Higher Education in Regional and City Development

State of Penang, Malaysia

OECD

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State of Penang, Malaysia 2011

Please cite this publication as:
OECD (2011), *Higher Education in Regional and City Development: State of Penang, Malaysia 2011*, OECD Publishing.
http://dx.doi.org/10.1787/9789264089457-en

ISBN 978-92-64-08945-7 (PDF)

Series: Higher Education in Regional and City Development:
ISSN 2218-3140 (online)

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Foreword

Universities and other higher education institutions can play a key role in human capital development and innovation systems in their cities and regions. Reviews of Higher Education in Regional and City Development are the OECD's tool to mobilise higher education for economic, social and cultural development of cities and regions. The reviews analyse how the higher education system impacts local and regional development and help improve this impact. They examine higher education institution's contribution to human capital and skills development; technology transfer and business innovation; social, cultural and environmental development; and regional capacity building. The review process facilitates partnership building in regions by drawing together higher education institutions and public and private agencies to identify strategic goals and work together towards them. To know more about the OECD review process and requirements, visit Higher Education and Regions' website at www.oecd.org/edu/imhe/regionaldevelopment.

These reviews are part of a wider multi-annum work of higher education in cities and regions co-ordinated by the OECD Programme on Institutional Management of Higher Education (IMHE). In 2004-07, the OECD/IMHE conducted an extensive study with 14 regional reviews across 12 countries. This resulted in the OECD flagship publication Higher Education and Regions: Globally Competitive, Locally Engaged (OECD, 2007) with recommendations to benefit both higher education institutions and national and regional governments. In 2008, the OECD/IMHE launched a second series of OECD reviews of Higher Education in Regional and City Development to address the demand by national and regional governments for more responsive and active higher education institutions. As a result, 14 regions in 11 countries underwent the OECD review process in 2008-10. The reviews were carried out by the OECD/IMHE in collaboration with international organisations and associations and other OECD programmes and directorates. This work also supports the OECD Innovation Strategy and OECD Green Growth Strategy.

Acknowledgements

Numerous national and regional stakeholders and representatives of higher education institutions provided valuable insights during the review visit and in the form of comments. The OECD would like to thank in particular the lead co-ordinators and other active local counterparts for this review: the Ministry of Higher Education, Malaysia; Universiti Sains Malaysia and the related departments and staff; Professor Morshidi Sirat (Project Co-ordinator) of the National Higher Education Research Institute (IPPTN) and other IPPTN staff; and the Penang self-evaluation report writing team.

As for the other Penang local stakeholders involved, a sincere thanks is extended to the Penang Secretary Office/State Economic Planning Unit, Penang Municipal Council and Seberang Perai Municipal Council, Penang Skills Development Centre (PSDC), Northern Corridor Economic Region (NCER), IXC Malaysia Berhad, Wawasan Open University, Socio-Economic and Environmental Research Institute (SERI), Southeast Asian Ministers of Education Organization (SEAMEO) Regional Centre for Education in Science and Mathematics (RECSAM), Universiti Teknologi MARA, Penang Medical College, Penang Education Department, Dewan Perniagaan Melayu Malaysia Pulau Pinang, Intel Malaysia, Intellectual Avenue Sdn. Bhd., InvestPenang and Software Consortium of Penang (ScoPe).

We are also grateful to all other Penang stakeholders not mentioned above and steering committee that provided needed information and guidance in improving the quality of the Penang review.

This publication draws on interviews carried out during a week-long review visit in 16 – 21 May 2010, on the findings of the State of Penang's Self-Evaluation Report and using additional information provided to the review team. The OECD Review Team were also able to rely on a range of other reports, including the World Bank report on Malaysia's higher education and tested its conclusions and recommendations within the higher education system Penang.

The review visit was led by Jaana Puukka (OECD/IMHE) who also co-ordinated this publication with support from Austin Delaney (OECD/IMHE). The other members of the review team were Patrick Dubarle, Aims McGuinness (National Center for Higher Education Management Systems – NCHEMS, US), Andrea Hofer (OECD/LEED), N.V. Varghese (UNESCO International Institute for Educational Planning, IIEP) and Hena Mukherjee (National Expert). Further details about the Review Team can be found in Annex 1 of this report. Rachel Linden supervised the publication process.

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List of acronyms

AARG	AIDS Action and Research Group
ASIC	Application-specific integrated circuit
Apex	Accelerated plan for excellence
AMDI	Advanced Medical and Dental Institute
BJIM	The Division of Industry and Community Network
CEDEC	Microelectronic centre of excellence
CETREE	USM's Centre for Education, Training and Research in Renewable Energy and Energy Efficiency
CGSS	Centre for Global Sustainability Studies
CIP	Cradle Investment Programme – the programme provides financing from idea conceptualisation to commercialisation, combined with expert assistance in legal and other business related matters.
CSE	Chalmers School of Entrepreneurship
CUTEC	Cambridge University Technology and Enterprise Club
E&e	Electrical and electronics industry
EPP	Entrepreneur Placement Programme
FDI	Foreign direct investment
FTZ	Free trade zones
GDP	Gross domestic product

GERD	Gross domestic expenditure on R&D
GRI	Government research institutes
HEI	Higher education institutions
HKUST	Hong Kong University of Science and Technology
HND	Higher National Diploma
ICT	Information and communication technology
IMHE	OECD Programme on Institutional Management in Higher Education
INSKEN	The National Institute for Entrepreneurship
IGS	Industry R&D Grant Scheme
IP	Intellectual property
IPPTTN	Institut Penyelidikan Pendidikan Tinggi Negara (National Higher Education Research Institute)
ITA	Investment Tax Allowance
ISI	Import substitution industrialisation
KDU	Kolej Damansara Utama College
MASTIC	Malaysian Science and Technology Information Centre
MATRADE	Malaysia External Trade Development Corporation
MBS	Modified budgeting system
MHRD	Ministry of Human Resource Development
MECD	Ministry of Entrepreneurship and Co-operative Development
MIBPC	Multimedia Development Corporation's annual business plan competition
MIDF	Malaysian Industrial Development Finance
MIEL	Malaysian Industrial Entrepreneur Location
MNC	Multinational corporation

MOE	Ministry of Education
MOHE	Ministry of Higher Education
MPPP	Penang Municipal Council
MPSP	Seberang Perai Municipal Council
MQF	Malaysian Qualifications Framework
MSC	Multimedia Super Corridor
MYR	Malaysian Ringgit
NCER	Northern Corridor Economic Region.
NHERI	National Higher Education Research Institute *(Institut Penyelidikan Pendidikan Tinggi Negara)*
NCIA	National Corridor Implementation Authority
NPC	National Productivity Corporation
NUDP	National Unipreneur Development Programme
NCIA	Northern Corridor Implementation Authority
NEAC	National Economic Advisory Council
NHEFC	National Higher Education Fund Corporation
NEM	New Economic Model
OECD	Organisation for Economic Co-operation and Development
PDC	Penang Development Corporation
PECC	Penang Educational Consultative Council
PSDC	Penang Skills Development Centre
PTPTN	Perbadanan Tabung Pendidikan Tinggi Negara
QCC	Quality Control Circles
RCE	Regional Centres of Expertise
RCMO	Research Creativity and Management Office
SEDC	The state economic development corporations
SEDIA	Student Entrepreneur Development Initiative

	Agenda programme
SERI	The Socio-Economic and Environmental Research Institute
SME	Small and medium-sized enterprises
SMT	Surface-mount technology
SPC	Statistical Process Control
Tpm	Total productive maintenance
Tqm	Total quality management
TTO	Technology transfer office
UNESCO	United Nations Educational, Scientific and Cultural Organization
UICCF	University-Industry Commercialisation Collaboration Forum
UiTM	Universiti Teknologi MARA
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UPM	Universiti Putra Malaysia
USAINS	Universiti Sains Malaysia Holdings
USM	Universiti Sains Malaysia
USPTO	United States Patent and Trademark Office
VSLI	Very large scale integration
WOU	Wawasan Open University
WUR	Times Higher Education-QS World University Rankings
UTP	Universiti Teknologi Petronas

Assessment and recommendations

Penang: Moving up the value chain

With a population of 1.77 million Penang is the leader in manufacturing activities and the growth centre for northern Malaysia. In 2007, 200 multinational corporations had large scale operations in Penang, making it the second growth centre in Malaysia, after the Klang valley. Manufacturing of electrical and electronic (E&E) goods have generated a dynamism for the last 25 years, keeping Penang's GDP growth ahead of the national average, above 7% between 1970 and 2005. The major contributors to Penang's growth rates are E&E manufacturing and services, such as utilities, telecommunications and tourism. Penang is an international tourist destination famous for its historic and scenic attractions and its diverse cultures with the Malay, Chinese and Indians constituting the major ethnic groups.

Penang's advantageous low cost and low wage scenario has been highly successful in its strategy to maximise opportunities in the global manufacturing chain. Since the adoption of export-oriented strategies, Penang has been exporting consumer products targeted at advanced economies. But the regional economy is at a crossroads: Penang is no longer a high growth economy and a low cost centre. Following the current economic crisis, Malaysia's traditional market will wane as consumers in the advanced economies are not able to consume as much as they used to. China, India, Indonesia and Vietnam produce cheaper consumer goods than Malaysia, having paved the way to frugal innovation. Penang's economic sustainability is threatened not only by low-cost countries but also highly-skilled countries with research and design capabilities in the region – Singapore and Taiwan. Multinational corporations have started moving away, their independence from the local economy giving them the flexibility to move to locations with lower costs.

Both federal and state governments are working on a scenario which would bring back rapid growth and productivity to Penang. This is

embodied in an intensified industrialisation programme grounded in technological transformation towards a knowledge-based economy producing higher value-added products and services. The focus of industrialisation is shifting from the assembly stage of E&E products of high technological value.

Furthermore, Penang's position in northern Malaysia has been reinforced by the development started under the Northern Corridor Economic Region (NCER) programme. The programme includes 21 districts in Penang island and the mainland, and the states of Kedah, Perlis, and northern Perak. The Northern Corridor Economic Region programme aims to accelerate economic growth and elevate income levels in the north of Peninsular Malaysia. It is part of a national strategy focusing on regions which can benefit from land, labour and natural resources, combining these with manufacturing experience and international linkages. The aim of the Northern Corridor Economic Region is to become a competitive, world-class sustainable economic region. It is expected that the Northern Corridor Economic Region would be a destination of choice for foreign and domestic businesses to invest in the electrical and electronic cluster, agriculture, tourism and biotechnology. Social development activities, community infrastructure and environmental integrity are expected to raise the overall standard of living for both Malaysians and foreigners to work, study, visit and live.

Skill shortages, inadequate infrastructure and regulatory bottlenecks have contributed to the reduction of productivity and overall growth. A critical challenge is to improve labour policy and reform of educational system to improve the flexibility of the workforce in the face of the rapid changes in the global economy and to guarantee inclusiveness and sustainability. Penang has a diverse higher education system but its full potential has not been mobilised for regional and local development. In this context, the region faces a quadruple challenge:

- How to improve the educational attainment of the population?
- How to promote new business formation, indigenous innovation and the development of the local industry?
- How to address the problems of poverty and growing disparities, and health and environment needs of the population?
- How to capitalise on the existing assets, for example the co-existence of three cultures, new opportunities created by the Northern Corridor Economic Region and the UNESCO World Heritage site?

Human resources development in Penang

A region that wants to be globally competitive needs to have a highly-skilled workforce and a knowledge-based economy that can absorb it. While Penang has made great strides in widening participation in education, it continues to face challenges in developing and retaining human resources to meet aspirations for the region's future economy and quality of life.

Malaysia and Penang have made great strides in widening participation in education. During the period 1985-2008 primary, secondary and tertiary education saw an unprecedented increase in enrolments. Higher education showed the greatest growth at 93.1%, representing a yearly increase of 4.1%. Enhanced access is reflected in the percentage of the higher education enrolment in the 19 to 24-year-old age cohort which grew from 0.6% in 1970 to 24.4% in 2007. According to the Ninth Malaysian Plan (2006-10), it is expected that 1.6 million students or 40% of the relevant age cohort are enrolled in tertiary education in 2010 and 50% of these at private institutions.

The educational profile of the labour force has also changed in Malaysia, revealing a gradually growing proportion of population with tertiary education. However, with 80% of the work force having secondary education, Malaysia faces a major challenge to retain its global competitiveness in terms of the knowledge and skills of its population. Only 25% of Malaysia's labour force is composed of highly-skilled workers compared to 49% in Singapore, 33% in Taiwan, and 35% in Korea. There is also evidence of brain drain, with an estimated 350 000 Malaysians working abroad in 2008, over half of whom had tertiary education.

The development of Penang since the 1970s has been driven by a policy of low-skill, low-wage manufacturing. In 2000, only 8.9% of the regional population had achieved tertiary level education. The economy has depended on importing labour from throughout Malaysia as well as from other countries. Within the Northern Corridor Economic Region, the State of Penang has a better educated population than the other three states, but in international comparison Penang is a low-skilled region. While there is a push to move to a high-skill, high-wage economy, Penang remains dependent on low-skill industries and occupations. The level of educational attainment remains significantly below that of OECD countries in the

region. Furthermore, the region faces a number of human resource issues: there is a shortage of skilled personnel, a shortage of highly qualified people and a loss of talent.

The ability of Penang to compete on the basis of low-skilled labour is increasingly limited by competition from other countries in Southeast Asia and restrictions on foreign workers. Penang also faces competition from Singapore and other countries that have the human resources and access to research and innovation needed to compete at the high-end of the value chain. The problem is not only an inadequate supply of graduates but the lack of an economy and other regional amenities that retain graduates who are otherwise attracted to Kuala Lumpur, Singapore and other major economic centres.

Penang has a diverse education sector dominated by Universiti Sains Malaysia. USM is shifting the balance of enrolments from the undergraduate to the post-graduate level. Combining the aspirations of world class excellence and regional engagement will require special attention from the university leadership.

The greater Penang-Seberang Prai area is well endowed with tertiary education institutions. The 23 public and 31 private tertiary level institutions include a regional institution (Regional Centre for Science and Mathematics), public tertiary and post-secondary institutions such as Universiti Sains Malaysia (USM), Universiti Teknology MARA (UiTM), located in Seberang Prai, two teacher training colleges and the Open University Malaysia. There are also a number of non-public education and training institutions such as the Penang Skills Development Corporation, Wawasan Open University and Kolej Damansara Utama college (KDU). In general, however, the private sector institutions act as "feeder" organisations to universities in Kuala Lumpur accelerating the loss of human resources.

The establishment of University Sains Malaysia (USM) in 1969 outside the traditional core region reflects the Government of Malaysia's effort to use higher education as an instrument to redress ethnic inequity and regional imbalances. Today, Universiti Sains Malaysia plays a major role in the Penang higher education system. With the goal to become one of the top performing higher education institutions worldwide as an APEX university, USM has set forth an agenda, *Transforming Higher Education for a Sustainable Tomorrow* in order to "support the drive to improve the well-being of humanity, the bottom billion."

As a result, University Sains Malaysia is shifting the balance of its enrolments from the undergraduate to the post-graduate level. The strengthening of the post-graduate programmes, in medical health, life sciences, health sciences, engineering and technology, and information technology is directly in line with regional priorities. Developing the pool of highly-qualified researchers and engineers is critical to the capacity of the region to compete on the basis of design and development and innovation in the electrical and electronics industry and other industries. However, limiting undergraduate education may have a detrimental impact on wider regional development. The percentage of students from the region in the USM has been declining and this trend is likely to strengthen as the APEX status will permit the university to recruit more widely to increase its global ranking.

The APEX university status is a significant achievement and has the potential to build the university into a globally competitive and locally engaged institution which can drive the development in Penang and Northern Corridor Economic Region. However, at the moment there appears to be a conflict with the university's designation as an APEX University and the regional engagement mission. While Universiti Sains Malaysia strives to become a globally competitive research university serving "billions", there is limited targeted attention to the needs of the population within its region.

Malaysia, the Northern Corridor Economic Region and Penang in particular need to move "up the value chain" from a low-skill, low-production economy to a higher skill, higher wage economy. But it is constrained by skills shortages and mismatches. There is a need to increase the relevance of education and its alignment with the regional labour market needs.

Penang is constrained not only by a shortage or inadequacy of available skills. Firms in Penang are being impeded in their R&D or produce/process development efforts by shortages of specialised skills. While the multinational corporations hire some technical personnel to work on design, testing and product developments, the supply of R&D engineers and technicians is too small for them to expand their R&D in Penang.

Penang also suffers from a skills mismatch. Although the overall stock of human capital has increased in terms of outputs from tertiary institutions, there are deficiencies. About a quarter of graduates from local public universities remain unemployed for six months upon completion of study in

2008. Local graduates' wait period for a job has increased and their wages have stagnated, suggesting that tertiary and secondary graduates' skills do not match those required by employers. The contrast between the wage premiums of local graduates and those from abroad is significant and suggests a mismatch between local education programmes and labour market requirements. For the short-term, employers need to provide on-the-job general and specific skills training. In the longer term, the mismatch of skills suggests a critical need for stronger alignment of education and skills training with regional labour market needs.

Higher education institutions in the region do not have courses that are especially designed to meet the needs of the Penang region. There is no systematic regional strategy at the federal, supra-regional (Northern Corridor Economic Region) or state levels to engage higher education institutions in addressing the region's human resource challenges. In many cases, student internships and industrial placements are concentrated in engineering and technical disciplines and not across the breadth of the higher education institutions. Student engagement with industry and the region should be connected more strongly with the university's core academic programmes and curricula. Furthermore, industrial placements appear to be peripheral to the students' core academic programme and academic staff's responsibilities.

Skills mismatches are partly addressed by the industry-driven Penang Skills Development Centre (PSDC), a premier (skills) learning institution in Malaysia, dedicated to meeting the immediate human resource needs of the business community. The centre plays a critical role as a broker between the needs of employers and higher education institutions and other sources of training capacity. In addition to its traditional training functions, PSDC's new initiatives "School 2 Work," and "FasTrack" address the gaps in the current education system by providing school leavers a complete education-to-employment pathway for and university graduates the skills they need for employment.

While the focus on skills development for the benefit of industry is necessary, too narrow skills development will not serve Penang and its population in the long run. Stronger emphasis needs to be placed on general competencies that will allow people to adjust to rapid changes in the labour market and have the capacity for lifelong learning.

Educational attainment levels in Penang are higher than other states in the Northern Corridor Economic Region but inadequate to meet the demands of a knowledge-based economy. Due to rapidly changing skill requirements in working life, lifelong learning, skills upgrading and re-skilling are becoming increasingly important. For non-traditional learners, who combine work and study and/or family obligations, flexible ways of provision need to be in place through work-based, e-learning and distance education. In addition, attendance on the basis of non-formal and informal learning should be allowed.

In Penang, there is limited data available to understand the needs of the adult population or the efficacy of higher education in meeting these needs. Important institutions in fostering lifelong learning include the Penang Skills Development Centre and the Wawasan Open University. Wawasan Open University is dedicated to serving working adults, expanding access to university education using technology-enhanced open and distance learning. It emphasises flexibility to meet students' needs: access to students from any place and at any time; acceptance to the university, not to a particular programme; and enrolment by course (subject) not by programme. Furthermore, Universiti Sains Malaysia's School of Distance Learning was the first distance learning programme at the tertiary level in Malaysia.

One of the main issues impeding human capital development in Penang and the Northern Corridor Economic Region is the fragmented governance architecture in education. There is a lack of a region-wide co-ordinating structures and mechanisms to articulate a long-term vision and implement an integrated development strategy for all educational institutions.

Because education is a federal responsibility in Malaysia, the state governments have no direct authority for higher education. As a consequence, federal policy is vertically linked with each higher education institution with limited attention to horizontal relationships among institutions within a region. Central determination of curricula and other institutional policies promote uniformity and hinders adaptation to the unique needs of regions. As a consequence there is limited alignment of education provision to regional needs. Public and private institutions operate under different regulatory and financing rules, resulting in the absence of a unified education system. To date, development plans for these two sectors are undertaken separately. For example the Penang Educational Consultative

Council (PECC) under the state government provides the mechanism for a coherent vision of an education system at the regional level, but this council is only for the private higher education institutions. There is also a lack of incentives for regional engagement of higher education and for collaboration among institutions and limited pathways for students through the education system. There is a need for stronger credit recognition schemes, course and programme articulation agreements, clear and enforceable policies related to credit transfer and increased support for joint and collaborative programmes.

The following measures would promote human resource development in Penang

Recommendations for the federal/national policy

- *Develop a component of national strategy (New Economic Model) explicitly linking higher education institutions to regional human resource development.*

- *In higher education policy, add a regional dimension to criteria for academic programme/curricula approval and provide incentives for regional collaboration and student pathways.*

- *Add a regional human resource development element to criteria for APEX university performance e.g. increasing the percentage of the region's population completing undergraduate and post-graduate degrees in fields linked to regional priorities.*

Recommendations for the sub-national level: Northern Corridor Economic Region

- *Establish goals and benchmarks linked to year-by-year progress toward the 2020 goal of increasing the educational attainment of the region's population to globally competitive levels e.g. percentages of the population ages 25 to 64 with tertiary education (A and B) compared to OECD countries.*

- *Establish a public/private investment fund to provide competitive grants for higher education institutions contingent upon: i) collaboration with industry and ii) collaboration between and among institutions, including public and private universities, polytechnics, community*

colleges, Universiti Teknologi MARA Training Centres, Penang Skills Development Centre etc.

- *Give increased priority to building a long-term regional teaching/learning capacity linked to the future regional economy and quality of life by developing higher education institutions with a mission and flexibility to serve the region.*

Recommendations for the sub-national level: for the state of Penang

- *Continue forward-thinking strategies aimed at developing the region's human resources.*

- *Focus on creating the conditions (environment, cultural resources, housing, public safety and health) that will make Penang an attractive place for students from the region, the rest of Malaysia and other countries.*

- *Take advantage of initiatives of the Northern Corridor Economic Region for* the *benefit of Penang; recognise that Penang's human resource needs are inter-related with the wider region (Northern Corridor Economic Region) and support initiatives to narrow disparities between Penang and the Northern Corridor Economic Region.*

- *Establish a state-level human resource development fund (public/private) to promote collaboration among institutions/providers.*

Recommendations for the universities

- *Develop a data/information capacity to monitor and report on how each university serves the region's population,* including but not limited to data on: i) major disparities in regional participation in tertiary education, ii) *percentage* of students from each region enrolled in and completing degree programmes at undergraduate and post-graduate levels and iii) undergraduate and post-graduate degrees and scholarship granted related to regional priority fields.

- *Use research and engagement with industry as a means to leverage institutional change in the university.* Modify curriculum to strengthen

and deepen student learning through greater integration of research and engagement with industry and community within the curriculum. Increase regional dimension in student experience through problem-based learning, internships, etc. Use short-term training and projects in centres/research as tool for professional development leading to changes in curriculum/teaching and learning.

- *Strengthen the alignment of study programmes with the needs of the region and increase the supply of technical workers.* Firms in the region suffer from the shortage of qualified personnel and inadequate skills offered to the labour market. University students' skills need to be upgraded in transferable and soft skills, such as communication, team working and analytical thinking. There is also a need to increase industry involvement in curricula development and a general need for the private sector to invest in longer periods of training for new recruits.

- *[For USM] Use the flexibility of the Malaysia APEX Designation to leverage change in core teaching and learning capacity. Revisit the university mission by adding an addendum:* Not just "bottom billions" in the world but also "bottom thousands" in the region. Not just sustainable university, but sustainable region in terms of the globally competitive educational attainment of the region's population.

- *[For USM]Take the lead in shaping tertiary education strategy for Penang and the Northern Corridor to develop the region's human resources by engaging all public and private higher education institutions and other education providers and develop a limited number of priority initiatives stressing collaboration.* The initiatives could focus on enhancing student pathways among institutions, increasing the percentage of students from low-income and minority populations gaining a tertiary education certification/degree or increasing opportunities for adult/mature students to pursue and complete tertiary education.

Regional innovation in Penang

Malaysia dual economy has an export-oriented part, dominated by multinational corporations with few linkages to local firms, and a domestic part characterised by low skills and low R&D

and innovation intensity. Within this context, Malaysia is encountering difficulties to translate scientific knowledge into technological capabilities. Although an important player in knowledge diffusion and S&T activities, universities have not yet enlarged the national research potential and reached the quality of R&D performed in the OECD countries.

Malaysia underperforms in R&D compared to the OECD average and the South East Asian average. The country has been over-performing in terms of publication intensity, but among ASEAN economies, its scientific publications are less frequently cited and its researcher population less numerous. Malaysia has a better record than its neighbours for patenting activities. However, numbers are far lower than the OECD average. Furthermore, the majority of patents are held by foreign company affiliates in Malaysia.

Most of Malaysia's S&T personnel are employed in the education sector and Malaysian universities are important drivers of the innovation processes. They, nevertheless, face administrative constraints and their R&D base is narrower than those of OECD countries. In terms of research quality, Malaysian universities underperform with regard to main competitors in Singapore, Taiwan and Hong Kong.

Within the framework of the Ninth Malaysia Plan, the government has focused on science and technology activities. The government has been concerned not only with FDI investment, the acceleration of technology commercialisation and boosting business spending on R&D, but also with the need to increase local innovation capabilities and it has concentrated its interventions on the elaboration of R&D tax incentives and the encouragement of strategic investment. Numerous schemes have been launched but so far the volume of grants channelled to university research has remained modest.

Penang is one of the key drivers of Malaysia's economy. However, the overreliance of the regional economy on multinational corporations and underinvestment in innovation are undermining the region's growth trajectory. Local HEIs could become instrumental in helping the economy to follow a more knowledge-based path of development.

They have a major role to play in training entrepreneurs that will invest in, and manage new knowledge-based enterprises.

Penang state GRP contributes to approximately 8% of Malaysian GDP while Penangites enjoy an average income that is above the average for Malaysia as a whole. Continuous inflows of foreign direct investments since the 1970s accelerated by the establishment of a free trade zone have consolidated Penang's economic growth. At the same time, the dependence on labour-intensive and low to medium-skilled industries has grown.

While continuing to promote key industries such as E&E, food processing, furniture and jewellery, the Penang state government is making efforts to attract high tech and knowledge-based investments in green industries, display technologies or medical devices and biotech. The service sectors identified as potential areas for development include healthcare, education tourism and logistics. But the shift is possible only if Penang is able to count on a reservoir of capable entrepreneurs willing to invest in these industries. Penang should therefore not only improve the technical content of its education system, but also pay attention to the injection of an entrepreneurial dimension in its R&D and higher education system.

The Universiti Sains Malaysia (USM) plays a dominant role in the RDI activities in Penang. USM has embarked on a broad range of research programmes that cover numerous multidisciplinary fields including multimedia, renewable energy, microelectronics, marine technologies, astronomy and medicine. USM is committed to accelerate the transfer of technology from university results. While a strategy is being elaborated to increase patenting and commercialising public R&D, it is still limited in scope and at early stages of development.

Universiti Sains Malaysia has provided leadership in R&D over four decades, setting up research centres and institutes in diverse areas such as the Centre for Policy Research and International Studies, AIDS Action Research Group, Women's Development Research Centre, Centre for Drug Research to name a few. Its transdisciplinary approach to research has contributed results and outcomes beneficial to Penang. In research generation, it leads other Malaysian universities in terms of publication output. The quality of its R&D is similar to those of the best Malaysian

universities. It, however, lags behind the main Singaporian and Hong Kong universities in terms of research quality and quantity.

While there is a long-established co-operation between Universiti Sains Malaysia and some multinational corporations, in general, contract research between the business sector and higher education institutions remains underdeveloped. In the last three years, only 16% of firms surveyed in the state have partnered with a university when upgrading or acquiring a new technology, a figure that is actually lower in Penang than the national average.

Universiti Sains Malaysia has set up the Innovations Office to promote and co-ordinate technology licensing and commercialisation efforts. The establishment of a commercial arm, Sanggar SAINS Sdn Bhd, with a commercialisation and enterprise development programme, and the creation of an on-campus innovations complex have produced some promising results: 26 projects have passed the proof of concept phase and 11 projects/products have been introduced to potential commercialisation partners. Long-term success will depend on the ability to attract high calibre organisations such as federal research laboratories that are able to generate new intellectual properties as well as investors (domestic and foreign) to support and grow start-up companies commercialising USM's R&D and innovation outcomes.

The Penang state economy is biased towards manufacturing (43% of its GDP) and the central government is struggling to retain foreign investments. The government is also seeking to move the economy up on the value chain with focus on new technology niches. University-industry collaboration is increasingly seen as a target for new policy measures. It is important to better align education with local industry needs. This would be easier if HEIs and skill centres improved their collaboration and partnerships.

The Government of Malaysia is increasingly aware of the intensified competition in a number of industries. In 20 years, the share of FDI directed to Malaysia and Penang within South East Asia has been divided by nearly a factor 3. As a response to this challenge, the regional strategy has been extended to the Northern Corridor Economic Region (NCER). It aims at reactivating the attractiveness of the country and the Penang state and to regain competitiveness. In that context, the higher education sector,

particularly Universiti Sains Malaysia, are key assets that need to be more efficiently leveraged. The biotechnology research infrastructure in Universiti Sains Malaysia and the future microelectronic centre CEDEC could become anchors and R&D bases for future development.

In order to make such a strategy successful, a number of barriers need to be removed. First, higher education institutions are considered as a low source of technology and often not an option for partner search. Second, the government's research institutes and HE R&D often do not coincide thus limiting the potential for co-operation. Third, despite the relative abundance of venture capital, the number of deals is low and decreasing. Fourth, small and medium-sized enterprises only rarely embark on collaborative programmes with higher education institutions. The Government of Malaysia is called upon to take steps to reduce or eliminate these obstacles. Increasing the incentives for collaborative research would be particularly helpful. Higher education institutions should also become more transparent with regard to the research programmes they are involved in and more systematically communicate the results obtained.

The mismatch between the supply and demand of skills is an area that deserves special attention. While the industry-led Penang Skill Development Centre is a model of shared learning among manufacturing and service industry and a one-stop human resource development centre, after two decades of its inception, it is still not fully integrated in the Penang higher education system. Co-operation is weak with universities in Malaysia and Penang and the PSDC diploma are not recognised in the public sector. These gaps are detrimental to the regional innovation system in Penang and contribute to its fragmentation.

The following measures would promote regional innovation in Penang

Recommendations for the federal/national policy:

- *Enhance the regional contribution of higher education institutions. Given the expected budget cutbacks,* it is important to build on existing strengths and align research programmes with regional priorities to ensure future sustainability.

- *Launch an independent review of the educational and research programmes of higher education institutions in order to assess the alignment of these programmes with the regional priorities.* The Universiti Sains Malaysia's educational and research programmes

should be reviewed in order to assess the alignment of these programmes with the regional priorities of the National Corridor Implementation Authority (NCIA). A similar exercise could be envisaged for Universiti Teknologi MARA.

- *Strengthen the Regional Innovation System by launching new initiatives at state and central level to help higher education institutions to forge stronger links with the business sector.* New initiatives are required at state and national level to strengthen the Regional Innovation System. First, policy measures should be taken to improve HEI services to firms and to develop communication policies about research results. Second, an incentive system should be established to favour the development of contract research. Voucher systems (such as those operating in Netherlands or Italy) could be a way to link SMEs and HE R&D units. Third, public grants to research programmes should be extended to priority sectors other than the E&E and biotech industry.

- *In collaborative research, research awards and research collaboration move away for direct allocations and subsidies as the major modus operandi to competitive mechanisms in order to enhance outcomes and to increase overall productivity.*

- *In collaboration with the state governments, encourage and support collaborative research between the higher education institutions at the sub-national level and also with higher education institutions in neighbouring regions to better exploit the complementarities between the different institutions and to reach a critical mass in a number of disciplines.* In Penang, collaborative research programmes should draw together the Universiti Sains Malaysia, Universiti Teknologi MARA, Universiti Malaysia Perlis and other regional higher education institutions. Collaborative programmes taking advantage of complementarities between Universiti Malaysia Perlis, Universiti Teknologi MARA (engineering) and Universiti Teknologi Petronas could tap the interdisciplinary innovation potential of the region. This could be facilitated if higher education institutions were requested to elaborate joint regional strategies.

- *Strengthen the recently introduced requirement for compulsory field training in all study programmes and help higher education institutions establish quality frameworks for internships so that industries will manage them efficiently thus facilitating students' eventual entry to the labour market*. Internships programmes should be generalised to all

students, including social sciences and arts in order to develop capacity for innovation services.

- *Increase the training potential and student enrolment within vocational tertiary education institutions, professional institutions and community colleges to enable the eligible age group to acquire (middle level) skills in non high technology sectors such as agronomy, engineering, equipment maintenance, handicrafts and culinary skills.*

- *Develop policies to provide ways in which higher education institutions can either cap enrolment in low priority areas and/or provide incentives in high national and regional priority areas.*

Recommendations for the universities

- *[For UMS]: Rationalise – reorganise and reduce – the number of overlapping innovation offices and strike a balance between basic and applied research by introducing a research portfolio that is aligned with the needs of Penang and more generally the Northern Corridor Economic Region.*

- *Define clearly the institutional regional mission and conceived strategies adjusted to regional needs.*

Entrepreneurship support in Penang

Promoting graduate entrepreneurship is a national priority in Malaysia. Entrepreneurship support is provided through a networked system with more than a dozen ministries and over 30 agencies. A number of programmes have been created but so far results remain modest, only a few students developing businesses.

In 2007, within the framework of the Ninth Malaysia Plan, the Ministry of Entrepreneurship and Co-operative Development (MECD) launched a wide range of programmes to promote graduate entrepreneurship with the aim of producing 150 000 new graduate entrepreneurs a year. The development of "managerial and entrepreneurship skills" are also required for higher education programme accreditation. In 2007, altogether 17 public

universities implemented entrepreneurship programmes. Despite the progress made, the results are still at a low level. In 2004, only 30 out of 2 275 graduate respondents chose to get involved in entrepreneurship either by running a business on their own or by being part of a team.

Entrepreneurship support in Malaysia is provided through a networked system that includes more than a dozen ministries and over 30 agencies. Several universities participate in the government's incubator programme MTDC, the National Unipreneur Development Programme (NUDP) that stimulates technology-related start-ups and university-industry relationships, and the annual business plan competition (MIBPC). Furthermore, a range of funding mechanisms have been developed to provide medium- and long-term capital financing, such as the "Cradle Investment Programme" (CIP) and the "Start Your Own Business" by the Multimedia Development Corporation. The Malaysian Venture Capital and Private Equity Association targets high technology and knowledge-based enterprises of all sizes.

Penang higher education institutions are offering an increasing number of entrepreneurship courses. Penang has a rich support framework for new firm creation and increasing investments are being made to support the creation of new business formation in knowledge-based fields.

Universiti Sains Malaysia provides a wide range of entrepreneurship courses which are integrated in the curricular. During the period 1955-2009, courses on offer have seen an increase in student enrolment of more than 78%. There is also an increasing number of start-ups amongst USM graduates. Since 1995, 190 firms were started, of which 100 in the period 2005-09. Progress is being made in other higher education institutions too. For example, Wawasan university has recently launched a Bachelor of Business in Entrepreneurship and Small Business Management and the Entrepreneurship Development course. Followed by the success in national business plan competition, KDU College has increased in-house facilitators and coaches for student start-ups. Furthermore, the unemployed graduates with a Bachelor's degree have access to entrepreneurship training.

Well-developed start-up support programmes can facilitate business formation but do not create financial dependency. Increasing investments are being made to support entrepreneurship in Penang. In 2009, the Penang Skills Development Center (PSDC) received MYR 30 million from the Government of Malaysia to provide incubation services to start-up firms and young companies as well as to existing small and medium-sized firms that

want to use PSDC laboratory space for innovation purposes. The Penang Cluster Alliance Sdn. Bhd. (PCA) announced in summer 2010 the opening of a new incubation facility for around 40 start-up firms in ICT in a new, 10 800 square feet "enterprise laboratory" worth MYR 1.7 million. Furthermore, the National Institute for Entrepreneurship INSKEN is launching a promotional campaign on graduate entrepreneurship in 2011, with a focus on the commercialisation of research related to *Halal* products.

Supported by its top leadership, Universiti Sains Malaysia focuses on promoting technology-intensive entrepreneurship and spin-off activities through the commercialisation of research results. Sanggar SAINS Sdn Bhd, one of its commercial units, has developed the "Innovator Programme" dedicated to provide guidance, advice and support to start-up companies commercialising R&D outcomes of the university. Sanggar SAINS is also at present managing business incubation facilities at the university's innovations park, sains@usm "USM Connectors" enhance technology scouting and increase collaboration with industry. USM is also offering the winners of international business plan competitions the opportunity to locate in the USM's incubator space. Finally, the university's"3-Track promotion exercise" provides a tool to reward and incentivise not only leading-edge research and quality teaching but also community engagement and entrepreneurship support. The overall conditions for new business generation have become more beneficial.

The following measures would enhance entrepreneurship support:

Recommendations for the national government

- *Continue forward thinking strategies to develop a more entrepreneurial higher education sector and to boost graduate entrepreneurship in Malaysia.*

- *Develop incentive and reward systems and accountability schemes for higher education institutions.* Governments at different levels wishing to see strong move towards entrepreneurship need to ensure adequate incentive and accountability schemes that can mobilise higher education institutions.

Recommendations for the sub-national level

- *Establish a joint resource centre, providing an on-line information system of pedagogical practices freely accessible for teachers, researchers, students and other organisations involved in entrepreneurship education in order to create a more entrepreneurial learning environment.* The tasks of the resource centre could be to produce innovative and pertinent teaching material (case studies, videos, games, course contents, syllabi etc.) and to organise regular events, also using on-line services, targeted at different and mixed audiences to enhance communication on, and exchange of, new and innovative approaches in entrepreneurship education.

- *Develop co-operation and referral between internal and external business start-up support providers.* Consideration should be given to establish a business plan competition in Penang, devised around the key opportunity areas for new firms resulting from the strengths and weaknesses of the local economy. Penang has critical mass in terms of students and entrepreneurship support providers.

Recommendations for the universities

- *Use entrepreneurial pedagogies in entrepreneurship education and organise it in a dynamic way by taking* account of the needs and interests of students, real businesses and research results. Engage students as partners in, and creators of entrepreneurship support. Use a differentiated approach to reach out to students at different stages of their study process. Use performance assessment exercises, including regular feedback sessions with people from the business community, alumni entrepreneurs and students and to track and survey alumni with entrepreneurial careers. Build and expand linkages between research and teaching, for example by getting doctoral students to work on research topics related to entrepreneurship education. Recognise that compulsory courses may reduce genuine interest in entrepreneurship. Interdisciplinary team efforts in entrepreneurship education allow individuals to concentrate on what they know and like best and at the same time become familiar with new knowledge that can be associated in a new way of solving a problem or creating a new product or service.

- *Develop the teaching methods in entrepreneurship and support. Provide "training the trainer" activities and engage entrepreneurs and business practitioners in entrepreneurship teaching.* Invite international visiting

entrepreneurship professors to enhance the research base and to improve the students' learning experience. Promote entrepreneurial spirit by entrepreneurship educator development programmes and workshops, careers adviser awareness programmes, and faculty deans' and directors' development programmes and workshops.

- *Link entrepreneurship education with start-up support efforts.* Entrepreneurial professors and researchers can provide the link between education and start-up support, by being role models, *sharing* research results for commercialisation and acting as mentors for student projects. To facilitate this, start-up support needs to be embedded in education.

- *Ensure university leadership support for the entrepreneurial mission and incentivise individual entrepreneurialism.* There is a need for the university leadership to create synergies between education, research and entrepreneurship and to establish an institution-wide commitment to entrepreneurship with appropriate incentive structures for professors, researchers, administrative personnel and students. Provide soft incentives that stimulate involvement by professors and teaching staff by annual awards such as the "Best Entrepreneurship Innovative Pedagogy" and the "Best Entrepreneurship Professor". Reduce the teaching load for those involved in "strategic" entrepreneurship activities, such as entrepreneurship ambassadors and mentors should be considered.

Health, cultural tourism and sustainability and green growth

In Penang, the rapid and uneven growth and urbanisation have impacted the population's health outcomes. Drug abuse, demographic changes such as ageing and ethnic diversity also pose challenges, while Malay, Chinese and Indian populations feature diverse health profiles. At the same time, Penang is making progress to become a medical tourism hub in South East Asia by providing high-quality but more affordable specialised medical procedures. There is a need to focus on preventive care and improve skills development in the health sector

The social conditions in Penang have improved considerably in the last two decades. Penang has been successful in reducing poverty with less than 0.3% of the population below the poverty line in 2006, compared with 29% in 1980. Despite the progress made, Penang continues to feature urban-rural divide and new urban poverty which have a negative impact population's health outcomes.

The HIV/AIDS pandemic is a major health and social problem in Malaysia. In May 2010, there were 86 127 cases of HIV infected persons and 14 955 with AIDS, representing a significant increase since the first case was detected in 1986. In Penang, there were 3 524 people infected with HIV, 812 with AIDS, while 514 had died from HIV/AIDS. Responding to the locan, regional and national needs, the AIDS Action and Research Group (AARG) at Universiti Sains Malaysia has grown into a multi-disciplinary centre of excellence, acknowledged by the federal and state authorities for its research, policy advice, counselling and community service.

Universiti Sains Malaysia (USM) plays a dominant role in research activities in health and medicine. It is the leading research entity with a health campus and research centres, such as the Pharmaceutical Research Institute and the Advance Medical and Dental Institute (AMDI). The research-based work carried out in medicine and health, supported by government programmes, illustrates that high quality research is not jeopardised by regional co-operation and application. USM's research centres provide the region with advanced technology and help retain and attract talent to the region. They have the potential to improve human capital and innovation outcomes in Penang.

It will be increasingly important that Universiti Sains Malaysia will help improve health outcomes of the diverse populations in Penang by using the region as a laboratory for its teaching, research and service. The scale and expertise in health and medicine should be applied to develop strategies to increase the quantity and quality of health care provision across Penang and the Northern Corridor Economic Region. There are many opportunities to improve regional development in Penang and the Northern Corridor Economic Region, for example by providing an opportunity to: *i*) address the regional health challenges, *ii*) undertake multi-disciplinary research on the inter-connections between improving education, social and economic conditions and improving health outcomes, *iii*) provide community-based medicine and ambulatory care facilities and *iv*) provide innovations in medical education and health care delivery.

The experience from OECD countries shows that innovation in medical education and health care delivery are more likely to succeed if supported by

deliberate policies. The following are examples of strategies that can be used to support the new initiatives: *i)* partnerships with medical schools that have implemented community-based medical education to boost innovation in medical education or new forms of health care delivery; *ii*) competitive funds (with public and private support) dedicated to supporting a new research agenda (use information technology for innovation in health care delivery within the region). Without financial incentives, focus will remain on a traditional research agenda; and *iii*) incentive funding for recruiting and training the region's population in medical and health careers while at the same time attracting talent from elsewhere.

Penang is making progress to become a medical tourism hub in South East Asia by providing high quality but affordable specialised medical procedures. The region's goal is to be known as the centre for excellence in areas such as cardiac care and oncology, possessing globally-accredited hospitals and highly-qualified medical and healthcare professionals. Penang has strong public health and medical facilities, buttressed by international level private sector establishments. Private sector initiative and partnerships have contributed to medical tourism in Malaysia which, in 2006, brought in USD 59 million, with Penang attracting 70% of this revenue. The Penang Health Association (representing a group of private hospitals) as well as good communication and travel facilities, low cost of services and availability of good accommodation have contributed to the growth of medical tourism. However, Penang's ability to build a health hub is faced with human resource challenges and intense competition in the wider region. There is acknowledged shortage of skilled health personnel, particularly nurses, a shortage of highly qualified people.

Tourism is the second largest contributor to the Penang economy and nationally it plays a significant role in the promotion and expansion of Malaysia's tourism industry. There is considerable growth potential in tourism through diversification into higher value-added segments.

In 2009, Penang's contribution to the Malaysian tourist industry was the third highest in the country with nearly six million tourist arrivals. Penang is an international tourist destination famous for its many historic and scenic attractions, beaches and diverse cultures. The Penang Investment Tourism Office is consolidating the shift from sun, sea and sand tourism to higher value-added segments. The aim is to leverage on the UNESCO World Heritage Status to effectively promote George Town and Penang and retain

the authenticity of the city while making it more tourist-friendly. The state government stresses its cultural and ethnic diversity reflected in the language, costume, custom and cuisine and its historic links with the neighbouring countries such as Singapore and Indonesia.

State and federal governments can play an important role of supporting the cultural heritage of Penang and strengthening its tourism appeal. Universiti Sains Malaysia and other higher education institutions have supported this work by undertaking research, innovation and making their space available for events. There is, however, a lack of efforts to provide learning and skills development programmes in tourism and concerted efforts to develop and enhance entrepreneurship activities. There is also scope to increase knowledge transfer from higher education institutions to the tourism industry. Higher education institutions could for example help SMEs to better access global markets. Policy measures and collaboration by universities and other tertiary education institutions are needed to ensure that SMEs do not miss out in their ability to compete with larger suppliers. Higher education institutions could also support eco-efficiency and eco-innovation in tourism, and help improve the measurement and evaluation of policy outcomes to estimate impacts of changes in tourism demand on the tourism sector and across the economy. An important challenge is to set up governance mechanisms to improve tourism's competitiveness and quality at the local level and to ensure coherence of policy development and implementation for a more balanced and sustainable tourism development in the region.

Penang faces many environmental challenges, such as congestion, rampant property development on hill slopes, and water and air pollution. The main economic pillars of the Northern Corridor Economic Region – agriculture, manufacturing and tourism – rely on and impact the conditions and sustainability of the environment. Penang is building a renewable energy economy and also in R&D efforts that can position the region internationally as a leader in new renewable energy technologies.

Penang faces environmental challenges because of the fragility and limits of its island environment, rapid population growth and economic development. Traffic volumes and congestion, floods, rampant and unsynchronised property development on hill slopes, water pollution from

industrial effluent and air pollution from high usage of private transport are some of the results of rapid growth. A major issue is the lack of integrated management of water resources, energy and waste. The main economic pillars of the Northern Corridor Economic Region – agriculture, manufacturing and tourism – rely on and impact the conditions and sustainability of the environment. Sustainable practices need to be introduced to reduce the stress on natural resources in the region.

The State of Penang aims to become Malaysia's first green state and it is collaborating with the United Nations Environmental Programme (UNEP) to develop Penang into an eco town to ensure that commercial activities co-exist with nature in a sustainable manner. The state government is providing incentives to housing developers to adopt the Green Building Index (GBI) in order to retain the UNESCO World Heritage status. The Penang Transport Council was established in 2009 to improve public transport by moving people instead of cars, but the absence of public transport operators in the council limits its impact. The previous Penang Government commissioned an environment conservation strategy plan under its think tank SERI (Socio-Economic and Environmental Research Institute) but the strategy plan was never adopted as a policy. At the local level, the municipality of Penang Island with jurisdiction over George Town, is concerned about the sustainable environmental development but lacks the instruments to implement a coherent environmental protection policy and the capacity to conduct comprehensive impact analyses of investment projects.

Universiti Sains Malaysia has a pool of experts in various disciplines, research centres and laboratories in environmental studies and research. The university's expertise and facilities are in high demand among the local industries and agencies. The environmental testing and analytical services use the equipment and facilities of various schools and centres such as the Environmental Technology Division, School of Industrial Technology, School of Chemical Sciences, School of Physics and various schools and centres of the Engineering campus. The university's broad portfolio of activities are connected under the healthy campus programme. USM's APEX university transformation plan is linked to sustainable development. USM has improved the design for new developments and mitigated environmental degradation in the region. The mobile unit of the Centre for Education, Training and Research on Renewable Energy and Energy Efficiency (CETREE) has introduced the issues of renewable energy and energy efficiency to 25 million school children in Malaysia and has carried out programmes to 150 000 members of public via community centres. Small scale recycling projects have brought tangible improvements in village communities.

Despite the commendable progress, the contribution of higher education institutions to sustainable development in Penang has not yet reached its full potential. The current programmes are often small in scale and fragmented among higher education institutions. Co-operation with the higher education community faces a number of constraints. There are many of projects but no coherently planned initiatives. The only institute fully dedicated to environmental studies and sustainability is USM's Center for Global Sustainability Studies (CGSS) which has limited resources. The municipality has made efforts to create a chair for urban studies within the USM that could have taken on board urban and environmental issues and amenity policy problem, but so far the university has not appointed a professor for this task.

There is a lack of dissemination of good practices across the higher education sector and scope to enhance joint RDI efforts to support the development of renewable energies and green growth, and outreach activities to support technical, organisational and process improvements for energy efficiency in the regional industry. Universities and other tertiary education institutions in Penang could increase their co-operation with local or regional one-stop-shop agencies for business support. By training the trainers and other knowledge dissemination activities, universities could help these agencies acquire the specialised skills to advise firms on the cost-effective ways to reduce emissions. Furthermore, higher education institutions could strengthen their efforts in greening the SMEs in the tourism and E&E industry.

In the absence of a comprehensive regional approach and incentives, higher education institutions are less likely to make rapid progress in supporting green economy. There is also a risk that the main beneficiaries of technology transfer from higher education institutions will be the large enterprises, delaying the market penetration of zero-emission as well as water efficient technologies. Positive outcomes require action to identify opportunities for change, to create innovations in water management and to make low-carbon technologies more attractive, and develop skills to make wider use of green technologies.

Jobs related to renewable energy and energy efficiency are projected to increase to several millions worldwide by 2030, most of these new jobs in a small number of innovative regions. The development of a green economy depends on the availability of skilled people to fill the new jobs related to renewable energy and energy efficiency. Simultaneous development of diverse skills and extensive retraining will be necessary. Skill creation and re-skilling activities in green growth are delivered by Universiti Sains Malaysia and the Penang Skills Development Centre. Penang should take steps to anticipate the employment effects and labour reallocation needs

across industries. Skill creation could be more efficiently organised by pooling learning resources of educational institutions and industries at the regional level. Stronger partnerships between tertiary education institutions and industrial associations could stimulate innovation in the modes of delivery of education and training. This would require transparent pathways between different levels of education and also between higher education institutions.

The following measures would enhance social, cultural and environmental development in Penang

Recommendations for the national policy

- *Provide incentives for "challenge-driven" research to connect university research to community development*. In order to make the connection between the current research focus and a more broadly defined third mission, "translational research" could be adapted to address the critical issues that bridge the university and community.

- *Create a school of environmental research in Penang to train students in those disciplines and to embark on research that will be useful for Pulau Penang and beyond in the Northern Corridor Economic Region*.

Recommendations for the sub-national level

- *Apply the university expertise in health to develop strategies to increase the quantity and quality of health care provision in the region.* Use this expertise to develop the region as a whole as an internationally recognised centre of expertise and innovation on health care practices and technical innovations that improve health care outcomes of the population but also attract health tourism. Scale up medical personnel training. Support university partnership with medical schools and health care delivery systems that have implemented community-based medical education to boost innovation in medical education or new forms of health care delivery.

- *Provide competitive funds (with public and private support) dedicated to supporting a new research agenda and incentive funding for recruiting and training the region's population for health careers.*

- *In view of the importance of the environmental protection and preservation of urban cultural heritage in Penang, define a comprehensive amenity policy strategy and launch initiatives to leverage assets for cultural and gastronomy tourism with the help of university expertise.*

- *Create an integrated approach to address the challenges of rapid urbanisation and unsustainable construction projects and promote inter-ethnic initiatives.* Consider the development of a school of environmental research should be created and the awareness on conservation and preservation fostered through increasing links with local communities in the region.

Recommendations for the universities

- *Develop a forum for social, cultural and environmental development to build on strengths, to identify unexploited opportunities and to address the* regional *needs.* An exchange forum should be put in place to, track and monitor different initiatives and their outcomes and identify best practices for publication and policy fine-tuning. Such a forum could organise thematic events, with regular information retrieval and exchange facilitated by a dedicated website. As a first step, universities' current connections, initiatives and projects involving stakeholder collaboration, community development and/or outreach should be mapped and published in the collaboration platform.

- Improve the monitoring and follow-up of the success and results of their initiatives, projects and programmes to show return on public investment. The lack of robust and comparable data constrains the visibility and impact of universities' activities. It also makes difficult to measure the success or failure of programmes. Building on the existing successful models, capacity should be developed in regional data gathering, and sharing regional data repositories and technical skills associated with using regional data.

- *Collaborate with authorities, schools and the private sector, reach out to socially underprivileged population to ensure social and economic cohesion.* Current activities need to be scaled up in a systematic way, including long-term multi-stakeholder collaboration to raise aspirations among youth in socially unprivileged population and to improve their quality of life.

- *Address regional health challenges in Penang and the Northern Corridor Economic Region*. University Sais Malaysia's health-related centres should widen their focus on community-based medical education and new forms of health care delivery as well as generation of innovations.

- *Provide advice and expertise for local planning and urban development by reactivating and revamping the USM urban studies within the university should be reactivated and revamped. This* would facilitate training for local government and provide an opportunity to embark on consultancy services and to provide the skill basis for more proactive local government with strong commitment to sustainability. Basic foundations for stronger university involvement are already in place: the Universiti Sains Malaysia has issued a blueprint on housing and environment, while the Socio-Economic and Environmental Research Institute (SERI) is a useful think tank.

- *Collaborate with the public and private sector in Penang to increase joint efforts to support sustainable environmental and economic development through a comprehensive regional approach to growth management bringing together diverse regional actors to sustainability process.* Scale up their efforts to provide learning and further education programmes for "green" jobs and to act as a source of expertise through research, consultancy and demonstration. Provide analysis of the benefits and costs of controlling emissions from the wide variety of emissions sources, for example multinational corporations.

- *Strengthen and develop interactions between higher education institutions and non-governmental organisations in order to maintain and enhance civic co-operation in Penang*. The role of non-governmental organisations in is critical and the higher education institutions are already in interaction with non-governmental organisations in connecting students with community learning opportunities.

- *Engage in long-term community development seeking ways to empower communities to find their own solutions to various economic, social, cultural, environmental challenges which are global, national and local in nature*. The region should be seen as a "laboratory" for developing research, students' work-based and experiential learning and development projects in many different fields.

Capacity building for regional development

Higher education institutions in Penang and in Malaysia in general do not have an explicit regional mission, but this is left to the individual institutions' initiative. For research-intensive universities, the principal driver is scientific excellence. There is a need to acknowledge the key role that HEIs can play in local and regional development and provide incentives at the institutional and individual level to mobilise the full potential of HEIs.

There is a need to acknowledge across the government the key role that the higher education institutions can play in regional development by joining up a wide range of policies such as science and technology, industry, education and skills, health, culture and sport, environmental sustainability and social inclusion. If Malaysia wishes to mobilise its higher education system in support of regional development, the higher education policy which embraces teaching, research and community service should include an explicit regional dimension. There should be an acknowledgement that the diverse regional contexts within which higher education institutions operate and the national policies, especially funding regime, have differential regional impacts.

In Malaysia, public higher education institutions are established, financed and managed by the national government. They are accountable to the federal authorities, and, on the whole, more concerned with national development than with regional or local engagement. As in many other countries, higher education institutions in Malaysia do not have an explicit regional mission which is left to the individual institutions' initiative. For research-intensive universities, the principal driver is scientific excellence. There is no formal process for monitoring outcomes and assessing the impact of local engagement. As a result, a considerable amount of university research is theoretically-oriented with limited relevance to local and regional development.

Universities and other higher education institutions in Penang and Malaysia need greater incentives in order to play an effective role in regional development. Currently, public resource allocation criteria for higher education institutions in Malaysia do not give adequate emphasis to

regional engagement. Unless this becomes a regular element of ongoing planning and is accepted and approved by the authorities, it can be difficult to ensure an adequate alignment of higher education institutions' activities with local and regional needs.

The issue of incentives is also important at the individual level. Currently, the criteria for staff recruitment and promotion in Penang higher education institutions do not sufficiently encourage activities related to local engagement. As a result, staff members consider that their responsibility in terms of teaching and research is more relevant to national needs than to regional requirements. The Universiti Sains Malaysia has taken steps to introduce a "3-track promotion exercise" based on research, teaching and community engagement or industry collaboration to reward and incentivise community engagement and entrepreneurship support. This development is commendable and should be strengthened.

Higher education institutions in Penang are engaged in diverse collaboration with regional, local and industry partners. Nonetheless, much of this collaboration is at *an ad hoc* basis without long-term planning, adequate resources and monitoring of the results. In some instances, development agencies engage in regular dialogue with the higher education leaders but there is no appropriate follow up. Permanent long-term collaboration is needed to address the challenges and opportunities of Penang. Collaborative work should be supported by a detailed knowledge of the needs and opportunities of the region and the knowledge of the higher education institutions' research and education portfolio so that when opportunities arise, the development agencies can identify appropriate institution or part of it to be engaged in the negotiation process.

The following measures would enhance capacity building for regional development

Recommendations for the national policy

- *Make regional engagement, and its wide agenda for economic, social and cultural development explicit in higher education legislation and policy.*

- *Provide incentives for higher education institutions' regional engagement in the form of long-term core funding and strategic incentive-based funding schemes on a competitive basis.*

- *Strengthen higher education institutions' accountability to society by developing indicators and monitoring outcomes to assess the impact of the higher education institutions on regional performance.* Include the contribution of higher education institutions to local and regional development in their annual evaluations.

Recommendations for sub-national level

- *Establish a partnership structure of key stakeholders from local and regional authorities, business and industry, the community and higher education to provide a focus for dialogue with higher education in relation to its contribution to regional development and identify a and develop leaders within the public and private sectors to populate this partnership structure.*

- *Develop a clearly articulated long-term integrated strategy to drive the economic, social, cultural and environmental development of the city and the state.* Mobilise the resources of higher education institutions in the preparation and implementation of regional and urban strategies.

- *Mobilise university expertise for regional development by establishing Chairs in areas of special needs or opportunities. Help identify areas of research for regional development.*

- *Invest jointly with higher education institutions in programmes which bring benefit to regional businesses and community*, for example translational research facilities which are aligned with the needs and opportunities of the region, advisory services for SMEs, professional development programmes, graduate retention and talent attraction programmes.

Recommendations for universities

- *Building on existing links and initiatives that align higher education institutions with the regional needs develop a common vision of local and regional development among higher education institutions,* support the vision with a strategy and milestones and funding in order to ensure that local engagement is part of higher education institutions' activities and reflected in their development plans.

- *Establish a permanent partnership organisation with own staff and resources* to link all higher education institutions in Penang in order to undertake substantive collaborative projects and programmes that address regional needs and opportunities.

- *Review staff recruitment, hiring and reward systems so as to include the regional development agenda.* Create mechanisms to systematically monitor and evaluate the activities in this area, to share good practice within their institution and benchmark this experience with other organisations and localities.

- *Develop senior management teams to deliver the corporate response expected by regional and local stakeholders without disincentivising entrepreneurial academic*.

Chapter 1.
National and regional context[1]

Penang – Pulau Pinang or literally "Isle of the Betel Nut" – is one of the 13 states of Malaysia. Known popularly also as "Pearl of the Orient", Penang is an international tourist destination famous for its many historic and scenic attractions and its diverse cultures. Growth and development based on foreign direct investments and E&E manufacturing has made Penang one of Malaysia's most successful states. Today, Penang is at the crossroads, in need of new strategies to revitalise its economy and attractivity.

This chapter presents the profile of Penang, with its main socio-economic features. It highlights the key features of the higher education system in Malaysia and in Penang and identifies the main strengths and challenges that Penang is now faced with.

Introduction

Malaysia is one of the smaller countries in the Asia Pacific region and consists of Peninsular Malaysia, and the states of Sabah and Sarawak in the island of Borneo, with a population of about 28.7 million at the first quarter of 2008 (see Figure 1.1. and 1.2.). It is a multi racial, multi cultural country (Table 1.1.) consisting of Malays, Chinese, Indians and indigenous groups such as the Kadazans in Sabah and the Ibans in Sarawak. Malaysia obtained her independence from the British in 1957 and thereupon established a constitutional monarchy with a political system based on the UK's parliamentary democracy.

Table 1.1. Population distribution (%) by ethnic group - Malaysia

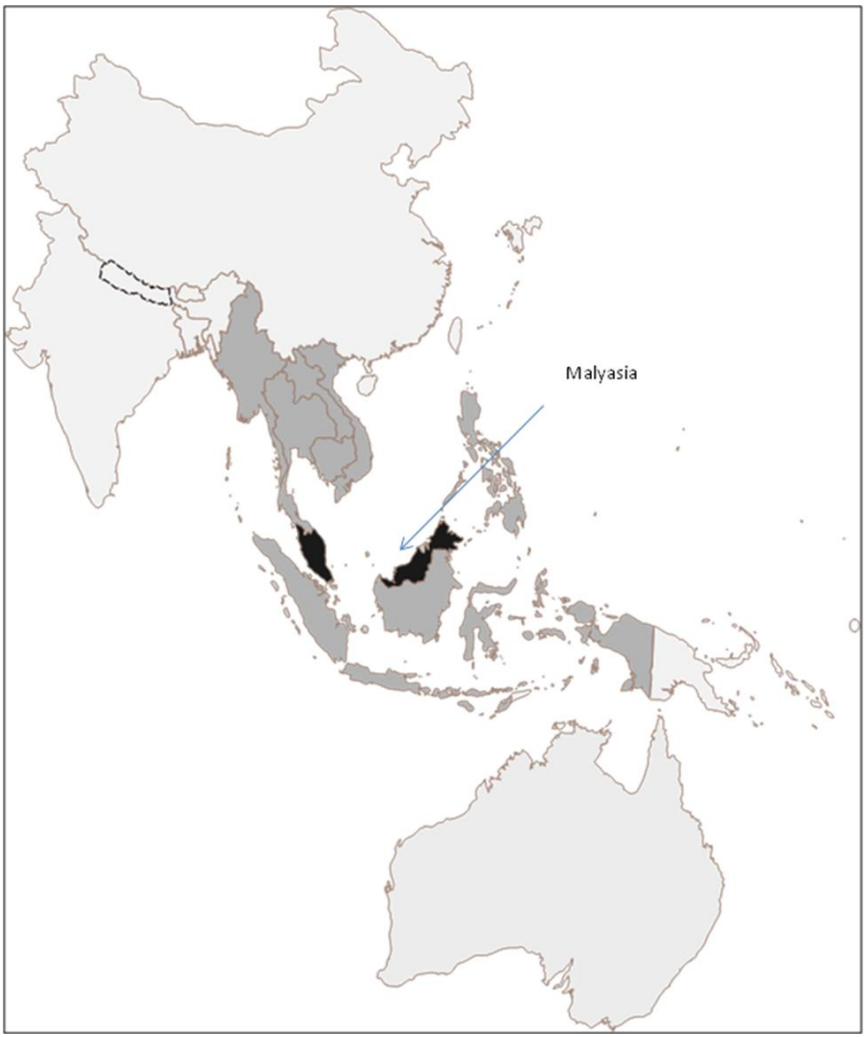
Ethnic group	Malaysia (28.7 million)
Malays/Bumiputeras*	65
Chinese	26
Indians	8
Others	1

Source: Annual Report, Malaysia, 2009.

*Malays and the indigenous peoples in Sabah and Sarawak in North Borneo are collectively called Bumiputras.

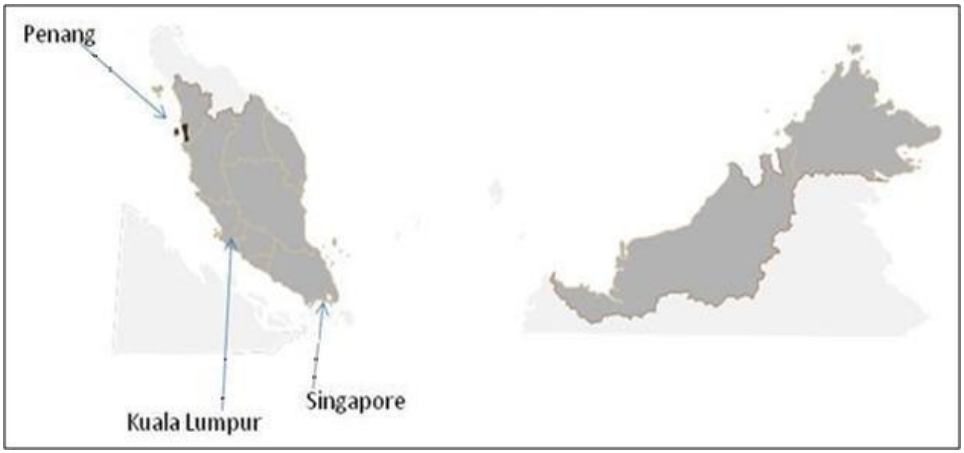
In the wake of the racial riots of May 1969, the New Economic Policy (NEP) was launched in 1971. It was designed to forge national unity through the twin objectives of eradicating poverty and restructuring Malaysian society by eliminating the identification of race with economic function. It is widely acknowledged that the NEP, and later the National Development Policy (1991-2000) and the National Vision Policy (2001-2010), all based on NEP tenets, have been successful in reducing poverty, promoting social mobility through education and training, developing a professional and commercial middle class, and increasing the ownership of capital for the Bumiputra community.

Figure 1.1. Map of South East Asia



Note**:** This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Figure 1.2. Map of Malaysia



Note**:** This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

1.1 State of the economy

Malaysia, a middle-income country, has transformed itself since the 1970s from a producer of raw materials into an emerging multi-sector economy, a large part of it focusing on export of manufactured products particularly products which include electronic components, electrical goods and appliances. In the last decade efforts have focused on developing a value-added production chain by attracting investments in high technology industries, medical technology, pharmaceuticals, and tourism, an effort that is ongoing. Determined efforts are being made to move away from dependence on exports towards boosting domestic demand. However exports continue to drive the economy. Malaysia is also an oil and gas producer from which it derives 40% of its revenue. Malaysia has been successful in reducing the incidence of poverty in the last five decades. In 2007, there were 3.6% of the population below the poverty line and 0.7% in the hard core category with the incidence of poverty higher amongst the rural population and in the states of Sabah, Trengganu and Kelantan (SERI, 2010).

Malaysia consistently achieved more than 7% GDP growth along with low inflation in the 1980s and the 1990s with recent GDP rates of 4.6% in 2007 and 5.5% in 2008. The impact of the global economic downturn brought the GDP down to -1.7% in 2009 and 8.9% in the second quarter of 2010 (Department of Statistics Malaysia, 2010). Some countries in the

region, however, such as Hong Kong, Singapore and South Korea, have outshone Malaysia's achievements over the last two decades as shown in Table 1.2.

Table 1.2. GDP per capita income for Malaysia, South Korea, Hong Kong and Singapore (1970 and 2005)

Country	GDP per capita current USD	GDP per capita current USD
	1970	2005
Malaysia	394.1	5 141.6
South Korea	278.8	16 308.9
Hong Kong	913.8	25 592.8
Singapore	959.2	26 892.9

Source: International Monetary Fund, World Economic Outlook Database, 2009

New Economic Model – 2010

In the proposed New Economic Model (2010) Malaysia will seek to position itself in high growth industries under the new reform proposals, aiming to move from the per capita gross national income of USD 7 000 to USD 17 000 by 2020, which would make it a developed nation by World Bank standards. Countries such as South Korea and Singapore have already made that leap. Without radical reshaping of its economy and a move away from low-value added electronics exports and labour intensive industries, Malaysia risks losing ground to the likes of China and Vietnam and not making it to developed nation status. Reforms are planned particularly in the service sector in order to attract foreign direct investment and domestic financing sources. Re-energising the private sector is a key element in the Economic Transformation Programme (NEM Concluding Part, 2010).

1.2. The National Education System

Since Independence in 1957, the Malaysian education system, inherited from the British, had been used as an important strategy in the development process of the nation. It is expected to fulfil the manpower demands of the economy, provide equality of educational opportunity for all and promote national unity in the plural society of Malaysia. Education in Malaysia is overseen by two government ministries: the Ministry of Education for matters up to the secondary level, and the Ministry of Higher Education for tertiary education. Although education is the responsibility of the federal government, each state has an Education Department to help coordinate

educational matters in their respective states. The main legislation governing education is the Education Act of 1996.

Education may be obtained from government-sponsored schools, private schools, or through home-schooling. By law, primary education is compulsory. The system is characterised by six years of primary schooling, five of lower (3 years) and upper secondary, and two of pre-university. The medium of instruction in national schools is Bahasa Malaysia, the national language, with English as one subject. Parallel tracks using Chinese and Tamil as instructional languages are available at primary level. Chinese secondary schools are privately owned, and there are no secondary schools using Tamil as the medium of instruction. National schools follow a common curriculum marked by common standardised examinations leading to a major school-leaving examination at the end of 11years of schooling, and another at the end of 13-years for those intending to continue to tertiary education.

Student admissions

Selection and admission of students to the nation's public universities is centrally orchestrated by the Ministry of Higher Education. Universiti Sains Malaysia is the exception as its APEX (Accelerated Programme for Excellence) status enables it to select and enrol students. Malaysian school-leavers have primarily two modes of entry to access public university education. The first is that of the Malaysian Higher School Certificate based on a national, standardised examination (local acronym STPM) gained at the end of 13 years of primary, secondary and higher secondary education. Good results in examinations however are not guarantees for university admission. The second mode is the one-year or two-year (for weaker students) matriculation programme, developed and conducted by various institutions at the end of eleven years of schooling. It was initiated in the 1970s as part of the nation's overall affirmative action policy and aimed to increase the number of Bumiputra students in science and technology-based disciplines.

In 1971, the Majid Committee, set up after the 1969 racial riots to look at campus affairs, recommended that student enrolment should reflect the ethnic composition in the country in the proportion of 55:45 for Bumiputera to non-Bumiputera students. This quota was followed by a few universities such as Universiti Malaya and USM. Others particularly the newer universities have largely Bumiputera students. The 2002 policy of admitting students based on merit as measured by the results of STPM examinations and matriculation assessments raises important questions about the dual entry mode. All students admitted are required to have a minimum

Cumulative Grade Point Average of 2.5 out of 4, but the extent to which these very different schooling standards and assessments are equivalent is an issue which has not been thoroughly debated. Currently, the students in matriculation programmes comprise about 90% Bumiputra and about 10% non-Bumiputra. While the different pathways increase access they do not ensure quality at entry.

There is a strong private sector, providing primary and secondary education using English as the main language medium. Students in these schools may choose to prepare for qualifying examinations leading to Australian, UK and US universities or the International Baccalaureate. A small but effective segment of privately-financed Chinese-medium secondary schools exists. Their United Education Certificate (UEC) is recognised by Malaysian private higher education institutions, Singapore and another 100-odd universities globally. Negotiations are ongoing between Chinese Schools and the government regarding acceptance of the UEC for public university admission in Malaysia.

The nation embarked on the implementation of various education and economic development plans in realisation of the need to strengthen economic development. The cumulative effect of these actions is best reflected in the development and growth of the higher education sector, increasingly recognised as the cornerstone of the continued growth of a country. In late 2000, the Malaysian government announced that technology education and high-tech industries would have leading roles in the country's economy which would thereafter be predominantly "knowledge-based". The government would focus on education as a means to deliver the promise of empowering the individual in the twenty-first century with the implication that economy and education would aim at closing the digital divide between the rural and urban centres of population.

Governance

Malaysian public universities are structured as statutory bodies, with vice-chancellors appointed by the cabinet and the strategic direction of a university overseen by a university council (more recently Board of Governors) comprising public and private sector figures who are appointed by the government. The Ministry of Higher Education has key representation on the Board, which appoints the Vice Chancellor. A selection board is normally set up, which undertake to interview all short-listed candidates. A recommendation (with several names of potential candidates) is forwarded to the Minister for Higher Education for his consideration. The Minister then appoints VCs of public universities after consultation (officially or unofficially) with other parties/stakeholders.

Public universities are generally administered as government departments, with faculty and administrative staff salary structures pegged to that of the civil service system. The system is highly centralised with decisions on student admissions, their distribution across faculties, tuition fees, financing of students, staffing numbers and salaries centrally determined. A comprehensive regulatory framework defines the parameters within which the university can function.

The Malaysian government introduced the idea of corporate governance for state-controlled universities in 1996, in an effort to pave the way for the incorporation of public universities. Incorporated universities would operate as independent, efficient, transparent and financially able entities. In the Malaysian context, public universities which have been corporatized ' are incorporated entities expected to adopt management systems similar to those of the corporate sector while at the same time accepting the fact that the government will retain explicit control' (Morshidi, 2008). However the full legislation required to implement the Act has not been completed. Universities are publicly funded adhering closely to government direction, unable to take full advantage of a more agile corporate approach. Government-linked universities such as Multimedia University, however, and private universities such as Limkokwing University are able to function as corporate entities.

Major policies governing the higher education system

In the mid-1990s, five watershed pieces of legislation were passed in Malaysia for the higher education sub-sector, defining parameters for public university management and administration while providing a regulatory framework for the burgeoning private higher education sector. These were: *i*) The National Council on Higher Education Act, 1996 to establish a council which formulates policy for the Malaysian higher education sector including the planning and coordination of the public and private sub-sectors; *ii*) The Corporatisation of Higher Education Act in 1997 was enacted to enable the corporatization of public universities and to modernize the management of public universities; *iii*) Private Higher Education Act 1996 which allowed for the liberalisation of the growing privatised segment in the sector; *iv*) The National Higher Education Funding Board Act 1997 to establish a higher education student loan funding agency; and *v*) The National Accreditation Board Act 1996. The last made way for the Malaysian Qualifications Agency Act 2007 which develops the Malaysian Qualifications Framework to unify and harmonize all Malaysian tertiary qualifications. In 2004, the Ministry of Higher Education was established, taking over from the Ministry of Education to manage the expanded tertiary

sub-sector with the aim of modernizing and improving operations, providing strategic directions, and overseeing development.

Financing of higher education

The government of Malaysia provides about 2.7% of the GDP annually to the education sector and approximately 25% of public expenditure is allocated to higher education. The bulk of financing for public higher education institutions comes from Federal funds channelled through the Ministry of Higher Education (MoHE). Only one university – Universiti Kuala Lumpur – is financed by a state government, the state of Selangor. A few older universities, such as the University of Malaya, Universiti Sains Malaysia, Universiti Kebangsaan and Universiti Putra Malaysia, have a proportion of self-generated income with some revenue generated by tuition fees, training fees, commercialisation of products, research grants from international or national bodies, and consultancies. They appear to be on track to comply with the MoHE plan for all universities to eventually move to a government to institutional contribution ratio of 70:30.

Malaysia relies on a traditional historical/negotiated incremental-cost approach, linked with inputs, in the distribution of funds among the public universities, after reviewing each university's annual budget proposal. This practice is in force despite the fact that the Modified Budgeting System (MBS) which operates as an output-oriented budget allocation was introduced in 1997. The Ministry of Higher Education's final allocation reflects the previous year's allocation plus a small increase based on the overall availability of public resources. However, Universiti Sains Malaysia, as an APEX university, is deemed to have greater flexibility in access and utilisation of institutional financing. Details are being negotiated and will have to be approved by Parliament prior to implementation.

Private higher education institutions are privately financed through local corporate and individual investments. Given the disadvantages of the quota-based and dual-mode admissions to public higher education institutions, three have been established by the Chinese and Indian ethnic communities. These received government financing on establishment and at least one continues to receive 50% of recurrent funds annually. Branch campuses of established overseas universities such as Monash may have mixed sources of funding from foreign bodies including the participating universities, private local corporate bodies and, in a few cases, state agencies (Curtin University in Sarawak). The varied sources of funds reflect a range of providers – government including federal and state government, private corporations, family and individual trusts and foundations, and foreign university funds. Private higher education institutions in Malaysia do not

enjoy any direct public funding or other forms of incentives that are extended to private companies in the manufacturing and hospitality sector.

A matter of concern for planners is that public expenditure for education in Malaysia does not exhibit consistent levels of allocations to the various sub-sectors. Between the years 1970 and 2006, overall public expenditure on education as a percentage of GDP in 1970 constituted 3.98%, climbing to a peak in 2006 to 7.66%, falling to 4.67% in 2008. The impact is seen in the reduced allocations of public expenditure per tertiary student (as percentage of per capita GDP) from 97.83 in 2002 to 59.72 in 2006. A comparison between the University of Malaya (UM) and a regional university, the National University of Singapore (NUS), revealed that in 2006, annual student expenditure in the National University of Singapore was USD 6 300 compared with USD 4 053 in the University of Malaya (Salmi, 2009). Decreasing allocations translate into a lower level of financial support for institutional development. It is also evident in research allocations which are not consistent over time.

Research

Research in Malaysian universities has historically been dependent on individual energy and interest of academic staff working within a context of very low and inconsistent funding. In 2006, the Ministry of Higher Education (MoHE) brought a vital change to the research scene by designating four universities as 'research universities' under the Ninth Malaysia Plan – Universiti Malaya, Universiti Sains Malaysia, Universiti Kebangsaan (National) Malaysia and Universiti Putra Malaysia. Additional funding amounting to approximately USD 300 000 annually would be allocated to these four institutions with the aim of engaging in emerging areas and supporting both stronger links with industry and the commercialisation of research outputs. MoHEs expectation is that concentrating resources in institutions with most potential will pay better dividends than spreading them thinly over the 20 public universities. As an initial stage, required infrastructure such as buildings, equipment and training of academic and support staff take precedence, developing a platform for substantive research activities. For national priority areas, particularly in science and technology, where local academic staff are not available, universities are encouraged to recruit foreign staff. It will be noted that traditionally research grants are allocated and not subjected to rigorous competitive funding mechanisms. The scenario currently however is moving towards increased inter-university and intra-university competition for research funds.

Tuition fees

While public universities can determine the fees for postgraduate students (this is the main source of income for incorporated universities), the undergraduate student fees must adhere strictly to the guidelines laid out by the MoHE (Morshidi, 2006). Revenue for operating activities arising from student fees has continued to decrease while income from consultancy, contract research, sale of expert services and other market-related activities has become an important source of revenue for many public universities in Malaysia.

With low tuition fees, costs for student expenditure are highly subsidised by the government. International students are charged double or triple the local fee, depending on whether it is a science/technology programme or humanities/social science this amount. This would contribute to greater cost-recovery but the proportion of international students, largely at the post-graduate level, is increasing only in some universities and not all. Table 1.3. below provides information on the typical tuition fees charged by public and private universities, indicating the high level of subsidy in five fields of study. In a business/social science programme, a local student would pay USD 1 935.8 for the entire undergraduate degree programme with the government subsidy amounting to USD 14 440.6. The full-cost fees charged by private higher education institutions for similar programmes would range from USD 9 434.0 to USD 26 415.1, depending on their international-local components. Higher education analysts have voiced concern regarding the amount of government subsidy and the extent to which it is sustainable, given that higher education costs will continue to rise universally.

Table 1.3. Tuition fees and total government subsidies for five field of studies in Malaysian Ringgit*

	Public		Private
Type of Study	Tuition Fee (MYR)	Government Subsidy (MYR)	Fee** (MYR)
Business & Social Science	6 156	45 921	30 000 - 84 000
Engineering	9 408	80 460	46 000-102 000
ICT	6 816	61 530	32 000 –84 000
Medicine	13 260	157 700	250 000 – 333 000
Hospitality & Tourism	6 816	61 530	31 000 – 55 000
Music	6 156	45 921	53 000 – 59 000

*USD= MYR 3.18, 27 August, 2010.

**Range includes local, 3-year and branch campus with fees shown for the full programme.

Source: Fernandez-Chung. R.M. (2010), Access and Equity in Higher Education, Malaysia. Unpublished paper presented at Higher Education and Dynamic Asia Workshop, Asian Development Bank, Manila, June 2010.

Student financing

The National Higher Education Fund Corporation (NHEFC), introduced in 1997, has in the last ten years provided higher education loans to the amount of MYR 26.2 billion benefitting about 1.3 million students. In 1997, NHEFC approved 12 000 applications and 2008 approvals increased to 97 000. The availability of study loans has increased enrolment in the private higher education sector (which charges higher fees), now at 50% of the total student enrolment in the country. Several issues have been raised regarding the Fund's implementation and sustainability. These include the eligibility criteria for applicants, seen as too broad; inappropriate targeting with only 32% of loan beneficiaries from private university students; repayment period; high incidence of default – estimated at 25% of expected repayments (World Bank, 2007); inefficient administration with high staff numbers; and overall threat to sustainability due to depleting base financing. In terms of supporting equitable access to all groups, figures available (for 2000) show that of the 60% of Bumiputeras enrolled in higher education institutions, 75.4% had obtained loans from the fund compared with the 40% of non-Bumiputera students of whom only 24.6% were successful in accessing loans.

The government of Malaysia also provides financial support through scholarships based on merit to students pursuing accredited courses of study in local and foreign institutions, a large proportion of which is allocated for disciplines deemed to be critical such as medicine and pharmacy. These used to be preponderantly for Bumiputeras but the spread has been more equitable since 2008. In 2000, for instance, 80 percent of the 748 scholarships for study overseas were awarded to Bumiputera applicants. By 2008, the pattern has improved where of the 2000 scholarships available 45% of these were awarded to non-Bumiputeras.

Expansion of education

The period 1985-2008 saw unprecedented expansion at all levels of education, primary, secondary and tertiary. All sub-sectors saw their enrolment expand with higher education enrolment showing the most dramatic increase. While primary enrolment increased by 30.5% over this period and secondary school enrolment increased by 45.8%, tertiary education enrolment increased by 93.1%. This represented an annual increase of 1.3% for primary schools, 2.0% for secondary schools and 4.1% for tertiary education institutions (Table 1.4.), showing great improvement in access to higher education in Malaysia.

Table 1.4. Expansion in enrolment by educational level, 1985-2008

	1985	1990	1995	2000	2005	2008	% increase	Annual rate increase (%)
Primary	2 191 676	2 447 206	2 827 627	2 907123	3 137 280	3 154 090	30.5	1.3
Secondary	1 251 447	1 366 068	1 589 584	1 950 746	2 217 749	2 310 660	45.8	2.0
Tertiary	64 025	99 687	146 581	363 949	463 582	921 548	93.1	4.1
Total	3 507 148	3 912 961	4 563 792	5 221 818	5 818 611	6 386 298	45.1	2.0

Source: Sources for 1985 – 2008 primary and secondary level data, and tertiary level until 2000, Ministry of Education (2010), Pembangunan Pendidikan 2001 – 2010. For 2005 and 2008 tertiary level see Ministry of Higher Education (2010), *www.mohe.gov.my/web_statistic*.

Economic growth and social demand fuelled the expansion of public and private tertiary education in Malaysia, resulting in a highly diversified landscape of public and private provision. Currently the public sector comprises 20 universities, 34 polytechnics and 37 community colleges; the private sector has 34 private universities and university colleges including branch campuses or colleges of five foreign universities, and 488 education institutions including branch campuses. Enrolments in undergraduate programs in public universities increased by 37.6% during the 2000-03 period and by 20% between 2003 and 2005; enrolments in private higher education institutions increased by 60% from 1998 to 2000, and by 19.2% during the 2000-05 period. Since the late 1980s private sector institutions have introduced a complex of modalities such as twinning where students may complete a degree from a foreign university at home, a move supported by the government as it reduced the numbers studying abroad, curbing expenditure of Malaysian currency overseas. Apart from public higher education institutions, there are several foreign universities such as Monash (Australia) and Nottingham (UK) which have established branch campuses as well as a host of twinning programmes with largely private institutions. Malaysia is an attractive destination for international students given its comparatively low tuition fees, affordable living costs, broad range of education levels and programmes, and for Islamic countries, a facilitating environment for Muslim students.

Besides university degrees, students also have the option of continuing their education in professional courses such as the courses offered by the Institute of Chartered Secretaries and Administrators and diploma (3 years) and certificate level (2 years) programmes in polytechnics; and two-year community college programmes.

Increased access to higher education is reflected in the percentage of the population 19-24 enrolled in higher education. Table 1.5 shows that in 1970 only 0.6% of the age group 19-24 was enrolled in higher education. By 1990, 2.9% of this age group was enrolled in higher education and by 2000, it increased to 8.1% of the age group. A huge leap in enrolments took place after 2000 so that by 2005 19.4% and by 2007, 24.4 percent of the 19-24 age group was placed in higher education institutions (Table 1.5.). According to the Ninth Malaysian Plan (2006-10), it is expected that 1.6 million students or 40% of the relevant age cohort in tertiary education would be enrolled in tertiary education in 2010 and 50% of these would be studying at private institutions.

Table 1.5. Percentage population age 19-24 enrolled in tertiary education

Year	Population	Enrolment	%
1970	1 420 687	8 633	0.6
1980	1 624 274	26 410	1.6
1990	2 028 100	58 286	2.9
2000	2 626 900	211 484	8.1
2005	3 353 600	649 653	19.4
2007	3 474 200	847 485	24.4

Source: Ministry of Education, Pembangunan Pendidikan 2001-2010, Department of Statistics and MOE, Educational Statistics. MOHE Website.

Higher education system and student enrolments

Tables 1.6. and 1.7. provide the profile of student enrolment and output in Malaysian higher education institutions between 2002 and 2008 (July). By 2008, the 214 941 number in 2002, the year from which electronic data are available from MoHE, increased to 933 728. Of these, 533 831 students were in public universities, whereas 399 897 students were from private institutions. Table 1.6. provides a breakdown by sector and by programme for the years data were accessible, culminating in 2008.

Table 1.6. Enrolment in public higher education, 1987 - 2008

Date	Certificate		Diploma		Degree		Masters		Doctoral		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
1987	8 537	7.8	54 318	49.4	43 430	39.5	3 252	3.0	381	0.3	109 918	100
1990	9 907	9.8	32 588	32.2	53 557	53.0	4 499	4.9	539	0.5	101 090	100
1995	15 226	7.7	93 506	47.5	79 227	40.2	7 622	3.9	1 255	0.6	196 836	100
2000	27 830	8.8	129 177	41.0	137 538	43.5	19 045	6.0	2 813	0.9	316 403	100
2005	35 380	8.3	139 562	32.6	210 973	49.3	34 969	8.1	6 733	1.6	427 617	100
2008	49 114	9.2	164 975	30.9	271 405	50.8	36 094	6.8	12 243	2.3	533 831	100

Source: 1987 – 2005 Ministry of Education: Educational Statistics of Malaysia; 2008 MoHE website

Table 1.7. Enrolment in private higher education, 2002-08

	Certificate		Diploma		Degree		Master's		Doctoral		Grand total	
Year	No	%	No	%	No	%	No	%	No	%	No	%
2002	93 393	31.7	129 929	44.1	67 062	22.8	4 019	1.3	197	0.1	294 600	100
2004	84 212	26.1	130 265	40.3	105 325	32.6	2 981	0.9	108	0.1	322 891	100
2006	68 442	21.1	123 937	38.3	124 071	38.3	6 477	2.0	860	0.3	323 787	100
2008	60 662	15.2	177 773	44.5	151 591	38	8 540	2.1	1331	0.2	399 897	100

Source: Ministry of Higher Education, 2009

Graduate output by discipline

Despite concerted efforts by the government to increase the number of graduates in science and technology to meet the demands of economic growth, both public and private higher education outputs show that arts and social science graduate are clearly far higher than science and technology graduates. Tables 1.A.1.2. and 1.A.1.3. in the Appendix show the intake, enrolment and graduate output by discipline from public and private higher education institutions in 2008.

Education profile of labour force

With increased access to tertiary education and expansion of the system, the educational profile of the labour force has also changed, revealing a gradually increasing proportion of employed persons with tertiary education. In 1985, 2.7% of employed persons had obtained diploma certificates and 2% had obtained degree qualifications. By the year 2000, 5.8% of the employed were diploma holders while 5.7% were degree holders. In 2008, 7.4% of employed persons were diploma holders and 8.2% were degree holders. Thus, by 2008, 15.6% of all employed persons had some kind of tertiary education, an increase of 10.8% since 1985 (Table 1.8.). The Report on the New Economic Model (NEAC, 2010) points out that despite the rapid expansion in higher education, 80% of the work force are secondary school leavers.

Table 1.8. Number of employed persons by highest certificate obtained, Malaysia, 1985, 1990, 2000, 2001, 2005 and 2008 (000)

Year	Total	Diploma		Degree	
		N	%	N	%
1985	5 653.4	150.8	2.7	120.2	2.1
1990	6 685.0	216.8	3.2	165.8	2.5
2000	9 269.2	535.1	5.8	471.3	5.1
2001	9 357.0	564.5	6.0	533.9	5.7
2005	10 045.4	840.7	8.4	733.5	7.3
2008	10 659.6	786.1	7.4	874.1	8.2

Source: Labor Force Survey, 2009

Tertiary student profile

The Malaysian tertiary education student profile has changed over the last decade as higher education institutions develop strategies for international recruitment as part of a government initiative to reach 60 000 international students by 2010. The current figure has exceeded the target and stands at 80 750. The initiative is particularly targeted to increasing post-graduate enrolment as a way to augment the number of researchers on Malaysian campuses. The long-term impact of decreasing numbers of local undergraduates has not been assessed. Taking both undergraduate and post-graduate student numbers together the top ten countries in descending order are: Iran, Indonesia, China and Colombia, Nigeria, Yemen, Libya, Saudi Arabia, Bangladesh, Botswana, and Iraq (MoHE Education Statistics online, 2010). The contribution of international post-graduates to research in Malaysia is yet to be evaluated.

Academic staff in universities

The rapid expansion of the higher education system, both the public and private sectors, has made the recruitment of highly qualified and experienced academic staff a difficult task. For example, Table 1.9. below shows that only 17.8% academic staff members possess doctoral degrees, almost 50% have masters level and slightly above 25% have first degrees. The situation is dire in private institutions where only 8.9% academic personnel have PhDs. The range of qualifications across public universities is quite remarkable where more established universities may have 40 to 55% of academic staff with doctorates while newer universities have less than 10% staff with doctoral degrees. Universiti Sains Malaysia reports 53.6% staff with doctoral degrees and University of Malaya 40.5% while Universiti Malaya Pahang reports 11% and the National Defence University only 0.7%. Training schemes to upgrade staff qualifications have started but will take considerable time to change the situation.

Table 1.9. Academic staff by qualifications in public and private HEIs, 2008

Qualification	Public HEIs		Private HEIs		Total	
	Number	%	Number	%	Number	%
Doctoral	6 601	26.3	2 116	8.9	8 717	17.8
Masters	13 800	55.0	10 370	43.6	24 170	49.5
Degree	4 165	16.6	8 485	35.7	12 650	25.9
Others	518	2.1	2 825	11.8	3 343	6.8
Total	25 084	100.0	23 796	100.0	48 880	100.0

Source: Ministry of Higher Education, 2009

In order to accelerate the recruitment of appropriately qualified staff, public universities are encouraged to recruit international staff, particularly in science and technology areas, capping the proportion of foreign to local staff at 15%. However salary packages offered by universities, which operate within a civil service framework, are unable to be internationally competitive. Universiti Sains Malaysia with its APEX status can be fairly flexible in its wage package offers. Also Universiti Malaya and Universiti Kebangsaan Malaysia have offered flexible salary packages to outstanding international academics.

Migration of talent

Exacerbating the issue of insufficient high level human resources is the loss of qualified personnel to other countries. Recently, the Vice-Chancellors of Universiti Sains Malaysia and the national University of Malaysia reported the departure of 15% of their best 2010 graduates in medicine to Singapore, attracted by better salaries and working conditions. Many move further afield. Table 1.10. shows that between 1990 and 2000 Malaysian migrants possessing tertiary education increased by 40.84% in OECD countries.

Table 1.10. Number of Malaysian migrants with tertiary education in OECD countries

Tertiary educated Malaysians residing in	Year 1990	Year 2000	Increase (%)
Australia	34 716	39 601	14.07
Canada	8 480	12 170	43.51
New Zealand	4 719	5 157	9.28
United Kingdom	9 812	16 190	65.00
United States	12 315	24 695	100.53
Others	2 607	4 508	72.92
Total	72 649	102 321	40.84

Source: Frederic Docquier & Abdesiam Marfouk, Brain Drain database, World Bank 2007, quoted by Fong Chan Onn in the Sunday Star, May 16, 2010.

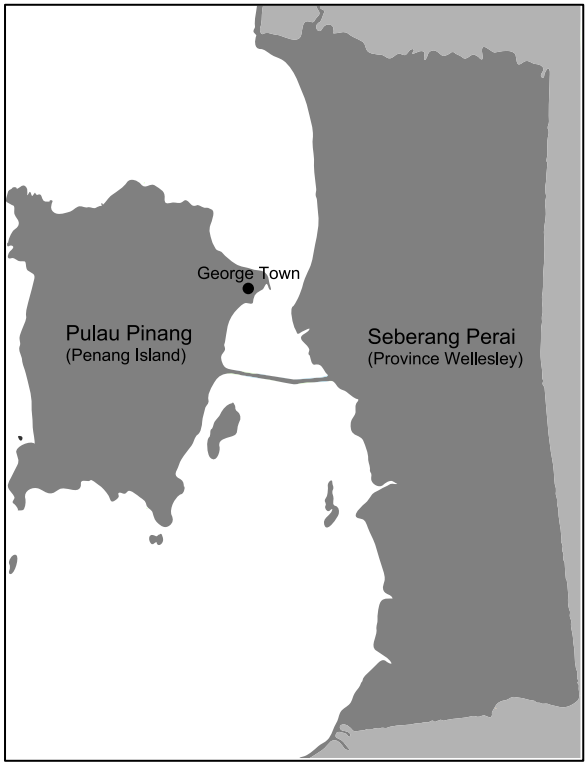
It may be concluded that significant expansion has taken place in public and private higher education in Malaysia. However, the rapid expansion has failed to channel, graduate and retain required numbers in science and technology to meet the requirements of the economy which is seeking to move to a knowledge-based economy. The expansion appears also to have been at the expense of diluting the quality of academic staff, and by implication, the quality of graduates and their research outputs.

1.3. State of Penang

Pulau Pinang or literally "Isle of the Betel Nut" is one of the thirteen states of Malaysia. Known popularly also as "Pearl of the Orient", Penang is an international tourist destination famous for its many historic and scenic attractions and its diverse cultures. Growth and development has made Penang one of Malaysia's most successful states without losing most of its historical charm. On 7 July 2007, Penang along with Malacca, another state in Peninsular Malaysia, were named as World Heritage Sites by the United Nations Educational, Scientific and Cultural Organisation (UNESCO). The built environment can be described as a living museum that represents the link between Penang's past history and the present which is home to diverse communities and cultures.

Penang is located in the northern region of Peninsular Malaysia (see Figure 1.3.). Its area is approximately 1 030 square kilometres, consisting of two separate areas, namely the Penang Island and Seberang Perai on the mainland (see Figure 1.3) The Penang state has five administrative districts, namely the North-East district (daerah Timur Laut) and South-West district (daerah Barat Daya) on Penang Island; and the Northern Seberang Perai district (daerah Seberang Perai Utara), Central Seberang Perai district (daerah Seberang Perai Tengah) and Southern Seberang Perai district (daerah Seberang Perai Selatan) in Seberang Perai (formerly known as Province Wellesley).

Figure 1.3. Map of Penang



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map

Governance structure

The Malaysian government is run within a framework that has three tiers, namely, federal, state and local. All effective powers rest with the federal government (including the responsibility for higher education) with the state responsibilities including land, logging, water and mining, signifying the limited capacity states have to carry out broad-based development projects. National and state projects are coordinated through federally-established Councils such as the National Economic Council and National Land Council. Penang being a former British settlement has no hereditary state ruler but a governor appointed as Head of State by the constitutional king. While the state has the autonomy to develop and implement policies and programmes deemed necessary, these are

subordinate to the rules and regulations of the federal government. At the local government level, there are local authorities referred to as municipalities and district councils. These have some discretionary power on local development issues but these are subordinate to the state government.

Division of powers between federal and state government gives the former jurisdiction over external affairs, defence and security; trade, commerce and industry; shipping, communication and transport; water supply, rivers and canals; finance and taxation; education and health; and public utilities. The state government holds responsibility for Islamic affairs; land ownership and use; agriculture and forestry; state works and water supply; Malay reservation and custom; and local government. Shared areas of responsibility include social welfare; public health; town and country planning; drainage and irrigation; rehabilitation of mining land and soil erosion; national parks and wildlife; and labour and social security.

Demographics, population numbers, gender, ethnic proportions

The Penang population is distributed unevenly among the five administrative districts. The most densely populated area is the Timur Laut district on Penang Island, 60% of which constitutes metropolitan George Town. In the mainland, generally referred to as Seberang Perai, the most urbanized district is the Seberang Perai Tengah district. In year 2010, it is estimated that the total population ratio between Penang Island and the Seberang Perai mainland will be 60:40. This structure is expected to change in year 2020 due to intense development in Seberang Perai (evidenced by the rapid development in recent years reversing the population ratio between these two entities to 40:60.

Penang has experienced rapid population growth since the 1970s, largely due to its urban and industrial developments that promoted internal migration of adult population from other states to Penang. In 1970, the state population was only 776 124 and this increased to 900 772 in 1980 (Table 1.13.)**.** The annual growth rate between 1970 and 1980 was 1.50% with almost the same rate of increase for the following decade at 1.53% between 1980 and 1991. Significant increase at 2.37 annual growth rate took place between 1991 and 2000. During the last decade (2000 to 2010), the population increased at 3.05% annually reaching 1 773 442 in 2010. It is estimated to increase at 2.89% annually to 2 357 982 by 2020. The recent population data gathered in 2005 indicated a population of 1 468 900 which shows an annual growth rate of 2.23% between 2000 and 2005. Population composition by ethnicity is shown in Table 1.15. which indicates a more significant increase in the Malay population than the Chinese population

between 1970 and 2010. Other categories such as the Indians and other races show no significant changes.

Table 1.11. Population growth of Penang 1970-2020

Census year	Population	Increase	Average annual population growth rate (%)
1970	776 124	-	-
1980	900 772	124 648	1.50
1991	1 064 166	163 394	1.53
2000	1 313 449	249 283	2.37
2010 (estimate)	1 773 442	459 993	3.05
2020 (estimate)	2 357 982	584 540	2.89

Source: Department Of Statistics (1973, 1983, 1995, 2005); Department Of Town and Country Planning (2009)

The rich and diverse cultures of Penang originated from the mixture of cultures from the eastern and western civilisations. The state is a microcosm of a multi-racial, multi-religious, multi-cultural and multi-lingual society. The Malay, Chinese and Indians constitute the major ethnic groups in the state. The common languages of Penang, depending on social class and circles as well as ethnic backgrounds, are English, Penang Hokkien, Tamil and Malay.

Table 1.12. Population growth of Penang by ethnicity

	Total	Malay		Chinese		Indian		Other bumiputera		Others		Non Malaysia citizens	
		total	%	Total	%	Total	%	Total	%	total	%	total	%
1970	776 124	237 253	30.57	436 745	56.27	86 673	11.56	-	-	12 453	1.60	-	-
1980	900 772	303 176	33.66	485 161	53.86	102 583	11.39	-	-	9 852	1.09	-	-
1991	1 064 166	405 348	38.09	523 211	49.17	112 830	10.60	1 146	0.11	5 770	0.54	15 861	1.49
2000	1 313 449	533 111	40.59	588 693	44.83	133 899	10.19	3 924	0.30	5 438	0.41	48 382	3.68
2005	1 468 900	600 300	40.87	631 800	43.01	14 720	10.02	5 200	0.35	6 100	0.42	78 300	5.33
2010 (estimate)	1 773 442	762 580	43.00	727 111.2	41.00	168 477	9.50	8 867	1.50	8 867	0.50	97 539	5.50

Source: Department of Statistics Malaysia (1973, 1983, 1995, 2001*)*

Age groups, dependency ratios, work force characteristics and internal migration

Penangites have fewer children than Malaysia as a whole resulting in lower costs for education and other child services but this is also a limiting growth factor for the future. Between 1970 and 2000, young people of the 0-14 age group made up 41.10% of the total population, decreasing to 26.90% in 2000 and an estimated 26.30% in 2010. This trend has implications for declining costs in education but also lower higher education participation, a factor which may limit future economic growth.

Table 1.13. Population growth, main age groups, dependency ratio and median age In Penang, 1970-2020

Year census	Total	Average annual population growth	Age group			Dependency ratio			Median age
			0-14	15-64	65 and over	All	Young	Old	
1970	776 124	1.50	41.1	55.4	3.5	80.5	74.2	6.3	17.4
1980	900 772	1.53	34.1	61.7	4.2	62.1	55.3	6.8	19.6
1991	1 064 166	2.37	29.4	65.8	4.8	52.0	4.7	7.3	21.9
2000	1 313 449	3.05	26.9	68.1	5.0	46.8	30.5	7.3	23.6
2010 (Estimate)	1 773 442	2.89	26.3	68.4	5.3	46.2	38.4	7.7	27.4
2020 (Estimate)	2 357 982		26.7	67.0	6.3	49.2	39.8	9.4	28.6

Source: Department of Statistics (1973, 1983, 1995, 2000, 2005)

Penang has a higher ratio of workers than in Malaysia as a whole, particularly between the ages of 20 and 40. The number of female workers is higher than male workers, reflecting the opportunities for women workers in the assembly operations in the manufacturing sector. The overall working age group (15-64) increased from 55.40% in 1970 to 61.70% in 2000. It is estimated to stabilise at 68.40% in 2010, dipping to 67.00% in 2020. The aging population (65 years and above), on the other hand, steadily increased from 3.50% of the total population in 1970 to 5.00% in 2000, expected to rise to an estimated 6.3% in 2020. This factor, coupled with the trend of declining numbers of children in the 0-14 group, signals the importance of attracting migrants from the rest of Malaysia.

Internal migration

Between 1986 and 1991, Penang experienced a net migration of 1 800, increasing to 13 600 for the period 1995-2000 (Department of Statistics, 2000). In 2001-02, the net migration was 8 400 declining further to 4 300 in 2002-03. Since 1990, Penang' net migration has always been positive, indicating that Penang has attracted migrants from other states in Malaysia.

Employment profile

In 2007, the manufacturing sector was the biggest employer with 36% of Penang's total labour once. The lowest number of 2% worked for the agricultural sector with the rest of the labour force in the services sector, being particularly high in the wholesale and retail trade at about 15%. Significant employers in the services sector are hotel and restaurants (8.40%); transport, storage and communication (5.80%); public administration and defence, and compulsory social security (4.80%); and education (4.60%). Other major employment sectors are health and social work (3.50%); other community, social and personal services (3.00%); private households with employed persons (2.80%); financial intermediation (2.20%); and electricity, gas and water supply (0.50%) (NHERI, 2010).

The unemployment rate in Penang is low compared to that of the nation as a whole. It ranged from its lowest point 0.70% in 1996 to its highest in 2001. For the same period female unemployment was lower than male although during the 1997 Asian financial crisis female unemployment at 1.40% was higher than that of men at 0.90% (NHERI, 2010).

Education attainment

In 2000, only 8.9% of the population in Penang had achieved tertiary level of education (Table 1.14.). About 31% had attained primary, 24% lower secondary and 28% upper secondary levels respectively. Those enrolled in vocational/technical education and trade and technical institutions constituted only 0.5%. Given the role of the manufacturing sector in Penang, and the low proportion enrolled in these institutions, this last statistic needs attention from educational planners.

Table 1.14. Level of education attainment for Penang 2000

	Total	Percent	Male	Percent	Female	Percent
Total population	1 041 622		526 988		514 634	
Pre-school	26 553	2.50	13 698	2.60	12 864	2.50
Primary school	318 334	30.60	155 351	29.50	162 983	31.70
Lower secondary school	249 289	23.90	134 051	25.40	115 238	22.40
Upper secondary school	287 551	27.70	140 142	26.60	147 409	28.60
Vocational/technical education	10 336	1.00	6 346	1.20	3 990	0.80
Trade and technical skills institution	5 495	0.50	3 796	0.70	1 699	0.30
Post secondary education	31 447	3.00	14 051	2.70	17 396	3.40
Tertiary education	93 158	8.90	49 341	9.40	43 817	3.40
Unknown	19 459	1.90	10 221	1.90	9 238	1.80

Source: Department of Statistics (2000*)*

Data in Table 14 show that women in Penang have had higher levels of education than men at upper secondary and post-secondary levels. Over the past decade, female workers have had 10.3 years of education compared with the 9.8 years of male workers (Kharas *et al*. 2010, p. 73). The expectation that highly-educated workers would move into higher paying jobs does not necessarily hold true. The experience has been that employees with better qualifications such as higher degrees receive higher salaries only if they demonstrably function at the high end of production – for which condition an environment of high level skills, technology, research and innovation is required.

1.4. Higher education in Penang

Penang is a city of many firsts in education. The first English, Malays and Chinese school were all established in Penang with Penang Free School the oldest English school in Southeast Asia, founded in 1852. Table 1.17. shows the level of educational attainment in Penang in the year 2000. At this time, only 8.9% of the total population had achieved tertiary level education and of this 49 341 (53%) were males and 43 817 (47%) were females. Tertiary students were mainly enrolled in Universiti Sains Malaysia, teacher training and technical colleges including some private colleges.

In 2010, the state of Penang had 23 public higher education institutions (HEIs) which comprise branch campuses, training institutes and centres, and community colleges (Table 1.18.). It also has 31 private higher education institutions offering various post-secondary programs from pre-university and certificate to degree levels (NHERI, 2010). Many of the private higher education institutions are feeders to institutions in the Klang Valley. Some provide twinning programmes with overseas institutions. Most were established in the 1980s and 1990s and have small enrolments and modest physical facilities, 60% of whom own their premises. Students' ethnic pattern reflects the national private sector picture with majority (60%) being Chinese, followed by Malays, Indians and others. The majority of students are from Penang followed by other northern states of Kedah, Perlis and Perak. Foreign students, largely from Indonesia, China and Thailand, and others from India, Korea, Mongolia, Nigeria, Taiwan, Japan and the Middles East, numbered 452 and 650 in 2007 and 2008 respectively.

Leading the multiple education providers in Penang is Universiti Sains Malaysia (USM) established in 1969, Malaysia's second university after the University of Malaya. It was conceived as a strong contribution to the growth of the Penang and northern Peninsular Malaysia region. USM was first established as a science-focused institution but became a more comprehensive university by adding arts and education programmes as it expanded. The university currently offers a wide range of programmes at undergraduate and graduate levels, which include certificate, diploma and degree programmes, non-graduating and off-campus study programmes. The last, started in 1971, was the first distance learning tertiary-level programme in the country, providing adult learners second chance opportunities for higher education.

Universiti Sains Malaysia (USM)

After independence in 1957, development focused on the southern section of Malaysia, largely in the Klang Valley. The establishment of Universiti Sains Malaysia in 1969 in Penang did much to open up education opportunities in the north and bring about a measure of regional balance (Morshidi 2009). It has been noted however that establishing its medical faculty in Kuban Krian in Kelantan (north-eastern state), and engineering in Tronoh, a lagging sub-region in the central state of Perak provided important inputs to local development but has diluted USM's contribution to Penang's and the region's own human resources and overall development. The rationale reportedly is that since higher education is a Federal responsibility, all public universities including USM have roles in overall national development and not only the state's development. In the current Penang scenario, the lack of skilled professional and technical personnel presents an

enormous challenge to its planned development. It could also prevent the transition to a higher wage scenario which could attract fresh talent to the region.

Universiti Sains Malaysia: Structure and governance

Currently Universiti Sains Malaysia has 27 schools, seven research platforms, two academic service centres and 21 research and service institutes. University management is the responsibility of the vice chancellor, four deputy vice chancellors (academic and international affairs; research and innovation; student welfare and development; and industry and community network), the registrar, the bursar, and the chief librarian. Supporting the chancellery are departments covering development and corporate offices, public relations, management and research innovation, bursaries and other areas. The USM Board of Directors which oversees overall policy development comprises a chairman, the vice-chancellor, two government representatives, one local society representative, three appointees of the Minister of Higher Education and a secretary.

Following the passing of the Corporatization of Higher Education Act in 1997 by the Federal Government, USM was incorporated on 15 March 1998. As the full legislative framework for the Act had not been completed, the original intention of allowing public universities to manage themselves like corporate bodies never materialised, which otherwise might have reduced bureaucratic delays and the decision-making process. Public universities depend on Ministry of Higher Education (MoHE) for a centralised student selection and admissions process; senior management and leadership appointments (vice chancellors) and compensation packages for staff. However, the award of APEX (Accelerated Program for Excellence) status by MoHE in September 2008 has helped to loosen up some regulations such as student admission. The university leadership is currently undertaking a review of its constitution with the objective of amending it, subject to a Parliamentary review.

Universiti Sains Malaysia: Financing

The Federal Government through the Ministry of Higher Education (MoHE) provides Universiti Sains Malaysia (USM) an annual grant for development which increased by 6% over the previous year in 2006 (USM Annual Report, 2006). Of the revenue for operating activities, 90.9% (MYR 55.7 million) was from government grants, 6.6% (MYR 38.6 million) from student fees and 2.5% (MYR 15.0 million) from other sources. The annual budget process for public universities relies on a historical/negotiated

allocation approach premised on a budget proposal based on student enrolment/intake numbers decided by MoHE. Allocations usually reflect the previous year's allocation plus a small increase based on the availability of public resources.

Financial assistance in the form of loans and scholarships are available to students in public and private educational institutions to help cover tuition fees, accommodation costs, living and other expenses. Loans largely sourced by the National Higher Education Fund (local acronym PTPN) are given to applicants based on financial status or background as evidenced by household income level. Scholarships are awarded to students for outstanding academic performance and also for extra-curricular participation, with the former weighted more heavily. Scholarships are sponsored by the Public Services Department, large national conglomerates such as Petronas and Sime Darby, and individual corporations such as Yeoh Tiong Lay Sdn. Bhd. Construction Company. Data were not provided to enable this report to conclude if loans and scholarship awards reflect the social dimension such as inclusiveness as well as the economic.

Profile of USM students

The total student population of Universiti Sains Malaysia (USM) in 2008 was 20 276 with roughly 75% at undergraduate level and 25% at post graduate level. International students comprise 10% of the total student population, the majority at post graduate level (Table 1.15.)**.** As with other Malaysian public universities, the Ministry of Higher Education's plan is to decrease the proportion of undergraduate students and increase post graduate students in order to develop a corpus of competent researchers who could contribute to research and innovation activities. In line with this policy approach, Bachelor degree students declined from 18 148 in 2004 to 15 088 in 2008 while the number of post-graduate students increased from 3 680 in 2004 to 5 006 in 2008. Keeping to the same policy approach, post-graduate international students have increased from 743 in 2004 to 1 691 in 2008.

Table 1.15. Profile of students at Universiti Sains Malaysia 2004-08

Data	Year				
	2004	2005	2006	2007	2008
Total no of full time students (local and international including postgraduate students)	21 828	22 354	21 869	21 117	20 276
i. Total no of local students	20 963	21 294	20 543	19 507	18 269
ii. Total no of international students	865	1 060	1 326	1 610	2 007
i. No of undergraduate students	18 148	18 541	17 768	16 700	15 270
a. No of local students	18 026	18 378	17 768	16 507	14 954
b. No of international students	122	163	172	193	316
a. Bachelor students	18 148	18 541	17 940	16 610	15 088
b. Diploma students	-	-	-	90	182
ii. No of postgraduate students	3 680	3 680	3 929	4 417	5 006
a. No of local students	2 937	2 916	2 775	3 000	3 315
b. No of international students	743	897	1 154	1 417	1 691
a. Master students	2 945	2 968	2 864	3 063	3 380
b. PhD students	735	845	1 065	1 354	1 626
No of research centres (with its own operating budget and/or postgraduate students)	13	13	13	13	13

Source: Abdul Razak, D. and R. Mohamed (2008), *Transforming higher education for a sustainable future*, USM, Penang.

Note: figures for 2006-08 are based on Universiti Sains Malaysia's unaudited data and student data are based on full-time students

Universiti Sains Malaysia: Staffing

Between 1989 and 2009, academic staff strength has almost doubled from 961 to 1 380. Of these, (Table 1.18) professors comprise 11.4%; associate professors 24%; senior lecturers, constituting the bulk with 729 or 52.8%; and lecturers numbering 163 or only 11.8% of total academic staff. Lecturers with PhDs are promoted after three years and the effect of this service regulation has served to increase the number of Senior Lecturers. However, non-academic staff (Table 1.20) increased from 3 921 to 7 317 over the same period giving in 2009 a proportion of 20.7% academic staff to a surprising 79.3% of non-academic staff in 2009. The categories of non-academic staff included in the increase are not known.

Universiti Sains Malaysia: Research

The university has created research programmes that are structured and organised along multi-disciplinary clusters with borderless facilities. These include social transformation clusters comprising the social sciences and humanities, medical health, life sciences, health sciences, engineering and technology, information technology and fundamental research. The designation in 2006 of Universiti Sains Malaysia as one of the country's four research universities has helped to garner additional government funding. Table 1.17. provides detailed information on research and publication achievements within the university.

In the drive for innovation as part of the journey towards a more competitive, knowledge-based economy, universities' contributions are often measured according to publications, citations and registered patents. Taking Scopus-indexed citations in Table 1.17., these were 659 in 2004, 1 629 in 2007, falling to 555 in 2008. Between January 1999 and February 2009, Universiti Sains Malaysia received 4.08 citations per paper with two other Malaysian universities (Universiti Malaya 4.16 and Universiti Kebangsaan Malaysia 3.68) receiving approximately the same (Wong and Ho, 2010). This was lower than the other comparison Asian universities such as Seoul National University (8.04) and University of Hong Kong (10.02). In terms of commercialising of research output, USM had three US patents cumulative to 2005, compared with Seoul National University's 22 and University of Hong Kong's 52 (ibid.49). Nationally, however, Penang as a region is a key player in the development of Malaysian-invented patents granted by the United States Patent and Trademark Office. Reviewing Malaysian patents by region, Penang residents invented one-third of all Malaysian patents. However, on examination the bulk of these patents were owned by foreign-based multi-national companies (Wong and Ho, 2010).

The comparisons imply that research and innovation activities need to be seriously examined by the region and Universiti Sains Malaysia as its leading research institution, and important decisions need to be reached regarding investments in local research personnel, institutions, R&D technology, appropriate facilities and overall research funds.

Development of Penang as an education hub

The issue of developing Penang as an education hub has been much discussed by state and education authorities. It is unclear whether the priority is to establish a hub serving students from the North, from the Southeast Asian region or as a major international education destination (Campbell, 2010). Penang would be competing with Kuala Lumpur and the

Klang Valley in the South with its established institutions, cultural and social amenities, well-developed transportation and accommodation infrastructure.

The state would need to consider its contribution to improving infrastructure and the role of private higher education institutions. Currently, many are small units, thinly spread over a variety of disciplines. Identifying niche areas of study, consolidating and sharing their resources such as libraries and specialised equipment would greatly increase their viability. Not being part of the public sector could present an advantage insofar as institutions could link up with industries and other institutions, both local and foreign, with greater speed involving less bureaucracy. Such strategies require multi-layered participation of all stakeholders, including the federal and state government, public and private sector institutions and industry. The Penang state government's limited responsibilities and income are impediments to policy change.

Existing infrastructure for supporting Penang's education hub

Lines of co-operation and co-ordination between federal, state, and local educational institutions and their development strategies are unclear. Collaboration between Universiti Sains Malaysia, UiTM, private higher education institutions and industry could provide Penang with a strong competitive and comparative advantage in terms of implementing the region's development goals. Penang's position as part of a broader national, regional and global system of networks and information is significant and could be well leveraged to build capacity though partnerships and targeted programmes.

Penang's human resources, infrastructure and its many existing strengths are advantages in the marketing of Penang as an educational hub. George Town's status as a UNESCO heritage city, its second home status for many talented expatriates, the international recognition enjoyed by segments of Penang's educational sector (such as the international schools, and APEX university), its reputation in tourism, and the electronics and semi-conductor industry, provide Penang with considerable advantages. Regenerating Penang's position through developing and preserving George Town, reversing the economic slowdown and integrating Penang's educational infrastructure with the needs of a developing economy, and building and maintaining human capital and talent could form the critical foundations from which building Penang's reputation as an educational hub can be based (Campbell, 2010).

1.5. Economic growth in the region

The state of Penang has been exceedingly successful in reducing poverty with less than 0.3% of the population below the poverty line in 2006 compared with 29% in 1980. Between 1995 and 2007, total wage rates grew by 4.5% annually while consumer price inflation averaged only 2.5% (Kharas *et al*., 2010). Having husbanded its resources so efficiently, the task before the state is maintaining and managing gains made while developing a robust strategy forward, building on those gains.

The nation's economic transformation started after Malaya's independence in 1957, with specific transformation policies and programmes instituted in the 1960s. Structural transformation started with import substitution industrialisation (ISI) in the 1960s, followed by export-oriented strategies in the 1970s and 1980s within the region. Industry and trade have been the twin engines of growth in Penang's development, with agriculture consistently small relative to the other economic sectors, particularly to the manufacturing and service sectors.

The industrialisation process in Penang was intensified by the establishment of the Bayan Lepas Industrial Park in 1972 which was the first Free Trade Zone in Malaysia, starting with seven multi-national corporations (MNCs), becoming a model for the country. Penang now has two additional Free Trade Zones and five industrial parks with a total of 64 multinational corporations. In 2007, 200 multinational manufacturing companies had large operations running in Penang, becoming the second growth centre in Malaysia, second to the Klang valley. Penang's economic growth historically has been comparable to the growth rate of the country as a whole, sometimes exceeding it as GDP comparisons show in Table 1.16.**.** Manufacturing of electrical and electronic goods engendered a dynamism driven by Foreign Direct Investment (FDI) through multinational corporations in the last 25 years, keeping Penang's GDP growth ahead of the national average, above 7% between 1970 and 2005. The major contributors to Penang's healthy growth (Table 1.17.) rates are electrical and electronic (E&E) manufacturing and services (such as utilities, telecommunications and tourism).

Table 1.16. Gross Domestic Product (GDP) growth rates (%)

	1991 – 1995		1996 – 2000		2001 – 2005		2006 - 2010	
	Malaysia	Penang	Malaysia	Penang	Malaysia	Penang	Malaysia	Penang
GDP at market prices	9.50	11.41	4.60	4.97	4.50	6.90	6.00	7.30
GDP per capita	9.21	9.80	4.03	3.90	4.99	5.90	6.70	6.20

Source: NHERI, 2010, p. 14

Table 1.17. Sectoral share of Gross Domestic Product (GDP)

	1995	2000	2001	2002	2003	2004
Agriculture, forestry and fishing	1.60	1.30	1.60	1.60	1.60	1.60
Mining and quarrying	1.20	1.10	1.20	1.10	1.00	0.90
Manufacturing	43.90	45.70	41.30	41.30	41.30	42.30
Construction	3.30	2.40	2.40	2.10	2.10	2.00
Services	50.00	49.50	53.50	53.80	54.00	53.20

Source: Socio-Economic and Environmental Research Institute (2008)

Manufacturing constituted 12% of Penang's GDP in 1979 rising to 43% by 2005. The Penang region is acknowledged as the lead centre in Malaysia for manufacturing, particularly for the E&E sector which constitutes 58% of manufacturing activities. Subsectors subsumed in the manufacturing sector include automation/machinery/precision-tooling/equipment (13%), fabricated metal (13%), plastic and plastic products (8.9%) and manufacturing related services (6.5%). The sector as a whole comprises approximately 1 400 registered firms employing 200 000 workers. Other sectors are ICT, largely multimedia activities (2%), biotech medical equipment and agro-based production (3.2%) and 32% bunched under "Others" which include food-processing (6.1%), chemical/petro activities (5%) with the remaining 20.9% distributed in paper, metal, publishing, gold and jewellery (InvestPenang, 2008, 13). The largest share (82%) of total revenue for 2007 came from the multinational corporations and large foreign firms which group constituted just 11% of the manufacturing sector and which employed 68% of the work force in the manufacturing sector (InvestPenang, 2008). Clearly, this sector constitutes the heart of Penang's economic growth.

Penang's advantageous low cost and low wage scenario, highly successful in its strategy to maximise opportunities in the global production networks of manufacturing in the electric and electronic, textile and

garments industries, has been threatened by low-cost China, India and neighbouring countries such as Vietnam as well as successful highly-skilled research and design capabilities in the region – Singapore and Taiwan, for example. Coupled with this are structural issues such as skill shortages, inadequate infrastructure and regulatory bottlenecks. Productivity and overall growth have dropped. Many multinational corporations have started moving away, their independence from the local economy giving them the flexibility to move to locations with lower costs. In some cases some of their employees move with them.

Recent analyses conclude that a new growth scenario can no longer depend on the previous strategy of providing generous fiscal incentives which worked in the 1970s and 1980s for the manufacturing sector. Both federal and state governments are working on a scenario which would bring back rapid growth and productivity to Penang. This is embodied in an intensified industrialisation programme grounded in technological transformation. Such a transformation would work towards a knowledge-based industry based on human capital intensive activities rooted in research and development to produce higher value-added products and services (Kharas *et al.*, 2010). The industrialisation focus has shifted from simple E&E products, the assembly stage of semiconductor production with very little research involved, to high value-added products such as disk drives, and computer parts and components; to communication and consumer electronic products; and products of high technological value. This policy has also opened up many opportunities for small and medium-sized enterprises (SMEs) which complement the multinational corporations (MNCs).

As in the case of the country as a whole, Penang is constrained not only by a shortage or inadequacy of available skills: it also suffers from a skills mismatch. There is a growing demand which constantly increases the demand-supply gap as the recovery strategy stresses the need to move from cost-base to value- and knowledge-base (World Bank, 2009). Although the overall stock of human capital has increased as Table 1.19. illustrates in terms of outputs from tertiary institutions, there are still deficiencies. Local graduates' wait period for a job has increased; and their wages stagnate, suggesting that general education tertiary and secondary graduates skills do not match those required by employers.

Graduates from overseas or those who graduated from high-quality twinning programmes, who received employer-provided training in the areas of marketing, information technology and management as well as those who received off-the-job training particularly from the services sector were readily employed and enjoyed higher salary levels. The contrast between the wage premiums of local graduates and those from abroad is significant and

suggests a mismatch between local education programmes and labour market requirements. For the short-term, employers need to provide on-the-job general and specific skills training. In the longer term, the current mismatch of skills suggests a critical need for education and skills training providers to better understand and respond to labour market signals.

There is considerable evidence (World Bank, 2009) that firms find it difficult to locate and recruit the skills they seek. More than 40% of firms have reported vacancies of skilled production workers, and the average time to fill a vacancy is about four weeks. Out of desperation, firms often hire people who do not have the appropriate skills for the job. Many workers lack the appropriate level of education for their jobs or their skills do not match what they were hired to do. Approximately 25% of workers with a high-school certificate felt they needed a university education to do their jobs properly. Only 10-15% of workers believed their chosen field of education suited their current job; likewise, more than 15% believed their educational qualifications were irrelevant to their current occupation.

Northern Economic Corridor Region (NCER)

Nonetheless, Penang remains the leader in manufacturing activities and the growth centre for the northern region in Malaysia. This position has been reinforced by the development started under the Northern Corridor Economic Region (NCER) programme, initiated during the Ninth Development Plan (2007-12) period to continue to the Twelfth Malaysia Development Plan. The programme includes 21 districts in Penang island and the mainland, and the states of Kedah, Perlis, and northern Perak. It is a government initiative to accelerate economic growth and elevate income levels in the north of Peninsular Malaysia and is part of a national strategy focusing on regions which can benefit from land, labour and natural resources, combining these with manufacturing experience and international linkages found in the major exporting centre (NCIA, 2009).

The aim of the NCER is to become a competitive, world-class sustainable economic region empowered by a population living a balanced lifestyle with a holistic approach to business. Through the provision of a conducive business environment, improved physical infrastructure, such as irrigation, utilities and transportation, as well as soft infrastructure such as human capital, funding, incentives and an improved public service delivery system, it is expected that the NCER would be a destination of choice for foreign and domestic businesses to invest in, whose key sectors include the electrical and electronic cluster, agriculture, tourism and biotechnology. Social development activities, community infrastructure and environmental

integrity are expected to raise the overall standard of living for both Malaysians and foreigners to work, learn, visit and live.

The National Corridor Implementation Authority (NCIA) was established under the Northern Corridor Implementation Authority Act 2008 (Act 687) to provide direction and devise policies and strategies to help the region achieve this vision, through identifying commercially-viable opportunities and implementing strategic initiatives approved by the Government of Malaysia. For Penang, the NCER provides renewed focus on the urban centres, its people and its economy. The expectation is that execution under the NCIA will promote locally-based approaches to implementation, and better understanding of local challenges with access to on-site capabilities and capacity building.

Under the aegis of the Northern Corridor Economic Region, the first pillar of the federal government's strategy is to modernise the logistical and infrastructural facilities required to support higher economic growth. These include the expansion of the Penang bridge, construction of a second bridge, the upgrading of the port and supporting infrastructure, double tracking the railway and establishing Butterworth on the mainland as the northern transport hub, upgrading of public transportation, housing development, sewerage treatment, broadband infrastructure, industrial estate expansion, and improved regional air and sea links. The second pillar focuses on increasing the value-added in existing industries while developing new industries, aiming to become a world-class economic region by 2025, where it is amongst the world's best in a number of its key economic sectors, such as the electrical and electronics sector, agriculture, tourism and biotechnology.

Streamlining government regulations is important for the successful implementation of NCER plans. Although the region is a relatively business-friendly region, its attractiveness as a production base has declined in recent years. Firms experience delays in connecting to basic public infrastructure such as electricity. Obtaining licences, permits, and approvals/certificates are also more time-consuming than in all other regions. Overcoming these obstacles could help to boost new investments moving into the NCER. The role of the northern region as a hub for Malaysia's electrical and electronics sector is expected to get stronger with the establishment of a micro-electronics centre of excellence. To raise the capability of local E&E producers, the NCER initiative will support more advanced activities such as silicon, automation and materials design. NCER also plans to promote new industries such as biotechnology, downstream agriculture, sustainable materials and oil and gas.

1.6. Higher education and the renewal of Penang

The regional development policy in northern Malaysia with the George Town conurbation as its major nucleus aims to reduce disparities and inequity at inter-regional, inter-city and urban-rural levels. In any scenario that emerges, the role and responsibilities of higher education institutions have a premier position in providing the bedrock of knowledge creation, innovation and training of highly-skilled human resources for the growing and re-vitalised economy.

Penang, USM, R&D and innovation

Better technology and innovation are hallmarks of higher performance as an economy becomes knowledge-based and requires high levels of investment. An assessment based on a sample of firms found that firms engaging in R&D activities generally have 22% higher labour productivity than those who do not (World Bank, 2009). Penang is home to a number of research institutes and R&D facilities, universities, colleges, and training centres that provide a healthy platform for the development of a knowledge-based economy.

The proximity of research centres such as Universiti Sains Malaysia (USM) and industries in the Free Trade Zone would have been serendipitous if stronger strategic and working links existed. Upgrading technology and stepping up R&D leading to innovation in any place are activities highly dependent on local conditions, where strong networking and collaboration exist among government agencies, investors, research institutes and technological units. This is particularly true of smaller firms which need to easily access shared facilities, knowledge, ideas and expertise, better information regarding suppliers, human resources, access to more workers from the same industry, and better information on business opportunities with positive "spillover" effects (Hutchinson, 2010). In the Penang situation, major strategic decisions regarding complex economic growth strategies and their local implementation tend to be made in the capital city – Kuala Lumpur – in the south, de-emphasising the local dimensions of economic growth and innovation and its potential to leverage the region's comparative advantage.

However, the research and innovation system is itself a fragmented one with no established forum which could support big and small firms' interaction with public, university and private research agencies, providing opportunities for knowledge and information sharing, articulating these with needs of not only the firms but institutional and regional strategies. R&D and product development of expenditure of firms is low and is carried out by

a small group of multinational corporations and even fewer SMCs (less than 5%) (Hutchinson, 2010). Competencies exist in some local firms but these are dispersed and consequently their contribution to value chains is difficult to capture.

An analysis of Penang's firms (Rasiah *et al*., 2009) concluded that technological capabilities can be substantially increased through greater expenditure on training, process technology and R&D, as well as increasing the number of R&D personnel. Penang's institutions can play a significant role as research intermediaries to firms engaged in upgrading technology. The resources of Universiti Sains Malaysia (USM) and UiTM and the two research institutes – the Fishery Research Institute and the Malaysian Institute of Pharmaceuticals and Neutraceuticals at USM – can contribute greatly to the upgrading of industry. For instance, USM has recently decoded the genome for rubber which can be a source of patents and subsequent product commercialisation. While the firms in the study found the quality of local university graduates as employees generally adequate although skills improvement would be welcomed, research linkages for purposes of product upgrading and innovation between industry and university were few; industry-university interactions tended to be limited to consulting arrangements and troubleshooting contracts. The relatively small number of firms which have collaborated with universities in Penang regarded their services satisfactory, particularly in relation to new technology identification, modification of existing technology, and conducting R&D work. Firms also lacked knowledge on what institutions could offer which would be relevant to their operations; the services on offer; and the people to contact (Yusuf and Nabeshima, 2009).

With renewed focus on industry, and new investments from the NCER development, the issue is the extent of readiness for the appropriately qualified, skilled human resources to take on the challenges. With its many public and private tertiary institutions with Universiti Sains Malaysia as a leader, and UiTM in the wings, multiple providers for education and training exist and this is a clear advantage in any change scenario. USM has provided leadership over four decades, setting up research centers and institutes in diverse areas such as the Centre for Policy Research and International Studies, AIDS Action Research Group, Women's Development Research Centre, Centre for Drug Research to name a few. Its transdisciplinary approach to research has contributed results and outcomes beneficial to Penang. Collaborations with other research institutes in Penang such as SERI (Socio-Economic and Environmental Research Institute); and governmental agencies and non-governmental organisations such as the Consumers Association of Penang, contribute significantly to social development in the region. Educational opportunities for specific target

groups such as senior citizens, the physically challenged and school dropouts are seen as ways in which the human capital base may be expanded and capacity improved in the state.

Intermediary bodies can provide critical assistance in organising linkages and collaborations which would help to close information gaps between industry and education/training/R&D providers. The Penang State Government has a reputation for its proactivity and entrepreneurial strength, effective administration, innovative policy-making, strategic liaison and communications with international investors, and development planning. One of its most successful agencies is the semi-autonomous Penang Development Corporation (PDC) established in 1971 as the government's implementation arm, charged with overseeing economic growth and spearheading industrialisation. In the 1970s and 1980s, PDC monthly meetings included USM-related activities as a regular item on its agenda, giving its research activities a high profile. After significant restructuring in 2004, the Penang State government downsized PDC, creating InvestPenang which is the chief agency currently facilitating investment and fostering industrial development for the state.

The Penang Development Corporation (PDC) was active in the education and training sector as well. It established the successful Penang Skills Development Corporation (PSDC) which is run by a group of industries and is mandated to provide technical training to high-school graduates. Industry-driven, its client companies pool their resources, including equipment, and provide training on industry-specific issues. PSDC has established twinning arrangements with some institutions overseas, offering Masters level programs in areas such as Micro-electronics and Photonics. A significant initiative is the Graduate Re-skilling Programme which aims to make unemployed graduates more industry-ready. PSDC also works with SMEs focusing on training programs in managerial, marketing and technical subject areas.

Current discussions on the NCER and the role of higher education, particularly Universiti Sains Malaysia (USM), in supporting regional growth in the medium term point to: *i)* improving the quality of education, particularly in the science and engineering disciplines, by enhancing soft skills including communication, use of English, team working and analytic skills; *ii)* establishing a strong scholarship and research culture by initiating post-doctoral programmes in critical areas facilitating the generation of knowledge, some of which could be commercialised; *iii)* encouraging entrepreneurship through the provision of training and specialised services through incubators and a science park. Penang Science Park and Research and Innovation Park in Bukit Jambul are intended to provide infrastructural support to universities, research institutes and industry forming a value

chain of research, development, commercialisation and entrepreneurship; and *iv)* engaging in research and internship programmes with local firms, using government funding to catalyze the activities (Kharas *et al*., 2010).

Attracting and retaining talent

The regional development approach is new to Malaysia and has opened up a more holistic consideration of dimensions where previously the economic sector was predominant. Factored into the new equation are issues related to the "liveability" of Penang as a location of choice for the young, technically skilled and creative, both local, international and from the diaspora. Apart from job opportunities, better wages, and a strong pro-business environment, people look for a location which is safe, attractive and a likely place to raise children and retire. The existence of excellent education with lifelong learning opportunities and international-level health facilities are critical pre-requisites.

The availability of international quality educational and medical establishments both in the public and private sectors are critical pre-requisites for attracting and retaining the highly-skilled workforce. The educational sector with its increasingly strong public and private institutions is acknowledged as an important basis for moving to Penang as are its medical sector and facilities. The region has strong public health and medical facilities buttressed by international level private sector establishments. In fact, private sector initiative and partnerships have contributed a great deal to medical tourism in Malaysia which, in 2006, brought in USD 59 million, with Penang attracting 70% of this revenue. Penang now accounts for 70% of the nation's revenue from medical tourism much of which is attributed to the initiative of the Penang Health Association (representing a group of private hospitals) (Kharas *et al*., 2010).

In terms of "liveability", tracking of some indicators show that Penang has basic issues such as traffic volumes and congestion, road accidents, and air pollution (Penang People's Report 1999). Highly-qualified local and international immigrants considering a move with their families will look for amenities such as well-stocked libraries, bookshops and interesting meeting points for discussion and participation in community and civic life. All of these are available on the campus of he Universiti Sains Malaysia but this is distant from the centre of Georgetown. Efficient and convenient public transport systems which could support the commute are not in place. However, Penang's stress-free lifestyle, low cost of living (but increasing prices of housing), parks, sports facilities, excellent range of local and international cuisine, lively social networks, and attitudes open to change and innovation serve as invaluable counterpoints and sources of attraction.

Equally, Penang's linguistic diversity and its population's facility with languages such as English (albeit requiring greater attention), Mandarin, Tamil and Malay are important capacities that are useful in the regional positioning of Penang. Rich cultural traditions, ample recreational and entertainment facilities, and a more sophisticated lifestyle overall, provide enhanced pull factors. For the diaspora, family and cultural ties with strong community roots intensify re-location possibilities.

Penang plays a vital and significant role in the promotion and expansion of Malaysia's tourist industry. The state's contribution to the Malaysian tourist industry was the third highest in the country with nearly six million tourist arrivals 2009. The state government stresses its cultural and ethnic diversity reflected in language, costume, custom and cuisine; and its historic links with regional countries such as Singapore and Indonesia. The listing of Penang by UNESCO as a World Heritage Site continues to be a major tourist feature as do its natural scenic beauty and popular beaches. The Penang Investment Tourism Office, established in June 2010, recognises leisure tourism, medical tourism mentioned above, education and heritage as growth areas for Penang. Supporting features include good communication and travel facilities, low cost of services and availability of good accommodation. Cultural and religious affiliations are also sources of attraction to neighbouring countries such as Indonesia.

Co-ordination and co-operation

The greater Penang-Seberang Prai area's 54 public and private tertiary level institutions include a regional institution – Regional Centre for Science and Mathematics; public tertiary and post-secondary institutions include Universiti Sains Malaysia, Universiti Teknology MARA (UiTM), located in Seberang Prai, two Teacher Training Colleges and the Open University Malaysia. At state level, there are a number of excellent non-public education and training institutions such as the Penang Skills Development Corporation (PSDC), Wawasan Open University (WOU), and Kolej Damansara Utama (KDU).

Additionally, Penang is home to a number of broad-based initiatives which have supported and continue to support development along many dimensions. Among these are the Sahabat Alam Malaysia, the country's leading civil society social environment organisation, and Pantai Acheh, the world's smallest national park and Consumer's Association of Penang whose well-researched studies have provided substantive strength on many fronts to Malaysians. SERI or the Socio-economic and Environmental Research Institute, a private think-tank, is one of many public and private research institutes which provide capacity, perhaps currently under-utilised,

for more effective human resource development. As a port city, there is potential for maritime education and research. Above all, the Penang area has a significant repository of diverse ethnic groups, including retirees and expatriates, who constitute an untapped source of talent. There is indeed much going for the Penang region but robust co-ordinating structures are required to harness and link together the various strands of educational and other life-enhancing activities.

Conclusion

Penangites are actively debating the best ways forward. The concerns of Penang's business community were recently highlighted by the Malaysian International Chamber of Commerce and Industry (northern region). These included issues relating to Penang's infrastructure, talent pool and a liveable environment (Emmanuel, 2010, p. B2) There is recognition that many opportunities exist and coalesce to provide a strong basis for Penang to meet its goals as an education hub, a dynamic cultural centre, and a renewed platform for new industry together with the development of the knowledge economy. Embedded in its efforts would be the issues of diversity, inclusiveness, informed support for the environment, fused by partnerships among educational institutions, industry and civil society. Recognition of and building on the existing strengths in infrastructure and human capital are as important as identifying new areas of growth and skills development. Prioritising growth areas and developing detailed implementation modalities are critical, particularly in those areas where collaboration is required between federal and state governments.

Notes

1 The section on the national context in this chapter owes much to a World Bank study in progress on *Access and Equity* in Higher Education in Malaysia. The section on the regional context depends a great deal on information and data from USM's National Higher Education Research Institute's Self-Evaluation Report put together for the OECD Review. This second segment of the chapter used some ideas presented in James Campbell's mimeograph on the Penang Blueprint. For specific information on the current status of and ways forward for the Penang Region's economic growth, particularly in terms of R&D, the World Bank's 2009 *Malaysia Productivity and Investment Climate Assessment Update and Cities, People & Economy: A Study on Positioning* Penang by H, Kharas, A. Zeufack and H. Majeed have been invaluable resources.

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Annex 1.A.1.

Table 1.A.1.1. List of higher education institutions in Penang

No.	Institutions	No.	Institutions
1	Universiti Teknologi MARA Training Centre (Pusat Giat Mara)	17	Kepala Batas Comminity College
2	Cosmopoint College	18	Penang Methodist College
3	Institut Kemahiran Belia Negara	19	Olympia College
4	Institut Bina Pulau Pinang	20	Island College Of Technology
5	Industrial Training Institute	21	Tunku Abdul Rahman College
6	Nuri Technology Institute	22	Maktab Pengajian Al-Quran
7	Sentral Tehnology College Penang	23	Federal Teachers Training College
8	Institut Yayasan Bumiputra Pulau Pinang	24	Tuanku Bainun Teachers Training College
9	Technology And Management Institut (Itp)	25	Seberang Perai Polytechnic
10	Tun Abdulk Razak Technology Institute (Ittar)	26	Universiti Teknologi MARA Training Centre (Pusat Giat Mara)
11	Industrial Training Institute	27	Samudera Research Centre, Universiti Sains Malaysia
12	Japan Malaysia Technical Institute (Jmti)	28	Universiti Teknologi Mara (Uitm)
13	Informatics College	29	Universiti Sains Malaysia
14	Inti International College Penang	30	Engineering Campus, Universiti Sains Malaysia
15	Kolej Damansara Utama (Kdu)	31	Regional Centre For Education In Science And Mathematics (Recsam)
16	Community College	32	Wawasan Open University (Wou)

Source: NHERI (National Higher Education Research Institute) (2010), *The State of Penang, Malaysia: Self-Evaluation Report (SER)*, OECD Reviews of Higher Education in Regional and City Development, IMHE: Paris *www.oecd.org/edu/imhe/regionaldevelopment.*

Table 1.A.1.2. Intake, enrolment and graduates in public HEIs by discipline, 2008

Discipline	Intake		Enrolment		Graduates	
	N	%	N	%	N	%
Education	9 546	7.2	41 511	9.9	11 675	12.3
Arts and social sciences	62 666	47.1	187 320	44.7	39 844	42.1
Science	24 778	18.6	73 421	17.5	16 923	17.9
Technical	27 731	20.8	92 532	22.0	20 517	21.7
ICT	7 464	5.6	23 788	5.7	5 663	6.0
Others	915	0.7	762	0.2	0	0.0
Total	133 100	100.0	419 334	100.0	94 622	100.0

Source*: Ministry of Higher Education, 2009.*

Table 1.A.1.3. Intake, enrolment and graduates in private HEIs by discipline, 2008

Discipline	Intake		Enrolment		Graduates	
	N	%	N	%	N	%
Arts		55.9		54.6		53.8
Foundation course	9 250	8.9	11 287	5.2	4 735	11.2
Art, design & music	4 996	4.8	6 832	3.1	2 584	6.1
Admin & business	64 196	61.7	137 511	62.9	24 641	58.3
Education	8 816	8.5	26 659	12.2	1 490	3.5
Humanities	1 843	1.8	3 573	1.6	623	1.5
Law	3 717	3.6	7 773	3.6	1 517	3.6
Services	2 722	2.6	4 838	2.2	1 167	2.8
Social sciences	4 877	4.7	11 623	5.3	2 651	6.3
Language	3 559	3.4	8 381	3.8	2 878	6.8
Sub-Total	103 976	100.0	218 477	100.0	42 286	100.0
Science and technology		30.8		30.4		31.1
Agriculture	635	1.1	607	0.5	136	0.6
Computer technology	21 323	37.3	51 354	42.3	11 453	46.9
Health	21 389	37.4	34 502	28.4	5 302	21.7
Medical	8 830	15.4	20 367	16.8	2 818	11.6
Science and maths	5 015	8.8	14 569	12.0	4 682	19.2
Sub-Total	57 192	100.0	121 399	100.0	24 391	100.0
Technical vocational		13.3		15.0		15.1
Engineering and technical skills	20 506	83.1	52 671	87.8	10 570	88.9
Air and maritime	935	3.8	2 587	4.3	220	1.9
Building/architecture	2 583	10.5	4 156	6.9	984	8.3
Others	654	2.7	562	0.9	110	0.9
Sub-Total	24 678	100.0	59 976	100.0	11 884	100.0
TOTAL	**185 846**	**100.0**	**399 852**	**100.0**	**78 561**	**100.0**

Source*: Ministry of Higher Education, 2009*

Table 1.A.1.4. Quantity and Quality of research at Universiti Sains Malaysia, 2004-08

		Year				
Publications #		**2004**	**2005**	**2006**	**2007**	**2008**
a. Total no. of publications in citation-indexed journals (including those undergoing refereed proceedings in Institute for Scientific Information serials)		221	329	467	521	151
b. Total no. of publications in non-citation-indexed journals		404	350	325	635	31
c. Total no. of books authored		81	146	33	85	18
d. Total no. of chapters in books authored		48	47	311	244	78
e. Other publications that have created an impact on the government/policy (abstracts and articles in magazines, newsletters, etc. (not including unpublished reports))		478	414	850	1 304	15
f. Cumulative impact factor of publications		289.08	402.32	503.16	575.19	63.30
Citations						
Total no. of citations in papers published in the Scopus-indexed Journals		659	899	1 463	1 629	555
Research grants for the science and technology academic staff						
a. Total amount of public funding (from government agencies)		11 472 361	18 186 327	23 442 996	74 034 163	5 598 623
b. Total amount of private funding (including contract research)		2 267 658	1 840 199	629 123	1 175 464	14 689 627
c. Total amount of international funding		2 270 326	1 793 650	1 729 125	749 482	102 480
Research expenditure for research projects						
a. Total amount of research grants received		20 014 252	27 724 482	28 056 775	87 101 969	21 861 238
b. Total amount of research grants spent		31 981 380	31 006 084	24 626 344	35 081 759	11 654 570
Postdoctoral appointment						
a. Number of doctoral graduates appointed		7	10	2	5	11
	national	0	4	2	2	2
	international	7	6	0	3	9

Note: Figures for 2006-07 are based on Universiti Sains Malaysia's unaudited data while figures for 2008 are from January–April 2008
Source: Universiti Sains Malaysia, Annual Report (2007*)*

Chapter 2.
Higher education in regional human resource development

Penang faces significant challenges in developing and retaining the human resources to meet aspirations for the region's future economy and quality of life. The State of Penang has a better educated population than the other three states in the Northern Corridor Economic Region, but in international comparison educational attainment level is low. Furthermore, it is not clear, however, that the region's population has the knowledge and skills necessary to "move up the value chain" as needed to compete in the regional and global economy. The significant urban-rural disparities in socioeconomic conditions and educational attainment between Penang and the other states in the Northern Corridor Economic Region also present challenges.

The main message is that the ability to fuel local growth by cultivating relevant skills is the best guarantee that Penang will thrive in the future. Tertiary education institutions should work together towards better alignment of their education provision with the needs of the region. They should strengthen the learning outcomes of their students and improve retention and employability. Sustained efforts are needed in Lifelong Learning, re-skilling and up-skilling the population and improving its flexibility to face rapid changes in the labour market. Collaboration among tertiary education institutions, and between tertiary education institutions and business and industry should be strengthened and encouraged.

Introduction

Universities and other tertiary education institutions can contribute to the human capital development in Penang basically in four different ways, by:

- *Widening access to and success in tertiary education of the existing youth and adult population of the region.*
- *Attracting talent to the region, including students and highly qualified faculty and researchers.*
- *Producing graduates with knowledge/skills relevant to the region's economy.*
- *Contributing to developing an economy that will employ graduates and retain and attract educated population.*

Human capital is critical to regional development also because individuals with higher level skills are more productive. Furthermore, individual workers are more productive in regions where their peers have high levels of educational attainment. In this context, this chapter examines the following three dimensions to assess the effectiveness and coherence of human capital development policies in Penang:

- *Do the existing tertiary education providers offer adequate learning and training opportunities to the local population in terms of age, gender and socio-economic and ethnic backgrounds?*
- *Are existing tertiary education institutions and their programmes adequately aligned with the skill needs of the local economy and do they support entrepreneurship in the region?*
- *What lessons can be learned from international experience?*

2.1. Regional educational attainment

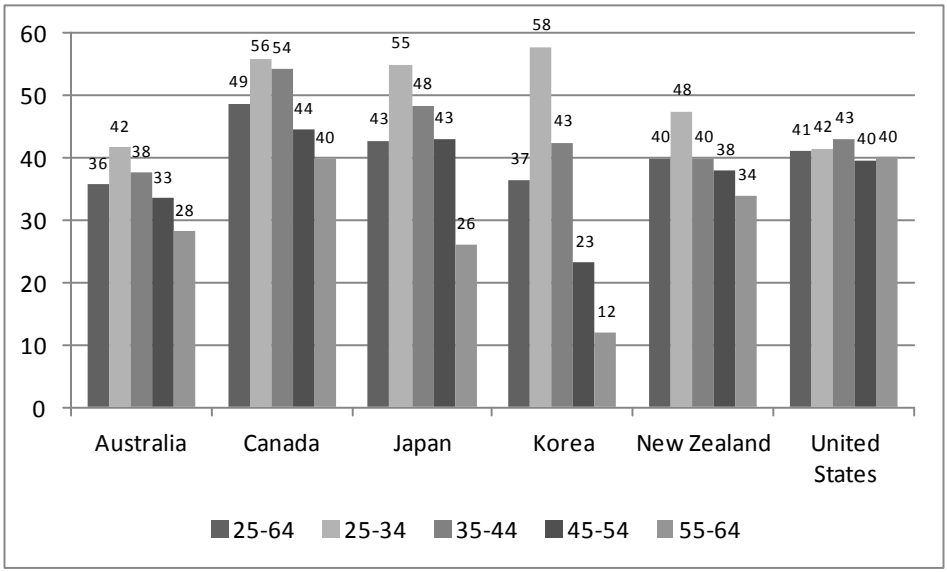
The human resource capacity of a region's population defined in terms of the educational attainment of a region's population is highly correlated with the region's economic competitiveness. Higher education institutions can contribute to this human resource capacity, but other sources such as

demographic changes are also important. These other considerations are especially important in Penang.

The development of Penang since 1970 has been driven by a deliberate policy of low-skill, low-wage manufacturing. The economy depended on importing labour from throughout Malaysia as well as from other countries. Meanwhile, through the New Economic Policy, the Government of Malaysia emphasised social equity for the Malaysian Bumiputera population (the indigenous people of the Malay Archipelago). The region's profile, therefore, evolved into a population composed of small, highly educated primarily ethnic Chinese and Indian elites and a large low-skilled workforce. The size of the low-skilled workforce is most likely undercounted in official population data because of migrant workers who were not officially sanctioned. Within the region, the more highly educated population is concentrated on the island of Penang, while the less-educated population is concentrated in the developing industrial sites on the mainland in Seberang Perai.

Increasing the knowledge and skills of the population is a central priority of the Government of Malaysia as expressed in the New Economic Model. The National Economic Advisory Council notes that the only 25% of Malaysia's labour force is composed of highly-skilled workers compared to 49% in Singapore, 33% in Taiwan, and 35% in Korea (NEAC, 2010, p. 51). The New Economic Model (NEM) also emphasises that the skill level of the labour force is linked to education. The share of the labour force with tertiary education for advanced countries is usually high and there is a high correlation between Gross Domestic Product and educational levels of the population with the relationship getting stronger as countries shift toward a knowledge-based economy.[1] The percentage of the population ages 25 to 34 with a tertiary education degree (tertiary education at levels A and B) in OECD countries in the Asian-Pacific region has increased dramatically in recent years to levels ranging from 40% in Australia to more than 50% in Japan and Korea. While comparable data for Malaysia are not available, a percentage ranging from 20 to 25% would not be surprising. Whatever the precise figure, the New Economic Model underscores that Malaysia faces a major challenge to become globally competitive in terms of the knowledge and skills of its population.

Figure 2.1. Percentage of the population ages 25 to 64 who have completed tertiary education, OECD Asian Pacific countries, 2008.



Source: OECD (2010a), *Education-at-a-Glance 2010*, OECD, Paris.
http://dx.doi.org/10.1787/888932310092.

Penang, one of four states in the Northern Corridor Economic Region, differs significantly in demographics and economy from the other largely rural states (Perlis, Kedah and Perak). Penang has a better educated population than the other three states. It has a smaller percentage of its population with no formal education and a higher percentage with tertiary education.

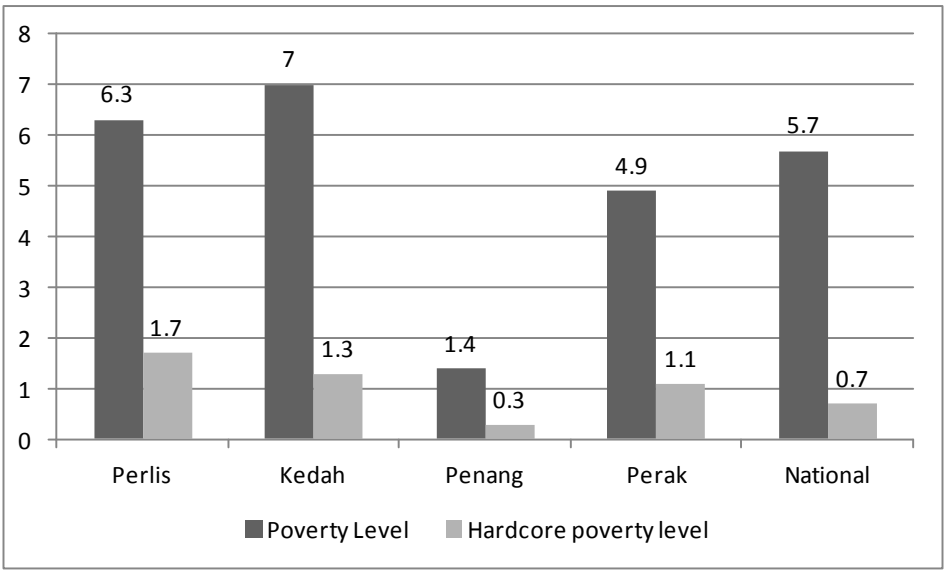
Table 2.1. Educational attainment, states in Northern Corridor Economic Region, percent with different educational levels

	Kedah	Perak	Perlis	Penang
Tertiary	15.9	12.8	17.6	22.5
Secondary	57.9	61.3	60.6	59.5
Primary	22.5	22.3	17.7	16.0
No formal education	3.7	3.6	4.1	1.8

Source: NCER Blueprint*, www.ncer.com.my/?q=education_human_capital*

Poverty is highly correlated with low levels of educational attainment and this is reflected in the far lower level of poverty in Penang than in the other states and Malaysia as a whole.

Figure 2.2. Percent of population at poverty level in the states in the Northern Corridor Economic Region and Nation



Source: Northern Corridor Economic Region Blueprint citation, p. 96, from UNDP Report 2004, Ninth Malaysia Plan 2006.

The population of Penang has increased over the past two decades and is projected to continue to increase. However, this increase is not coming from natural growth. The region has a declining birth rate. Penang's fertility rate is now below replacement level and the older population is increasing in part because of the in-migration of a retirement-age population.

A significant portion of the population increase has been driven and continues to be driven by migration of labour from the less developed regions of Malaysia and from in-migration from other countries such as Bangladesh and the Philippines.

Table 2.2. Ethnic distribution of Penang population

Percentage distribution of population by ethnicity, 1991 and 2010 (estimate)

	1991	2010 Estimate
Malay	38.09	43.0
Chinese	49.17	41.0
Indian	10.60	9.5
Other Bumiputera	0.30	0.5
Others	0.41	0.5
Non-Malaysian Citizen	3.68	5.5

Source: Department of Statistics Malaysia as cited by NHERI, Table 1.2

Table 2.3. Percentage change in ethnic distribution of Penang population

Percentage Increase	Total	Malay	Chinese	Indian	Other Bumiputera	Others	Non-Malaysian Citizen
1990 - 2000	23	32	13	19	243	-6	205
2000-05	12	13	7	10	32	12	62
2000-10	21	27	15	14	71	45	25

Source: Department of Statistics Malaysia as cited by NHERI Table 1.2

In 1970, the ethnic distribution of the population was 56% Chinese, 31% Malay, 12% Indian, and other populations 1%. As shown in Table 2.2, the Malay population had become the majority population by 2010, while the percentages from Chinese and Indian populations decreased. Since 1990, the overall population and the population of each ethnic group have increased but the rate of increase has varied substantially (see Table 2.3). While some of these are natural increases, the most significant changes have most likely occurred through migration. The percentage of increases in the Malaysian and "Other Bumiputera" populations far exceeds the increases in the Chinese and Indian populations, increases that most likely reflect a deliberate policy for ethnic redistribution and migration of labour from other parts of Malaysia to Penang. While the pattern of these changes has been consistent over the past forty years, the pace of change has accelerated in the past decade. Accurate information on the impact of undocumented foreign workers is not available.[2]

Data on changes in the educational attainment and ethnicity of the Penang population over the past decade were not available. However,

interviews in the course of the OECD review expressed concern about the continued out-migration of the better educated population and continued in-migration of a less educated population and continuation of dependence on in-migration of low-skilled workers from other parts of Malaysia and from outside the country. A concern about out-migration is a main issue for the Government of Malaysia. The National Economic Advisory Council cited evidence from the Ministry of Human Resources (MOHR) that an estimated 350 000 Malaysians adults are working abroad in 2008, over half of whom had tertiary education (NEAC, 2010).

2.2. Regional demand for human resources

Moving up the "value chain"

Concerns regarding the availability of human resources to support the rapidly changing economy of Penang have been a consistent concern in Penang over the past 20 years (Fold and Wangel, 1997). The establishment of the Penang Skills Development Corporation (PSDC) in 1989 was a critical step in the effort to provide skilled workers for the rapidly expanding multinational corporations (MNCs) primarily in electrical and electronics (E&E). The underlying issue for Malaysia and for the Northern Corridor Economic Region and Penang in particular is the need to move "up the value chain" from a low-skill, low-production economy to a higher skill, higher wage economy. The ability of Penang to compete on the basis of low-skilled labour is increasingly limited by competition from other countries in Southeast Asia and restrictions on foreign workers. At the same time, the region faces competition from Singapore and other countries that do have the human resources and access to research and innovation needed to compete at the high-end of the value chain. As emphasised by the National Economic Advisory Council in the New Economic Model, the problem is not only an inadequate supply of graduates. It is also the lack of an economy and other regional amenities that retain graduates who are otherwise attracted to Kuala Lumpur, Singapore and other major economic centres. Malaysians who have left for higher education or employment often do care to return home (NEAC, 2010).

Employment by industry and occupation in Penang differs from other states in the Northern Corridor Economic Region with the most pronounced difference being in the high concentration of manufacturing in Penang as opposed to the high concentration of agriculture in the other states.

Table 2.4. Percentage of employment by industry, Northern Corridor Economic Region and Penang

Industry	Northern Corridor Economic Region (NCER)	NCER without Penang
Manufacturing	23.7	32.8
Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods	15.5	15.9
Agriculture, hunting and forestry	11.1	1.2
Public administration and defence, compulsory social security	8.4	5.0
Construction	8.5	5.6
Hotels and restaurants	8.3	8.1
Education	6.5	5.2
Transport, storage and communications	4.2	6.8
Real estate, rental and business activities	3.5	6.6
Health and social work	2.8	3.6
Private households with employed persons	2.4	3.3
Other community, social and personal service activities	2.0	2.9
Fishing	1.5	0.6
Financial intermediation	1.3	2.0
Electricity, gas and water supply	0.4	0.4

Source: For NCES, Northern Corridor Economic Region Blueprint, *www.ncer.com.my/?q=education_human_capital; for Penang, NHERII, 2010)*

Data for the four quarters of 2009 show a pronounced decrease in the percentage of employment in manufacturing in Penang from 37.6% to 32.8% and slight increases in hotels and restaurants (from 7.7% to 8.1%) and in health and social work (4.0% to 6.6%). While these changes may be seasonal they may also reflect a gradual shift in the economy toward tourism, including medical tourism (SERI, 2010).

Despite the push to move to a "high-skill, high-wage" economy, Penang remains highly dependent upon low-skill industries and occupations. If one assumes that the top three occupational categories (technicians and association professionals, professionals, and legislators, senior officials and managers) are those requiring some level of formal tertiary education, only 23% of the occupations in the Northern Corridor Economic Region and 19% in the Northern Corridor Economic Region not including Penang require this level of education. Most of the occupations continue to require only basic education and training at the secondary level or less. As noted earlier, the

level of highly skilled labour in Malaysia was 25% (NEAC 2010). While precise data were not available, the level of highly skilled labour in Penang is likely to be at or slightly above the national average and the level for the remainder of the Northern Corridor Economic Region significantly below that level.

Table 2.5. Percent of employment by occupation, Northern Corridor Region (Including and not Including Penang)

Occupation	Northern Corridor Economic Region (NCER)	NCER without Penang
Legislators, senior officials and managers	6	5
Professionals	5	4
Technicians and associate professionals	12	11
Clerical workers	9	8
Service workers and shop and market sales workers	17	19
Skilled agricultural and fishery workers	10	13
Craft and related trade workers	12	12
Plant and machine operators and assemblers	16	14
Elementary occupations	13	14

Source: Northern Corridor Economic Region Blueprint.
www.ncer.com.my/?q=education_human_capital.

Future demands

The Northern Corridor Economic Region's Socioeconomic Blueprint envisions development in three broad areas: agriculture, manufacturing, and services. Within these, the areas of development most relevant to Penang are manufacturing, especially increasing the "value added" in electrical and electronics (E&E) and in services, especially tourism. To achieve regional and global competitiveness in these areas, the Blueprint forecasts that more than 250 000 direct jobs will be created by 2025 (154 000 in tourism, 52 000 in agriculture and 42 000 in manufacturing).

Within tourism, the area of focus is to be positioned as the regional medical tourism hub in Asia by providing high-quality but more affordable specialised medical procedures. The region is to be known as the centre for excellence in areas such as cardiac care and oncology, possessing globally-accredited hospitals and highly-qualified medical and healthcare professionals.

While some of the dynamics of the regional economy have changed in the past decade, Penang continues to face a number of perennial human resource issues. A 2001 report by the Socio-economic and Environment Research Group identified several issues that were cited in the interviews conducted in the 2010 OECD review:

- Shortage of skilled personnel: Manufacturing establishments face shortages of engineers, especially those in the fields of electronics, mechatronics and software. There is a mismatch between supply and demand of workers and evidence that universities produce graduates in fields irrelevant to the demands of the developing economy.

- A shortage of highly qualified people and the "Brain Drain": out-migration of highly qualified Malaysian managers and researchers and the challenges of attracting back to Penang the highly qualified Malaysian Diaspora.

- Lack of entrepreneurial expertise.

- Shortage of production workers.

The changing demands for training on the Penang Skills Development Centre (PSDC) are a clear indication of the dynamics in the region. When established in 1989, the Penang Skills Development Centre (PSDC) concentrated on technical and vocational training programmes for employees of multinational corporations (MNCs). Over a 20 year period, the knowledge and skills of every level (operators, technicians, supervisors, engineers and managers) have increased significantly (PSDC, 2009, 2010).

- Training for operators: from training in basic skills in radio repair, soldering and SMT (surface-mount technology, a method of constructing electronic circuits), then for Total Productive Maintenance (TPM), and Statistical Process Control (SPC), and most recently for a Higher National Diploma (HND) in engineering, teambuilding and control technology.

- Training for technicians: from training in technical skills, pneumatics and hydraulics, then to training in Quality Control Circles (QQC), Higher National Certification in Engineering, control technology, and most recently training in Total Productive Maintenance (TPM), Total Quality Management (TQM) and technical report writing.

- Training for supervisors: from training in problem solving and decision-making, then in Total Productive Maintenance (TPM), and Total Quality Management (TQM) and most recently in leadership and team development.

- Training for engineers: from training in CAD/CAM and automated manufacturing, then to training in ASIC (application-specific integrated circuit) design and VSLI (very large scale integration), software simulation, and dynamic modelling, and most recently in knowledge management, aerospace and avionics, and supply chain management.

- Training for managers: from training in basic supervision and problem solving and decision-making, then training in ethics and productivity and negotiation skills, and most recently in talent management, strategic planning and succession planning.

As a further indication of the challenges facing Penang as it makes a transition up the value chain, a study by the World Bank Development Research Group in 2008 found that firms in Penang were being impeded in their R&D or produce/process development efforts by shortages of specialised skills. While the multinational corporations (MNCs) hire some technical personnel to work on design, testing and product developments, the supply of R&D engineers and technicians was too small for them to expand their R&D in Penang. (Yusuf and Nabeshima, 2009)

In addition to the needs for an expanded pool of highly educated professionals and technicians, Penang and the Northern Corridor Economic Region face remaining challenges in narrowing the rural/urban gaps in education attainment. The level of educational attainment remains significantly below that of OECD countries in the region.

2.3. Engagement of higher education institutions in meeting regional human resource challenges

Currently, there is considerable scope to increase the extent that higher education institutions in Penang, especially the public institutions, consider regional needs when planning their academic programmes. As the Penang self-evaluation report notes higher education institutions in the region do not have courses that are especially designed to meet the needs of the Penang region or are "drawn upon based upon the specific characteristics of Penang." (NHERI 2010). There is no systematic regional strategy at the federal, supra-regional (Northern Corridor Economic Region) or state levels to engage higher education institution in addressing the region's human resource challenges. The engagement of the Universiti Sains Malaysia (USM) in the region is largely a consequence of being the largest institution in the region, not a result of deliberate strategy of the institution or region. In fact, the designation of the university as an APEX university is likely to draw the institution even further away from regional engagement. This reality stems largely from the highly centralised nature of educational policy

in Malaysia and the legal and political constraints on the State of Penang to take a lead role in higher education policy.

Despite these shortcomings, higher education institutions are important resources for meeting the regional human resource needs. They provide access for large numbers of the region's students and graduate students many of whom remain within the region for employment. Through student engagement in the region through internships, volunteer activities, and other ways, the institutions have an impact on the region.

The OECD review team received detailed information on and conducted interviews at only two of the higher education institutions in the region: the Universiti Sains Malaysia and the Wawasan Open University (WOU). Except for basic information on numbers of admissions, enrolment and graduates, no substantive information was available on the branch of UiTM in Penang, the two polytechnics, the four community colleges, and private institutions in Penang and on higher education institutions in the three other states (Perlis, Kedah and Perak) in the larger Northern Corridor Economic Region. The findings and observations are therefore based on a limited perspective on higher education institution in the region.

Universiti Sains Malaysia

The establishment of the Universiti Sains Malaysia (USM) in 1969 outside the traditional core region reflects a bold attempt by the Government of Malaysia to use higher education as an instrument to redress ethnic inequity and regional imbalances (NHERI, 2010). Since its founding, the university has made great strides in the quality and breadth of its academic and research programmes, quality of its academic staff and in undergraduate and graduate enrolments. Designation as an APEX University, a designation to become one of the top performing higher education institutions worldwide in international ranking, is a singular achievement (MoHE, 2007). In its vision as an APEX university, the Universiti Sains Malaysia has set forth an impressive agenda, *Transforming Higher Education for a Sustainable Tomorrow* (USM, 2010). The ultimate goal is to "support the drive to improve the well-being of humanity, the bottom billion, in particular (USM, 2010).

In line with its long-term agenda, the Universiti Sains Malaysia is shifting the balance of its enrolments from the undergraduate to the post-graduate level. From 2005 to 2008, bachelor's degrees granted decreased from 18 541 to 15 088, master's degrees increased from 5 142 to 5 245 and PhDs increased from 1 379 to 2 213 (USM, 2008). The strengthening of the post-graduate programmes, especially in fields such as medical health, life sciences, health sciences, engineering and technology, and information

technology are directly in line with regional priorities. Developing the pool of highly qualified researchers and engineers is critical to the capacity of the region to compete on the basis of design and development and innovation in electrical and electronics (E&E) and other industries.

The National Economic Advisory Council's report on the New Economic Model cites data from the Ministry of Higher Education that about a quarter of graduates from local public universities remained unemployed for six months upon completion of study in 2008 (NEAC, 2010). A tracer study of students graduating from the Universiti Sains Malaysia in 2007 and 2008 shows a similar pattern. Of the 6 464 graduates of 2007, 1 583 (24.5%) were unemployed. Of these graduates, 1 395 (88.8%) were still seeking a job while others had various reasons for not seeking employment. Of the 6 093 graduates of 2008, 1 384 (22.7%) were unemployed. Of these graduates, 1 113 (80.4%) were still seeking a job while others had various reasons for not seeking employment.

Of the 6 093 graduates in 2008, 42.8% were in arts and social sciences, 32.8 % in sciences, 11.1% in technical fields, 2.7% were in IT and communications, and 0.3% in education. All fields except education had more than 20% of the graduates not working yet. The highest percentage was in arts and sciences at 28.1%

Table 2.6. Universiti Sains Malaysia, graduates by field and employment status

Field	Percent of graduates by field	Not working yet	Percent not working yet by field	Total
Arts and social sciences		734		2 609
	42.8	28.1%	53.0	100%
Sciences		454		2 240
	36.8	20.3%	32.8	100%
Technical		154		744
	12.2	20.7%	11.1	100%
IT and communication		38		188
	3.1	20.2%	2.7	100%
Education		4		314
	5.2	1.3%	0.3	100%
Total		**1 384**		**6 093**
	100.0	**22.7%**	**100.0**	**100%**

Source: USM Division of Student Affairs and Development and MoHE (2007-08)

Local graduates' wait period for a job has thus increased; and their wages stagnate, suggesting that general education tertiary and secondary graduates skills do not match those required by employers. Furthermore, graduates from overseas or those who graduated from high-quality twinning programmes, who received employer-provided training in the areas of marketing, information technology and management as well as those who received off-the-job training particularly from the services sector were readily employed and enjoyed higher salary levels. The contrast between the wage premiums of local graduates and those from abroad is significant and suggests a mismatch between local education programmes and labour market requirements. For the short-term, employers need to provide on-the-job general and specific skills training. In the longer term, the current mismatch of skills suggests a critical need for education and skills training providers to better understand and respond to labour market signals.

The 2009 survey conducted by the World Bank Development Research Group found that firms (primarily multinational corporations) in Penang had a positive assessment of the quality of students from local universities in Penang (most of whom would have graduated from Universiti Sains Malaysia.

Table 2.7. Assessment of quality of students graduating from local public universities in Penang

Assessment	Number of firms	Percent
Very poor	0	0.0
Poor	5	7.3
Fairly good	50	72.5
Very good	14	20.3

Source: Authors' calculations based on investment climate survey data, Yusuf and Nabeshima (2009)

Interviews by the OECD team reflected a similar positive assessment of the core competencies of Universiti Sains Malaysia graduates but emphasised that most graduates needed intensive training to develop "soft skills" and specialised training through an entity as the Penang Skills Development Centre (PSDC) to meet requirements of industry in Penang.

The 2009 study by the World Bank Development Research Group identified four areas where Universiti Sains Malaysia (USM) could contribute to the overall regional capacity for innovation and global competitiveness:

- Improving the quality of education particularly in science and engineering disciplines, by enhancing soft skills and enlarging the

supply of technical workers. Communication, team working, and analytical skills are the ones which many employers feel students lack.

- Initiating post-doctoral programmes in key areas so as to deepen the culture of research and to position the university to generate knowledge in new areas some of which could have commercial potential.

- Encouraging entrepreneurship with the help of training and specialised services provided through incubators and a science park.

- Engaging in exploratory research and internship programmes with local companies with government funding.

In line with these recommendations, Penang's Self-evaluation Report outlines the ways that Universiti Sains Malaysia engages its students in regional issues through work-based learning arrangements such as industrial training, internships and practicum. The report cites as examples the Division of Industry and Community Network (BJIM), the Division of Research and Community Network which, while originally established mainly for industrial training placement and to enhance students' employment opportunities, is now actively taking part in community engagement and outreach programmes (NHERI, 2010).

Universiti Sains Malaysia makes a significant contribution to educating first degree undergraduate and post-graduate students from the Northern Corridor Economic Region and Penang. Prior to its designation as an APEX university, student selections were done centrally and a centralised process continues for all non-APEX higher education institutions. Course placements at higher education are made to reflect the demographic profile of the country and are based on academic marks. The intent is to promote integrated study for students from different ethnicities and nationalities. There is no focus on having universities serve the region in which it is located. Beginning in the academic year 2009-10, Universiti Sains Malaysia has assumed responsibility for applications, processing, selection, offer letters, announcements and appeals. There was no indication, however, that this would lead to a greater focus on regional needs. On the contrary, autonomy in the selection process will permit the university to seek highly qualified students from throughout Malaysia and to increase its recruitment of foreign students. In 2009, 15.1% of the students came from Penang and a total of 43% came from the Northern Corridor Economic Region. At the same time, the percentage of students from the region has been declining in recent years.

Table 2.8. Enrolment first degree students, Universiti Sains Malaysia, states in Northern Corridor Economic Region and Malaysia, 2007-09

State of origin	2007		2008		2009	
	No. of Students	%	No. of Students	%	No. of Students	%
Penang	3 375	15.4	3 165	15.3	2 908	15.1
Perlis	356	1.6	328	1.6	310	1.6
Kedah	2 531	11.5	2 421	11.7	2 245	11.7
Perak (entire state)	3 377	15.4	3 116	15.0	2 907	15.1
Total (from Northern Corridor Economic Region)	9 639	43.9	9 030	43.5	8 370	43.4
Total Malaysia	**21 975**	**100.0**	**20 741**	**100.0**	**19 276**	**100.0**

Source: USM (2010), Enrolments and Admissions (unpublished)

Universiti Sains Malaysia also draws many of its post-graduate students from Penang and the Northern Corridor Economic Region. However, the APEX university status will permit the university to recruit more widely to increase its global ranking.

Table 2.9. Enrolment post-graduate students, Universiti Sains Malaysia, States in the Northern Corridor Economic Region, 2009

State of origin	Male	Female	Total
Kedah	337	391	728
Perak (entire)	333	415	748
Perlis	41	47	88
Penang	502	608	1 110
Total	1 213	1 461	2 674

Source: USM (2010), Enrolments and Admissions (unpublished)

An analysis of the tracer study of 2008 graduates indicates that one-half were still in the Northern Corridor Economic Region and 21% were in Penang. Of those in Penang, 18.9% were still seeking employment (USM, 2010).

Alignment of USM education to regional needs

Despite the evidence of the contributions of Universiti Sains Malaysia to the human resource needs of the region, student engagement with industry and the region could be connected more strongly with the university's core

academic programme and curricula. For example, internships and industrial placements for students appear to be concentrated in engineering and technical disciplines and not across the breadth of the university. The result is that many of the graduates in arts, humanities and social sciences may not have had practical experience in the labour market, a point that may contribute to higher rates of unemployment of recent graduates. More importantly, even the industrial placements that do occur appear to be peripheral to the students' core academic programme and academic staff's responsibilities. The School of Computer Sciences visited by the OECD team is a major exception to this observation.

Internationally, many universities and other tertiary education institutions are building closer, more systematic links with the world of work. SMEs represent about 90% of industry partners. Some universities, such as the University of Aalborg in Denmark, have also taken steps to embed employability and transferable skills in their core curriculum through problem-based learning in multidisciplinary teams (see Box 2.1.) Co-op education in Canadian universities helps students of all disciplines to complete work terms in industry as part of their curriculum (see Box 2.2. for the University of Waterloo experience).

Box 2.1. Problem-based learning at Aalborg University

Aalborg University was established in 1974 after years of popular campaign in the region to establish a university in northern Jutland in Denmark. The campaign formed the basis for a close dialogue with the surrounding society relying on cooperation with the business sector, trade unions and cultural life. An important early decision was to base research and educational activities on interdisciplinary integration, problem orientation and group work.

In project-oriented problem-based learning, study programmes are organised around interdisciplinary project work in groups. Up to 50% of the study is problem-oriented project work: student work in multidisciplinary teams to solve real-life problems which have been defined in collaboration with public and private sector and NGOs. At any one time, there are 2 000 to 3 000 ongoing projects to ensure a high degree of collaboration with the society and private sector.

Box 2.1. Problem-based learning at Aalborg University (continued)

The Aalborg model is based on a win-win situation: It provides students with transferable skills and authentic work experience while enterprises benefit from a clearer picture of what the university stands for and how students might fit in as prospective employees. Finally, the university gains feedback from the world of work and also benefits from access to instructive cases and ideas for research and teaching.

Source: *OECD (2007),* Higher Education and Region – Globally Competitive, Locally Engaged*, Paris, OECD.*

Box 2.2. The Co-operative Education Programme at the University of Waterloo, Canada

The Waterloo Region in Ontario, located about 100 km west of Toronto, has a strong factor advantage of a rich local labour pool largely as a result of a strategic decision made at the inception of the University of Waterloo. The founding document for this university in the 1950s (the Waterloo Plan), called for a new type of education to be offered on a co-operative basis with industry. The rotation of students to industry and back to the classroom solidified the university's relations with local industry. Today, the University of Waterloo has the largest co-operative education programme in the world, with over 11 000 students (60% of the student body) and 3 000 employers involved in the programme each year.

Extensive co-op programme offerings are available in all faculties and departments and in over 100 different programmes. Many of local and global firms have strong links with the co-op programme. At Sybase, an enterprise software company that spun-off from the original WATCOM Corporation, with over 250 employees in its Waterloo campus alone, 15% of its current employees are Waterloo co-op students, and more than half of their Waterloo staff is former co-op students.

The co-op programme brings a number of benefits to the local economy. It acts as a steady source of new hires, because firms know that the students have work experience, and they get an opportunity to evaluate their performance in the work place before hiring them. Students act as an important transfer mechanism for tacit knowledge and know-how; they also act as a critical source of knowledge circulation within the local high-technology cluster, between different firms as they undertake placements over the course of their integrated work-study programme. The relationship between the university and local industry allows the curriculum to keep up-to-date with the changing technological frontiers of industry while industry support of the programme funds the acquisition of technology to enhance classroom learning.

Box 2.2. The Co-operative Education Programme at the University of Waterloo, Canada (continued)

Furthermore, the Enterprise Co-op Programme enables students to start their own venture instead of doing a co-op placement with an established firm, and focuses on creating a local network of contacts and mentors to support it. The principal obstacle to the success of the Co-op Programme is the high cost of finding and maintaining the placement positions for the student body. The university invests a considerable amount of its own resources in financing and managing the programme. However it now benefits from the high reputation that both the programme and the university's students enjoy, which makes it easier to find firms willing to take the students on work placement. The key lesson to be drawn from this experience is that the investment of resources in a programme such as this can pay dividends to the local economy over a long period of time.

Source: OECD (2010b), *Entrepreneurship, SMEs and Local Development In Andalusia, Spain*, OECD, Paris.

Alignment of USM research with regional needs

An even more fundamental concern is that some of the research centres and projects could have far stronger connections with the core academic teaching and learning units and functions of the university. For example, while the Advanced Medical and Dental Institute has as one of its objectives "to establish innovative and relevant postgraduate programmes," the OECD team did not observe significant connections with Universiti Sains Malaysia (USM) in terms of joint faculty appointments and extensive involvement of post-graduate and other students in the research projects. In contrast, USM School of Computer Sciences had extensive collaborative relationships across its teaching and research mission. In addition to wide research collaboration, the school has extensive linkages related to human resource development including industry involvement in curriculum development. The school also provides industrial training and certificate programmes to upgrade the knowledge and skills of existing of Multi National Corporations in the E&E industry.

Universiti Sains Malaysia has embarked on an important agenda as it seeks to implement the expectations for an APEX university. What is difficult to find in the agenda, however, is any reference to the university's impact on human resources in the region in which it is located except as

there will be spiller-over effects of the university's increasing strength as a globally competitive research university on the region.

The OECD team fully recognises that Universiti Sains Malaysia must operate within the framework of national policy and the expectations for an APEX university. However, the world wide experience is that the intense pressures to increase the university's standing in international rankings will continue to draw the university away from regional engagement. Combining the aspirations of world class excellence and regional engagement will require special attention from the university leadership.

Wawasan Open University

The second higher education institution visited by the OECD, the Wawasan Open University (WOU), represents an impressive contribution of higher education to the human resource development needs of Penang and other regions of Malaysia. A private not-for-profit virtual university officially established in 2005, the Wawasan Open University "…was founded on the belief that given the right learning environment, most members of the workforce are capable of benefiting from a quality learning experience to increase their productivity and in so doing contribute toward increasing the productivity of the nation as a whole." Wawasan Open University is dedicated to serving working adults, expanding access to university education using technology enhanced open and distance learning (e-Learning). The university's mission is to:

- Provide admission and access to values-based learning for all adult working Malaysians, regardless of their prior academic achievement and present knowledge, age, socio-economic situation, gender and residential location.
- Provide innovative and comprehensive academic programmes that offer top quality instruction, high institutional standards and excellence in a wide range of educational opportunities.
- Provide life-long learning and personal development opportunities.
- Establish and strengthen institutional partnerships and community outreach.

The university's main office and campus is in Penang but has sites throughout Malaysia. The key strategies include quality course materials (print, CD and Web-based), quality learner support (tutor and tutorials, E-Library, etc.) and an assessment strategy benchmarked to international standards (assignments and exams within individual courses and the use of external examiners).

Student enrolment at the Penang campus in 2010 included 180 at the master's degree level, 906 at the undergraduate degree level and eleven at the "headstart" level. Approximately 65% of the students at the undergraduate level are between the ages of 21 and 30 and 68% of those at the post-graduate level are between the ages of 26 and 40. The university emphasises flexibility to meet students' needs: access to students from any place and at any time, acceptance to the university, not to a particular programme, and enrolment by course (subject) not by programme each semester. The Wawasan Open University makes it possible for students to take from zero to four courses (maximum 15 credits), exit the system after one course/subject, exit with intermediate awards, and change programme freely. The Wawasan Open University strives to be affordable. The cost to students is about 50% of that charged by private conventional colleges and the university provides grants and merit scholarships.

The Wawasan Open University maintains extensive local, national and international relationships through collaborations with local entities such as the Penang Skills Development Centre (PSDC), most local universities, Open University Malaysia and other open universities in the Asia-Pacific region. As an indication of its responsiveness to the adults employed within the Penang region, the Wawasan Open University is the only university in Penang formally identified by the Penang Skills Development Centre (PSDC) as a collaborating higher education institution in the Centre's publications.

Penang Skills Development Centre (PSDC)

While not a higher education institution, the Penang Skills Development Centre (PSDC) is a central element of the regional capacity for human resource development. It has grown to become the premier (skills) learning institution in Malaysia, dedicated to meeting the immediate human resource needs of the business community, and supporting and strengthening business requirements. It is the preferred one-stop human resource development entity geared towards the promotion of shared learning among the manufacturing and service industries (NHERI, 2010).The centre plays a critical role as a broker between the needs of employers and higher education institutions and other sources of training capacity.

The evolution of services provided by the Penang Skills Development Centre (PSDC) over its 20-year existence, reflects the dynamics of the demand for human resources over that period. In addition to its traditional training functions, the Penang Skills Development Centre (PSDC) is embarking on a new initiative, "School 2 Work," with the objective of

providing a complete education-to-employment pathway for school leavers (see Box 2.4.).

Box 2.3. PSDC and School2work and FasTrack programmes

"School2work" provides a complete pathway from education to employment. Students are admitted from secondary school on the basis of their performance on the Malaysian examinations (SPM and STPM). They can earn a Penang Skills Development Centre Diploma in Engineering in three years in electronic engineering, mechatronic engineering, computer engineering, and telecommunication engineering. The programme includes extensive field experience including factory visits, talks with external examiners, professors and CEOs.

After earning a diploma, students may enter a programme of skills enhancement ("FasTrack" programme) to equip them for employment or enter a bachelor's degree programme through an affiliated university. One option is to earn a degree locally in two to three years at a local private university: UCSI University (Originally the Canadian Institute of Computer Studies), Wawasan Open University or Multimedia University. The other option is to earn a degree through one of several affiliated foreign universities most of which are British (e.g. the University of Hull, University of Kent). Students completing a degree programme are then given intensive skills enhancement training ("FasTrack") to prepare them for employment. The "FasTrack" programme is a government-funded initiative designed in collaboration with multinational corporations to accelerate learning and hands-on experience of new and existing engineers to support industry's competitiveness in design and development. (PSDC, 2010).

Both the "School2Work" and "FasTrack" initiatives are commentaries on the perceptions of employers and the Ministry of Human Resources (the funding source for FasTrack) of the quality and responsiveness of the programmes provided by public higher education institutions. The Universiti of Sains Malaysia is not identified as a major collaborator in either of these initiatives. The FasTrack programme, however, is a means to provide the Universiti Sains Malaysia engineering and other graduates with the skills they will need for employment.

Other higher education institutions engaged in regional human resource development

Penang Self-Evaluation Report (NHERI, 2010) lists and provides brief information about other public and private institutions in the region engaged

in vocational and technical education and training. However, the OECD received insufficient information on these entities to be able to comment on their role in regional human resource development. Nevertheless, the comparatively low enrolments in polytechnics and community colleges in the region contrasts sharply with the Northern Corridor Economic Region projects of substantially increased employment in manufacturing and the developing tourist and health/medical fields.

2.4. Lifelong learning

Due to rapidly changing skill requirements in working life, lifelong learning, skills upgrading and re-skilling are becoming increasingly important. Upgrading the skills of the adult population is likely to have a more direct effect on the region's economic performance since adult learners are generally less mobile than younger students due to family commitments. For non-traditional learners, who combine work and study and/or family obligations, flexible ways of provision need to be in place through work-based, e-learning and distance education. In addition, attendance on the basis of non-formal and informal learning should be allowed (OECD 2007; Santiago *et al*., 2008).

The Wawasan Open University and the Penang Skills Development Centre (PSDC) are important vehicles for serving the needs of the Penang region's adults for lifelong learning. The OECD team received insufficient information beyond basic descriptions to comment on the extent to which other institutions serve the lifelong needs of the Penang region. The Universiti Sains Malaysia's School of Off-campus Studies, established in 1971, has been university's most prominent feature as it was the first distance learning programme at the tertiary level in Malaysia. It offers degrees in the sciences, humanities, social sciences and civil engineering. (NHERI, 2010). The Malaysian Open University, a private university owned by Multimedia Technology Enhancement Operations (METEOR) Sdn. Bhn, is a consortium of eleven Malaysian public universities. The Malaysian Open University has 61 learning centres throughout Malaysia.

2.5. Widening access to higher education

As enunciated in the New Economic Policy, widening access and narrowing disparities in education and economic opportunity, especially for the Bumiputera population, has been a priority in Malaysia. The controversial policy, which was initiated in 1971 and formally ended in 1990, had a profound impact on the country. A deliberate affirmative action

policy significantly increased access to higher education for the Bumiputera population. For regions such as Penang with historically majority ethnic Chinese and Indian populations, this policy created special political and economic challenges. While no longer a formal policy, underlying themes of the policy still permeate Malaysian politics and aspects of higher education policy today.

Social equity is a central theme in national and regional policy. One of the three goals of the New Economic Model (NEM) is "Inclusiveness", a goal to ensure that all communities are "enabled to benefit fully from the wealth of the country" (NEAC, 2010). The Blueprint of the Northern Corridor Economic Region gives high priority to strategies to strengthen social equity by reducing poverty, narrowing rural/urban disparities and improving basic education.

Penang Self-evaluation Report notes that the National Higher Education Strategic Plan 2020 has clearly defined the role of higher education in increasing access to and equity in higher education, spurring human capital formation. Nevertheless, the plan has no explicit spatial biases aimed at redressing disparities at the regional and city level. "Apparently, the old adage, what is good for the nation is good for the region seems to be the underlying assumption of the plan." (NHERI 2010)

Ensuring affordable access is a major concern in Penang. The Wawasan Open University has a mission of affordable access to adult learners and not only operates in an open flexible manner to meet diverse learner needs but also provides scholarships and loans on the basis of financial need and academic merit. Universiti Sains Malaysia provides financial assistance to students. Monetary assistance is awarded in the form of loans and scholarships to the students to help cover their tuition fees, accommodation costs, living and other expenses. Scholarships are provided to students with outstanding academic performance and extra-curricular involvement. Loans, most of which are provided by the National Higher Education Fund (PTPTN) are given based upon the applicant's financial status or background (household income level) (NHERI, 2010). There is no indication that the Universiti Sains Malaysia uses student financial assistance to give high priority to ensuring access for low-income students within Penang and Northern Corridor Economic Region.

Furthermore, Universiti Sains Malaysia provides educational opportunities for various target groups such as senior citizens, the physically challenged and school dropouts to further enhance their personal development (NHERI, 2010).

Table 2.10. Universiti Sains Malaysia, Monetary assistance awarded to students according to campus, 2008

Sponsor	Type of Monetary Assistance	Main	Engineering	Health
National Higher Education Fund (PTPTN)	Loan	2 197	493	335
Public Services Department (JPA)	Scholarship	388	166	310
Ministry of Education (KPM)	Federal Teaching Scholarship	83		
Academic Staff Training Scheme (SLTP)	Federal Teaching Scholarship	8		
Yeoh Tiong Lay Sdn. Bhd. Construction Corporation	Scholarship	4		
Petronas	Scholarship	3		
Sabah State Government	Scholarship	9		
Ruler and Governor's Higher Education Scholarship Fund (through JPA)	Scholarship	2		
Sumotomo Mitsui Banking Corporation (SMBC)	Global Foundation Scholarship	6		
Total		2 700	659	645

Source: Universiti Sains Malaysia (USM) (2008)

2.6. System governance, transfer and pathways among institutions

One of the main issues impeding human capital development in Penang is the fragmented governance architecture and the absence of region-wide co-ordinating structure and mechanisms to articulate a long-term vision and implement an integrated development strategy for all tertiary education institutions.

Penang has a large number of educational institutions but public and private higher education institutions operate under different regulatory and financing rules, resulting in the absence of a unified higher education system. To date, development plans for these two sectors are undertaken separately. For example the Penang Educational Consultative Council (PECC) under the state government provides the mechanism for a coherent vision of an education system at the regional level, but this council is only for the private higher education institutions in the state. (NHERI, 2010)

As a result, regional collaboration among the universities and other tertiary education institutions in the region takes place on a voluntary, *ad hoc* basis. The pathways between and among institutions in Penang are limited. According to Penang's Self-evaluation report, "There are no multiple pathways with well co-ordinated transfer routes and accreditation, including transfer systems, to ensure flexible student transfer between different educational institutions or between higher education institutions.", (NHERI, 2010). While Universiti Sains Malaysia has an agreement to allow the transfer of credit for students from public higher education institutions to continue their studies at university, this applies only for students transferring from public higher education institutions such as a polytechnic and UiTM. The OECD received no information on the number of students who take advantage of this credit transfer agreement.

Conclusions and recommendations

Malaysia and Penang has made considerable progress in widening access to tertiary education and reaching out to students from lower socioeconomic background. Educational institutions in Penang have significant activities underway to improve academic performance and to promote human capital and skills development.

However, there are considerable system-level barriers to regional co-ordination and collaboration within the tertiary education sector. While education is a federal responsibility, the state government has no direct authority for higher education. Federal policy is vertically linked with each institution with limited attention to horizontal relationships among institutions within a region. There is also a lack of incentives for collaboration among institutions. Central determination of curricula and other institutional policy promotes uniformity and hinders adaptation to the unique needs of regions. As a consequence there is limited alignment of education provision to regional needs. Public and private institutions operate under different regulatory and financing rules, resulting in the absence of a unified education system. To date, development plans for these two sectors are undertaken separately.

Universiti Sains Malaysia's designation as an APEX university is a significant achievement and has a potential to build the university into a globally competitive and locally engaged institutions which can drive the development in the region. However, at the moment there appears to be a conflict of the university's designation as an APEX University and the regional engagement mission. While Universiti Sains Malaysia strives to become a globally competitive research university serving "billions", there is limited targeted attention to the needs of the population within its region.

Furthermore, the flexibility implied in the APEX university stresses flexibility for global competitiveness, but not links with regional strategies for human resource development, for example within the Northern Corridor Economic Region.

At the same time, there are limitations of the Northern Corridor Economic Region as means to address issues specific to Penang. Realities of differences in socio-economic issues facing Penang and those facing the other three states include the urban-rural divide and the priority of agriculture in other three states. Furthermore, the focus of Northern Corridor Economic Region does not encompass higher education except indirectly through other issues, such as human resource development from the perspective of the Ministry of Human Resource Development, not the Ministry of Higher Education. As a result, initiatives remain on periphery of higher education institutions, *e.g.* developing student hostels.

While it is acknowledged that higher education is within the purview of the central government, it is important that the state government sets clear directions with respect to synergy and collaboration among higher education providers in the region (NHERI, 2010). In the past, the state of Penang has benefited from forward thinking civic and private sector leaders, including representatives of multinational corporations. However, currently Penang as an "opposition" state has limited authority to implement initiatives to address human resource needs through higher education institutions. Furthermore, the Government of Malaysia is shifting federal funding from Penang to the Northern Corridor Economic Region and other federally-controlled entities.

Finally, there is limited history of regional collaboration among universities and other tertiary education institutions. Regional collaboration among the institutions in the region takes place on a voluntary, *ad hoc* basis. The Penang Educational Consultative Council (PECC) under the state government provides the mechanism for a coherent vision of an education system at the regional level, but this council is only for the private higher education institutions in the state (NHERI, 2010). The Penang Skills Development Centre (PSDC) and institutions such as the Wawasan Open University serve as important "brokers" of regional collaboration among institutions as well as between the higher education institutions and the needs of students and employers.

The OECD review team recommends that following measures are taken in promoting human capital development:

The following measures would promote human capital development in Penang

Recommendations for the federal/national policy

- *Develop a component of national strategy (New Economic Model) explicitly linking higher education institutions to regional human resource development.*
- *In higher education policy, add a regional dimension to criteria for academic programme/curricula approval and provide incentives for regional collaboration and student pathways.*
- *Add a regional human resource development element to criteria for APEX university performance e.g. increasing the percentage of the region's population completing undergraduate and post-graduate degrees in fields linked to regional priorities.*

Recommendations for the sub-national level: Northern Corridor Economic Region

- *Establish goals and benchmarks linked to year-by-year progress toward the 2020 goal of increasing the educational attainment of the region's population to globally competitive levels e.g. percentages of the population ages 25 to 64 with tertiary education (A and B) compared to OECD countries.*
- *Establish a public/private investment fund to provide competitive grants for higher education institutions* contingent upon: i) collaboration with industry and ii) collaboration between and among institutions, including public and private universities, polytechnics, community colleges, Universiti Teknologi MARA Training Centres, Penang Skills Development Centre etc.
- *Give increased priority to building a long-term regional teaching/learning capacity linked to the future regional economy and quality of life by developing higher education institutions with a mission and flexibility to serve the region.*

Recommendations for the sub-national level: for the state of Penang

- *Continue forward-thinking strategies aimed at developing the region's human resources.*

- *Focus on creating the conditions (environment, cultural resources, housing, public safety and health) that will make Penang an attractive place for students from the region, the rest of Malaysia and other countries.*

- *Take advantage of initiatives of the Northern Corridor Economic Region for the benefit of Penang; recognise that Penang's human resource needs are inter-related with the wider region (Northern Corridor Economic Region) and support initiatives to narrow disparities between Penang and the Northern Corridor Economic Region.*

- *Establish a state-level human resource development fund (public/private) to promote collaboration among institutions/providers.*

Recommendations for the universities

- *Develop a data/information capacity to monitor and report on how each university serves the region's population,* including but not limited to data on: i) major disparities in regional participation in tertiary education, ii) percentage of students from each region enrolled in and completing degree programmes at undergraduate and post-graduate levels and iii) undergraduate and post-graduate degrees and scholarship granted related to regional priority fields.

- *Use research and engagement with industry as a means to leverage institutional change in the university. Modify curriculum to strengthen and deepen student learning through greater integration of research and engagement with industry and community within the curriculum. Increase regional dimension in student experience through problem-based learning, internships, etc. Use short-term training and projects in centres/research as tool for professional development leading to changes in curriculum/teaching and learning.*

- *Strengthen the alignment of study programmes with the needs of the region and increase the supply of technical workers. Firms in the region suffer from the shortage of qualified personnel and inadequate skills offered to the labour market.* University students' skills need to be upgraded in transferable and soft skills, such as communication, team working and analytical thinking. There is also a need to increase industry involvement in curricula development and a general need for the private sector to invest in longer periods of training for new recruits.

- *[For USM] Use the flexibility of the Malaysia APEX Designation to leverage change in core teaching and learning capacity. Revisit the university mission by adding an addendum*: Not just "bottom billions" in the world but also "bottom thousands" in the region. Not just sustainable university, but sustainable region in terms of the globally competitive educational attainment of the region's population.

- *[For USM]Take the lead in shaping tertiary education strategy for Penang and the Northern Corridor to develop the region's human resources by engaging all public and private higher education institutions and other education providers and develop a limited number of priority initiatives stressing collaboration*. The initiatives could focus on enhancing student pathways among institutions, increasing the percentage of students from low-income and minority populations gaining a tertiary education certification/degree or increasing opportunities for adult/mature students to pursue and complete tertiary education.

Notes

1 For example, in the United States., the correlation between the percent of the population with at least a bachelor's degree has increased from .60 in 1980 to .83 in 2005 (NCHEMS of data from U.S. Census and Bureau of Economic Analysis)

2 Differences in officially reported data and other sources on job loss and gain in the late 1990s reflected the fact that only changes in permanent employees were counted, while temporary, contract and casual workers were not. In addition, undocumented foreign workers were not countered (Wangle, 2001)

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Chapter 3.
Regional innovation in Penang

The promotion of regional innovation and the development of a Regional Innovation System are important drivers of long-term economic growth and competitiveness. All regions can improve their capacity to adapt and transfer knowledge to regional needs.

This chapter examines the effectiveness of current innovation policies and practices in the State of Penang and the role of research and knowledge transfer conducted by the higher education institutions. It considers the efforts made by the State Government of Penang and the Universiti Sains Malaysia and, to a lesser extent, the technological institutes. It examines the current knowledge transfer and exchange mechanisms and highlights good practice from other regions. Finally, the chapter concludes with specific recommendations to improve the regional innovation outcomes in Penang.

Universities and other educational institutions have an important role to play to strengthen the Penang regional innovation system. To play this role in a more meaningful way, they need to make a quantitative and qualitative leap in research by extending their current fields of investigation, embarking on new areas such as cultural services and tourism and by broadening their engagement in the sustainable development field. Increasing efforts need to be devoted to co-operation with the private sector that has remained at a low level so far. Collaboration between higher education institutions needs also to be enhanced.

Introduction

Over the last two decades, Malaysia has made great strides in economic development, through the development of manufacturing capabilities and attraction of foreign direct investment (FDI). The context is now less favourable than in the previous decades. New emerging economies are making it more difficult for Malaysia to further develop its economy and to escape the "middle income trap".

For "latecomer nations", the effort to sustain economic growth in the long-term necessitates catching-up in terms of industrial and technological capability. This catch-up process requires sustained investment in two phases of learning: first, acquiring the ability to do what others have done, and second, generating innovations and new capabilities (technologies, products, services). Furthermore, latecomer nations also need to develop specialisations in economic activities to differentiate from other competing nations/regions. Such specialisations typically need to be at a sufficient scale to achieve critical mass and agglomeration economies through industrial clustering.

Despite substantial growth so far, Malaysia continues to operate as a dual economy, with an export-oriented economy on the one hand, dominated by multinational corporations with few linkages to local firms, and on the other, a domestic economy, where skills-intensity, R&D intensity and innovation activities have yet to become internationally competitive.

The presence of a dual economy can be partly attributed to a government policy targeting multinational corporations with limited attention to the pro-activity of these investments *i.e.* their capability to spill-over and plug local business into international networks. In Malaysia, the bulk of foreign direct investment has in essence been more of the passive type and with little effect on the regional innovation potential of the economy.

In order to enlarge its research potential and the quality of R&D, the Malaysian government now recognises the necessity to refocus its interventions. Higher education sector is a crucial area, not only because higher education institutions can increase the supply of skilled people, but also because they can drive national and regional growth. The corporatisation of public universities has been a first step to engage universities on the regional development path, but more is needed to ensure that the current focus on the world class status will not undermine regional and local engagement of universities.

On the innovation front, the government has concentrated its intervention on the elaboration of R&D tax incentives and the encouragement of strategic investment. While schemes have been numerous, the volume of grants channelled to university research has remained modest. There has also been a limited focus on assessment of projects. Assistance goes to local firms, but not to individuals and start-ups. Policy for clusters is also at an early stage of development.

In Penang, one of the most industrial states of Malaysia, overreliance on multinational corporations and underinvestment in innovation are now undermining the region's growth trajectory there is a growing concern about the long-term regional competitiveness. Conditions for new products and new processes to thrive are not fully established. Despite efforts to make Penang a Wifi state, ICT capabilities are insufficient and not fully mobilised to increase productivity especially of small firms. Technology diffusion remains low and few indigenous firms are committed to innovation.

In the context of over-dependency of multinational corporations and a lack of indigenous innovation, this chapter examines the following three dimensions to assess the effectiveness and coherence of innovation and R&D policies and practices in Penang and the role that the higher education institutions play in regional innovation system:

- Is the innovation system well connected and responsive to the industrial structure of Penang?
- Do the higher education institutions support the regional innovation system in an optimal way? Are there gaps in delivery where performance could be improved?
- What lessons can be learnt from international experience?

3.1. Innovation framework conditions, higher education institutions and government policy: Current trends

Malaysia underperforms in innovation and R&D compared to other countries in the South East Asia. For example, while the three Asian newly industrialised economies (NIEs) – Singapore, Korea and Taiwan – have reached GERD/GDP intensity ratios that are on par with G5 countries (USA, Japan, Germany, France and UK), the R&D spending intensity in Malaysia is significantly lower at 0.63% of the GDP in 2006, considerably below the OECD average. Business expenditure in R&D is also relatively modest (0.45%) and below most European countries.

A similar trend applies to publication intensity, measured by the number of publications per million people (See Table 3.1.). Singapore has made the greatest improvements in this area, with publication intensity in the most recent period higher than both the United States and Japan. Malaysia has, nevertheless, consistently achieved the highest publication intensity among the ASEAN4 countries – Thailand, Malaysia, Indonesia and the Philippines – and is more publication-intensive than both China and In dia. Over the last three decades, ASEAN4 countries have regularly increased their publication intensity. However, its level is very low compared to the newly industrialised economies in Asia (0.51% of world total publications for ASEAN4 as a whole and 0.14% market share for Malaysia) (Wong and Ho, 2009).

Table 3.1. Publication intensity per million population

	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005
NIES3	25.27	65.37	166.54	343.69	569.52
Singapore	117.80	242.18	443.48	778.54	1315.45
South Korea	11.14	31.35	89.92	247.70	456.60
Taiwan	42.06	111.49	284.79	471.32	669.17
ASEAN4	3.88	4.06	5.21	7.52	11.61
Malaysia	18.17	19.97	28.24	39.02	56.60
Thailand	9.55	9.85	12.57	19.64	36.84
Indonesia	0.74	0.88	1.30	2.00	2.47
Philipines	4.30	4.04	4.09	4.93	5.42
China	0.60	1.19	1.71	2.84	5.33
India	2.77	2.49	2.32	2.13	2.50
Japan	6.22	7.11	8.06	8.83	8.70
USA	39.52	38.49	37.18	34.1	32.87

Source: Wong and Ho, 2007

The growth in scientific publications among the ASEAN4 economies is impressive, particularly in the case of Malaysia and Thailand. It is, nonetheless, overshadowed by the increase in publications in other Asian economies. This reflects a lower scientific output from R&D activities and weaker processes of knowledge transfer in Malaysia.

Moreover, compared to other Asian economies, Malaysia's scientific publications are less frequently cited. The population of researchers is also less numerous (see Table 3.2.). Coupled with a relatively low quantitative scientific output, this implies that there is a gap in Malaysia's scientific research community, potentially hampering the development of its industrial and technological capabilities.

Table 3.2. Normalised S&T performance score of Malaysia vs. Korea and Singapore

Selected S&T Indicators	Malaysia		Singapore		Korea	
	Actual	Normalised	Actual	Normalised	Actual	Normalised
Human Development Index, 2005	0.81	6.16	0.92	8.26	0.92	8.19
Researchers in R&D / mil. people, 2006	508.93	4.00	5.479.14	9.67	3.723.28	8.56
Total expenditure for R&D as % of GDP, 2006	0.63	5.26	2.36	8.87	2.99	9.59
Scientific and technical journal articles / mil. people, 2005	23.97	5.11	831.22	9.57	339.5	8.20
Patents granted by USPTO / mil. people, avg 2002-06	3.03	7.79	97.01	9.21	88.44	9.00
8th Grade achievement in mathematics, 2003	508	7.35	605	10.00	589	9.59
8th Grade achievement in science, 2003	510	5.51	578	10.00	558	9.59

Source: World Bank Knowledge Assessment Methodology (KAM) 2008.

As a whole, the Asia Pacific region contributes more to global publications (16% in the most recent period) than to global patenting (7.7%). Malaysia too faces challenges in translating scientific knowledge into technological capability. Furthermore, while it has made progress is in scientific output (publications), it also needs to improve its record of catching up in technology output (patenting).

Malaysia has the highest patenting intensity, at around three patents (USPTO) for a population of one million, which is at a considerably higher level than the average of 0.44 patents for the ASEAN4 region as a whole. It has as a greater share of world patents (See Table 3.3.) While this is a positive outcome, the number lags far below the OECD average and levels achieved by the Asian NIEs. In 2006, more than 300 USPTO patents were registered by Malaysia,w hile 131 patents were granted; and the bulk of

them were held by foreign company affiliates in Malaysia. Licensing and royalties accounted for 1% of the GDP against 7% in Singapore and 10% in Ireland. (Yusuf and Nabeshima, 2008)

Table 3.3. Share in world total patents

	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005
NIES3	0.21	0.73	2.11	4.49	6.26
Singapore	0.01	0.02	0.05	0.13	0.29
South Korea	0.04	0.15	0.79	2.03	2.53
Taiwan	0.16	0.57	1.27	2.33	3.43
ASEAN4	0.02	0.02	0.03	0.06	0.11
Malaysia	0.00	0.00	0.01	0.03	0.06
Thailand	0.00	0.00	0.01	0.02	0.02
Indonesia	0.00	0.00	0.01	0.01	0.01
Philippines	0.01	0.01	0.01	0.01	0.02
China	0.05	0.11	0.15	0.21	0.47
India	0.02	0.03	0.04	0.09	0.24
Japan	15.45	20.59	22.26	20.77	21.18
USA	57.76	53.03	54.81	55.67	53.27

Source*: Wong and Ho, 2007*

Universities' contribution to innovation

In Asia, universities can be, and often are important drivers of innovation processes. Since many of the local firms that developed in the earlier industrialisation phases tend to be "laggards", rather than leaders in engaging in R&D and innovation activities, local industries in latecomer countries often have less experience and lower capabilities to develop their own innovations and to commercialise knowledge generated from local universities (Wong, Ho and Singh, 2007). Moreover, while the universities in these countries need to take on a more entrepreneurial role, they also face specific constraints. These may include overregulation of higher education which may stifle mission diversification or development of an entrepreneurial culture in the universities, and an emphasis on absorbing and diffusing technological knowledge from advanced countries rather than on indigenous innovation, resulting in a lower research and innovation output from the university (Wong, Ho and Singh, 2007).

International university rankings reveal a significant gap between Malaysia's top universities and other leading Asian universities. The Times Higher Education-QS *World University Rankings* (WUR) for 2006 gave the Universiti Sains Malaysia (USM) an overall ranking of 277th, while the Universiti Kebangsaan Malaysia (UKM) and the Universiti Malaya (UM)

were ranked 185th and 192nd respectively. However, other emerging economies around Asia, especially Hong Kong, Korea, Taiwan, China, Japan and Singapore, have some universities ranked within the top 100.

There is a significant gap between the research output of top Malaysian universities and the universities of the leading Asian countries. For example the number of SCI and SSCI-indexed papers produced over 1999 to February 2009 by the Universiti Sains Malaysia was 3 250 – equivalent to the University Malaya's 3 440 and double of Universiti Kebangsaan Malaysia's (UKM) 1 530. However, the publication output of the Universiti Sains Malaysia was only about one-third of the output of the next closest university, the Hong Kong University of Science and Technology (HKUST), which published 10 400 papers over the period. The difference is all the greater when taking into account the size difference between the universities: HKUST has a faculty size of approximately 400, while USM has approximately 1 200. (Wong and Ho, 2009)

In terms of research quality, the Malaysian universities also fall somewhat behind the leading institutions in the region, whether measured by citations per paper or citations per faculty. All three Malaysian universities received approximately 4 citations per paper, whereas most of the comparison universities received more than 7 citations per paper. For the latter, the Times Higher Education-QS *World University Rankings* (WUR) gave the Universiti Sains Malaysia a ranking of 393rd for its citations/faculty in 2005, while the Universiti Malaya (UM) was ranked 376th. This was lower than most of the comparison universities.

Box 3.1. Lower patenting activities of Malaysian universities and government research institutes

Asian universities play a particularly important role in commercialising their research output because the private sector often lacks the capabilities to absorb technology coming from the universities and develop them to the point where they can be utilised. One indicator of the commercialisation potential of universities is their patenting output, as it is a measure of the pool of innovations with the potential to be commercialised through licensing or spin-off formation.

Box 3.1. Lower patenting activities of Malaysian universities and government research institutes (continued)

Generally, the patenting output of Malaysian universities remains low, with the Universiti Sains Malaysia (USM) having only three patents issued by the US Patent and Trademark Office (USPTO) as of 2005, while the University Malaya (UM) had one and the Universiti Kebangsaan Malaysia (UKM) none. This is a substantially lower output than that of the leading Asian universities, most of which had more than 20 patents, with the largest patenting universities (Korea Advanced Institute of Science and Technology and National University of Singapore) having 200 or more patents.

The low level of patenting by Malaysian universities may be partly an outcome of a government policy which clearly delineated the research roles played by universities and government research institutes (GRIs) (Cheng, 2009). The Fifth Malaysia Plan, implemented from 1986 to 1990, stipulated that universities would give greater emphasis to basic research (40%) relative to GRIs (10%) (Cheng 2009). Likewise, the rapid rise in patenting among the leading Asian universities such as National University of Singapore and Tsinghua over the last ten years coincided with a growing emphasis on basic research. Rather than the basic vs. applied distinction, it seems that the quality of the research and its strategic focus on economic significance (the so-called strategic basic research or "Pasteur quadrant"), are the main parameters that matter.

The fact that the government research institutes (GRIs) in Malaysia have generally focused on applied and developmental R&D, but have produced relatively low patenting outputs, suggests that there is scope to improve the quality of research. Even among the top Malaysian GRIs, the number of US patents granted has been rather low (three for the Malaysian Palm Oil Board up to 2005, one each for the Rubber Research Institute of Malaysia and the Institute for Medical Research). By comparison, the top patenting GRIs in Singapore, Korea and Taiwan have produced at least ten times this number, with Singapore's Data Storage Institute producing 30 patents and the Institute of Microelectronics producing 80 patents. The gap is even wider with the other two newly industrialised economies – Korea and Taiwan – with their leading GRIs exhibiting at least 200 patents.

Source*: Wong P.K. and Y. P. HO (2009),* Asia Shift towards Innovation and its Implications for Penang*. Centre for Entrepreneurship, University of Singapore, Singapore*

Overall, Malaysia has scope for improving both the quantity and quality of public research and its subsequent commercialisation compared with not only Taiwan, Korea and Singapore, but also China. In terms of technology transfer and commercialisation, some progress has been made, as witnessed

by the establishment of the technology transfer offices in major public universities. However, the data shows that there is much to be done, not just in terms of building university culture and infrastructure, but also in the wider innovation system (Cheng, 2009).

The Government of Malaysia policy effort

The Ninth Malaysia Plan sets the ambitious target that science and technology activities contribute at least one-third of Malaysia's annual economic growth**.** To achieve this goal, the Ninth Malaysia Plan calls for increasing the application of new and improved technology, increasing local innovation capability, providing an improved enabling environment for technology development, accelerating technology commercialisation, and boosting private sector spending on R&D. So far Malaysia has succeeded essentially by focusing on a FDI-led strategy that was not especially concerned by a rapid shift towards higher value-added activities. As a consequence, Malaysia's electronics industry continues to be characterised by relatively low skills and modest R&D intensity.

High-tech activities have been promoted by means of tax incentives based on the following criteria: *i)* R&D expenditure of Malaysian operations exceeding 1% of gross sales and *ii)* the share of science and technical graduates exceeding 7% of the workforce. In addition, investment classified as strategic also qualified for total tax exemption under the private sector and ITA (Investment Tax Allowance). There were five criteria determining whether investments could qualify as strategic. The investment should: *i)* exceed MYR 100 million, *ii)* involve integrated manufacturing activities, *(iii)* stimulate backward and forward linkages, *iv)* involve high-tech products and *v)* involve improvement of R&D facilities.

In addition to these schemes, there has been a tax incentive for R&D spending in the form of a double deduction on R&D expenditures. However, for a firm spending more than 1% of its gross sales on R&D, the double deduction scheme gave no incentive for increasing R&D spending, since the firm already enjoyed tax exemption as a result of its high-tech status. Similarly, for a firm that undertook investments in a manner qualifying as strategic, the double deduction scheme was redundant, and thus an ineffective incentive for increasing R&D spending in firms (WB, 2007).

Public funds for technology upgrading and commercialisation

During the Eight Malaysian Plan, MYR 1.4 billion have been spent by the Government of Malaysia to stimulate private sector R&D. A number of new public funding schemes, designed to promote technology acquisition,

adaptation and commercialisation were introduced: the Technology Acquisition Fund (TAF) to help Malaysian firms seek strategic technology from foreign sources; the Industry R&D Grant Scheme (IGS) to encourage firms to adapt and create new technologies; the Commercialisation of R&D Fund (CRDF) to promote the commercialisation of R&D results and the Intensification of Research in Priority Areas (IRPA) to fund R&D in Malaysian R&D institutions.

These schemes suffer from a number of deficiencies, such as: *i)* limited involvement of the private sector, *ii)* insufficient project evaluation, *iii)* lack of multinational corporation (MNC) participation, *iv)* lack of *ex post* appraisal of projects and *v)* the fact that grants only apply to successful local firms, not to foreign multinational corporations or individual innovators/start-up companies (WB, 2007).

Policies to promote training and skills upgrading

The Government of Malaysia has gradually increased its focus on stimulating training and skills upgrading, for example by making training expenses liable to a double deduction tax incentive. Efforts to diversify production activities and increase training and R&D activities and seek greater market penetration into higher value added activities were strengthened with the Human Resource Development Act and the creation of the HRD Fund (HRDF). The HRDF was operational in 1993 and manufacturing firms with an employment size of 50 or more were required to pay 1% of their payroll to the HRD council, which they could then reclaim for approved training expenses. Penang was the exception to this pattern. Inter-firm networks in Penang were good, and in 1989 contributed to the creation of the Penang Skills Development Centre (PSDC) (see Box 3.9.).

Policies to promote linkages and cluster synergies

With the Second Industrial Master Plan (IMP2), launched in 1996, the Government of Malaysia fostered and supported industrial clusters. However, two major constraints prevented the achievement of cluster synergies: There was a lack of human capital to drive technological deepening and a lack of network cohesion.

The Multimedia Super Corridor (MSC) and the Multimedia Development Corporation (MDC) were subsequently launched with sophisticated infrastructure. However, as with the efforts of the Second Industrial Master Plan to deepen high tech activities, the Multimedia Super Corridor has suffered from serious human resource and network constraints.

In addition, the provision of incentives to only ICT firms went against the very definition of clustering as the differentiation and division of labour required obvious extension into a multiplicity of complementary industries (WB, 2007).

Dynamic clustering constitutes the anchor for driving learning, innovation and performance of embedding firms in particular locations. The Penang cluster has enjoyed far stronger network cohesion than other regions in Malaysia. Strong relationships between the intermediary organisations of Penang Development Corporation (PDC), state government and firms – both multinational corporations and local firms – helped to forge strong systemic co-ordination in the Penang clusters. The state economic development corporations (SEDC) of other regions in Malaysia (Selangor, Melaka, Johor etc.) have limited their support activities to the provision of land. These contrasting roles – the pro-active but intermediary role of the Penang Development Corporation and the hands-off role of the other state economic development corporations, once firms obtain their operating licenses – has produced contrasting systemic synergies in these regions. In spite of dynamic clustering features in Penang, firms, nonetheless, did not engage in new product development. Lack of human capital and ineffective support instruments has been the main obstacles for embarking in new product development. Hence, the Penang clusters have not achieved R&D intensities comparable to Korea and Taiwan.

3.2. The case of Penang [1]

Some 6% of Malaysian live in Penang but the state's GRP contributes some 8% of the nation's GDP pointing to a better than average GDP per capita performance. In the last decades, Penang's output share to the nation's agriculture fell from less than 4% in 1975 to less than 2% by 2006. Since the 1970s, the region has been seen as an industrial centre for the country with dynamic economy and free trade zones (FTZ) that encouraged foreign investment in export-oriented activities. The first FTZ was established in Bayan Lepas in 1971. Since then inflow of FDI in the region (2 to 4% of GRP in the 2000s) has consolidated Penang's contribution to the country's manufacturing sector (about 16% of the national output). Despite sizeable investments in chemical products in 2009, Penang remains mainly an electronic and electrical manufacturing hub.

Penang has significantly under-invested in innovation, despite its relatively high level of manufacturing sophistication. In comparison to Korea, Taiwan and Singapore, innovation activity and output levels are low, suggesting weaknesses in the local innovation system. Unless greater public investment is channelled to innovative capability development, Penang risks

falling further behind the Asian newly industrialised economies and China and India.

The success stories from the Asian newly industrialised economies reveal diverse strategies for technological development and economic catching-up. Both Taiwan and Korea have tapped their large overseas "diasporas" to speed up technological learning and catching-up. Apart from attracting highly skilled and entrepreneurial returnees, they also involved those who stay overseas to access technology, capital, markets and network contacts. Increasingly, China and India are also drawing on this rich resource to establish business links and to facilitate knowledge and technology upgrading. Penang has scope for improvement on this front.

The experience of the newly industrialised economies also points to the importance of adopting an industrial cluster development strategy, which entails promoting investments into selected industrial clusters to achieve sufficient scale and agglomeration economies. The increasing globalisation of production in recent years is likely to lead to even greater importance of scale and geographic concentration.

Box 3.2. The Penang RIS: trends and prospects

The Penang State Government's objective has been to move the economy away from its reliance on labour-intensive industries towards knowledge-based activities. Knowledge-based industries are expected to create higher paying jobs for the people and provide the conditions for the country and the state to depart from the "middle income trap" where they stand.

The State Government of Penang continues not only to promote key industries such as electrical and electronics, food processing and packaging, furniture and jewellery but also industries with high tech and knowledge contents. InvestPenang Bhd, the main government investment promotion agency is at the centre of the drive to attract investors in the new direction. Areas targeted include green technologies-photovoltaic, display technologies and also medical devices and biotech. The service sector is notably seen as an engine of growth for the future. The sectors deemed as potential areas for development include healthcare and education, e.g. for international procurement centres, tourism, MICE and MM2H (Malaysia My 2nd Home) and logistics.[2]

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Box 3.2. The Penang RIS: trends and prospects (continued)

The concerted effort by the government to position the state as an international *halal* hub is an interesting strategic move. The global *halal* industry in the region is estimated to be worth USD 1 050 billion. Today, *halal* industries include more than just food production. They include a holistic *halal* supply chain including logistics, agro-based industries, financial services, life sciences, manufacturing and tourism. In 2009, the Penang state government established up a new agency Halal Penang to spearhead the co-ordination, facilitation and development of the *halal* industry.

Source: *Penang economic monthly,* October-December 2009 preview issue and May 2010 issue

The international financial crisis has produced a period of global economic deceleration that has affected industrialised countries, emerging economies and developing countries. In early 2009, Penang and Malaysia began to feel the impact of the economic crisis. Total investment registered in Penang started to dwindle and the region accounted for 22.8% of the investments approved for the same period in 2008. The Penang state maintains its fourth position in the ranking chart for Malaysia. Retrenchments began to decrease at the end of 2009 and some companies have started to increase their workforce to face the resumption and meet rising demands.

Penang and Malaysia are facing strong global competition for foreign direct investments (FDI). The three Asian newly industrialised economies, Ireland, and more recently China and India, have established strong competitive positions as high tech FDI hubs. At the same time, other high tech hubs for FDI are emerging among the transition economies (*e.g.* Estonia) and the Middle East (*e.g.* United Arab Emirates). To compete for FDI effectively, Penang needs to target specific industrial clusters that leverage on the existing competencies of the state and the natural resources in its regional hinterland. Examples of possible industrial clusters where Penang could forge comparative advantages might include the marine & agro-technology sector, opto-electronics and precision engineering, as these are sectors where Penang has already built some foundations over the years.

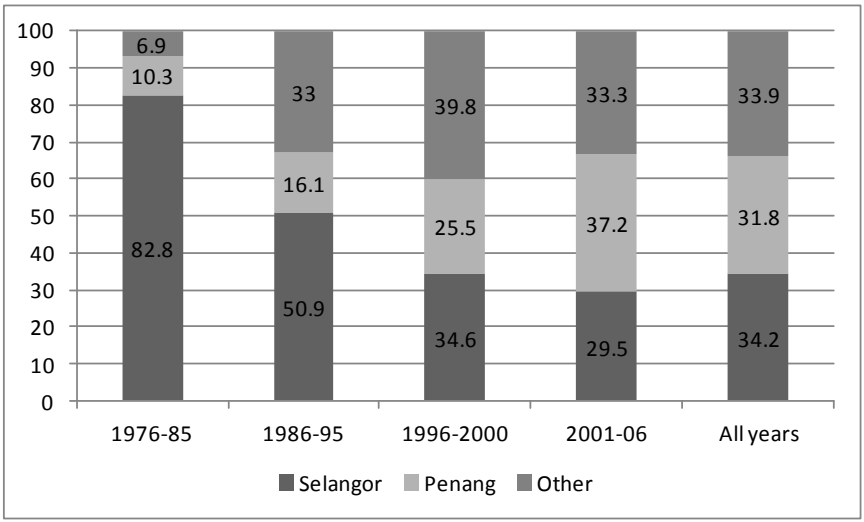
The creation of new high tech industries can only occur if there is a good supply of private sector entrepreneurs. Indeed, while public policies had played a facilitating role, the many successful companies that have emerged from Taiwan and Korea such as Acer, Hong Hai, HTC, Hyundai,

Samsung and LG owe their success primarily to the entrepreneurial drive and visionary leadership of individuals. In addition to improving the technical contents of its educational system, Penang should also look into injecting an entrepreneurial dimension to its university research and education system, for example by offering educational programmes involving experiential learning of entrepreneurship among the students of science and engineering, and other disciplines and by providing seed funding and mentoring of entrepreneurial start-ups by university professors and students. (Wong and Ho, 2007)

The key position that Penang holds in the Malaysia's national innovation system is evident in its share of Malaysian-invented patents granted by the USPTO (United States Patent and Trademark Office) (Figure 3.1). Overall, about one-third of Malaysian patents are invented by residents of Penang. Moreover, the region's role is improving, accounting for a consistently rising share of Malaysian patents, from 10.3% over 1976-85 to 37.2% over 2001-06. By this last period, Penang was responsible for a greater share of patents than Selangor (29.5%) or the rest of the country combined (33.3%).

However, much of the patenting activity is due to foreign-based multinational corporations (MNCs). Three quarters of patents invented in Penang are owned by foreign organisations. This is in fact an understatement of the extent of foreign ownership of Penang's patents, since some MNCs extend ownership of patents to the local subsidiary where the technology was invented rather than to the corporation's headquarters. Thus almost half of Penang-invented locally assigned patents are actually owned by German company Osram Opto Semiconductors and the Japanese Nikko Group. The proportion of locally invented patents that are owned by domestic entities is low compared to Singapore, where half of Singapore-invented patents are owned by Singaporean organisations.

Figure 3.1. Malaysian patents by region of inventor 1976-2006



Source: Wong and Ho (2007), Computed from National University of Singapore (NUS) Entrepreneurship Centre's US Patent Database.

While the recent growth in foreign patenting by multinational corporations in Penang is encouraging, Penang's very high proportion of foreign-owned patents also point to a dearth of innovation activities in local organisations, such as local firms or universities and government research institutes (GRIs). This will hinder Penang's shift towards a knowledge-based economy, which requires a significant increase in the indigenous capabilities of local enterprises to create and commercialise new knowledge, rather than just relying on knowledge transferred from foreign companies. The reluctancy of multinational corporations to share technologies at the higher level of the technological spectrum will strengthen this trend (Wong, Ho and Singh, 2007; Wong and Singh, 2000). Singapore started the shift towards a more balanced pattern of innovation more than a decade ago.

3.3. Higher education responding to regional needs

Higher education R&D output

The State of Penang is endowed with 23 public higher education institutions consisting of branch campuses and training institutes and 31 private educational institutions offering various post-secondary courses. In

2008, around 29 000 students were enrolled in the main public universities, in particular, the Universiti Sains Malaysia (USM), while about 4 700 were in the polytechnics including the Institute of Technology Universiti Teknologi MARA (UiTM) and 3 000 in the community colleges. Higher education students account for around 2% to 3% of the population, representing a substantial potential for innovation, especially for the organisation they will join after graduation.

The Universiti Sains Malaysia (USM) is the main university institution in Penang. It is host to 15 000 students in bachelor's programmes, 5 600 in distance learning, 5 245 in master's programmes and 2 213 in PhD programmes. About 2 000 students are coming from abroad (a majority from Indonesia, notably from Aceh and also from the University of Sumatra in Sutara. Students coming from the Middle East, from Iran, Saudi Arabia, Yemen and Libya are a more recent phenomenon.

The Universiti Sains Malaysia (USM) plays a dominant role in research activities in Penang. It has an incubation facility and is the leading research entity with 25 schools on three campuses. 15 of these schools are focused on applied and basic sciences including physics, industrial technology, chemistry, computer science, pharmacy and mathematics. There are 6 schools of engineering at the engineering campus and 3 schools on life sciences at the health campus. 12 research centres and centres of excellence deal with multidisciplinary fields such as multimedia (IPV6), renewable energy, microelectronics (CEDEC), marine and coastal studies (CEMACS), astronomy, drug research and advanced medical and dental research (AMDI). Health-related research plays an important role in the region. For details, see Chapter 5.

In terms of R&D capacity, performance of the Universiti Sains Malaysia (USM) is close to that of the University Malaya, the oldest university in Malaysia, the main campus of which is in Kuala Lumpur. The Universiti Sains Malaysia nonetheless over-performs (see Table x.4) the other Malaysian research University (Kebangsaan and Putra) – all based in Selangor – as well as the Universiti Teknologi Malaysia (UTM) (the main technology university). However, in terms of the quantity and quality of publications, the USM lags behind the University of Singapore, the University of Nanyang (also located in Singapore) and the University of Hong Kong.

Table 3.4. Selected Malaysian and international universities in the Scimago institutions ranking

	University	Output	CxD (Citation / document)	International collaboration	Journal average importance	Field normalised citation score
58	U of Singapore	19 431	5.98	41.15	0.99	1.43
122	Nanyang	12 879	3.95	37.36	0.93	1.29
132	U of Hong Kong	12 388	7.67	50.64	1.03	1.45
825	USM	2 588	2.65	41.77	0.94	0.79
846	U Malaya	2 512	2.76	44.03	0.95	0.78
1263	U Kebangsaan	1 319	1.74	28.20	0.87	0.54
1 315	UPM	231	2.60	25.59	0.96	0.63
1 781	UTM	622	2.01	26.85	0.76	0.94

Note*:* Universities are ranked according to their publication output (column 3). CxD is an indicator showing the average scientific impact of an institution's publication output in terms of citations per document. Column 5 shows the institution's output ratio that has been produced in collaboration with foreign institutions. Column 6 shows the journal average importance where an institution output is published. Column 7 reveals the ratio between the average scientific impact of an institution and the world average impact of publications of the same time frame and subject area.

Source: SCImago Research Group (2009), "SCImago Institutions Rankings: World Report", Granada, Spain, *www.scimagoir.com/pdf/sir_2009_world_report.pdf.*

University-industry relationship

Another way in which Asian universities can translate their research into technologies with commercialisation potential and help build the technological capabilities of private firms is through collaborative research projects with industry (Wong *et al*., 2009). In the area of university-industry collaboration, Malaysia lags behind newly industrialised economies (NIEs). The Global Competitiveness Report ranked Malaysia as 20th on this factor whereas Singapore ranked fifth and Taiwan and Korea ranked 10th and 12th respectively.

In Penang, the Universiti Sains Malaysia (USM) has signed 44 Memoranda of understanding (MoU) with industries and 23 Memoranda of Agreement (MoA) in 2008. It is also carrying out several social programmes. Co-operation with industries is rooted in the internship programmes that involve 3 098 students. The national government has taken measures to introduce industrial training in all study programmes and aims to make such programmes compulsory. To date the development has been uneven and internships have benefited only a small proportion of students. There is also some evidence that some industries and firms do not manage

the internships efficiently. Closer partnerships between universities and industry could ensure quality work-based learning opportunities for students.

There is a long-established co-operation between the Universiti Sains Malaysia (USM) and some multinational corporations such as Agilent or Intel. Contract research is, however, not well developed. University-industry interactions in research and development remain limited to consulting arrangements and "troubleshooting" contracts. In the last three years, only 12% of firms surveyed in Penang have collaborated with a research institute when upgrading or acquiring a new technology. Among companies, the propensity to work with universities is actually lower in Penang than the national average (16%) (see Table 3.5.).

Table 3.5. Collaboration partners when developing technologies locally

	YES	NO
With other firms	52	86
	37.7%	62.3%
With universities	22	116
	15.9%	84.1%
With research institutions	30	108
	21.7%	78.3%

Source: Shahid Y. and N. Kaoru (2009). World Bank.

University start-ups and spinoffs

The organisation of technology transfer within the Universiti Sains Malaysia (USM), is relatively complex, with several entities in charge of innovation and collaboration with the business sector. The Innovation Office is managing the intellectual part of the innovation platform with the aim to facilitate commercialisation. There is also a Research Creativity and Management Office (RCMO) which is involved in research processes and grants management. Its focus is on research information, grants, university facilities, equipment and human resources. Finally, the Division of Industry and Community Network (BJIM) aims to foster and strengthen existing linkages and partnerships with business and to establish new ones at the regional national and international level.

USAINS incorporated, established in 1998, is the commercial arm of the Universiti Sains Malaysia (USM) responsible for managing all of university's commercial activity. It markets and promotes the intellectual property of the University such as its innovative products, processes,

patents, designs, copyright material and consultancy services of the USM staff.

University Sains Malaysia is in the planning stage of the development of sains@usm – Science and Arts Innovation Space – an innovation park aimed at boosting commercialisation of university R&D results. This innovation park is conceived on the basis of models of new-generation research parks in developed countries. It is developed in an urban area as a component of neighbourhood regeneration plan and offers, or is starting to offer planned multi-tenant facilities as well as housing and on-site amenities for researchers, postdocs and graduate students (see Box 3.4). The Science and Arts Innovation Space is at early stages of development and the university has not yet actively developed international partnerships to develop the concept. Furthermore, the space has not yet been able to leverage on the presence of high calibre organisations such as federal laboratories.

Box 3.3. Sanggar SAINS an innovation complex in the campus

The Universiti Sains Malaysia (USM) has established Sanggar SAINS Sdn Bhd a private limited company incorporated in 2008 with a mandate to provide facilities and services for the creation, nurturing and early stage growth of university-based enterprises, enhance commercialisation of research products covering science, arts and technology related ventures including the innovator programme and attract global talents. Sanggar SAINS also aims at creating revenue generating activities for the USM.

A number of buildings are being erected close to the campus to house those activities. They include: a science and arts incubators (7 blocks), a business incubator and offices, a hotel and a convention centre, residences and an international schools. All these buildings offer a gross floor area of 1.78 million square feet. The cost is estimated at MYR 615 million.

The park strategy (referred to as the Innovator Programme) is organised around five components:

i) I-Roadshow, a joint effort with the USM Innovation office to educate researchers on the commercialisation mechanisms, intellectual property management and strategies. Visits are organised for USM schools;

ii) I-Bootcamp is about basic business tools to translate innovations into business ideas. Training is opened to selected incubate companies only;

Box 3.3. Sanggar SAINS an innovation complex in the campus (continued)

iii) I-Connect is aiming at connecting the innovations with industries, researchers with each other and starting assessing potential commercial partners. All researchers and aspiring entrepreneurs are welcome to take part to this forum. Sessions include presentation of selected products and innovative projects;

iv) I-Cradle POC/POV Forum designed to screen and channel startup candidates that have proof of concept (POC) or proof of value (POV) project to cradle fund for pre-seed funding; and

v) I-Pitch, a workshop to train researchers/aspiring entrepreneurs on presenting the effective pitch to potential investors or funding partners.

Source: *USM*

The development strategy for the science@usm is nonetheless well articulated and has produced promising early results (see Table 3.6). Altogether 26 projects/products have passed the proof of concept stage and 11 projects/products have been introduced to potential commercialisation partners involved in activities ranging from pharmaceutical, water and waste management, construction to management of cars. Four projects involving products such as bio-organic fertilisers and microelectronics design are to be commercialised by former USM students graduated from the Student Entrepreneur Development Initiative Agenda (SEDIA) programme. Furthermore, commercialisation of *halal* meningococcal vaccine and treatment of palm oil effluents using membrane technology are currently in progress.

Table 3.6. USM's spin-off companies

Types of USM's spin off companies	Established
Malaysian Bio-Diagnostics Research Sdn. Bhd.	1994
Mlabs Systems Bhd	1996
iNetmon Sdn. Bhd	1994
EQ-USAINS (USAINS Holding Sdn. Bhd	2000
IXC Malaysia Berhad	2009
Innogredients Sdn. Bhd	2009

Source*: Innovation Office Research & Innovation Division Universiti Sains Malaysia*

3.4. Challenges and concerns

Regional economic strategy

A main goal for Malaysia and the Penang region is to move the economy towards higher value-added and knowledge-based activities. The overall theme is to increase income from existing industries and to diversify activities. The main thrust is to improve the scale and professionalisation of agriculture and using better seeds and good agricultural practices and strengthen the service sector notably tourism as well as the logistics and trading sector through enhanced efforts to encourage the flow of raw and semi-finished goods into the Northern Corridor Economic Region. Manufacturing that is the backbone of Pulau Pinang economy and 43% of its GDP remains a main target for the regional economic policy.

Box 3.4. The Northern Corridor Economic Region (NCER) framework

The NCER has a focus on agriculture, tourism and logistics. Agriculture is expected to become the basis for establishing a sustainable materials industry whereby the region will pioneer research and production of bioplastics and fibre from agricultural waste. Biodiversity of the region will be harnessed through bio-prospecting activities to discover active pharmaceutical ingredients. Various initiatives include paddy farming, aquaculture, animal husbandry and livestock, vegetable farms, herbs, horticulture and specialty foods and commercial crops such as oil palm and rubber. Another objective is to enhance key tourism assets including Pulau Penang to attract higher yield tourists seeking world class resorts and long stay vacations. The region also wants to become a medical tourism hub. Logistics is a third priority on which to leverage to be a major processing center and entrepot port.

In manufacturing, the NCER strategy aims to increase local capability to perform R&D and to expand investment. The central government policy is designed not only to enhance the contribution of the electrical and electronics industries through a growing capacity to source components and to create offshoot industries but also to promote the establishment of entirely new activities such as biotech, downstream agriculture, food processing, bio-fuel, sustainable material and oil and gas offshore structures fabrication.

Source: Koridor UTARA

Within the Northern Corridor Economic Region, manufacturing is contributing to 34% of regional GDP, while a similar figure is registered for

Malaysia as a whole. The electrical and electronics industry (E&E), which accounts for 64% of manufacturing export and 42.6% of FDI, cluster around Penang and Kulin. However, the share of FDI directed to Malaysia within the South East Asia region has diminished from 31% to 11% over the 1985-2005 period. The reduction of FDI flows point to the need to improve the attractiveness of the country and Penang in order to regain competitiveness. The value added of these industries remains low. "Moving up the ladder" is crucial if they are to sustain the competition from emerging countries in the area.

Higher education institutions in general and the Universiti Sains Malaysia (USM) should be mobilised to consolidate the regional strategy and elevate the research level for these activities. USAINS Malaysia is a leader in biotechnology research in Malaysia and has established several industry-academia collaborations. There are also plans to establish a microelectronic centre of excellence (CEDEC) within USM focusing on R&D and undergraduate teaching. CEDEC is, however, at early stages of development and it remains to be seen how it will be able to remedy to the scarcity of local designers in microelectronics.

RDI effort

Underinvestment in innovation in Malaysia has already been highlighted. The majority of innovative firms (90% to 95% of them) in the country spend less than MYR 100 000 on innovation[3]. This ensures that only a small share of Malaysian firms undertakes innovation targeted at global markets and that it is unlikely that innovation in manufacturing will lead to the introduction to new, globally competitive products[4]. For example, in Pulau Penang local companies in the E&E sector are unable to compete with foreign players in high precision manufacturing due to the lack of investment in technology and R&D.

The centralised innovation policy needs to be overhauled. During the Eight Malaysian Plan, MYR 1.4 billion was devoted to stimulating private research and development. Numerous grant schemes have been directed to basic research and commercialisation of R&D but in a relatively piecemeal way. Competition between the 13 Malaysian states to attract research institutions and higher education campuses is intense. The scarcity of land in Penang and the high cost of it act as a barrier to investment. According to the NCER 2007 Blueprint a number of industrial estates and technology parks remain underutilised or unutilised. Overreliance on the techpush model is making knowledge transfer more difficult. A Penang Science Council, driven by industry, has been created to ensure that Penang can implement its strategy.

Most of Malaysia's S&T personnel (around 12 400 researchers) are employed in the higher education sector. Improving the national R&D system will require the support and participation of research-intensive public and private universities.

However, a number of constraints remain impeding collaboration and reducing the efficiency of "triple helix" initiatives between government, industry and higher education to boost the innovation process. These include in particular the following:

- Universities are ranked as a low source of technology and have limited research capacity. Many firms are specialised in E&E which are research-intensive fields, but not an option for university-industry collaboration. Firms do not regard university and research institutes as main collaborators. Furthermore, universities are not organised to efficiently deliver services to firms (see Box 3.7. for good practice in such services.)

Box 3.5. Network of Support Centres for Technological Innovation (Xarxa d'Innovación Tecnològica, Xarxa IT) in the region of Catalonia

The XIT was created in 1999 with nine centres by the Regional Agency for Innovation and Business Development (CIDEM), the Interdepartmental Commission for Research and Technological Innovation (CIRIT) and nine universities. With the creation of the XIT, the Catalan Government got involved as active player in a new structure of interface among universities and firms. The XIT is formed by units and groups of researchers with the capacity to offer innovation services to Catalan companies.

The main objective of the XIT is to have a more effective way to transfer technology from the universities to the firms, introducing a new model of organisation based on a system of external accreditation to provide some quality guarantees to both enterprises and research groups. The units that form part of the XIT have to maintain a research of high quality but they receive incentives to engage in knowledge transfer. To facilitate this relationship these units receive public support to hire a manager responsible for enhancing and co-ordinating the co-operation with firms. The number of accredited centres grew rapidly to 24 in 2000 and to more than 70 currently, most of them belonging to universities. Currently, as the other technological centres, they are under the new brand TECNIO promoted by ACC1Ó with the objective to consolidate the model of technological transfer of Catalonia.

Box 3.5. Network of Support Centres for Technological Innovation (Xarxa d'Innovación Tecnològica, Xarxa IT) in the region of Catalonia (continued)

This initiative aims to encourage a trend which began some years ago when Catalan universities started progressively to target their R&D activities towards meeting the current and future needs of the productive sector. The initiative is funded mainly by ACC1Ó (Department of Universities, Innovation and Enterprise of the Regional Government of Catalonia) and the universities.

The main rationale behind this initiative comprises the promotion and stimulation of research groups and units to provide innovative technological services to Catalan firms, and aims to strengthen the R&D subcontracting market in Catalonia and increase companies' capacity for innovation. The objective is to improve, based on supply, the access of companies to the stock of know-how which exists at universities, technological centres and engineering firms.

Furthermore, the presence in Catalonia of a network of technology centres which speak the same language as companies and that are run according to business parameters provides a source of competition for small and medium-sized firms. The challenge is to constitute a virtual community composed of companies which are active in R&D and is backed by nearly a hundred technological centres and other complementary agents (private engineering companies, legal advisors etc.)

The Xarxa IT has had numerous results translated into the number of patents and spin-offs generated, the amount of European funds awarded and the number of R&D projects with companies. Presently the Xarxa IT is under the TECNIO brand.

Source: CRSC (Catalonia's Regional Steering Committee) (2010), "The Autonomous Region of Catalonia, Spain: Self-evaluation Report", OECD Reviews of Higher Education in Regional and City Development, IMHE, *www.oecd.org/dataoecd/49/19/44899776.pdf*

- Government research institutes (GRI), private sector and HE research have different sector focus: respectively agrofood and metallurgy; auto cluster and electronics; biochemistry and engineering. Despite a number of overlapping niches, the different sector focus limits the potential for co-operation.

- While venture capital is relatively abundant in Malaysia (3% of total investment), the number of deals have peaked in 2000 at 20 and diminished since then. For seed and start-up stage, the peak was only 5

deals in 2000 and 2001. In general, there are few attractive projects to fund.

- Interactions between small and medium-sized enterprises (SMEs) and higher education institutions are limited in Malaysia and in Penang. Examples include the SME association (SAMENTA), SMI Development Corp. (SMIDEC), Small and Medium Industries Association of Penang that represents the interest of SMEs and disseminate information and provide training. The latter have some collaboration with the Universiti Sains Malaysia (SME award and training) but co-operation in R&D remains limited.

The weak industry-university co-operation is not uncommon in the OECD area, but governments have established mechanisms and incentives to overcome the challenges, by creating "demand-pull" in industry for example by launching voucher programmes. These types of mechanisms do not seem to exist in Malaysia. An example of such mechanisms is given in Box 3.6. below.

Box 3.6. Knowledge Voucher Programme in the Netherlands

The aim of the Knowledge Voucher Programme is to encourage knowledge transfer from knowledge institutes, such as universities and universities of applied sciences, to small and medium-sized enterprises (SMEs) and to help SMEs to access and use the knowledge produced by knowledge institutes for the development of new products, processes and services. SMEs can use innovation vouchers to commission knowledge institutes to address appropriate research issues.

Vouchers are available in two sizes: small and large. A small voucher is worth EUR 2 500 and a large voucher is worth up to EUR 7 500. To use a large voucher, an SME must make a contribution of at least one third of the total project cost; the government will then contribute up to EUR 5 000. Vouchers are available for two types of projects: knowledge transfer projects and patent applications. Large knowledge transfer vouchers may be bundled: up to ten enterprises may collectively use vouchers which have been awarded to them individually to cover the cost of a major knowledge transfer project.

Vouchers may be used for projects involving knowledge transfer from public knowledge institutes and various private knowledge institutes. A knowledge transfer project involves the transfer of knowledge that is new to the receiving SME. The knowledge is used by the enterprise to modernise a product, production process or service. All projects must benefit the Dutch economy. No individual enterprise is entitled to receive more than one small voucher for a knowledge transfer project at any time and more than one large voucher per year. The bundling of patent application vouchers is not permitted.

Source: Agenschaft NL, Dutch Ministry of Economy.

Lack of specialised skills

To position the Northern Corridor and Penang as a destination for R&D and new technology activities, a strong pipeline of industry relevant human capital is required. In the electrical and electronics sector (E&E), in addition to electronics skills, also mechanical engineering (automation, precision robotics, micro-systems), chemical engineering, materials science (R&D packaging) and supply chain management are in demand.[5]

The use of low skilled labour has increased between 2002 and 2007 in Malaysia. The electrical and electronics sector, which is a major contributor to Malaysia's growth has experienced some of the biggest declines in the use of skilled labour. Easy access to low-skilled migrant workers has also led to an over-reliance on low cost unskilled foreign labour that has sustained the profitability of low value added business.

The proportion of labour force with tertiary education is significantly smaller in Malaysia than in Singapore, Korea and Taiwan despite a modest upward trend in the recent years.

Furthermore, this mismatch between the demand and supply of skills is partly caused by the brain drain: some 350 000 Malaysians are working abroad. Over half have tertiary education. In Penang, the Universiti Sains Malaysia (USM) aims to shift the focus to master's and PhD programmes and improve graduate retention (in particular to comply with the APEX label).

The exodus of talented Malaysian is compounded by the fact that the education system is not delivering the skills needed. There is an increasing trend of a higher share of arts graduates in comparison to the technical and science streams. At the same time technical and vocational schools are producing a declining number of graduates. There is a growing recognition of the need to strengthen these training programmes in Penang.

There have been long-term efforts to bridge the skill gap. For example the Penang Skills Development centre (PSDC) was established as early as 1989. This centre is a pioneering tripartite industry-led skills training and education centre. It has now attained both national and international recognition as a model of shared learning among the manufacturing and service industry and one stop human resource development entity. PSDC is currently providing proactive human resource development initiative to companies.

The Penang Skills Development centre (PSDC) is, however, not fully integrated in the Penang Higher Education System. Co-operation with the

Universiti Sains Malaysia (USM) is limited and PSDC diploma is not recognised by the higher education system. PSDC partners are mainly foreign universities. The centre has an international consultancy programme and it has exported its expertise in places such as Chittagong and Manaus (see Box 3.9). As a result, its international network appears to be more established than the links with the higher education institutions in Penang.

Box. 3.7. The Penang Skills Development Centre (PSDC) Rationale

The Penang Skills Development centre (PSDC) supports the building of the knowledge infrastructure in the state of Penang: The centre is developing its strategy with five goals: i) to establish a new PSDC to serve NEM, ii) develop a fast track programme to accelerate learning on experience, iii) to establish technology training lab to conduct a fast track programme, iv) to provide shared service facilities and v) to provide incubation facilities.

PSDC remains dedicated to providing quality programmes to serve the needs of SMEs and operates with an SME cradle fund. PSDC is a training institution but it is also in charge of reskilling. It aims at promoting linkages between MNCs and local companies and to promote fast track for radio-frequency, computer-embedded and green technologies.

To improve its efficiency and diversify its offer the centre has recently set up five commissions that focus on the following tasks: i) sustainable education and learning (led by Motorola), ii) mentoring young scientific entrepreneurs, iii) establishing a science tech park, iv) encouraging innovation and research (led by INTEL) and v) life science and medicine.

PSDC is 80% financed by the private sector with 149 member firms representing 60% of the Penang workforce. 32% of these members are electronic companies, 22% engineering and 19% manufacturing. Initially there were 589 participants to the programme (1989/90). In 2008, the number of participants had increased to 12 108.

Conclusions and recommendations

Penang is host to Malaysia's important manufacturing assets. Its development has been based on the E&E and textile industries, mainly by attracting multinational corporations with tax incentives, custom rights exemptions and the establishment of free trade zones.

The electronics industry has had a strong capacity to absorb Penang's semi-skilled labour. This strategy has successfully created a kind of "silicon

island" with a good record of growth and income generation for the region's population. At the same time, the development has triggered a process of reduction of disparities. Today, this model has reached its limits. The competitiveness of firms in Penang is under increasing pressure because competitors from emerging countries are increasingly able to introduce cheaper skill-intensive products on the markets. Malaysian firms lack creativity and efficient practices and systems. They feature relatively weak productivity and have a low productivity growth record. Even the E&E manufacturing firms, supposedly the most innovative, continue to focus on less sophisticated activities.

The days of building the "sweatshop" of the West are over, but switching to "smartshops" remains a challenge. Currently, Penang offers a favourable environment for manufacturing, but not for R&D-based activities. The pool of skills in Penang is too small for radical innovations. At the same time, the wage level has risen undermining the low skilled/low cost model. There is a growing need to move away from manufacturing activity towards research and development and marketing and design. It is also crucial to foster the diversification of the economic base into the service sector and to encourage the development of an eco-system of small and medium-sized enterprises in niche activities.

In order to create the conditions for this paradigm shift, the OECD review team recommends that the following measures are taken to promote regional innovation:

Recommendations for the federal/national policy

- *Enhance the regional contribution of higher education institutions.* Given the expected budget cutbacks, it is important to build on existing strengths and align research programmes with regional priorities to ensure future sustainability.

- *Launch an independent review of the educational and research programmes of higher education institutions in order to assess the alignment of these programmes with the regional priorities.* The Universiti Sains Malaysia's educational and research programmes should be reviewed in order to assess the alignment of these programmes with the regional priorities of the National Corridor Implementation Authority (NCIA). A similar exercise could be envisaged for Universiti Teknologi MARA (UiTM).

- *Strengthen the Regional Innovation System by launching new initiatives at state and central level to help higher education institutions*

to forge stronger links with the business sector. New initiatives are required at state and national level to strengthen the Regional Innovation System. First, policy measures should be taken to improve HEI services to firms and to develop communication policies about research results. Second, an incentive system should be established to favour the development of contract research. Voucher systems (such as those operating in Netherlands or Italy) could be a way to link SMEs and HE R&D units. Third, public grants to research programmes should be extended to priority sectors other than the E&E and biotech industry.

- *In collaborative research, research awards and research collaboration move away for direct allocations and subsidies as the major modus operandi to competitive mechanisms in order to enhance outcomes and to increase overall productivity.*

- *In collaboration with the state governments, encourage and support collaborative research between the higher education institutions at the sub-national level and also with higher education institutions in neighbouring regions to better exploit the complementarities between the different institutions* and to reach a critical mass in a number of disciplines. In Penang, collaborative research programmes should draw together the Universiti Sains Malaysia, Universiti Teknologi MARA, Universiti Malaysia Perlis and other regional higher education institutions. Collaborative programmes taking advantage of complementarities between Universiti Malaysia Perlis, Universiti Teknologi MARA (engineering) and Universiti Teknologi Petronas could tap the interdisciplinary innovation potential of the region. This could be facilitated if higher education institutions were requested to elaborate joint regional strategies.

- *Strengthen the recently introduced requirement for compulsory field training in all study programmes and help higher education institutions establish quality frameworks for internships so that industries will manage them efficiently thus facilitating students' eventual entry to the labour market.* Internships programmes should be generalised to all students, including social sciences and arts in order to develop capacity for innovation services.

- *Increase the training potential and student enrolment within vocational tertiary education institutions, professional institutions and community colleges to enable the eligible age group to acquire (middle level) skills in non high technology sectors such as agronomy, engineering, equipment maintenance, handicrafts and culinary skills.*

- *Develop policies to provide ways in which higher education institutions can either cap enrolment in low priority areas and/or provide incentives in high national and regional priority areas.*

Recommendations for the universities

- *[For UMS]: Rationalise – reorganise and reduce – the number of overlapping innovation offices and strike a balance between basic and applied research by introducing a research portfolio that is aligned with the needs of Penang and more generally the Northern Corridor Economic Region.*

- *Define clearly the institutional regional mission and conceived strategies adjusted to regional needs.*

Notes

1 This subsection relies heavily on Wong and Ho, 2007.

2 MICE: Meetings, Incentives, Conventions and Exhibitions. MM2H: Malaysia My 2nd Home.

3 See MASTIC (Malaysian Science and Technology Information Centre) Innovation surveys 2005.

4 See the WB report: Malaysia and the Knowledge Economy: Building a World-Class Higher Education System, Draft, March 2007.

5 See Sime Darby Berhad, Northern Corridor Economic Region Blueprint 2007-2025, Kuala Lumpur 2007.

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Annex 3.1 Steinbeis Foundation in Baden-Wurtemberg (Germany) Focus on competitive transfer

The Steinbeis Foundation for Economic Promotion, was established in 1971 to bridge the gap between science and the economy, by supporting the interests of the economy, and particularly those of small and medium-sized enterprises The Steinbeis Foundation is ready to discuss new, complex market concepts, overall company structuring and efficient technology transfer.

The central office – the foundation's "umbrella" – is based in Stuttgart. The actual transfer work is conducted by nearly 700 Steinbeis Transfer Centres which are independent, flexible, decentralised and close to their customers. The centres work annually on more than 21 000 commissions, providing solutions to problems not only in various technology sectors, but also in all fields of the economy and the design world. Each centre specialises in a particular set of topics and works in direct contact with companies.

Most regional Steinbeis Transfer Centres are situated close to a university and use the existing research infrastructure as a source of technology for the economy. The Steinbeis Foundation implements technology projects both for the government and industry. 21 000 projects totalling EUR 110 million are carried out every year with the help of over 4 000 employees (full time or appointed for special projects), including 870 professors. A steadily increasing sector of the foundation is technology transfer on an international scale via a network of subsidiaries abroad, joint venture partners and project associates in 47 countries.

The activities of the Steinbeis Foundation are characterised by maximum usefulness and tailored solutions to the problems of the companies seeking assistance and reduced levels of bureaucracy. The foundation's extensive range of activities includes not only targeted advice on technologies and markets, and a wide range of information and further training measures, but the implementation and knowledge transfer and development projects.

The know-how of running such this system is also offered to other countries. "Transfer of Transfer (ToT)" is the product of years of work by the Steinbeis Foundation in the field of technology transfer. The result of this project is a technology transfer system adapted to the recipient country and which forges the necessary links between industry, research and government. The international network of the Steinbeis Foundation includes partners, local networks and transfer centres in more than 50 countries.

Source: Ministry of Economic Affairs of Baden-Wurttemberg.

Chapter 4.
The role of higher education in promoting graduate entrepreneurship

The strong dependence on foreign investments and multi-national corporations has brought growth and development in Penang but also resulted in an underdeveloped local industry, limited indigenous innovation capacity and a lack of dynamic new entrepreneurship. There is a growing recognition that Penang needs to move up the ladder into higher value-added segment and create indigenous entrepreneurship, for example via its higher education institutions. With a diverse set of higher education institutions, including universities, polytechnics and community colleges, Penang is well positioned to successfully promote graduate entrepreneurship.

This chapter highlights current policies and practices in the promotion of graduate entrepreneurship in Penang in terms of entrepreneurship education and start-up support provision. It gives a brief overview of the national framework for graduate entrepreneurship and the role of universities in its promotion. It presents the key opportunities for new firm formation in three higher education institutions in Penang as well as available start-up support. The chapter highlights international good practice and concludes with key overarching issues in promoting graduate entrepreneurship in Malaysia.

Introduction

Start-ups founded by teams of, or single students, researchers and professors have considerable entrepreneurial and innovation potential because their early development was in close proximity to research, and because the founders have been exposed to a range of ideas and tools in their studies and academic work. Appropriate training and hands-on support in business start-up and early development play a key role in turning knowledge advantages into viable business ventures (OECD, 2010a; 2010b). Worldwide, the number of universities providing entrepreneurship support for their students, graduates, researchers and professors is growing. Entrepreneurship support encompasses the provision of start-up support and entrepreneurship education which aims at generating motivation and attitudes for entrepreneurship and the skills and competencies needed to launch and grow a business. Different strategies have been advanced and various forms of support mechanisms established. Tailored practices have emerged in educating future entrepreneurs and in helping them to take their first steps in forming and growing a business. Universities have established dedicated start-up support services, often also as single units that centralise and steer a multitude of activities, to offer would-be entrepreneurs and those already in the start-up process consultation and access to networks and premises.

There is growing evidence of promoting graduate entrepreneurship in Malaysia. In recent years, mobilising university graduates for entrepreneurial careers, enhancing their entrepreneurial skills and providing support for the business start-ups have emerged as new tasks for higher education institutions. Over the last two decades, entrepreneurship has received growing attention from both theoretical and public policy perspectives (Othman *et al*., 2008). Since the late 1990s, particularly ICT has played a central role in new firms creation by *technopreneurs* in Malaysia *(*Ariff and Abubakar, 2002).

Penang offers a wide range of business opportunities for new firm creation, for example in design and development in manufacturing, ICT and multimedia, agriculture and biotechnology, and tourism and healthcare.

This chapter examines the following three dimensions to assess the effectiveness and coherence of entrepreneurship support policies and practices in Penang and the role that the higher education institutions play in this support:

- Is the entrepreneurship support system well connected and aligned with the needs of Penang?

- Do the higher education institutions support entrepreneurship in an optimal way? Are there gaps in delivery where performance could be improved?

- What lessons can be learnt from international experience?

4.1 Graduate entrepreneurship support in Malaysia

Malaysia's New Economic Model calls for greater autonomy of universities in "matters pertaining to course offerings, student enrolment, staff emolument, financial management and daily operations". With regard to curriculum development, a greater flexibility to respond to business and industry needs is expected and reflected in the key performance indicators of universities. The aim is to align universities' research and development activities with national growth objectives and priority sectors. To this end, a range of national programmes are underway to promote entrepreneurship among higher education graduates, university researchers and professors in the key growth sectors.

Entrepreneurship education

Polytechnic colleges launched entrepreneurship education in Malaysia in the late 1990s in order to introduce students to the essentials of small business management (Ismail, 2010). According to the evaluation in 2006, this education had an excessive focus on theory and limited scope for practice and application. As a result, more interactive courses were developed to attract students in engineering and non-business subjects.

In 2007, within the framework of the Ninth Malaysia Plan, the Ministry of Entrepreneurship and Co-operative Development (MECD) launched a range of activities and programmes in higher education institutions to promote graduate entrepreneurship with the aim of producing 150 000 new graduate entrepreneurs a year (Ariff *et al.*, 2010). Currently, entrepreneurship education is an essential component of curricula in many private and public higher education institutions in Malaysia. This development is supported by the Malaysian Qualifications Framework, which considers "Managerial and Entrepreneurship Skills" as one of the eight learning outcome domains; therefore the development of managerial and entrepreneurial skills are also required for programme accreditation

(Ismail, 2010). As a result, the higher education system provides beneficial framework conditions for nurturing entrepreneurial attitudes, as well as motivations and skills for business start-up.

Some of the existing programmes have a clear focus on technology-intensive entrepreneurship. The Universiti Teknology MARA (UiTM), for example, collaborates with the University Utara Malaysia and the University of Technology Malaysia in a master of science programme in technopreneurship and other technology-based entrepreneurship programmes at post-graduate level. There are also general programmes. In 2007, 17 public universities implemented the following programmes (Ariff *et al*.,2010):

- Entrepreneurial attitudes promotion through the Pembudayaan Keusahawanan programme.
- Graduate Development Programme, Pembangunan Usaha Siswa.
- Graduate Entrepreneurship Training Scheme, Latihan Keusahawanan Siswa.
- Basic Course in Entrepreneurship for Graduates, Asas Keusahawanan Siswazah.

The Government of Malaysia has high expectations for graduate entrepreneurship, but so far student involvement in entrepreneurship has remained limited. A survey by the Ministry of Entrepreneurship and Co-operative Development (MECD) in 2004 showed that only 30 out of 2 275 graduate respondents had become entrepreneurs either by running a business on their own or as part of a team. According to a survey among 121 final-year students of business accountancy who had participated in entrepreneurship training in Universiti Malaya and Universiti Utara Malaysia, there is a lack of multidiciplinarity, the compulsory nature of entrepreneurship courses reduces interest among students and teaching methods remain traditional, building on lectures and class assignments that fail to support creativity and "out-of-the-box" thinking (Ariff *et al.*, 2010). Most respondents believed that family members and connections play a core role in business start-up. There was, however, a strong agreement on the usefulness of their studies for business management, which gave the graduates confidence that they would succeed in running their own businesses. A wider range of entrepreneurship courses with stronger element of multi-disciplinarity, flexibility in overall curriculum design at university level and stronger policy support for universities to develop graduate entrepreneurship have been proposed (Ariff *et al.*, 2010). Furthermore, the

appraisal of successful graduate entrepreneurs as role models is a well-tested way to inspire students.

There is evidence of a lack of interest in entrepreneurship among Malaysian students, particularly students in non-business subjects due to the excessively theoretical or outdated curriculum, inadequate support from university administration and Malaysian cultural specificities which may hinder the development of an entrepreneurial mind-set (Ismail, 2010.) More than two-third of the heads of departments involved in the entrepreneurship courses identified the lack of additional budget as a constraint to deliver the courses, to provide training for teachers, to involve external businesspeople as teachers and to engage in off-campus activities. The majority of respondents also supported the idea of a dedicated unit to manage the entrepreneurship support activities (Ismail, 2010).

Start-up support

In Malaysia, a wide array of support schemes and physical infrastructure has been devised to promote entrepreneurial development, ranging from attitude and skills generation to incubation and business growth assistance (see Table 4.1.). the Ministry of Entrepreneurship and Co-operative Development (MDEC) and the Ministry of Higher Education (MoHE) have launched broad programmes, bridging education with consultancy and advice in start-up and access to financing and premises. Entrepreneurship support is provided through a networked system that includes more than a dozen ministries and over 30 agencies (Ismail, 2010). One of the most popular programmes is the *Technopreneur Development Flagship* initiative, a free support service for business plan development and start-up support targeted at people with technological and innovative business ideas in ICT, multimedia and biotechnology (MSC, 2010).

Several universities in Malaysia are part of the government's incubator programme MTDC, which belongs to the broader Technology Development Cluster programme that is designed to strengthen linkages between industries and universities and research organisations. Technology-based companies can apply to locate in the incubator programme if they are operating in one of the country's priority clusters, are majority-owned (minimum of 51%) by Malaysians, registered for at least for three months and with a minimum paid up capital of MYR 20 000.

Table 4.1. A networked system of entrepreneurship support

Mindset creation and skills development	Premises	Financing	Development and growth support
Entrepreneurship education offered by MECD and MoHE	Malaysian Industrial Entrepreneur Location (MIEL)	Malaysian Industrial Development Finance (MIDF)	Malaysian Technology Development Corporation (MTDC)
Courses offered by National Entrepreneurship Institute (INSKEN)	Incubation initiatives	Small and Medium Industries Development Corporation (SMIDEC)	Malaysian Industrial Development Association (MIDA)
Technopreneur Development Flagship initiative			National Productivity Corporation (NPC)
Malaysian Entrepreneurship Development Centres (MEDEC) established by MARA Institutes of Technology			Malaysia External Trade Development Corporation (MATRADE)

Source: Adapted from Ismail, M. Z. (2010), "Developing Entrepreneurship Education: Empirical Findings from Malaysian Polytechnics", unpublished PhD thesis University of Hull, UK.

Technology-intensive start-ups often face difficulties in accessing financing, because of the prolonged time-to-market phase that characterises high technology applications and a lack of sufficient collaterals for securing a loan. In Malaysia, a range of development financing institutions provides medium- and long-term capital financing. Key support programmes are the "Cradle Investment Programme" (CIP) (see Box 4.1.) and the "Start Your Own Business" by the Multimedia Development Corporation, a government agency. The absence of permanent local outreach centres in the CIP and other support schemes may negatively impact on take-up rates at the local and regional levels. Also of relevance for new and young technology-intensive firms is the Malaysian Venture Capital and Private Equity Association that targets high technology and knowledge-based enterprises of all sizes.

Box 4.1. Cradle Investment Programme

The Cradle Investment Programme (CIP) was launched in May 2003 by the Ministry of Finance. CIP is unique in Malaysia as it provides financing from idea conceptualisation to commercialisation, combined with expert assistance in legal and other business related matters. CIP Catalyst is a pre-seed fund that offers aspiring "technopreneurs", aged 18 years and older of Malay nationality and with permanent residence in Malaysia, a conditional grant of MYR 150 000 to support business ideas and commercialise technology-oriented business ideas. Teams of up to five people can apply online at www.cradle.com.my.

The investment focus is largely on ICT but also non-ICT and high growth technology industries are included (e.g. medical devices and advance materials, biotechnology and life sciences, natural resources management and renewable energy). In contrast to venture capital funding, the ideas are evaluated mainly from a technological perspective and not from a purely commercial perspective in terms of potential profits and time and profile of return.

Costs are eligible for CIP Catalyst funding include: testing of concepts, business plan development, market feasibility research, IP search and registration, prototype development and product sampling expenses. In addition to financing, CIP Catalyst provides assistance in idea commercialisation through mentoring and coaching, access to networks, and financial training.

The University Cradle Investment Catalyst (U-CIP Catalyst) programme targets researchers, lecturers and students with technology-related ideas. The eligibility criteria and amount of funding is similar to the CIP Catalyst, but applicants must either be employed or studying at public research institutes or private and public universities, colleges and institutes of higher education in Malaysia. CIP works in collaboration with the technology transfer offices of these organisations in the development of the business ideas submitted to CIP. Applications are made online on CIP's website. CIP organises monthly workshops in Kuala Lumpur and regular road shows to increase outreach to the rest of the country.

Source : www.cradle.com.my

The National Unipreneur Development Programme (NUDP) is another initiative of the Multimedia Development Corporation. The aim is to stimulate technology-related start-ups and university-industry relationships. The programme facilitates skills and competence development of students, researchers and professors, who wish to start-up their own business, and supports higher education institutions in their relationships with industry actors. Assistance is also offered in establishing student technopreneur clubs

and facilitating knowledge sharing and networking between faculties and between higher education institutions. NUDP organises every second month a University-Industry Commercialisation Collaboration Forum (UICCF) in which researchers present their work to industry representatives.

Since 2004, the Multimedia Development Corporation has organised an annual business plan competition (MIBPC) in collaboration with the Ministry of Higher Education and public and private tertiary education institutions. The budget of the business plan competition is around EUR 60 000; around EUR 7 000 is donated by private sector partners, such as iPertintis Sdn. Bhd. and Telekom Malaysia Bhd. This competition provides an opportunity to students, researchers and lecturers to present their business ideas and to advance their commercialisation. The competition runs nine months (from July to March). The participating higher education institutions organise courses around key skills and competencies relevant for successful start-up, development and early growth of a business. The key goal is to encourage people from different backgrounds to share ideas and form teams in order to leverage technology and business competencies. In the period 2006-09, 14 projects emerging from the business plan competition received funding from the Malaysia Technopreneur Preseed Fund and the Cradle Investment Programme (CIP). MIBPC lacks permanent local contact points which may act as a constraint to increase participation and follow-up broader entrepreneurship support activities.

4.2 Opportunities for graduate entrepreneurship in Penang[1]

Penang's economy offers a wide range of business opportunities for new firm creation, especially in design and development in manufacturing, ICT and multimedia, agriculture and biotechnology, tourism and healthcare. For example, Penang is an important destination of medical tourism because of its well-endowed medical research and growing health care infrastructure. Furthermore, the UNESCO World Heritage Site status has opened up a broad range of opportunities for new businesses in cultural and culinary tourism. With more than 50 higher education institutions, including universities, polytechnics and community colleges, Penang is well-placed to promote graduate entrepreneurship. (See also Chapter 5 for health and tourism.)

The newly strengthened internship policy of public universities will create opportunities for students to get in touch with and gather experiences in industry. The presence of multinational corporations may also provide students with valuable experiences in global research and development. Furthermore, research grants help to stimulate university-industry collaborations. At Universiti Sains Malaysia, every year almost 4 000

students participate in internship programmes, which has so far been a compulsory component only in engineering studies and an optional training component for students of humanities and social sciences. A key interlocutor with industry in USM is the School of Computer Science.

Box 4.2. USM School of Computer Science

The School of Computer Science of Universiti Sains Malaysia maintains contacts with more than 500 firms, including both multinational and local firms. Collaboration ranges from student internships and collaboration on thesis research to contract research. More than 139 first-year students and 165 second-year students were engaged in four-month internship periods in the academic year 2009-10 as part of USM's Industrial Training programme. There is a tradition of industry involvement in curricula design. To this end, an Industry Advisory Panel has been created including representatives from the Multimedia Development Corporation, Panasonic's R&D centre, Intel Corporation, Mobit and G.Tek Elektroniks.

The level of engagement, openness to industry needs and readiness to develop joint solutions demonstrated by the dean and core faculty of the School of Computer Science are factors that attract companies to collaborate with the school. Besides the establishment of trust, professionalism and flexibility in responding to the needs of industry are pre-requisites for industry relationships to work. Intel, for example, established three evaluation criteria – i) innovation, ii) generation of new skills and competences that are of relevance for Intel and iii) solutions to current problems the corporation is facing – that the School of Computer Science and other university partners need to fulfil in order to be awarded research grants or contracts.

The existing social challenges emerging from rural dependence on subsistence agriculture, issues of rural and urban poverty and the spread of HIV/AIDS in urban areas call for social entrepreneurship whose realisation can be fostered by education and tailored start-up support. Community engagement of universities can become a source for business ideas. Penang's status as UNESCO cultural heritage site could also open a wide range of opportunities for new products and services.

The multicultural environment in Penang is relevant to new firm creation and the early development and growth of these firms. Malays, Chinese and Indians, the three main population groups in Penang, have different attitudes towards entrepreneurship: While the Chinese and the Indian communities have long traditions in entrepreneurial activities, the Bumiputeras have traditionally exhibited a lower propensity to start up a

business (Ariff and Abubakar, 2002). Studies that take into account the ethnic background of new entrepreneurs in Malaysia note differences between the three main ethnic groups, in particular between the Bumiputera Malays and the Chinese (Ismail 2010). For the Chinese, kinship and interpersonal *guanxi* ties are crucial in financing business start-up, development and growth as well as in developing networks of suppliers and clients. Networking is highly relevant for Chinese students in job search and business start-ups.

Bumiputera Malays have traditionally been involved in agriculture and civil service rather than enterprises. Since the 1970s, the Government of Malaysia has encouraged their entrepreneurship systematically. With the establishment of the Bumiputera Commercial and Industrial Community (BCIC) in 1991 with branches throughout Malaysia, a support infrastructure was established to create and nurture a new middle class. In January 2010, PUNB, the National Council for Bumiputeras' participation in economic development, launched an initiative that seeks to create 400 new growth potential businesses by the end of the year. The Graduate Entrepreneur initiative targets young Bumiputera graduates and has a budget of MYR 50 million, divided into MYR 30 million for training programmes and MYR 20 million for start-up financing. A total of 2 000 young Bumiputera graduates will be selected with the participation of local universities, the Skills Institute Mara and the National Vocational Graduate Council. (PUNB, 2010).

Entrepreneurship education

Penang has a wide range of higher education institutions, including polytechnics and community colleges. In 2010, University Sains Malaysia (USM), Wawasan and KDU College participated in the national business plan competition MIBPC, organised by the Multimedia Development Corporation. As the participation in MIBPC requires a degree of institution-wide engagement in the development of skills and competencies for successful start-up, the entrepreneurship activities of these institutions are presented in more detail.

Universiti Sains Malaysia (USM)

Supporting students, researchers and professors in the creation of new firms is a key aim of Universiti Sains Malaysia. As the first APEX university, it also aims to be a pioneer and role model in the transformation of higher education through change management, increased research and higher performance in commercialisation. Promoting entrepreneurship can

also help attract talent that seeks entrepreneurial careers in research, which could enhance USM's future orientation to attract world class talent among postgraduate students.

Universiti Sains Malaysia (USM) provides a wide range of entrepreneurship courses which are all integrated in the curricular (see Table 4.2). So far, the university has not taken up the opportunity to design extra-curricular courses and programmes that are not accredited. All teaching is conducted by the USM lecturers. During the period 1955-2009, courses on offer have seen an increase in enrolment of more than 78%. The mandatory "Core Entrepreneurship" course includes a basic introduction to entrepreneurship and small business management as well as a student-run on-campus business activity. The entrepreneurship course at the school of management is compulsory for bachelor of management students. The teaching method is largely interactive and combines lectures with case study work and tutorials. In the project-based component, students interview business owners and business managers and report back to the class in form of a written paper and an oral presentation.

Table 4.2. Entrepreneurship education at USM

Course	1995-1999	2000-2004	2005-2009	Current status
Entrepreneurship	5 000	6 000	3 500	Terminated in 2007*
Core Entrepreneurship			10 000	Running
Entrepreneurship Undergraduate Training	200	500	600	Running
Basic Entrepreneurship	500	800	1 000	Running
Technopreneurship	200	200	250	Running
Biotech Entrepreneur	50	50	50	Running
Young Enterprise	1 500	2 000	2 100	Running
Small Business Management	2 500	3 000		Terminated in 2003
Entrepreneurship for BA Management	200	360	400	Running
Business Undergraduate Program	200	370	400	Running
Career and Entrepreneurship seminar	5 000	6 000	7 000	Running

Source: IPPTTN (Institut Penyelidikan Pendidikan Tinggi Negara), 2010. Unpublished data (from 1995 to 2009) provided by Student Affairs and Development Division, Universiti Sains Malaysia specifically Student Personality Development Section, and Centre for Curriculum Programme.

Note: *continued as "Core Entrepreneurship"

Universiti Sains Malaysia alumni tracer studies show an increasing number of start-ups amongst USM graduates. Since 1995, 190 firms were started, of which 100 in the period 2005-09 (IPTTN (National Higher Education Research Institute) 2010).

Incentives for professors and researchers to commercialise research results either by themselves or in collaboration with a group of students, who have a higher propensity to entrepreneurship, are of crucial importance to start the commercialisation process. Universiti Sains Malaysia's "3-track promotion exercise" based on research, teaching and community engagement or industry collaboration provides a promising tool for rewarding and incentivising community engagement and entrepreneurship support.

Wawasan Open University

Wawasan Open University is a private university, established in 2006, that offers globally benchmarked distance-learning based on new methods and technologies. There is no quota system, curricula are flexible and allow students to follow individually set pace without any penalties for interruptions. Curriculum design is industry-driven and two-thirds of the teaching staff have industry experience. Each of the four schools have advisory boards, of which half of the members are industry representatives, as well as Kulim Technology Park Corporation, Penang Skills Development Centre, local and national science foundations and universities abroad.

In 2010, the Malaysian Quality Agency approved a new bachelor of business in entrepreneurship and small business management, scheduled to start in early 2011 together with the entrepreneurship development course. The latter will be an elective for all students of business and economics and a compulsory course for the bachelor of arts in liberal studies students. The aim is to offer students from different backgrounds and with different interests an opportunity to meet and jointly develop ideas with business potential.

KDU College

In 2009, two second year KDU students of bachelor of engineering in electrical & electronic engineering won the first prize in the MSC-Malaysia IHL Business Plan Competition. Their business idea for an SMS-commanded multi-socket that allows to switch on and off consumer electronic devices had emerged from the electronics product development course. The KDU staff had helped the team to undertake a market survey

and to develop a marketing strategy and a business model together with a business plan for submission to the MIBPC business plan competition.

As a follow-up, the KDU leadership decided to promote entrepreneurship education more broadly, for example through a training for trainers programme in order to increase the number of in-house facilitators and coaches for student start-ups. The success of the KDU team in the business competition was celebrated inside the institution which raised interest in the contest and entrepreneurship in general. For the MIBPC business plan competition in 2011, KDU is organising an internal selection process to increase the number of students and staff interested in participating from the two campuses in Penang and Petaling Jaya. The aim is to facilitate the formation of multidisciplinary teams.

Furthermore, the unemployed graduates who have achieved their bachelors degree after 2003 have access to entrepreneurship training is offered in the so-called Graduate Training Scheme. The programme lasts five months and is designed and delivered by the Human Resources Development Council, Pembangunan in Sumber Manusia Berhad and the Penang Skills Development Council.

Key issues to take forward in entrepreneurship education

In order develop entrepreneurial mindsets and in nurture and strengthen the skills and competences needed for successful business start-up, early development and growth, it is recommended that higher education institutions use entrepreneurial pedagogies and organise entrepreneurship education in a dynamic way, taking account the needs and interests of students and real business needs.

Use of entrepreneurial pedagogies

In all of the three higher education institutions, entrepreneurship education is integrated into curricula. Compulsory courses prevail, which may reduce genuine interest in entrepreneurship, if these courses are perceived by students as being forced on them. In OECD countries, there is a trend to move away from compulsory towards elective courses which are open for students from different faculties and schools. This approach facilitates the formation of teams of students with different backgrounds and interests. Interdisciplinary team efforts allow individuals to concentrate on what they know and like best and at the same time become familiar with new knowledge that can be associated in a new way of solving a problem or creating a new product or service.

At Universiti Sains Malaysia, a range of entrepreneurship courses are offered to students. To what extent these courses use creative teaching methods and are tailored to the needs of the undergraduate, graduate and post-graduate students is not clear. There are two issues for university management to follow up: *i*) teaching methods and teachers and *ii*) interests and needs of students.

Most academic teachers have limited or no practical experience of being entrepreneurs themselves, which, one the hand, calls for "training the trainer" activities, and, on the other hand, suggests for a greater involvement of entrepreneurs and business practitioners in teaching. Although "externals" with business experience are generally involved in teaching by providing personal testimonials, giving guest lectures and acting as member of competition committees, there are relatively few examples of entrepreneurial practitioners engaged in the full curricula experience. Linkages between research and teaching should be strengthened, for example by involving doctoral students in research topics that a linked entrepreneurship education. Inviting international visiting entrepreneurship professors on a regular basis could also strengthen the research base, the students' learning experience and the efforts to "train the trainers".

The interests of students and their expectations from entrepreneurship education are likely to vary throughout the course of their studies. A differentiated approach is needed to reach out to students and provide them the input they can take on at their current point in their progress towards employment. Dynamic organisation of entrepreneurship education takes into account research and real-business needs and requires regular performance assessment, including feedback sessions with people from the business community, alumni entrepreneurs and students and tracking and surveying alumni with entrepreneurial careers.

Higher education institutions may wish to consider the example of Cambridge Centre for entrepreneurial Learning when developing and delivering entrepreneurship education (see Box 4.3.).

Box 4.3. Cambridge Centre for Entrepreneurial Learning: A "people-based approach" instead of a "how-to-approach"

The focus of Cambridge Centre for Entrepreneurial Learning (CfEL) is on planning and implementing entrepreneurship courses, within the whole University, using a specific philosophy and learning approach – www.cfel.jbs.cam.ac.uk. The entrepreneurship courses are mainly delivered by 200 entrepreneurs and practitioners (venture capitalists and business angels, bankers etc.). CfEL was established in 2003 as a not-for-profit organisation, resulting from the division of the University of Cambridge Entrepreneurship Centre founded in 1999 in two units.

Teaching and training moved to CfEL (part of Cambridge Judge Business School), and Cambridge Enterprise became the office for university-industry relations and knowledge transfer alongside with the Technology Transfer Office and the University Challenge Fund. At present, CfEL has nine full-time staff to plan and organise entrepreneurship courses, including a director, programme managers, a centre manager and administrative staff.

All of CfEL's activities aim at developing self-confidence among students. Entrepreneurship is understood as a set of skills, attitudes and behaviours rather than just venture creation. Teaching methods range from lecturing, video and online assignments, to problem-based learning, project work on real technologies and entrepreneurs in the classroom.

CfEL follows a people-based approach instead of a how-to-approach that emphasises business administration skills and tools to develop a successful business plan.. The people-based approach focuses on the development of entrepreneurial skills, attitudes and behaviours through an entrepreneurial pedagogy. It develops soft skills (developing student self-confidence, self-efficacy, helps students to understand the why and the when of becoming an entrepreneur, learning to deal with uncertainty, learning by trying, trial and error, learning from mistakes and failures) instead of to a 'how to approach'

The achievements of ten years of entrepreneurship education at the University of Cambridge include more than 12 000 participants, more than 165 programmes and events completed as well as more than 60 undergraduate and postgraduate entrepreneurial courses delivered, and 14 business plan competitions organised together with the Cambridge University Entrepreneurs (CUE). In the last decade, more than 140 new firms were founded by CfEL alumni and over 350 entrepreneurs and practitioners have contributed to CfEL activities.

Source: OECD (2010b), "Universities, Innovation and Entrepreneurship: Criteria and Examples of Good Practice", OECD Local Economic and Employment Development (LEED) Working Papers, 2010/10, OECD, Paris.

Start-up support

Start-up support provided by partner organisations

Start-up support facilitates business start-up without creating a financial dependency. It makes entrepreneurship support systems accessible and attractive for future entrepreneurs and rectifies market and system failures in financing and premises. For universities to be effective, partnerships with entrepreneurship support actors in the region and beyond are relevant. Many of the current start-up support systems do not have local contact points in Penang, and thus rely more on arms-length connections for example through on-line facilitation.

The key local support providers that collaborate with higher education institutions include Penang Skills Development Council (PSDC), The Penang Cluster Alliance Sdn. Bhd. (PCA), The Chinese Chamber of Commerce, INSKEN, the National Institute for Entrepreneurship and the chambers of commerce.

A key actor in the Penang entrepreneurship support system is the Penang Skills Development Council (PSDC). Initially established as a training centre for the labour force employed in the large multinational corporations and their local suppliers, PSDC has developed into a major player in skills development and related business development support. In 2009, PSDC received MYR 30 million from the Government of Malaysia to provide incubation services to start-up firms and young companies as well as to existing small and medium-sized firms that want to use PSDC laboratory space for innovation purposes.

A number of clusters exist in Penang; all of them are actively supporting graduate entrepreneurship. The Penang Cluster Alliance Sdn. Bhd. (PCA) announced in summer 2010 the opening of a new incubation facility for around 40 start-up firms in ICT in a new, 10 800 square feet "enterprise laboratory" worth MYR 1.7 million. The company freshmen will be trained in ICT business model development, software design and development, technical and soft skills training as well as marketing. The PCA will act as broker for these firms to access financing from the SME Corp Malaysia, Malaysian Industrial Development Authority (MIDA) and the Malaysia External Trade Corporation. The support will cover the rent (around MYR 100 000) for one year incubation, marketing support and costs related to the ISO certification of their products. The "enterprise laboratory" is managed by PCA and funded by the Penang state government, the Software Consortium of Penang and the Bumiputera ICT clusters Techbiz and ICT

Penang. It is the first incubator in Malaysia financed by both public and private sectors (see article in Daily Star online, 4 January 2010).

The *Halal* industry is on the rise in Penang state. INSKEN, the National Institute for Entrepreneurship will introduce a broad promotional campaign on graduate entrepreneurship in 2011, with a focus on the commercialisation of research related to *Halal* products. For the Entrepreneur Placement Programme (EPP), 1 000 graduates will be selected for a one-year programme and Malaysian graduates currently residing abroad can also apply for EPP. Programme participants will be placed for six months in selected companies. Access to loans is facilitated for successful programme graduates.

Also chambers of commerce in Penang, organised along ethnicity, have their own entrepreneurship support systems. For example the Chinese Chamber of Commerce in Penang has a young entrepreneur section which organises regularly international gatherings and technopreneur seminars. Attendance is open to young ethnic Chinese aged between 21 and 45 years as well as students of Japanese origin.

Start-up support provided by USM

Supported by its top leadership, Universiti Sains Malaysia focuses on promoting technology-intensive entrepreneurship and spin-off activities through the commercialisation of research results.[2]

The Innovation Office is the technology transfer office of the USM. It assists researchers and professors with intellectual property rights and promotes participation in nation and international exhibitions, fairs and competitions. The Innovation Office is part of InnovationXchange Malaysia Berhad, which is part of InnovationXchange, an international technology transfer scheme that connects research and industry worldwide. At present, the Innovation Office has around 20 staff who frequently travel overseas to attend business plan competitions in research areas related to the USM's key areas of strategic interest and offer the winners the opportunity to locate in the USM's incubator space. The USM students and researchers are well-represented in international events. For example in the 21st International Invention, Innovation, Industrial Design & Technology Exhibition (ITEX 2010) in July 2010 in Kuala Lumpur, USM participants won 26 awards; 8 gold, 12 silver, 6 bronze and 17 qualified as green inventions. The school of aerospace engineering is connected with PolyU Innovation & Entrepreneurship Global Student Challenge (GSC), which is a world-wide business plan competition. The school covers for participants travel and accommodation costs to attend the final pitching event in Hong Kong.

Recently, Universiti Sains Malaysia introduced "USM Connectors" to facilitate and enhance technology scouting in the different departments and schools and to increase collaboration with industry. "USM Connect" is a new initiative by the Innovation Office that seeks to establish closer connections with the local industry at departmental and school levels. As of July 2010, three full-time posts with post-doc salaries were created and filled with PhD graduates with research background.

Sanggar SAINS, or Sains@usm, will be the new incubation and technology development facility of Universiti Sains Malaysia. On almost 30 acres, divided in two plots, Sains@usm will host incubators and engineering support facilities, five-star quality guest-houses, a convention centre, an international school, as well as apartments and recreation facilities for tenants. The aim is to create an area that attracts and retains talents to start-up, manage and contribute as staff to the development and growth of new businesses. [3]

Key issues to take forward in start-up support

Penang has a rich support framework for new firm creation, including support provided by national and regional programmes and higher education institutions themselves. Universiti Sains Malaysia has a structure dedicated to start-up support with facilities for on-campus business incubation. The involvement of key actors, such as the school of computer science in the design and organisation of incubation facilities suggests that the university leadership collaborates, co-ordinates and integrates faculty-internal entrepreneurship support in the USM's support infrastructure and thus ensure cross-faculty collaboration. Two key issues for further development call for closer links between entrepreneurship education efforts and start-up support, and closer co-operation and referral between internal and external business start-up support organisations.

Linking entrepreneurship education with start-up support efforts

Assisting the establishment of new firms is one of the key objectives of university entrepreneurship support. Of the many inputs and circumstances contributing to the success of an entrepreneurial venture, having the right skills and competencies is of particular importance. Particularly important is the ability to identify entrepreneurial opportunities and to turn entrepreneurial projects into successful ventures.

Entrepreneurial professors and researchers can provide the link between education and start-up support, by being role models, sharing research results for commercialisation and acting as mentors for student projects. To facilitate this, start-up support needs to be embedded in education. Box 4.4.

explains how this integration process happens at Chalmers School of Entrepreneurship.

Box 4.4. Matching technology and entrepreneurship at Chalmers School of Entrepreneurship

Since 1997, Chalmers School of Entrepreneurship, located at the University of Chalmers, has been successful in matching technology based ideas with teams of highly motivated students and supporting them in turning ideas into viable ventures. Chalmers School of Entrepreneurship (CSE), www.entrepreneur.chalmers.se, is both an educational platform, where entrepreneurship skills can be acquired and a pre-incubator to developed early-stage business ideas and to start-up a company (most students start a legal company during the project-year). Core to this is a network that brings together innovative individuals, universities and firms interested in developing and commercialising early stage high-tech ideas with high market potential. CSE is an interesting example of an integrated approach to university entrepreneurship support, that is, how education can be incorporated into start-up support in the form of incubation. Today, CSE practices an "Encubation" process, that is, offering a Master-level education combined with business incubation through an incubator organisation – Encubator – operating in symbiosis with the education but owned by Chalmersinvest.

The early stage high-tech ideas are provided from researchers and innovators, who can develop their idea in partnership with the student team and an international network of experienced business people, venture capitalists and others, and supported with coaching and advice from CSE. When participating as an idea provider, university researchers and other inventors, get an opportunity to test their invention in a one-year innovation project at CSE. If a limited company is founded after the project-test period, the idea provider will have a share in the new venture. IP agreements play an important role in CSE; a collaboration agreement is signed between CSE and the idea provider.

ChalmersInvest is an incorporated company of Chalmers University (since 1998). It has made seed equity investments in university spin-off companies in the entire Gothenburg region. ChalmersInvest owns equity, directly or indirectly, in at present more than 40 companies. ChalmersInvest is in the process of attracting more external capital from private investors, large private corporations in addition to the several private and public financing organisations in and around Gothenburg. For example, KTH Chalmers Capital fund has established itself as a leading investor, and is one of the largest privately financed Swedish venture capital companies focusing on technology investments at an early phase. Exits include well-known companies such as Avinode, Vehco, Ambria Dermatology and ICU Intelligence. The close collaboration with ChalmersInvest, allowed CSE ventures to link with external private venture capital investors. In two major business reviews per year the venture projects are presented to potential investors.

Box 4.4. Matching technology and entrepreneurship at Chalmers School of Entrepreneurship (continued)

To date, CSE has more than 200 alumni. Over 35 companies have been founded through CSE. The total valuation of CSE portfolio companies goes beyond EUR 70 million, their total turnover of CSE portfolio companies exceeds EUR 18 million. Key success factors include close linkages between education and start-up support, recruitment and matchmaking of students and high-tech projects, action-based venture creation pedagogy and the structured venture development process and network centered around Encubator.

Source : OECD 2010b.

Co-operation and referral between internal and external business start-up support providers

Business plan competitions can be an effective platform to increase the linkages between entrepreneurship support provided by universities and business support partnerships and networks in the region and wider economic context. Consideration should be given to the establishment of a business plan competition in Penang, devised around the key opportunity areas for new firms resulting from the strengths and weaknesses of the local economy. Penang has critical mass in terms of students and entrepreneurship support providers to experiment what is well-developed in the Berlin-Brandenburg metropolitan area in Germany (Box 4.5.).

Box 4.5. Berlin-Brandenburg's Business Plan Competition

An important instrument to promote entrepreneurship in the metropolitan area of Berlin-Brandenburg is the Business Plan Competition Berlin-Brandenburg (BPW), www.b-p-w.de. BPW is open for everyone who has an idea and wants to turn it into a business venture. The privately funded BPW has been organised every year since 1996 with a duration of eight months. It receives annually approximately EUR 250 000 of sponsor's money for activities and prizes. Almost 5 000 business ideas have been submitted since 1996. 1 126 companies have been established generating 5 154 jobs.

Box 4.5. Berlin-Brandenburg's Business Plan Competition (continued)

The competition has three phases: i) idea and concepts of potential products and services, ii) analysis of the existing market place and iii) financial tools and requirements of the potential entrepreneur. Participation is free of charge and registration is on-line. The support offered include: learning and know-how; feedback by a jury; coaching; contacts; prize money. Participants can enter the competition also in the second or third phase. Participation to seminars, coaching sessions and networking is also open to people not submitting a market analysis or a business plan. In the final phase 26 business plans are awarded prize money of up to EUR 10 000.

BPW is organised by the Berlin Investment Bank, Brandenburg Investment Bank and the consortium of business associations in Berlin and Brandenburg, in conjunction with the governments of the federal states of Berlin and Brandenburg. A vast number of companies, universities and other institutions are partners of the competition.

Source : OECD 2010b.

4.3 Overarching issues in the promotion of graduate entrepreneurship

Top-management support for the entrepreneurial mission

Higher education institutions fail to realise their entrepreneurial potential, if promoting entrepreneurship falls into their third mission "with no or weak links to the core missions of teaching and research and if there is a lack of incentives and rewards for professors and researchers, who act as mentors for would-be-entrepreneurs and are sharing research results. Internal administrative barriers and a lack of incentives may impede students, researchers, professors and administrators to think and act entrepreneurially. Efforts to develop entrepreneurship skills support may not be fully effective because of a missing interface with the local economy's wider entrepreneurship support system. There is, therefore, a need for the university leadership to create synergies between education, research and entrepreneurship and to establish an incentive and rewards system that targets professors and researchers, administrative personnel or universities as well as students.

Incentive and reward system

Introducing an entrepreneurship-related incentive and reward system requires a pro-entrepreneurship positioning of the university leadership and its administration can facilitate this. Monitoring and evaluating the impact of entrepreneurship support on entrepreneurial behaviour of graduates and business activities of members of the university community will help to advocate the introduction of a reward and incentives system. At present, the universities' budgets largely depend upon the number of students, the degree of scientific excellence measured by publication and other aspects not directly related to entrepreneurship. Incentives and rewards for those involved in entrepreneurship support are, however, of crucial importance for a university to succeed in its entrepreneurial mission. Time can be an important factor for professors, which should be taken into account when designing incentives and rewards.

Take account of research results and real business needs in entrepreneurship education

Entrepreneurship education should take into account research and business needs. To ensure this, regular performance assessment exercises are useful, including regular feedback sessions with people from the business community, alumni entrepreneurs and students and to track and survey alumni with entrepreneurial careers. It is important to build and expand linkages between research and teaching, for example by involving doctoral students to work on research topics related to entrepreneurship education.

In a region, that has a high density of higher education institutions, such as Penang, a joint resource centre, providing an on-line information system of pedagogical practices freely accessible for teachers, researchers, students and other organisations involved in entrepreneurship education, could contribute to the development of a more entrepreneurial learning environment. Its task could be to produce innovative and pertinent teaching material (case studies, videos, games, course contents, syllabi, etc.) and to organise regular events, also using on-line services, targeted at different and mixed audiences to enhance communication on, and exchange of, new and innovative approaches in entrepreneurship education.

Invest in students…

Students can add value if given the opportunity and support to act. However, often they are considered beneficiaries and not partners in, and creators of entrepreneurship support. Students can create their own

businesses demonstrated by entrepreneurship clubs, such as CUTEC, Cambridge University Technology and Enterprise Club, which runs a "Start-Up Café" on campus and the introduction of paid student entrepreneurship interns by Cambridge University, which work across campus to promote and support entrepreneurship actions and to carry out applied entrepreneurship research. Collaboration amongst different local universities and other higher education institutions should be promoted to allow student participation.

…and in teachers

Entrepreneurship support in universities, in particular entrepreneurship education, requires efforts in human resource redevelopment and recruitment of new staff. Working with entrepreneurs, chief executives, bankers, venture capitalists and business angels can help overcoming bottlenecks. Entrepreneurship educator development programmes and workshops, careers adviser awareness programmes, and faculty deans' and directors' development programmes and workshops promote a university's entrepreneurial spirit. Annual awards such as the "Best Entrepreneurship Innovative Pedagogy" and the "Best Entrepreneurship Professor" for students to vote are soft incentives that can stimulate more involvement by professors and teaching staff in entrepreneurship education and also raise the awareness of entrepreneurship among students. Reducing the teaching load for those involved in "strategic" entrepreneurship activities, such as entrepreneurship ambassadors and mentors should be considered.

The OECD review team recommends that following measures are taken in entrepreneurship support:

Recommendations for the national government

- *Continue forward thinking strategies to develop a more entrepreneurial higher education sector and to boost graduate entrepreneurship in Malaysia.*

- *Develop incentive and reward systems and accountability schemes for higher education institutions*. Governments at different levels wishing to see strong move towards entrepreneurship need to ensure adequate incentive and accountability schemes that can mobilise higher education institutions.

Recommendations for the sub-national level

- *Establish a joint resource centre, providing an on-line information system of pedagogical practices freely accessible for teachers, researchers, students and*

other organisations involved in entrepreneurship education in order to create a more entrepreneurial learning environment. The tasks of the resource centre could be to produce innovative and pertinent teaching material (case studies, videos, games, course contents, syllabi etc.) and to organise regular events, also using on-line services, targeted at different and mixed audiences to enhance communication on, and exchange of, new and innovative approaches in entrepreneurship education.

- *Develop co-operation and referral between internal and external business start-up support providers.* Consideration should be given to establish a business plan competition in Penang, devised around the key opportunity areas for new firms resulting from the strengths and weaknesses of the local economy. Penang has critical mass in terms of students and entrepreneurship support providers.

Recommendations for the universities

- *Use entrepreneurial pedagogies in entrepreneurship education and organise it in a dynamic way by taking account of the needs and interests of students, real businesses and research results.* Engage students as partners in, and creators of entrepreneurship support. Use a differentiated approach to reach out to students at different stages of their study process. Use performance assessment exercises, including regular feedback sessions with people from the business community, alumni entrepreneurs and students and to track and survey alumni with entrepreneurial careers. Build and expand linkages between research and teaching, for example by getting doctoral students to work on research topics related to entrepreneurship education. Recognise that compulsory courses may reduce genuine interest in entrepreneurship. Interdisciplinary team efforts in entrepreneurship education allow individuals to concentrate on what they know and like best and at the same time become familiar with new knowledge that can be associated in a new way of solving a problem or creating a new product or service.

- *Develop the teaching methods in entrepreneurship and support*. Provide "training the trainer" activities and engage entrepreneurs and business practitioners in entrepreneurship teaching. Invite international visiting entrepreneurship professors to enhance the research base and to improve the students' learning experience. Promote entrepreneurial spirit by entrepreneurship educator development programmes and workshops, careers adviser awareness programmes, and faculty deans' and directors' development programmes and workshops.

- *Link entrepreneurship education with start-up support efforts*. Entrepreneurial professors and researchers can provide the link between education and start-up support, by being role models, sharing research results for commercialisation and acting as mentors for student projects. To facilitate this, start-up support needs to be embedded in education.

- *Ensure university leadership support for the entrepreneurial mission and incentivise individual entrepreneurialism*. There is a need for the university leadership to create synergies between education, research and entrepreneurship and to establish an institution-wide commitment to entrepreneurship with appropriate incentive structures for professors, researchers, administrative personnel and students. Provide soft incentives that stimulate involvement by professors and teaching staff by annual awards such as the "Best Entrepreneurship Innovative Pedagogy" and the "Best Entrepreneurship Professor". Reduce the teaching load for those involved in "strategic" entrepreneurship activities, such as entrepreneurship ambassadors and mentors should be considered.

Notes

1 This chapter draws on the information provided by Ms Suhaila Salleh, who manages the National Unipreneur Development programme at the Multimedia Development Corporation, Ms Hazlina Ahmad of USM, who teaches the entrepreneurship course at the School of Management, Ms Deehbanjli Lakshmayya, lecturer at Wawasan Open University, and Mr Gerard Boey Kong Hoong, Business Development Manager at KDU College in Penang.

2 The Deputy Vice Chancellor for Research and Innovation professor Bhg. Asma Ismail underlined in a keynote address to the National Science Officer Conference in 2010 the importance of entrepreneurship for research at USM.

3 The developers of Sains@usm in USM got inspired from a business trip to Boston, US.

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Chapter 5.
Community health, cultural tourism and sustainability and green growth

Social, cultural and environmental development supports economic growth, improves community health and welfare, social cohesion and contributes to clean, healthy and sustainable environment. It also provides an opportunity to transform the existing challenges into assets for the benefit of the regional and local economy.

The higher education institutions in Penang have an important role to play in addressing the environmental, social and cultural challenges and opportunities facing the region. This chapter focuses on three critical areas of higher education institutions' activity in the region: health, culture and tourism and environmental sustainability and green growth. The chapter highlights good practice from the region and internationally and concludes with recommendations to make collaboration and outreach more effective. The main message of the chapter is that whilst higher education institutions are often actively engaged with their local stakeholders, the picture of diverse projects and programmes is fragmented. Much more could be achieved through a comprehensive region-wide approach to development, stronger evidence base and co-ordination of targeted efforts to address the key challenges in the region. There is also a need for collaboration in the initiatives, better monitoring of the impacts and stronger alignment with the regional needs.

Introduction

Penang has cultural, historical and natural assets that offer a broad range of opportunities for the development of the region. They also develop the attractiveness of the region, not only in terms of tourism, but also in terms of attraction of talent and inward investment. At the same time, Penang is faced with social and environmental challenges including urban and rural poverty, rural-urban divide in the Northern Corridor Economic Region, ageing, HIV/AIDS and environmental degradation resulting from rapid development and unbalanced growth.

Penang and its higher education institutions are faced with three key opportunities and challenges. Firstly, the higher education institutions can contribute more to the role that culture and tourism play in the socio-economic development of the region in order to develop the region into an attractive place to live, work, invest and study. Secondly, the higher education institutions need to address the unbalanced growth and challenges linked to health and social cohesion. Thirdly, the higher education institutions need to respond more actively to environmental challenges and opportunities, seeking new sources of growth in the green economy.

In the context of these challenges and opportunities, this chapter examines:

- What is the contribution of higher education institutions to Penang's cultural, social and environmental development, particularly in terms of health, social cohesion and ethnic co-existence, culture and tourism, and sustainability and green growth?

- Are the higher education institutions' activities appropriately targeted to address the key challenges in Penang? Are there gaps in delivery and are resources and incentives aligned with the objectives?

- What lessons can be learnt from international experience?

5.1. Penang HEIs' contributing to health

Despite rapid changes in life expectancy, health remains an important policy concern in OECD countries and beyond. There have been significant changes in the nature of health problems, with a growth in conditions related to chronic conditions such as diabetes, depression and the deterioration of

health-related behaviour in the areas of diet, exercise and drinking. Increasing life expectancy has led to a growing share of the population at risk of "old-age conditions". There are also concerns related to health inequalities while certain demographic and socio-economic groups face significantly poorer health circumstances (OECD, 2010a; WHO, 2008).

In Penang, the rapid and uneven growth, and unsustainable environmental development and urbanisation have had an impact on the population's health outcomes. Penang has been successful in reducing poverty with less than 0.3% of the population below the poverty line in 2006, compared with 29% in 1980. Despite the progress made, Penang continues to feature urban-rural divide and new urban poverty which impact population's health outcomes. Urban-rural divide, growing disparities, drug abuse, ageing and ethnic diversity also poses challenges, while Malay, Chinese and Indian populations feature diverse health profiles. There is a general need to focus on preventive care and improve nutritional awareness.

There is limited robust evidence on the extent to which the Penang higher education institutions are responding to the health challenges in the region through translational research, teaching and learning and outreach activities, and there appears to be limited push to go towards this direction. However, the research-based work carried out in medicine and health, supported by government programmes, illustrates that high quality research is not jeopardised by regional co-operation and application. Universiti Sains Malaysia (USM) plays a dominant role in research activities in health and medicine. It is the leading research entity with a health campus and research centres and centres of excellence, such as the well-established Pharmaceutical Research Institute and the Advanced Medical and Dental Institute (AMDI) (See Box 5.1.). Collaboration between the two units should be enhanced to build critical mass and to avoid duplication of efforts.

Box 5.1. The Advanced Medical and Dental Institute (AMDI)

The Advanced Medical and Dental Institute (AMDI) was established in 2002 to respond to the needs more medical, dental and health specialists in certain areas of specialisation. AMDI is a postgraduate research institute with three main activities: clinical services, collaborative and cross-disciplinary research and postgraduate academic programme.

The main activities of AMDI are focused on advanced research to train and develop individuals that excel in medicine and dentistry. In order to achieve this goal, AMDI is building top notch facilities including a selomic, proteomic, therapeutic and animal labs as well as a clinical research centre.

Box 5.1. The Advanced Medical and Dental Institute (AMDI) (continued)

The institute aims to become the first and only research centre in Malaysia to be accredited by world accreditation quality bodies through the development of a vivarium and the quality of animal care during research.

AMDI is in the process of developing a main facility to focus on the work of translational research i.e. research to develop a basic form of treatment that can be applied to the patient. This facility can be used to generate therapeutic and diagnostic products for industrial usage. Every patient that comes to AMDI will contribute to the collection of information to create a patient disease data base for research purposes. Specific clusters have been set up by AMDI to thrust forward the research activities and produce more scientists and medical specialists in fields such as oncology, cardiovascular, integrative medicine, infectious disease, behavioral science and brain science, immunology, oral science, transfusion medicine, nuclear medicine, toxicology and a healthy lifestyle.

AMDI offers several study modules in postgraduate studies for example "mixed mode" masters in science (transfusion science, medical research). Two new programmes linked with toxicology and oral science were launched in 2010. AMDI also offers four-year residency programmes that aim at producing specialists with a master degree in transfusion and nuclear medicine.

AMDI has also developed programmes aiming at deriving pharmaceutical products and drugs from plants and relationships have been established with rural communities that can collect these plants. AMDI researchers are transferring knowledge to village people and involving them in the processing. This co-operation is highly appreciated by the communities and AMDI is now seeking to extend this experience.

In 2010, AMDI has 740 staff. It runs 6 academic programmes and benefits from 28 research grants. 74 postgraduates are working in the institute. Its annual operating cost is RM 57 million.

Source: AMDI, www.amdi.usm.edu.my.

The scale and expertise in medicine should be applied to develop strategies to increase the quantity and quality of health care provision across Penang and the Northern Corridor Economic Region. The Pharmaceutical Research Institute and the Advanced Medical and Dental Institute (AMDI) provide the region with advanced technology and help retain and attract talent to the region by offering competitive salaries and infrastructure for

research. They have the potential to improve human capital and innovation outcomes in Penang.

However, the Advanced Medical and Dental Institute (AMDI) is located in Bertam in Kepala Batas district, at a considerable distance from the Universiti Sains Malaysia and its heath campus. The aim is to build a "Healthy Bertam Region" including a residential area and lifestyle and recreational centre, with AMDI spearheading the health industry. Partly due to the distance from Universiti Sains Malaysia, AMDI recruits its staff increasingly from outside of the region. This can have a detrimental effect on research-education linkage.

Through AMDI, Universiti Sains Malaysia has been able to provide health services for the local community, including clinics for out-patient treatment and health screening. However, the focus on research in oncology and women's health may reduce engagement with the community as only referred patients will be treated. There is a need to implement the plans to establish partnerships between AMDI's specialist researchers and local communities in identifying health problems and providing solutions for healthy lifestyle. The institute has also commendable plans to build its collaboration with schools to develop health care education.

AMDI's research follows the national targets and funding opportunities which effectively divert the attention from local needs. There is considerable urban-rural divide in Penang and particularly in the Northern Corridor Economic Region: rural areas have reduced access to public services and due to ageing population are in need of paramedical care and nutritional awareness. AMDI conducts some research through collaboration with the indigenous population, on plants that may have health impacts and may also provide entrepreneurial opportunities. Similar experimentations have been undertaken in the state of Veracruz in Mexico by Universidad Veracruzana. Veracruz has the third largest indigenous population in Mexico, featuring lower earnings and educational levels than the non-indigenous population and face barriers in accessing formal education and the labour market. The Universidad Veracruzana has a support group of students and teachers to develop traditional medicine which enhances the skills levels and create jobs in the indigenous communities. The commercial potential exists for example in the traditional medicine offered by healers. (See Box 5.2.).

Box 5.2. Universidad Veracruzana: preserving traditional medicine

In 1995, the Universidad Veracruzana launched a Regional Group to Support the Traditional Indigenous Medicine (GRAMIT, in its Spanish acronym) with the support of several government agencies. The group was established as a joint effort of the Universidad Veracruzana in partnership with the Organisation of Indigenous Traditional Healers (OMIT) of central Veracruz and the Mexican Social Security Institute, with the aim of developing traditional medicine in the State of Veracruz.

GRAMIT supports around 300 indigenous healers in providing technical support to develop specific equipment and procedures, including the: *i)* development of a regional catalogue of healing plants, *ii)* methods to ensure quality assurance of herbal remedies, *iii)* registry of herbal remedies at the Federal Ministry of Health, *iv)* guidelines and support in the establishment of healing plants' garden, *v)* establishment of commercialisation protocols for herbal remedies and *vi)* small-scale manufacturing of herbal remedies at the Herbal Products Regional Lab in Ixhuatlancillo, Veracruz.

The participation of students and academic staff from several disciplines, (e.g. biology, chemistry, agronomy) in GRAMIT has brought benefits in terms of knowledge acquisition and dissemination. The group has released publications on alternative therapy methods used by indigenous healers as well as the identification of social, cultural and economical factors influencing dwellers' health in rural communities. An important contribution of GRAMIT is the development of a set of hygienic standards that have been followed by the traditional healers in the preparation of remedies.

Source: OECD (2010b), *Higher Education in Regional and City Development. Veracruz, Mexico,* OECD, Paris.

While strengthening links with units such as the Institute of Medical Research in Kuala Lumpur, which is a centre of research of the South East Asian Ministers' of Education Organisation, it will be increasingly important that Universiti Sains Malaysia will help improve health outcomes of the diverse populations in Penang by using the region as a laboratory for its teaching, research and service. There are many opportunities to improve regional development in Penang and the Northern Corridor Economic Region, for example by providing an opportunity to: *i*) address the regional health issues, *ii*) undertake multi-disciplinary research on the inter-connections between improving education, social and economic conditions and improving health outcomes, *iii*) provide community-based medicine and

ambulatory care facilities and *iv*) provide innovations in medical education and health care delivery.

The experience from other OECD countries shows that innovation in medical education and health care delivery are more likely to succeed if supported by deliberate policies. The following are examples of strategies that can be used to support the new initiatives: *i*) partnerships with innovative medical schools that have implemented community-based medical education to boost innovation in medical education or new forms of health care delivery; *ii*) competitive funds (with public and private support) dedicated to supporting a new research agenda (use information technology for innovation in health care delivery within the region). Without financial incentives, the pressure will be to shift to a focus on a traditional research agenda; and *iii*) incentive funding for recruiting and training the region's population in medical and health careers while at the same time attracting talent from elsewhere.

Universiti Sains Malaysia has made progress in "frugal innovation" by developing a rapid diagnostic test for typhoid. This kit is cost effective and meets the criterion of urgency needed to detect typhoid for fast treatment. The product has been produced commercially and marketed to at least 18 countries worldwide since 1994. It has helped support local industries, generating about 500 jobs around the world and has helped diagnose typhoid in more than 2 million people. Frugal innovations will have increasing markets not only in the emerging economies but also in the OECD countries. The search for cutbacks in public spending will become urgent when demand for welfare services is rising as the baby-boomers start to retire and medical innovations push up health-care costs. By 2050, one in three people across the OECD countries will be on a pension.

Box 5.3. Frugal Innovation in emerging economies

Frugal innovations, "reverse" or "constraint-based" innovation strip the products down to their bare essentials. Frugal innovation is about redesigning products and involves rethinking entire production processes and business models. Companies reduce costs so they can reach more customers and accept thin profit margins to gain volume. In addition to contracting out more work, the most important ways of reducing costs include using technology in innovative new ways and applying mass production techniques in new areas such as healthcare. Frugal innovations also use existing technology in imaginative new ways. For example, applying mass-production techniques in new and unexpected areas such as health care can bring major savings and improve the lives of the bottom millions.

Box 5.3. Frugal Innovation in emerging economies (continued)

Frugal products are robust and user-friendly and often combine high-level and low-level innovation. Examples from India are aimed at two of the country's most pressing health problems: heart disease and contaminated water. The first one is a hand-held electrocardiogram, driven by a state-of-the-art algorithm, which instead of the multiple buttons on conventional ECGs, has only four. It is small enough to fit into a small backpack and can run on batteries as well as on the mains. It sells for USD 800, instead of USD 2 000 for a conventional ECG, and has reduced the cost of an ECG test to just USD 1 per patient. Another example is a water filter that uses rice husks to purify water. It is robust, portable and cheap, giving a large family an abundant supply of bacteria-free water for an initial investment of about USD 24 and a recurring expense of about USD 4 for a new filter every few months. Rice husks are among the most common waste products in India.

Frugal innovations are conquering also the advanced economies, particularly in health care. For example, a cheap ultrasound device, originally developed for the Chinese market, has become the basis of a global business. The current financial crisis is likely to be followed by a long periods of slow growth reducing the purchasing power of consumers. The need for retrenchment will increase when demand for welfare services is rising as the baby-boomers start to retire and medical innovations push up health-care costs. By 2050, one in three people across the OECD countries will be on a pension. The experience of the emerging markets suggests that a low-cost business model and "cost innovation" – redesigning both products and processes from scratch to take out costs – can be a productive strategy.

Source: The Economist (2010) "First break all the rules, The charms of frugal innovation A special report on innovation in emerging markets" article dated April 15 2010, *www.economist.com/node/15879359.,* accessed 2 February, 2011.

HIV/AIDS

The HIV/AIDS pandemic is a major health and social problem in Malaysia. In May 2010, there were 86 127 cases of HIV infected persons and 14 955 with AIDS, representing a significant increase since the first case was detected in 1986. In Penang, there were 3 524 people infected with HIV, 812 with AIDS, 514 had died from HIV/AIDS.

The AIDS Action and Research Group (AARG), based in the school of social sciences at Universiti Sains Malaysia, was established in 1992 by a

group of social scientists to address a growing need to prevent the spread of HIV/AIDS and help those infected and affected by HIV/AIDS. Over the years, AARG has grown into a multi-disciplinary centre of excellence, acknowledged by the federal and state authorities for its research, policy advice, counselling and community service. AARG is active in community service through its drop-in-centres which now cover the entire country, especially in the needle exchange programme to the community of drug users and capacity building related to HIV/AIDS counselling and harm reduction. AARG engages not only academic and non-academic staff but also volunteers, often with history of substance use to be fully aware of the needs of the community. Furthermore, it engages students in community action. To build capacity, AARG could develop stronger collaboration also with Universiti Malaya's faculty of medicine which has received a substantial grant from the United States for AIDS work.

Box 5.4. AARG providing research, counselling and community service related to HIV and AIDS

The AIDS Action and Research Group (AARG) based in the School of Social Sciences at Universiti Sains Malaysia was established in 1992 by a group of academic staff of the school of social sciences. Today, it consists of a multidisciplinary group of academic and non-academic staff and volunteers. It aims to: *i)* to create awareness of HIV/AIDS, *ii)* provide educational training in psychosocial aspects of HIV/AIDS related issues, *iii)* co-operate with all parties in reducing HIV/AIDS infections in Malaysia, *iv)* fight the stigma and discrimination associated to HIV/AIDS, and to *v)* to conduct research on issues related to HIV/AIDS. To achieve these objectives AARG works with all agencies, NGOs, ministry of health, health department, hospitals, police. Activities and services include: *i)* educational, training and counselling programmes on prevention, management and conflict resolution related to HIV/AIDS, *ii)* seminars and educational campaigns, *iii)* hotline telephone counselling, *iv)* community action programmes, *v)* facilitation of public debate and exchange of knowledge and experience, *vi)* research on knowledge, attitudes, behaviour and policies related to HIV/AIDS education, prevention and treatment in Malaysia including the social and psychological impact of HIV/AIDS. The AARG activities are part of the university's social responsibility.

AARG engages the community in its activities, provides research-based knowledge to the community and provides practical training for social sciences students i.e. social work programme and job opportunities for the IDUs in NSEP, resource centre for HIV/AIDS information, training centre for various psychosocial topics on HIV/IADS.

Box 5.4. AARG providing research, counselling and community service related to HIV and AIDS (continued)

Research centres on psychosocial aspects on HIV/AIDS. Activities include harm reduction workshop for the police department, workshops for women and girl with HIV/AIDS, research on knowledge and attitudes of university students on HIV/AIDS in three universities. In 2005, the ministry of health launched a number of harm reduction programmes with the support from local NGOs and stakeholders. AARG's needle and syringe exchange programme (NSEP) in drop-in centres and stand alone premises. Between 2006-09, the number of NSEP centres increased from 3 to 12 in 8 states providing service for nearly 6 000 clients in Malaysia. AARG aims to increase its advocacy work with stakeholders and awareness raising programmes. In future it will also have a mobile unit.

Source: OECD Review Team Interviews in May 2010.

Health and medical tourism

Penang aims to become a regional medical tourism hub in Asia by providing high-quality but more affordable specialised medical procedures. The region's goal is to be known as the centre for excellence in areas such as cardiac care and oncology, possessing globally-accredited hospitals and highly-qualified medical and healthcare professionals. Penang has strong public health and medical facilities, buttressed by international level private sector establishments. Private sector initiative and partnerships have contributed to medical tourism in Malaysia which, in 2006, brought in USD 59 million, with Penang attracting 70% of this revenue (Kharas *et. al.*, 2010). The Penang Health Association (representing a group of private hospitals) as well as good communication and travel facilities, low cost of services and availability of good accommodation have contributed to the growth of medical tourism.

Penang's ability to build a health hub is faced with human resource challenges and intense competition in the wider region in health tourism. There is acknowledged shortage of skilled health personnel, particularly nurses, a shortage of highly qualified people and the "Brain Drain". Recently the Penang Skills Development Centre (PSDC) has provided skills development for health personnel. Furthermore, Universiti Sains Malaysia has strengthened its postgraduate programmes in medical health and health science which support the regional priorities in this field. At the same time, there is a growing competition in medical and health tourism which is a growing field in international trade. Other countries in South East Asia such

as Singapore and Thailand have already made considerable progress (see Box 5.5.).

Box 5.5. The growth of medical tourism

An increasing number of countries or individual hospitals and clinics have actively marketed themselves as medical travel destinations, hoping to attract patients from neighbouring countries and further afield, through the promise of high quality, technologically advance and competitively priced health services.

The Thai Investment Board reports that Thailand treated over one million foreign patients in 2006. These patients were part of an expanding global trade in medical tourism which the board valued at USD 40 billion worldwide and with global growth potential of some 20% per year. While hard statistics on the value of health-related travel remain patchy and tend to underestimate activity, they show that OECD countries consumed more than USD 5 billion worth of healthcare services abroad in 2008.

A 2008 report by the Deloitte Center for Health Solutions estimated that the value of the world medical tourism market in 2008 was around USD 60 billion, and they expected double digit growth rates in the years ahead. While a follow up report in 2009 suggested that the recession would slow this growth, it still forecast that the number of US outbound medical tourist would reach 1.6 million by 2012.

Medical tourism is the most visible part of a generalised growth in the globalisation of health and international trade in health services. Cost plays an important role and many health tourists seek equivalent treatment in countries that are able to provide it more cheaply. Legal and ethical obstacles such as for stem cell or donor-related treatments have been major driving forces behind the increase in health tourism. Growing economic and political co-operation is also promoting international movement of patients and healthcare professionals.

Source: OECD (2010c), The growth of medical tourism*,* OECD Observer No 281 October 2010, OECD, Paris based on Deloitte (2008), "Medical Tourism Consumers in Search of Value", Deloitte Center for Health Solutions; Deloitte (2009), "Medical tourism: Update and implications", Deloitte Center for Health Solutions, 2009, *www.deloitte.com/centerforhealthsolutions;* Thai Board of Investment (2008), "A Medical Trade Valued at USD40 billion with a 20% Annual Growth", *www.boi.go.th/english/why/Medical.pdf.*

5.2. Tourism – moving from beach holidays to higher value added segments

International tourism accounts for approximately 30% of global service exports. Penang plays a significant role in the promotion and expansion of Malaysia's tourist industry. Penang's contribution to the Malaysian tourist

industry was the third highest in the country with nearly six million tourist arrivals in 2009.[1] After manufacturing, tourism records the second largest export income for Malaysia, making up about 7% of the total. Likewise, Penang's tourism sector is the second largest contributor to its economy, after the manufacturing sector.

There is considerable growth potential in tourism and opportunities for diversification into higher value added segments with the expansion of ASEAN's middle class and their disposable incomes to travel. There are also close to one million Singaporeans who have family ties in Penang.

Recently, there has been a resurgence in Penang's tourism arrivals since the slump of the late 1990s. This has been due to the rise of budget airlines, which has brought an increasingly large number of independent travellers to the island. Penang has regional air links with Thailand, Indonesia, Hong Kong and Singapore. At the same time, however, visitors from Singapore, the largest group of arrivals for Malaysia, seldom visit Penang. Although over half of the total international tourist arrivals in Malaysia are from Singapore, only 1.3% fly into Penang (arrivals by land are not included in the figures). A considerably larger proportions of visitors from Indonesia (14%) and Japan (12.3%) end up in Penang, possible thanks to the availability of educational institutions (Indonesians) and the presence of Japanese manufacturing plants.

There is a growing recognition within the state and local governments about the need to move from mass tourism to higher value-added segments – health tourism, cultural tourism and ecotourism – in order to drive regional attractiveness and competitiveness. The state government stresses its cultural and ethnic diversity reflected in the language, costume, custom and cuisine and its historic links with the neighbouring countries such as Singapore and Indonesia. The listing of Penang by UNESCO as a World Heritage Site has become a major tourist feature as do its natural scenic beauty and popular beaches which, however, suffer from environmental degradation. The Penang Investment Tourism Office was established in 2010 to consolidate the shift from promoting Penang as a sun, sea and sand destination to higher value-added segments, such as leisure tourism, medical tourism, education tourism and heritage tourism. The aim is to leverage on the World Heritage Status to effectively promote George Town and Penang and retain the authenticity of the city while making it more tourist-friendly.

Benefits of cultural tourism

OECD has highlighted the mutually beneficial relationship between culture and tourism which can strengthen the attractiveness and competitiveness of cities, regions and countries (OECD, 2009a). The

combination of tourism and culture is a potent economic engine. Atlas Survey (2007) has shown that expenditure by cultural tourists far exceeds that by other type of tourists, particularly those on sun and beach holidays. According to Europa Nostra (2005) "more than 50% of tourist activity in Europe is driven by cultural heritage and cultural tourism is expected to grow the most in the tourism sector." UN World Tourism Organization estimates that cultural tourism accounts for 40% of international tourism.

Cultural tourism is attractive because of the widespread cultural, economic and social benefits it can deliver to local communities.[2] Cultural institutions can be used to lead the urban regeneration of old industrial or distressed areas, rejuvenating local economies and increasing property values. In rural areas, cultural tourism can be even more important, since there are often few alternative sources of income. Tourism can be used to support traditional livelihoods and crafts and sustain communities threatened with out-migration. Culturally motivated tourists are also likely to show more respect to the local environment. However, in order to attract them the tourism entrepreneurs will have to adapt to the cultural tourists' expectations of hand-made, eco-friendly and quality products and services.

State and federal governments can play an important role of supporting the cultural heritage of Penang and strengthening its tourism appeal. Considerable efforts have already been made in Penang to diversify tourism to higher value-added segments, particularly in terms of the UNESCO World Heritage Site in George Town. Universiti Sains Malaysia and other higher education institutions have supported this work by undertaking research, innovation and collaborating in flagship events and making their space available for events. There is, however, a lack of efforts to provide learning and skills development programmes in tourism and concerted efforts to develop and enhance entrepreneurship activities. A consortium of Penang's public and private higher education institutions could take advantage of the investments in hospitality and tourism that are being made under Malaysia's "National Key Education Areas".

Skills development in tourism

Despite the importance of tourism to the economic development of Penang, programmes to support education, training and RDI in tourism do not feature highly in the portfolio of the higher education institutions, with the exception on some private institutions. This is in contrast to many OECD countries and regions which are building skills to move to higher value-added segments in tourism. The leading university in hospitality and hotel administration is the Cornell University in the United States which provides education, R&D and innovation, as well as professional

development opportunities in the increasingly global business. Recently, the school has also embarked on stronger internationalisation efforts and the development of students' entrepreneurial skills (see Box 5.6.).

Box 5.6. Cornell University School of Hotel Administration

Founded in 1922, Cornell University's School of Hotel Administration was the first higher education programme in hospitality management in the United States and is today the world leader in its field. Its students learn from 60 full-time faculty members, who are experts in their disciplines and dedicated to teaching, research and service. Learning takes place in state-of-the-art classrooms, in the on-campus Statler hotel and in varied industry settings around the world. The school's large alumni group of corporate executives and entrepreneurs advance the industry and share their experience with the students and faculty.

The school is active in industry relations. In 1973, it launched the first master's degree programme for the industry. This programme gives senior managers the knowledge and skills required in a complex global industry. Executive courses help industry leaders accelerate their careers. In 2006, the hotel school partnered with the Culinary Institute of America on a collaborative degree programme offering education in hospitality management and the culinary arts. Students earn a BSc degree in Hotel Administration and an Associate in Occupational Studies degree in Culinary Arts. The school's Center for Hospitality Research (CHR) undertakes research on and for the hospitality industry. It creates new knowledge and shares that knowledge to develop the industry. Hotel school faculty, corporate partners and other industry leaders collaborate at roundtables and meetings to frame and understand the developments in the industry. Fellows work with business leaders to develop new ideas, theories and models that improve strategic, managerial and operating practices. These insights are captured in research reports and industry tools that are available online at no cost. An active knowledge-sharing programme distributes the center's work around the globe. CHR also publishes the award-winning hospitality journal, the Cornell Hospitality Quarterly.

The hotel school is also widening its global reach. In 2004, it established a joint master's programme in hospitality management with Nanyang Technological University in Singapore. Launched in 2006, the Cornell-Nanyang Institute educates up to 50 students per class who split their time between NTU's campus and Cornell's campus in Ithaca, N.Y. The programme is the first joint degree programme for both institutions.

Box 5.6. Cornell University School of Hotel Administration (continued)

In 2006, Leland '69 and Mary Pillsbury announced a USD 15 million gift to the Hotel School. The gift, the largest single gift ever made to the school and one of the largest ever in hospitality education, supports the Leland C. and Mary M. Pillsbury Institute for Hospitality Entrepreneurship. Faculty teams with entrepreneurs to give students the knowledge and skills to pursue their entrepreneurial ambitions.

Source: Cornell University School of Hotel Administration *www.hotelschool.cornell.edu.*

Many countries have launched skills development programmes to train and up-skill personnel for tourism. Some of the programmes have a regional focus and emphasis on cultural tourism. This is the case for example with the Welcome Ireland programme ("Fáilte Ireland") that has funded a regionally-focussed capacity building programme for SMEs (see Box 5.7.).

Box 5.7. Programmes to support workforce education, training and development in tourism

Major initiatives which are helping to enhance the status and position of the tourism sector as a career option include the United Kingdom's People 1st Programme and Canada's Tourism Human Resources Council which emphasise stakeholder engagement as well as industry needs. These programmes highlight the need for long-term continuity in state policies and investment in tourism training and development to build the capacity of the workforce.

Ireland has made a sustained intervention through the funding of its national training body CERT which was merged to create Fáilte Ireland. It is one of the most comprehensive approaches to education and training, co-ordinating all education and training needs for the industry as well as labour-market planning. Fáilte Ireland trained 10 000 staff in the sector in 2007 to improve skills and industry capability to complement the higher level skills at the Institutes of Technology and Universities. Fáilte Ireland has also funded a Human Resource Development Strategy, Management Development Programme and a regionally focused capability building programme for SMEs.

Box 5.7. Programmes to support workforce education, training and development in tourism (continued)

Many OECD countries are using migration policies to address skills shortages in tourism since the financial rewards in the hotel and catering sectors are often uncompetitive. For example, the Scottish government's Fresh Talent Policy – a managed migration policy to attract returning Scots and overseas skilled labour – has addressed skills shortages in tourism and hospitality, notably in larger cities with high labour turnover rates. Here, eastern European labour has been used to fill significant skill gaps. In Canada, the Temporary Foreign Worker Programme helped streamline the time required to employ a foreign worker while also extending the length of time lower-skilled workers could stay in the country. A new scheme introducing faster processing of job applications helps employers facing labour shortages in high demand occupations such as tourism.

Source: OECD (2010d), *Tourism Trends and Policies 2010*, OECD, Paris. 2010.

Innovation in tourism

OECD countries and regions invest in tourism innovation programmes and to address specific barriers to tourism such as seasonality[3], peripherality and the challenges of the SME sector. For example Sweden is developing a network for tourism research to improve competitiveness. Innovation Norway has funded the ARENA Programme to create regional clusters of tourism and developed a project that aims to develop mountain tourism into an all-year activity with attractive products by focusing on network development, entrepreneurship and innovation. Scotland has a dedicated tourism innovation programme and in Quebec, the Tourism Intelligence network was developed in collaboration between the University of Québec in Montreal and the public and private sector.

In Penang, the role of higher educaiotn institutions in tourism innovation was focused on building knowledge on new products. For example, the Tourism Research Circle (TRC) of Univeristy Sains Malaysia helps the state government to develop and improve the Homestay Programme which has become an important feature in Penang. RTC also conducts workshops to improve the knowledge among tourism entrepreneurs especially the bumiputeras.

There is scope for increasing the knowledge transfer from higher education institutions to the Penang tourism industry. Higher education institutions could help SMEs to better access global markets. Global value chains and networks encourage SMEs to make improvements in skills development, innovation and products and process. Policy measures and

collaboration by universities and other tertiary education institutions are needed to ensure that SMEs do not miss out in their ability to compete with larger suppliers. Tourism industry faces also significant challenges in Penang with environmental degradation and rampant building in hill slopes. Higher education institutions could support eco-efficiency and eco-innovation in tourism. Furthermore, the measurement and evaluation of policy outcomes in tourism – whether policies and programmes are appropriate and efficient in achieving their intended objectives – is still in their infancy. Universities have taken steps to address this challenge. For example, researchers at Nottingham University in the United Kingdom and the Sustainable Tourism Cooperative Research Centre (STCRC) in Australia are working with specially constructed tourism Computable General Equilibrium (CGE) Models which can be used to estimate impacts of changes in tourism demand on the tourism sector and across the economy. This type of analytical tools would help the state and local development authorities also in Penang.

Investments in cultural and creative arts could also vitalise the region and bring creative talent and knowledge-intensive businesses. The Penang Government could be a catalyst in the birth of a cultural and creative hub. Creative sector is a key economic driver globally; in several major economies, the value of the cultural industries ranges between 3% and 6% of the total economy. Rich cultural traditions, ample recreational and entertainment facilities provide enhanced pull factors. Equally, Penang's linguistic diversity and its population's facility with languages such as English, Mandarin, Tamil and Malaya are important capacities useful in the regional positioning of Penang.

The leading region in cultural and creative industries in South East Asia is Singapore (see Box 4.8.). While Penang and George Town lack the agglomeration assets of Singapore, they could tap into the growing stream of cultural tourists in Singapore by providing ready-made packages in authentic South East Asian environment.

Box 5.8. Singapore and creative industries

At the turn of the millennium, Singapore developed a holistic plan to develop a new sector – the Creative Industries – to help transform the country's economy. It defined the creative industries as: i) arts and culture, ii) design and iii) media. The Singapore Government wanted to reposition Singapore as a vibrant and exciting creative hub, utilising the formula that fuse arts, business and technology. Its Department of Statistics had estimated that creative industries contributed around 3% of the country's GDP in 2000. Developing these industries would give them the potential to contribute 6% of GDP by 2012, out of which 5 to 7% of the national workforce could be employed. In the area of arts, using the tag "Renaissance City" the Singapore Government aimed to "position Singapore as a key city in the Asian Renaissance of the 21st century and a cultural centre in the globalised world", to make Singapore "one of the top cities in the world to live, work and play in, where there is an environment conducive to creative and knowledge-based industries and talent".

Today, Singapore's arts scene is buzzing, cultural groups come from all over the world to perform there and the island itself has become an entertainment destination for tourists. In 2009, in the annual survey of the world's most liveable cities conducted by the magazine Monocle, Singapore was ranked 18th, and this had much to do with it museums, performing arts venues and galleries. There are more than 700 registered arts companies and groups there, about double the number ten years ago. On average, there are more than 50 arts performances and exhibitions going on, on any given day.

At the same time Singapore has successfully projected itself as a safe and efficient international transportation and financial centre. It has also launched Singapore One North as a hub for biosciences, interactive media, physical sciences and healthcare to attract talent.

Source: Kee Thuan Chy (2010), *A dream for Penang*, Penang Economic Monthly, January 2010, Issue 1.10

Collaboration in flagship projects: George Town and the UNESCO Heritage Site

Pulau Pinang is popularly known also as the "Pearl of the Orient". Penang is an international tourist destination famous for its many historic and scenic attractions and its diverse cultures. In 2007, Penang along with Malacca, another state in Peninsula Malaysia, were named as World Heritage Sites by the United Nations Educational, Scientific and Cultural organisation (UNESCO). The built environment can be described as a living museum that represents the link between Penang's past history and the

present which is home to diverse communities and cultures. George Town has more pre-World War II shop house buildings, clan associations and temples in a compact city than anywhere else in South East Asia (see Box 5.8.).

George Town has thousands of heritage buildings, hundreds of festivals and urban traditions, and more than one hundred NGOs, associations and clan houses. The multi-ethnic and religious mix of the residents of George Town is reflected not only in its buildings, ceremonies and festivities, but also its food. This setting provides a living laboratory for university research & innovation, learning and outreach and provides ample work-based learning opportunities for university students in all study programmes.

The rich and diverse cultures of Penang originated from the mixture of cultures from the eastern and western civilizations. The state is a microcosm of multi-racial, multi-religious, multi-cultural and multi-lingual society. The Malay, Chinese and Indians constitute the major ethnic groups in Penang. The common languages of Penang, depending on social class and circles as well as ethnic backgrounds are English, Penang Hokkien, Tamil and Malay. Penang's multi-cultural heritage and geographical location constitute strong assets that the region could capitalise on in developing cultural tourism, attracting foreign direct investment and encouraging ethnic entrepreneurship. There is considerable scope for expanding joint efforts by the regional stakeholders in this area.

Furthermore, to translate the cultural diversity and social capital into economic terms, George Town needs cultural and social entrepreneurs. There is also a need for a preservation plan for the entire urban setting and the living human traditions. Preservation can create jobs and generate income based on traditional technologies and know-how. Local communities should also be empowered to play a leading role in the conservation, monitoring, maintenance and preservation of their heritage.

Many NGOs, *e.g.* Penang Heritage Trust and Badan Warisan Malaysia, work to promote the preservation and conservation of heritage building in Penang and particularly George Town. Universiti Sains Malaysia's school of arts and school of housing, building and planning have worked directly and with the NGOs on restoration of buildings, research projects involving the buildings and life in George Town. The scope of the research and expertise in the area of heritage conservation and restoration contributed to the heritage status. Furthermore, the university's arts education committee collaborates with the local community and NGOs in its efforts to help young residents to retrace the lost narrative of their multicultural heritage through mapping and documenting their history, cultural assets and natural environment.

Box 5.9. George Town

The modern history of Penang began when it was acquired by the British East India Company in 1786 to serve its expanding global trade. Originally a backwater island populated by pirates, Penang became one of the most important British settlements in the Far East, enjoying a brief and lucrative reign over its peers. Penang boasted a fine sheltered harbour and was well-located at the northern end of the Straits of Malacca. It served the British in business and as a military base.

Weld Quay was one of Penang Island's economic activities to which ships from all over the world came to trade. After the Opening of the Suez Canal in 1869, Penang was the first port of call east of the Indian subcontinent. Penang was the site of the European and Chinese capital in the rubber and tin trade. Revenue farm networks of Penang, i.e. opium trade links, stretched as far as Saigon, Hong Kong and China. At the apogee of the British period, Penang had become a regional educational hub for Islamic, English and Chinese education. With Singapore's emergence in 1823 and the addition of Port Klang, the reign of the Penang port started to decrease and in 1932 Singapore overtook Penang as the main port of the Straits Settlements.

Since its heyday, Penang's waterfront has seen a decline, culminating in the removal by the federal government of its free port status around 1970. Efforts have been made to revitalise the Weld Quay and to transform it into a vibrant tourist sport by tapping into its heritage of colonialism and clan jetties. Old abandoned buildings are being converted into hotels without destroying their history. Weld Quay's old role as a transportation centre is being revived, with plans to integrate Penang's ferry and bus services. Penang's clan jetties are a cluster of villages built on foreshore waterfront at the North-East District of Penang Island. Six main clans – the Lim, Tan, Chew, Lee, Yeoh and Mixed Clans – reside there totalling in about 200 households.

Once a fishing centre and port, Penang's clan jetties, which are no longer able to depend on fisheries or trade, are struggling to reinvent themselves. With George Town on the UNESCO World Heritage Site list, they are turning to tourism.

Source: Penang Economic Monthly (2010), Yesterday, today and tomorrow: Weld Quay, Penang Economic Monthly January 2010, Issue 1.10.

Nonetheless, the World Heritage site is faced with many challenges. There are: *i*) attempts to violate the UNESCO-endorsed high limits with high rise development, *ii*) unapproved renovations that strip away heritage character, *iii*) illegal conversions of old houses into bird's nest breeders that pose a public health risk and *iv*) an accelerated gentrification process. While

property prices are soaring, growth has resulted in growing disparities and many have low wages.

UNESCO expects George Town to prepare a comprehensive conservation plan which takes into account the proper conservation of shop houses and adequate techniques of intervention. The city should also implement measures for decreasing motor traffic and controlling tourism pressures. A set of indicators for urban and architectural heritage components needs to be established. In order to maintain the World Heritage status, George Town needs to protect its "outstanding universal values" (OUV) including the trading settlements at the crossroads of civilisations, historic towns paces with a range of shop houses and townhouses and the hubs of living multicultural heritage. UNESCO expects George Town and Malacca to prepare their Special Area Plans by early 2011. The federal government has allocated RM 30 million for Malacca, but nothing for George Town. In Penang, the responsibility of the delivery falls to the Penang World Heritage Office, with the involvement of the Cultural Heritage Advisory Team, The Penang Heritage Trust and Universiti Sains Malaysia's School of Housing, Building and Planning. (Goh Ban Lee, 2009)

Tourism policies and their integration into local plans can be used to address intra-regional socio-economic disparities by developing complementary tourism products. An important challenge is to set up governance mechanisms to improve tourism's competitiveness and quality at the local level and to ensure coherence of policy development and implementation and balanced tourism development in the region.

5.3. Environment and sustainable development

The environment is a shared responsibility of the federal and state governments in Malaysia. Malaysia's expanding carbon footprint jolted the federal government into including green technology as part of the Ministry of Energy and Water's portfolio and into launching its National Green Technology Policy in July 2009. The Government is also committed to reduce carbon emissions by 40% within the next ten years, but may find this target may be difficult to reach due to increasing emphasis on Malaysia as a regional aviation hub and extensive private transport.

The State of Penang aims to become Malaysia's first green state and it is collaborating with the United Nations Environmental Programme (UNEP) to develop Penang Cyber City into an eco town to ensure that commercial activities to co-exist with nature in a sustainable manner. Under the guidelines set by UNESCO, Penang has also been committed to preserving itself as a World Heritage city and incentives are given to housing

developers to adopt the Green Building Index (GBI). The Penang Transport Council was established in 2009 to improve public transport by moving people instead of cars. Penang has also a focus on river cleaning efforts. The previous Penang Government commissioned an environment conservation strategy plan under its think tank SERI (Socio-Economic and Environmental Research Institute) but strategy plan was never adopted as policy.

Penang faces significant environmental challenges because of the fragility and limits of its island environment, rapid population growth and economic development. Traffic volumes and congestion, rampant and unsynchronised property development on hill slopes, floods, water pollution from industrial effluent and air pollution from high usage of private transport are some of the results of rapid growth. The main economic pillars of the Northern Corridor Economic Region – agriculture, manufacturing and tourism – rely on and impact the conditions and sustainability of the environment. A major issue is also the lack of integrated management of water resources, energy and waste. Sustainable practices need to be introduced to reduce the stress on natural resources in the region.

The municipality of Penang Island, which has jurisdiction over George Town, has been highlighted as one of the better performing local authorities in a survey conducted by the Ministry of Housing and Local Government. The municipality is concerned about the sustainable environmental development but lacks the instruments to implement a coherent environmental protection policy. It also lacks the capacity to conduct comprehensive impact analyses of investment projects.[4]

Penang suffers from severe traffic congestions. Public transport remains underdeveloped in Malaysia: only 10% of population take public transport, compared to 60% in Singapore. Only 60% of the population resides within 400 metres of a public transport route. In the past, the national policy has increased cars on the road in support of the local car industry. Instead of limiting private vehicles on the roads, elevated highways and additional bridges were built. Currently, Penang has 1.4 million registered vehicles. The Penang's Transport Council introduced measures including a Penang transportation masterplan encompassing land and water transportation, but the absence of public transport operators are not part of the council, limiting its impact.

Co-operation within the higher education community faces a number of constraints. There are a number of projects but no coherent planned initiatives. The only institute fully dedicated to environmental studies and sustainability is the Center for Global Sustainability Studies (CGSS) within Universiti Sains Malaysia, which has limited resources. Furthermore, while Universiti Sains Malaysia and some higher education institutions have a

focus on construction technologies, *i.e.* the infrastructure and "hardware" aspect of cities and urban life, they have neglected the software side *i.e.* urban studies and related questions such as city environmental protection and preservation of urban cultural heritage. The municipality has made efforts to create a chair for urban studies within the university that could have taken on board urban and environmental issues and amenity policy problem, but so far the university has not appointed a professor for this task. Given the importance of these issues in Penang, both the state and national government should define a comprehensive amenity policy strategy and launch initiative to leverage cultural assets. The national Ministry of Education could consider creating a school of environmental research in Penang so as to train students in those disciplines and to embark on research that will be useful for Pulau Penang and beyond in the Northern Corridor Economic Region.

Environmental sustainability and Green Growth

Universities and other tertiary education institutions can contribute to sustainable environmental development in their regions in many ways, for example by: *i*) generating human capital in the region through their learning and further education programmes in areas of sustainable development, *ii*) acting as a source of expertise through research, consultancy and demonstration, *iii*) playing a brokerage role in bringing together diverse regional actors and elements of capacity to the sustainability process, *iv*) demonstrating good practice through on-campus management and development activities, strategic planning, building design, waste minimisation and water and energy efficiency practice, responsible purchasing programmes and pursuing good citizen type initiatives like a "green campus" and *v*) offering recognition and reward incentives for staff to be involved in sustainable development leadership groups in the regional community (OECD, 2007).

Higher education institutions in Penang have taken steps to develop on-campus management and development activities, including building design, waste management and minimisation, and water and energy efficiency practice as well as recycling and tree planting. They have established environmental management units which disseminate information and organise a broad range of activities, including courses, seminars, debates, exhibitions and competitions, to raise awareness among the university community and general public about environmental sustainability. They also work with key stakeholders, including NGOs to identify lines of action in environmental sustainability.

Universiti Sains Malaysia (USM) has developed several ecological programmes including the healthy campus programme which is based on the "University in a Garden" concept.[5] The healthy campus programme embraces most of the university's sustainability activities and initiatives. The programme is based on volunteerism, research and evidence-driven activities, team-based and multi-disciplinary initiatives, in-sourcing (*i.e.* using the university expertise) and documentation of activities. Moreover, the university's transformation plan as the first APEX university is entitled "Transforming Higher Education for a Sustainable Tomorrow" reflecting the leadership commitment to sustainability. One of the key targets has been to establish a strong functional and institutional link between universities and communities locally, regionally and internationally.

Universiti Sains Malaysia is the secretariat for the Regional Centre of Expertise (RCE) for education on sustainable development which has received recognition by UNESCO/UNU and has brought together a wide range of NGOs, organisations and individuals engaged in sustainable development related activities at local, regional and international level. The university has also engaged in disseminating knowledge to the local community via training seminars and conferences. For instance, River Engineering and Urban Drainage Research Centre (REDAC) and the Department of Irrigation and Drainage Malaysia jointly organised trainings in compliance with national guidelines. This training has had direct impact on improving the design for nee developments and mitigating environmental degradation in the region (NHERI, 2010).

Universiti Sains Malaysia is also engaged in developing sustainable communities. The university's Centre for Education, Training and Research on Renewable Energy and Energy Efficiency (CETREE) provides school material in sustainability and runs a mobile unit that has introduced the issues of renewable energy and energy efficiency to 25 million school children in Malaysia and has carried out programmes to 150 000 members of public via community centres. The university has also engaged in awareness raising campaigns for example in terms of the importance of water resources and the impact of water pollution. Driven by university students, the "White Coffin Campaign" and "Say No to Plastic" have worked against the use of polystyrene and plastic on the university campus (MHERI, 2010).

Moreover, the Going Bananas project is an attempt by Universiti Sains Malaysia to use cross-disciplinary R&D projects to benefit the community and the environment by generating income for a village community in the Penang island from recycling banana trees into products such as specialty paper. Another example is the worm composting project, using the technology developed by the university in a community to turn waste into

valuable, ready to market chemical free compost. As a result the villagers' income increased by up to 100%. The same technology has been used in the university kindergarten.

In addition to Universiti Sains Malaysia, also other higher education institutions have built their capacity in sustainable development. For example the KDU college, one of the private higher education institutions, is active in promoting sustainability on campus and in the region. On-campus management and development activities have been developed as bottom up initiative and then adopted by the KDU leadership. KDU students have been actively involved in sustainability initiatives. For instance, in 2009, the KDU Student Council launched the Green Environmental Project encompassing Green Peace Fair, visits to recycling plants, environmental workshops (NHERI, 2010).

Despite the commendable progress, the contribution of higher education institutions to sustainable development in Penang has not yet reached its full potential. The current programmes are small in scale and fragmented among higher education institutions. Most of the actions are focused on demonstrating good practice through on-campus management and development activities, building design, waste minimisation and water and energy efficiency practice as well as pursuing small scale good citizen type initiatives. In most cases, no robust information is available on the outcomes of the various activities. There is scope for enhancing the training for green jobs, joint RDI efforts to support the development of renewable energies and green growth, and outreach activities to support energy efficiency in the regional industry.

Supporting eco-efficiency of the regional industry

Global greenhouse gas emissions are projected to increase by more than 50% by 2050, causing a significant increase in world temperatures. While climate change is a challenge, they can also be an opportunity to develop a more resilient and sustainable economy. It can encourage positive developments for regions, including increased efficiency in energy management, industrial production, spatial development, public and private transport, construction and operation of buildings and water management. Up-scaling the research and innovation effort may yield significant returns in local and regional development.

Deloitte's 2009 survey on Global Trends in Venture Capital reports that, despite the economic and financial crisis, 63% of venture capitalists anticipate an increase in their investment in clean-tech, the highest percentage among all sectors considered. Many of the new green technologies rely on local know-how, and generate new applications and

higher demand for technologies developed by other, "non-green" industries. For example, the design of the new, three-blade turbines in the wind-energy clusters of Aalborg and Arhus in Denmark was heavily influenced by the advances of the Danish agricultural engineering industry. These knowledge spillovers and technological branching of eco-innovation raise overall "inventiveness" of a region, and productivity and growth (OECD, 2011, forthcoming).

In the absence of a comprehensive regional approach and incentives, higher education institutions are less likely to make rapid progress in supporting sustainability and green economy. There is also a risk that the main beneficiaries of technology transfer from higher education institutions will be the large enterprises, delaying the market penetration of zero-emission as well as water efficient technologies. Positive outcomes would require concrete action to identify opportunities for change, to create innovations in water management and to make low-carbon technologies more attractive, and develop skills to make wider use of green technologies. International experience has shown that universities can play a key role in this arena through research and cluster-based development (See Box 5.10.).

Box 5.10. HEIs in supporting renewable energies and eco-innovation clusters

Eco-innovation clusters between government, industry and academia merge excellence in education, frontier research in environmental technologies and job creation through spin-offs, venture capital and integration of enterprises. The Lahti Cleantech cluster in Finland has encouraged innovation and development of environmental technologies by bringing together small and large enterprises, educational institutions and regional authorities. As a result, 170 new jobs have been created and the project has attracted more than EUR 30 million. In the Rhône Alpes Region in France, regional and national investments in R&D helped develop the Tenerrdis competitiveness cluster which develops clean technologies in construction, transport and energy production (Kamal-Chaoui and Robert, 2009). Knowledge Transfer Networks (KTNs) in the United Kingdom have been set up in eco-innovation to foster the growth of new green industries. 75% of business respondents have rated KTN services as effective; 50% developed new R&D and commercial relationships with people met through these networks; and 25% made a change to their innovative activities as a result of their engagement within KTN (TSB, 2010).

Box 5.10. HEIs in supporting renewable energies and eco-innovation clusters (continued)

Expertise in wind engineering and wind energy at the Danish Technological Institute and at Ålborg and Århus Universities is essential in the development of the Danish wind energy industry (Cooke, 2008). Similarly, patented research on improved pasture seed mixes (SugarGrass) at the Institute for Grassland & Environmental Research (IGER) has given rise to a dynamic bio-fuel cluster in the rural North Wales. Research in storm-water treatment at Monash University in Australia resulted in one of the most efficient technologies (Enviss) of porous pavement to capture storm-water which is now being commercialized by a spinoff firm (Enviss, 2010). Swinburne University of Technology in Australia collaborates with Suntech to develop the next generation of solar cells, expected to double the efficiency of current solar cells (SUT, 2009).

Source: OECD (2011), *Higher Education in Regional Development: For Stronger, Cleaner and Fairer Regions,* Paris, OECD, *forthcoming.*

Penang is building a renewable energy economy and also in R&D efforts that can position the region internationally as a leader in new renewable energy technologies. With respect to university participation in sustainable energy R&D, there are significant initiatives led by Universiti Sains Malaysia which has a pool of experts in various disciplines, research centres and laboratories in environmental studies and research. The university's expertise and facilities are in high demand among the local industries and agencies. The university's commercial arm of the university, USAINS Holding Sdn. Bhd. promotes university's R&D and expertise, oversees the rent of facilities, equipment and services and provides consultancy testing and analytical service as well as personnel training and development. The environmental testing and analytical services use the equipment and facilities of various schools and centres such as the Environmental Technology Division, School of Industrial Technology, School of Chemical Sciences, School of Physics and various schools and centres of the Engineering campus in Nibong Tebal, Penang. The university staff conducts environmental impact studies for various activities such as construction of dams and waste water treatment plans and flood mitigation designs. River Engineering and Urban Drainage Research Centre (REDAC) of the engineering campus has conducted research and consultancy projects on sustainable river management which include appraisals for the design of flood mitigation project in Sungai Muda and effects of sand mining of three rivers (MHERI, 2010). These services can also generate eco-efficiency *i.e.*

creating more goods and services while using fewer resources and creating less waste and pollution.

Despite progress made, there is scope for improvement in supporting technical, organisational and process improvements for eco-efficiency of the existing industry. Universities and other tertiary education institutions in Penang could also increase their co-operation with local or regional one-stop-shop agencies for business support. By training the trainers and other knowledge dissemination activities, universities could help these agencies acquire the specialised skills to advise firms on the cost-effective ways to reduce emissions. Furthermore, higher education institutions could assist in greening the SMEs in the tourism and the E&E industry. There is a rapid evolution of technologies and tools available to business to monitor the environmental sustainability of their production (*e.g.* sustainability audits) and undertake action to improve environmental performance (*e.g.* systematic use of life cycle assessments practices). With the help of them, the provision of technical assistance is now more carefully designed to build capacity within the firm, rather than substitute for it (OECD, 2011, *forthcoming*).

Creating skills for green growth

Jobs related to renewable energy and energy efficiency are projected to increase to several millions worldwide by 2030, most of these new jobs in a small number of innovative regions (OECD, 2009b). Human capital development is critical to enhance the opportunities for wide market penetration of renewable energy and low carbon technologies. Inadequate skills and poor quality systems may limit the growth of renewable energy technologies. Many national and regional governments are adjusting their skill strategies to address the emerging demand for new skills in the green industries, by introducing incentives to facilitate re-training and efficient mobility of learners between vocational institutes, universities and industries. Emerging green occupations will also require the creation of new industry-recognised credentials and training programmes, and modifications of training packages for workers in traditional occupations. The development of a green economy depends on the availability of skilled people to fill the new jobs related to renewable energy and energy efficiency. Simultaneous development of diverse skills and extensive retraining will be necessary. (OECD, 2011, *forthcoming*)

Green growth would appear as one of the fields for Penang to focus its workforce development. Skill creation and re-skilling activities in green growth centre around Universiti Sains Malaysia and the Penang Skills Development Centre which offers a certificate programme in water management. Penang could take steps to anticipate the employment effects

and labour reallocation needs across industries. Skill creation could be more efficiently organised by pooling learning resources of educational institutions and industries at the regional level, requiring collaboration across the university-vocational education divide. Stronger partnerships between tertiary education institutions and industrial associations could stimulate innovation in the modes of delivery of education and training. This would require transparent pathways between different levels of education and also between higher education institutions. In Penang, there is a lack of pathways between higher education institutions on the one hand, and between higher education institutions and vocational institutions.

Conclusions and recommendations

Higher education institutions play an increasingly important role in facilitating social, cultural and environmental development in Penang. They provide contributions to local development by providing training for health professions. Universities are making available for public access a wide range of culturally-specific programmes and infrastructure, such as museums, places of worship, libraries and sporting facilities. They contribute with education and community outreach to sustainable development, cultural vibrancy and alleviation of socio-economic problems. Faculty and students are engaged in outreach activities. Some activities are also carried out in rural communities, bridging the gap between the university and the society. The higher education institutions have also contributed to developing co-operative strategies that respond to issues that are difficult to address through inter-governmental co-operative efforts. Major achievements include the development of co-operative initiatives that address needs in the region, such as Universiti Sains Malaysia's efforts in sustainability and the AIDS Action and Research Group (AARG) which has become a national model. AARG has had notable success in uniting stakeholders and leveraging significant amounts of co-operation across agencies and institutions.

However, much of this activity is project-based and dependent on short term and unsustainable funding. Limited resources are often spread thinly and there is a lack of critical mass to generate comprehensive regional approach that would have real impact at the cross border regional level. Each institution has responded according to their own mission to the social, cultural and environmental needs. Collaborative mechanisms between the higher education institutions at the state level or Northern Corridor Economic region to build capacity and foster joint efforts remain limited in scope and representation. There is a lack of critical mass to generate projects

which have strong impact at the local and regional level. Inter-ethnic and inter-religious dialogue and collaboration remain limited.

There is a lack of systematic engagement of higher education institutions in Penang with the local city councils' and state government's work. This is evident for example in the UNESCO cultural heritage site development. Consultation process is in place with some universities and further education for civil servant is organised. The relationship with Universiti Sains Malaysia (USM) is most developed because of long-standing collaboration with the School of Housing, Building and Planning and the involvement of USM in the state think tank Socio-Economic and Environmental Research Institute (SERI). However, more needs to be done on both sides to establish a win-win relationship. On the higher education institutions' side, efforts should be undertaken to increase the visibility of connections that exist at individual staff level through incentives and rewards in order to increase the breath of co-operation and the involvement of students. Also, more publicity on community and applied research and teaching activities at departmental and school levels may help to get the message broadly spread and to generate interest in collaboration. At present, the impression is that the higher education institutions approach the city and state governments with proposals for collaboration in order to generate funding. The approach remains supply-driven and fails to address the needs of the region's long-term development needs.

There is scope for stronger partnership building to develop capacity and foster joint efforts for regional development. This is necessary to ensure that limited resources are not spread thinly and that the projects will generate multiplier effects. There is considerable potential in a number of fields, such as health and social development, green growth, cultural and eco-tourism tourism and long-term community development. This would entail mobilising universities' teaching, research and service functions and better aligning them with the needs of the region. Focus on "challenge-driven" research would ensure that Universiti Sains Malaysia is able to combine global excellence with local engagement.

Higher education institutions could develop and expand learning and skills development programmes, research activities and outreach efforts to support the region in its key development needs. The Ministry of Higher Education's new requirement to include work-based learning component to all study programmes can contribute to a curriculum development process that will help university-industry collaboration also beyond engineering and business fields and interdisciplinary collaboration. Currently, the development of these internship experiences is uneven across the universities and different disciplines. These internship experiences could be

extended to community-based organisations in the context of a university commitment to a wider range of regional needs.

To continue to deepen the universities contribution to the social, cultural and environmental development in Penang the OECD review team recommends:

Recommendations for the federal/national policy

- *Provide incentives for "challenge-driven" research to connect university research to community development*. In order to make the connection between the current research focus and a more broadly defined third mission, "translational research" could be adapted to address the critical issues that bridge the university and community.

- *Create a school of environmental research in Penang to train students in those disciplines and to embark on research that will be useful for Pulau Penang and beyond in the Northern Corridor Economic Region.*

Recommendations for the sub-national level

- *Apply the university expertise in health to develop strategies to increase the quantity and quality of health care provision in the region.* Use this expertise to develop the region as a whole as an internationally recognised centre of expertise and innovation on health care practices and technical innovations that improve health care outcomes of the population but also attract health tourism. Scale up medical personnel training. Support university partnership with medical schools and health care delivery systems that have implemented community-based medical education to boost innovation in medical education or new forms of health care delivery.

- *Provide competitive funds (with public and private support) dedicated to supporting a new research agenda and incentive funding for recruiting and training the region's population for health careers.*

- *In view of the importance of the environmental protection and preservation of urban cultural heritage in Penang, define a comprehensive amenity policy strategy and launch initiatives to leverage assets for cultural and gastronomy tourism with the help of university expertise.*

- *Create an integrated approach to address the challenges of rapid urbanisation and unsustainable construction projects and promote inter-ethnic initiatives.* Consider the development of a school of environmental research should be created and the awareness on conservation and preservation fostered through increasing links with local communities in the region.

Recommendations for the universities

- *Develop a forum for social, cultural and environmental development to build on strengths, to identify unexploited opportunities and to address the regional needs.* An exchange forum should be put in place to, track and monitor different initiatives and their outcomes and identify best practices for publication and policy fine-tuning. Such a forum could organise thematic events, with regular information retrieval and exchange facilitated by a dedicated website. As a first step, universities' current connections, initiatives and projects involving stakeholder collaboration, community development and/or outreach should be mapped and published in the collaboration platform.

- *Improve the monitoring and follow-up of the success and results of their initiatives, projects and programmes to show return on public investment.* The lack of robust and comparable data constrains the visibility and impact of universities' activities. It also makes it difficult to measure the success or failure of programmes. Building on the existing successful models, capacity should be developed in regional data gathering, and sharing regional data repositories and technical skills associated with using regional data.

- *Collaborate with authorities, schools and the private sector, reach out to socially underprivileged population to ensure social and economic cohesion.* Current activities need to be scaled up in a systematic way, including long-term multi-stakeholder collaboration to raise aspirations among youth in socially unprivileged population and to improve their quality of life.

- *Address regional health challenges in Penang and the Northern Corridor Economic Region.* University Sais Malaysia's health-related centres should widen their focus on community-based medical education and new forms of health care delivery as well as generation of innovations.

- *Provide advice and expertise for local planning and urban development by reactivating and revamping the USM urban studies*

within the university should be reactivated and revamped. This would facilitate training for local government and provide an opportunity to embark on consultancy services and to provide the skill basis for more proactive local government with strong commitment to sustainability. Basic foundations for stronger university involvement are already in place: the Universiti Sains Malaysia has issued a blueprint on housing and environment, while the Socio-Economic and Environmental Research Institute (SERI) is a useful think tank.

- *Collaborate with the public and private sector in Penang to increase joint efforts to support sustainable environmental and economic development through a comprehensive regional approach to growth management bringing together diverse regional actors to sustainability process.* Scale up their efforts to provide learning and further education programmes for "green" jobs and to act as a source of expertise through research, consultancy and demonstration. Provide analysis of the benefits and costs of controlling emissions from the wide variety of emissions sources, for example multinational corporations.

- Strengthen and develop interactions between higher education institutions and non-governmental organisations in order to maintain and enhance civic co-operation in Penang. *The role of non-governmental organisations in is critical and the higher education institutions are already in interaction with non-governmental organisations in connecting students with community learning opportunities.*

- *Engage in long-term community development seeking ways to empower communities to find their own solutions to various economic, social, cultural, environmental challenges which are global, national and local in nature. The* region should be seen as a "laboratory" for developing research, students' work-based and experiential learning and development projects in many different fields.

Notes

1. International tourist arrivals and departures at Penang International Airport showed unstable growth between 2007 and 2009, between 30 000 and 45 000 per month. The contraction of the national economy by 1.7% in the last quarter of 2009 notwithstanding, the figure jumped to 53 000 in the same period. With increases in the number of flights to and from Penang, inbound tourism has increased. For 2009, visitors from Indonesia and Singapore made up over half of the total international tourist arrivals at Penang Airpot. Travellers from mainland China, Hong Kong and Macau together contributed about 6.5%. Other major disembarkation countries for Penang arrivals were Japan (5.2%), Taiwan (4.7%), Thailand (4.1) and the UK (3.8) (Ong Wooi Leng, 2010).

2. According to the National Trust for Historic Preservation in the United States these benefits include: creating jobs and businesses, increasing tax revenues, diversifying the local economy, creating opportunities for partnerships, attracting visitors interested in history and preservation, increasing historic attraction revenues, preserving local traditions and culture, generating local investment in historic resources, building community pride in heritage and increasing awareness of the site or area's significance.

3. In Spain, to reduce seasonal variations in tourism, a project called Turismo Senior Europa has been launched to increase Spain’s winter tourism by showcasing the low-season potential of Spanish destinations to tap into a target public of over 100 million EU citizens in the 55-75 age bracket, 50% of whom have never travelled outside their home countries. This will be the driving force behind a revitalisation of the low season and an improvement of the sector’s profitability and sustainability.

4. Every land development project, including change of land or building use, has to be approved by the local authority and in the process go through the scrutiny if town planning officers. Most local councils also require that all applications, in the form of layout plans accompanied by town planning reports, must be submitted by town planners. In Penang, several structural plans exist for the island and Seberang Perai. Since 2007, these have been replaced by a state-wide structure plan. In Penang, only one –

Penang Hill Local Plan – has been prepared and gazetted. There is also a plan for Penang Island, prepared in 2005 but not shared with the public.

5. The University in a Garden concept governs the overall process of policy development and implementation within the USM campus. The idea is to develop the university based on the following "garden"concept: Garden and the People, Garden of Knowledge,Garden of Vistas, Garden of Nature, Garden of Heritage and Garden of Tomorrow. This metaphor has been translated into a Healthy Campus Programme which hosts most sustainable projects and activities of Universiti Sains Malaysia.

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Chapter 6.
Capacity development for regional engagement

This chapter discusses the role played by the state Penang's higher education institutions in relation to capacity development for regional engagement. It discusses the need to develop skills in order to meet current and foreseen shortages in emerging areas, as well as these institutions' modes and mechanisms of engagement to promote regional development. The chapter also explores the preconditions necessary for the successful promotion of local engagement in relation to these institutions. It concludes with recommendations for national and sub-national agencies as well as higher education institutions themselves.

6.1. Skill requirements for regional development

The State Government of Penang is continuing its efforts to maintain and develop economic resilience in the region. In its press release No. 1357, InvestPenang, which is owned by the State Government of Penang, indicated that while manufacturing will remain the main engine of growth in the region, the importance of emerging service sectors will be emphasised. The Penang State Government intends to turn the state into a high-income zone through the creation of well-paid jobs for Penang's "knowledge workers". This will necessitate a move towards a knowledge-based economy focused on high value-added activities such as research, design and development. The state will be relying on higher education institutions (HEIs) to realise these objectives and will be seeking their increasing engagement both in relation to research and accelerated skills development within the region.

Penang's economy had to grapple with a shortage of skilled labour in the 1970s, which led the state to depend, to a large extent, on migrant workers for its growth and progression. Migration has been both internal and international. Internal migration from the country's other less developed regions has possibly been higher than that from other countries. Consequently, the region's population has increased and its ethnic composition has changed.[1]

The shortage of skills continues to have a negative impact on the local economy and is becoming a major constraint to its growth and progression. Due to the paucity of skills in the region, the state has had to decline offers of foreign direct investment. The nature of skills demanded is also changing. While traditionally Penang depended on low-skill jobs in the manufacturing sector, the market has shifted and is now oriented towards service sector jobs, especially those related to tourism and electrical and electronic goods industries. Projections for future employment prospects indicate that more than 250 000 jobs will be created in the region by 2025 and over 60% of them will be in the above-mentioned sectors (Koridor Utara, 2010).

Skill requirements in these sectors will be higher than in the traditional manufacturing sector and it is expected that there will be a serious shortage of qualified labour in the areas of electronics and software. Malaysia also faces an additional challenge: that of the migration of highly qualified professionals to neighbouring countries. This further accentuates the problem of skill shortages in relation to regional development. The state is therefore counting on universities, other higher education institutions and

training centres to contribute to increase the supply of skilled personnel and thereby accelerate the region's capacity to develop rapidly.

6.2. The role of HEIs to enhance capacity for regional engagement

In Malaysia, public higher education institutions are established, financed and managed by the national government. Higher education institutions – and universities in particular – are therefore directly accountable to the federal authorities. Higher education institutions are, on the whole, more concerned with national development than with regional or local engagement. They are often vertically linked to reputed institutions located outside the region rather than with local institutions. However, this state of affairs is changing, and as of very recently universities and other higher education institutions are increasingly concerned with regional development issues. The general approach seems to be to sustain higher education institutions that are "globally competitive" but "locally engaged" (OECD, 2007).

The State of Penang has a large network of higher education institutions: in 2008, it counted 53 institutions. Twenty-two of them were public, while 31 were private. The higher education institutions differed in terms of the study courses and the qualifications on offer. Post-secondary institutions included, *inter alia*, community colleges, training institutes and medical colleges (Morshidi *et al*., 2010). Private higher education institutions can be established by individuals, corporations, or philanthropic organisations. Most of them are primarily financed by student fees. Students are attracted to these institutions since they offer courses which are of immediate relevance to the job market. In this sense, private higher education institutions respond more easily than their public counterparts to the demands emerging from local business and the industrial community. Thanks to the large number of higher education institutions in the state of Penang, the share of the population that has tertiary-level education has increased progressively. In 2010, among the four states of the Northern Corridor Economic Region, Penang had the highest share of people with post-secondary qualifications. This educated workforce has contributed substantially to the development of the region, although considerable skill gaps still exist.

The most important and influential institution in the region is the Universiti Sains Malaysia (USM). It was founded in 1969 and is the second oldest public university in Malaysia. The institution is funded by the national government and is accountable to the National Ministry of Higher Education. There are many other higher education institutions, including distance education institutions, which cater to national requirements and

attract students from all over the country. Universiti Sains Malaysia, although it is located in Penang and its main campus is in Gelugor, has its engineering campus in Seri Ampangan in Seberang Perai and its medical faculty is in Kelantan. In 2006, USM became one of Malaysia's four research-intensive universities, and in 2008 it became the only national institution to be granted APEX (Accelerated Plan for Excellence) status.

Penang also has a branch campus of the Universiti Teknologi MARA (UiTM), a private medical college, two public polytechnics and a large number of other types of private colleges. The state also has technical institutions, training centres and open universities offering distance education courses in the private sector. Some of these institutions directly cater to the needs of the region. For example, the Penang Medical College (which was established in 1996 in collaboration with several universities in Ireland, the Wawasan Open University – which promotes adult learning) – and the Disted College, owned by the Wawasan Education Foundation) provides training for young people according to industrial and community requirements.

Many higher education institutions in Penang have good relationships with the local industrial sector, national institutions and international organisations. In some of the private institutions, personnel from the industrial sector participate in the teaching of courses in an effort to make them more relevant to market needs. Certain institutions – such as the Penang Skill Development Centre (PSDC) train youth in function of the regional labour market. There are also several research institutions and organisations located in the region. The Socio-Economic and Environmental Research Institute (SERI) is one of the important institutions that focus their activities on sustainable development in the Penang region.

6.3. HEIs' modes of engagement in favour of local capacity development

In Penang, capacity development for local engagement is facilitated by higher education institutions through different modes: *i*) study programmes, *ii*) research activities, *iii*) direct services and *iv*) advisory services to extend expertise.

Study programmes

Universiti Sains Malaysia has introduced study programmes that link graduates with local labour markets, the business community and industry. Apart from the courses offered, students from different departments have the possibility to carry out field surveys and market surveys as part of their

study programme and on a voluntary basis. These activities, irrespective of the programme they follow, are a useful means to change the students' mindset and orientation and bring them closer to the local community. In general, however, only a proportion of students benefit from these arrangements.

Close links with the industry and business sectors are maintained by the Penang Skill Development Centre (PSDC), a non-profit organisation, which was established in 1989 as a tripartite institution between the industrial, governmental and academic worlds in order to meet the growing demand for skills emanating from local businesses. The PSDC has a membership of around 150 companies. Over a period of three years, the PSDC has trained more than 150 000 participants and prepared them for professional life. The organisation provides training mainly to improve technical and engineering skills. It offers courses leading to various levels, such as: *i*) certificate, *ii*) diploma, *iii*) bachelor's degree, *iv*) Master's degree and *v*) doctoral degree. The degrees are awarded by the Multi-media University of Malaysia. Apart from the training provided in technical and engineering areas, the PSDC also provides language training to improve the employability of the trainees in the business sector, since on the whole graduates have a poor level of English. Despite its 20 years of existence, PSDC operates at a distance from most of the higher education sector.

Thanks to policies implemented by the Northern Corridor Economic Region (NCER), a development plan which encompasses four states and whose aim is to turn these into world-class economic regions by 2025, efforts are being made to develop technical and vocational institutions. Priority is given to acquiring skills in agronomy, engineering, equipment maintenance, handicraft design and production and culinary skills. The key strategy adopted to expand skills development is to rely on the private sector – Corporate Social Responsibility (CSR) – to improve access to, and the quality of, the provision of higher education, and to produce a more highly skilled workforce for the local economy. NCER's strategy also involves the "Adopt a School" programme (Koridor Utara, 2010), which identifies disadvantaged schools which can be "adopted" by the corporate sector. NCER also includes strengthening the vocation emphasis of learning process in pre-university education.[2]

Another illustration of efforts to link institutions with the local needs of Penang concerns the post of Chair of Urban Studies in Universiti Sains Malaysia. The Chair of Urban Studies used to be funded by the State Government of Penang, and a professor occupied the position until 1985. Following the professor's retirement in 1985, the position of Chair of Urban Studies in Universiti Sains Malaysia has remained vacant for various

reasons. An effort is currently under way to revive the post and recruit a suitable person as professor of urban studies.

The general feeling among local authorities, especially among the authorities of Penang municipality, is that they have a limited role to play in higher education, since higher education institutions are for the most part the direct responsibility of the Ministry of Higher Education (MOE). Education is not an important element of the municipality's activities and budget. At times, therefore, it is difficult for the local authorities to approach higher education institutions to help them in their regional development efforts. This does not imply, however, that they do not co-operate on issues of mutual interest.

Research programmes

Many university research programmes are directly relevant to the way regional and national policies and plans are shaped. The poverty studies carried out by Universiti Sains Malaysia in the 1980s were not only useful at the regional level; they were also useful for developing anti-poverty strategies at the national level. These studies were carried out by the Centre for Policy Research which Universiti Sains Malaysia established in the 1970s and which was funded jointly by national and local governments. During its early years, this centre contributed to the development of a national integrated data system, analysing social problems of migrant women workers, for example.

The Northern Corridor Implementation Authority (NCIA) was established to optimise infrastructure in the region. Three ministries – those of Human Resource Development (MHRD), Higher Education (MOHE) and Education (MOE) – participate in the NCIA. Universiti Sains Malaysia supports the NCIA by conducting studies focusing on the electrical and electronic (E&E) industry in the Northern Corridor Economic Region.

Recent efforts to link research, development and commercialisation (RDC) have led to the creation of a science and arts innovation space known as sains@usm. The sains@usm space provides a private customised space for entrepreneurs, investors and scientists within a secured area. The research and business development integrated community known as sains@usm Bukit Jambul specialises in incubator laboratories and nurtures start-ups from USM's research community.

To maintain Malaysia's leading position in the production and export of rubber, USM launched research in decoding the rubber tree genome (CCB@USM). CCB@USM intends to develop fundamental research in chemical biology and to transfer innovative technology through partnership.

Its first breakthrough was to produce the rubber tree genome, and it was the first in the world to do so.

Box 6.1. USM collaboration with NCIA

The Centre of Excellence (COE) for Electrical and Electronics Integrated Circuit Design Industry was officially launched in July 2009 when a MOU was signed by the USAINS Holding Sdn. Bhd. and NCIA. The COE brings together industry leaders and university resources for the growth of E&E. This is the first joint venture between USAINs and NCIA. It aims to nurture active research collaboration and business co-operation among academia, industry and local enterprises. The COE initiated a Northern Corridor Analogue and Digital Design (NCAAD) Programme which started in February 2010. The centre is also planning to offer a Master of Science programme in micro-electronics in collaboration with the Electrical and Electronic engineering department of USM.

The Division of Industry and Community network (BJIM) collaborates closely with NCIA through academic staff attachment programmes, which enables USM staff to gain experience and expertise with regard to the latest trends and future orientation of industry.

The NCIA is planning to establish sector-specific tertiary institutions, including schools for hospitality and tourism, business management, high technology manufacturing and industry; it also intends to set up vocational schools and invest in research centres. NCIA is not only depending upon existing HEIs, but also plans to expand the network of HEIs in the region.

Source: USM, 2009; USM, 2010a; Koridor Utara, 2009.

The Socio-Economic and Environmental Research Institute (SERI) was established in 1997. It focuses its activities related to sustainable development in Penang. The institute works in close collaboration with Penang state governments, municipal councils and local councils. The SERI has undertaken to prepare a Penang Blueprint 2011-15 to make Penang globally competitive.

Direct services

Higher education institutions are directly involved in community development activities for example in health and social fields. The health services are good examples of such engagement. For example the Advanced Medical and Dental Institute (AMDI) of the Universiti Sains Malaysia

works directly with the community, although its mandate, especially in research, is national rather than regional. It has engaged in various activities to improve community health in the region, providing out-patient treatment. This collaboration is, however, likely to decrease with the current research focus. The AIDS Action and Research Group (AARG), hosted by Universiti Sains Malaysia, provides information and educational training on all aspects of HIV and AIDS. It works to mitigate HIV and AIDS infections and fights stigma and discrimination associated with the pandemic. It organises programmes, workshops, seminars, fora, exhibitions and dialogues about HIV and AIDS to raise community awareness. USM students also actively campaign against drug use, in favour of smoke free-zones, and promote peace. (See Chapter 4).

Efforts to link educational institutions within the region include the establishment of Regional Centres of Expertise (RCE) on education and sustainable development in Penang. RCE's mission is to build capacity to deliver, support and generate innovative education for sustainable development in Penang. This will be achieved by working with partners and developing a co-ordinated communication and dissemination framework for regional economic and social development projects and programmes. Universiti Sains Malaysia is one of the organisations involved in this effort. Potential actors include the Department of Environment, Penang State Government, the Municipal Council and NGOs such as SERI. Furthermore, USM's Centre for Education, Training and Research in Renewable Energy and Energy Efficiency (CETREE) promotes community services in relation to energy efficiency. It has a mobile unit to provide advocacy to school children on the themes of sustainability to operate more effectively.

An off-shoot of Universiti Sains Malaysia, the Industry and Community Network (BJIM), was created in 2007 to accelerate engagement with the local community and industry. BJIM has established partnerships with industry through academic staff attachments, as well as collaboration with many agencies including the Northern Corridor Implementation Agency (NCIA). The BJIM also encourages community-based participatory projects and research. For example, it funded nearly 60 community projects over 2008/09. These projects covered themes such as drug and tobacco abuse, family health, culture and heritage, environmental conservation, community empowerment etc. (USM, 2010a and 2010b). One of the collaborative projects linking with a local government was targeted at eradication of Dengue fever (see Box 6.2) The conference organised by BJIM in 2009 in collaboration with the Global Alliance for Community Engaged Research (GACER) and UNESCO-APEID was a successful initiative to empower the local community by conducting research in university community

engagement through networking between industry, government agencies and NGOs.

Box 6.2. Eradication of Dengue Mosquitoes: a collaborative project with the Subang Jaya Municipal Council

The Subang Jaya Municipal Council is keen to eradicate Dengue mosquitoes in the region so as to avoid frequent outbreaks of Dengue. It initiated a bilateral research project with Universiti Sains Malaysia (USM) to prevent Aedes Egypti (the mosquito species that spreads Dengue) from breeding, using chemical and biological methods. The latter focus mainly on breeding Toxorhynchites Splendens, which are another species of mosquitoes that feeds on the larvae of Aedes Egypti. This experiment may be extended to other regions that are affected by outbreaks of Dengue.

Source: USM, 2010b.

Another example of community linkages with the higher education system is the incubation services and space provided by universities, such as Universiti Teknologi MARA (UITM) and the UILC.

Expert and advisory services

Universiti Sains Malaysia staff are members of the Arts Education Working Committee of the Penang State Education Department. USM is the Secretariat of the Regional Centre for Expertise (RCE) for education and sustainable development, the Centre of Excellence (CoE), E&E and also the USAINS Holdings and Northern Corridor (NCIA). Similarly, staff members from Universiti Sains Malaysia and other higher education institutions work on advisory capacity in many committees at the regional level.

6.4. Mechanisms of engagement with local community

As discussed above, The Penang Skill Development Centre (PSDC) has developed a broad portfolio of mechanisms that bring together the industrial sector, the government sector and academic institutions. It provides training in technical and engineering skills in particular. Graduates from PSDC are directly engaged by the companies that need the skills developed by the centre.

Universiti Sains Malaysia, through its various research and study programmes, is formally linked to activities concerning regional

development. While the contribution of BJIM, USAINS Holdings Sdn. Bhd. and the centres of excellence are formal and direct mechanisms of engagement with industry and local community, there are also examples of collaboration with other agencies to promote regional development. For example, collective work between Universiti Sains Malaysia, the Malaysian Institute for Accounts, and the Malaysian Accountancy Research and Education Foundation provides detailed reports on small and medium-sized enterprises (SMEs), which can be a reliable basis for designing and offering training programmes.

Universiti Sains Malaysia collaborates with Motorola in a staff exchange programme to familiarise staff with the industrial sector. Collaboration with Universiti Sumatara Utara and Prince Songkla University, Thailand, facilitates the exchange of expertise in regional development in the context of the Indonesia–Malaysia–Thailand Growth Triangle (IMT–GT), which aids the exchange of ideas, experience and skills transfer. There are also examples of collaboration in relation to training programmes. For example, joint work with Intel Technology Sdn. Bhd. provides training in the application of software and tools related to multi-course architecture. In collaboration with the Penang State Government, courses on oral and written English are offered to the support staff. Furthermore, the school of computer sciences works in close collaboration with several industries such as Intel Penang and the Software Consortium of Penang. This collaboration involves providing industrial training to students and training staff from other institutions.

6.5. Conditions for successful regional engagement for capacity development

Sustainable engagement between higher education institutions and regional development requires: *i*) recognition of the need for such engagement as expressed by the local authorities and the community, *ii*) mechanisms to establish linkages between higher education institutions, *iii*) organisational arrangements to link higher education institutions with local activities, *iv*) incentives for higher education institutions and their staff for regional engagement, including financial support and *vi*) institutional leadership.

A distinct need for engagement, as expressed by the local authorities and community

Although in Penang the distinct need for engagement has been expressed in several fora, it is rarely articulated in regional or institutional

plans. For example, it was reported that the Chief Minister of Penang had had to decline an offer to invest MYR 10 billion because there were not enough skilled workers, especially engineers, to meet needs. In 2010, there were 4 204 vacancies and only 2 297 unemployed people registered in Catch Centres (career assistance centres in Penang). The region feels the deficit in human resources as a major constraint to progress. However, there are no plans to fill the skills gap in the immediate future. The State Secretary also pointed out that there is a mismatch between the research priorities set by higher education institutions, the research activities carried out by the staff of higher education institutions, and local needs, especially when their funding comes from the national government.

What is needed is a way for the government to incorporate these concerns into regional plans, and also that they be reflected in the institutional plans of the higher education institutions in the region. In fact, there is a need to clearly map out the regional needs and requirements on the one hand, and what higher education institutions can offer on the other. Such exercises will help in orienting, if not directing, the activities of the regions and of the universities and other higher education institutions in a more harmonious way. The university and the business community may have a broader mandate that surpasses the regions in their area; however, a clear articulation of what can be expected and provided will help develop mutually beneficial linkages. The state government should ideally be in the driving seat in this regard.

In order to mobilise the full potential of the higher education sector in regional development, it is important to build links, on the one hand, between universities and research institutes and, on the other hand, with universities of applied sciences and with small and medium-sized enterprises. This also necessitates a joint effort by all higher education institutions to follow a well-articulated plan of action that provides a framework for local engagement.

Mechanisms to establish linkages among higher education institutions

Inter-institutional co-operation and collaboration of higher education institutions need to be strengthened. At times, the institutions are funded by one set of agencies and managed by another set. Some institutions are small and recent, while others are old and well established; some are private, while others may be public. These institutions cater to the local labour markets through their education and training programmes. Many of them do not have institutionalised mechanisms of establishing these linkages, as in case of Penang Skills Development Centre and Universiti Sains Malaysia.

Universiti Sains Malaysia has mechanisms with which to encourage and promote linkages with local industries and the community. Penang Skills Ddevelopment Centre is closely linked to the business community and its skill requirements. However, in many instances there is a lack of formal mechanisms to strengthen linkages between higher education institutions and the local and regional community.

There is a need for institutional leadership to articulate and facilitate such interaction. One of the reasons for the absence of such co-ordination is a lack of a lead organisation or leader in the region. This is not the case in Penang. USM is not only a well-established prestigious institution; it remains unchallenged as a leader in the region and would have the capacity to play a stronger role in regional development.

A list of the local authorities' needs and a plan detailing the university's action plan in favour of regional causes needs to be drawn up. Areas where the universities' or higher education institutions' support is required also need to be identified. Higher education institutions' need to commit to developing sustainable local engagement; in fact this is a weak point and greater efforts need to be made in this area.

Another related issue is the lack of clearly earmarked funding for activities related to local engagement. It is a serious drawback to initiating and sustaining such activities. Furthermore, in the absence of strong incentives, there is a risk that the various initiatives that have been started may not be sustained in the long term. Funding support needs to be created in order to encourage such activities. There are examples around the world where universities are provided with such funds that give them enough freedom to co-operate with each other and undertake joint activities to promote regional and community development.

Organisational arrangements to link HEIs with local activities

As regards managing higher education institutions' interaction with the region, it may be preferable to establish a regional office at the university level; Purdue University in Indiana, USA, and the University of Newcastle, UK, for example, have established regional offices and have helped build on individual commitments to institutional capacity (OECD, 2007). Similarly, recruitment, hiring and reward systems should reflect a commitment to regional engagement, which in turn needs to be recognised as a scholarly practice. Some universities, such as the University of the Sunshine Coast, Australia, have introduced a system of promotion which takes into account applicants' regional engagement activities (OECD, 2007).

Penang does not have a mechanism to regularly review arrangements for engagement between the region and higher education institutions, although some institutions may have limited arrangements for engagement with local organisations or industries. For example, in Universiti Sains Malaysia, engagements between the university and the region are co-ordinated by the Industry and Community Network (BJIM), and in the Universiti Teknologi MARA (UiTM) this responsibility is assumed by the UILC.

A company called USAINS Holding Sdn. Bhd. provides another link between the industrial sector and Universiti Sains Malaysia. Although USAINS is owned by the university, it operates as if it were in the corporate sector and contributes revenues to USM through its income-generating activities. For example, in 2009 USAINS received consolidated revenue of MYR 23.6 million. The revenue generated by USAINS is an indication of the increasing number of requests addressed to USM by the private sector for contract research as well as courses, seminars and other services.

Box. 6.3. USAINS Holding Sdn. Bhd.

USAINS – the corporate arm of USM – is made up of Usains Holding Sdn. Bhd. and four subsidiaries It started off as a centre for innovation and consultancy and over the years it became a holding company. The USAINS group has been striving to increase its client base and chart out new areas of business activities that could benefit USM. It has succeeded in expanding its own independent client base among the local business community, multi-national corporations and SMEs. In the process it has diversified its activities, although the mainstay of the company continues to be the provision of contract research, development activities, courses and seminars, which together account for nearly 80% of its activities in 2009.

The group's income increased from MYR 23.6 million in 2000 to MYR 23.6 million in 2009. This rise is mainly due to increased demand for contract research, courses and seminars, an increase in income from sub-letting office units and equipments and new business activities through its subsidiaries.

The company distributed a dividend of 6% in 2009. The operation of USAINS represents a major success for USM in generating income and enabling its staff to supplement their salaries by commercialising their professional services.

Source: USAINS, 2009.

Incentives for institutions and individuals for regional engagement

In Malaysia, as in many other countries, higher education institutions are not given specific regional development tasks and this is left to the individual institutions' initiative. For research-intensive universities, the principal driver is scientific excellence. In the case of federally funded research institutes, they are under less pressure to be attentive to city development since they are profiled to respond to national needs. Furthermore, there is no formal process for monitoring outcomes and assessing the impact of local engagement. In some instances, development agencies engage in regular dialogue with university rectors in the region but there is no appropriate follow up.

Universities and other higher education institutions in Malaysia need greater incentives to fully engage in regional development. Currently, the work they carry out in a regional context does not count amongst the criteria applied to assess their performance. Universities are often assessed and ranked on the basis of research contributions. As a result, a considerable amount of university research is theoretically-oriented and in some cases only moderately relevant to the local community. Furthermore, universities are often primarily concerned with their contribution to national development and international linkages.

Currently, public resource allocation criteria for higher education institutions in Malaysia do not give adequate emphasis to regional engagement. Unless this becomes a regular element of ongoing planning and is accepted and approved by the authorities, it can be difficult to ensure a regular flow of resources to sustain activities related to local engagement. Again, even when universities are owned and operated by the national government, it is important to have budgetary provision for institutions' regional engagement. This not only provides the needed financial support, but also orientates the institution's activities.

The issue of incentives is also important at the individual level. Currently, the criteria for staff recruitment and promotion in Penang higher education institutions do not sufficiently encourage activities related to local engagement. At present, staff members consider that their responsibility in terms of teaching and research is more relevant to national needs than to regional requirements. This attitude may change when performance evaluations take into account their contribution to local engagement as is planned in Universiti Sains Malauysia. The Universiti Sains Malaysia has taken steps to introduce a "3-track promotion exercise" based on research, teaching and community engagement or industry collaboration to reward and incentivise community engagement and entrepreneurship support. This

development is commendable and should be strengthened with other incentives.

Institutional leadership

Finally, in all these instances, entrepreneurial institutional leadership within higher education institutions is needed to help mobilise the academic community and administrative services in support of city and regional development. Leadership on the part of the regional authorities is equally important to clearly articulate where the regional development needs are and where support from educational institutions can be most effective.

Conclusions and recommendations

Although in Malaysia the state governments do not have any significant role to play in the creation and management of higher education institutions, they rely on the higher education institutions for their development needs, *i.e.* in relation to research, skills development and training. Higher education institutions in turn are engaged in regional development in several ways. However, the nature of the engagement between higher education institutions and the local development authorities is very often informal and voluntary and driven by entrepreneurial academics or departments rather than higher education institutions. This relationship should be developed and formalised in order to make it more effective and proactive.

The State Government of Penang needs to define its development requirements from the higher education institutions operating in their region so that these can respond more effectively to needs. At present, there are limited mechanisms with which the state government can express its expectations in relation to higher education institutions. The same is true of the local government in relation to higher education institutions.

Recommendations for the national policy:

- *Make regional engagement and its wide agenda for economic, social and cultural development explicit in higher education legislation and policy.*
- *Provide incentives for higher education institutions' regional engagement in the form of long-term core funding and strategic incentive-based funding schemes on a competitive basis.*
- *Strengthen higher education institutions' accountability to society by developing indicators and monitoring outcomes to assess the impact*

of the higher education institutions on regional performance. Include the contribution of higher education institutions to local and regional development in their annual evaluations.

Recommendations for sub-national level:

- *Establish a partnership structure of key stakeholders from local and regional authorities, business and industry, the community and higher education* to provide a focus for dialogue with higher education in relation to its contribution to regional development and identify and develop leaders within the public and private sectors to populate this partnership structure.

- *Develop a clearly articulated long-term integrated strategy to drive the economic, social, cultural and environmental development of the city and the state.* Mobilise the resources of higher education institutions in the preparation and implementation of regional and urban strategies.

- *Mobilise university expertise for regional development by establishing Chairs in areas of special needs or opportunities. Help identify areas of research for regional development*.

- *Invest jointly with higher education institutions in programmes which bring benefit to regional businesses and community,* for example translational research facilities which are aligned with the needs and opportunities of the region, advisory services for SMEs, professional development programmes, graduate retention and talent attraction programmes.

Recommendations for universities

- *Building on existing links and initiatives that align higher education institutions with the regional needs develop a common vision of local and regional development among higher education institutions,* support the vision with a strategy and milestones and funding in order to ensure that local engagement is part of higher education institutions' activities and reflected in their development plans.

- *Establish a permanent partnership organisation with own staff and resources to link all higher education institutions in Penang* in order to undertake substantive collaborative projects and programmes that address regional needs and opportunities.

- *Review staff recruitment, hiring and reward systems so as to include the regional development agenda.* Create mechanisms to systematically

monitor and evaluate the activities in this area, to share good practice within their institution and benchmark this experience with other organisations and localities.

- *Develop senior management teams to deliver the corporate* response *expected by regional and local stakeholders without disincentivising entrepreneurial academic.*

Notes

1 . Between 1970 and 2010, the share of the Malay population living in Penang increased from 30.6% to 43.0%. Meanwhile, the share of Chinese and Indian populations in Penang shrank from 56.3% to 41% and from 11.6% to 9.5% respectively.

2. One of the NCER programmes involves extending vocational training to young people under the age of 18. Companies in the region will be invited to interview potential employees and identify areas of skills training which the identified candidates need. They will be given training as appropriate, after which they will be hired by the companies in question. Another NCER programme targets secondary school students by introducing vocational courses within study programmes. Students will be able to opt for basic subjects, such language tuition and mathematics, and devote the rest of their study time to learning vocational skills destined to help the development of the rural economy. The NCER works in conjunction with the Ministry of Education and is in the process of developing an appropriate curriculum for these study programmes.

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Annex I: Review Team Members

Jaana Puukka leads the OECD work on Higher Education and Regional and City Development. She joined the OECD Programme on International Management in Higher Education (IMHE) in 2005 to co-ordinate and manage the first round of OECD Reviews of Higher Education in Regional Development which took place in 2005-2007 and embraced 14 regions in 12 countries. She is leading the second round of reviews in 2008-10 which is reaching out to 14 regions and city-regions in G8 countries and emerging economies. She is the co-author and editor of the OECD publication "Higher Education and Regions – Globally Competitive, Locally Engaged" (OECD, 2007). Before joining the OECD, Puukka had experience in higher education and regional development in Finland as a national and local government adviser, programme manager, practitioner and evaluator. She has management experience from both the university and polytechnic sector and has worked in university internationalisation, PR & communication and stakeholder management. In addition, she has experience in the corporate sector in the pharmaceutical industry.

Patrick Dubarle, former Principal Administrator at the OECD Public Governance and Territorial Development Directorate (GOV), has co-ordinated and contributed to a number of OECD territorial reviews at the national and regional level and has recently participated in the regional innovation reviews in Italy and Mexico. In 2004-2007 he represented GOV in the OECD project on supporting the Contribution of Higher Education Institutions to Regional Development and coordinated the review of the Mid-Norwegian region. Patrick Dubarle is a graduate from the French *Ecole des Mines*, and holds a Master's degree in Economics from the University of Paris Sorbonne. He joined the OECD in 1978 as Administrator in the Directorate for Science Technology and Industry. He was appointed Secretary of the OECD Working Party on regional development policies in 1992, where he was responsible for country regional policy reviews and horizontal programmes. He has worked with national governments in many OECD countries and has spoken at several international conferences. He is the author of documents on high technology policies and sectoral questions

including space industry, technological change, technology fusion, innovation and higher education in regional development.

Aims McGuinness is senior associate with NCHEMS, a private non-profit policy center in Boulder, Colorado. At NCHEMS, he specialises in state coordination and governance of higher education and advising state governments on long-term strategies to improve the effectiveness of their education systems and linking education to the state's future economic competitiveness and quality of life. Prior to joining NCHEMS in 1993, he was a senior staff member for 17 years at the Education Commission of the States (ECS), one of the principal sources of policy advice on education reform for state governments. On the international level, he has served as examiner for Organisation for Economic Co-operation and Development (OECD) reviews of education policy in the Dominican Republic, Egypt, Estonia, Ireland, Korea, Latvia, Lithuania, the Russian Federation, and Turkey, He is currently a consultant to the World Bank on governance of technical/engineering in India. He was general rapporteur for the September 2007 OECD International Conference, *Globally Competitive, Locally Engaged*. McGuinness earned his undergraduate degree in political science from the University of Pennsylvania, an MBA from The George Washington University, and a PhD in social science from Syracuse University (Maxwell School).

Andrea Hofer, a German/Italian national, joined the OECD in spring 2004 and works as a policy analyst in the areas of local governance, employment and skills, and entrepreneurship, innovation and SME development at the LEED Trento Centre for Local Development in Italy. She has managed several country reviews and pioneered capacity building activities around local governance and entrepreneurship development. Before joining the OECD, Hofer undertook research and local policy development projects on decentralisation, local governance and public administration reform issues at the University of Federal Armed Forces in Munich, and at the United Nations (UNDP and UNODC). She holds a MA degree in Political Science from the Ludwig-Maximilians University in Munich and a MSc degree in Agricultural Engineering/Rural Development from the Technical University of Munich. She has written several articles and book chapters on local governance in transition economies, policy frameworks for local entrepreneurship and innovation support, the role of universities in local economic development, and the impact of outmigration on skills and business sector development. She is pursuing doctoral studies on the impact of local governance on local economic development.

N.V. Varghese holds MPhil and doctorate degrees in Economics of Education (Educational Planning). He was Professor and Head of Educational Planning at the National Institute of Educational Planning and

Administration (NIEPA), New Delhi. He was also responsible for the Asian Network of Training and Research Institutions in Educational Planning (ANTRIEP) and was editor of its Newsletter. Since joining the International Institute for Educational Planning (IIEP/UNESCO) in 1999, he was Head of Training and Education Programmes, Head of Higher Education and Specialized Training, and is currently Head of Governance and Management in Education. He has directed several projects and published many books and several articles in the area of management of higher education. His recent publications include a book on *Higher education reforms: Institutional restructuring in Asia* (IIEP/UNESCO, 2009).

Hena Mukherjee studied at the University of Singapore, University of Malaya, and Harvard University. She was founding Head of the Department of Social Foundations at the Faculty of Education, University of Malaya in Kuala Lumpur, Malaysia. She has vast experience working and consulting with several international agencies including the Commonwealth Secretariat, UK, the World Bank and UNESCO as well as institutions such as the National Institute of Educational Research in Tokyo, Japan and Boston University, USA. Focusing on developing and managing basic and higher education reform programmes, she is currently an education consultant working with governments and institutions in South Asia as well as East Asia.

Annex II: Programme of the review visit

OECD REVIEW VISIT TO THE STATE PENANG REGION ON 16 – 21 MAY 2010

Sunday 16 May 2010

18:00 **OECD Review Team Internal meeting**

20:00-21:30 **OECD Review Team Meeting with Regional Co-ordinator and panel of experts**

- Morshidi Sirat, Regional Coordinator, National Higher Education Research Institute, Universiti Sains Malaysia

Monday 17 May 2010

9:30 - 10:30 **First Group -Visiting the students Centre, Universiti Sains Malaysia**

- Students that involved in Contest on Research and Innovation International level (NRIC)
- Fadzilla Bosman, Assistant Registrar (Activities and students development) , Universiti Sains Malaysia
- Marimuthu P. Ratnam, Assistant Registrar (International Students relationship), Universiti Sains Malaysia

Second Group- Visiting Institute for Postgraduate Studies, Universiti Sains Malaysia

- Postgraduate students – meeting up local and international students as well

11:30-1:00 **Penang secterary Office/ State Economic Planning Unit**

- Zainal Rahim Seman, Penang State secretary
- Nazrul Aziz, Assistant Director Head of State Economic Planning Unit
  Nor Farahani Saad, Assistant Director, Department of Research & Development, State Economic Planning Unit

14:30-17:00 **Science and Arts Innovation Space (Sains@USM)**

- Zainul Fadziruddin Bin Zainudin, Director of Innovation Office, Universiti Sains Malaysia
- Hasannudin Saidin Chief Executive Officer, IXC Malaysia Berhad

20:15-22:00 **Principal Officers of Universiti Sains Malaysia**

- Ahmad Shukri Mustapa Kamal, Deputy Vice-Chancellor, (Academic & International Affairs), Universiti Sains Malaysia
- Tuan Haji Azman Abdullah, Registrar, Universiti Sains Malaysia
- Puan Hjh. Salmiah Che Puteh, Bursar, Universiti Sains Malaysia
- Mohd Pisol Ghadzali, Chief Librarian, Universiti Sains Malaysia
- Muhamad Jantan, Director of Corporate & Sustainable Development Division, Universiti Sains Malaysia

Tuesday 18 May 2010

9:00 – 12:00 **Penang Municipal Council/Seberang Perai Municipal Council**

- Patrick Khoo Poh Aik, Director of Management Facility, Penang Municipal Council
- Nur Faradilla Bt. Fahrudin, Deputy Director
- Ir. Ang Aing Thye Municipal council secretary
- Riduan Merican bin A. Aziz Merican Senior Director Assistant (Public Relations)

14:30 – 17:00 **Penang skills Development Centre (PSDC)**

- Dato Boonler, Chief Executive Office, Penang Skills Development
- Lim Wei Chen, General Manager
- Mohd Yazid Osman, Senior Executive Officer, Corporate and Public Relations

Wednesday 19 May 2010

9:00 -11:00 **Penang's Stakeholders & SER Writers**

- Fatimah, Manager special projects, SERI
- Muhammad Nurazli Razali, Senior Vice President, Education Human Capital of NCER
- Foo Toh Wah, Head of Divison (Training Programme) Department of Education
- Associated Professor Suriati bt. Ghazali, School of Humanities, USM, chapter 1 writer
- Sharifah Rohayah Shaikh Dawood, Schools of Humanities, USM, Chapter 3 writer
- Usman, School of Humanities, USM, chapter 1 writer
- Ahmad Nurulazam Md. Zain, School of Education Studies, writer
- Melissa Ng Lee Yen Abdullah, School of Education Studies, Chapter 4 writer

11:00 – 12.00 **Project Warga**

- Norpisah Mat Isa, Director of Projek Warga
- Associated Professor Zarina, Secretary of Projek Warga School of Social Sciences, Universiti Sains Malaysia

12:00-13.00 **AIDS Action & Research Group**

- Associated Professor Ismail Baba, Convener of AIDS Action and Research Group
- Sundramoorthy Pathman, committee member of AIDS Action and Research Group

- Dato Jamalludin Sulaiman, committee member of AIDS Action & Research Group
- Azrina Husin, committee member of AIDS Action & Research Group

14.30-16.00 **ICT Cluster meeting**

- Rosni, Dean of School of Computer Science, Universiti Sains Malaysia
- Abdullah Zawawi Hj Talib Deputy Dean of Industry and Community Network
- Lee So Cheran, (Intellectual Avenue Sdn Bhd, Invest Penang,
- Jeffrey Lim, Vice Chairman, SCoPe – Software Consortium of Penang
- Vincent Khoo Kay Teong, School of Computer Science
- Bahari Belaton, Dean, ICT Research Platform, Universiti Sains Malaysia.
- Mohd. Hasri Mohd. Harizan, Intel Malaysia
- Tan Seong Fook, Intel Malaysia

16:15-18.00 Northern Corridor Economic Region (NCER)

- Muhammad Nurazli Razali**,** Senior Vice President, Education & Human Capital of NCER

Thursday 20 May 2010

9.00am- 12.00 - **Site Visit in Advanced Medical & Dental Institute, Universiti Sains Malaysia**

- Haji Ramli Saad, Director Advanced Medical and Dental Institute, Universiti Sains Malaysia
- Norehan Mokhtar Deputy Director (academic section), Advanced Medical & Dental Institute, Universiti Sains Malaysia
- Narazah Mohd. Yusoff, Deputy Director (Clinical/ Deputy Head of Onkologi cluster) Advanced Medical Dental Institute, Universiti Sains Malaysia

- Dr Bakiah Shaharuddin, Deputy Director (Research), Advanced Medicaland Dental Institute, Universiti Sains Malaysia
- Associated Professor Dr. Ishak Mat, Manager of Services Centre, International and Translational research network, Advanced Medical & Dental Institute, Universiti Sains Malaysia
- Zainoodin Sheik Abdul Kader, Divison of Industry and Community Network
- Aishah knight Abd Shatar, Advanced Medical& Dental Institute, Universiti Sains Malaysia
- Muhammad Sallehuddin Abdul Hamid, Information Officer, Advanced Medical and Dental Institute, Universiti Sains Malaysia

14.30 pm – 17.00 pm **Lifelong learning cluster meeting (Wawasan Open University)**

- Wong Tat Meng, Vice Chancellor, Wawasan Open University
- Dato' Dr. Ho Sinn Chye, Asst Vice Chancellor- Academic Support, Wawasan Open University
- Mogana Dhamotharan Dean, School of Foundation & Liberal Studies, Wawasan Open University
- Yeong Sik Kheong, Register, Wawasan Open University
- Lim Yao Han, Acting Head, Corporate Communications, Wawasan Open University
- Rozinah Jamalludin, Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia

Friday 21 May 2010

10:00 am- 14.00 pm **OECD Review Team Internal Meeting**

14.00pm - 16:00pm **Feedback session to Top officials of Universiti Sains Malaysia,**

Penang stakeholders, SER writers and steering committee

- Y. Bhg. Prof. Tan Sri Dato' Dzulkifli Abdul Razak, Vice Chancellor of Universiti Sains Malaysia Azlena Zainal, School of Language Academic, Uitm
- R Fauziah Md. Taib Deputy Director of National Higher Education Research Institute, Universiti Sains Malaysia
- Sarjit Kaur, National Higher Education Research Institute, Universiti Sains Malaysia
- Sarjit Kaur, School of Humanities, Universiti Sains Malaysia
- Rozinah Jamalludin, Centre for Instructional Technology & Multimedia, Universiti Sains Malaysia
- Munir Shuib, School of Humanities,Universiti Sains Malaysia
- Azhari Karim Director of CENPRIS, Universiti Sains Malaysia
- Rosni Abdullah, Dean of Computer Science, Universiti Sains Malaysia
- Norpisah Mat Isa, Deputy of senior registrar, International Office, Universiti Sains Malaysia
- Patrick Khoo Poh Aik, Director of Management facilities, Penang Municipal Council
- Dato Rosli Jaafar, Main manager of Penang Development Corporation
- Ahmad Shukri Mustapa Kamal, Deputy Vice-Chancellor, (Academic & International Affairs), Universiti Sains Malaysia
- Tuan Haji Azman Abdullah, Registrar of Universiti Sains Malaysia
- Puan Hjh. Salmiah Che Puteh, Bursar of Universiti Sains Malaysia
- Mohd Pisol Ghadzali, Chief Librarian of Universiti Sains Malaysia
- Lim Koon Ong, Deputy Vice-Chancellor (Industry & Community Network)
- Anwar Fazal, Director of Right Livelihood College, C/o Centre for Policy Research and International Studies (Cen PRIS)
- Wong Tat Meng, Vice Chancellor of Wawasan Open University
- Padmanathan, Wawasan Open University
- Nor Farahani Saad, Assistant Director, Department of Research and Development

- Suriati Ghazali, School of Humanities, Universiti Sains Malaysia
- Narimah bt Samat, School of Humanities, Universiti Sains Malaysia
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- Sharifah Rohayah Sheik Dawood, School of Social Sciences, Universiti Sains Malaysia
- Mohd Asri Baharum, Director of PERDA- Tech.
- Roslan, Department of Penang Education
- Wan Mazlan Wan Ab Rahman, Universiti Sains Malaysia

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Higher Education in Regional and City Development

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This publication is part of the series of OECD reviews of Higher Education in Regional and City Development. These reviews help mobilise higher education institutions for economic, social and cultural development of cities and regions. They analyse how the higher education system impacts upon regional and local development and bring together universities, other higher education institutions and public and private agencies to identify strategic goals and to work towards them.

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