Industrial Transformation at the Sub-National Level –Challenges faced by the E&E Sub-Sector in Penang, Malaysia

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Structure of my presentation

- Some basic information on Malaysia's economy
- Current status of Malaysia's and Penang's industrial sector
- Efforts at technological upgrading and innovation capability enhancement in the electronics and electrical machinery (E&E) sub-sector
- Role of institutions, in particular, the Penang Development Corporation (PDC), in industrial development
- PSDC and skills development

Malaysia's Economy –some basic information

- **Economic Data**
- **GDP (Current USD) - USD 303 billion in 2012**
- **GNI Per Capita (Constant 2005 USD) - USD 6,513** (ranked 52 out of 252 countries; not all countries have values for 2012)
- **GNI per Capita, PPP (Constant 2005 USD) - USD 14,224** (ranked 52 out of 252 countries; not all countries have values for 2012)
- **Poverty headcount ratio at rural poverty line (% of rural population)** - 3.4 % in 2012
- **GINI Index - 0.462** – 34/140 in 2009 (No update aside from 2009 data)
- (Source: World Bank)
- **Rate of unemployment Malaysia (Department of Statistics)** - 3.0% as of July 2013
- **Social indices (United Nations)**
- **Human Development Index**, 2012 - 0.769 (ranked 64 out of 186)
- **Gender inequality index,** 2012 - 0.256 (ranked 42 out of 186)

Malaysia's Economy – some basic information

- GDP Growth Rate - 4.3% (Q2 2013)
- Total external debt as a % of GDP - 28.8% (as of June 2012)
- External Debt Service Ratio - 10.5 % (as of June 2012)
- Cumulative International Reserves - RM 428.8 billion (as of June 2012) (approximately USD143 billion)
- Budget Deficit:GDP Ratio - 4.5% (as of 2012)
- Manufacturing as a % of GDP in Q2 2013 (Constant 2005 prices) - 25%
- Manufactured exports as a % of total exports - 67.6% (as of August 2013)
- Electronics and electrical machinery as a % of total exports as of August 2013 - 32.7%
- As of % of manufactured exports, 44.3% (as of July 2012)

Source: Department of Statistics and Ministry of Finance

Industrial development in Malaysia – current status

- After slightly more than 4 decades of FDI-based growth, Malaysia, especially Penang, has amassed immense capabilities in manufacturing, with particular focus on electronics and electrical machinery (E&E), for export
- Our ability to organize and ramp-up production capacity to manufacture products based on even very highly sophisticated engineering specifications is what constitutes the core element of our competitive advantage
- In other words, we have done well in efficiency-oriented imitation
- Our success has been due to fiscal incentives, targeted infrastructure, available supply of semi-skilled and later skilled workforce, a free trade regime, consistent, predictable and transparent investment policies and political stability
- This success is, however, largely in the low mix, high volume and low value-added end of the value chain, which has been eroded by the emergence of other high volume, low value- added producers such as China

Promotion of Cluster Development (1)

- Enhanced global competitiveness, in particular the emergence of China, meant that Malaysia needs to move up the value chain if it is to sustain growth and raise incomes
- One such move is the promotion of cluster development in E&E, which is the dominant sub-sector
- More specifically, we need to shift to higher value-added activities of the value-chain like design and development (D&D) and research and development (R&D).
- Towards this end, domestic technological and innovation capabilities need to be enhanced
- Such upgrading requires institutional support, a conducive enabling environment and organizational support
- Already, some such technological upgrading has been achieved through local outsourcing, some success in nurturing local small and medium-scale industries (SMIs) as suppliers of components and ancillary parts and intra-firm transfer of technology within multi-national corporations (MNCs)

Promotion of Cluster Development (2)

- Despite some technological upgrading, Malaysia is still stuck at the low value-added section of the value-chain and what is called the capability triad.
- This triad has three key components which are production, skill formation and the business model (Michael Best in Jomo (ed), NUS, 2007)
- Malaysia is strong in production but weak in both skills formation and the business model
- The latter refers to the capability to create new entrepreneurial firms defined as firms with design and new product development capabilities
- Another factor is the MNCs' capacity to subdivide and distribute the production process internationally to match host countries' differing skill levels and capabilities

Challenges in Moving up the Value-Chain

- To create and nurture entrepreneurial firms, both local and foreign, which will drive cluster dynamics that will in turn foster capability development and innovation
- Development of greater design capabilities like chip design, systems integration and application engineering, which are currently in short supply
- Malaysia faces a critical shortage of scientists and engineers, with negative implications on R&D capability. The key is to enhance the technological effort, with special emphasis on developing a high quality education system and an excellent skills development infrastructure

State of Technological Development

- "Effective industrial policy is more about education policy and technology policy than tax incentives" (Michael Best *ibid)*
- Malaysia's long-term industrial competitiveness and hence growth depend on its ability to enhance innovative capabilities, conceived broadly as its ability to embrace technological progress and upgrading
- Malaysia's record in acquiring and deploying advanced technology is mixed
- The country is fairly successful as seen via the extent of use of personal computers, internet penetration and ICT expenditures as a % of GNP. It is ranked in the middle of the Technology Achievement Index but is the 9th largest exporter of high technology products
- However, % of GNP spent on R&D is low, as is the rate of commercialization of research
- Overall, these paint a picture of an economy adept at acquiring and using technology (operational technology), but one that has yet to register significant growth in autonomous local innovation
- Malaysia is still very much an OEM, with hardly any ODM and a non-existent OBM

Efforts at Technological Upgrading (1)

- Aware of the need to enhance local technological inputs into industrial growth, the Malaysian Government has sought to build a comprehensive integrated national innovation system
- Such efforts of the government include:
- institution building to support technological development
- extension of tax incentives, grants and subsidies for R&D
- the creation of new technology institutions for specific industrial sectors
- the establishment of centralized policy planning and funding
- intensified consultations with industry representatives
- establishment of Intensified Research in Priority Areas (IRPA)
- boosting research capacities in public technology institutes and later, even to the private sector, through greater budgetary allocations on science and technology

Efforts at Technological Upgrading (2)

- New policy initiatives were developed to create appropriate intra- and inter-firm networks to capture technological externalities emanating from the demands of MNCs as customers for components and inputs
- One such initiative was the launching of the Local Vendor Development Program to encourage large foreign and local assembly firms to assist designated local suppliers in a bid to strengthen inter-industry linkages
- Other initiatives include the setting up of research and consultancy firms within public universities to commercialize research output and to foster closer university-industry collaboration in R&D

Efforts at Technological Upgrading (3)

- Hopefully, these efforts will overcome some structural weaknesses in Malaysian technology development which are:
- Inadequate institutional infrastructure
- Low private sector investments in technology, which is a market failure
- The targeted areas for such efforts at technological development are automated manufacturing technology, advanced materials, biotechnology, electronics and IT, energy, environmental and aerospace technology

Institutional Support to Promote Technological Upgrading in Malaysia

Targeted infrastructural development	Technology Promotion Agencies	Incentives with Performance Criteria Attached	University-Industry Collaboration	Skills Development
• Multimedia Super Corridor (MSC) for development of ICT, multi-media, software • Technology Parks (shared services like test labs, incubation centres) • Bio-Valley for biotechnology development	• Malaysian Technology Development Corporation (MTDC) • MIMOS • SIRIM (standards certification, calibration, metrology, training, some R & D) • Multimedia Development Corporation (MDC) • National Aviation Development Centre (for aerospace engineering)	• Generous tax exemptions • Liberal hiring of experts from overseas • No regulation & control over ICT content • Funding through making available venture capital funds • Tax exemption for R &D • Grants for hiring of critical & key skilled personnel	• Limited research capability of universities • Research that is not targeted to serve industry • Lack of the necessary incentives to promote university-industry collaboration	• PSDC & skills development centres in other states • Universities & polytechnics • Joint skills development institutes with foreign governments (Japan, Germany, UK, France) • 'invisible colleges' – shopfloor training

Weaknesses of Malaysia's Technological Effort

- The technology system was too centralized and top-down, and in many ways became institutionally isolated from sectoral development programs
- The policy machinery as a whole remained poorly equipped to evaluate, at a detailed sectoral level, the actual capabilities and external assistance needs of the private sector, much less to encourage the pace or direction of private sector technology development
- MNCs did not use much of local research institutes' R&D capacity
- Limited inter-industry linkages, although these were later strengthened through the development of sub-contracting firms, low productivity growth and minimal indigenous technological development
- The latter was partly caused by the country's almost complete reliance on foreign firms for technology inputs

Some Positive Results of Efforts at Technological Upgrading

- There was increasing reliance on automation and process technology upgrading to enhance production efficiency and to face rising global competitiveness, particularly in the E&E sub-sector
- There was also considerable genuine technological learning within subsidiaries of MNCs
- There developed growing linkages between electronics MNCs and local vendors of components and more technological sophisticated machine tools
- All these were particularly pronounced in Penang, consequent upon the successful role of the Penang Development Corporation (PDC)

The Role of PDC in Promoting Industrial Development

- Successful marketing of Penang as a suitable centre for investment
- Providing targeted infrastructure
- Initiated start-ups (self-discovery)
- Reducing information asymmetries and overcoming co-ordination problems
- Success in its intermediary role of linking firms with suppliers of parts and components
- Skills provision through initiating a tripartite collaborative venture that involves industry, academia and the government at the sub-national level

Penang's success at industrial growth: some lessons

- At the sub-national level, the PDC played a key role in spurring industrial development
- 3 achievements stand out –
- The conversion of MNCs into developmental firms that created spin-offs, resulting in the attendant diffusion of technology
- Successful integration of skills formation with technology advance and new firm creation policies
- Effective co-ordination of the different instruments designed to achieve goals very well

Skills Formation and Development

- The importance of a highly skilled workforce, with sound training and knowledge in science and technology, to a country's industrial development and transformation cannot be over-emphasized
- Hence, human resource development is key
- Such development requires a democratized but high standard system of education and a good network of vocational and technical institutes that have substantial capabilities in imparting engineering, telecommunication, managerial and financial control skills to both the existing and would-be workforce
- In Malaysia, access to primary and secondary education is near universal while enrolment in universities and polytechnics has increased significantly.
- However, standards have fallen drastically in part as a result of the government's use of education as a vehicle for ethnic redistribution of life chances to the neglect of excellence
- Many industry-relevant skills development institutes have been set up by the government, of which the Penang Skills Development Centre (PSDC) is the most famous, and by foreign governments from Japan, United Kingdom, France and Germany
- To finance skills training, the government has set up the Human Resource Development Fund (HRDF) to which firms hiring above a certain number of employees are required by law to contribute

Skills Formation – The Case of the Penang Skills Development Centre (PSDC)

- Formed in 1989 through the joint efforts of the Penang State Government, industry and academia
- Its key objectives are to provide industry-relevant skills through both in-service and new training courses at the certificate, diploma and degree, both undergraduate and post-graduate, as well as professional courses to both the current and would-be industrial work force
- The involvement of both industry and academia ensures that the curricula design is relevant to the changing skill needs of industry
- Among the courses offered include basic machining, advanced computer numerical control machining, electronic, mechatronic, computer and telecommunication engineering, information technology and business administration
- Funding of skills training is from the government and industry, though the latter can claim re-imbursement from the Human Resource Development Fund
- PSDC's skills training has enhanced considerably the skills level of Penang's workforce and the state's capacity in technological absorption

Conclusion (1): Lessons from Malaysia's Experiences in Industrial Policy

- Malaysia's manufacturing capabilities have been built up through heavy reliance on FDI and some local entrepreneurial support
- The success in drawing in FDI was due to fiscal incentives, targeted infrastructure, available supply of semi-skilled and later skilled workforce, a free trade regime, consistent, predictable and transparent investment policies and political stability
- However, Malaysia's success was primarily in the low value-added, high volume end of the value-chain of the dominant E&E sub-sector
- Its attempt at moving up the value chain to design engineering and R&D, marketing and logistics has not been that successful as the country has been constrained by its limited design and R&D capabilities
- Lack of the requisite supply of skilled manpower like engineers and research scientists is one major contributing factor to this limited design and R&D capabilities

Conclusion (2):Lessons from Malaysia's Experiences in Industrial Policy

- The country has absorbed operation technology well, and has made some progress in adaptation, modification and improvement of imported process technology. The latter has been due to the success of fiscal incentives and industry as well as technology development institutions in forging linkages through the system of outsourcing and sub-contracting
- But for linkages to be forged, local entrepreneurship and technological capabilities must be there
- Over-reliance on FDI, while successful in forging mass manufacturing capabilities has, however, hampered the nurturing and development of an indigenous national innovation system
- A top quality education and training system must be in place to nurture a well-educated and technically trained workforce so essential for both indigenous technological development and enhancing the absorptive capacity for imported technology
- While pursuing a free market system helps industrial development, the design and implementation of an industrial policy is vital, too.

- Thank You