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Benchmarking Malaysia in the Global Information Society: Regressing or Progressing?

by

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Abstract

The purpose of this paper is to elucidate how the Dalenius-Hodges stratification methodology typically used in sampling, when combined with ranking and index standardization procedures, becomes a powerful policy tool for classifying and benchmarking global information society (GIS) phenomena. The Dalenius-Hodges methodology is preferable to other popular benchmarking methodologies; it has an objective criterion in demarcating strata boundaries and a standardized procedure of compiling indexes irrespective of the nature of the variables and is conceptually simple and easy to compute. For studying GIS phenomena, the paper proposes a socio-technology model, focusing on nine basic variables apportioned under information communications technology (ICT) access, diffusion, usage, and skills. The model uses raw data extracted from 154 International Telecommunication Union (ITU) member countries for 2002 and 2007. For each variable, the countries are ranked and classified under the proposed 8-S Framework, with the most advanced group termed Skaters and the least developed group Sleepers; the other categories are Striders, Sprinters, Sliders, Strollers, Shufflers, and Starters, as determined by the index values, which theoretically range from a minimum score of zero to a maximum of 100. In an attempt to understand the performance of various nations in the GIS ladder, Malaysia's performance received special attention. After enjoying spectacular growth for more than two decades during the preceding agro-industrial era, Malaysia has been losing its economic advantage to a number of newly liberated economies, in particular, in attracting foreign direct investment (FDI). Malaysia was one of the early adopters of Internet technology among developing nations and pioneered the promulgation of a knowledge-based economy to overcome its loss of investment advantage to a number of low-wage countries in Asia. This has become a major policy concern for Malaysia's economic performance especially in the wake of new investment factors and criteria related to the information age.

Keywords:Benchmarking Nations Global Information Society, Socio-Technology Model, Dalenius-Hodges Methodology, Goal-Post Methodology

Introduction

This paper expounds the use of the classical approach of Dalenius and Hodges' (1959) method of stratification in classifying nations into groups or clusters according to their level of development. Dalenius and Hodges used the cumulative frequency root method in sampling work to minimize variations within a cluster before demarcating the threshold limits for creating strata required for undertaking an improved sample selection procedure (Cochran, 1977). This technique implicitly reduces variation within a data set, thus increasing its stratification and estimation efficiency. Moreover, the square-root transformation technique also provides continuity in the data series, that is, an essential criterion for objectivity in identifying the requisite demarcation points for each stratum or group.

In recent years, the concept of stratification, apart from its intensive use in sampling exercises, has also gained favor in other fields of study where the stratification techniques have been viewed in different forms. For instance, the geometric stratification technique was used in studying accounting data, but this technique is applicable to a skewed population (Gunning & Horgan, 2004). Since this paper focuses on classifying global nations constituting highly developed to least developed categories in both extremes, the classical approach of the Dalenius-Hodges methodology of stratification is more appropriate than the geometric stratification technique. Combined with ranking and index standardization procedures, the Dalenius and Hodges stratification methodology has served as a useful policy tool in classifying and benchmarking global nations.

The paper also addresses a number of concepts and methodologies popularly known globally for measuring development phenomena, in particular, information society development. These concepts include the Human Development Index (HDI) of the United Nations (Anand & Sen, 1993; United Nations Development Programme [UNDP], 1990); the Digital Divide Index (DDI) of the Orbicom Network of UNESCO Chairs in Communication (Sciadas, 2002); the Millennium Development Goal (MDG) Index (UNDP, 2004); the Digital Access Index (DAI) of the International Telecommunication Union (ITU; Minges, 2003) and the Network Readiness Index (NRI) of the World Economic Forum (Dutta, Lanvin, & Paua, 2003). A close examination revealed that these methodologies have their own definitions and concepts, scope and coverage, as well as target users. Moreover, the strategic interest and focus of the organizations that are responsible for compiling these indexes vary greatly. Sometimes, these indexes as policy tools and instruments pose great difficulties to make international comparisons meaningful, especially to understand the basic elements and features characterizing the emerging information society at a global level. The intention of this paper is not to expound in great detail the merits and demerits of the nuances involved in the compilation of the various indexes mentioned above, but to highlight some pertinent aspects of the well-known index measures to provide the requisite understanding of why the Dalenius and Hodges method is preferred over the other methodologies.

The HDI employs only three core development variables, namely, Gross Domestic Product (GDP) to indicate economic development, literacy for social development, and longevity for demographic development, despite covering most member countries of the United Nations. As such, the HDI is solely dedicated to measuring the agro-industrial development aspects rather than information age development phenomena. The DDI of Orbicom has its own comprehensive conceptual and measurement framework, as well as competent methodology, but conceptually it focuses mainly on measuring and accentuating digital divide phenomena. Similarly, the purpose of the MDG Index, a regional UNDP effort in Asia, is to measure, monitor, and evaluate the cross-fertilization effects of ICT and MDG variables pertaining to hunger and poverty, primary education, gender equality and empowerment, child mortality, maternal health, HIV/AIDS, environment sustainability, and global partnership for development (UNDP, 2004). The NRI, like the DDI compilation, is based on a comprehensive conceptual framework constituting a wide range of variables solicited from various secondary and primary means, but again it focuses on level of network readiness, which is one of the concerns among many fundamental issues the paper investigates regarding information society phenomena (Ramachandran, 2008). In the same vein, the DAI of the ITU compiles the indexes using the goalpost method, where a variable is compared against the best performing country but lacks the classification effort analogous to HDI or DDI (ITU, 2009). Some of the methodologies used in compiling these development indexes are also subject to biases. For instance, in the range equalization method (REM), used in the MDG Index, compilation introduces inherent bias when a variable value is measured against the average of a data set that contains the variable itself (Ramachandran, 2008). As such, the REM will also be highly skewed when extreme variables, denoted by a nation's highly developed or least developed status, are present in the data set. In the HDI compilation, the minimum value is arbitrarily set and thus makes the computational procedure less efficient. The DDI methodology of Orbicom employs two types of artificial benchmark, termed *hypothetica*, referring to an economy with values equal to the average of all economies covered in the empirical application, and *planetia*, which represents the planet at large, as if it were one economy (Sciadas, 2002). These imaginary benchmarks were compared against the performance of other nations in the uptake of new technology in an attempt to reduce digital divides. In the case of NRI, the methodology only ranks nations at variable levels but lacks a specific computational procedure for grouping nations, similar to DAI, DDI, or HDI. In its introductory stages in 2003, the DAI compilation was akin to technology, particularly focused, on ICT as the enabler of the economy. Moreover, in its goalpost methodology, because the best performing nation that is regarded as the benchmark can change over time, it did not serve well for comparisons over space and time. Upon recognizing the methodological concerns and contemporary ICT not only as an enabler of development if properly harnessed or used, but also as a crucial ingredient for the formation of knowledge societies, the ITU expanded the study scope and repositioned DAI as the ICT Development Index (IDI) in 2009 (ITU, 2009). Though the IDI methodology groups nations into high, upper, medium, and low, the grouping lacks an objective criterion. Besides that, the IDI methodology employs the normalization method, that is, measuring a given variable to a reference value of 100, for standardizing its data. However, in this procedure, an exception was applied to four variables, namely, main fixed telephone lines, cellular mobile phones, international Internet bandwidth, and broadband, thus making the methodology less efficient in ensuring uniform treatment of variables. Nonetheless, the intention of this paper is not to expound the merits and demerits of the foregoing methodologies in greater detail. Because of the various shortfalls in terms of data treatment and computational complexities, the best option in terms of the purpose of this paper is the Dalenius-Hodges methodology in orde to benchmark nations in the global information society (GIS) ladder. As is widely acknowledged, the information society is typically characterized by online connectivity and real-time interactive phenomena (Ramachandran, 2003) or popularly understood by laypersons as “anyone, anytime, anywhere” (Pepper, Rueda-Sabater, Boeggeman, & Garrity, 2009) means and modes driven by contemporary information communications technology (ICT).

Malaysia as a Case Study

It is approaching two decades since Malaysia introduced borderless connectivity, interactivity, and networking for communication and information sharing, through the provision of Jaring services that started in 1992. Unequivocally, this commercial introduction marked the distinct beginning of the emergence of an explicit information society in the country, in conjunction with other countries that embraced Internet technology (Ramachandran & Asha, 2003). Thereafter, a number of public and private sector initiatives were put in place to move the nation towards becoming an information society. Among others, some of the most important steps that the Government of Malaysia has taken included the liberalization of the telecommunication sector in 1994 for the provision of seamless communication (Anbalagan, 2004; Economic Planning Unit [EPU], 1996); the introduction of an Internet Service Provider (ISP) for anytime and anywhere connectivity; and the enactment of the Education Act of 1995 towards fostering private sector education (EPU, 1996).

In parallel, the government also reviewed and realigned a number of policy-relevant institutions apt for information age developments such as the initiation of the National Information Technology Council (NITC) in 1994 as a think tank for the Government of Malaysia (EPU, 1996). There followed the National Information Technology Agenda (NITA) in 1994 to provide requisite policy directions; the Malaysian Communications and Multimedia Commission in 1999 to provide requisite legal and regulatory support (Anbalagan, 2004; EPU, 2001); the Multimedia Development Corporation in 1996 (later rebranded as MDeC in 2005) to oversee the Multimedia Super Corridor program that began in 1996 (and later evolved into MSC Malaysia in 2007); and the restructuring of relevant ministries to inject greater focus on provision of infrastructure, technology, content, and people developments (EPU, 1996, 2001; Mahathir, 1996). As part of this evolutionary process and socioeconomic drive, the knowledge-based economy was adopted as the major development thrust of the Third Outline Perspective Plan (OPP3: 2001-2010) to provide long-term planning for the country. In contrast, the OPP1 (1971-1990) and OPP2 (1991-2000) focused on agro-industrial development activities. Complementing the top-down approach, a number of grassroots initiatives such as financial incentives for transitioning research from basic to the commercialization level were also spawned (EPU, 2001). Additionally, there were other initiatives including the establishment of the Multimedia University (MMU) in 1998 specifically dedicated to providing ICT-relevant courses and research, the provision of ICT-relevant courses among private educational institutions following the liberation of the education sector in 1995, the initiation of e-community activities, the establishment of cyber cafes, and ICT research funding for both academia and industry players (Ramachandran & Asha, 2003).

Despite the great strides that have been made top-down and bottom-up, the basic question still lingers in the minds of many Malaysians as to whether the country is progressing or regressing in realizing the envisaged goal of becoming an information and knowledge society. Indeed, the foregoing warrants urgent attention in the wake of growing globalization and market liberalization phenomena that are sweeping the world today. Such changes affect the way people work, play, learn, share, govern, interact, communicate, and network (Castells, 1996; Earl, 1999; Mansel & Wehn, 1998; Ramachandran, 2003). They determine new parameters for competitive edge and comparative advantage. Countries like China, Vietnam, India, and a number of countries in Eastern Europe, which once were struggling in the clutches of closed economic policies and practices, have begun to overtake Malaysia in many ways (Rasiah, 2009).

The newly liberated economies not only provide lower cost labor in adequate numbers, but also are conjectured to provide a quality workforce for new age economic growth. Factors such as stable political environment, democratic practices, rule of law, regulatory and institutional framework aimed at reducing unwarranted bureaucracies, supply of an educated workforce in adequate numbers, world-class infrastructures (such roads, air transport, and ports), sound financial and insurance systems, an easily accessible health system, and leisure and entertainment outlets that once were considered dominant factors in attracting foreign direct investment (FDI) no longer hold (Shariffadeen, 2000). Many developing countries equally have equally become caught up in the provision of traditional infrastructure facilities especially for attracting foreign investments (Rasiah, 2009).

Instead, potential investors nowadays are looking for new age factors such as global connectivity and interactivity technological elements; an adequate and steady supply of knowledge workers (Ross & Ali, 2009); multilingual skills, specifically good command of English in speaking, reading, and writing (Nair, 2009); prevalence of e-commerce practices at all levels; online learning facilities; and Internet democracy. Other factors considered include responsive online and real-time civil service ingrained with a transparent, accountable, and corruption-free governance system (Kaliannan & Ramachandran, 2009); work culture compatible for the aspirations of the X-Y generations (Khoo, 2009); adoption of best practices, standards, certification, and quality accreditations such as the Capability Maturity Model Integration (CMMI), People Capability Maturity Model (PCMM), Information Technology Infrastructure Library (ITIL), and others (Bangah, 2009; Ramachandran, 2009).

Acknowledging the fast-changing scenarios and growing challenges, this paper's aim is to attempt to gauge the position of Malaysia in the global information society (GIS). As such, the GIS ranking is considered a fundamental and crucial policy tool for assessing the competitive edge of a nation in the current information era. For this purpose, the paper made due reference to data for the years 2002 and 2007 from 154 member countries of the ITU. Recognizing the constraints and, more pertinently, data limitations in terms of scope and coverage as well as availability, I have limited the investigations in this paper to basic variables considered minimum requirements for a GIS. Given the rapid pace of technological evolution, a quinquennial period is considered sufficient to study a nation's progress in the GIS. As such, the paper attempted to investigate the answers to the following questions by making due reference to Malaysia, considered one of Asian Tigers during the agro-industrial economy:

i. How well has the global information society been emerged over a quinquennial period, from 2002 to 2007?
ii. Which are the top 20% of nations in the global information society ladder in 2002 and 2007? Which are the leading nations demonstrating growth dynamism? In these developments, where is the position of Malaysia in these two years?
iii. Is there a relationship between ICT-related technology and people variables?
iv. How is Malaysia doing when nations are categorized into various levels of development?
v. What are the critical factors that warrant immediate attention for Malaysia to move forward especially for embracing ICT-driven innovation?

Working Definition: Information Society

The origins of the term *information society* are not well understood (Duff, 2000). However, it can be traced back as early as 1959, when Drucker first coined an associated word *knowledge worker* in his book *Landmarks of Tomorrow*. Subsequently, Machlup (1962) implicitly described the elements of an information society in *The Production and Distribution of Knowledge Industry in the United States*. Cawkell (1987) linked the term to "information industry"; and Kulthau (1987) explored information society in the context of "information skills." These are glimpses of earlier definitions. Moreover, there was no clear consensus among early authors or policy makers on a definitive meaning of an information society. Today, the advent of Internet technology that is perceived to shape the contemporary information society provides an explicit connotation (Castells, 1996; Earl, 1999; Euroscom, 1995; ITU, 2009; Kuyama, 2001; Mansel & Wehn, 1998).

In brief, *information society* is defined as a society where work, economic transactions, communications, information sharing, building relationships, and interactions involving individuals, organizations, governments, and communities are conducted via information and communications technology (ICT). As such, ICT is used in creating data, which are converted into information by subjection to some process; when internalized in the context of one's experience, cultural background, and value system, the processed information becomes knowledge (Rahman, 1990; Shariffadeen, 2000). Such created information and knowledge in the virtual environment is increasingly becoming ubiquitous and pervasive, irrespective of time, culture, and traditions. More importantly, it is used to enhance creativity, innovation, productivity, and competitiveness as well as quality of life.

However, it is duly acknowledged that the new age technologies are also responsible for dislocating individuals from the workforce or workplace when their skills become irrelevant or when they find it difficult to acquire new skills through relearning or retraining programs. A result is the creation of new societal divides such as "ICT haves" versus "ICT have-nots" or "info-haves" versus "info-have-nots" (Haywood, 1995).

Conceptual Framework: A Socio-Technology Model Approach

Premising upon the foregoing contemporary working definitions, a generic information society model outlined according to the Organization for Economic Cooperation and Development (OECD) model (OECD, 2003), as shown in Figure 1, integrates or intertwines people and technology.

Indeed, people are becoming an integral component or "people-chip" in the modern information and communications system, where data, information, and knowledge tend to flow in and out of a person at any time and anywhere irrespective of cultures and traditions (Ramachandran, 2002). As such, users of such systems tend to have a comparative advantage in accessing information and knowledge globally in comparison to those who have remained outside the system.

Thus, it is not about technology alone (Shariffadeen, 2000). The capability of people having access to the right information and subsequent conversion of information into useful knowledge are equally important, especially for making due advances in the fields of research, innovation, creativity, and development activities that are deemed to create wealth for the nation and society.

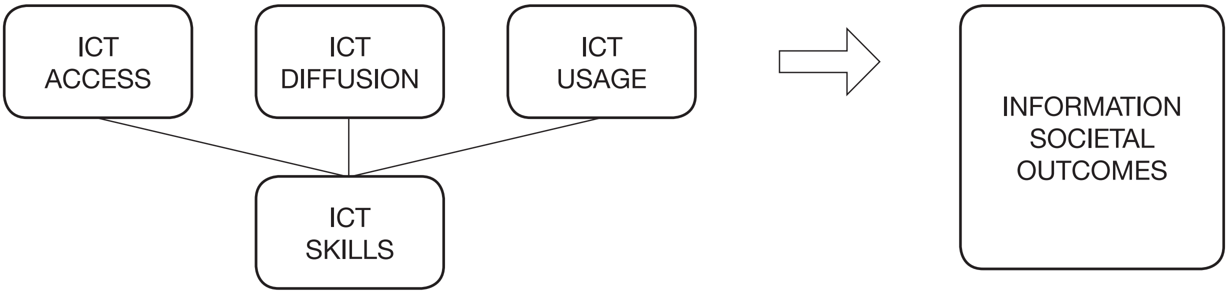


Figure 1. A generic information society model framework.

Scope of Current Information Society Variables

Taking cognizance of the socio-technology approach, the proposed information society model above entails four basic ICT elements. Under the technology perspective, ICT access and technology diffusion are key components, while the ICT usage and requisite skill sets needed to drive the technology elements (Rogers, 1995) and usage ability are key people elements.

Theoretically, a wide range of variables is needed to describe a full-fledged information society model. As mentioned earlier, the study did not have the luxury of having all the key variables depicting the technology and people elements of the information society model. With this simplistic notion and based on the criterion of data availability, the proposed benchmark study has identified the following nine fundamental variables necessary for driving an information society:

- ICT Access and Diffusion
- Fixed lines per 100 inhabitants
- Mobile cellular phone subscriptions per 100 inhabitants
- Internet users per 100 inhabitants
- Fixed broadband subscribers
- Mobile broadband subscribers
- ICT Usage and Education Skills
- Secondary gross enrolment ratio
- Tertiary gross enrolment ratio
- Proportion of households with computers
- Proportion of households with Internet

However, with the growing incidences of rapid technological evolution, convergence of technologies, and emergence of new technologies, such change may give rise to new information society variables in the near future. A total of 154 economies are considered in the study (ITU, 2009). The data were extracted from ITU websites. In the index computation procedure, all variables implicitly assumed equal weights.

Methodology

The proposed benchmarking exercise involves five stages of computation procedures and analyses, as follows:

Stage 1: Arranging Variables in a Descending Order

In the first stage, each variable is arranged in a descending order using a simple sorting procedure. The best performing nation, denoted by $\max\{y_{ij}\}$ occupies the first position, and the least performing nation, denoted $\min\{y_{ij}\}$, occupies the last position.

Stage 2: Minimizing Variable Variations

As acknowledged, the number of countries considered in the study is not only large but also demonstrated the presence of large variations in each data set. Thus, with the purpose of reducing these variations, the square-root technique is used, analogous to the concept deployed in the Dalenius and Hodges (1959) method of stratification before demarcating the threshold limits, as shown in Equation 1 (Cochran, 1977). This technique implicitly reduces variation in a data set, thus increasing its stratification efficiency. Moreover, the square-root transformation technique also provides continuity in the data series, that is, an essential criterion for objectivity in identifying the requisite demarcation points for each stratum or group:

$$Z(y) = \int_{y_1}^{y_2} \left[\sqrt{f(y)}\right] dy$$

(Equation 1)

Stage 3: Converting Variables into Index Series

The ranked variables are converted into an index series by dividing performance of a given nation, denoted by $\sqrt{y_i}$, against the best performing nation, denoted by

$\max\{\sqrt{y_{ij}}\}$), using the goalpost method as shown in Equation 2:

$$Index,\ I_{i,j}=\sqrt{y_i}/\max\{\sqrt{y_{i,j}}\}*100, \quad \text{(Equation 2)}$$

where, $i=1, 2, 3 \ldots\ldots\ldots\ldots n$ for j^{th} variable, and i refers to country.

An index score of 100 is assigned to the best performing nation. A zero score is assigned to the lowest performance when the original value of the variable ($y_{i,j}$) itself assumes a zero value.

Stage 4: Ranking Analysis

The index series are subsequently ranked, where the best performing nation will be assigned with a rank score of "1" and the least performing nation with the last rank number (n), provided no tied ranks exist. In the case of tied ranks, countries with the same variable values assume the same rank value. This step is done for each variable. As in sports, it is rare to find a nation that demonstrates "best performance" in all variables. Thus, the overall ranking of a nation is determined by aggregating the rank scores obtained for each variable. As such, if k number of variables is considered over n nations, a country's score will be subjected to the following boundaries:

$$k \leq I_{i,j} \leq nk \quad \text{(Equation 3)}$$

Stage 5: Grouping of Nations According to Levels of Development Analysis

The aim of grouping nations according to the levels of development is to identify nations that are homogenous within a cluster so that their development performances are comparable over time or across geography. In the classical Dalenius and Hodges (1959) method of stratification, the number of clusters is determined arbitrarily. But, in this benchmarking exercise, the threshold or cut-off points for each stratum or category are determined objectively using the index score series mentioned above and the 8-S Framework of Category of Development, shown in the Table 1:

Overall Performance

Based on the nine variables and the coverage of 154 countries, the index score for a country is expected to lie between 9 and 1386. If a country is best in all fields, then it will secure a rank score of 9. Similarly, for a nation performing worst in all fields, the rank score will be 1386. As indicated earlier, it is rare to find a nation at these two extremes on the premise that each nation has a tendency to do better than another nation in certain fields. Moreover, the performance of a nation can change over time. It depends on the institutional efficiency and effectiveness of policy and program implementation, as well as responsiveness and participation of target communities. Indeed, the proposed benchmarking exercise is analogous to school sports where teams show different talents or performances.

Table 2 shows the overall performance of the 154 nations investigated for the years 2002 and 2007. The maximum or minimum figures clearly indicate that no country is at a superb level in all fields as far as emergence of GIS is concerned. However, the increase in the average rank scores from 583 in 2002 to 616 in 2007 indicates that, at a global level, the information societal gap among nations is widening. This can clearly be seen by the measure of coefficient of variation, which had increased from 46.6% in 2002 to 49.5% in 2007.

Further investigations showed that Chad ranked last in overall performance for both the years of study although registering 992 points in 2002 and 1164 in 2007. In the same vein, Denmark consistently secured the first position in the ranking by registering 55 in 2002 and 71 in 2007. As shown in the spider charts, Figure 2 and Figure 3, Malaysia is in mid position between these two extreme nations through securing a rank score of 499 and 537 for the two years respectively.

Table 1
8-S Framework of Category of Development

Index score range	Classification nomenclature	Description
More than 80 to 100	Skaters	In a strong position for taking advantage of information age opportunities
More than 70 to 79	Striders	Moving very fast and gaining momentum for information age activities and participation
More than 60 to 69	Sprinters	Moving fast but lacking consistency in the momentum
More than 50 to 59	Sliders	Moving steadily but lacking momentum due to lack of motivation
More than 40 to 49	Strollers	Moving ahead with ICT uptake but not very consistent in growth
More than 30 to 39	Shufflers	Embracing ICT in a slow phase due to challenges like affordability
More than 20 to 29	Starters	Recognize the importance of ICT phenomena and have begun to embrace ICT
20 and below	Sleepers	Hardly started to embrace new age ICT technology

Table 2
Global Inf ormation Societal Gap, 2002 and 2007

Descriptive statistics	Rank score 2002	Rank score 2007
Maximum	989	1105
Minimum	55	71
Average	583	616
Median	634	615
Skew	-0.34	-0.31
Standard deviation	271	305
Coefficient of variation (%)	46.6%	49.5%

Top 20 Percent of Nations in the GIS

Table 3 shows the top 20% of 154 countries covered in the study for the years 2002 and 2007. Table 3 results indicate that all countries except Austria and Taiwan maintained their top 20% nation status in the information society ladder. The new entrants in the club include Malta and Lithuania.

In both years, Denmark maintained its first position. Nevertheless, within these top nations, competition to become an information society nation has increased. Notably, countries like Estonia, Luxemburg, Macau, and Ireland have made great strides in moving up the information society ladder. In particular, Estonia and Macau each gained 13 positions upward, Luxemburg moved up by 11

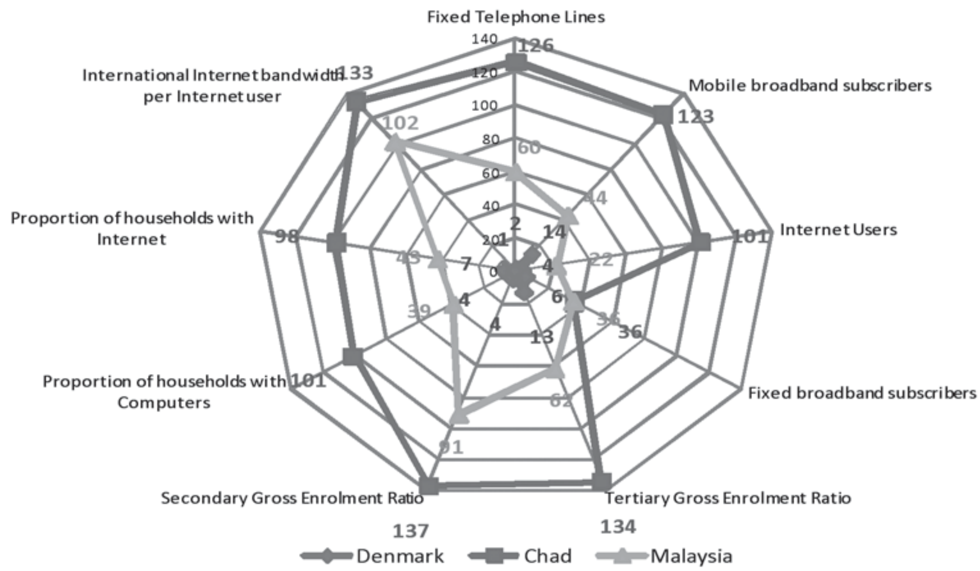


Figure 2. Information society position for Malaysia against best and worst performing nations, 2002.

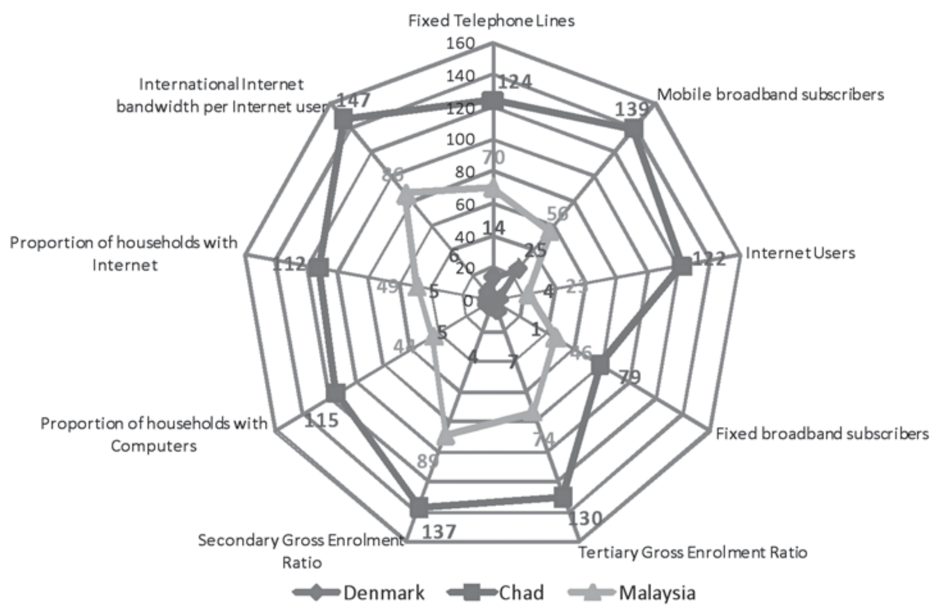


Figure 3. Information society position for Malaysia against best and worst performing nations, 2007.

positions, and Ireland by 7 positions. On the other hand, Slovenia and the United States slipped downwards, each by 10 positions.

Most of the top-listed countries come from developed blocks, and the only Asian countries in the list include The Republic of Korea, Hong Kong, Macau, Japan, Taiwan, and Singapore. It is also interesting to note that a number of countries such as Slovenia, Estonia, and Austria are ex-socialist nations, which are registering substantial growth in becoming information society nations following their political and market liberations in the last decade.

Table 3
Top 20 Percent of Nations in the Global Information Society Ladder

Country	Rank scores 2002	Country	Rank scores 2007
1. Denmark	55	1. Denmark	71
2. Sweden	72	2. Sweden	74
3. Norway	90	3. Netherlands	83
4. Finland	99	4. Norway	102
5. Netherlands	105	5. Iceland	108
6. Canada	124	6. Finland	126
7. United Kingdom	128	7. United Kingdom	138
8. Iceland	133	8. Germany	140
9. Belgium	133	9. Switzerland	157
10.Switzerland	134	10.Canada	165
11.United States	148	11.Macao, China	170
12.Rep. of Korea	151	12.Belgium	170
13.Germany	155	13.Australia	174
14.Australia	155	14.Ireland	178
15.Slovenia	177	15.New Zealand	185
16.Austria	181	16.Luxembourg	187
17.New Zealand	187	17.France	190
18.France	190	18.Estonia	197
19.Hong Kong, China	193	19.Italy	197
20.Spain	198	20.Hong Kong, China	197
21.Ireland	201	21.United States	202
22.Italy	202	22.Spain	204
23.Japan	208	23.Rep. of Korea	215
24.Macao, China	214	24.Singapore	232
25.Singapore	218	26.Slovenia	236
27.Israel	225	28.Japan	240
29.Luxembourg	237	30.Greece	245
31.Portugal	239	32.Malta	255
33.Taiwan, China	245	34.Lithuania	262
35.Greece	256	36.Portugal	273
37.Estonia	268	38.Israel	275

Growth Dynamism

It can also be reckoned that the top 20% of information society nations (listed in Table 3), except for ex-socialist nations, are traditionally more advanced nations in social and economic development, thus providing a strong foundational basis and requisite rigor and impetus for adopting and adapting to new technological advancements. Nevertheless, this does not mean that these nations can continue to enjoy high positions in becoming information society nations.

Today, the playing field is leveled and as such, a number of emerging economies among developing nations are also making greater strides in development. A possible demographic advantage that the developing nations have over the developed nations is a younger population, as opposed to aged societies that are likely to demonstrate complacency and laggardness in embracing new technologies. However, one must also recognize that the criterion of the youth of a nation alone would not suffice, unless the population has equitable access, usage capability, institutional capacity, and skills endowment, as well as motivation to participate in the GIS.

Interestingly, detailed scrutiny revealed that a number of developing countries such as Qatar, United Arab Emirates, Saudi Arabia, and Algeria in the Middle East and Bulgaria, Lithuania, Estonia, Moldova, Slovak Republic, and Latvia in Eastern Europe are experiencing higher "growth dynamism." Despite being one of the pioneer nations with a strategic implementation approach, Malaysia receded to the 88th position, when its total information society rank scores slipped from 276 in 2002 to 300 in 2007 (lower rank scores indicate improved performance). Malaysia is also falling behind its counterparts in Asia when benchmarked against China, Vietnam, Macau, Kazakhstan, Thailand, Azerbaijan, Hong Kong, and Singapore.

Relationship Between ICT Access, Usage, and Skills

Sometimes, it is argued that countries that are better off in information and communications technology do not necessarily perform better in terms of ICT usage level or deemed higher skill levels. It may not be a perfect correlation, but further investigation, as shown in Table 4, has revealed that there is a strong correlation between ICT access, usage, and skills.

Indeed, these relationships have become stronger over the five years 2002 to 2007. In particular, correlation between ICT access and skills increased from 0.80 in 2002 to 0.81 in 2007, and similarly, the relationship between usage and skills grew even more from 0.79 to 0.82 over the same period; the relationship between ICT access and usage remains almost the same. In other words, nations that have strong ICT access are also high on education skills, which, in turn, have demonstrated to have a strong linkage with high level usage skills.

Table 4
Correlation Between ICT Access, ICT Usage, and Education Skills

Variables	2002	2007
ICT access versus ICT usage	0.89	0.89
ICT access versus educational skills	0.80	0.81
ICT usage versus educational skills	0.79	0.82

Level of Development Grouping By Variables

Instead of analyzing at aggregated levels, an attempt is made to group nations using the 8-S Framework at the variable level. The variable level is chosen as it makes sense to compare nations on how they are achieving in each, as the development objectives and the nuances tend to be similar. In this regard, the first variable explored is fixed line telephone penetration rates, which not only have been long in the industry, but have also paved the way for the introduction of various new technologies.

Fixed Line Telephone Penetration

Table 5 shows the classification of nations based on fixed line telephone penetration rates. Interestingly, it can be noted from the Table 5 that more countries are moving towards the higher level of development category. For instance, in the year 2002, there were 21 countries in the Skater (or most advanced group). This number increased to 25 in 2007, indicating that more countries had joined the advanced club. Similarly, the Strider and Sprinter categories also showed upward movement.

As reckoned from past experiences, following the liberation of telecommunication sectors worldwide since the late eighties, many countries have realigned and restructured their telecommunication policies, regulatory framework, institutions, and programs. These policy reviews and institutional and structural changes enabled greater free market forces and liberalized practices. These reforms totally eliminated or minimized traditional market monopolies in the telecommunication sectors, allowing increased participation of the private sector. Increased participation was not only within a country but also from outside. The scope of telecommunication products and services expanded. The cellular markets, in particular, have proliferated in a short span of time (EPU, 2006).

The market registered competitive and affordable prices for online and real-time telecommunication devices and services; and due to heightened competition among service providers, the service level quality improved a great deal. As a result of such phenomenal changes, the provision of fixed line telephony services has begun to register declines in many countries, including Malaysia (EPU, 2006).

Indeed, this partly explains the declining number of countries in the bottom three categories of the 8-S Framework, namely, Sleepers, Starters, and Shufflers, between 2002 and 2007. Despite registering a decrease of 10 ranking places, that is, from 60 in 2002 to 70 in 2007, Malaysia's position moved from the Slider to the Stroller category.

Mobile/Cellular Phone Penetration

In the mobile phone category, the classification of nations by level of development distribution did not undergo any change, as shown in Table 6. Nevertheless, the penetration rates of mobile phones in all categories in the 8-S Framework have moved up significantly. This growth pattern indicates that today in the world, the masses are

Table 5
Classification of Nations by Level of Development Based on Fixed Telephone Line Penetration Rates

Fixed telephone lines					
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	21	58.5	25	52.4
More than 70-79	Striders	12	44.5	13	37.6
More than 60-69	Sprinters	13	30.6	16	28.2
More than 50-59	Sliders	17	22.4	17	20.3
More than 40-49	Strollers	13	15.1	18	13.7
More than 30-39	Shufflers	20	9.7	19	8.4
More than 20-29	Starters	17	4.8	10	4.1
Less than 20	Sleepers	41	1.1	36	1.0

Remarks: Malaysia moved downwards from Sliders to Strollers for 2002 and 2007 respectively. As such, Malaysia registered a decrease of 10 ranking places (from 60 to 70, from 2002 to 2007). This coincides with a 15.9% decrease in the fixed telephone lines per 100 inhabitants.

increasingly resorting to mobile devices for ubiquitous and convenient communication, which is also becoming cheaper. In this positioning, Malaysia maintained its position in the Slider category.

Table 6
Classification of Nations by Level of Development Based on Mobile Cellular Phone Rates

Mobile cellular subscriptions					
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	27	85.4	27	130.5
More than 70-79	Striders	32	63.0	32	99.7
More than 60-69	Sprinters	18	46.8	18	77.5
More than 50-59	Sliders	15	33.2	15	58.3
More than 40-49	Strollers	22	20.9	22	36.0
More than 30-39	Shufflers	21	13.3	21	22.2
More than 20-29	Starters	10	6.8	10	11.4
Less than 20	Sleepers	9	1.2	9	3.9

Remarks: Malaysia remained in the Slider category from 2002 to 2007, despite decrease in the overall rank position from 44 to 56 (-11 places). Mobile cellular subscriptions increased by 132.5% per 100 inhabitants from 2002 to 2007.

Internet Users

Similarly, in the Internet users category, there is no change in the country distributions between 2002 and 2007, as shown in Table 7. However, all categories registered substantial increase in Internet user rates. A close examination of the rates revealed that the increase in the Internet user rates was more pronounced in the Skater, Strider, and Sprinter categories, compared to the other categories. Malaysia registered an upward movement from Sprinters to Striders, where the average Internet penetration rate increased from 45.4% to 52.0%.

Fixed Broadband Subscriptions

In the case of fixed broadband subscriptions, there was a major shift in the distribution between 2002 and 2007. As shown in Table 8, only very few countries were involved or at an embryonic stage in the provision of fixed broadband services at the beginning of this century. Over the quinquennial period, the number of countries in the first four categories of the 8-S Framework moved from 13 to 38 nations, registering a threefold increase. Despite losing in terms of rank position from 36 to 46 during this period, Malaysia moved up from the Sleeper to the Shuffler stage. Nevertheless, the performance of Malaysia in the provision of broadband moving from 0.1% in 2002 to 3.8% in 2007 is not very encouraging, in particular compared to 28.9% and 20.4% for Skaters and Striders respectively.

Table 7
Classification of Nations by Level of Development Based on Internet Users

Internet users					
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	23	63.6	23	73.3
More than 70-79	Striders	14	45.4	14	52.0
More than 60-69	Sprinters	10	32.2	10	38.0
More than 50-59	Sliders	16	24.4	16	28.4
More than 40-49	Strollers	17	16.9	17	19.2
More than 30-39	Shufflers	22	9.6	22	11.0
More than 20-29	Starters	22	4.7	22	5.6
Less than 20	Sleepers	30	1.1	30	1.6

Remarks: Malaysia registered an upward movement from Sprinters to Striders from 2002 to 2007. Malaysia decreased in overall rank from 22 to 23 (-1 place), while the Internet users increased by 70% per 100 inhabitants from 2002 to 2007.

Table 8
Classification of Nations by Level of Development Based on Fixed Broadband Subscribers

		Fixed broadband subscribers			
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	2	18.7	17	28.9
More than 70-79	Striders	1	11.2	12	20.4
More than 60-69	Sprinters	3	8.7	4	15.2
More than 50-59	Sliders	7	6.8	5	10.4
More than 40-49	Strollers	6	4.3	10	7.7
More than 30-39	Shufflers	6	2.8	11	4.3
More than 20-29	Starters	7	1.2	18	2.2
Less than 20	Sleepers	122	0.1	77	0.3

Remarks: Malaysia went down from Sleepers to Shufflers from 2002-2007. Malaysia decreased in rank to 46 from 36 (-10 places), although there was an increase in the penetration rate to 3.8 from 0.1 per 100 inhabitants.

It also must be reckoned that countries are on the verge of embracing the next wave of mobile broadband technology. This technology was alien to many countries at the beginning of this century. Today, of the 154 countries investigated, a total of 50 countries have embraced mobile broadband technology.

Malaysia is still at its lowest ebb with a penetration rate of 5.9% as far as uptake of this mobile technology is concerned. As acknowledged, this high-end broadband technology, be it in fixed line or mobile forms, is crucial for advanced applications involving multimedia development, advanced research and innovation activities, e-commerce practices, online learning, web-based television programs, et cetera.

Recognizing the economic and business imperatives, the Government of Malaysia is attempting to increase the penetration rate to 50% by 2010. In order for the government to accomplish this target, the growth trend as shown in Figure 4 needs to be adhered to. Indeed, this is a formidable challenge for the service providers especially to accomplish MyICMS 886 targets.

Gross Tertiary Enrolment Ratio

As shown in Table 9, the overall gross tertiary enrolment ratio has improved in all categories, though the distribution of the number of counties did not undergo much change. In particular, the gross tertiary enrolment ratio in the Skater category increased significantly from 65.7% to 77.2% over the period. Similarly, in the Sleeper category, the gross tertiary enrolment ratio improved from 1.8% to 2.2%. In other words, the number of students entering tertiary institutions is increasing globally. This is considered a positive outlook towards becoming an information society,

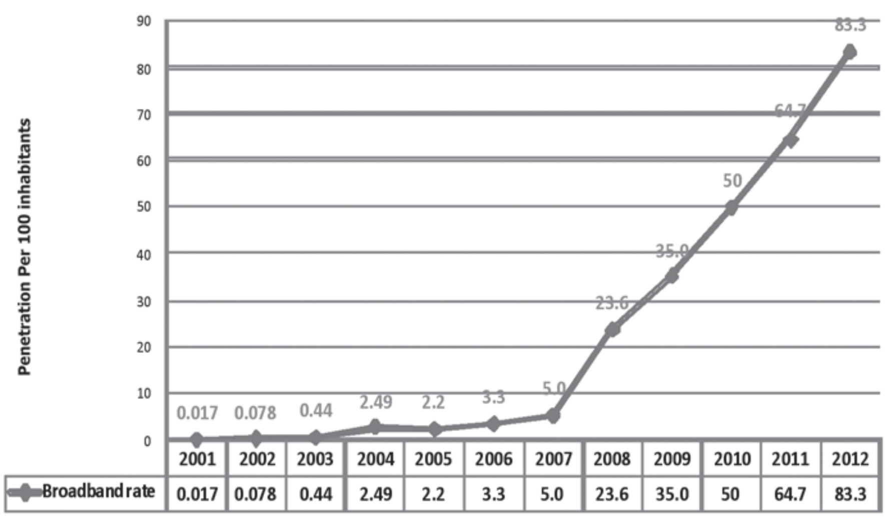


Figure 4. Broadband penetration rate in Malaysia: 2001-2012.

Table 9
Classification of Nations by Level of Development Based on Gross Tertiary Enrolment Ratio

Gross tertiary enrolment ratio					
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	26	65.7	23	77.2
More than 70-79	Striders	12	48.9	19	56.6
More than 60-69	Sprinters	21	36.3	20	42.9
More than 50-59	Sliders	20	25.4	17	30.4
More than 40-49	Strollers	21	16.5	15	20.1
More than 30-39	Shufflers	11	10.5	17	12.7
More than 20-29	Starters	20	4.8	21	6.1
Less than 20	Sleepers	23	1.8	22	2.2

Remarks: Malaysia became a Stroller from a Slider for 2002 to 2007. Malaysia registered a decrease in rank position to 74th from 62nd (-12 places), with a decrease of 11% in the gross tertiary enrolment ratio.

for which a higher level of education is essential. In this development, Malaysia surprisingly slipped into the Stroller category in 2007 from its Slider category in 2002 because the gross tertiary enrolment ratio dropped from 28.0% to 24.9%, despite a liberalized education system.

Gross Secondary Enrolment Ratio

However, detailed scrutiny according to the classification of nations by gross secondary enrolment ratio revealed that Malaysia remained in the Sprinter category in both 2002 and 2007; see Table 10.

The data showed Malaysia's gross secondary enrolment ratio improved by 5.2%, when its ratio moved up from 65.7 to 69.1 during the years under study. At global level, the students entering secondary level education also showed tremendous improvement. As shown in Table 10, the number of countries joining the ranks of Skaters increased from 23 in 2002 to 38 in 2007, indicating a reduction in disparity among nations.

Computer Uptake at Household Level

In the ICT usage category, the 8-S Framework study showed significant improvement in the uptake of computers at the household level. As Table 11 shows, in the top three categories, namely Skaters, Striders, and Sprinters, the number of nations increased from a total of 33 to 58 within a span of five years, indicating proliferation of computer usage in daily routines. For the most advanced category, the Skaters, the penetration rate increased from 65.2% in 2002 to 73.7% in 2007.

Similarly, the number of countries in the Sleeper category, the countries considered least developed,

Table 10
Classification of Nations by Level of Development Based on Gross Secondary Enrolment Ratio

Gross secondary enrolment ratio					
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	23	115.7	38	105.9
More than 70-79	Striders	58	88.3	58	86.6
More than 60-69	Sprinters	26	68.4	17	64.5
More than 50-59	Sliders	16	44.3	16	44.9
More than 40-49	Strollers	14	31.2	15	30.8
More than 30-39	Shufflers	11	20.4	8	18.4
More than 20-29	Starters	5	10.2	1	11.2
Less than 20	Sleepers	1	5.8	1	5.8

Remarks: Malaysia stayed a Sprinter from 2002 to 2007, though the ranking position for Malaysia increased to 89 from 91 (+2 places), which indicates improvement. There was an increase of 5.2% in the gross secondary enrolment ratio.

Table 11
Classification of Nations by Level of Development Based on Proportion of Households with Computers

		Proportion of households with computers			
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	20	65.2	31	73.7
More than 70-79	Striders	7	46.4	9	51.4
More than 60-69	Sprinters	6	36.1	18	37.9
More than 50-59	Sliders	14	25.4	13	26.9
More than 40-49	Strollers	15	17.7	14	17.6
More than 30-39	Shufflers	11	9.8	24	11.0
More than 20-29	Starters	21	5.3	25	5.3
Less than 20	Sleepers	60	1.1	20	1.7

Remarks: Malaysia improved from Sliders to Sprinters from 2002 to 2007. However, Malaysia's rank decreased from 39 to 44 (-5 places), although the proportion of households with computers increased by 49.6%.

significantly dropped from 60 to 20 over the same period. Indeed, this indicates an increasing rate of pervasiveness globally in the usage of computers. In computer uptake, Malaysia registered upward movement from Sliders to Sprinters, following a 49% increase in the proportion of households with computers between 2002 and 2007; that is, the computer penetration rate increased from 24% to 35.9%.

Internet Technology Uptake at Household Level

As typically conjectured, the increase in the penetration of computers at household level is accompanied by an increase in the uptake of Internet technology. As Table 12 shows, analogous to computer uptake, distribution of Internet uptake as per 8-S Framework distribution also registered a substantial change from 2002 to 2007.

Collectively, the number of countries in the top three advanced categories increased from 28 in 2002 to 43 in 2007. Likewise, the number of countries in the Sleeper category, where most of the economically very backward countries are listed, declined drastically from 82 to 55. In tandem with an increasing personal computer penetration rate, Malaysia also registered upward movement from Shufflers in 2002 to Strollers in 2007, despite falling behind in rank position.

Key Challenges Plaguing Malaysia in Moving Up in GIS

From the foregoing analysis at variable level, two critical issues, namely, provision of broadband and tertiary enrolment warrant the attention of policy makers and development practitioners as well as industry players in order to move Malaysia forward to be competitive globally and also towards becoming an innovative society.

Table 12
Classification of Nations by Level of Development Based on Proportion of Households with Internet

		Proportion of households with Internet			
Index score range	Classification nomenclature	2002	Average	2007	Average
More than 80 to 100	Skaters	13	59.3	21	72.7
More than 70-79	Striders	9	44.0	8	55.3
More than 60-69	Sprinters	6	33.0	14	40.0
More than 50-59	Sliders	5	23.1	7	28.7
More than 40-49	Strollers	13	15.2	13	18.1
More than 30-39	Shufflers	12	9.5	16	11.0
More than 20-29	Starters	14	4.7	20	6.0
Less than 20	Sleepers	82	0.6	55	1.7

Remarks: Malaysia moved up from Shufflers to Strollers from 2002 to 2007, despite registering a decline in the ranking position to 49 from 43 (-6 places). Nonetheless, the proportion of households with Internet increased by 90.5% over the quinquennial period.

Provision of Broadband

The article "*The Edge* Special Focus on Telcos in Malaysia: Choice and Challenges in 2009" (Singh, 2009) highlighted a number of key issues and also made recommendations for moving forward the broadband industry in the country. Four key issues highlighted by the telecommunication industry representatives and players are as follows:

- First, the existence of monopolies in the telecommunication industry artificially inflates the cost of infrastructure rentals. The incumbent controls the provision of fiber infrastructure, last-mile solution, and high-speed broadband (HSBB). Such controls not only limit openness but also affect the service level guarantees.
- Second, the telecommunication towers in the country are controlled either by state-backed companies or building owners, who impose exorbitant rentals that translate into high prices for customers.
- Third, the intellectual transit prices in Malaysia, especially in Sabah and Sarawak, are very high.
- Fourth, there is a lack of transparency in the tender processes and award criteria especially for the provision of Universal Service Provision (USP) and spectrum assignment. In particular, the implementation processes are very slow; criteria for selection are not adhered to; and very often, there is political interference.

In response to these issues, recommendations suggested are as follows:

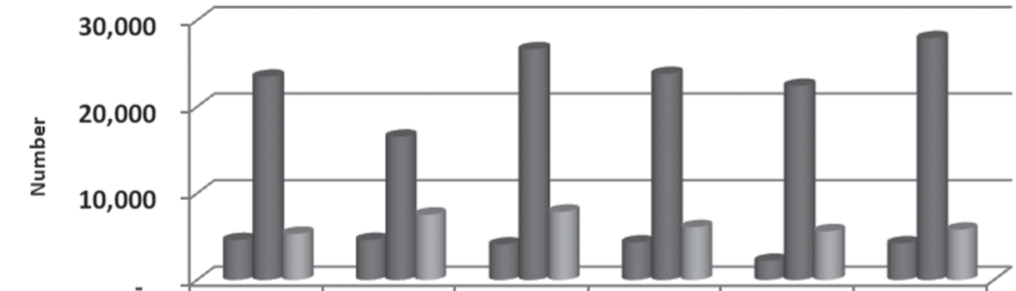
- First, the industry players are looking forward to a regular dialogue with the policy makers, especially at the ministry level, in order to thresh out all issues, problems, and challenges that plague industry growth.
- Second, tender awards based on meritocracy and accountability and a level playing field towards promoting healthy and fair competition are crucial for the provision of quality services at affordable rates. With such practices, not only the industry players will benefit, but also the country as a whole; in particular, customers will receive the best in terms of price and performance.
- Third, it is high time the government makes communication services a utility, as with water and electricity, so that the service is available on demand. In other words, telecommunication infrastructure must be in place from onset at the same price irrespective of geographical locations.
- Fourth, the Malaysian Communications and Multimedia Commission (MCMC) requires fresh and dynamic leaders to spearhead the industry with appropriate and timely regulatory frameworks that are crucial to cope with growing global competition.
- Fifth, the government should not favor any specific company in terms of awarding projects, funding, and competition. The industry players prefer that government consultation be confined to the MCMC and, wherever needed, the industry representatives and associations.
- Last, a singular mission and a well-engaged and supportive industry is crucial to compete with other countries in the region especially in the accomplishment of MyICMS886 targets that countries like Singapore, South Korea, and Japan are implementing. (Extracted with permission from The Edge editor)

Provision of Tertiary Education

One of the pressing issues affecting the Malaysian ICT is adequate supply of quality graduates. As highlighted in the Figure 5, the supply issue from the public universities has been steady in terms of new entrants, enrolments, and output. Understandably, public universities have constraints in terms of budget and policy directions in churning out graduates every year. However, it was startling to observe the supply of ICT graduates from private institutes of higher learning registered a sharp decline (Ramachandran, 2009). In particular, the number of new entrants dropped drastically from 53,340 in 2002 to 19,896 in 2007 (Ministry of Higher Education [MOHE], 2008). Over the same period, the enrolments into information technology (IT) courses also almost halved from 96,090 to 51,766. The output numbers became even more disturbing when the IT graduates entering the Malaysian workforce showed a sharp decline from 48,392 to 13,694.

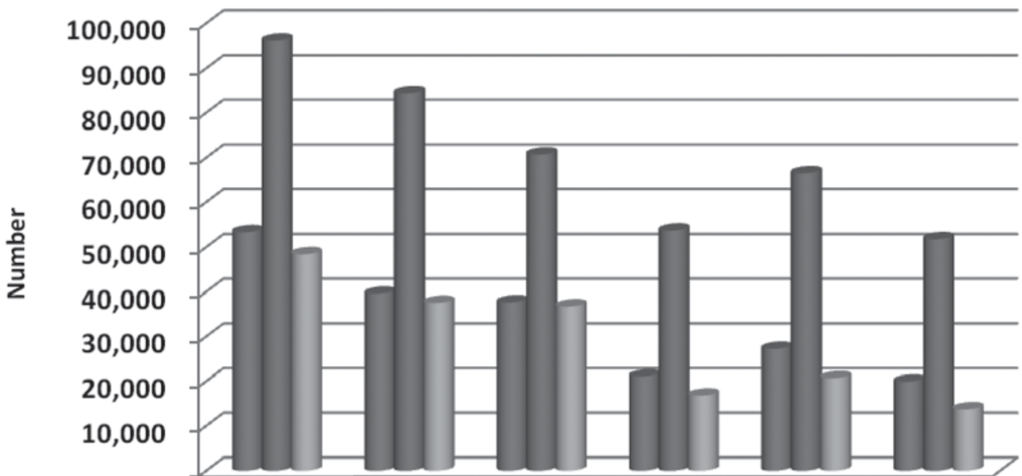
According to an independent study carried out by Kelly Services, the decline is due to the fact that ICT courses lack the interest and glamour that young generations are seeking (Khoo, 2009). The supply problem is accentuated when the IT graduates entering the job market lack linguistic skills, especially in English, which is the *lingua franca* of the private sector.

A study conducted by the Ministry of Higher Education in 2006 (MOHE, 2007) indicated that the proportion of fresh graduates who have scored a distinction in the Sijil Pelajaran Malaysia (SPM) level English was only 11%, in comparison to 34% in Bahasa Malaysia, which is the official language and also, the main medium of instruction and communication in Malaysia. The SPM is the national level certification for students completing their secondary level education and passing this examination is a pre-requisite for pursuing any tertiary or college level education. Thus, the number and quality of IT graduates clearly indicate the reason for the difficulty the industry finds in locating employable graduates.



	2002	2003	2004	2005	2006	2007
New Entrants	4,594	4,609	4,078	4,316	2,198	4,206
Enrolments	23,466	16,529	26,632	23,783	22,408	27,911
Output	5,320	7,538	7,876	6,086	5,620	5,802

Figure 5. Supply of IT graduates in public institutions: 2002-2007.



	2002	2003	2004	2005	2006	2007
New Entrants	53,340	39,559	37,620	21,061	27,234	19,896
Enrolments	96,090	84,366	70,691	53,710	66,476	51,766
Output	48,392	37,514	36,719	16,776	20,693	13,694

Figure 6. Supply of IT graduates in private institutions: 2002-2007.

Besides quality issues, the ICT sector also faces a quantity issue. The number of new entrants into ICT courses or ICT graduates entering the workforce almost halved over the past five years. For instance, the new entrants to IT courses declined from 57,934 in 2002 to 24,102 in 2007, and similarly, the number who entered the workforce declined from 53,712 in 2002 to 19,496 in 2007 (MOHE, 2008; Ramachandran, 2009).

According to Kelly Services, the decline is due to a lack of interest and glamour in ICT courses. Moreover, analyst firm Gartner also indicated that a worldwide shortage in IT personnel was partly due to the coming generation shunning the industry because of its reputation for hard work and long hours in the office (Khoo, 2009).

Conclusion

Shortfalls in the provision of high capacity broadband and an adequate and consistent supply of quality ICT graduates can seriously inhibit the growth of research and development as well as innovation activities in Malaysia. In comparison to preceding development plans, the Ninth Malaysia Plan (2006-2010) emphasizes the "endogenous economic growth model" as opposed to "exogenous growth" that depended very much on foreign direct investment (EPU, 2006).

In the past, the main emphasis of FDI was to create employment opportunities; however, employment is not a critical problem anymore, especially lower-rung employment. As acknowledged, Malaysia has a large number of imported low-skilled workers employed in manufacturing and construction. The FDI is declining sharply due to globalization and market liberalization phenomena that enable investment funds to move towards low-cost countries.

Having recognized this challenge, the government decided to embrace a knowledge-based economy as the main development thrust to catalyze and accelerate economic and societal growth (EPU, 2001) towards becoming a developed nation by 2020.

The development thrust also emphasized that this can be only achieved provided the nation aggressively pursues its own research and innovation activities that can lead to global branding and quality recognition, as well as market entry worldwide. In turn, the research, development, and innovation are poised to foster and nurture Domestic Direct Investment (DDI) which currently is not at an encouraging level. This requires quality graduates that are well-equipped with interdisciplinary knowledge, skills, and experience. Otherwise, it will be a formidable task to realize the envisaged knowledge economy or society.

In the field of ICT, overdependence on knowledge workers from countries like India may provide short-term solutions but in the long term, it will not bring competitive edge and comparative advantage if the country wants to pursue an endogenous growth model both in the production and services sectors of ICT. One way to stimulate the economy is to expand export ICT services through creating innovative products and services.

However, most of the ICT players in the country lack adequate capacity and capability to compete globally, where industry-recognized certifications and accreditations are crucial. Without such accreditations, it will be a formidable task for ICT industry players to compete globally or to gain a foothold in foreign markets. As reckoned, industry accreditations provide the requisite confidence and economic standing in the business world.

India, which has now gained recognition and a foothold in the global market, was once like Malaysia in that it faced difficulty in bidding for lucrative jobs from developed countries. Despite having a steady supply of ICT graduates, both numbers and quality, Indians realized that due to the lack of industry accreditation certification, they faced difficulties in entering foreign markets. Recognizing the challenge, the Indian ICT industry players on their own without depending very much on government support have begun to pursue globally known certifications in the ICT field such as CMMI, PCMM, ITIL, Six Sigma, and ISO (Bangah, 2009). These certifications are essential for industry recognition, to enter global markets, and to benchmark for quality and standards. Such bottom-up initiatives and entrepreneurial spirit are generally lacking among Malaysian ICT players who also tend to be reliant on government aid, support, and impetus.

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