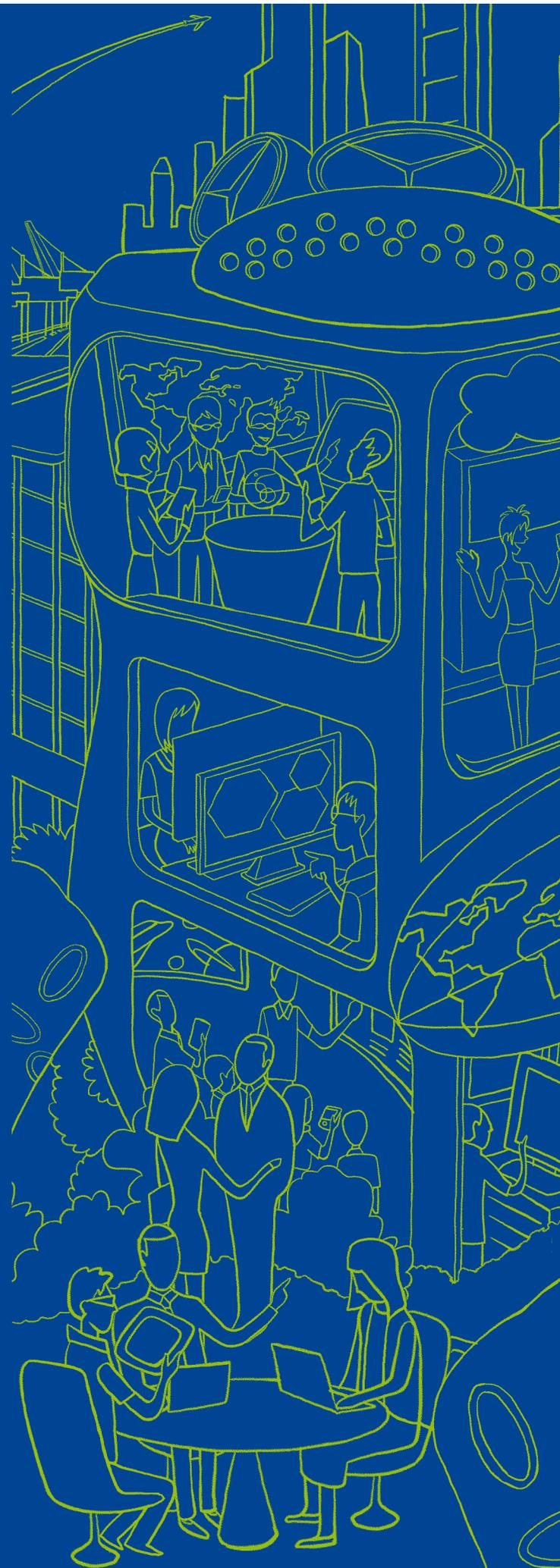


iN2015 < IMAGINE YOUR WORLD

DRIVE THE FUTURE. BE A
PLAYER. GO INFOCOMM
Report by the iN2015 Infocomm
Competency Council

Singapore: An Intelligent Nation, a Global City,
powered by Infocomm



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Preface

Looking back on the last decade, infocomm innovations have changed the way individuals express themselves, acquire knowledge and quite simply, live. The use of infocomm has become such an integral part of our everyday lives that when we think of infocomm, mobile phone messaging, online messaging, surfing and blogging immediately come to mind. But infocomm goes beyond these. It has also allowed global entities to go local, and local entities to go global, by enabling them to move closer to their international customers, and to tap overseas talent. Basically, infocomm has transformed businesses.

Currently, most organisations are using infocomm to manage information and automate processes. In fact, using infocomm has become more or less a prerequisite to being a player in the knowledge-based economy.

But what role will infocomm continue to play moving forward?

As its use becomes more pervasive, it is highly likely to go from being merely utilitarian to becoming a valuable differentiating factor to help an organisation stand out in an increasingly competitive world, if used effectively. For this to happen, we need people who are able to see infocomm systems as one piece of an organisation's overall business strategy. People who can create, adapt, even actively embrace, the opportunities to do things better and faster using infocomm innovations. People capable of designing infocomm tools to enhance an organisation's ability to meet its current and future targets.

It is with this perspective that the Infocomm Competency Council set out to examine the impending challenges for Singapore and its infocomm industry. The Council discussed how the country's human resources can be mobilised to use infocomm to turn those challenges into opportunities. In doing so, it looked not just at the country's existing manpower pool, but the next generation on which the country's future rests. The Council was unanimous in its belief that opportunities for these young people should be created so they can see that infocomm means much more than email and messaging, that in fact, it can empower individuals and power economies.

The Council's Infocomm Manpower Development Plan summarises these ideas in its vision of developing an infocomm-savvy workforce and globally competitive infocomm manpower to drive national economic competitiveness. The plan also lays out the strategies and recommendations for achieving this vision. In the years ahead, the Council hopes that its recommendations will have provided the basis on which the Government, the industry and the community work together in positioning people here to take advantage of infocomm to create opportunities for themselves and for Singapore.



Mr Lee Kwok Cheong

Chairman

iN2015 Infocomm Competency Council

iN2015 Infocomm Competency Council

Name	Designation
Mr Lee Kwok Cheong (Chairman)	President Singapore Computer Society
Mr Chan Yeng Kit (Co-Chairman)	Chief Executive Officer Infocomm Development Authority of Singapore
Mr Ong Ye Kung (Co-Chairman)	Chief Executive Singapore Workforce Development Agency
Mr Steve Ingram	Former Managing Director Head of Global Technology and Operations Chief Information Officer DBS Bank Ltd (Currently Advisor to the Vice Chairman and Chief Executive Officer)
Mr Kang Meng Chow	Regional Chief Security & Privacy Advisor Asia Pacific Region Microsoft Corporation
Mr Lim Chin Hu	President & Chief Executive Officer Frontline Technologies Corporation Ltd
Mr Stephen Lim	Chairman Singapore infocomm Technology Federation Chief Executive Officer & Managing Director SQL View Pte Ltd
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Mr William Liu	President Green Dot Capital Pte Ltd
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Mr Andrew Sansom	Director DP Search Pte Ltd
Mr Richard Tan	Vice President International Carrier Services Singapore Telecommunications Ltd
Mr Wong Heng Chew	Managing Director, Singapore Sun Microsystems Pte Ltd
Mr Stephen Yeo	President EDS Southeast Asia

Executive Summary

Background

Infocomm has significantly transformed the global landscape over the last few decades, breaking down geographical and cultural barriers to information and markets, and forcing fundamental paradigm shifts in the way people think and operate. This digital revolution has seen an explosion of innovative business models made possible by infocomm, producing a new generation of economic forerunners, such as Google, eBay and Skype.

Looking ahead, the acceleration of infocomm technology advances will create even stronger competitive pressures on economies and companies, while generating immense growth opportunities for those who are able to differentiate themselves from the competition. Whether a country or company succeeds in this will be determined by its ability to develop, attract and retain talented manpower which is able to innovatively exploit infocomm.

Set against this global landscape, the Infocomm Competency Council's vision for Singapore is to have an **infocomm-savvy workforce and globally competitive infocomm manpower to drive national economic competitiveness.**

Target

This vision is tied to the target for the year 2015 to:

- Boost the number of infocomm jobs by 55,000 to about 170,000.

This is expected to generate another 25,000 non-infocomm jobs in the infocomm industry, to bring the number of such jobs to about 70,000.

In total, the number of new jobs created would be about 80,000.

Strategic Thrusts

To realise this vision and target, these strategic thrusts are recommended:

- **Develop Infocomm Competencies in Key Economic Sectors**

Infocomm is a key enabler for economic growth. In today's information age, its use is pervasive. To remain relevant and competitive, economies and companies will need to move beyond using infocomm for automation to harnessing it to generate new economic value.

So, business leaders need to make infocomm deployment a strategic priority for their organisations. Singapore's workforce also needs to have the capacity, resourcefulness and sophistication to integrate infocomm to deliver better results at work.

Indeed, in the infocomm-immersed world of tomorrow, infocomm skills will be as essential as reading, writing and arithmetic are today. It is crucial that Singapore's children, who will make up the manpower of the future, be exposed to these 21st century skills from an early age.

- **Develop Globally Competitive Infocomm Professionals**

While the large, emerging markets in China and India present exciting business opportunities for Singapore's infocomm industry, they also represent greater cost competition as they can offer large numbers of well qualified infocomm professionals.

To remain competitive, Singapore-based infocomm enterprises must move towards higher value-added infocomm activities. Currently, the majority of those in the infocomm workforce here are focused on marketing, sales and distribution. So there is a need to refocus manpower development efforts on providing solutions, research and development (R&D), and building up a pool of techno-strategists and technologists.

Techno-strategists are infocomm professionals who possess both technical and business expertise, and are able to integrate infocomm use within an organisation. This requires the ability to model and re-engineer business processes, and develop innovative infocomm applications that help businesses meet their goals. Singapore has the potential to develop internationally recognised techno-strategists in sectors where it is strong, such as Banking and Finance, Education, Healthcare and Public Administration.

Singapore also needs to develop a pool of technologists who are equipped with in-depth infocomm technical knowledge to engage in R&D. Developing this area is highly important, particularly when it applies to R&D areas identified at the national level, such as Interactive and Digital Media, Environmental and Water Technologies, as well as Biomedical Sciences, all of which are heavily reliant on infocomm technology. The infocomm industry also believes Infocomm Security and Communications Engineering should be added to this list of R&D focus areas.

Having a strong pool of techno-strategists and technologists will support the growth of the local industry, and will continue to be a key asset when it comes to attracting and anchoring infocomm MNCs here, all of which will boost the nation's status as a regional business hub.

- **Develop, Attract and Retain Infocomm Talent**

In a future where economic prosperity is linked to the ability to innovate, countries that can best develop, attract and retain manpower talent will have a distinct advantage. This is especially so for the infocomm industry, whose key resource is human capital.

Singapore, with its limited manpower resources, must establish itself as the city of choice for global infocomm talent, and ensure that it attracts the best and brightest from all over the world. It is also important to ensure a sustainable pipeline of talent for the future, which means that infocomm talent has to be groomed while these people are still young.

In time to come, Singapore should aim to nurture its own Larry Page and Sergey Brin, whose Internet search engine is making "googling" the norm; and Niklas Zennström and Janus Friis, who created the billion dollar Internet telephony company Skype.

Recommendations

Here is a summary of the recommendations supporting each of the strategic thrusts:

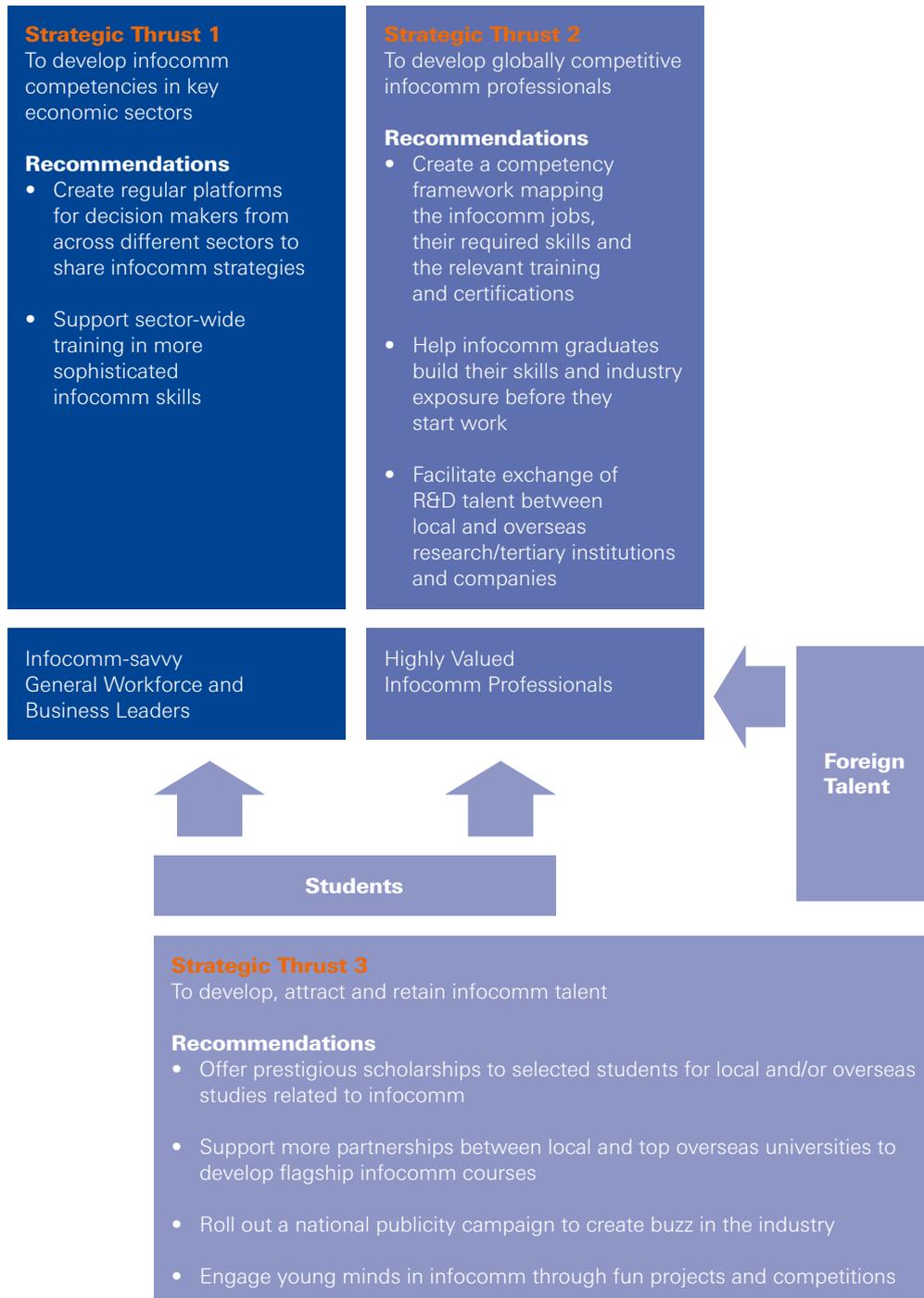


Figure 1: Summary of Strategic Thrusts and Recommendations
Source: IDA

CHAPTER 1

TRENDS AND IMPLICATIONS

Singapore's infocomm industry¹ has seen strong competition from the rising infocomm powerhouses, China and India, in the five years since the dotcom bubble burst in 2001.

Despite this, the amount of revenue the industry generated grew 42 per cent between 2001 and 2005, from S\$26 billion to about S\$38 billion. In the same period, the number of infocomm jobs also went up by 10 per cent, from 106,700 to 117,100 (see Figure 1-1).

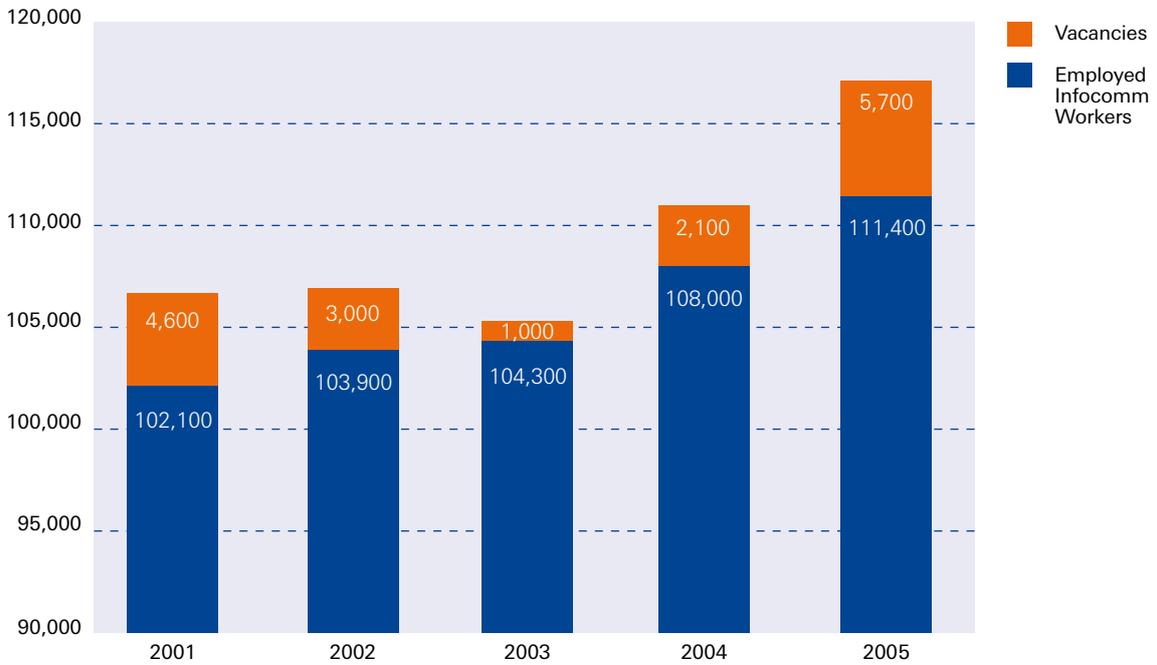


Figure 1-1: Total Infocomm Jobs
 Source: Annual Survey on Infocomm Manpower for 2005, IDA

¹ This is an activity-based definition. The main categories of activities included are: Wholesale of infocomm products such as telecommunication equipment; computer equipment, hardware and software; office equipment etc.; Retail sale of infocomm products; Telecommunication services; Computer and IT services; and Content services.

Whether the industry can sustain such increases will depend on its ability to respond to global trends and challenges. In developing the Infocomm Manpower Development Plan, the Council identified these global trends and implications (see Figure 1-2).

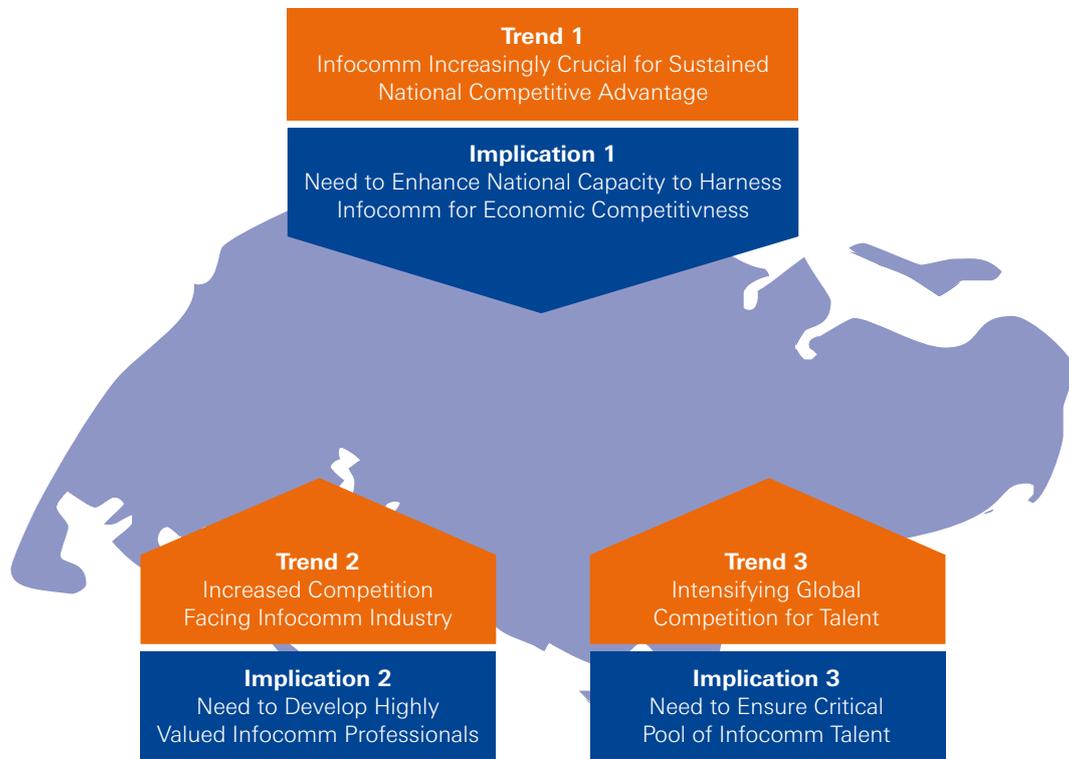


Figure 1-2: Trends and Implications facing iN2015 Infocomm Manpower Development
 Source: IDA

Trend 1 – Infocomm Increasingly Crucial for Sustained National Competitive Advantage

In the past, companies used infocomm to automate manual processes, often in a piecemeal fashion. As companies grew more complex, infocomm was used to better manage information, streamline resources and integrate business processes. Companies that were quicker to adopt infocomm were able to cut costs and raise productivity ahead of their competitors.

Today, using infocomm for cost and efficiency benefits has become fairly widespread. Now, companies need to take a more strategic perspective in using technology. This means effectively adopting infocomm-enabled innovation to meet business goals and create opportunities for growth. In a 2005 poll by management consulting firm A T Kearney, a

group of top North American business executives from different industries listed emerging technologies as the main factor that would impact on their competitiveness, ahead of industry consolidation and new entrants to the market.

With continual advancements in technology being steered towards meeting business goals, the twinning of infocomm and business success looks set to deepen. Already, there have been examples of this happening. In the voice communications market, Skype has emerged as a key player with its winning combination of bold marketing – offering free calls – and the roll out of Voice over Internet Protocol technology. EBay took buying and selling to the virtual realm when it made its mission of “connecting people” a reality by using online automation technology to enable person-to-person auctioning.

Implication 1 – Need to Enhance National Capacity to Harness Infocomm for Economic Competitiveness

Singapore has long recognised the importance of harnessing infocomm to gain strategic advantage. The Government is regarded as one of the world’s top thought-leaders in the use of infocomm technology, ranking high in international studies on infocomm competitiveness and readiness.

Successful Transformation of Sectors through Infocomm over the Years

“TradeNet is an interesting class of IT system that possesses two distinct components: first, it is an example of an interorganisational strategic application that forms the core of a successful redesign of the trade process, which solidifies the country’s position as a transshipment port for Southeast Asia; second, TradeNet also provides an information management and communication infrastructure that can be used to create additional strategic applications.”

Excerpt from “Singapore TradeNet: Beyond Tradenet to the Intelligent Island”, Harvard Business Review, 10 October 1995

“What began in 1984 as an effort to automate the port of Singapore to achieve productivity savings, by 2000 had evolved into a global e-business called Portnet.com.”

Excerpt from “PSA: The World’s Port of Call”, Harvard Business Review, 31 July 2001

“The Singapore Public Library system was transformed from being mediocre at best to world class using information technology, progressive human resources management, and marketing approaches unusual for government agencies.”

Excerpt from “Transforming Singapore’s Public Libraries”, Harvard Business Review, 18 October 2004

Global Rankings

- Fifth in World Economic Forum’s Global Competitiveness Index (2005)
- Top two in Asia, in EU e-Readiness Rankings 2001 – 2006²
- Top three in Accenture Annual e-Government Rankings from 2000 – 2005³

However, the increasingly strategic role of infocomm in businesses implies a need for Singapore to continue raising the people’s capacity and capability to effectively use infocomm. When people are empowered through infocomm to make task-specific improvements, their organisations benefit from continual innovations that contribute to greater market differentiation and long-term sustainability. This means that there is a need to upgrade the infocomm skills of the general workforce, right from the shop floor worker to the head of the company, and help them be attuned to constantly seek innovative ways to deliver better results using infocomm.

² Economic Intelligence Unit, 2006

³ Accenture e-Government Overall Maturity Scores

Trend 2 – Increased Competition Facing Infocomm Industry

Countries that offer lower cost infocomm services, such as China, India, the Philippines and Vietnam, are providing stiffer competition as well as market opportunities for the global industry.

On the one hand, the dominance of China and India is growing as more and more companies offshore their software development, call centre operations and other infocomm technology functions to these countries. In response, Australia, Hong Kong and the US have been moving to higher value-added activities in a bid to stay ahead of the competition. For instance, Australia is exporting its expertise in infocomm consulting, software development and managed services, while Hong Kong is placing its bets on research into wireless application and mobile terminal development.

At the same time, economic liberalisation, international connectivity and the mobility of talent

have created opportunities for countries to tap global markets and resources. India, for one, has a young, English-speaking population, and established infocomm companies capable of designing enterprise-level solutions for export. Across the border, China is drawing companies not just with its huge market opportunities but also with its low cost of labour.

Currently, the majority of Singapore’s infocomm activities are in marketing, distribution and support. As the industry matures, it needs to be rooted in higher value-added⁴ activities like providing solutions and R&D, areas which can better differentiate Singapore from its global competitors and strengthen the country’s position as a key node in the global network. Overseas capabilities in software development and hardware manufacturing would then become a valuable resource that Singapore can leverage on, while focusing its efforts on creating and commercialising intellectual property.

Implication 2 – Need to Develop Highly Valued Infocomm Professionals

Given this analysis, and in line with the recommendations of the iN2015 Enterprise Development Sub-Committee, the Infocomm Competency Council recommends that Singapore’s infocomm industry shifts its focus to higher value-added activities in intellectual property creation and exploitation (see Figure 1-3).

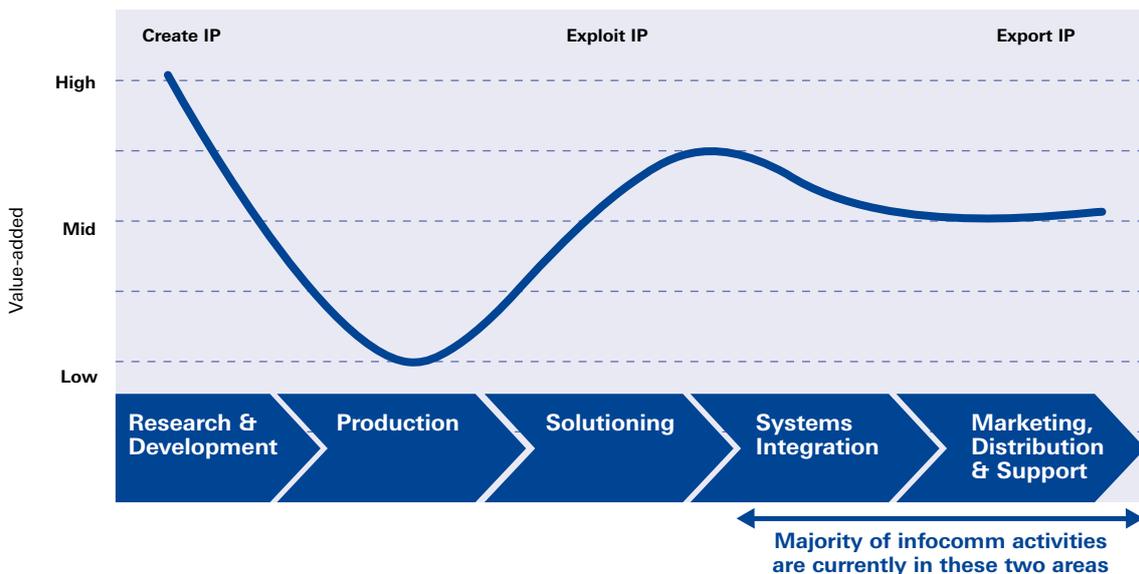


Figure 1-3: Value-added Across Infocomm Activities

Source: IDA

⁴ Also known as net output, value-added is the gross output less the intermediate inputs used in the course of production. It comprises compensation of employees, operating surplus, consumption of fixed capital and excess of indirect taxes over subsidies.

To support the shift in focus, there is a need to develop highly valued infocomm professionals, namely, the techno-strategists and technologists.

To be a techno-strategist requires the ability to combine technical know-how with domain experience to develop innovative solutions. These professionals will be critical in supporting the growth of the local infocomm industry, and in efforts to attract and anchor large MNCs in Singapore. Just as importantly, their ability to customise infocomm solutions to suit specific domain requirements will generate greater and more impactful benefits for the economy and businesses.

As technologists, infocomm professionals need to be equipped with deep technical expertise that allows them to engage in research that results in marketable applications. Singapore's National Research Foundation has decided that the focus in R&D should be on Interactive and Digital Media, Environmental and Water Technologies, and Biomedical Sciences. Infocomm Security and Communications Engineering are other important areas in which Singapore is

building capabilities. Infocomm researchers will be required to support the development of these areas, given their heavy dependence on technology.

In developing highly valued infocomm professionals, Singapore needs to raise its proportion of professionals who can provide solutions and who can carry out R&D. This means raising the education level, industry exposure and innovative capacity of professionals here.

Singapore is more than ready to make this transformation. Its infocomm workers are young but experienced, well-qualified, and have exposure to business domains and the global market. In 2005, more than 80 per cent were tertiary educated⁵ and more than 70 per cent were below 40 years of age⁶ (see Figure 1-4). About 50 per cent of infocomm professionals work in companies that are users of infocomm. A significant proportion work in wholesale and retail, and financial services, a reflection of the profession's contribution to Singapore's hub status in trade and finance (see Figure 1-5).

New Competencies Required

“Singapore must train a new breed of ICT specialists who can translate tech ideas into business solutions.”

Mr Nicholas Donofrio, Executive Vice-President, Innovation and Technology, IBM, in explaining the need for Singapore infocomm professionals to have both technical and business knowledge, during the meeting among members of Singapore's Infocomm International Advisory Panel held on 13 March 2006.

National Push Towards R&D

“Innovation, enterprise and R&D, these are the ways to remake the economy.”

Mr Lee Hsien Loong, Prime Minister and Finance Minister of Singapore, explaining Singapore's focus on R&D in the coming years, in his speech for National Day Rally 2005.

⁵ Tertiary educated persons include diploma and degree holders.

⁶ In comparison, about 30 per cent of the employed labour force in Singapore is tertiary educated, and about 50 per cent is below 40 years of age.

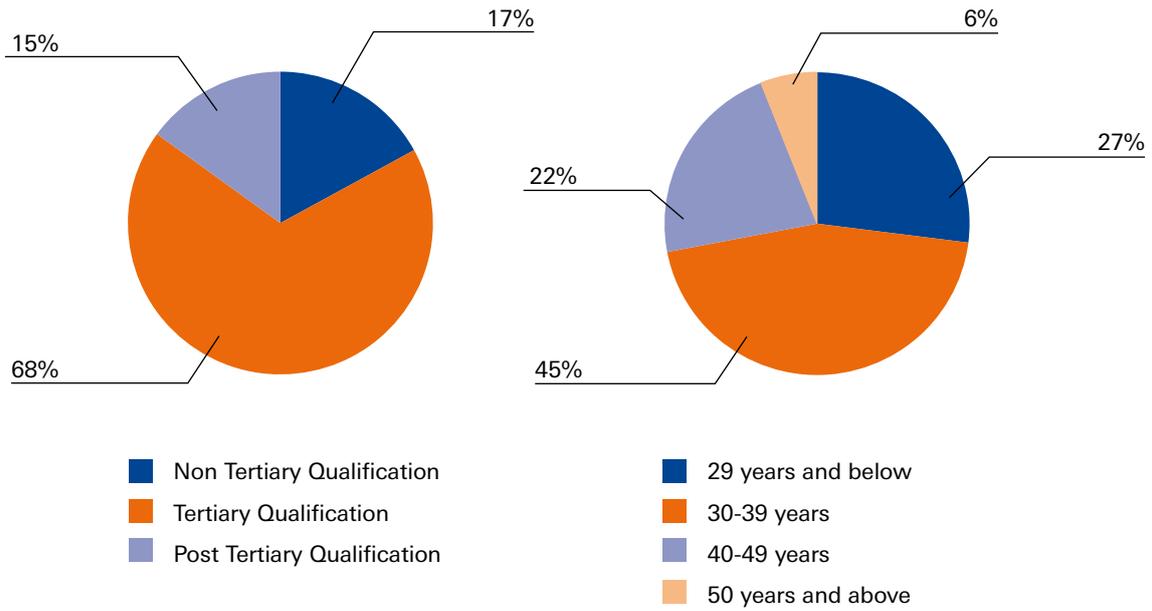


Figure 1-4: Education and Age Profile of Infocomm Manpower (2005)
 Source: Annual Survey on Infocomm Manpower for 2005, IDA

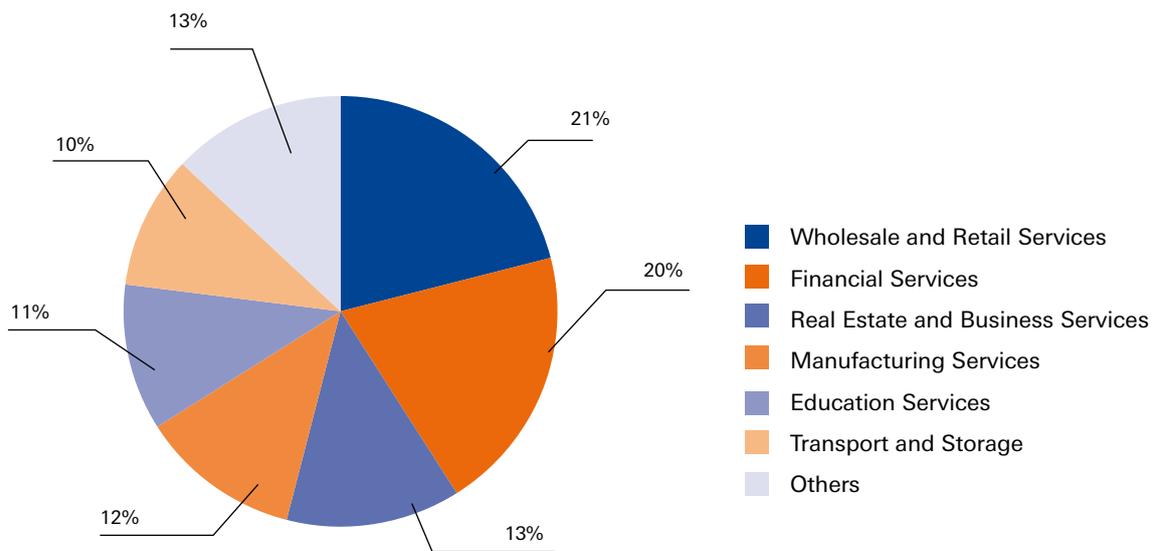


Figure 1-5: Distribution of Infocomm Manpower in End-user Organisations (2005)
 Source: Annual Survey on Infocomm Manpower for 2005, IDA

Trend 3 – Intensifying Global Competition for Talent

The world is moving into the “Talent Age”, where countries that can best attract and retain highly skilled, creative people will have a distinct advantage in the global economy. Innovation and economic growth flourish where there is a concentration of such talent.

This phenomenon of having the best is becoming particularly pertinent to the infocomm industry, where global companies scour the world for the people they need. Even China, despite its large population, is courting foreign high-tech and management professionals in a bid to boost its software industry.

Implication 3 – Need to Ensure Critical Pool of Infocomm Talent

Set against such a backdrop, one implication for Singapore, with its limited manpower resources, is that it must establish itself as the city of choice for global talent. Singapore will therefore need to aggressively attract the best and brightest from all over the world.

A longer-term implication is that the Republic must start ensuring a sustainable pipeline of indigenous talent for the future. While the nation welcomes foreign talent, given the global competition for such highly mobile individuals, it is crucial that Singapore spares no effort to groom and retain local talent as well, starting from young.

This is all the more important in view of the apparent misconception that an infocomm career is “technical” or “unglamorous.” In reality, there are a myriad high value-added infocomm jobs that offer the challenge of having to design infocomm solutions to meet business targets. Efforts should therefore be made to correct the misperception and attract students to an infocomm career.

CHAPTER 2

VISION, TARGET AND STRATEGIC THRUSTS

The trends and implications outlined in the previous chapter underpin the vision, target and strategic thrusts for the iN2015 Infocomm Manpower Development Plan.

iN2015 Infocomm Manpower Vision

The Council's vision for Singapore in 2015 is to have an infocomm-savvy workforce and globally competitive infocomm manpower to drive national economic competitiveness.

Imagine...

Singapore-based companies, through the strategic use of infocomm, making waves on the global stage. They are able to create business opportunities and reach out to new overseas markets, and in turn generate wealth and employment for Singapore.

The nation's manpower is highly valued by global companies not only for its ability to leverage on infocomm to raise productivity and effectiveness, but more importantly, for its capacity to harness infocomm innovatively to generate business value and differentiate the companies from those of competitors. This ability to innovate stems partly from the workers' exposure to infocomm from a young age.

Singapore's infocomm manpower is globally recognised for its ability to develop creative solutions for businesses, through the integration of technology within the business environment, particularly in the areas of Banking and Finance, Education, Healthcare and Public Administration.

The nation's infocomm scientists are gaining international prominence for their breakthroughs in areas such as Interactive and Digital Media, Infocomm Security and Communications Engineering. Tapping the intellectual properties created, local infocomm entrepreneurs are creating a number of high-profile infocomm MNCs active in the world market.

The availability of a large pool of infocomm talent in Singapore, both local and foreign, is cited by infocomm MNCs and renowned research institutes as the main reason they have based their operations here.

Target

The iN2015 Infocomm Manpower Development Plan has been drawn up to achieve this target by 2015:

- Boost the number of infocomm jobs by 55,000 to about 170,000.

This is expected to generate another 25,000 non-infocomm jobs in the infocomm industry, to bring the number of such jobs to about 70,000.

In total, the number of new jobs created would be about 80,000.

Strategic Thrusts

To achieve the vision and target, the Council recommends these three strategic thrusts:

- Develop infocomm competencies in key economic sectors;
- Develop globally competitive infocomm professionals; and
- Develop, attract and retain infocomm talent.

Strategic Thrust 1:

Develop Infocomm Competencies in Key Economic Sectors

The pervasive use of infocomm in economies and companies has become a given today. This strategic thrust aims to build the national capacity to innovatively harness infocomm by empowering people to create business value and competitive advantage through infocomm.

Strategy 1.1: Develop a Technology Receptive Mindset among Decision Makers

For infocomm to be used strategically in organisations, there must be strong support from the top management. This happens when top level managers see significant economic value in using infocomm to enable their business operations. Attention should therefore be given to develop a technology receptive mindset in business leaders that allows them to appreciate how infocomm can help differentiate their offerings, and push their companies ahead of competitors.

Among the top level managers, Chief Information Officers (CIOs) are regarded as their organisations' experts in technology. For them, the challenge is in convincing the rest of management of the benefits of investing in infocomm systems and solutions. To achieve this, CIOs will need to comprehend the business aspects of their organisation and then clearly articulate how adopting certain infocomm solutions would help enhance these.

Strategy 1.2: Equip the General Workforce with More Sophisticated Infocomm Skills

It is not only organisations' decision makers that require sophisticated infocomm competencies. To remain globally competitive, the Council recommends that Singapore's workforce be equipped with more sophisticated infocomm skills that enable it to add value to its daily work.

At the minimum, the country's general workforce needs to be able to effectively use job-specific infocomm applications to enhance productivity. For example, some waiters at restaurants in Singapore are taking orders on PDAs and using these gadgets to transmit the orders directly to the kitchen. This significantly reduces staff overheads as well as the number of erroneous orders. Having a "technology nimble" workforce which is able to adopt new technologies to do things quickly and more effectively will be an advantage in today's fast-changing environment.



Strategic Thrust 2:

Develop Globally Competitive Infocomm Professionals

Although the emergence of countries that can offer infocomm services at a lower cost has resulted in stiffer competition for Singapore's infocomm industry, it has also created opportunities for locally-based infocomm enterprises to tap the strengths of China in hardware manufacturing and India in software development. This will complement Singapore's efforts in higher value-added infocomm activities. To support the industry's shift in focus, the Council recommends Singapore beef up the number of infocomm professionals engaged in providing solutions and in R&D.

Strategy 2.1: Develop Techno-strategists

Singapore needs to develop a pool of techno-strategists. These are infocomm professionals who possess both technical and business expertise, and are able to successfully integrate infocomm into business operations.

This requires the ability to model and re-engineer business processes, and develop innovative infocomm applications to enhance business competitiveness. Such abilities are especially important in sectors where Singapore is recognised

as a pioneer in successfully deploying integrated end-to-end solutions, such as in Banking and Finance, Education, Healthcare and Public Administration. Techno-strategists will have to capitalise on such strengths to define and implement innovative solutions that are trusted, replicable and exportable in these sectors.

Strategy 2.2: Develop Technologists

The nation must also develop a relatively small but critical pool of infocomm researchers and scientists, whose knowledge of technology is deep enough to allow them to create intellectual property. R&D people here should be exposed to overseas research environments where there is a strong culture of innovation. Interaction and cross-pollination of ideas between local and foreign talent will also create opportunities for the development and commercialisation of intellectual property.

Developing R&D requires long-term commitment, and in the face of global competition, iN2015's efforts to do so should be in concert with the national focus to ensure the best use of the nation's resources and the best chance of success.



Strategic Thrust 3:

Develop, Attract and Retain Infocomm Talent

With the development of global competition for talent, Singapore must both aggressively attract the best and brightest people in the world here to shore up its pool of infocomm manpower, as well as ensure a sustainable pipeline of talent for the future.

Strategy 3.1: Attract Bright Local and Foreign Students to an Infocomm Career

Singapore must attract young people both here and from abroad to study and work on infocomm related areas in the country. The buzz generated by a dynamic, diversified pool of such people can, in turn, draw more talent to join their community.

Strategy 3.2: Bring Out the Initiative in the Young to use Infocomm Innovations Whenever they can

The nation should complement the targeted approach with a broad-based one. While some students will eventually become infocomm professionals, the majority will not. Nonetheless, all of them will certainly find infocomm tools and applications embedded in many aspects of their work and personal lives. Hence, to better prepare youngsters for a dynamic and digital future, they should be exposed to creative uses of infocomm from young, to the point where they are excited about experimenting with various ways of using infocomm to make their lives more fulfilling.



CHAPTER 3
RECOMMENDATIONS
ON GETTING THERE

Building on the vision and strategic thrusts, the Council has proposed specific initiatives to support the strategies.

Strategic Thrust 1:

Develop Infocomm Competencies in Key Economic Sectors

Strategy 1.1: Develop a Technology Receptive Mindset among Decision Makers

The objective here is to strengthen the belief of business leaders in the strategic value of infocomm to their organisations.

Recommendation 1

CXO programme – There should be opportunities for decision makers at the “C-level” – CEOs, CIOs, CFOs – in user organisations to network and share views on how infocomm can be used as a differentiating factor in a changing business environment. Overseas business experts and technology gurus could be engaged to take part in roundtables and networking sessions.

Further help could also be extended to those who lack experience in finding the right infocomm solutions for their businesses, for instance, through organising consultancy clinics with suitable technology vendors and industry organisations. They could also be linked with infocomm suppliers by tapping the platforms being set up under the iN2015 Enterprise Development Plan to build the capabilities of Singapore-based infocomm enterprises.

From a longer-term perspective, the tuning of “technology receptive” mindsets should start with the young.



Strategy 1.2: Equip the General Workforce with More Sophisticated Infocomm Skills

The objective is to raise the level of infocomm skills among the general workforce so they too can innovatively harness infocomm to improve business productivity and competitiveness.

Recommendation 2

Infocomm competency development initiative – Efforts should be made to develop the necessary competencies for key sectors and occupations for maximum national impact. This plan should provide training and certification opportunities for non-infocomm workers to attain more sophisticated infocomm skills. This will allow them to optimise their performance, and more importantly, to innovate using infocomm to reduce costs and create more value for their organisations.

Domain Specific Example 1: Accountancy Services Sector

With more sophisticated infocomm tools, finance departments can improve the accuracy of their companies' annual budgets, and their timelines in completing them. The tools would also help them in planning their finances and preparing management reports.

The time saved in such tasks would free them to focus on more critical tasks such as fraud management and risk assessment, hence strengthening support for corporate governance.

Each level of the accounting profession, for example, accountants, assistant accountants and account clerks, should therefore be trained in the use of advanced financial modelling tools, with the training customised to the needs of each level. A structured, sector-wide training programme will also help streamline workflow, cutting down unnecessary duplication, resulting in faster generation of accurate financial reports.

Strategic Thrust 2:

Develop Globally Competitive Infocomm Professionals

Strategy 2.1: Develop Techno-strategists

The objective is to build a pool of infocomm professionals who have a breadth of technology know-how and a good understanding of business. The need for such competencies is further underlined by the inputs of other iN2015 Sector Sub-Committees, who identified a preliminary set of essential domain-related competencies required of infocomm professionals. Figure 3-1 provides some examples.

	Financial Services	Healthcare	Education
Domain Related Infocomm Competencies	<p>Technical knowledge in:</p> <ul style="list-style-type: none"> • Infocomm Security • Disaster Recovery • Java • Enterprise Resource Planning (ERP) • Systems, Applications and Products in Data Processing • Automation, e.g. over-the-counter trading • Online and Mobile Micro-payment Infrastructure • Identity Management <p>Domain knowledge in: Wealth management and risk management, two areas identified to be Singapore's differentiating strengths in the global financial market.</p>	<p>Technical knowledge in:</p> <ul style="list-style-type: none"> • Enterprise Architecture • Service Management • Processes <p>Domain knowledge in:</p> <ul style="list-style-type: none"> • Clinical, Laboratory and Hospital Administration • Electronic Medical Records <p>Business knowledge in contract management to manage outsourcing contracts.</p>	<p>Technical knowledge in:</p> <ul style="list-style-type: none"> • Digital Media • Interactive Software Development <p>Domain knowledge in:</p> <ul style="list-style-type: none"> • Learning and teaching pedagogy to design learning and instructional software • Knowledge of foreign education environment to localise education content <p>Business skills in consultancy service to sell the Singapore model of infocomm in education.</p>
	<p>Solutioning Activity</p> <ul style="list-style-type: none"> • Finance IT analyst • Business continuity consultant 	<p>Solutioning Activity</p> <ul style="list-style-type: none"> • Bioinformatics consultant <p>R&D Activity</p> <ul style="list-style-type: none"> • Bioinformatics researcher 	<p>Solutioning Activity</p> <ul style="list-style-type: none"> • Educational instructional designer <p>R&D Activity</p> <ul style="list-style-type: none"> • Education technologist

Figure 3-1: Examples of Domain-related Infocomm Competencies

Source: IDA

Recommendation 3

National infocomm competency framework – The skills required of workers in the various domains should be clearly set out at the national level, and training incentives should be provided to encourage infocomm professionals to acquire such competencies. More specifically, a national infocomm competency framework for all infocomm occupations, and the corresponding training and certifications, should be drawn up. Such a framework should be complemented with a process to monitor emerging trends, so that it can be refreshed frequently to ensure its continued relevance.

Individuals can use this framework to assess their level of competency, and map out their training and career path. Employers can use it to better articulate their job requirements and understand the competency and skill gap of their workers. Furthermore, to encourage companies and individuals to make use of the framework, the IDA can provide incentives for them to take up the training courses suggested through its existing Critical Infocomm Technology Resource Programme (CITREP), which defrays a proportion of the course fees.

Domain Specific Example 2: Education and Learning Sector

The capacity of educators in using infocomm effectively for teaching and learning is critical to the successful use of infocomm to transform the learning environment. There is thus a need to train instructional designers in how to develop education technology products and resources that are based on sound pedagogical practices.

Currently, instructional designers hired by infocomm enterprises are either infocomm professionals with little or no experience in teaching, or educators who have picked up these skills in the course of their work. This is an ad-hoc and sometimes ineffective approach.

The competencies should be clearly spelt out in the competency framework so that infocomm professionals and potential educators interested in this area know what skills they require and where to get training for them. The Government can also look at putting together courses (e.g. through CITREP) to provide such competencies.

Recommendation 4

Work-study opportunities – Very often, companies require industry experience and more advanced infocomm skills for higher value jobs, which fresh infocomm graduates will not have. Thus, besides equipping new graduates with the relevant technical skills, there is a need to help them get some experience under their belt before they enter the workforce.

One way would be for youngsters to use the competency framework to identify the certifications they can obtain while studying. They should also have the opportunity to gain business exposure and learn on the job through work-study programmes with corporate sponsors.

Strategy 2.2: Develop Technologists

Here, the plan is to develop technologists capable of creating intellectual property.

Recommendation 5

Talent exchanges and partnerships – The sharing of talent and ideas between local and overseas infocomm enterprises, research institutes and tertiary institutions should be strongly supported. In particular, foreign talent should be persuaded to study, work and live in Singapore, to help foster a culture of innovation and entrepreneurship.

Such efforts would be in line with A*STAR's Science & Technology 2010 plan, as well as the iN2015 Enterprise Development Plan which proposes a technology capability development programme to foster closer collaboration between the infocomm industry and the academic research community.

Strategic Thrust 3:

Develop, Attract and Retain Infocomm Talent

Strategy 3.1: Attract Bright Local and Foreign Students to an Infocomm Career

The objective is to ensure that Singapore's infocomm manpower attracts a fair share of talent to drive the growth of the industry.

Recommendation 6

Scholarships – Top students, whether local or foreign, can be drawn to pursue infocomm as a field of study by offering them scholarships. The IDA's extension of its National Infocomm Scholarship to support overseas studies and foreign students who have the intention to stay and pursue an infocomm career, are steps in the right direction.

Domain Specific Example 3: Healthcare Services Sector

The healthcare sector, in particular, requires health informatics specialists to plan how medical data can be collected and structured for use by medical researchers.

To address the need for such expertise in the local market, overseas scholarships in healthcare informatics could be awarded to outstanding individuals. When they complete their studies, they would be attached to local healthcare clusters.

Recommendation 7

Flagship infocomm courses – In addition, agencies like the IDA can facilitate the launch of more flagship infocomm courses offered jointly by local and top overseas universities, and set up "fast-track" bachelors and masters programmes that attract more students to pursue post-graduate degrees. A*STAR's National Science Scholarships and A*STAR Graduate Scholarships, for instance, aim to draw top academic talent into R&D, including technical research. Efforts should also be made to encourage the formation of hybrid infocomm courses, which combine technology and business to develop more infocomm professionals who can come up with solutions.

The IDA should also work with the local universities to make their infocomm schools among the best in the region. Based on the universities' high overall international rankings today, having the "best in

class" schools should be well within their reach. "Best in class" means that their students can graduate with much of the solutioning and R&D skills necessary to quickly move to higher value-added activities. In the longer-term perspective, having well-established schools will serve to attract more local and foreign talent to infocomm.

International Ranking of Singapore's Universities

Top Universities in Technology

National University of Singapore (9th ranking)
Nanyang Technological University (26th ranking)

Source: *The Times Higher Education Supplement, 2005*

Strategy 3.2: Bring out the Initiative in the Young to use Infocomm Innovations Whenever they can

The objective is to ensure that young people, who will become the leaders and workforce of the future, are motivated to make technology innovation a part of their everyday life.

Recommendation 8

National campaign – To raise interest in infocomm among the young, the first step is to launch a national campaign that creates a buzz to capture greater mindshare of students and the public. The campaign can include competitions to generate excitement

and recognise students skilled in infocomm, as well as dialogue sessions to inspire students, where the speakers – who are infocomm leaders – talk about their trials and success.

Recommendation 9

Infocomm co-curricular activities – Learning about infocomm can be made more engaging through co-curricular activities offered in schools. Students can acquire infocomm competencies that will serve as a life skill by being involved in interesting projects and competitions. Regardless of what career they embark on, these skills will be essential to them at work and at play.

Strategic Thrust 1 Develop infocomm competencies in key economic sectors	Strategic Thrust 2 Develop globally competitive infocomm professionals	Strategic Thrust 3 Develop, attract and retain infocomm talent
<ul style="list-style-type: none"> • Develop a technology receptive mindset among decision makers • Equip the general workforce with more sophisticated infocomm skills 	<ul style="list-style-type: none"> • Develop techno-strategists • Develop technologists 	<ul style="list-style-type: none"> • Attract bright local and foreign students to an infocomm career • Bring out the initiative in the young to use infocomm innovations whenever they can
<p>Recommendations</p> <ul style="list-style-type: none"> • Create regular platforms for decision makers from across different sectors to share infocomm strategies • Support sector-wide training in more sophisticated infocomm skills 	<p>Recommendations</p> <ul style="list-style-type: none"> • Create a competency framework mapping the infocomm jobs, their required skills and the relevant training and certifications • Help infocomm graduates build their skills and industry exposure before they start work • Facilitate exchange of R&D talent between local and overseas research/tertiary institutions and companies 	<p>Recommendations</p> <ul style="list-style-type: none"> • Offer prestigious scholarships to selected students for local and/or overseas studies related to infocomm • Support more partnerships between local and top overseas universities to develop flagship infocomm courses • Roll out a national publicity campaign to create buzz in the industry • Engage young minds in infocomm through fun projects and competitions

Figure 3-2: Summary of iN2015 Infocomm Manpower Development Strategic Thrusts and Recommendations
Source: IDA

CHAPTER 4

CONCLUSION

Powerful global economic changes enabled and accelerated by infocomm are underway. In this dynamic and increasingly digital world, those that can effectively leverage on infocomm to sharpen their competitive edge will stay ahead in the global race.

For Singapore to stay relevant in this context, locally-based companies must effectively harness infocomm to enhance productivity, enter new markets, establish new business models and enlist global talent. Against increasing low-cost competition from the region, the country's infocomm industry must diversify to higher value-added activities that involve the creation and commercialisation of infocomm intellectual property.

To achieve all this, Singapore must build its national capacity to strategically and effectively use infocomm to meet business goals. This should involve providing Singapore's people with the opportunity to gain access to infocomm tools and acquire more sophisticated infocomm skills. Among the infocomm professionals, the focus must be on developing infocomm solution architects, researchers and scientists, whose mix of technical and domain expertise will be a major drawing point for international companies to locate in Singapore, strengthening the nation's status as a regional infocomm hub.

Singapore must also cast its attention further upstream to invest in the leaders and workforce of tomorrow, to develop infocomm appreciation and encourage innovation from young. As the global competition for talent increases, no effort should be spared in trying to attract and retain talent, both locally and from overseas, to ensure a continued pipeline of infocomm talent to the industry.

In short, manpower must be made the crucial differentiator for Singapore as the nation strives to keep ahead of global and regional competition.

However, these efforts will not be successful without the support of the industry, government agencies, tertiary institutions, schools and the community. The Council welcomes feedback from the people and the industry on its recommendations and encourages all to participate in the iN2015 infocomm manpower initiatives when they are launched over the next few months.

CHAPTER 5

EPILOGUE

As the iN2015 Infocomm Competency Council deliberated on various recommendations, there was an urgency to quickly pursue the recommendations aimed at raising interest in infocomm among young people, and attracting some of them to infocomm careers, in order to coincide with the academic year. Hence, the IDA has proceeded to implement several student-related programmes ahead of the iN2015 announcement.

Student Infocomm Outreach Programme

This programme aims to develop students' interest in infocomm through:

Infocomm Clubs in schools, where students can learn infocomm skills in a fun manner. Students will be mentored by industry players, and participate in school-wide enrichment programmes and community project work, to spur their creativity and entrepreneurial spirit.

The Singapore Science Centre exhibition on infocomm, where visitors will be able to journey through the history of infocomm technology, be inspired by iconic figures in the industry, appreciate the use of infocomm technology in their lives and at work, and peek into the future of what technology can offer.

Infocomm Connect, where industry speakers share their experience. They can provide students with a glimpse of the excitement and prospects of a career in infocomm, and hopefully motivate them to take up infocomm as a course of study and as a career.

National Infocomm Scholarship

Expansion in scope of scholarship. Since 2006, this scholarship has been extended to foreign students and to include overseas studies and hybrid courses offered jointly by local and top overseas universities. The scholarship is offered by the IDA in collaboration with leading companies. Scholarship holders will also be mentored by their industry sponsors, and have the chance to do overseas attachments during their studies.

Flagship Infocomm Courses

Launch of a fast-track masters programme. In March 2006, a special fast-track programme was jointly launched by the Singapore Management University and Carnegie Mellon University, one of the world's top universities in infocomm education. This programme allows students to obtain their bachelors degree from the Singapore Management University and their masters degree from Carnegie Mellon, in four years of full-time study, instead of the usual five.

Annex A: Acknowledgements

The Infocomm Competency Council set up two Working Groups to look into the details of building the National Infocomm Competency Framework and to examine long-term manpower issues.

iN2015 Infocomm Competency Council Working Group

Since mid-2005, members of the Infocomm Competency Council Working Group have met fortnightly to build the Framework. They participated in many focus group discussions to define and validate the content in the Framework for various infocomm occupations, to align it with market needs.

The Group also formulated the adoption plan for the Framework, to promote its use by companies and infocomm professionals. Their contributions have been especially critical in ensuring the industry accepts the Framework.

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iN2015 Infocomm Competency Council Education Working Group

Within three months, the Infocomm Education Working Group held four meetings and five focus group discussions with employers, parents, students, teachers and principals from primary and secondary schools, junior colleges, institutes of technical education, polytechnics and local universities.

The Group examined the impact that the negative perception of infocomm has had on the quality of infocomm students and recommended comprehensive measures to attract more young people to the industry.

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Infocomm Development Authority of Singapore

IDA is committed to growing Singapore into a dynamic global Infocomm hub. IDA uses an integrated approach to developing info-communications in Singapore. This involves nurturing a competitive telecoms market as well as a conducive business environment with programmes and schemes for both local and international companies.

For more information, visit www.ida.gov.sg

Singapore Computer Society

SCS, established since 1967, is the premier professional body for IT practitioners and IT users in Singapore. With a membership of over 22,000, it is an invaluable network for its members. SCS administers various certification programmes that help individuals gain professional recognition for career development.

For more information, please visit their website at www.scs.org.sg

Singapore infocomm Technology Federation

SiTF is Singapore's national infocomm industry association. It brings together 500 corporate members from MNCs and local companies, who collectively account for over 80% of the industry revenue. The SiTF assists its members in business development, market intelligence, overseas trade missions, networking and alliances.

For more information, please visit their website www.sitf.org.sg

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