Knowledge cluster formation as a science policy: lessons learned

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Knowledge Cluster Formation as a Science Policy: Lessons Learned

Hans-Dieter Evers

Abstract:

Regional science policy aims at the creation of productive knowledge clusters, which are central places within an epistemic landscape of knowledge production and dissemination, K-clusters are said to have the organisational capability to drive innovations and create new industries. The following paper will look at Malaysia, Indonesia and Vietnam and their path towards a Knowledge-based economy. All governments have used cluster formation as one of their development strategies. Some evidence on the current state of knowledge cluster formation is provided. If the formation of a knowledge cluster has been the government policy, what has been the result? Is there an epistemic landscape of knowledge clusters? Has the main knowledge cluster really materialised? Data collected from websites, directories, government publications and expert interviews have enabled us to construct the epistemic landscape of Peninsular Malaysia and the Mekong Delta of Vietnam. Several knowledge clusters of a high density of knowledge producing institutions and their knowledge workers have been identified and described. An analysis of the knowledge output, measured in terms of scientific publications, patents and trademarks show that knowledge clusters have, indeed, been productive as predicted by cluster theory, though the internal working of clusters require further explanation.

Key Words:
Science policy, knowledge and development, knowledge-based economy, knowledge clusters, knowledge corridors

Contents

Introduction: Industrial and Knowledge Clusters for Development

International agencies, governments and experts have identified industrial cluster formation as a prime strategy to induce innovations, increase the GDP and to develop a nation (OECD, 1996). The beneficial effects of the formation of industrial clusters have already been investigated by Alfred Marshall (Marshall, 1920) and Alfred Weber (Weber, 1909). As Michael E. Porter has argued in his well-known book, the competitive advantage of nations is greatly enhanced by the formation of industrial clusters. "The phenomenon of industry clustering is so pervasive that it appears to be a central feature of advanced national economies" (Porter, 1990:149). According to Porter "a cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities." (Porter, 2000:16).

Knowledge clusters, more specifically, "are agglomerations of organizations that are production-oriented. Their production is primarily directed to knowledge as output or input. Knowledge clusters have the organisational capability to drive innovations and create new industries. They are central places within an epistemic landscape, i.e. in a wider structure of knowledge production and dissemination. Examples for organisations in knowledge clusters are universities and colleges, research institutions, think tanks, government research agencies and knowledge-intensive firms" (Evers 2010).

Whereas the reduction of transaction costs because of proximity has been formerly emphasised, the ease of distributing information and of sharing knowledge has been identified as essential for emerging knowledge-based economies (KBEs). "Clusters are concentrations of highly specialized skills and knowledge, institutions, rivals, related businesses, and sophisticated customers in a particular nation or region. Proximity in geographic, cultural, and institutional terms allows special access, special relationships, better information, powerful incentives, and other advantages in productivity and productivity growth that are difficult to tap from a distance. As a result, in a cluster, the whole is greater than the sum of the parts" (Porter 2000:32). Whether or not knowledge and information is, indeed, transferred more easily in clusters as assumed by Porter and others, needs to be verified empirically. Several of our studies have produced contrary evidence (see Evers 2009; Evers and Bauer 2011; Menkhoff et al. 2011; Swan et.al. 1998).

If indeed, as Porter has argued, the formation of industrial clusters is the outcome of successful economic development and a signifier of the competitive advantage of a nation, then the formation of knowledge clusters should be a measure of the degree a nation has advanced towards a knowledge-based economy (KBE) as well as a blueprint for a successful development policy. Building a knowledge infrastructure means initially creating knowledge-producing and disseminating organisations such as research institutes, universities and colleges. To be effective, these have to be located closely to make use of common types of infrastructure such as laboratories, libraries and computing facilities. The geographical clustering theory assumes that proximity increases an organisation's innovative capacity when employees – especially researchers – can share ideas, products and services (Evers 2008). Finally, as a study of the European Cluster Observatory has concluded, "there is plenty of evidence to suggest that innovation and economic growth is heavily geographically concentrated" (Sölvell, Örjan, Christian Ketels, and Göran Lindqvist n.y.:14). A survey of the European Commission (Europe INNOVA / PRO INNO Europe paper N° 9, Commission Staff Working Document, p. 22) concluded that "cluster firms are more innovative than non-cluster

firms. These innovative cluster companies are more than twice more likely to source out research to other firms, universities or public labs than were the average European innovative firms in 2004. This supports the view that clusters are encouraging knowledge sharing which may further stimulate innovation. Moreover, cluster firms patent and trademark their innovations more often than other innovative companies" (p. 22-23).

As the respective terminology is not yet standardised, the central terms used in this paper have to be clarified in the context of ongoing research on cluster formation.

The most general concept is 'agglomeration', whereby clusters are agglomerations with 'proximity' as a crucial variable. Henry and Pinch use the terms 'agglomeration' and 'cluster' synonymously "to refer to geographical groupings of firms (both large and small but often SMEs), broadly in the same sector, but extending beyond to incorporate greater parts of the value chain" (Henry, 2006). Knowledge clusters are agglomerations of production-oriented organisations, which primarily direct their efforts toward knowledge as an output or input. Knowledge clusters have the organisational capability to drive innovations and create new industries, and are central places within an epistemic landscape, i.e. in a wider structure of knowledge production and dissemination. The various knowledge clusters in a particular region form an 'epistemic landscape', i.e. the geographical distribution of knowledge-producing organisations, their research staff and other knowledge workers and their output. The concept "epistemic landscape" is a subcategory of the more general term 'knowledge landscape'. In this usage we borrow Karin Knorr's concept of "epistemic culture, the culture of knowledge production" (Knorr-Cetina, 1999) and refer to the geographical space of knowledge production.

Knowledge hubs take time to develop. They often emerge on the basis of earlier social and economic conditions; in other words they are strongly path-dependent. The institutions that were created in earlier times show their own dynamics and strongly influence outcomes at a later date. This statement goes beyond the simple assertion that history matters and argues that the knowledge architecture, as defined above, has its roots in local conditions and local knowledge. as well as local concepts of knowledge, i.e. the creation of what types and forms of knowledge are especially fostered. Development strategies aiming at the creation of knowledge clusters and ultimately knowledge societies will produce different outcomes dependent on which location is chosen[1]. The success of knowledge cluster strategies will ultimately depend on the interconnection between knowledge hubs within and beyond clusters and the embedding of hubs and clusters in a wider epistemic landscape. As we have shown elsewhere, path dependency, i.e. the historical antecedents play a major role. Creating successful knowledge clusters in practically empty spaces (as the MSC to be discussed later) will be an uphill task.

Our paper will look at Malaysia's path towards a KBE. We will first provide evidence of the current knowledge cluster formation in Peninsular Malaysia, which will then be checked against the current measures to form "corridors", "economic zones" or "growth triangles" and answer the question whether or not these planned "corridors" have already developed into knowledge clusters or, in other words, how far "natural" clustering conforms to regional cluster planning. By forming innovative knowledge clusters resources become available on a local level either through channelling of government funds and corporate investments into the "epistemic landscape" (Evers and Bauer 2011) or through the benefits produced by effective cluster policies.

[1] We have substantiated this argument on the basis of our case study of knowledge hubs in the Straits of Malacca region (Evers and Hornidge 2007).

We shall then try to answer the question, whether or not cluster (or corridor) policies have been successful and which lessons can be learned from the experience of Malaysia.

Cluster Formation as Development Policy in Malaysia

Malaysia and Singapore (Hornidge 2007; Menkhoff and Evers 2011) have followed vigorous cluster policies[2]. In 1991 Prime Minister Mahathir pronounced the long term development goal that Malaysia was to be an industrialised and developed country by the year 2020 in its 'own mould' (Mahathir, 1991: 21). The policies highlighted by Mahathir were implemented in the Sixth Malaysia Plan (6MP) to the Ninth Malaysia Plan (9MP). Knowledge-based development started with the utilisation of information and communication technology (ICT) in all sectors of the economy to increase productivity. The MSC Malaysia and Cyberjaya were created to set into practice the vision of making Malaysia a knowledge-based economy (KBE) by utilising ICT. The government also encouraged the growth of companies related to biotechnology, advanced electronics and software development. Technology based incubator centres were set up by Malaysian Technology Development Corporation (MTDC) and Technology Park Malaysia (TPM) to facilitate industries related to high technology base. MSC Malaysia and TPM are examples of the formation of groups utilising the technology to strengthen their power with new resources (Evers, Nordin and Nienkemper 2010; Evers and Nordin 2011; Gerke and Evers 2011).

In the 9MP, that covers the period of 2006-2010, apart from the requirement of "knowledge", strong emphasis was also specified on innovation. The establishment of high-tech and technology based clusters were suggested to shift from low end industries to high end technology. Regional development was given a new 'branding'. The implementation of economic corridor or cluster development was spearheaded by the major GLCs (Government Linked Companies).

On 30th March 2010, the Malaysian Prime Minister, Najib Razak unveiled the New Economic Model (NEM). The NEM was to ensure Malaysia would be able to achieve the target set by Mahathir. The Vision 2020 and NEM, inaugurated in March 2010, suggested the formation of clusters and corridors with a focus on different economic activities.

MSC Malaysia, Cyber Cities and Cyber Centres

Multimedia Super Corridor Malaysia (MSC) was designed to intensify the knowledge content in various economic activities (K-Based Master Plan, 1993). It was originally a 15x50km zone, stretching from the Kuala Lumpur City Centre (KLCC) to Kuala Lumpur International Airport (KLIA) (Ramasamy, B.et al., 2002) constructed in 1996. It includes Putrajaya, the new administrative capital and Cyberjaya the ICT hub, in addition to the Kuala Lumpur Conference Centre (KLCC) and the Kuala Lumpur International Airport (KLIA). The MSC Malaysia was the physical visualisation of Mahathir's vision towards transforming Malaysia into a knowledge-based economy. The revenue from MSC Malaysia rose from RM12.99 billion in 2006 to RM17.06 billion in 2007 with total employment created at 63,883 (MSC Malaysia, 2009).

[2] The case of Singapore has been discussed elsewhere (Hornidge 2008; Menkhoff and Evers 2011; Menkhoff, Evers, Chay, Fong 2011)

The potential of creating new sources of growth has encouraged the political establishment to designate areas in different parts of the country as Cybercities and Cybercentres. Cybercities and cybercentres are based on a development strategy that locates industrial companies of similar technology within the same geographical area (Malaysian Business, 2009a)

Cyberjaya, opened in 1999 was the first and leading cyber city development in MSC Malaysia. The city covers an area of 7000 acres and was designed as a cutting edge multimedia centre to attract world class multimedia and ICT companies (Neo, W.H et.al. 2008). The city is located adjacent to Putrajaya and between Kuala Lumpur International Airport (KLIA) and Kuala Lumpur. There are 414[3] companies which provide employment to 35,000 people (MDeC, 2009). There are three universities located in Cyberjaya i.e Multimedia University, Limkokwing University of Creative Technology and Cyberjaya University College of Medical Science catering for 15,000 students[4].

Knowledge Clusters in Malaysia

The 1990s saw a policy shift in line with the global higher education restructuring (Lee, 2004; Sivalingam, 2006). In Malaysia, the number of public universities almost tripled from merely eight before 1990 to twenty in 2009. Indonesia followed a similar policy of university expansion, which did not necessarily increase scientific productivity. Concentration of new institutions within an existing knowledge cluster, like the Jabotabek region or the Bandung knowledge cluster, would have probably yielded better results then spreading new institutions throughout the country.

Apart from universities, the government also increased the number of polytechnics and community colleges to cater for the needs of the industries. Private universities saw the number grow from none in 1990s to 37 in 2007[5] and other form of private institutions grew from 156 in 1992 to 460 in 2009. The expansion of these institutions has created different groups of ownership i.e. individual proprietors, private companies, consortium of companies, public listed companies, government corporations, foundations, philanthropic organisations and community financing (Lee, 2004: 1). The formation of these different groups is derived from the lucrative business of higher education in Malaysia. Looking at the past 200 years of Malayan history it becomes clear that the establishment of research institutes, colleges and universities was not only motivated by the quest for knowledge but has formed different groups and usually also strengthened the respective power elites (Evers and Nordin 2010.

The outcome of decades of regional development planning is the formation of knowledge clusters with different degrees of "knowledge density". By this we mean that certain areas show a disproportionately high number of knowledge producing institutions and knowledge workers.

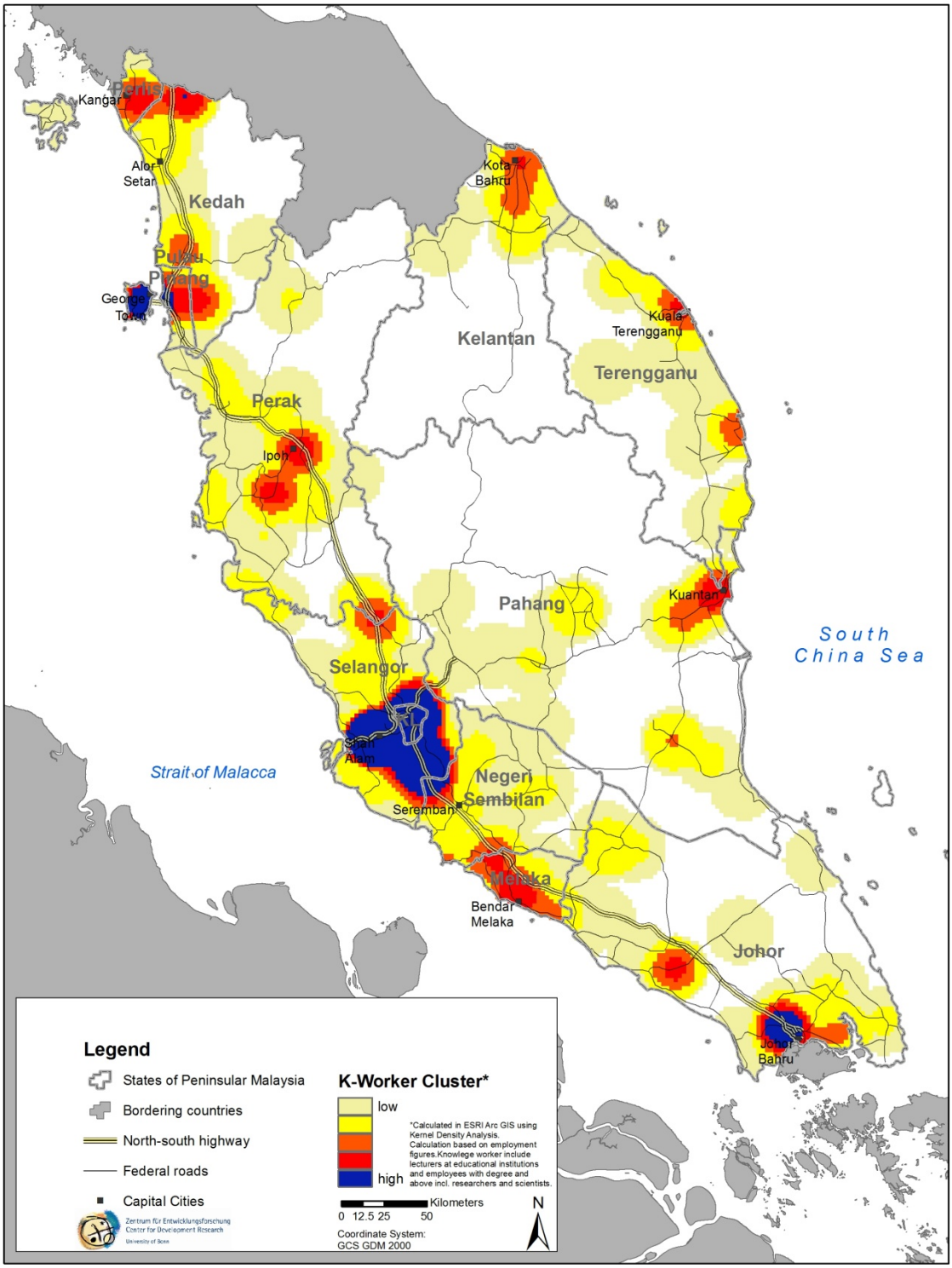
The knowledge cluster map shows that knowledge clusters in Peninsular Malaysia are still concentrated on the west coast with three main locations having the highest concentration of

[3] This was the official figure given by MDeC but the fieldwork done between April-December 2009, only manage to locate 348 companies in Cyberjaya.
[4] The unpublished figure of the total number of students was provided by the Ministry of Higher Education during the fieldwork, 2009.
[5] The numbers comprise of Private Universities (18), College Universities (15) and Foreign Branch Campuses (4).

knowledge producing institutions and knowledge workers, namely Kelang Valley, Johor Bahru and Penang. Penang has the most dense knowledge clusters in the Northern Region of Peninsular Malaysia. Interestingly, the area in Northern Kedah and Perlis bordering Southern Thailand has a strong presence of knowledge clusters even though both areas are economically less developed in comparison to the other areas in the West Coast. The concentration of the knowledge clusters in the West Coast also correlates with the major infrastructures and economic development.

The East Coast of Peninsular Malaysia is still less developed in terms of knowledge clusters. Knowledge clusters are only found at the main cities in the region i.e. Kota Bahru, Kuala Terengganu, Dungun and Kuantan. According to our data, Kuantan has the highest density of knowledge workers in comparison to these other three cities. Comparing the clusters to the West Coast, the knowledge clusters did not spread along the major highways but rather within the main urban areas, where most economic and social activities are concentrated. Also kernel density tends to be much lower than on the West coast.

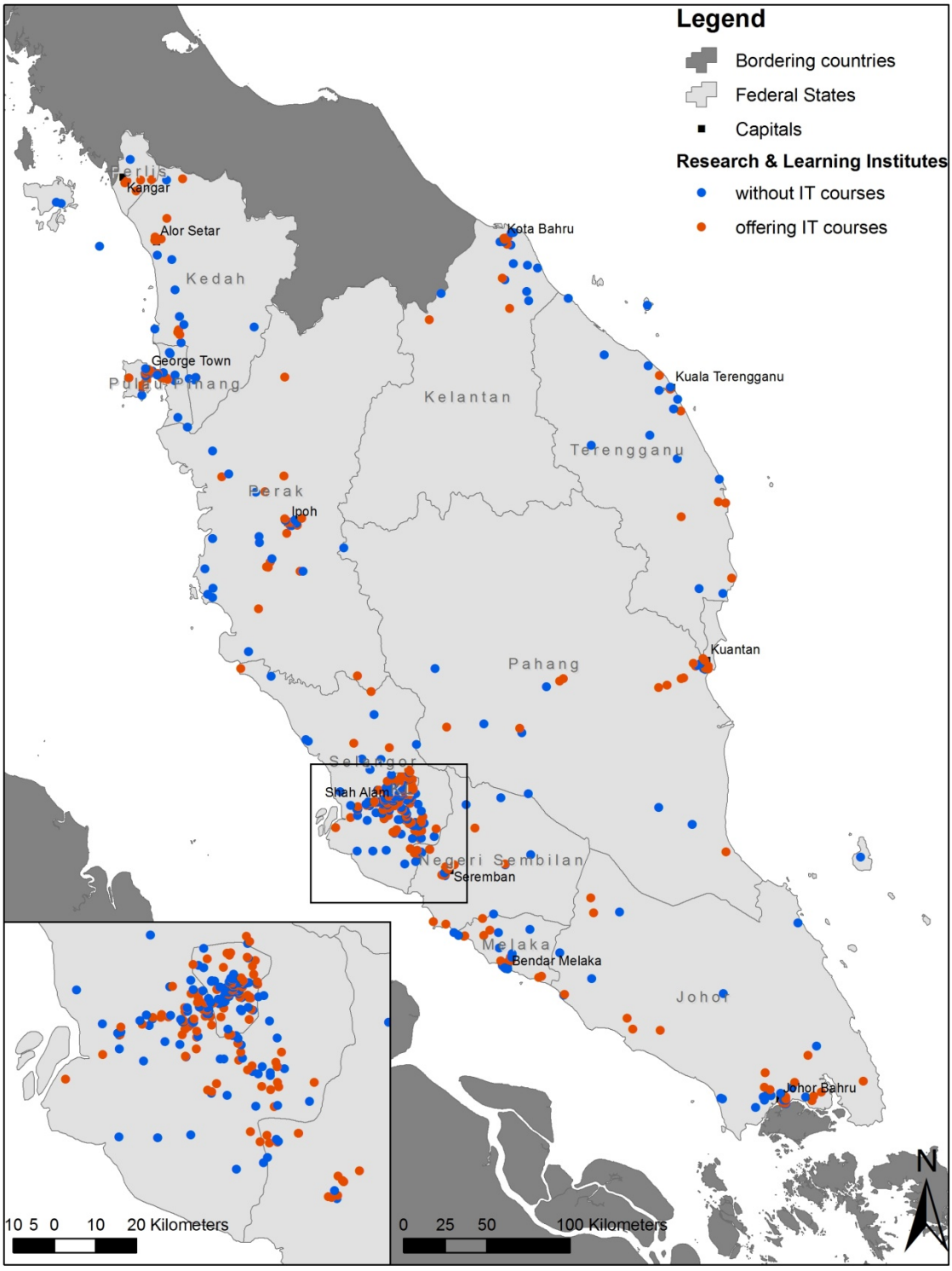
Figure 4: Knowledge Clusters in Peninsular Malaysia[6]



Sources:
Ministry of Higher Education, 2008a, 2008b, 2009, 2010(unpublished data); Ani Asmah(eds), 2009 and field data, 2009[7]. Map design: H.D. Evers, cartography: Pamela Nienkemper.

[6] The map is based on number of employee as of 31 December 2008.
[7] Data on employees for some of the R&D Institutions were collected by Ramli Nordin through a telephone survey between April-December, 2009.

Figure 5: Distribution of Research Institutes and Institutions of Higher Learning with or without ICT Courses, Peninsular Malaysia 2000

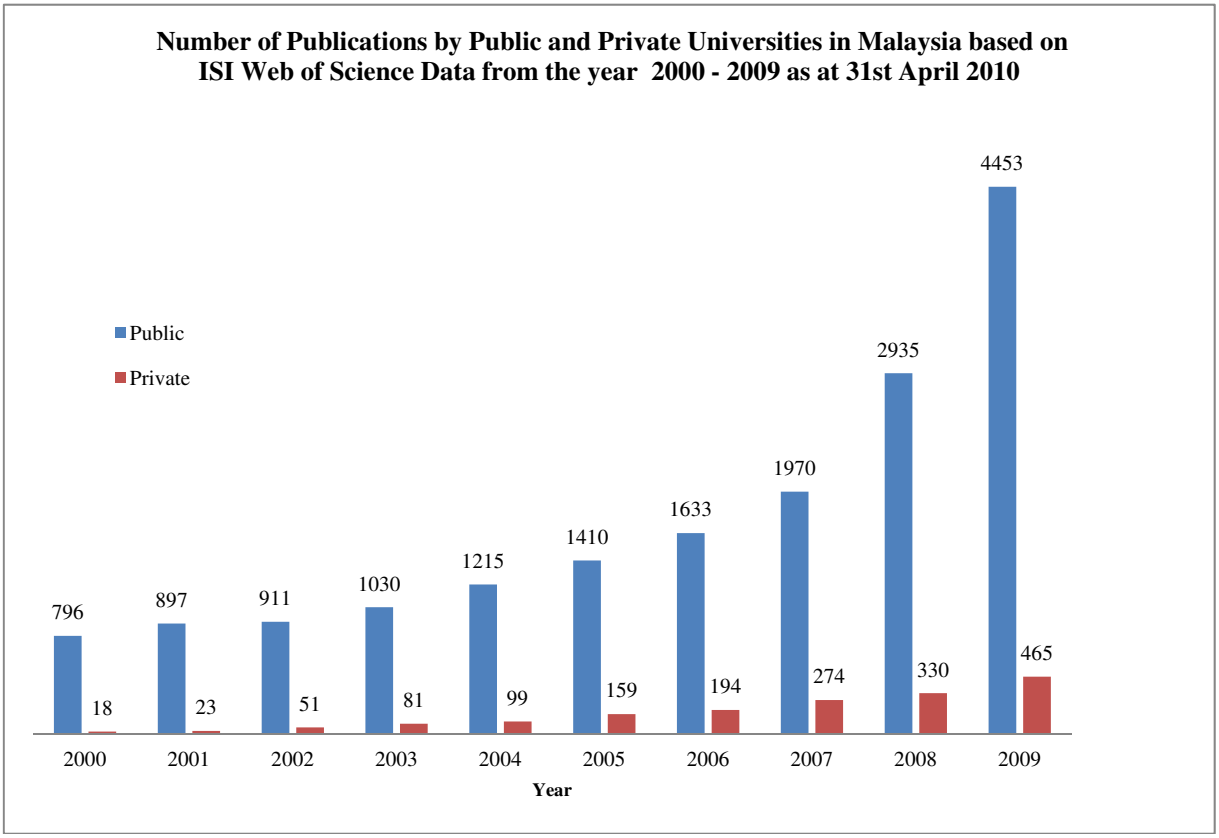


Sources: Ministry of Higher Education, 2008a, 2008b, 2009; Ani Asmah(eds), 2009; Ministry of Higher Education, 2009 (unpublished data) and fieldata, 2009[8].

[8] Data of courses offered by Private Higher Learning Institutions were collected from individual web pages from April – December 2009.

Recognising that knowledge clusters have emerged, the most important question remains whether this clustering process has also resulted in higher knowledge production, as predicted by clustering theory. We try to measure knowledge output by using scientific publications, patents and trademarks as indicators of innovation and knowledge output.

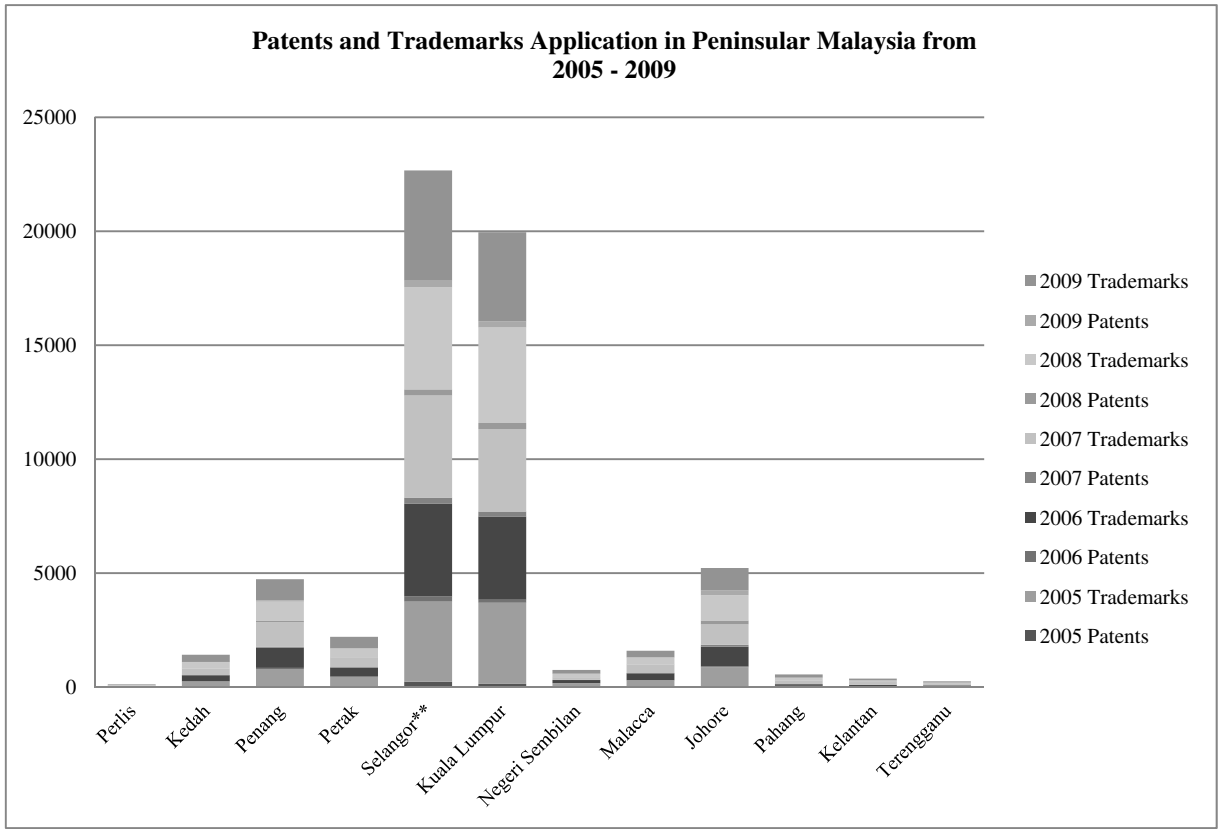
Figure 6: Knowledge Output: Number of Publications of Malaysian University Staff, 2000 to 2009



Source: Web of Science, 2010

Data were also collected on another form of knowledge output i.e. patents and trademarks. As shown in Fig.9, Selangor and Kuala Lumpur have the most numbers of applications for both from the year 2005 to 2009. Penang and Johor, located in the south and north knowledge cluster in Peninsular also have high numbers of patents and trademarks application followed by Perak, Malacca and Negeri Sembilan which are located in the most concentrated knowledge clusters in Peninsular Malaysia. The data for Kedah shows that the total number of application is significant in comparison to data for the state of Perlis. This again shows that the density of knowledge clusters does not necessarily contribute towards the knowledge output. Data from all the states in the East Coast have the lowest number of applications for both patents and trademarks. As evidenced by our data, Kelang Valley still dominates the knowledge output in Peninsular Malaysia.

Figure 9: Applications for Patents and Trademarks, Peninsular Malaysia 2005 to 2009



Source: MyIPO, 2010

Case Study: Penang as a Knowledge Hub

Malaysia has two strong knowledge clusters: the Klang valley with KL and the MSC, Penang State and a number of smaller clusters. A calculation of the density of knowledge institutions and knowledge personnel show the epistemic landscape of Malaysia. Penang has the potential to change from an industrial cluster to a knowledge cluster. For this purpose Penang has to reinvent itself as a „knowledge hub“ (Evers 2011, Evers and Sezali 2011).

In the case of Penang as a knowledge hub (see also Sin 2010:178), it can be shown that in Penang, as well as in other places along the Straits of Malacca, the modern knowledge clusters emerged mostly at localities that had a long tradition of trade and learning in the past (Evers, Gerke and Hornidge, 2008). The growth and the knowledge architecture of knowledge clusters and hubs appear to be highly “path dependent”, i.e. determined by history. This fact is often neglected in development programmes advocating the establishment of knowledge hubs “out of the blue” without regards for the existing knowledge landscape.

The history of schools of higher learning in the Straits of Malacca region correlates with the rise and fall of centres of trade along the pathway. The first modern school of Malaysia opened in Georgetown, the then centre of maritime trade. The first university in the region was founded in the then British Crown Colony Singapore, now NUS. While Malacca had been the most important trading port from the fifteenth right up to the early nineteenth century (long before the first universities in the Straits region), it was overtaken by Georgetown/Penang and Singapore in the later nineteenth and twentieth century. Today,

Malacca mainly houses branch offices of Malaysian schools of higher learning, no main campus, while the knowledge structures of Singapore and Penang (in 1969, the Universiti Sains Malaysia is founded in Penang) rest on a far more diverse environment of universities, polytechnics, private and public research institutes (Gerke and Evers 2011).

Science Policy: Planning Industrial and Knowledge Clusters in Malaysia

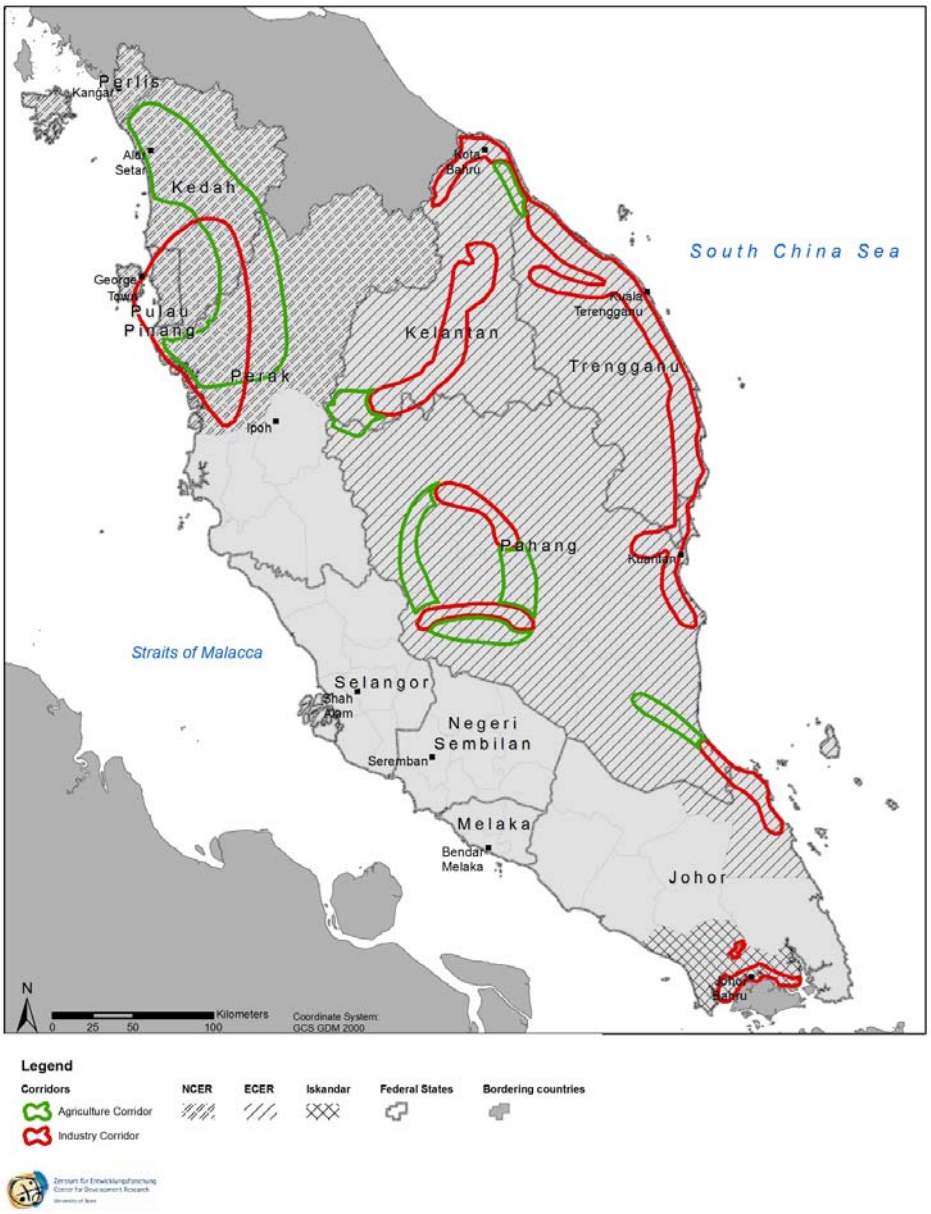
In the1960s, Malaysia's policy makers realised the importance of export-oriented industrial clusters which should focus on light and heavy industries (Zaharudin et.al. 1986). Industrial clusters in the form of free trade zones were developed to encourage export oriented industrialization. The clusters were located in the relatively developed west-coast states of Penang, Selangor, Malacca and Johor.

In 1991 Prime Minister Mahathir promulgated a new goal, the "Vision 2020". Malaysia was to be an industrialised and developed country by the year 2020 in its 'own mould'. In the Seventh and Eight Malaysia Plan, covering the period from 1996-2005, a knowledge-based development started with the use of information and communication technology in all sectors of the economy to improve productivity (Turpin and Krishna 2007:146). The Multimedia Super Corridor Malaysia and the new city of Cyberjaya were built to spearhead Malaysia's development into a knowledge-based economy by utilising information and communication technology.

In the 9th Malaysia Plan, that covers the period of 2006-2010, "knowledge" for development and innovation were emphasized. The development of high-tech industries was to be concentrated in technology based knowledge clusters (Gerke and Hornidge 2011: 5-6). The implementation of economic corridor or cluster development was spearheaded by the major Government Linked Companies and the government investment arm Khazanah Nasional. The economic regions and their corridors are shown in Fig.1. Penang is integrated into the Northern Corridor Economic Region (http://www.ncer.com.my).

The New Economic Model (NEM) is to ensure that Malaysia will achieve the target. The Model emphasizes the formation of clusters and corridors concentrated on specific economic activities. The focus is on innovation and productivity growth, in addition to technological advancement and entrepreneurial development. Development regions and corridors provide the spatial framework for government support and investment plans. Realization of these plans will depend on the on the financial strength of the government budget and ultimately on the economic development of ASEAN and the world economy (Evers and Nordin 2010).

Map 2 Development Regions and Corridors, Peninsular Malaysia



Source: Evers, Nordin, Nienkemper 2010, Evers 2011 and Northern Corridor Economic Region (www.ncer.com.my); Iskandar Malaysia (www.iskandarmalaysia.com.my); East Coast Economic Region (www.ecerdc.com).

Science Cooperation: Penang as a Knowledge Hub

Penang is one of the knowledge clusters of Malaysia with a large number of universities, research institutes, and Research and Development (R&D) divisions located closely together. Cooperation between the sectors in a way mirrors the development of Penang's export oriented industry. "Penang is well placed to become a hub for the Northern Corridor, the Indonesia, Malaysia, Thailand Growth Triangle and the Bay of Bengal…" (Kharas, Zeufack and Majeed 2011:53).

Cluster theory is predicting an optimal output of knowledge in form of innovations, patents and research papers. In the context of our study, we add the idea that the knowledge hub

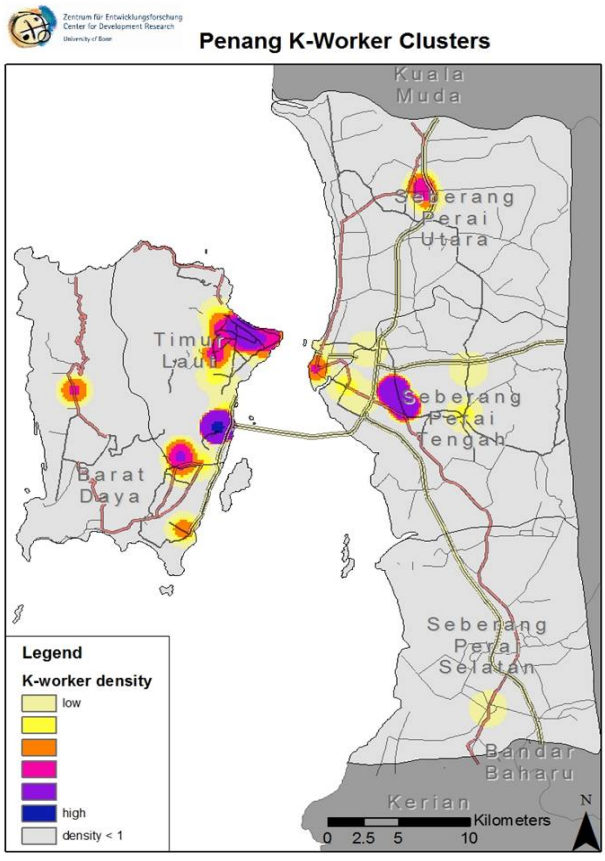
function, i.e. a close cooperation between the institutions as well as external connections, are an additional pre-condition for high knowledge productivity. We measured these external connections with an output indicator of joint journal articles to which Penang researchers in have contributed. Only scientific research results in internationally recognized journals have been taken into account. The indicator measures therefore not all projects of cooperation with international institutions, but only those that are documented by publications, recognized, visible and accessible

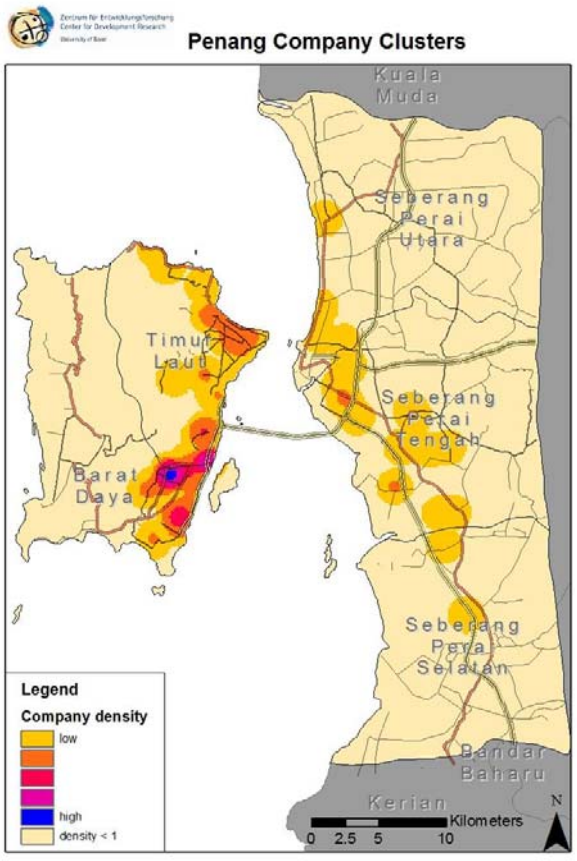
In the following section we present preliminary results of our analysis with a focus on changing international cooperation worldwide.

Penang is one of the traditionally grown centres of higher education and research along the Straits of Malacca and within Malaysia . During the past 40 years, USM with currently around 1300 researchers, lecturers and professors clearly emerges as the main producer of published research results in cooperation with international partners, followed by the Penang General Hospital as a leading institution in medical research. Other universities and colleges show surprisingly low international cooperation. Private sector companies increasingly take part in collaborative research, but are still dwarfed by USM and other research institutes with the World Fish Center and the Fisheries Research Institute standing out. In a later stage in our project we hope to document the local relations between research, government and industry, the so called triple helix, as we would like to hypothesise that either one would not have been possible without the support of the other.

In general it is interesting to note that most of the international research output is based on cooperation with foreign universities rather than local Malaysian universities and institutions. We therefore concentrate on the analysis of the evolving international network of scientific cooperation over the past 40 years.

Map 3 Penang Knowledge Clusters





Patterns of Scientific Cooperation

Social systems theory has taught us that in the course of history societal subsystems become increasingly differentiated to reflect and cope with the complexities of modern societies. Highly differentiated systems are more effective in dealing with external threats and have a higher capacity to cope with the external social and economic environments. Increasing systems differentiation also require a more sophisticated system governance, but on the other hand, differentiated systems produce higher output.

All in all, we can observe changing patterns of scientific cooperation over the last 40 years – changes which may have been triggered by external events rather than by changes in the science system itself.

Table 1 Patterns of Scientific Cooperation

	Dominant Scientific Cooperation	**Centuries**
Colonial Legacy	Commonwealth Countries, mainly UK, Australia and Canada	1970s to mid 1980s
Globalization	EU(incl.UK), China, India, Japan, ASEAN (mainly Thailand)	mid 1980s to mid 1990s
Asian Century	China, India, Japan, ASEAN (Thailand, Singapore, Indonesia) Australia, EU	1990s
The Indian Ocean and beyond	INDIA and EU and Iran	2000-2011

In the following we will take a closer look on how international scientific cooperation evolved during the last 40 years. Although we collected data on all countries worldwide, we will here look at measurable output that exceeds one or two publications a year. This is done by looking East at China and Japan, and further East at the US. If we look West, India is the dominating science hub, whereas researchers in Pakistan and Bangladesh only produced a few joint papers with Penangites. This is, with the exception of Iran, also true of Middle Eastern countries. Europe, including the dominating UK, is the main cooperation partner in the Far West. Scientific cooperation with other ASEAN countries is, as we will see later, slowly emerging. If we look East, China and Japan are the major cooperation partners, whereas, even further East, the USA plays a relatively minor role.

The time series of our data show the rapidly increasing international cooperation, especially after the foundation of the second Malaysian university in 1969, first as the University of Penang, then renamed in 1971 as Universiti Sains Malaysia (USM).

Data show evidence that the colonial legacy is mirrored in academic cooperation and joint paper writing in the 1970s and 80s as the majorities of articles have been published together with colleagues from the Commonwealth countries UK, Australia and Canada. From 1980-89 a similar picture evolves. This changes in the 1990s, when ASEAN countries (especially Thailand and Indonesia), as well as quite some European countries appear on the landscape. Scientific cooperation with India and China started in the early 90s, when joint publications with India and China are nearly at the same level and Japan becomes more important as a partner. The significant rise of cooperation with China is probably also due to more liberal politics in China. Since the year 2000 we can observe a dramatic change in science cooperation as most of the publications are written with colleagues from India which by far

exceeds China and Europe. Cooperation in the form of joint paper writing is interestingly low with the US, compared to Europe. In recent years, scientific cooperation with India, especially in the sciences is much on the rise and overhauls China.

The dramatic increase of joint research and publication with India from 2000 to 2011 is surprising and in the next step of the project we will have a look at the individual partners as well as the topics to see, with whom and in which field most of the scientific cooperation takes place. We have, until now, no explanation, why China, contrary to all expectations falls behind.

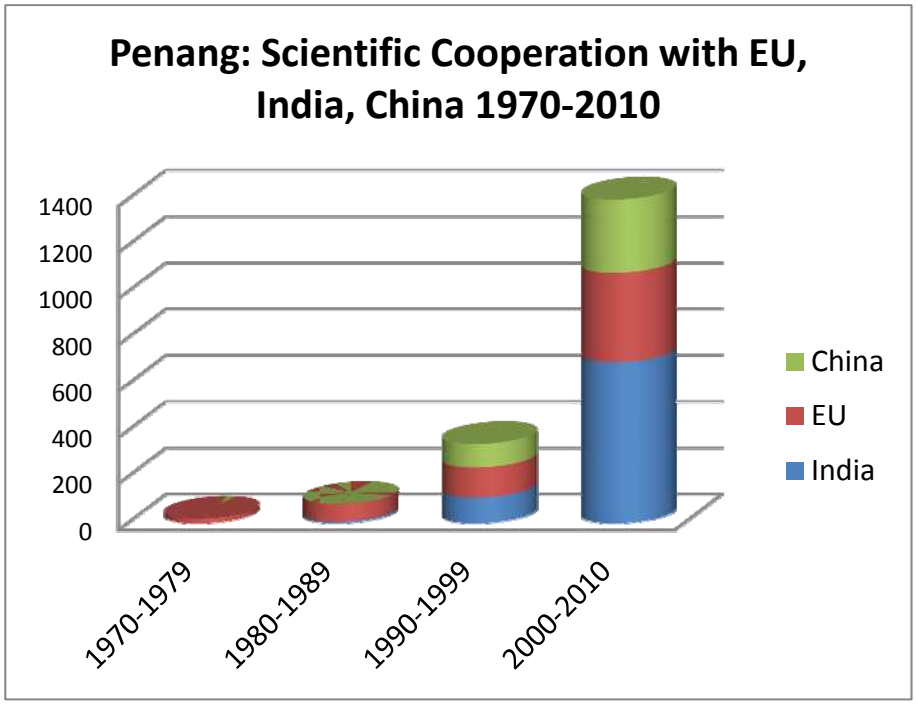


Fig. 1 Scientific Cooperation of Research Institutes, Universities and Companies in Penang State with EU, India, China 1970-2010
(joint articles in scientific journals, ISI Web of Science)

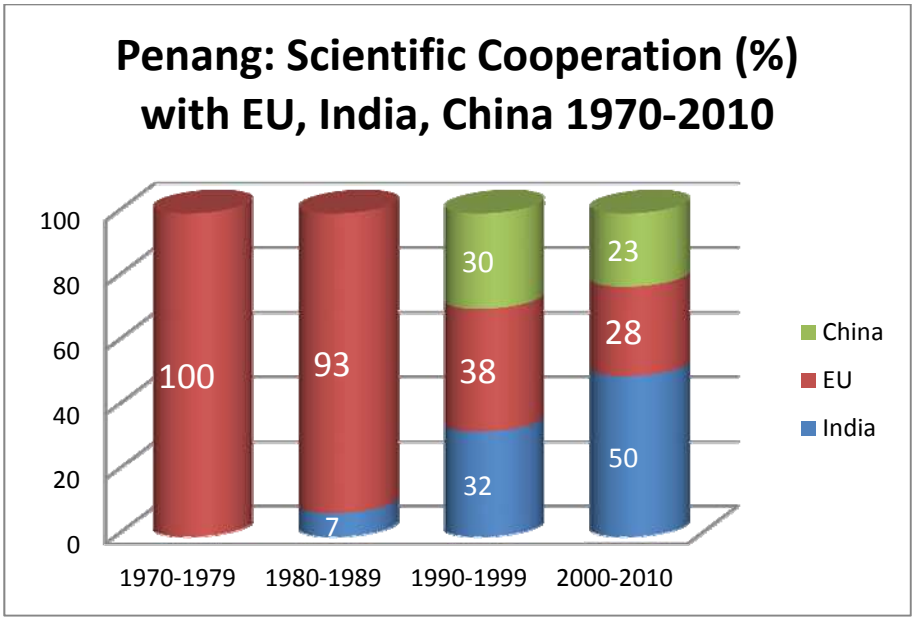


Fig. 2 Percentage Distribution, Scientific Cooperation of Research Institutes, Universities and Companies in Penang State with EU, India, China 1970-2010 (joint articles in scientific journals, ISI Web of Science)

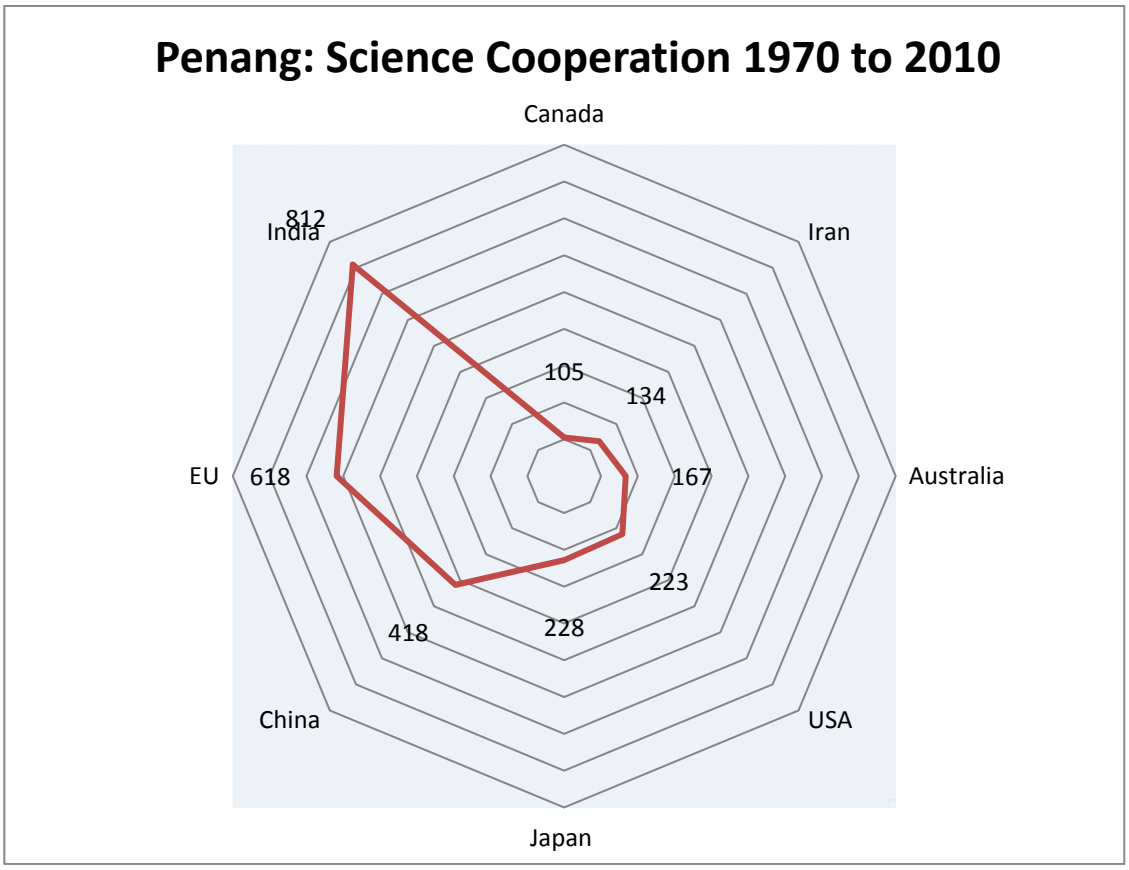


Figure 3 Penang Scientific Cooperation 1970-2010

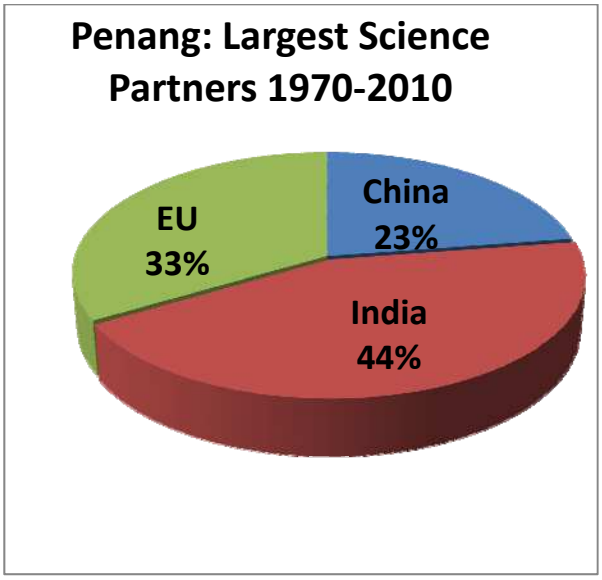


Figure 4 Penang Scientific Cooperation: During 1970 to 2010 India, the EU and China accounted for 55% of all joint article publication.

There are insufficient data on knowledge exchange within Penang, but it can be assumed that there is room for improvement. The so-called „triple helix“ of research institutes, government and industry needs to be strengthened. Our maps show that clusters of knowledge workers and high-tech companies do not completely overlap. This can be taken as an indicator that industrial companies are short of knowledge workers.

USM as an APEX university has impressive research capabilities and has improved its international cooperation considerably, but it is still not clear how far this potential is utilized to support industrial R&D, NGOs and government agencies. Penang can develop and integrate its knowledge clusters further and advertise its position as one of the major knowledge hubs in Malaysia and the ASEAN region. The existence of knowledge hubs are incentives for investment and attract capital and high level manpower.

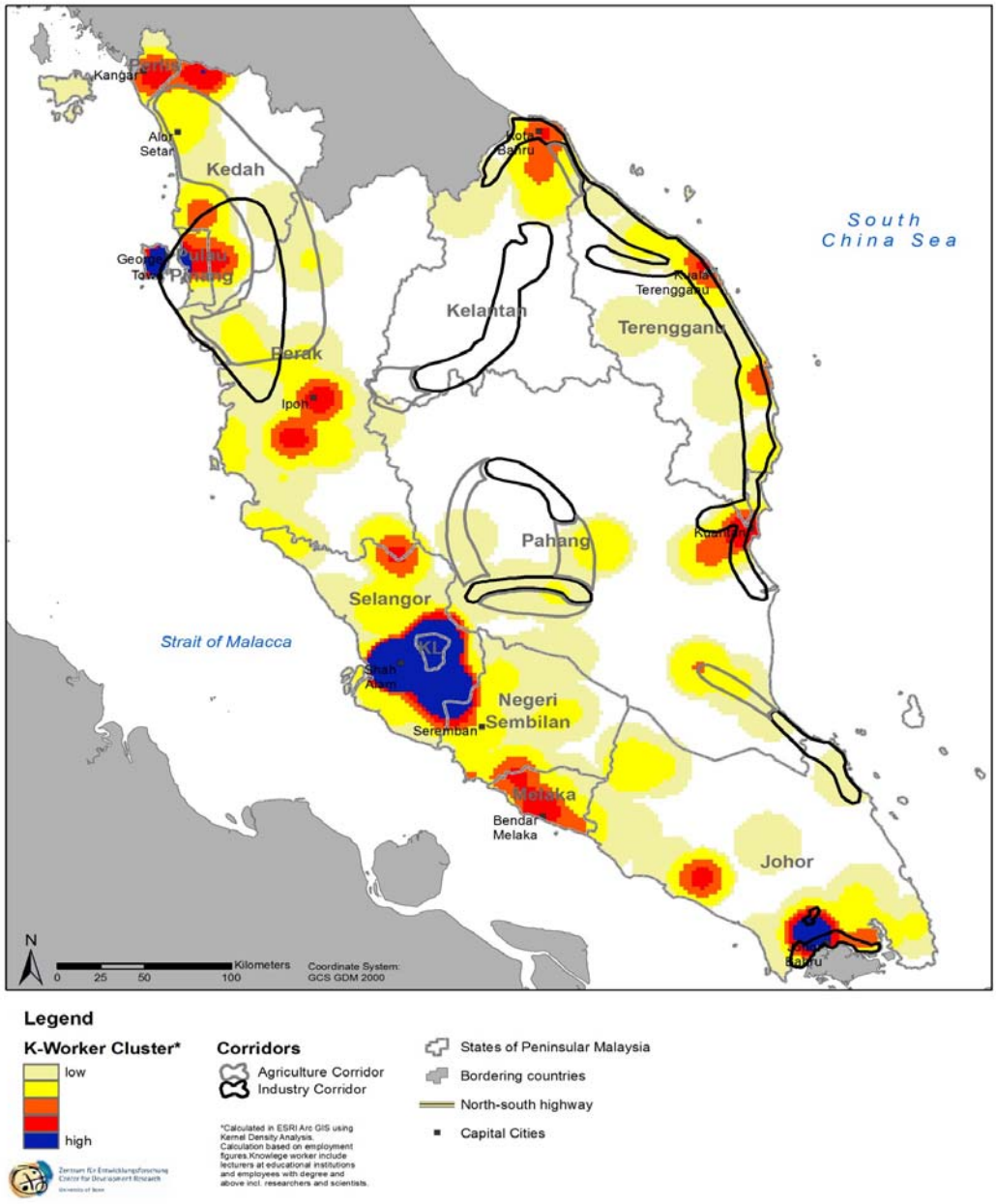
To sum up our arguments and results so far:

1. Penang has strengthened its position as one of Malaysia’s premier knowledge hubs by engaging in scientific cooperation worldwide. From an early start in the seventies scientific cooperation has shown an impressive upswing until today.
2. Penang has divorced itself from the colonial legacy of sole cooperation with the UK and other Commonwealth Countries (Australia, Canada) and has gone global, first establishing cooperation with neighbouring ASEAN countries, then with China, Japan and India.
3. Contrary to expectations concerning the dominance of China in the “Asian Century”, India has emerged as the major scientific cooperation partner of Penang, followed by the European Union countries. As the Middle East is also gaining in importance, Penang scientists are increasingly looking West rather than East.

Conclusion

The corridors planned by the policy makers mostly centred on the natural resources available in the respective states. Agriculture and natural resources such as petroleum and tourist site are the main catalyst for the corridors. The GLCs selected to spearhead the respective corridor is also a reflection of these i.e. Sime Darby, PETRONAS and Khazanah Berhad. The GLCs are primarily involved in plantation, oil and gas and property development. None of the corridors are planned for ICT or knowledge based industry apart from the electric and electronic cluster in the northern corridor.

Figure 11: Knowledge Clusters and Development Corridors



The corridors in ECER, do not correlate with the government aim to become a knowledge economy. The industries planned are mostly on tourism and agriculture. As observed by Fatimah (2009), progress in the Malaysian agriculture and plantation in general has not lead to invention and innovation but rather high dependence on foreign labour. The creation of development corridors which neglect the human capital factor will definitely produce the unintended results as can be seen in the development of Cyberjaya. Physical infrastructure alone will never produce the innovative and knowledge outcome.

The preliminary analysis of our data pertaining to Penang as a knowledge-hub and the "corridors" has yielded some outcomes, but needs to be developed further to produce more robust results.

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