

TRANSFORMING MALAYSIAN ECONOMY FROM PRODUCTION BASE
TO KNOWLEDGE BASE USING QUADRUPLE HELIX RESEARCH
COLLABORATIONS

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I wish to wholeheartedly dedicate this work to the one and only love of my life -- my wife Rabia -- who has steadfastly been the source of my encouragement; for her mighty confidence in me and most of all for her most profound love.

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ABSTRACT

The knowledge based economic transformation strategy in Malaysia is part of its broader economy competitiveness strategy developed to achieve the goals set for Vision 2020. However, Malaysia is facing hurdles in knowledge economy transformation such as weak education and training system, institutional support, and info-structure, deficient research and development capacity, unstable science and technology base, unskilled workers, and lack of techno-entrepreneurs. To discover the knowledge based transformation solution for these problems, a framework has been developed to check the impact of performance determinant variables on economic competitiveness of Malaysia using Quadruple Helix (university, industry, government and public/civil society) research collaboration as mediators. A quantitative, descriptive research design was used in which twenty nine economic performance determinant variables were tested for mediation with university, industry, government and public. Two hundred and eighty two questionnaires were distributed using the convenience sampling method to collect the data. The study validated the Quadruple Helix mediation impact using regression analysis. Mediation was further validated using the Sobel Test. The study confirmed that the performance determinant variables have a strong and positive role in determining economy competitiveness. The results also confirmed that a strong Quadruple Helix mediation is necessary; however, there exists a “weak link” between the key stakeholders in the economy of Malaysia. The results established that the university and government are comparatively strong contributors whilst civil society’s contribution is moderate and the industry is the weakest link in the competitiveness of an economy. It is therefore, concluded that a successful knowledge based transformation depends upon the collaborations between university, industry, government and civil society sector. It is recommended that a strong Quadruple Helix innovation based collaboration should be the focus and the tool for knowledge based economic transformation to strengthen the economic performance and competitiveness of Malaysia.

ABSTRAK

Pengetahuan berasaskan strategi transformasi ekonomi di Malaysia adalah sebahagian daripada ekonomi yang lebih luas strategi daya saing yang dibangunkan untuk mencapai matlamat yang ditetapkan bagi Wawasan 2020. Walau bagaimanapun, Malaysia sedang menghadapi halangan dalam pengetahuan transformasi ekonomi seperti pendidikan yang lemah dan sistem latihan, sokongan institusi, dan info-struktur, penyelidikan kekurangan dan keupayaan pembangunan, sains tidak stabil dan asas teknologi, pekerja mahir, dan kekurangan tekno-usahawan. Untuk mencari penyelesaian transformasi berasaskan pengetahuan masalah ini, rangka kerja yang telah dibangunkan untuk memeriksa kesan pembolehubah penentu prestasi daya saing ekonomi Malaysia dengan menggunakan Heliks Kuadrupel (universiti, industri, kerajaan dan masyarakat awam / sivil) kerjasama penyelidikan sebagai mediator. A kuantitatif, reka bentuk penyelidikan deskriptif telah digunakan di mana dua puluh sembilan ekonomi pembolehubah penentu prestasi telah diuji untuk pengantaraan dengan universiti, industri, kerajaan dan orang ramai. Dua ratus dan 82 soal selidik telah diedarkan dengan menggunakan kaedah persampelan rawak mudah untuk mengumpul data. Kajian ini mengesahkan Heliks Kuadrupel kesan pengantaraan menggunakan analisis regresi. Pengantaraan terus disahkan menggunakan Ujian Cetak Timbul itu. Kajian ini mengesahkan bahawa pembolehubah penentu prestasi mempunyai peranan yang kuat dan positif dalam menentukan daya saing ekonomi. Keputusan juga mengesahkan bahawa pengantaraan Heliks Kuadrupel yang kuat adalah perlu, namun wujud "link yang lemah" di antara pihak berkepentingan utama dalam ekonomi Malaysia. Keputusan menetapkan bahawa pihak universiti dan kerajaan adalah penyumbang agak kukuh manakala sumbangan masyarakat awam adalah sederhana dan industri adalah link paling lemah dalam daya saing ekonomi. Oleh itu, membuat kesimpulan bahawa transformasi pengetahuan yang berjaya berasaskan bergantung kepada kerjasama antara universiti, industri, kerajaan dan sektor masyarakat sivil. Ia adalah disyorkan bahawa Heliks Kuadrupel kerjasama berasaskan inovasi yang kuat sepatutnya menjadi tumpuan dan alat untuk pengetahuan transformasi ekonomi berasaskan untuk mengukuhkan prestasi ekonomi dan daya saing Malaysia.

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LIST OF ABBREVIATIONS

APEC	-	Asia Pacific Economic Cooperation
ASEAN	-	Association of Southeast Asian Nations
ASM	-	Academy of Science Malaysia
EPU	-	Economic Planning Unit
ETP	-	Economic Transformation Program
FDI	-	Foreign Direct Investment
GDP	-	Gross Domestic Production
ICT	-	Information and Communication Technology
ILO	-	International Labor Organization
IMF	-	International Monetary Fund
IT	-	Information Technology
K-Economy	-	Knowledge Based Economy
KEI	-	Knowledge Economy Index
KIS	-	Knowledge Intensive Services
MIT	-	Massachusetts Institute of Technology
MOHE	-	Ministry of Higher Education
MOSTI	-	Ministry of Science, Technology and Innovation

NEM	-	New Economic Model
NEP	-	New Economic Policy
NKRA	-	National Key Result Areas
NLS	-	National Learning System
NSI	-	National System of Innovation
OECD	-	Organization of Economic Co-operation and Development
P-Economy	-	Production Based Economy
R&D	-	Research and Development
SRI	-	Strategic Reform Initiative
S&T	-	Science and Technology
TFP	-	Total Factor Productivity
TTO	-	Technology Transfer Offices
UNDP	-	United Nations Development Program
UNESCO	-	United Nation's Educational, Scientific and Cultural Organization

CHAPTER 1

BACKGROUND OF THE STUDY

1.1 Introduction

Knowledge creation has always been considered as the most important factor for long term and sustainable economic growth and development. Due to its great impact on competitiveness in the global economy, it is considered vital, not only for a single company but also for a region or a country (Fagerberg, Mowerey and Nelson, 2006). Creativity and innovation as a notion for knowledge economy has changed the theme of knowledge management and had given birth to a new form of industry, university and government funded research and development (R&D) and innovation development activity. Mowery and Rosenberg (1998) termed this phenomenon as “institutionalization of innovation”. This institutionalization, further, has developed a new category of scientists (i.e. the entrepreneurial scientists) who combined basic scientific knowledge with innovation. Institutionalization also reduced the gap between scientific research and its utilization and has developed the dual use of theoretical and practical scientific research (Etzkowitz, 2002). Slaughter and Rhoades (2004) termed it as ‘academic capitalism’ which generate economic competition in the academic research. The academic capitalism highlighted the importance of universities and open up the ways for university academician to be involved in commercial activities, thus, develop the idea of commercialized research and entrepreneurial universities (Etzkowitz and Roest, 2008).

The quality education obtained from a university or other higher education institution, and its applicability to the economy, is getting greater importance in the attainment of national competitiveness. For example, the UK's Department of Innovation, Universities and Skills in its report (2008) have pointed out that universities are important because they unearth the hidden talents of students, work for local and national economic development, develop highly skilled manpower, promote innovation in products and services, generate jobs and support communities.

University's role as a producer and protector of knowledge and science has been changed; the universities are considered as the provider and producers of human resources and industry-ready workers (Lambooy, 2004; Lazzarotti and Tavoletti, 2005). In the modern world, the universities have been identified as academic entrepreneur houses which are strategically placing and positioning themselves as engines of sustainable economic growth and technological development (Mohar, Saeed and Leillanie, 2009). The transformation of university, either from inside or from outside, initially to research and later on to entrepreneurial as identified by Etzkowitz (2008) is a key determinant in developing true knowledge based innovation system. Therefore, a strong legislative support is necessary, although not enough, to support the innovation development, thus the role of government as a player in the innovation has emerged.

In order to attain the competitive advantage, governments are required to change the traditional ways and are needed to develop new skills, and are required to work as a promoter of initiatives taken by the other players of economic development (Plot *et al.*, 2001). In the new economic system, the role of the government is to introduce such measures which enhance innovation and associated processes of industrial and societal growth. Such steps are required to be taken jointly with university and industry (Etzkowitz and Roest, 2008).

Along with the core business activity, the role of industry in a knowledge economy is to search and to promote collaborations for learning and for external partnering as well as to develop linkages to provide complementary assets (Ramlee and Abdullah, 2004). These interactions help industry to spread the costs and risks attached with innovation. With the development of new products and procedures, the

industry determines which activity could be completed independently, which activity requires collaborations with other organizations (Hatzichronoglou, 1996). This interdependency of university, industry and government upon each other for the development of knowledge and innovation is relatively equal and is considered as the basis for the evolution of Triple Helix model of innovation. Therefore, the Triple Helix innovation model is appeared to be the balancing force in which all the three players i.e. government, university and industry, work together and grow and implement the innovation strategy for the development of knowledge economy (Etzkowitz, 2008).

Today we are part of a society developed on the basis of knowledge where sectoral collaborative efforts have been considered as an innovation source to attain the competitive advantage in the globalized business arena (Gray, 1999; Agrawal, 2001; Lambooy, 2004; Lazzeretti and Tavoletti, 2005). Knowledge and creativity as a part of knowledge based economic system can, therefore, be considered as the outcome of communications between producers and users, which collectively created an innovation system.

According to Florida (2002), creativity originates from people of all classes who are the essential source of knowledge economy. Karnitis (2006), further explained that people of all societies must put their efforts jointly to achieve the common objectives. He include society as a prerequisite for knowledge development. Therefore, involvement of the entire society in the process of innovative development becomes necessary (Ginevicius, Korsakiene 2005), which allows individuals to take more active part in knowledge based economic transformation along with society development.

The civil society or public is expected to promote the awareness in cluster formation and policy matters. It can thus be considered as the primary component for the development of cross-border clusters (Lindgren and Packendorff, 2009). Public or civil society is organized under the banner of Civil Society Organizations having involved in a non-profit business, and hence reached away from the domain of commercial enterprises, political institutions and scientific academy. The involvement of public has allowed the experts to break the narrow concept of Triple

Helix (consisting of university, industry and government) by incorporating another helix i.e. public, resulting in the formation of Quadruple Helix innovation system (Carayannis and Campbell, 2009). The Quadruple Helix innovation system originated from the model where four segments of economy i.e. government, university, Industry and civil society collectively work to strengthen the economic competitiveness of the country (Lindberg, Lindberg and Packendorff, 2010). Hence, according to Quadruple Helix innovation system regions and cities are considered as economic growth engines in which university and industry develop innovation ecosystem, government is responsible for providing support through finances, regulations and policies and civil society develop awareness and create demand for innovative goods and services (Afonso *et al.*, 2010).

According to Atkinson *et al.* (2010) knowledge development and economic competitiveness are correlated positively. Knowledge creation through innovation supports the economy in three major dimensions. First, knowledge and innovation based development provides organizations the first mover advantage, resulting in the increase in exports which ultimately support the economic expansion (Kletzner, 2002). Second, the impact of increase in knowledge and innovation develops a virtuous cycle of employment expansion. And finally, knowledge and innovation also increase productivity, which on one hand decreases the price and on the other hand develops the increasing trend in the wage market, collectively causing the expansion in the domestic economic activity and also generate more jobs and make the economy competitive (Castro *et al.*, 2010). According to Chen and Dahlman, (2005), knowledge and knowledge based activities are the key components in knowledge based economic transformation. In the transformation process they identified four major areas and termed these areas as pillars of knowledge economy framework

1.1.1 Knowledge Economy Framework

Chen and Dahlman (2005) in their World Bank series paper identified education, innovation, modern info-structure, and strong economic environment as

knowledge based economic system's pillars and collectively termed these as (Fig. 1.1) Knowledge Economy Framework (Chen and Dahlman, 2005).

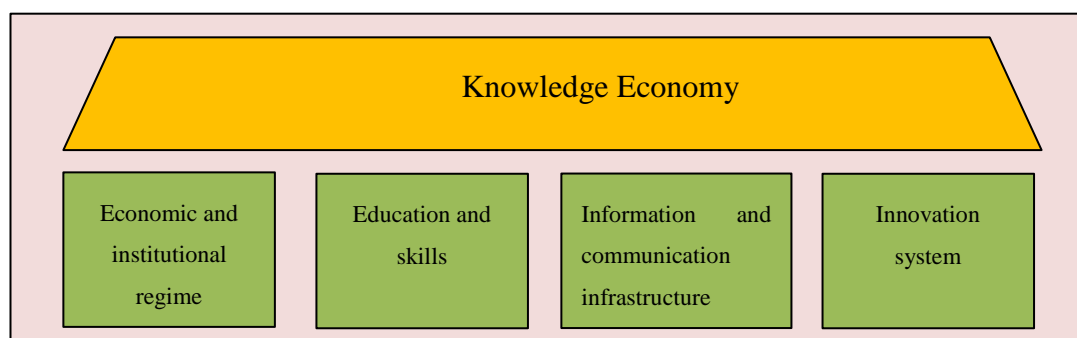


Figure 1.1 Knowledge Economy Framework

Source: The World Bank (2009)

According to knowledge economy framework, successful knowledge economy transformation involves factors like “long-term investments in education, developing innovation capability, modernizing the information infrastructure, and having an economic environment that is conducive to market transactions” (Chen and Dahlman, 2005; pp. 04) and termed these factors as “the pillars of the Knowledge Economy”. Therefore, the Knowledge Economy (KE) framework’s four pillars as proposed by Chen and Dahlman (2005; pp. 04) are:

1. **An economic incentive and institutional regime:** supports “good economic policies and institutions that permit efficient mobilization and allocation of resources and stimulate creativity and incentives for the efficient creation, dissemination, and use of existing knowledge”.
2. **Educated and skilled workers:** “continuously upgrade and adapt their skills to efficiently create and use knowledge”.
3. **An effective innovation system:** “of firms, research centers, universities, consultants, and other organizations that can keep up with the knowledge revolution and tap into the growing stock of global knowledge and assimilate and adapt it to local needs”.
4. **A modern and adequate information infrastructure:** “facilitate the effective communication, dissemination, and processing of information and knowledge”.

The Knowledge Economy framework therefore, emphasizes that investing in the pillars is important and compulsory for persistent creative, adoptive, adaptive and knowledge usage in domestic economic development, which will resultantly give the outcome in term of higher value added manufacturing and services. Consequently, the result would be the enhance probability of economic success and development.

Similar to World Bank, UNESCO (2005) also explains knowledge based economy as an economy which is developed by making use of its diversification and its capacity. Another important aspect given by UNDP (2008) report is that activity of knowledge sharing must be promoted in the knowledge societies. The reason behind this aspect is that the knowledge is considered to be an incentive available for the public; and it would be available for every person in the society.

In the above context, it is understood that the countries are required to simultaneously develop their innovation systems, their education base and their communication and information technology network to develop a competitive economic and institutional system. Innovation development as a part of knowledge based economy can, therefore, be considered as a major factor that improve country's competitiveness and enable it to sustain the swift economic development (Penksa, 2010).

As, in every economic system there exists knowledge assets and in order to make a successful economic system, it is imperative to develop the connections among these assets. This objective can be achieved if the new developmental techniques and extension of knowledge are combined. This research will, therefore, explain how university, industry, government and civil society based innovation development, later on termed as Quadruple Helix innovations, are applicable in the knowledge-based economy and are important for promoting sustainable economic competitiveness and performance.

1.1.2 The Case of Malaysia

The knowledge based economic transformation strategy in Malaysia is part of its broader strategy developed to achieve the goals set for Vision 2020. According to Vision 2020, Malaysia needs to achieve the technological competencies and economic performance at par with the developed nations by 2020 (Ramlee and Abdullah, 2004). In order to achieve the target and to compete in the global market, Malaysia needs to transform its economy to knowledge and innovation based economy in which competition is not based on low cost mass production and low waged unskilled workers but based on innovation, knowledge and creativity (Kefela, 2010). Along with conducive social, political, cultural and security environment to flourish knowledge based economy, Knowledge Economy Based Master Plan of Malaysia (2001) identified certain factors (Table 1.1) that are critical to strengthen country's economic base.

Table 1.1 Knowledge Economy Indicators

Factor	Indicators
Quality of human resources	Literacy; secondary enrolment; tertiary enrolment; enrolment in science and technology-related subjects; science graduates; technical graduates; expenditure on education; thinking and innovation skills; a learning culture; lifelong learning facilities; English language skills; receptivity to change.
(R&D)	Public and private sector expenditure on R&D; personnel in R&D; scientists and engineers in R&D; patents filed.
Infostructure	Newspapers; radios; television; telephone mainlines; mobile telephones; cost of international telephone calls; freedom/availability of information.
Infrastructure	Investment in ICT infrastructure; electricity power; personal computers; Internet hosts; Internet subscribers; Internet usage.
Economy	knowledge workers; knowledge-based industries; knowledge-based services; tacit and codified knowledge; knowledge embodied in work processes and products; (GDP); e-commerce; high-technology exports; venture capital; openness to foreign knowledge workers; entrepreneurship; risk-taking culture.

Source: Knowledge Economy Based Master Plan of Malaysia (2001)

While making efforts towards knowledge based economic transformation, Malaysia has faced problems in the secondary industry due the competition from its neighboring low-wage economies like Thailand and Vietnam. As reported by ASEAN Statistical Yearbook (2008), during the first decade of the 21st century, Thailand and Malaysia faced a declining trend in FDI inflows. For Thailand, FDI regain its pace and again moved up in 2003 and inflows reached US\$ 11,238.1 million in 2007. Indonesia has faced negative trends in FDI inflows due to 1998 financial Crisis. FDI inflows, however, improved vividly to US\$ 8,336 million in 2005. Philippines showed a fluctuated FDI flows during the same period. The trend of FDI inflows in Vietnam remained stable during the period. However, it showed a significant increase from US\$ 2,400 million in 2006 to US\$ 6,739 million in 2007. The trend continued in 2008 with FDI of US\$ 8,050 million, close to the Malaysian FDI during the same period. Due to this growing trend, Vietnam has become known to be the ASEAN's most favorite FDI host countries. In contrast to that, due to the huge drop in 2001, the FDI inflows in Malaysia keep on fluctuating (Changwachai, 2010).

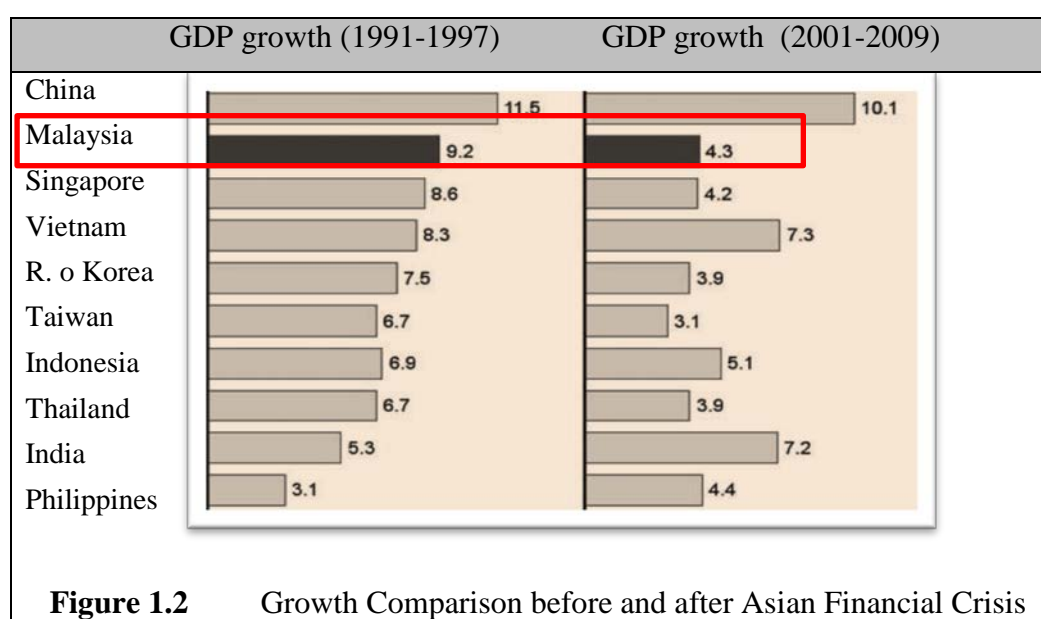
Keating (2010) reported that the emergence of neighboring low wage economies, affect 1980s high foreign direct investment (FDI) level adversely and the foreign direct investment (FDI) from Malaysia started shifting to other countries. Initially, use of immigrant labor in the low wage deregulated labor market was observed to be successful and provide better growth result but in the long run the dependence on low wage unskilled worker has damaged the capacity of the industry and its preferences to invest in technology transfer has been diminished (ILO Report, 2010). Resultantly, the skill development and training cultures in the industry, which rely on low wage worker, could not be developed.

Due to the non-creation of enough high skilled jobs, the share of skilled worker is decreasing across the industrial sector. This situation has a diminishing effect on wage growth. International Labor Organization (ILO) (2010) identified the following weaknesses of the wage sector of Malaysian economy:

- Malaysia has a deregulated economy in which government has high level of interference.

- The government of Malaysia took the measures such as reducing tariffs etc. to open its economy in 80s.
- No regulations like minimum wages have been developed for the Malaysian labor market.
- The unions are also weak and are organization based (ILO Report, 2010).

Along with low wage issues, Malaysian economy also facing hurdles in transforming towards knowledge based economy (K-Economy) transformation. After the Asian crisis of 1997-98, cumulative investment as a share of GDP has shown a declining trend. Productivity growth rate, as mentioned in Figure 1.2, is moving very slowly and has gone down to -1.6% in 2009 (World Bank Report, 2011) which affect the R&D to GDP ratio (Malaysian Science and Technology Indicators, 2010). According to Global Innovation Index (2012) Malaysian Score for R&D to GDP ratio is lowest (0.60 among the competing economies China (1.5), India (0.8), Singapore (2.0).



Source: World Economic Outlook (April 2010), International Monetary Fund

The number of researchers in Malaysia is relatively low as indicated by Malaysian Science and Technology Indicator (2010) that Malaysia only has 924.6 researchers per million population which is comparatively very low as compared to Singapore, Japan and South Korea who have 7059.1, 6934.2 and 6027.6 researchers per million population respectively. Lack of spending on R&D (Table 1.2) resulted

in a deficiency of innovation and creativity in the industrial and export sectors (NEM, 2009). This shows that the determination towards innovation and creation is unsatisfactory.

Table 1.2 GERD/GDP Ratio (%)

Country Name	R&D per GDP (%)	Country Name	R&D per GDP (%)
South Korea	3.47	China	1.49
Japan	3.45	India	0.80
Singapore	2.61	Malaysia	0.24

Source: Malaysian Science and Technology Indicators (2010)

Human capital development is below average and brain drain is the critical issue. Skilled Malaysian immigration rate is on the rise. As reported by Ministry of Human Resources (MOHR) (2008), the skilled Malaysians are leaving the country for better and high income prospects abroad. It is reported that around 350,000 Malaysian youngsters are working overseas, more than half of these expats hold tertiary degree (NEM, 2009). Similarly, the number of expatriate skilled workers in Malaysia is also declining as shown in Figure 1.3 that the overall annual growth rate (CAGR) of expatriate skilled worker has gone down to 9% from 2000 to 2008.

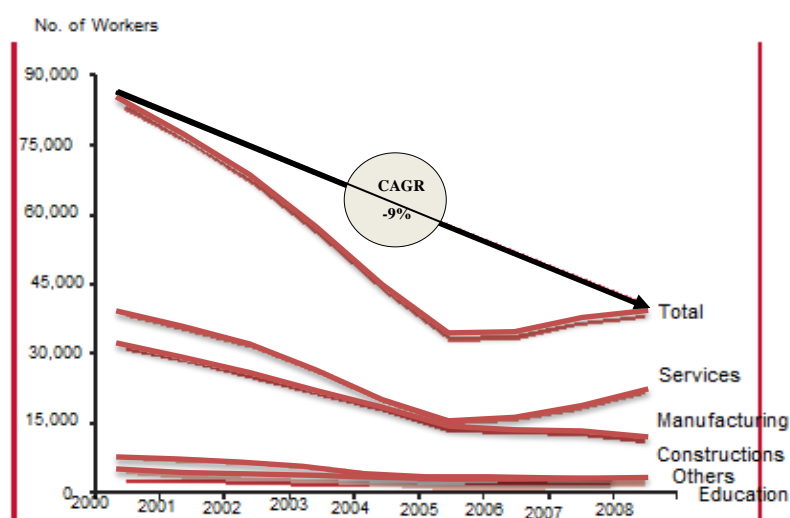


Figure 1.3 Number of expatriates in Malaysia (2000-2008)

Source: Department of Statistics, EPU

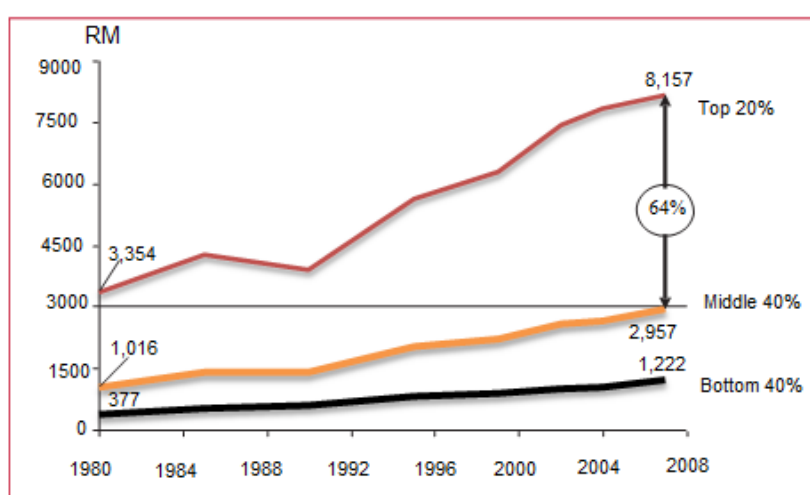
As reported by EPU (2009) that the system of education is weak and is not producing skilled workers as per industry demands. Rich and poor gap is increasing rapidly, despite of reduced poverty level, inequality, remains a big challenge for Malaysia (NEM, 2009).

Table 1.3 Gini Coefficients by Ethnicity and Strata, Malaysia (1970-2007; %)

	1970a	1987	1997	2007
Malaysia	0.513	0.456	0.459	0.441
<i>Ethnic</i>				
Bumiputera	0.466	0.447	0.448	0.430
Chinese	0.466	0.428	0.416	0.432
Indians	0.472	0.402	0.409	0.414
Other	0.667	0.663	0.555	0.546
<i>Strata</i>				
Urban	n.a.	0.449	0.427	0.427
Rural	n.a.	0.427	0.424	0.388

Source: EPU

According to the “Gini coefficient (with the overall Gini coefficient improving from 0.459 in 1997 to 0.441 in 2007), the disparity seem to have increased over the past decade for certain groups”. It has also been revealed that the income growth for top 20% income earners in Malaysia is strong whereas the growth for bottom 40% is the slowest as given in Figure 1.4.



Source: MDI

Figure 1.4 National household income (Average by segment, 1980-2008; RM)

Malaysia is also stuck up with its one of the biggest problem of high rate of savings and low rate of internal investment which is around 33% and 22%, respectively. On the other hand, in China and Singapore, although the saving rates are high but their level of internal investments are also at the higher side (Vietor, 2012).

Although, Malaysia has moved up to the growth ladder from lower to middle income very quickly (Vietor, 2012). As noted by Comin and Abraham (2010) the economic transformation from low to middle income is a bit easier either through the usage of natural resources or by taking the benefit of low cost production and services to attract FDI, as was done in Malaysia, however, this advantage of low cost is short-lived especially, at the time when other low costs economies are emerging. Previously, as identified by Comin and Abraham (2010) following the other economies, Malaysia had also increased its dependence on labor productivity for cost reduction instead of going for the value addition and hence stuck in the middle income trap. Therefore, in order to break this middle income trap Malaysia needs to move its innovation and creativity capabilities, through knowledge economy transformation (Vietor, 2012). Therefore, in these state of affairs, Malaysia cannot compete its neighboring economies on low wage and low cost production basis (National Brains Trust on Education, 2002),. Similar was the observation of Vietor (2012), according to him, “China absolutely dominated low-cost manufacturing and India dominated low-cost services, both of which Malaysia could not compete with” therefore, the only option left is to move towards knowledge based economic transformation which relies on innovation, investment and research, however, in this process of economic transformation Malaysian economy is facing some critical challenges which are discussed in the next section.

1.1.2.1 Challenges to Economic Transformation in Malaysia

As reported by Afzal and Lawrey (2012), Malaysian economy is currently passing through the transition stage i.e. from production based towards knowledge based economy, therefore, like western economies, the industrial sector in Malaysia

needs to work closely with universities and other higher education institutions (World Bank Report, 2007).

While moving on the knowledge transformation track, Malaysian economy is facing some critical challenges. According to Amran (2006) among the industry, the belief has been developed that the universities in Malaysia do not have the capacity to resolve their problem. He further argued that the biggest challenge in Malaysia is to modify the mindset of the industry and the government, which are of the view that the research conducted by the public sector universities is of low quality and has no relevance with the requirements of the industry. It was further argued that the colonial background could be the reason behind the doubts about the Malaysians capabilities and due to this reason industry tends to be “Eurocentric” and prefers to import foreign technology instead of relying on indigenous technology. If efforts have not been made to change such trend, it is feared that the Malaysian economy will continued to be a non-core technology-innovating economy.

Ali (2003) identifies the below mentioned issues and problems:

- The most important sector of the Malaysian economy is the manufacturing sector, especially the electronic industry which is dominated by the foreign investment;
- There is insufficient fund provision for research by the industry and the government;
- The Malaysian venture capital industry is still infant;
- There is a shortage of Research and Development (R&D) scientists who explore the new developmental spheres in the knowledge frontiers;
- There is a lack of culture that promote innovation and entrepreneurial activities;
- There is a mismatch in the objectives of industry and university.

Jarjis (2007) while discussing the problems which are creating hurdles in the efforts of transforming the Malaysian economy to knowledge based economy (K-Economy) furthered the arguments of Ali (2003) and also identified problems like

1. Shortage of qualified and skilled human capital

2. Limited technology transfer
3. Apparent lower quality supplier of education (on the supply side).
4. Preference to use low-skilled and less-paid workers (on the demand side).

The use of low skilled and less paid worker is very common in Malaysia (Juma, 2005) which has developed the tendency for the slow or limited transfer of technology which resulted in low level investment in technology, skill development and innovation. Similarly, Global Competitiveness Report (2010) also identified bureaucratic hurdles, low skilled and inadequately educated and trained workers, corruption and policy instability as obstacles for K-economy transformation.

Hence the discussion can be summed up by concluding that the deficient elements as identified by Ramlee and Abdullah (2004); Juma (2005); Jarjis (2007); Amran (2006); Majumdar (2008); Global Competitiveness Report (2010) and Vietor (2012) includes inappropriately educated and low skilled workers, weak capacity development and training system, deficient R&D capacity, comparatively unstable science and technology base, weaker support from institutions, weak info-structure, weak financial support and as identified by Govindan (2000) lack of technopreneurs.

In order to address the issues Majumdar (2008) suggested that the government-industry-university collaborative effort is one of the solutions and can be helpful in discovering endless possibilities in order to address social, economic and technology-driven challenges and knowledge economy transformation issues.

According to Ramlee and Abdullah (2004) for economic transformation educated, skilled, vibrant, creative, and innovative human capital is required which is difficult to achieve under the old existing production focused system that is currently applicable in Malaysia. Therefore, new skill development, education and employment policies and smart partnerships between sectors are required to transform Malaysia into a knowledge based economy (NEM, 2009).

1.1.3 Knowledge Based Economic Transformation

The knowledge based economic transformation strategy in Malaysia is part of its broader strategy developed to achieve the goals set for Vision 2020 (Knowledge-Based Economy Master Plan, 2001). According to Vision 2020, Malaysia needs to achieve the technological competencies and economic performance at par with the developed nations by 2020 (Ramlee & Abdullah, 2004). In order to achieve the target and to compete in the global market, Malaysia needs to transform its economy to knowledge and innovation based economy in which competition is not based on low cost mass production and low waged unskilled workers but based on innovation, knowledge and creativity (Tenth Malaysian Plan, 2011-2015).

Malaysia, during this transformation phase is influencing with certain transition factors (Ramlee and Abdullah, 2004; Jarjis, 2006; and Kefela, 2010) similar to the factors identified by the researchers like Veugelers (2010); Lall (2002); Blanchard (1996) and Aghion and Blanchard (1994) that are attached with successful transition. The identified factors include macro-economic stability, international integration, the quality of institutions and structural reforms, including political reforms, price/trade liberalization, restructuring of the production system, competition policy and sectoral reforms.

Different empirical studies noted that the transformation factors are highly interconnected, signifying the importance of a systematic transformation. Carlin *et al* (2004) investigated the association between innovation, investment, competition, and development in economies passing through transformation. They indicated that innovation capability enhances the competitiveness. Gorodnichenko *et al.* (2008), confirms that the impact of innovativeness on competitiveness is based on the technological developments. They confirm that FDI and trade play vital role in this situation, particularly vertical transmission of skills in multinational supply chains.

The study conducted by World Bank (2007) suggested the transformation measure for Malaysian economy (Table 1.4).

Table 1.4 Suggested measures to transform to knowledge based economy

No.	SUGGESTED MEASURES
1.	The industry in Malaysian needs to adopt creative ways of production while addressing the shortage of skillful employees which is the main hurdle in producing designing and marketing the innovative products and services. Along with that Malaysia also needs to develop and extend links with local and foreign firms and suppliers.
2.	Malaysian universities should develop a high standard at par with the international universities, in order to keep the balance between the system expansion and quality.
3.	There is a need to develop a long term strategy and vision to enhance the country's capability to establish high ranked universities and becoming a leading economy based on knowledge.
4.	To ensure that the HE sector of Malaysia should be financially secure and stable.
5.	Improving the Employability of Graduates.
6.	The Government of Malaysia should concentrate and develop such policies that create skillful labor, increase opportunities for university graduates and enhance knowledge flow from university to economy.
7.	Malaysia's objective to convert its economy from production to knowledge-based cannot be achieved unless and until the strong university-industry linkages has been developed.
8.	Malaysia's policy to become an innovation based knowledge based economy should accompany the efforts to develop world class university system and to increase the standard of living of the Malaysian people.

Source: World Bank (2007)

In short, growth through technology absorption and/or formation along with R&D capability, technological advancement, infocom infrastructure, market accessibility, competitiveness, availability of well trained, educated and skilled population, highly organized financial sector and, most importantly, excellent institutions and macro-economic stability could be the important drivers for knowledge based transformation that play key role in transforming economies from production based to knowledge based (Veugelers, 2010). Veugelers further suggested that due to interlinking nature these factors should not be studied independently, rather considered as key prerequisites for knowledge-based transformation.

The aforementioned discussion and World Bank's suggested measures have thus made it clear that for knowledge economy transformation four dynamics are vital (a) innovation through research and skill development (b) investment in cutting edge technologies (c) strong inter and intra sectoral linkages and (d) social

development and awareness. These four dynamics have thus magnified the role of four major sectors of economy i.e. University, Industry, Government and Public which are the components of a Quadruple Helix System, an extended version of Triple Helix System.

The Triple Helix System is helpful in growing technology based economic system with the collaborations between university-industry-government. According to Etzkowitz and Leydesdorff (2000), Triple Helix system focused on the network in which the expectations and the communications overlay and gives a new shape to the organizational arrangements between industry, university and government (Turpin et al., 1993; Etzkowitz and Mello 1994; Shinn, 1997, Leydersdorff 1997). With the emergence of innovation from the non-traditional sources and process, a new network of lateral relationship between multiple organizations emerged which develop a new model of the relationship among the institutional spheres and their internal transformation (Leydersdorff, 2011). The idea of Triple Helix according to Asheim (2005) is based on the concept that innovations are thought to be dependent on a coordination of institutional and cultural perspective. Which means that innovation is result of interconnected networks supported by rules, regulations, etc. (Asheim, 2005).

The Triple Helix along with university and industry gives government an equally important role in developing innovation networks (Etzkowitz & Leydesdorff, 2000). However, as identified by Carayannis and Campbell (2009; 2010) a very important player of innovation networking has been neglected in the Triple Helix, which has a key role in networking development. This fourth actor or player is the public or civil society (Afonso et al., 2010; Carayannis and Campbell, 2009; 2010). Public or civil society is organized under the banner of media based and culture based Civil Society Organizations (CSOs) having involved in a non-profit business, and hence reached away from the domain of commercial enterprises, political institutions and scientific academy (Danilda et al., 2009). The participation of CSO has changed the concept of Triple Helix Model of Innovation development by incorporating the fourth helix 'the civil society' and making it Quadruple Helix research collaborations for innovation development (Carayannis and Campbell, 2009).

According to Carayannis and Campbell (2010) the ‘civil society’ helix is an essential factor in all the developments made in the field of innovation and creativity. The National Ecological System of Innovation also gives importance to this helix (Yawson, 2009). Moreover, the addition of ‘civil society’ has got importance because of the social aspect of knowledge in the field of science and technology, evaluation of which has now getting importance increasingly. Therefore, the ‘civil society’ helix is important because it highlight the significance of innovations which have been produced to provide benefits to the society. It develops linkages between scientist, science and strategy for education (Carayannis and Campbell, 2010).

This research has, therefore, been used to identify how the Quadruple Helix research collaboration play role in Malaysian economy to transform it into a knowledge based economy {“an economy where knowledge, creativity and innovation play an ever-increasing and important role in generating and sustaining growth” (Knowledge Economy Based Master Plan of Malaysia, 2001; pp-02)} especially, for the development of knowledge societies using research collaborations as a platform for sustainable development.

1.1.4 Research Gaps

The search for better opportunities has moved the world towards the globalization. Malaysia being a part of global village can exploit the situation and can achieve the level of excellence. On the basis of aforementioned issues/arguments, the following gaps have been identified;

- There exists huge gap between different sectors especially between industry and universities; (Altbach, 2002)
- Quality and level of research, development and innovation activities are not at par with international standards; (Hunt-2005, Ramlee & Abdullah, 2004; Malaysian Science and Technology Indicators, 2010))

- Shortage of high quality human capital necessary for the creation of modern industry with social understanding; (Gill *et al.*, 2003-2005, Lip, in The Star, 2005: 12; Ministry of Human Resources, 2008; NEM, 2009)
- Entrepreneurship culture leading towards the establishment of indigenous high-tech industry is missing; (Leete 2007, Ramlee and Abdullah, 2004).
- Role of the government is needed to be redefined (Aslan, 2006; Genevois, 2008; Keating, 2010).
- The influence of civil society in increasing the level of economic competitiveness and performance has totally been neglected as identified by (Low *et al.*, 2012) since the civil society/public is progressively affecting the result of social order.

It can, therefore, be derived that in the current conducive but competitive environment, the growth initiatives available are whipping out day by day. Thus, to achieve the sustainability in the economic growth and the research expansion, availability and identification of new ideas is more important. A key lesson to be learnt is that in order to capitalize the emerging global trend – or other trends that might emerge in the future – we need investment in latest and high tech innovative system rather than just “hot” areas. An in-depth review of the literature reveals that several research studies have been conducted by the researchers like Ramlee and Abdullah (2005); Govindan (2000); Kefela (2010); Commin and Abraham (2010); Iqbal *et al.* (2011); Vietor (2012); Afzal and Lawrey (2012) and Low *et al.* (2012) on the issue of transformation of Malaysian economy to knowledge based economy. However, very little efforts have been made to find out the success and solution through Quadruple Helix mediation in Malaysia. As the challenges faced by the Quadruple Helix community (Government-University-Industry-Civil Society) could not be addressed individually by either of the stakeholders. Therefore, university, industry, government and publics’ joint efforts are the solution in these states of affairs.

1.2 Research Problem

As identified by 10th Malaysia Plan (2011-2015) few economies have achieved the goal by growing all the way to high income status, most of the middle-income economies lost the momentum of growth due to out-of-date strategies that may have been suitable during the earlier stage of growth. Malaysia's transformation, from a poor economy to an upper middle-income economy was a great success. However, the past achievements could not guarantee continuation of momentum of becoming a high income economy by 2020. Maintaining the status quo is not the option. It will only put Malaysia at risk of being leaving behind by other countries, the way Malaysia had surpassed others in the past. Malaysia on the one hand stuck in a middle-income trap, and on the other hand is sandwiched between fast paced developing and developed nations.

The above discussion has, therefore, highlighted the importance of transformation based on knowledge and innovation for increasing economic competitiveness. In this context, this research is focused on finding the solution for the transformation of Malaysian economy from Production Based Economy (P-Economy) to Knowledge Based Economy (K-Economy) using the Quadruple Helix Innovation as mediator. Therefore, this study measures the Knowledge economy competitiveness with the help of selected transformation factors that determines the economic performance in the mediation of Quadruple Helix Innovation based research collaborations (university, industry, government and civil society).

1.3 Research Objectives

The main objective of this research is to determine whether the Quadruple Helix innovation based research collaborations can be used as a mediator to transform the production based Malaysian economy into knowledge based economy. Malaysia, which is currently passing through the phases of transformation i.e. from

production based to knowledge based, is influencing with certain transition factors (Jarjis, 2006) similar to the countries which during their transition period influenced by these factors of overall development, therefore, to achieve the main objective, it is important to confirm that the drivers necessary for the knowledge based transformation are necessary to improve Malaysian economic competitiveness and support it for sustainable and swift economic development. Therefore, in order to achieve this objective, following sub-objectives of the study have been developed accordingly;

- To assess the factors of economic competitiveness in the knowledge economy.
- To explore the mediating role of Quadruple Helix innovation in increasing the economic competitiveness and economic performance.
- To explore the impact of performance determining variables in determining the overall competitiveness of the knowledge economy using Quadruple Helix research collaborations in Malaysia.
- To identify the actuality of Quadruple Helix innovation based research collaborations in Malaysia.
- To propose a frame work for Malaysian economy based on Quadruple Helix research collaborations

1.4 Research Questions

1.4.1 Main Research Question

Many economies in the world have got success by adopting a knowledge based economic system as a sustainable approach; the approach in which different players of the economy works closely for knowledge and innovation based economic growth and development of the country. This has, thus, highlighted the importance of knowledge and innovation based research collaborations which are identified as

Quadruple Helix innovation based research collaborations, and also develops a need to explore the potential of Quadruple Helix innovation based research collaboration in the context of Malaysian economy. Therefore, the main research question raised is: *Can the Quadruple Helix innovation based research collaborations be used as a mediator to transform the production based Malaysian economy into knowledge based economy?*

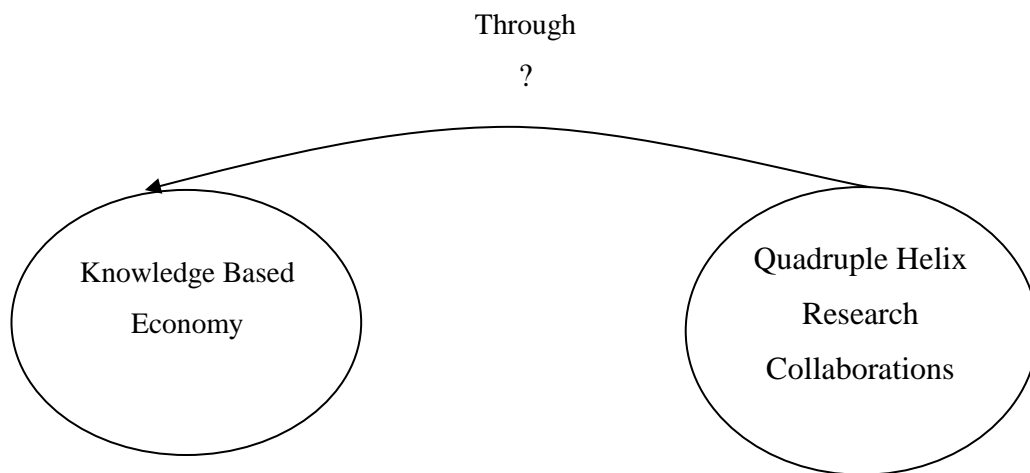


Figure 1.5 Main Research Question

1.4.2 Sub Questions

The main research question is further divided into sub question which are;

- RQ1** What factors are deemed as important to ensure the competitiveness in the knowledge based economy?
- RQ2** Will Quadruple Helix innovation based research collaborations be worked as mediators to ensure the success of knowledge economy?
- RQ3** What is the impact of performance determining variables through Quadruple Helix innovation based research collaborations on the economic competitiveness in knowledge economy?

RQ4 What is the level of Quadruple Helix innovation based research collaborations in Malaysia?

1.5 Purpose of the Study

The capacity of public sector systems are most of the time limited and are burdened with the bureaucratic hurdles, and the physical and administrative infrastructure is strictly remained under the control of public sector, however, the ever increasing development challenges for the economies are constantly demanding improvements in the policy structure and increase in the institutional capacity of the organizations. This situation has thus demanded to explore the possibility of adopting government-university-industry-public partnership as an implementation strategy for developing a mechanism. This issue can, however, be addressed if governments take the initiative for

- i. The identification of best suited model for government-university-industry-public partnership to maintain Malaysia's competitive drive, and
- ii. The development of public support for its implementation (Genevois, 2008).

There is growing concern in Malaysia regarding the need to shift the policy of traditional technology transfer to the system of new innovative technology production. Therefore, this research is designed to find out the solution through the implementation of a Quadruple Helix culture in which government, university, industry and public have a mutually supportive but dependent relationship. In this culture, universities have been assigned with a leading role for the provision of sustainable basis for innovation and technological progress as suggested by Saad *et al.* (2008). It will also be used to explore the possible ways to establish a link between government-university-industry-public and to search out a workable frame work in this context which in general considered as;

1. a joint collaboration in a responsible way to develop a solutions 'through sharing' with other sector's solutions, expertise and skills.

2. a multidimensional approach which can be used for political support, provision of better professional services, management of resources, financing issues, innovative solutions, and accountability.
3. a remedial measure for issues linked to innovation, research and development, cost of training, internationalization and other issues like quality, technology advancement etc.

This research has, however, been conducted with the hope that it will provide a valuable solution to the policy-makers in Malaysia who are engaged in developing high-tech innovation based economic system through university-industry-government-public interaction and linkages.

1.6 Rationale of the Study

The Third Outline Perspective Plane 2001-2010 shows that during the early period of economic growth till mid-90s, Malaysia was mostly dependent on capital investment as a driving force for economic development. Its strategy has later on been shifted from input based to productivity based. The reason to adopt this change was the declining trends shown by the marginal productivity of capital indicators, reflected by the increasing incremental capital output ratio.

The Seventh Malaysian Plan has adopted the idea of increase in the input to output of total factor productivity (TFP) as an important strategy. The Seventh Plan showed the slow transition to a productivity-driven economy. The reason of this slow transition was the large investments having long maturity periods along with the 1997 financial crises which have also impacted the decline in the output. Shortage of skilled workforce and technology development are also one of the contributing factors (Third Outline Perspective Plane 2001-2010- OPP3).

The comparison through input-output analysis revealed that knowledge-based industries have higher productivity level as compare to non-knowledge industries (Hussain 2009). This high tech and knowledge based productivity will provide new

opportunities for investment. The knowledge-based economy also contributes towards the improvement of productivity and investment. It will also develop the long-run growth potential and provide the foundation for persistent sustainable growth for the Malaysian economy. Therefore, the rationale behind this study is to search a strong mechanism for the Malaysian economy, by using the Quadruple Helix innovation based research collaboration to support the establishment of knowledge based economic system, which could ensure the high technology innovation based productivity in the economy; this would thus aid the integration of the national economy.

1.7 Significance of the Study

In the current global economic back drop, the growth opportunities available in the economic system are diminishing day by day, whereas, the resources available with the economic actors such as university, industry, government and public are still not properly utilized. These underutilized resources can be used to address the challenges and to develop a win-win situation for all the stakeholders in the Malaysian economic system. This position can be obtained by combining the resources and expertise of all actors involved.

The collaboration of government with university and industry has shown great success in the developed countries (Penkasa 2010). This success has been achieved by pooling the resources, expertise and capacities of public, university, government and industry, which either of the party may not achieve acting alone. The approach was developed on the idea that different sectors have expertise in different fields and these core competencies and resources if joined appropriately, will result in positive development of advanced services (Ingram *et al.*, 2006).

The literature on innovation success (Saad *et al.*, 2008; Amran 2006; Mohar *et al.*, 2009; Majumdar, 2008) revealed that transforming into knowledge economy in Malaysia demand modifications in the governance structure, the specialized and

expanded revenue generation activities, greater university-Industry linkage, need based R&D activities and the adoption of corporate managerial practices. This expansion and diversification has thus redefined the role of Malaysian government, university, industry and civil society (Lee *et al.*, 2000) and therefore, increased the significance of this research because it

- Provides a road map which will open new investment pathway for Malaysia.
- Provides help in exploring the opportunities and successes obtained through linkages between government, university, industry and public.
- Provides information which encourages the entrepreneurs to create profitable high tech business ventures.
- Provides help to develop a mechanism using Quadruple Helix strategy to provide support to business functions through technical up-gradation, providing expert academia, high quality R&D and advisory forums.

The results of the study will be significant for Malaysian universities, industry government and public in a way that the outcomes of this research will be used to develop a framework for Malaysian economy based on Quadruple Helix research collaborations.

1.8 Scope of the Study

Researchers like Altbach (2002); Hunt (2005); Ramlee & Abdullah (2004); Leete (2007) and Genevois (2008) reveals the fact that in Malaysia, there is a shortage of quality skilled human resource required for the development of competitive economy. Hence, there is a need to strengthen the linkages between the major actors of knowledge economy especially, the university whose contribution is comparatively low towards the development of industrial sector of Malaysia. This research is, therefore, aimed to measures the Knowledge economy competitiveness with the help of selected transformation factors that determines the economic performance in the mediation of Quadruple Helix Innovation. This study thus, provides a framework that can be used to overcome the capacity deficiencies in

Malaysia by developing the partnership among university, industry and government using Quadruple Helix concept.

Through this research, we will also search out the possibility of implementation of Quadruple Helix research collaborative system and its range of success in Malaysia. Simply this research will explore

- The potential and provide new insights into knowledge-based innovation systems.
- The policy frame work for transforming the Malaysian P-economy to K-economy.
- The strategy for the emergence of innovative and learning society through the implementation of the Quadruple Helix innovation based research collaboration which provides the basis for sustainable development.
- Measures to improve the inter and intra connectivity between four spheres of k-economy i.e. university, government, industry and public

Since the study is conducted to develop a frame work to transform Malaysian economy towards knowledge based economy using quadruple helix innovation based research collaboration, thus, the major players in the knowledge transformation are the institutes where research and knowledge development is the main focus. Therefore, it is found appropriate that the R&D and knowledge management experts from university and innovative business developers from business, people involve in knowledge economy policy making from government and the knowledge and innovation supporters from civil society should be taken as respondents in the study (Tornatzky *et al.*, 2002; Siegel *et al.*, 2004; Horng and Hsueh, 2005). For that reason and in line with the objective, the scope of the study covered those universities which have more focus towards research and development, therefore, five research universities of Malaysia i.e. Universiti Sains Malaysia (USM), Universiti Malaya (UM), Universiti Teknologi Malaysia (UTM), Universiti Utara Malaysia (UUM), Universiti Putra Malaysia (UPM), have been selected. R&D based companies within Malaysia (for that purpose thirty six R&D based companies were selected), government agencies with major involvement in knowledge based transformation such as Ministry of Higher Education (MOHE), Ministry of Science

Technology and Innovation (MOSTI), Malaysia Science and Technology Information Center (MASTIC), Economic Planning Unit (EPU), Research Management Centers (RMC), Malaysia Intellectual Property Corporation (MIPC), Standards & Industrial Research Institute of Malaysia (SIRIM), Ministry of International Trade and Industry (MITI), etc. and civil society organizations (CSOs) involved in creating awareness and research and development planning such as Foundation for Poverty Eradication, Amanah Ikhtiar Malaysia, The International Movement for a Just World (JUST), Perdana Global Peace Foundation, Transparency Malaysia.

1.9 Limitations

The scope of the study is limited. This study is bound by regional proximity to Malaysia, and may not be a true representation of all Asia Pacific economies.

This research is conducted to search out the innovation capacity and competitive capability of Malaysian industry, government, university and civil society and hence pointing out the loop holes in the system and also provide a solution for the transformation from Production economy to Knowledge economy on the basis of information collected during the literature review. However, several constraints create slight deviations in getting ideal results. For instance, time and money were the major limiting factors during the study.

Another major limitation to this study was the cooperation of participants and honesty in replying the answers to the survey questions. Since, relatively less information is available which influence the accuracy in random selection methodology, therefore, convenience sampling (non-probability sampling) is adopted to collect the data, which is another limitation in the study. The bureaucratic structure of government and resistance to share the information has also created some hindrances especially during the data collection and the response received from government departments is not encouraging. Due to the unorganized nature of civil society, the only possibility of getting media based culture based civil society

representativeness is from civil society organizations (CSOs). As the civil society sector is not well developed and highly organized in Malaysia, therefore, selecting CSOs for civil society representation is also one of the limitation of this study. All efforts have, therefore, been made to keep the research as unbiased and precise as possible.

1.10 Operational Definitions

Knowledge Economy -- In the Malaysian perspective the definition of knowledge economy is “an economy in which knowledge, creativity and innovation play an ever-increasing and important role in generating and sustaining growth. ...In a k-based economy, educated and skilled human resources, or human capital is the most valuable asset”.

Secondary Industry – “The industry which develops the products for the consumers such as automobile manufacturing, steel production and telecommunications is known as secondary industry”

High-Tech Industries – “The Organization for Economic Co-operation and Development (OECD) identifies high-tech industries based on a comparison of industry R&D intensities, a calculation dividing industry R&D expenditures by industry sales. Industries identified as high-tech are: aerospace, pharmaceuticals, computers and office machinery, communication equipment, and scientific (medical, precision, and optical) instruments. They are considered as science-based industries that manufacture products while performing above-average levels of R&D”.

Knowledge-Based Industries – “The term knowledge-based industries usually refers to those industries which are relatively intensive in their inputs of technology and/or human capital”.

Infostructure -- “Infostructure is the production and distribution of knowledge and information, rather than the production and distribution of things”.

Technopreneur – “The technopreneur is a bold, imaginative deviator from established business methods and practices who constantly seeks the opportunity to commercialize new products, technologies, processes, and arrangements”.

“Intellectual property – A product of intellect that has commercial value including copyright property such as literary or artistic works, and ideational property, such as patents, geographical of origin, business methods and industrial processes”

“Technology transfer – the transfer of research results from universities to the commercial sector and vice versa. It can occur in many ways i.e. through writings, speech, the physical transfer of a tangible product of research or through the relative complexity of an intellectual property licensing program”

Competitiveness -- competitiveness is "the ability to produce goods and services that meet the test of international competition while citizens enjoy a standard of living that is both rising and sustainable".

“Economic competitiveness-- a country is considered to be economically competitive, if it has a strong innovation base, educated and trained workforce, specialized human resource, competitive infrastructure, favorable business environment, stable political environment, knowledgeable entrepreneurs and a highly developed info-structure”.

1.11 Plan of the Thesis

The first chapter of this thesis gives the background of the research. This portion provides the general discussion about Triple Helix Model and also about the ‘public as a fourth helix of Quadruple Helix research collaborations. In the later section while discussing the Case of Malaysia, the issues and problems faced by the Malaysian economy due to rapid changes in world economic system were discussed. The transformation of economy from production to knowledge based with reference to Malaysia is also come under discussion. The reasons to conduct study are discussed under the heading “Purpose of the Study”. The literature in the chapter is

used to identify the problem areas based upon which research problems, research questions and research objectives have been finalized. The last part of the chapter provides the significance, scope and limitations of this research.

Chapter II is devoted to a review the evolution of the concepts of Triple Helix System, its shapes and types, advantages and disadvantages. A new idea of using public as a fourth helix in the innovation model has also come under discussion. Later on in the chapter, it is discussed that How & Why the Quadruple Helix Model can be help full in the current economic situation in Malaysia. The successes achieved by implementing Triple Helix in different developed and developing economies are also come under discussion. The review of literature starts by discussing history, importance and benefits of Triple Helix model. The significance of adopting public as a fourth helix has also been come under discussion. During the discussion the role of government, university, industry and public is highlighted with reference to the current discussion and also the importance of collaborations between university, industry, government and public come under discussion. More emphasis is given towards the new innovation system which is supposed to be evolved in case of adoption of Quadruple Helix model in Malaysia. This whole discussion leads towards the establishment of theoretical framework and conceptual model(s).

Chapter III gives an overview of the research methodology and the design for research along with sampling frame for the study. This research will be conducted using mixed mode technique of quantitative and qualitative research methods. The results in the research will be obtained with the help of primary and secondary data. In the 1st chapter four research questions have been developed. In order to achieve the answer for RQs, quantitative research technique has been used. A survey through questionnaire was used to perform a balanced and detailed analysis of important issues and questions developed during the review of literature. The answers obtained have been analyzed through factor analysis, correlation, regression and online Sobel Test techniques.

In the fourth chapter the data collected have been analyzed using Statistical Package for Social Scientists (SPSS) and online Sobel Test. Results obtained have been used to develop the findings of the study.

In Chapter V, the conclusion from the research analysis and findings have been drawn and a comprehensive discussion have been made on the research findings. Finally, based on research findings, recommendations have been put forward.

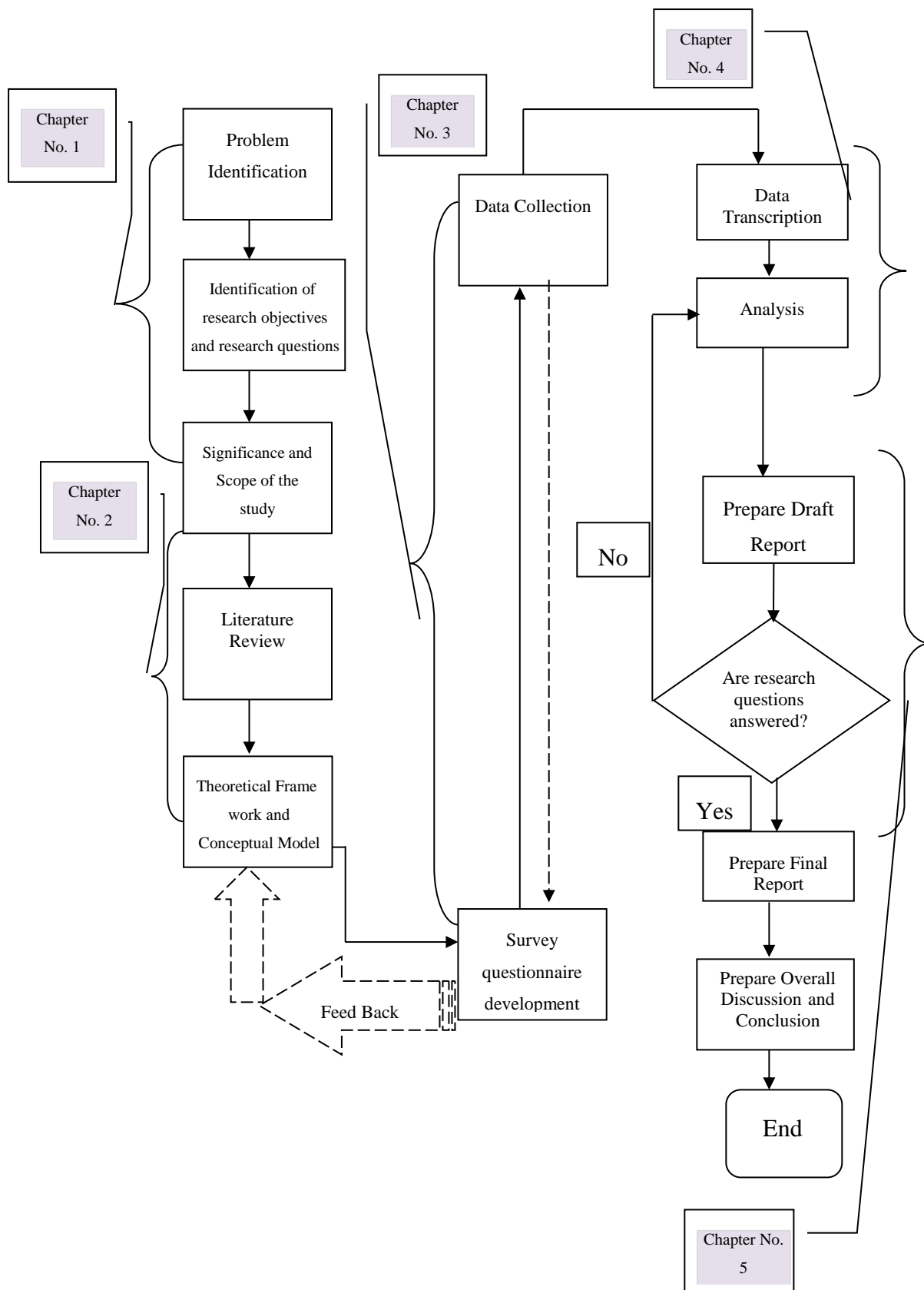


Figure 1.6 Plan of Thesis

REFERENCES

- Abramovitz, M. (1986) 'Catching up, forging ahead and falling behind',
Journal of Economic History 46, 2, 386-406
- Acemoglu and Robinson (2003). Economic backwardness in political
perspective, NBER working paper, NO 8831, March, available at
<http://www.nber.org/papers/>
- Afonso, O., Monteiro, S. and Thompson, M. (2010). A Growth Model for the
Quadruple Helix
- Afzal, M.N.I. and Lawrey, R. (2012). Knowledge-based Economy (KBE)
Frameworks and Empirical Investigation of KBE Input-output Indicators
for ASEAN. International Journal of Economics and Finance; Vol. 4, No.
9
- Aghion, P. and Blanchard, O. (1994) 'On the Speed of Transition in Central
Europe', NBER Macro Annuals
- Agrawal, A. (2001), "University-to-industry knowledge transfer: literature
review and unanswered questions", International Journal of Management
Reviews, Vol. 3 No. 4, p. 285.
- Ahmad D. R. and Rabelo, L.C. (2009), "Assessment Framework for the
Evaluation and Prioritization of University Inventions for Licensing and
Commercialization", Engineering Management Journal. 18(4), 28-36.
- Alan S. B. (2006). Offshoring: The Next Industrial Revolution? Foreign
Affairs. Vol. 85, No. 2. Pp- 113-128
- Alatas, S. H. (1977) - The Myth of the Lazy Native (London: Frank Cass).

- Aldrich, H. E., and Baker, T. B. (1997), "Blinded by the cites? Has there been progress in entrepreneurship research?," *Entrepreneurship* 2000, 377-400.
- Ali, A. (2003), *Engaging economic development through the commercialization of research: the Malaysian experience*. Paper presented at the General Conference of the Association of Commonwealth Universities, 31 August–4 September, Belfast.
- Altacit Global (2004), *Knowledge Based Economy: Role of IPR*. Altacit Global, Strategic Consultants for Intellectual Property. Symposium on "Intellectual Property Law in India: Challenges and Promises" Symbiosis International Educational Centre (Deemed University) Symbiosis Society's Law College, November 20th, 2004, Pune, India
- Altbach, P.G. (2002), *The Decline of the Guru: The Academic Profession in Developing and Middle Income Countries*. (Commercial edition published by Palgrave Publishers, New York and London.
- Amabile, T. M., Patterson, C., Mueller, J., Wojcik, T., Odomirok, P. W. and Marsh, M. (2001). Academic-practitioner collaboration in management research: A case of cross-profession collaboration. *The Academy of Management Journal*, 44 (2), 418-431. Available from <http://dx.doi.org/10.2307/3069464>
- Amran R. (2005). *Commercialization of UTM Research Findings: Problems and Challenges*. Working Paper 22, Proceeding of Innovasia 2005 at Bangkok, Thailand, 21-24 September 2005.
- Amran R. (2006), "Data analysis and interpretation: A handbook for postgraduate social scientist", Skudai, Johor: Universiti Teknologi Malaysia.
- Ariff, M., (1991), 'Managing Trade and Industry Reforms in Malaysia', in Ostry, S. (Ed), *Authority and Academic Scribblers: The Role of Research in East Asian Policy Reform*, ICS Press, California.
- Arnkil, R. Järvensivu, A. Koski, P and Piirainen, T. (2010). *Exploring Quadruple Helix: Outlining user-oriented innovation models*. Final

- Report on Quadruple Helix Research for the CLIQ project. Työraportteja 85/2010 Working Papers. University of Tampere, Institute for Social Research.
- Arocena, R. and Sutz, J. (2005). Innovation Systems and Developing Countries. Danish Research Unit for Industrial Dynamics (DRUID) Working Paper No 02-05. JEL: O31, O14, O54 ISBN 87-7873-121-6
- Arrindell, W. A. and Van de Ende, J. (1983), "An empirical test of the utility of the observation-to-variables ratio in factor and components analysis", *Applied Psychological Measurement*. 9, 165-178.
- Arrow K. (1962). The Economic Implications of Learning by Doing, *The Rev. Econ. Stud.*, 29(3): 155-173.
- Asheim B. T. (2005). Kluster, regionala innovationssystem och lärande regioner (Cluster, regional innovation systems and learning regions. In Benner Mats (ed). (Innovationer – dynamik och förnyelse i ekonomi och samhällsliv (Innovations –dynamics and renewal in economy and society). Lund: Studentlitteratur.
- Aslan, A. S. (2006). University-Industry Research and Technological Links in Malaysia. A PhD Thesis submitted at The University of Manchester, UK.
- ASM (2000). National Science and Technology Policy 2: 2000-2010 Building Competitiveness in a Knowledge Driven Economy. Kuala Lumpur, Malaysia, Academy of Sciences Malaysia.
- Association of Southeast Asian Nations Secretariat, (2008), ASEAN Statistical Yearbook 2008. Jarkata: ASEAN Secretariat.
- Atkinson, R. Andes, S. Ezell, S. Castro, D. Hackler, D. and Bennett, R. (2010) "Innovation Policy on a Budget: Driving Innovation in a Time of Fiscal Constraint," Information Technology and Innovation Foundation, <http://www.itif.org/files/2010-innovation-budget.pdf>.
- Atkinson, R.D. (2007). Deep Competitiveness. Issues in Science and Technology. Pp 69-75

- Baba, Y., Shichijo, N., and Sedita, S. R. (2009). How do collaborations with universities affect firms' innovative performance? The role of "Pasteur scientists" in the advanced materials field. *Research Policy*. Available from <http://dx.doi.org/10.1016/j.respol.2009.01.006>
- Baldwin, R. E. (2005). "Heterogenous Firms and Trade: Testable and Untestable properties of the Melitz Model", NBER working paper 11471.
- Balzat, M. and Hanusch, H. (2004) "Recent Trends in the Research on National Innovation Systems." *Journal of Evolutionary Economics*, 14, pp.197-210.
- Barkley, D.L, Markley, D. M., Freshwater, D., Rubin, J. S. and Shaffer, R. (2001), "Rural Policy Research Institute's (RUPRI) Rural Equity Capital Initiative". P2001-11A Part 1 of 4 of the Final Report, RUPRI, Rural Equity Capital Initiative Study of Nontraditional Venture Capital Institutions. Retrieved from the RUPRI website (www.rupri.org/pubs/equitycap/index.html)
- Baron, R. M. and Kenny, D. A. (1986) The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, Vol. 51, No. 6, 1173-1182
- Barro, R.J. and J.W. Lee. (1996). International Measures of Schooling Years and Schooling Quality. *American Economic Review*, 86, 218 -23.
- Beghin, J. C. (2006), "Nontariff Barriers" Working Paper 06-WP 438, Center for Agricultural and Rural Development Iowa State University, Ames, Iowa 50011-1070.
- Belkhdja, O. and Landry, R. (2007). The triple helix collaboration: why do researchers collaborate with industry and government? What are the factors that influence the perceived barriers? *Scientometrics*, Vol. 70, No. 20. Pp 301-332
- Benneworth, P. S. (2004). Bringing Cambridge to Consett? Economic development policies for university spin-offs in old industrial regions. *Regions* 259: 17-22

- Blanchard, O. (1996) 'Theoretical Aspects of Transition', American Economic Review Papers and Proceedings, May 1996, 117-122
- Blinder, A. S. (2000). The Internet and the new economy, http://www.internetpolicy.org/briefing/1_00.html .
- Blomström, M. and Kokko, A. (1998) 'Multinational Corporations and Spillovers', Journal of Economic Surveys 12, 3, 247-277
- Boden, R., Cox, D., Nedeva, M. and Barker, K. (2004) *Scrutinising Science : The Changing UK Government of Science*. Houndmills, Basingstoke, Palgrave Macmillan.
- Bogdan, R. C. and Biklen, S. K. (1982), "Qualitative Research for Education: An Introduction to Theory and Methods". *Boston, Allyn and Bacon Inc.*
- Braczyk, H., Cooke, P. and Heidenreich, M. eds. (1998) *Regional Innovation Systems: The Role of Governances in a Globalized World*. London, University College of London.
- Bradshaw, T. K., & Blakely, E. J. (1999). What are "Third-Wave" State Economic Development Efforts? From Incentives to Industrial Policy. *Economic Development Quarterly*, 13(3), 229-244.
- Brennan, J. King, R. and Lebeau, Y. (2004). The Role of Universities in the Transformation of Societies: An International Research Project, Synthesis Report. Association of Commonwealth Universities, London.
- Brinkley, I. (2010) Innovation, Creativity and Entrepreneurship in 2020, The Work Foundation Statement, <http://snipurl.com/108gxq>
- Brinkley, I. (2010), "Knowledge Economy Strategy 2020. The Work Foundation submission to the Comprehensive Spending Review. Pp 1-31.
- Brouwers, J. Duivenboden, H.V and Thaens, M. (2009). The Triple Helix Triangle: Stimulating ICT-driven Innovation at Regional Level. *2009 Annual Conference of EGPA, Malta*
- Bruton, H. (1992) - Sri Lanka and Malaysia: the political economy of poverty, equity, and growth (New York: Oxford University Press).

- Buckley, S., Duer, K., Mendel, T Seán O' Siochrú, Price, M. E. and Raboy, M. (2008), "Broadcasting, Voice, and Accountability: A Public Interest Approach to Policy, Law, and Regulation". The International Bank for Reconstruction and Development, The World Bank Group. Published in the United States of America by The World Bank Group.
- Bundy, C. (1979) - *The Rise and Fall of the South African Peasantry* (London: James Currey).
- Cahyadi, G. Kursten, B. Weiss, B. and Yang, G. (2004). *Singapore's Economic Transformation. Global Urban Development Singapore Metropolitan Economic Strategy Report*
- Caldentey, E.P. (2008). *The Concept and Evolution of the Developmental State. International Journal of Political Economy*, vol. 37, no. 3, pp. 27–53.
- Carayannis E. G. and Campbell D. F. J. (2009). 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*. Vol 46. No 3-4. Page 201-234.
- Carayannis, E. G. and Campbell, D. F. J. (2010). *Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? A Proposed Framework for a Trans-disciplinary Analysis of Sustainable Development and Social Ecology. International Journal of Social Ecology and Sustainable Development* 1(1),41-69.<http://www.igi-global.com/Bookstore/Article.aspx>
- Carlin, W., Schaffer, M. and Seabright, P. (2004) 'A Minimum of Rivalry: Evidence from Transition Economies on the Importance of Competition for Innovation and Growth', *contributions to Economic Analysis and Policy*, Berkeley Electronic Press, vol. 3(1), pages 1284-1284
- Carlsson, B. (1995) "On the Nature, Function and Composition of Technological Systems." In: Carlsson, B., ed. *Technological Systems and Economic Performance: The Case of Factory Automation*. Dordrecht, Kluwer, pp.21-56.

- Carlsson, B. and Stankiewicz, R. (1991) "On the Nature, Function and Composition of Technological Systems." *Journal of Evolutionary Economics*, 1(2), pp. 93-118.
- Carlsson, B. ed. (1995) *Technological Systems and Economic Performance: The Case of Factory Automation*. Dordrecht, Kluwer.
- Carlsson, B. ed. (1997) *Technological Systems and Industrial Dynamics*. Dordrecht, Kluwer.
- Castro, D. Atkinson, R and Ezell, S. (2010) "Embracing the Self-Service Economy," Information Technology and Innovation Foundation, <http://www.itif.org/files/2010-self-service.pdf>.
- Changwachai, P. (2010), "The Determinants of FDI Inflows by Industry to ASEAN (Indonesia, Malaysia, Philippines, Thailand, and Vietnam). Department of Economics, The University of Utah.
- Chen, D. H. C. and Dahlman, C. J. (2005), "The Knowledge Economy, the KAM Methodology and World Bank Operations". The World Bank. Washington DC, USA.
- Child, J., Faulkner, D. and Tallman, S. B. (2005). *Cooperative Strategy: Managing Alliances, Networks, and Joint Ventures*. Oxford University Press, Oxford.
- Coenen, L and Asheim, B. T. (2005), Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy* 34 (2005) 1173–1190
- Coenen, L., (2007). The role of universities in the regional innovation systems of the North East of England and Scania, Sweden: Providing the missing links? *Environment and Planning C* 25(6): 803-821.
- Cohen, W.M. and Levinthal, D.A. (1990) 'Innovation and Learning: The Two Faces of R&D', *Economic Journal* 99, 569-596
- Coleman, J. S. (1988) 'Social capital in the creation of human capital', *American Journal of Sociology* 94: 95-120.

- Collins, J. (2013). Defining Knowledge Based Economy. Retrieved from <http://www.alphadevx.com/a/18-Defining-the-Knowledge-based-Economy>
- Comin, D. and Abraham, J. (2010). Malaysia: People First. Harvard Business School Publication.
- Comrey, A. L., & Lee, H. B. (1992). A first course in factor analysis (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cook, P. (2002). Regional innovation systems: general findings and some new evidence from biotechnology clusters. *Journal of Technology Transfer* 27:133–145.
- Cook, P. (2004). The role of research in regional innovation systems: new models meeting knowledge economy demands. *International Journal of Technology Management*, 28(6): 507-528.
- Cook, W. J. 1998. Maximum merger. *U.S. News & World Rep.* May 18 124(19) 45-47.
- Cooke, P., Gomez, U. and Etxebarria, G. (1997) "Regional Innovation Systems: Institutional and Organizational Dimensions." *Research Policy*, 26(4/5), pp.475-491.
- Cooper, D.R. and Schindler, P.S. (2000), "Business research method (7th. Edition)", New York, McGraw-Hill/Irwin.
- Creswell, J. W. (2003), "Research Design: Qualitative and Quantitative Approaches," *Thousand Oaks*, CA: Sage Publications.
- Dalmarco, G. Dewes, M. D. Zawislak, P. A. and Padul, A. D. (2010). Universities' intellectual property: path for innovation or patent competition? 5th Annual Conference of the EPIP Association - September 20-21, 2010
- Danilda I, Lindberg M & Torstensson B-M (2009). Women resource centres - a quattro helix innovation system on the European agenda. Paper presented at Triple Helix VII, 17-19 June, Glasgow, UK.

- David, M. and Sutton C.D. (2004). *Social Research the Basics*. London: SAGE Publications.
- Denzin, N. K., and Lincoln, Y. S. (2005), *Collecting and Interpreting Qualitative Materials*”, Thousand Oaks, CA: Sage Publications. 3, 1-34.
- Dong, L. and Glaister, K. W. (2006). Motives and partner selection criteria in international strategic alliances: perspectives of Chinese firms. *International Business Review*, Vol. 15(6): 577-600.
- Dosi, G., Freeman, C., Nelson, R., Silverberg, G. and Soete, L. eds. (1988). *Technological Change and Economic Theory*. London, Pinter.
- Doutriaux, J. (2003). University-industry linkages and the development of knowledge clusters in Canada. *Local Economy* 18(1): 63-79.
- Drucker P.F. (Ed.) (1998). *From Capitalism to Knowledge Society. The Knowledge Economy*, Woburn MA: Butterworth
- Economic Analytical Unit Australia (2005). *Knowledge Based Economy and Society (KBE/S) Framework and Indicators*. Australian Bureau of Statistics. Asia-Pacific ICT Technical Meeting. Wellington, New Zealand
- Economic Planning Unit (2001). *The Knowledge Based Economy Master Plan*, Retrieved from: <http://www.epu.gov.my/knowledgebased>
- Economic Planning Unit (2002) *The Knowledge Based Economy Master Plan*, online: <http://www.epu.gov.my/knowledgebased>
- Economic Planning Unit (2013) *The Knowledge Based Economy Master Plan*, online: <http://www.epu.gov.my/keyeconomicindicators>
- Economic Research Services Department. (2000). *Special economic issue*. Kuala Lumpur,
- Economic Transformation Program (ETP) (2011). Retrieved from etp.pemandu.gov.my
- Edquist, C. (2004) "Reflections on the Systems of Innovation Approach." *Science and Public Policy*, 31(6), pp.485-489.

- Edquist, C. (2005) "Systems of Innovation: Perspectives and Challenges". In: Fagerberg, J., Mowery, D. and Nelson, R., eds. *The Oxford Handbook of Innovation*. Oxford, Oxford University Press, pp.181-208.
- Edquist, C. ed. (1997) *Systems of Innovation: Technologies, Institutions and Organisations*. London, Pinter.
- Eisinger, P. (1997). *The rise of the entrepreneurial state*. Madison WI: University of Wisconsin Press
- Etzkowitz, H. and Webster (1998a). The Triple-Helix as a model for innovation studies. *Science and Public Policy* 25(3): 195-203.
- Etzkowitz, H. (2008). *The Triple Helix: University–Industry–Government Innovation in Action*. New York and London: Routledge.
- Etzkowitz, Dzisah, Ranga and Zhou (2007). Professors of practice and the entrepreneurial university. *International Higher Education* 49:10–11.
- Etzkowitz, H. and Mello, J. M. C. D. (1994) "The Rise of Triple Helix Cluster: Innovation in Brazilian Economic and Social Development", *International Journal of Technology and Management & Sustainable Development*, 2:3, pp. 159-171
- Etzkowitz, H. (2002) *MIT and the Rise of Entrepreneurial Science*. London: Routledge.
- Etzkowitz, H. (2002). "Incubation of Incubators: Innovation as a Triple Helix of University-Industry-Government Networks." *Science and Public Policy* 29:115-128.
- Etzkowitz, H. (2002). *The Triple Helix of University - Industry – Government Implications form Policy and Evaluation*. Working Paper 2002-11. Science Policy Institute. Stockholm.
- Etzkowitz, H. and J. Dzisah. . "Route 128 and Silicon Valley: Towards A Spiral Model of Regional Growth and Renewal ". *European Planning Studies*.

- Etzkowitz, H. and Leydesdorff, L. (2000). The dynamic of innovation: from National System and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy* 29.
- Etzkowitz, H. and Roest, M. (2008), "Transforming University-Industry-Government Relations in Ethiopia" Ethiopia Triple Helix Conference Proceedings. International Organization for Knowledge Economy and Enterprise Development (IKED). Pp
- Etzkowitz, H. and Roest, M. (2008), "Triple Helix Approach & Lessons to Ethiopian Universities", IKED Publications, Malmö, Sweden
- Etzkowitz, H. and Webster, A. (1998b). *Entrepreneurial Science: A second Academic Revolution. Capitalizing Knowledge: The new Intersection of Industry and Academia*, pp 21-46. New York State University of New York Press.
- Etzkowitz, H., (1983). *Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science*, Minerva.
- Etzkowitz, H., and Leydesdorff, L. (2001). "The Transformation of University-industry-government Relations." *Electronic journal of Sociology*.
- Etzkowitz, H., Dzisah, J., Ranga, M. and Zhou, C. (2007). The Triple Helix model of innovation: University-industry-government interaction. *Tech Monitor, Special Feature: The Triple Helix Model for Innovation*, pp 14-23.
- Etzkowitz, H., Schuler, E. and Gulbrandsen, M. (2000), "The Evolution of Entrepreneurial University." Pp. 40-60 in *The Future of Knowledge Production in the Academy*, edited by Merle Jacob and Tomas Hellstrom. Ballmoor, Buckingham: Open University Press.
- European Commission (1999). *The On-going Evaluation of Regional Innovation Strategies*, p. 120. Brussels:
- Evans, P. (1995). *Embedded Autonomy: States and Industrial Transformation*. Princeton: Princeton University Press.

- Fagerberg, J. Mowerey, D. C. Nelson, R. R. (2006). The innovative firm. The Oxford Handbook of Innovation: pp 29-56. Oxford: Oxford University Press.
- Far Eastern Economic Review, (1991), Far Eastern Economic Review March 28, 1991: 51
- Field, A. (2005), "Discovering statistics using SPSS (2nd. Edition), London: Sage Publication.
- Florida, R. (1999), The role of the university: leveraging talent, not technology, Issues in Science and Technology Online, Summer 1999, www.nap.edu/issues/15.4/florida.htm .
- Floyd F.J. and Widaman K.F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. Psychology Assess Vol. 7: pp. 286-99
- Fong C.O. (2006). Developing Human Capital - The Way Forward: Managing Human Capital In the Globalized Era
- Fraenkel, J., Wallen, N., and Sawin, E.I. (1999). Visual Statistics. Needham Heights, MA Allyn and Bacon
- Freeman, C. (1987) Technology Policy and Economic Performance: Lessons from Japan. London, Pinter.
- Freeman, R. B. (2006). People Flows in Globalization. Journal of Economic Perspectives. Volume 20, Number 2. Pp. 145–170
- Fukuyama, F. (1995). Trust: Social Virtues and the Creation of Prosperity. NY: Free Press.
- Furman, J., Porter, M. and Stern, S. (2002) 'The determinants of national innovation capacity', Research Policy 899-934
- Fusfeld, D. R. (1994). The Age of the Economist. New York: HarperCollins.
- Gardner, H. (2004). "How Education Changes" In Globalization: Culture and Education in the New Millennium, ed. Marcelo M. Suarez-Orozco and Desiree Baolian Qin-Hilliard. Berkeley: University of California Press.

- George, I., Annabatette, W., Bidemi, C. and Felicity, T. (2006), "The Untapped opportunity : How Public Private Partnerships can advance Education For All". Academy for Educational Development, 2006
- Gibbons, M., C., L., Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. eds. (1994) *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London, Sage.
- Gill, S. K. (2004) "Medium of instruction policy in higher education in Malaysia: nationalism versus internationalization", in *Medium of instruction policies: Which Agenda? Whose Agenda?*, Toffleson, J. & Tsui, A.B.M. (Eds.) New Jersey: Lawrence Erlbaum. p. 35-152.
- Gill, S. K., Hazita A., Norizan R. and Fadhil M. (2003-2005) "Language policy and planning in higher education in Malaysia: responding to the needs of the knowledge economy". A project classified under the Intensified Research Priority Areas, funded by the Ministry of Science, Technology and Innovation, Malaysia.
- Gnuschke, J. (2001) *Intellectual Property and Economic Development, Business Perspective, Summer/Fall*
- Godin, B. (2008), "The Knowledge Economy: Fritz Machlup's Construction of the Synthetic Concept. Working Paper No. 37, Project on the History and Sociology of S&T Statistics. Montreal, Quebec, Canada.
- Goetz, A. M. and R. Jenkins (2005) 'Introduction', in Goetz and Jenkins, *Re-inventing Accountability: Making Democracy Work for Human Development*, International Political Economy Series, Basingstoke, Palgrave Macmillan.
- Gomez, G. J. M., Galiana, L. D. R., Mira S. I., Verdu J. A. J. and Sancho A. J. (2008). An empirical approach to the organizational determinants of spin-off creation in European universities. *International Entrepreneurship and Management Journal* 4(2): pp. 187-198.
- Gorodnichenko, Y., Svejnar, J. and Terrell, K. (2008) 'Globalisation and Innovation in Emerging markets', IPC Working Paper Series 76

- Govindan, K. (2000). Globalization, k-economy, and the virtual state. Paper presented at the 12th National Real Estate Conference, Kuala Lumpur, Malaysia.
- Gray, H. (1999), *Universities and the Creation of Wealth*, The Society for Research into Higher Education & Open University Press, Buckingham.
- Green, S.B. (1991). How Many Subjects Does it Take to do a Regression Analysis? *Multivariate Behavioral Research*, v.26, pp. 449-510
- Habibullah, K. and Omar, K.M.R.B, (2010), “The Impact of Globalization on Islamic Countries: A Brief Assessment”. U21Global Working Paper Series, No. 001/2010.
- Hair, J.F. Jr, Babin, B.J., Money, A.H. and Samouel, P. (2003), “Essential of business research methods, New Jersey, John Wiley & Sons, Inc.
- Hair, J.F. Jr, Black, W.C., Babin, B.J., Anderson, R.E. and Tatham, R.L. (2006), “Multivariate Data Analysis (6th Edition)”, Upper Saddle River, NJ, Pearson Prentice Hall.
- Hansen, J. (2009). Mode 2, Systems Differentiation and the Significance of Politico Cultural Variety. *Science, Technology & Innovation Studies* Vol. 5, No. 2, pp. 67-85
- Hargrave, T. J. and Van de Ven, A.H. (2006), “A Collective Action Model of Institutional Innovation”, *Academy of Management Review*. 31, 864–88
- Hart, G. (1994). The New Economic Policy and Redistribution in Malaysia: A Model for Post-Apartheid South Africa? *Journal of Transformation* No. 23, pp. 44-59
- Hatzichronoglou, T. (1996), *Globalization and Competitiveness: Relevant Indicators*, STI
- Helms, N. H. (2009). Is there such a thing as Tech Trans? Or learning from Pasteur. Working Paper from the Bonita Project. Retrieved from <http://www.bonitaproject.eu/papers/A01TechTrans/>.

- Helms, N. H. and Heilesen, S. B. (2012). Framing Creativity. User-driven Innovation in Changing Contexts. Unpublished Work, Retrieved from <http://www.ruc.dk/en/departments/paes>
- Hill, H. (2001) "Small and Medium Enterprises", Indonesia Asian Survey, 41: 2, pp. 248-
- Hemlin, S. Allwood, C. M. Martin, B. R. (2004). Creative knowledge environments—the influences on creativity in research and innovation. Edward Elgar, Cheltenham
- Hipps (2001), Politicization of economic growth, *Kyklos*
- Hoekman, B., Maskus, K. and Saggi, K. (2005) 'Transfer of technology to developing countries: unilateral and multilateral policy options', *World Development* 33, 10, 1587-1602
- Hollanders H., Arundel A. (2006), "Global Innovation Scoreboard" (GIS) Report," MERIT – Maastricht Economic and social Research and training center on Innovation and Technology. Retrieved: http://trendchart.cordis.lu/scoreboards/scoreboard2006/pdf/eis_2006_global_innovation_report.pdf.
- Horng, D. J., Hsueh, C. C. (2005). How to improve efficiency in Transfer of Scientific Knowledge from University to Firms: The Case of Universities in Taiwan. *The Journal of American Academy of Business*, Cambridge. Vol.7, No.2.
- Houghton, J. and Sheehan, P. (2000), "A Primer on the Knowledge Economy. Melbourne: Centre for Strategic Economic Studies, Victoria University".
- Howard, J. (2005), *The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Products and Services*. Report of a Study Commissioned by the Department of Education, Science and Training, Australia. ISBN 0 642 77511 7
- Howells, J. (1999) "Regional Systems of Innovation." In: Archibugi, D., Howells, J. and Michie, J, ed. *Innovation Policy in a Global Economy*. Cambridge, Cambridge University Press, pp.67-93.

- Howells, J. (2003). Industrial Consumption and Innovation. Paper for 'Industrial Ecology and Spaces of Innovation' Workshop, Manchester, 17-18 June, 2003.
- Howells, J. (2006). Intermediation and the role of intermediaries in innovation, *Research Policy* 35 (5) pp. 715–728.
- Howells, J. and Roberts, J. (2000) "From Innovation Systems to Knowledge Systems." *Prometheus*, 18(1), pp.17-31.
- Hu, C., and Racherla, P. (2008). Visual representation of knowledge networks: A social network analysis of hospitality research domain. *International Journal of Hospitality Management*, 27 (2), 302-312.
- Hunt, F. (2005) "The GATS's Article" (<http://libr.org/ISCArticles/15-HUNT.html>). (Accessed on 24/03/2005).
- Hussain, A.B. (2009), Assessing Economic Connectedness Degree of the Malaysian Economy: Input-Output Model Approach. *International Journal of Economics and Finance*. Vol. 1, No. 2, pp. 134-143
- Iona Genevois, (2008) "Public Private Partnerships and Education: Can and should public private partnerships play a role in education?" A research report published by UNESCO for International Institute for Educational Planning (IIEP).
- Imrohoroglu, A. Imrohoroglu, S. and Joines, D. (1999). Social Security in an Overlapping Generations Model with Land. *Review of Economic Dynamics*, Volume 2, Number 3, 638-665
- Ingram, Wils, Carrol, and Townsend (2006), "The Untapped Opportunity: How Public-Private Partnerships Can Advance Education for All," the Education and Policy Data Center, AED, Washington, DC.
- Iqbal, M.J., Amran, R., Low, H.H., Huam, H.T. and Hassan, I. (2011), "Knowledge Economy and University Performance". *International Journal of Academic Research*, Vol. 3. No. 5 pp. 27-32
- Irawati, D. (2006), "Understanding the Triple Helix Model from The Perspective of the Developing Country: A Demand or A Challenge for

- Indonesian Case Study”? MPRA Paper 5829, University Library of Munich, Germany, revised 10 Aug 2007.
- Jacob, M., (1997). The contract researcher, the university, and the knowledge society: Life in the Triple Helix. *Science Studies* 10(2): 35-49.
- Jarjis I. (2007) Determinants of total factor productivity growth in Malaysia, *Journal of Economic Cooperation*, 28, 3, 41-78
- Jassawalla, A. R. and Sashittal, H. C. (1998). An examination of collaboration in high technology new product development processes. *Journal of Product Innovation Management*, 15 (3), 237-254. Retrieved from <http://dx.doi.org/10.1111/15405885.1530237>
- Jean Jacques Rousseau (1762). *On the Social Contract*. Book I, ch. 6, tr. G. D. H. Cole, revised by J. H. Brumfitt and John C. Hall, Everyman’s Library, London, 1973.
- Jesudason, J. (1989) - *Ethnicity and the Economy: The state, Chinese business and multinationals in Malaysia* (Singapore: Oxford University Press).
- Jomo K. S. (1986) - *A Question of Class: capital, the state, and uneven development in Malaysia* (Singapore: Oxford University Press).
- Juma, C. (Ed.). (2005), *Going for Growth: Science, Technology and Innovation in Africa*. London: The Smith Institute.
- Kamitis, E. (2006). A knowledge-based human-centred growth model for Latvia, *Journal of Business Economics and Management* 7(3): 95-101.
- Karahan, O. (2012). Input - Output Indicators of Knowledge-Based Economy and Turkey. *Journal of Business, Economics & Finance* (2012), Vol.1 (2)
- Karl H. and Jean-Louis M. (2010) *Singapore from Temasek to the 21st Century: Reinventing the Global City* (National University of Singapore) Chapter 1 and 4

- Keating, J. (2010), Background Case Study on Malaysia, University of Melbourne Centre for Post-Compulsory Education and Lifelong Learning Skills and Employability Department, ILO.
- Keeble, D. and Wilkinson, F. (2000). High-technology Clusters, Networking, and Collective Learning in Europe. Aldershot, England: Ashgate.
- Kefela, G. T. (2010). Knowledge-based economy and society has become a vital commodity to countries. *International NGO Journal* Vol. 5(7), pp. 160-166, ISSN 1993–8225
- Khor, M. (2005). Bilateral/regional free trade agreements: An outline of elements, nature and development implications. *Third World Resurgence*, 182, 11.
- Kitagawa, F. (2005), Entrepreneurial universities and the development of regional societies: a spatial view of the Europe of Knowledge, *Higher Education Management and Policy*, Vol. 17, no. 3, pp. 65-89
- Klasen, S. (1999), “Does Gender Inequality Reduce Growth and Development? Evidence from Cross-Country Regressions”. Working Paper Series, No. 7, Policy Research Report on Gender and Development. The World Bank Development Research Group/Poverty Reduction and Economic Management Network
- Klein, K. J. and Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review*, 21, 1055-1080.
- Klerkx, L. and Leeuwis, C. (2009). Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. *Technological Forecasting and Social Change*. 76 (2009) 849–860
- Kletzner, L. (2002), “Imports, Exports and Jobs”, W.E. Upjohn Institute for Employment Research.
- Kratoska, P. (1983) - "'Ends that we cannot foresee": Malay Reservations in British Malaya', *Journal of Southeast Asian Studies*, 14.

- Lall, S. (1992) 'Technological Capabilities and industrialisation', *World Development* 20, 165-186
- Lambe, C. J., Spekman, R. E. and Hunt, S. D. (2002). Alliance competence, resources, and alliance success: conceptualization, measurement, and initial test. *Journal of the Academy of Marketing Science*, Vol. 30(2): 141-158.
- Lambooy, J.G. (2004), "The transmission of knowledge, emerging networks, and the role of universities: an evolutionary approach", *European Planning Studies*, Vol. 12 No. 5, pp. 643-57.
- Lavén F (2008). Organizing innovation – how policies are translated into practice. Göteborg University.
- Lawshe, C. H. (1975). A Quantitative Approach to Content Validity. *Personnel Psychology*. Vol. 28, pp. 563-575
- Lazzeretti, L. and Tavoletti, E. (2005), "Higher education excellence and local economic development: the case of the entrepreneurial university of twenty", *European Planning*
- Lee K., Joseph, K.J., Abraham, V. Eun, J-H. Wu, G., Wang, Y., Rasiah, R., Govindaraju, C., Intarakumnerd, P. Schiller, D., Cho, H-D., Eom, B-Y., and Kang, R.. (2009), " Promoting Effective Modes of University-Industry Interaction and their Evolution for Economic Catch-up in Asia". Final technical report, IDRC Project Number: 103470-010.
- Lee, S., Chang, S.I., Kim, H.S., Kwoun, K.H. and Park, J.K. (2000) *The Theory and Practice of Knowledge-Based Economy*, Korea Institute for Industrial Economics & Trade (KIET), Seoul.
- Leete, R. (2007), "Briefing on UNCTAD's World Investment Report 2007". United Nations Development Programme. http://www.undp.org.my/uploads/Oct_23_2007_WIR%20SpeechRR.pdf
- Leftwich, A. (1994) "The Developmental State", Working Paper No. 6, University of York.

- Lehrer M, Nell P, Gärber L (2009) A national systems view of university entrepreneurialism: Inferences from comparison of the German and US experience. *Research Policy* 38: 268–280.
- Lerner, J., (1999). The government as venture capitalist: The long-run impact of the SBIR program. *Journal of Business* 72(3): 285-318.
- Lester, K. (2005). MIT Industrial Performance Center Working Paper 05-010. Innovation and the Competitiveness of Local Economies. A Summary Report from the Local Innovation Systems Project – Phase I.
- Levy, C. Sissons, A. and Holloway, C. (2011). A plan for growth in the knowledge economy. A Knowledge Economy programme paper. Lancaster University Publication.
- Leydesdorff, L., (1997). The non-linear dynamics of sociological reflections. *International Sociology* 12, 25–45.
- Leydesdorff, L. Cooke, P. Olazaran, M. (2002), *Technology transfer in European regions: introduction to the special issue*, *Journal of Technology Transfer*, Vol. 27, pp. 5-13.
- Lichtenhaler, U. (2011). Open innovation: Past research, current debates, and future directions. *Academy of Management Perspectives*, Vol. 25(1): 75-93.
- Lim Chong-Yah and Peter. S. Lloyd, (1986). *Singapore's Resources and Growth*, Oxford University Press.
- Lim T. G. (1977) - *Peasants and their Agricultural Economy in Colonial Malaya, 1974-1941* (Kuala Lumpur Oxford University Press).
- Lim T. G. (1984) - 'British colonial administration and the "ethnic division of labour" in Malaysia', *Kajian Malaysia*, XL
- Lindberg, M. (2007). Deconstructing gender and innovation—four regional networks challenging Sweden's innovation policy. Paper presented at past, present and future, 14–17 June 2007, Umeå, Sweden
- Lindberg M (2010). Samverkansnätverk för innovation - en interaktiv & genusvetenskaplig utmaning av innovationspolitik och

- innovationsforskning (Joint action for innovation - a participative and gender scientific challenge of innovation policy and innovation research). Dissertation. Luleå: Luleå University of Technology.
- Lindberg, M. Danilda, I., and Torstensson, B-M. (2011). Women Resource Centres: A Creative Knowledge Environment of Quadruple Helix. *Journal of Knowledge Economy* (2012) 3:36–52
- Lindberg, M., Lindgren, M. & Packendorff, J. (2010) The role of NGOs in supporting women's' entrepreneurship: A study of a Quadruple Helix project in the Baltic Sea region. *Quadruple Helix reports* 2010:4. Norrtälje: Quadruple Helix Central Baltic.
- Lindgren, M. and Packendorff, J. (2010). A framework for the integration of a gender perspective in cross-border entrepreneurship and cluster promotion programmes. *Quadruple Helix reports* 2010:6, ISBN 978-91-979487-5-3.
- Ling, O.P., Sarjit K. and Morshidi S. (2010), "Revisiting The Role of University". Institut Penyelidikan Pendidikan Tinggi Negara, Malaysia. No. 75, 31 March 2010.
- Lip, G. (2005) "Plenty of jobs available but many graduates lack the required skills" *The Star*. 24 March. p.12.
- Low H. H., Nuratika F. M. O, Amran, R. and Iqbal, M.J. (2012), "Fourth Pillar in the Transformation of Production Economy to Knowledge Economy". *Asia Pacific Business Innovation and Technology Management*, Pattaya, Thailand, *Procedia - Social and Behavioral Sciences* 40 (2012) 530 – 536
- Luhmann, N. (1997). *Die Gesellschaft der Gesellschaft*. Frankfurt: Suhrkamp.
- Nordic Council of Ministers. (2006). *Understanding User-Driven Innovation*. TemaNord, 2006(522)
- Lundvall B. A. (2006). *Innovation systems between policy and research*. Paper presented at The Innovation Pressure Conference in Tampere, Finland, March 2006.
- Lundvall, B. A. (1992). *National Systems of Innovation*. London: Pinter.

- Lundvall, B. A., Johnson, B., Anderson, B., and Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy* 31: 213-231.
- Mac Gregor, S. P. Marques-Gou, P. Simon-Villar, A. (2010). Gauging readiness for the quadruple helix: a study of 16 European organizations. *Journal of Knowledge Economy* 1(3):173–190
- MacKinnon, D. P. & Dwyer, J. H. (1993) Estimating Mediated Effects in Prevention Studies. *Evaluation Review* vol. 17 no. 2 144-158
- MacMillan, I. C., and Katz, J. A. (1988), “Idiosyncratic milieus of entrepreneurial research: The need for comprehensive theories”, *Journal of Business Venturing*. 7(1), 1-8.
- Majumdar, S. (2008), “Industry-Institute Interaction to Public-Private Partnership: A Journey to Excellence” Malaysia: Bumiputra-Commerce Bank.
- Malaysian Industrial Plan (2006). Third Industrial Master Plan (IMP3) - Towards Global Competitiveness. Retrieved from http://www.miti.gov.my/cms/content.jsp?id=com.tms.cms.section.Section_8ab58e8f-7f000010-72f772f7-dbf00272
- Malaysian Education Development Plan (2001-2010). Retrieved from <http://planipolis.iiep.unesco.org>
- Malaysian Science and Technology Indicators (2010), Malaysian Science and Technology Information Centre (MASTIC). www.mastic.gov.my
- Maldonado, V. Lobera, J., Escrigas, C. (2009). The role of higher education in a new quadruple helix context. Paper presented at Triple Helix VII, 17–19 June 2009, Glasgow, UK
- Malerba, F. (2002) "Sectoral Systems of Innovation and Production." *Research Policy*, 31(2), pp.247-264.
- Malhotra, Y. (2003), “Measuring Knowledge Assets of a Nations: Knowledge Systems for Development. Research Paper presented at

- United Nations Advisory Meeting of the Department of Economics and Social Affairs, UN Head Quarters, New York.
- Manjarres-Henriquez, Gutierrez-Gracia, A. Carrion-Garcia, A. and Vega-Jurado, J. (2009). The effects of university industry relationships and academic research on scientific performance: Synergy or substitution? *Research in Higher Education*.
- Marks, S. (1978) - 'Natal, me Zulu royal family and the ideology of segregation', *Journal of Southern African Studies*. 4(1).
- Martin, B.R. (2003) "The Changing Social Contract for Science and the Evolution of the University." In: Geuna, A., Salter, A.J. and Steinmueller, W.E., eds. *Science and Innovation: Rethinking the Rationales for Funding and Governance*. Cheltenham, UK, Edward Elgar, pp. 7-29.
- Martin, R. and Sunley, P., (1996) 'Slow Convergence? Post-neoclassical Endogenous Growth Theory and Regional Development', Working Paper 44, ERSC Center for Business Research, University of Cambridge, Cambridge.
- Marwala, T. (2009). Foundations for a Developmental State: A case for technical education [arXiv:0907.2019v1](https://arxiv.org/abs/0907.2019v1)
- Mathiassen, L. (2002). Collaborative practice research. *Information Technology & People*, 321-345. Available from <http://dx.doi.org/10.1108/09593840210453115>
- Mehmet, O. (1986) - *Development in Malaysia: poverty, wealth, and trusteeship* (London: Croon Helm)
- Melin, G., and Persson, O. (1996). Studying research collaboration using co authorships. *Scientometrics*, 36 (3), 363-377. Available from <http://dx.doi.org/10.1007/BF02129600>
- Menyah, D. (2011). Re-Inventing the Wheel: Government – Informal Sector Relations Revisited. *Journal EXCELLENCE*. Malaysian Administrative Modernisation and Management Planning Unit (MAMPU). Vol. 2 No. 1 pp. 28-39

- Merriam, S. B. and Simpson, E. L. (1984), "A Guide for Research for Educators and Trainers of Adults", *Malabar, Florida: Robert F. Krieger Publishing Co.*
- Meyer, J. P., Becker, T. E., and Van Dick, R. (2006). Social identities and commitments at work: Toward an integrative model. *Journal of Organizational Behavior*, 27, 665–683.
- Miles, M. B. and Huberman, A. M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook*, Sage, London.
- Ministry of Higher Education, Malaysia. (2007). National Higher Education Action Plan, 2007-2010. Retrieved from <http://www.mohe.gov.my/transformasi/>
- Missen, G. (1986) - 'Wage labor and political economy in Malaysia', in Terrence McGee (ed) *Industrialization and Labor force Process in Peninsular Malaysia* (Australian National University, School of Pacific Studies).
- Mitchell A, Seliyson and John Passé- Smith (1998). Development and Under Development- Political Regime and Economic Growth, pp.394-405.
- Moers, L., (1999). Growth Empirics with Institutional Measures and Its Application to Transition Countries: A Survey. Tinbergen Institute Discussion Papers, No. 98, 126/2
- Mohan, A. V., Omar, A. A. and Aziz, A.K. (2004). ICT Cluster as a Way to Materialize a National system of Innovation: Malaysia's Multimedia Super Corridors Flagships. *The Electronic Journal of Information Systems in Developing Countries*. Vol. 16, Issue 5, pp. 1-18
- Mohar, Y. Saeed, M.S. and Leillanie, M.N. (2009), "An Integrated Model of a University's Entrepreneurial Ecosystem". *Journal Of Asia Entrepreneurship and Sustainability*. Vol. V, Issue 1, pp 57-77
- Morgan, K. and Nauwelaers, C. (1999). *Regional Innovation Strategies. The Challenge for Less-favoured Regions*, pp. 19–39. London: The Stationery Office.

- Morris, M and Morris, M. and Associates (2010). *Multi-Sectoral Collaboration and Economic Development: Lessons from England's Regional Development Agencies*. A UNBC Community Development Institute Publication. (pp. 1-51)
- MOSTE (1990) *Industrial Technology Development: A National Plan of Action*. Kuala Lumpur, Malaysia, Ministry of Science, Technology and Environment.
- MOSTI, (2005). Ministry of Science Technology and Innovation, Malaysia.
- Mowery, D., and N. Rosenberg. (1998), *Paths of Innovation: Technological Change in 20th Century America*. New York: Cambridge University Press.
- National Brains Trust (2002) *Master Plan for the Knowledge-Based Economy*, Kuala Lumpur, Government of Malaysia.
- Nedeva, M. (1997) *Strategies for Change: A Comparative Analysis of the National Research System of Bulgaria and the National Research System of Britain*. PhD thesis, Manchester University.
- Nelson, R. (1994). An introduction to evolutionary theories in economics. *Journal of Evolutionary Economics* (4):153-172.
- NEM (2009), *New Economic Model for Malaysia* (part 1). National Economic Advisory Council. www.neac.gov.my
- Neuman, W. (1997). *Social research methods: Qualitative and quantitative approaches* (3rd ed.). Needham Heights, MA: Allyn & Bacon.
- Nilsson, J., (2006). *The role of universities in regional innovation systems: A Nordic perspective*. Copenhagen: CBS Press.
- Noraieni, M. (2005), "*The Economics of Innovation* during Malaysian Economic Outlook Conference organized by ASLI on 3rd February 2005.
- Nowotny, H., Scott, P. and Gibbons, M. (2001) *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*. Cambridge, UK, Polity Press.

- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Nunnally, J. C., and Bernstein, I. H. (1994). *Psychometric theory*. New York: McGraw Hill.
- O'Neill, T., Foresti, M. and Hudson, A. (2007) *Evaluation of Citizens' Voice and Accountability: Review of the Literature and Donor Approaches*. London: DFID
- OECD. (1996). *The knowledge-based economy. Science, Technology and Industry Outlook*, Paris.
- Onu, B. (2005). Using newspapers to satisfy the information needs of readers at the Federal Polytechnic Library, Nekede. *Nigeria Library Link*, 3(1-2), 84.
- Organization for Economic Co-operation and Development (2001). *Trends in International Migration*. Paris: OECD.
- Palmintera, D., Hodgson, R., Tornatzky, L. G., and Lin, E. X. (2005). *Accelerating economic development through university technology transfer*. Reston, VA: Innovation Associates, Inc.
- Pasha, A. G. (2004). *Role of Civil Society Organizations in Governance*. 6th Global Forum on Reinventing Government Towards Participatory and Transparent Governance 24 – 27 May 2005, Seoul, Republic of Korea.
- Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods* (2nd ed.). Newbury Park, CA: Sage Publications, Inc.
- Penksa, J. (2010), "A Triple-Helix within the Triple-Helix" A Case Study of a University Government-Industry Network. Graduate School of the State University of New York at Buffalo
- Petty, G. C. (1995). Vocational-technical education and the occupational work ethic. *Journal of Industrial Teacher Education*, 32(3).
- Pisano, G.P. and Shih, W.C. (2009). *Restoring American Competitiveness*. Harvard Business Review. Pp 1-13

- Pollard, A. and Court, J. (2005). How Civil Society Organisations Use Evidence to Influence Policy Processes: A literature review. Working Paper 249. Overseas Development Institute, London
- Polt, W., Rammer, C., Gassler, H., Schibany, A. and Schartinger, D. (2001) *Benchmarking Industry-Science Relations: The Role of Framework Conditions*. Final Report to European Commission, Enterprise DG and Federal Ministry of Economy and Labour, Austria by Joanneum Research, Vienna.
- Porter, M., (1990) *The Competitive Advantage of Nations*, Free Press, New York.
- Porter, M. (1998) "Clusters and the New Economics of Competition." *Harvard Business Review*, 76(6), pp.77-90.
- Porter M. E. (2003). Determinants of regional economic performance, Harvard Business School, Harvard University (mimeo).
- Porter, M. (2007). *Colleges and Universities and Regional Economic Development: A Strategic Perspective*. Forum for the Future of Higher Education, Cambridge, Mass.
- Porter, M. and Ketels, C.H.M. (2003), UK competitiveness: Moving to the next stage. DTI economics paper No. 3, ESRC Economic and Social Research Council, available at www.berr.gov.uk/files/file14771.pdf.
- Preacher, K. J., and Leonardelli, G. J. (2012). Calculation for the Sobel test: An interactive calculation tool for mediation tests. Online Software. Available from. <http://quantpsy.org/sobel/sobel.htm>
- Putnam, R. (1993). *Making democracy work*, Princeton: Princeton University Press.
- Ramlee M. and Abu Abdullah (2004). Malaysia transitions toward a knowledge-based economy. *The Journal of Technology Studies*, May 200551-61. Source: Virginia Polytechnic Institute & State University. scholar.lib.vt.edu/Jejournal/JOTS/v30/v30n3/pdf/mustapha.pdf

- Richardson, P. (1986) - 'The Natal sugar industry in the nineteenth century', in *Putting a Plough to the Ground.* (Johannesburg Ravan Press)
- Rip, A. and van der Meulen, B. (1996) "The Post-Modern Research System." *Science and Public Policy*, 23(6), pp.343-352.
- Robert, K. (2007). Prospective and retrospective evaluation systems in context: insights from Japan. In Whitley, Richard & Glaser, Jochen (eds.), *Changing Governance of the Sciences: the Advent of Research Evaluation Systems (Sociology of the Sciences Yearbook)*. Springer: Dordrecht, Netherlands.
- Romer P. (2007). Economic Growth, by Forthcoming edition, *Concise Encyclopedia of Economics*.
- Rondinelli, D. A. (2002), *Transnational Corporations: International Citizens or New Sovereigns?*. *Business and Society Review*, 107: 391–413. doi: 10.1111/1467 8594.00143
- Rossi, P. H., and Freeman, H. E. (1993). *Evaluation: A systematic approach* (5th ed.). Newbury Park, CA: Sage.
- Rothenbusch, H. (2005), "The Role of Venture Capital in Fostering Economic Development". Paper presented at FEMIP Expert Committee Meeting on 8th March, 2005.
- Rowthorn, R. and Ramaswamy, R. (1999). Growth, Trade, and Deindustrialization. *IMF Staff Papers*. Vol. 46, No. 1
- Sargeant, M.N. Bornovalova, M. A. Trotman, A. J. M. Fishman, S. Lejuez, C. W. (2012). Facets of Impulsivity in the Relationship between Antisocial Personality and Abstinence: Duration of Longest Abstinence Attempts among Substance Users with Antisocial Personality Disorder: The Mediating Role of Impulsivity. *Addict Behaviour*. Vol. 37(3): 293–298. doi:10.1016/j.addbeh.2011.11.012.
- Saad M. *et al.*, (2008). The Triple Helix strategy for universities in developing countries: the experiences in Malaysia and Algeria. *Science and Public Policy*, 35(6), July 2008, pages 431–443. <http://www.ingentaconnect.com/content/beechn/spp>

- Sabato, J. and Mackenzie, M. (1982): La producción de tecnología. Autónoma o transnacional, Ed.
- Sábato, J. (1975), El Pensamiento latinoamericano en la problemática ciencia-tecnología-desarrollo-dependencia, Editorial Paidós, Buenos Aires, Argentina.
- Salamon, L. M., and Anheier, H. K. (1997). Defining the Non-profit Sector: A Cross-national Analysis, Manchester University Press, Manchester.
- Sanford, K. and Balasundram, M. (2011). China vs. India: Who is the Next Superpower in the East? The Journal of American Academy of Business, Cambridge. Vol. 16, No. 2, pp. 67-74.
- Santoro, M. D. and Chakrabarti, A. K. (2001). Firm Size and Technology Centrality in Industry-University Interactions. MIT IPC Working Paper IPC-01-001
- Schilirò D., 2010. Investing in Knowledge: Knowledge, Human Capital and Institutions for the Long Run Growth, in Governance of Innovation, edited by M.J. Arentsen, W. van Rossum, A.E. Steenge, Cheltenham, Edward Elgar, pp. 33 – 50.
- Schultz T.W. (1963). The economic value of education. New York: Columbia University Press.
- Schwab, K. (2009). The Global Competitiveness Report 2009-2010. World Economic Forum, Geneva
- Schwartzman, (2002). Higher Education and the Demands of the New Economy in Latin America.
- Sekaran, U. (2003), “Research method for business: A skill-building approach (4th Edition), New York, John Wiley & Sons.
- Shamsul A. B. (1986). From British to Bumiputera Rule. (Singapore: Oxford University Press).
- Shapira, P, Youtie, J, Yogeessvaran, K and Jaafar, Z. (2005), ‘Knowledge Economy Measurement: Methods, Results and Insights from the

- Malaysian Knowledge Content Study', Proceedings of the Triple Helix 5 Conference on New Indicators for the Knowledge Economy, Turin, Italy.
- Shinn, T. (1997) *Instrument Hierarchies: Laboratories, Industry and Divisions of Labor*, Macmillan, London
- Shinn, T. (2002) "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology." *Social Studies of Science*, 32(4), pp.599-614.
- Shuttleworth, M., (2008). *Quantitative Research Design*. Retrieved from <http://www.experiment-resources.com/quantitative-research-design.html>
- Siegel, D., Wright, M., and Lockett, A. (2007). The rise of entrepreneurial activity at universities: Organizational and societal implications. *Industrial and Corporate Change*.
- Siegel, D., Waldman, D., Atwater, L., Link, A., (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management* 21 (1–2), 115–142.
- Simmie, J., (2002). 'Trading Places: Competitive Cities in the Global Economy', *European Planning Studies*, Vol. 10, No. 2, pp. 201-214.
- Slaughter, S. and Leslie, L. (1997) *Academic Capitalism*, Baltimore: Johns Hopkins University Press.
- Slaughter, S. and Rhoades, G. (2004) *Academic Capitalism and the New Economy: Markets, State, and Higher Education*, Baltimore, MD, Johns Hopkins University.
- Smith, A. D. (2002). 'When is a nation', *Geopolitics* 7(2): 5–32.
- Snodgrass, D. (1980) - *Inequality and Economic Development in Malaysia* (Kuala Lumpur Oxford University Press).
- Sogunro, O. (2001). Selecting Qualitative or quantitative research methodology: an experience. *Educational Research Quarterly*, 26(1). Pp-3-10

- Solesvik, M. and Gulbrandsen, M. (2012). Comparing university-industry linkages in two industrial clusters in Norway. Proceedings of The 7th International Seminar on Regional Innovation Policies (RIP 2012), 11th to 13th October, 2012, Porto, Portugal.
- Sonnenwald, D. H. (2007). Scientific collaboration. *Annual Review of Information Science and Technology*, 41, 643-681.
- Soper, D.S. (2011). Sobel Test Calculator for the Significance of Mediation. [Online Software]. Available from <http://www.danielsoper.com/statcalc3>.
- Stenson, M.R. (1970) - *Industrial Conflict in Malaysia* (London: Oxford University Press).
- Stokols, D., Harvey, R., Gress, J., Fuqua, J., & Phillips, K. (2005, February). In vivo studies of trans-disciplinary scientific collaboration - lessons learned and implications for active living research. *American Journal of Preventive Medicine*, 28 (2), 202-213.
- Storper, Michael (1997), *The regional world*, The Guilford Press, New York, USA. *Studies*, Vol. 13 No. 3, pp. 475-93.
- Sundać D. and Krmpotić I. F. (2011). Knowledge economy factors and the development of knowledge-based economy, *Croatian Economic Survey*, 13(1), 105-141.
- Tan, B. S. (2004). The Consequences of Innovation. *The Innovation Journal: The Public Sector Innovation Journal*, Volume 9 (3), 2004
- The Global Competitiveness Report (2010–2011). World Economic Forum, Geneva
- The Global Innovation Index (2012). *Stronger Innovation Linkages for Global Growth*. INSEAD and the World Intellectual Property Organization (WIPO)
- Tornatzky, L., Wauguman, P., Gray, D., (2002). *Innovation U: New University Roles in a Knowledge Economy*. Southern Growth Policies Board. Research Triangle Park, North Carolina.

- Trochim, W.M.K. (2009), "The use of Likert scales in social studies", Cornell University. <http://www.socialresearchmethods.net/kb/index.php> (access on 19 February, 2009).
- Tuah, J., Harrison, T. G., and Shallcross, D. E. (2009). The advantages perceived by school teachers in engaging their students in university-based chemistry outreach activities. *Acta Didactica Napocensia*, 2(3), 31-44.
- Turpin, T., Sullivan, N. and Deville, A. (1993) *Crossing Innovation Boundaries: The Formation and Maintenance of Research Links between Industry and Universities in Australia*, Canberra: AGPS
- UNDP (2008). Alberic Kacou Resident Representative UNDP, Nigeria Human Development Report Nigeria. 2008 – 2009 Achieving growth with equity.
- UNESCO (2005). *Towards knowledge societies: UNESCO world report*.
- UNESCO Forum Occasional Paper Series (2005), Paper no. 9 "Implications of WTO/GATS on Higher Education in Asia & the Pacific" 27-29 April 2005, Seoul, The Republic of Korea, Part II
- Varga, Attila (2000), *Universities in local innovation systems*, in Acs, Zoltan (ed.), *Regional innovation, knowledge and global change*, Pinter, London, UK
- Verspagen, B. (1991) 'A new empirical approach to catching up or falling behind', *Structural Change and Economic Dynamics* 2: 359-80
- Veugelers, R. (2010) *Assessing the potential for knowledge-based development in the transition countries of central and eastern Europe, the Caucasus and Central Asia*. Bruegel Working Paper 2010-11
- Vietor, R. (2012). *Stuck in the Middle? Is there a middle income trap and can it be overcome?* Harvard IXP Course: Malaysia – Unstuck from the Middle. January 2012
- Viotti, E.B. (2002) "National Learning Systems: A New Approach on Technological Change in Late Industrializing Economies and Evidences

- from the Cases of Brazil and South Korea." *Technological Forecasting and Social Change*, 69(7), pp.653-680.
- Wan Jusoh, W. J. (1999). Determining key success factors in new product development using factor and correlation analysis: Evidence from manufacturing companies in Malaysia. *Proceedings of SPSS Users Annual Conference*, Kuala Lumpur, Malaysia.
- Wee, V. (2003) *Vision 2020 and Enhancing Competitiveness*. Prime Leadership and Management Course (Jusa) Series 28 No. 2/2003 Intan, Bukit Kiara On 11 July 2003
- Weingart, P. (1997) "From "Finalization" to "Mode 2": Old Wine in New Bottles? " *Social Science Information*, 36(4), pp.591-613. Wisconsin Press.
- Weyer, J., Schulz-Schaeffer, I., Werle, R. (2009) (Con-) Testing theories – (re) thinking mode 2. *Science, Technology & Innovation Studies*, North America. Available at: <http://www.sti-studies.de/ojs/index.php/sti/article/view/25>
- Wilson, E. J. (2012). *How to Make a Region Innovative*. *Strategy + business magazine*. Vol (1) 66. Pp- 01-06
- World Bank (1992) - 'Economic work program on South Africa' (Discussion document).
- World Bank (2008) *Global Economic Prospects 2008: Technology diffusion in the developing world*, Washington DC
- World Bank Report (2007), *Malaysia and the Knowledge Economy: Building a World Class Higher Education System*, Human Development Sector Report, East Asia and Pacific Region, The World Bank.
- Xue, L. and Yang, L. (2004). Estimation of semi-parametric additive coefficient model. *Journal of Statistical Planning and Inference* 136 (2006) 2506 – 2534

- Yang, Y. and Holgaard, J. E. (2012). The important role of civil society groups in eco-innovation: a triple helix perspective. *Journal of Knowledge-based Innovation in China* Vol. 4 No. 2, pp. 132-148
- Yawson, R. M. (2009) *The Ecological System of Innovation: A New Architectural Framework for a Functional Evidence-Based Platform for Science and Innovation Policy The Future of Innovation* Proceedings of the XXIV ISPIM 2009 Conference, Vienna, Austria, June 21–24, 2009.
- Yin, R. K. (1994), “Case Study Research, Design and Methods”, 2nd ed. Newbury Park, Sage Publications.
- Younis, M. Lin, X. X., Sharahili, Y. and Selvarathinam, S. (2008), “Political Stability and Economic Growth in Asia”. *American Journal of Applied Sciences* 5 (3): 203-208, 2008
- Yusof M. and Saeed, M.S. (2009). An Integrated Model of a University’s Entrepreneurial Ecosystem. *Journal Of Asia Entrepreneurship and Sustainability*, Vol. V, Issue 1, Refereed Edition, pp 57-77.
- Yusof, A. and Parilah, M.S. (2008). Globalization and the Malaysian Sports Industry. *Research Journal of International Studies - Issue 8*, pp 112-116
- Zehner, A. (2009), “Churning Jobs Through 2010”. *In-Context*, Vol. 10, No. 1. Retrieved from <http://www.incontext.indiana.edu/2009/jan-feb/article1.html>