the study, indicating its cost is higher when compared to Singapore, India and Hong Kong. Specifically, the average monthly tariff in Singapore is as low as 70% of what is incurred in Malaysia.

However, in the Philippines and Thailand, the average monthly tariff for Internet services is 1.13 and 1.28 times higher respectively than in Malaysia. In essence, the provision of broadband in Malaysia can be surmised as being expensive, which in turn results in a low penetration; low quality leading to low level of economic activities and low level of preparedness for tomorrow's applications.

4. Key Broadband Issues Inhibiting Business Growth

The provision of broadband services faces a number of issues and challenges that warrant due attention in order to increase its quality and benefits thereof, as well as customer satisfaction especially for the business sector. The key issues and challenges can be surmised as follows:

Broadband shortfall in meeting market and business demands: The supply side data showed that Malaysia's best effort speed offered under the Fixed Broadband (FB) services netting an average rate of 4.4 Mbps is only adequate for low-end applications, such as social networking, low density video streaming, basic video streaming like You Tube, small file sharing and Standard Definition Internet protocol TV (SDIPTV), and not adequate for future applications (note: best effort does not construe actual data speed experienced by users).

Similarly, Fixed Broadband (FB) or Mobile Broadband (MB) netting an average speed of 1.77 Mbps or Mobile Internet (MI) of 2.8 Mbps are considered obsolete for future applications, which require a download speed of at least 11.25 Mbps and an upload speed of at least 5 Mbps, with shorter latency of 60 milliseconds. Typical FB or MB services are far from adequate in meeting the demands of today's applications, which require at least 3.75 Mbps for downloads and 1 Mbps for uploads with a latency of 95 milliseconds.

The Said Business School study has indicated that 14 countries, including Korea, Japan and Hong Kong in Asia, are already equipped for future applications such as high density video streaming, High Definition Internet protocol TV (HD IPTV), visual networking and consumer tele-presence. Unfortunately, Malaysia is not in the league of these nations despite having high ambitions of becoming an innovative nation in the contemporary context. Thus, in order for the country to have a competitive edge in science and innovation and a comparative advantage regionally, it is imperative to spearhead the broadband quality in order to meet the long-term needs and not the short-term concerns that become obsolete very fast.

Quality of broadband services not meeting customer satisfaction: Capacity, speed and cost are highly skewed among broadband service providers. Service providers provide wide range of services that are confusing and pose difficulty for customers to make informed decisions. Highly skewed distribution of services is giving rise to uneven and unfair market practices.

Both businesses and individual customers lack adequate information on the type of services offered. Customers are unhappy with rigid terms and conditions attached to the services, especially unreasonable penalties imposed on breaching these terms and conditions. This situation can only be change provided policy and regulatory institutions ensure fair licensing and business practices, which are currently conjectured to be more aligned to service providers than to customers.

Lacking productive transformation capacity: The potential of ICT in creating an innovative learning society has not been fully realized. The economy and society lack agility to adapt to disruptive and rapid changes due to technological upheavals. As highlighted in Figure 8, current Internet usage is highly skewed towards social interaction and entertainment type of activities (e.g. 91% of Internet users are in social networks with only 14% in auctions and 44% in some form of retail businesses).

Low level of usage for innovation and development work (e.g. only 15% access health services, 5% on education and 66% use e-government services for filing taxes) indicates that Malaysians are good consumers and not producers of innovative Internet applications. Moreover, indigenous contents are insufficient and underdeveloped. This requires not only reviewing and realigning the educational system and the work culture, practices and standards for producing competent and innovative workforce but also motivational incentives for the private sector in converting science and innovation activities into business ventures, including commercially viable patents.

Poor governance as the major obstacles for small and medium enterprises (SMEs) moving up the value chain: Uptake of broadband services by SMEs is severely limited, despite its current economic contribution standing at 31 % to GDP, 19% to export and 56% to employment. As widely acknowledged, SMEs are complacent with traditional modes of doing business; lack awareness on how ICT can improve their businesses; have poor ICT literacy rate; have inadequate financial affordability to employ technology experts, acquire ICT infrastructure, tools and services; and more importantly, reluctance to embrace an ICT work culture. Despite the ubiquitous and pervasive ICT phenomena, many SMEs still have a lingering "fear factor" relating to business security, safety and authentication challenges as well as being techno-phobic. Currently, through various government-linked institutions, various forms of motivational incentives are accorded to move the SME businesses up the value chain but these have not come to a tangible fruition.

This is largely conjectured due to poor implementation, monitoring and evaluation mechanisms. Moreover, the current systems in place to help SME businesses lack openness and transparency, which presumably can be overcome through engaging institutions like industry associations that can provide independent monitoring, measuring and evaluation mechanisms.

Broadband affordability at the household level: The composition of household expenditure 2009/10, as published by the Department of Statistics Malaysia, showed that a typical Malaysian family spends on an average of RM124 or 5.6% of its total monthly expenditure of RM2,190 on communication. Assuming that the monthly broadband expenditure is being absorbed under this category, the price structure of the broadband services revealed that most of the households may not be able to afford FB that which, on an average, costs RM133 monthly! Some families can afford the MB at RM79.40 or MI at RM63.20, at the expense of capacity and speed. Exploring the data further by urban and rural breakdown, where the expenditure pattern and priorities vary significantly, the data showed that a typical Malaysian urban family on an average allocates RM147 or 6.0% of its average monthly expenditure of RM2,465 for communication purposes.

Again, on the same assumption that an urban family uses this allocation to gain access to broadband services, the data showed they would be able to afford all the three types of broadband services. In comparison, when a typical rural family sets aside only RM72 or 4.5% out of

its monthly total expenditure of RM1,599, then such a family may not only be able to afford FB but also MB, which has an average price of RM79.40 per month; some families are likely to be able to afford MI that is priced at RM63.20 monthly.

Though the analysis is crude and superficial, the data interestingly revealed that more families in the rural areas are deprived of broadband than in the urban areas on the basis of having the same price structure for both strata. It is highly recommended that the Government review the current broadband price structure by taking into consideration of rural needs, more so to reduce the regional disparity in the standards of living.

Conclusion

The definition of broadband has to be dynamic, fulfilling today's needs while anticipating future demand that is critical for science, innovation and business developments. The current 'near liberalisation' telecommunications policy, that at times seemingly favours incumbent service providers, has to be done away for healthy business growth - ensuring fair deals for businesses at supply side and customers at the demand side.

At the same time, the quality of broadband in terms of capacity, speed and cost as well as the service level must be globally competitive especially for investments, jobs and wealth creation. Without these basic and fundamental policy and business parameters in place, it is foreseen that the growth of science and innovation for producing new business ventures will be challenged. Indeed, a plethora of new wealth creation opportunities are emerging with science and innovation becoming global. Among the relevant institutions as well as research and scientific communities, the sharing of equipment, expert resources, knowledge and information are on the rise.

Thus, the provision of a top-notch broadband connectivity is imperative for inter-twining science, innovation and business and in which the government has an imperative role to create a more level playing field for service providers and user communities, nationally and globally.

PIKOM

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