Executive Summary

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1. RATIONALE OF THE PROJECT

There is a possibility that the distribution of industrial location and population could be changed as agglomerations in East Asia are integrated. The deepening industrial integration can stimulate diversification of industry and concentration of population in production and logistics hubs.

Said integration can also bring about and promote innovations through four ways.

The first way is through efforts driven by *ex-ante* productive firms. Such firms can extend the reach of their business toward the integrated market where they can supply goods. This increased access to the bigger integrated market with more business opportunities is expected to facilitate the firms' attainment of economies of scale, thereby allowing them to cut and economize on certain expenses and have more capital for innovation. With more capital on hand, firms will therefore be more encouraged to pursue innovations.

The second innovation-promoting effect of industrial integration is through the intensified competition that said integration is expected to bring about. The integration of the markets in ASEAN and East Asia into a single market along the pan-East Asian industrial corridor will intensify competition. In order to avoid cutthroat price competitions, individual firms will thereupon undertake more efforts to innovate to create new products and new markets. Firms can also focus on process innovations to improve productivity, decrease marginal costs and increase profit margins.

The industrial corridor will also provide firms with more alternatives of intermediate and capital goods and technologies that are available lower prices. This increased selection of varieties of accessible intermediate goods enables the formulation of new combinations of inputs, thus promoting product innovations, The improved availability of capital goods, meanwhile, will also facilitate diffusion of new processing technologies and process innovations. This is the third innovation-promoting effect of integration.

In the meantime, there are firms located in places where no distinct geographical advantages may exist. Under ordinary circumstances, these firms may be excluded or "hollowed out" from industrialization developments. However, with the creation of an integrated industrial corridor in East Asia, even these firms located in such disadvantaged areas will be able to benefit from and use the upgraded transportation infrastructure built and developed precisely to extend the geographical reach to various product/consumer and intermediate markets in the industrial corridor. Efficient infrastructures enable firms to renovate their production linkages and create higher value added in a supply chain. This is the fourth way by which integration promotes innovation, and this time, the outcome is driven by *ex-ante* non-productive firms.

As seen from the above effects, in designing policies to promote an Asia-wide industrial upgrading through the creation of a pan-East Asia industrial corridor, policy framers should carefully consider the potential impacts of market integration and market expansion on industrial upgrading and innovation.

And since said industrial corridor can affect the regional level of innovation via four ways as explained above, the policy instruments to be developed and instituted to encourage and promote innovations will have to suit and be appropriate to the ways described. It is therefore very important to identify pathways to innovation and to determine the possible impacts each pathway has. This will be useful in the formulation of each country's policy that will supplement the creation of an industrial corridor.

In this regard, the empirical studies on the determinants of upgrading/innovation and production linkages which the working group of this project plans to conduct will provide policy implications for stimulating innovation in ASEAN via the East Asian economic integration with the use of the following guidelines: (1) improvement not only of individual town's reputation in the world market but also the corridor's collective reputation; (2) upgrading of specialized fields, with common certification standards for engineers and lawyers to secure innovation incentive for local firms in ASEAN and to decrease costs of alternative dispute resolution on counterfeiters and of access to world technology; (3) combination of global scientific knowledge and shared local business knowledge in the integrated economy to achieve local market-driven innovation.

2. OBJECTIVE OF THE PROJECT

The findings from the previous firm-level survey in the earlier phase of the project indicate that it is the kind of management practices which take advantage of accessible production/intellectual linkages, institutions and other business environments that may determine the topology of production and intellectual linkages and achievements of upgrading and innovation. This is because the respondent firms were sampled from a specific region and acting in a similar business environment. There were however differences in the probability of achieving innovations among these firms and management practices were thus the deciding factor that would spell the difference. Another related finding suggests that organizational and intangible assets affect a firm's level of absorptive capacity.

The linkages can also be classified into on-market and off-market linkages. The former indicates a network based on daily transactions of material, parts, final products and services in the market through which firms can obtain information necessary for upgrading and innovation. The latter, on the other hand, includes cooperation and collaboration organized outside of the market mechanism. More macro- level institutions affect both the linkages and the resulting upgrading and innovation. For example, trade policy and related institutions may increase trade volumes, diffuse more information, technologies and knowledge and facilitate innovations. This pathway to innovation can be called "market-driven innovation." Another example would be science and technology (S&T) policies that emphasize new technology developments and new scientific discoveries to promote "S&T-driven innovation." It can be said that the quality of the institutions as well as the linkages, absorptive capacity, and function of management of firms located in a specific region affect the regional capability of innovation in the long run.

This phase of the research project is going to investigate the capacity/linkages in the building of innovation and shed light on the relationship between innovation outcome and innovation management. The research focuses on three factors: (1) knowledge transfer through production linkages, foreign direct investment (FDI) and trade (mutually beneficial relation between motivations, importation of intermediate and capital goods, and learning from exporting); (2) absorptive capacity and the current state

of sourcing inputs for innovation inside firms (human resources, foreign capital introduction, licensing arrangements, fund-raising and new technologies); and (3) agglomeration economies, including pro-competitive effects. The effects of these three factors on innovation outcome could predict the degree of success of innovation management.

The research project puts emphasis on institutional and policy designs that facilitate firms' innovation managements to upgrade the quality of products and to provide differentiated products. The research also hopes to determine the degree of complementarities between the policies of building capacity and of fostering linkages in the stimulation of innovation in ASEAN. If the empirical evidences show a strong complementary relationship between firm-level capacity and linkages to stimulate innovation, policymakers should then simultaneously allocate policy resources to strengthen both the building of firm capacity and the fostering of linkages.

Two procedural steps were followed and implemented. First, much attention was paid to the relationship between linkages and capacity: how production and intellectual linkages could be formulated by using internal resources of firm. Second, the research took into account the role of innovation management in achieving a higher or more differentiated innovation outcome by estimating the relationship among innovation outcome, absorptive capacity, and production and intellectual linkages.

And while the earlier phase of the project focused on matters related to the integration policy in the face of production and science and technology linkages and the relationship between economic integration and clustering effects, this phase will pay additional attention to institutions and policy instruments for economic integration to build innovation capacity.

3. RESEARCH METHODOLOGIES

The research used Schumpeter's definition of innovation such as: (1) product innovation; (2) application of new technology; (3) organizational change; (4) securing of new suppliers; and (5) securing of new markets.

Both questionnaire surveys and in-depth interviews were conducted.

The questionnaire survey covers an agglomeration of manufacturing firms (and

other actors) in four geographical areas in four ASEAN countries, namely, Greater Jakarta Area (JABODETABEK) in Indonesia, CALABARZON Area in the Philippines, Greater Bangkok Area in Thailand, and Hanoi and Ho Chi Minh Area in Vietnam. Firms were asked about their business profile, innovation and upgrading activities in the last three years, sources of new technologies and information for upgrading and innovation in the last 3 years, business linkages with main customers and suppliers, capabilities and strategies for technological upgrading and innovation, and geographical distribution of production and distribution networks.

To have better insights, in-depth interviews of ten firms in each geographical cluster were also conducted. The interviewed firms include subsidiaries of multinational corporations (MNCs), locally owned firms, and joint ventures. They were asked about the type (new products, new processes, new markets, new sources of raw materials, and new forms of organization) and degree (incremental vs. radical) of their innovations, and the importance of linkages within and across agglomerations for innovation. The interviews cover automotive firms in the Greater Jakarta Area (JABODETABEK), electronics firms in the CALABARZON Area, electronics firms in Penang, automotive firms in the Greater Bangkok Area, and motorcycle part makers in Hanoi and plastic firms in Ho Chi Minh. In addition, aerospace firms in Bangalore, India were included for comparative purpose.

4. KEY FINDINGS FROM THE QUESTIONNAIRE SURVEYS

A total of 864 firms participated in the survey: (1) 183 firms in Indonesia; (2) 203 firms in the Philippines; (3) 178 firms in Thailand; and (4) 300 firms in Vietnam. The analysis can be divided into two parts: descriptive statistics and inferential statistics.

Key Findings from Descriptive Statistical Analysis

- The average age of a firm is 16.8 years, with a standard deviation of 13.9 years.
- Average size is 340 employees, with a standard deviation of 499.
- Approximately 67.5 percent are local firms; 14.5 percent, joint venture firms; and 17 percent, MNCs.

- Seventeen (17) percent of the firms produce raw materials, 42 percent process raw materials, 36 percent produce components and parts, and 63 percent produce final goods.
- For the characteristics of top management, 28.4 percent hold master's degrees or higher. Almost 57.8 percent have experiences as engineers during their careers while 45.9 percent have had work experience in multinational companies (MNCs) or joint venture companies.
- Fifty-eight (58.1) percent of blue-collar workers finished high school while 50.4 percent of engineers have technical college degrees.
- Regarding product innovation, 64 percent were able to change the design of existing products. More than 80 percent of firms improved their own existing products. Almost 70 percent of firms developed new products based on *existing* technologies while only 57 percent developed new products based on *new* technologies. This suggests that it is more difficult to achieve *product innovation* combined with *new technologies*. Eighty-five (85) percent of firms succeeded to sell new products to *existing markets* while only 71 percent of firms were able to sell new products to *new markets*. This also implies that the creation of new markets is more difficult and costly.
- Regarding process innovation, more than 83 percent of the firms were able to buy *new machines*, 70 percent could *improve existing machines* while 71 percent introduced *new know-how* on production method. Firms in the sample tended to change production processes more than shipping processes. Changes in accounting systems and human resource management practices (HRMP) within firms were more popular than meeting regulations and global standardization. Other important reasons for upgrading production processes were related to: improvement in quality (84%), meeting of regulations (82%), decrease in defections (72%), reduction of pollution (61%), increase in domestic market (60%), decrease in inventories (58%), decrease in materials (50%), and reduction in lead time (50%).
- As for sources of innovation, internal sources (within the same companies) are quite important in all countries. Regarding the role of local firms, they were

regarded as very important by surveyed firms in Vietnam (almost 80%), moderately important (around 50%) in Thailand and Indonesia, and not so important in the Philippines. Interestingly, local firms located in the *same geographical area* in Vietnam are considered as very important in comparison with other countries. MNCs are relatively less significant, except in the case of the Vietnam where MNCs that are located far-away places like East Asia, the United States and Europe are more important than those in the same geographical area and within the country. Government agencies, universities, and research institutes are significantly less important in all countries. In relative terms, meanwhile, firms in Thailand had a more positive view of domestic agencies than those in other countries.

- Recruiting mid-career engineers is considered important for innovation in all countries. Most of these engineers came from local areas and within the countries. Vietnam, in particular, significantly sourced engineers from the same geographical area.
- Foreign-made equipment and licensing of technologies from other firms are not considered very important for innovation.
- As for the distance of most important customers and suppliers, they are mostly in the range of 100 kilometers. This signifies that they are within the same geographical area. Thus, agglomeration is seen to be important for innovation.

Key Findings from Inferential Statistical Analysis

After the robustness test, the following variables are considered to be statistically significant for innovation: firm size (measured by the number of full-time employees), cooperation with MNCs, technical assistance financed or provided by government-owned financial institutes, licensing technologies from other firms, and number of linkages with partners or sources of knowledge. However, information from academic publications is not seen to be important for innovation.

The results of the statistical analysis also confirm that the impact of face-to-face knowledge exchanges on product innovations is significant. Effective technology transfer needs face-to-face and two-way flows of knowledge. Managerial experiences

with foreign firms are considered important for innovation and upgrading.

Key Findings from Case Studies

There are interesting key findings in terms of similarities and differences, especially when industrial agglomerations in more or less the same sectors but in different countries are compared.

Hanoi, Greater Bangkok and Greater Jakarta Automotive Clusters

These three automotive agglomerations are facing similar circumstances. The benefits of becoming a part of global production networks of MNCs are quite clear and they are therefore struggling to access, stay on and gain most from the networks. For second-tier suppliers, being in such networks helped them standardize their manufacturing process and become much closer to demanding customers. However, only a few second-tier suppliers could manage to upgrade themselves to become first-tier suppliers. Many in the second tier are still struggling with low profit margin, and knowledge transfer from MNCs is limited only to quality control and production management system (e.g., the 5 Ss). Many others even left the industry. A few second-tier suppliers used capabilities gained in the automotive industry to diversify to other sectors like electronics, home appliance and others. In essence, being part of MNCs' production network is like a 'training school' for them. Benefits of being first-tier suppliers are much greater in terms of level and intensity of knowledge transfer such as receiving and dispatching engineers, high-level training and direct discussion, co-design and development.

'In-house' technology capabilities like R&D and design are important in being qualified to be first-tier suppliers (e.g., Summit Auto Seat in Thailand). Without in-house 'absorptive capacity', knowledge transfer or collaboration in terms of design and development of new parts as well as advanced manufacturing technologies will not be achieved. Educational qualifications and professional skills of engineers, technicians and laborers are critical in upgrading. Furthermore, a firm's culture, especially in terms of awareness of the importance of innovation and upgrading at all levels from top management to the laborers, is indispensable. The role of an intermediary such as the Thai Automotive Institute has been highlighted as important in facilitating networking

and knowledge transfer between MNCs and local firms.

Penang and CALABARZON Electronics Clusters

Innovations in these clusters are mostly incremental and new to the firms. Penang is relatively more advanced as firms conducted relatively more design and development activities whereas most firms in the CALABARZON area are only doing largely assembly activities. Radical innovations were also found in a few cases in Penang. Customers are the major source of knowledge and information in both cases. In-house R&D is a very important source of innovation.

The role of MNCs as lead firms is absolutely critical for innovation of local firms. MNC and local firm collaborations both 'within' and 'across' agglomerations are very important. Proximity does matter for effective linkages and innovation. Nonetheless, linkages in global production networks (across agglomerations) are equally significant.

Within Penang, some firms are more 'active' learners. They learned not only from customers/suppliers but also from competitors and publications. Universities and public research institutes are considered to be much less significant. However, this belief may have begun to change in Penang in recent years as firms have advanced enough as to have R&D collaborations with universities.

The big differences between Penang and CALABARZON are the roles of local governments and local agencies. These local agencies are much more pro-active in upgrading capabilities of local firms in the former. The Penang Skill Development Center (PSDC), in particular, acts as a trainer of local firms and an intermediary that connects MNCs with local firms, leading to business partners and knowledge sharing. In both cases, the dispatch of engineers between local firms and MNCs facilitated knowledge exchanges.

Ho Chi Minh City Plastic Cluster

There are three groups of firms in this cluster: a) low value-added packaging for export, b) highly competitive but low value-added products for domestic construction industry, and c) high value-added and high-skilled suppliers for manufacturing industries. In general, the demands of MNCs may help to upgrade local firms, but the latter are not aware of such nor are they active. They are not really competitive players

in the global production network or global value chain. Links with domestic finished goods manufacturers (forward industrial linkages) are weak, which is a typical phenomenon in developing countries. Low government attention both at the national and local levels has been paid to developing this sector.

Bangalore Aerospace Cluster

This is a cluster by nature since it requires proximity of manufacturers, specialized research institutes, and specialized education institutes. There are two sub-sectors: aeronautic and astronautic. For the aeronautic sub-sector, links with global players such as customers and strategic partners like Boeing and Airbus are critically important.

For the astronautic sub-sector, the main linkages are with domestic players, both governmental, especially in terms of defense and private actors.

The problems facing this cluster are different from other developing countries. While many developing countries need to develop technological capabilities from the very beginning, some capabilities in this sector in India have already been developed in the defense sector. The question is more of transferring these existing capabilities from the defense to the civilian sector.

Local (state) governments have significant roles in providing legal, tax, and physical infrastructure necessary for building agglomerations (e.g., special economic zones).

National/ local education institutes (Indian Institute of Science) play crucial roles in supplying specialized researchers and engineers. There are also mutual spillover impacts to other sectors like the automotive sector as firms in the sector started to produce automotive parts using existing high-precision production and engineering capabilities. Through transfer of skills and business diversification, the existence of the aerospace industry in India will help to upgrade other sectors in the future as well.

5. SUMMARY AND POLICY RECOMMENDATIONS

Key findings from the questionnaire surveys and case studies illustrate that firms in ASEAN are struggling to survive and prosper in the global value chains. For them to succeed in doing this, there are two alternatives or roads. On one hand, the ‘low road’ is

a trajectory in which producers face intense competition and are engaged in a "race to the bottom", On the other hand, the 'high road' is a trajectory in which producers increase and improve participation in the global economy and, hence, realize sustained income growth. 'Upgrading' is a necessary condition for a 'high road' path to competitiveness in the context of globalization. The key question therefore is how these firms can upgrade. The findings from this study point out that innovation to create new values or increase value added is a key factor for upgrading.

On closer examination, the ASEAN firms in the study can be divided into two groups.

The first group consists of firms that are still in the low road. They are struggling to penetrate the global value chains of MNCs. They are mainly competing on the basis of low labor cost. But to be able to be parts of global value chains, they have to strengthen their production capability, especially their production management system and quality control, to meet international standards. The cases of the Vietnamese auto parts and plastic packaging firms and the Thai second-tier auto part suppliers are examples.

The second group includes those which have, to a certain extent, succeeded in technological upgrading. Nonetheless, most of the innovations which the study found from this group are not breakthroughs for a product or a process that are new to the world. Rather, they are more of marginal, evolutionary improvements of products and processes that are new to the firm and allow it to keep up with international (moving) standards. Further, firms in this group pursued four different upgrading strategies, as follows:

1. *Process upgrading.* Firms upgraded processes – transforming inputs into outputs more efficiently by re-organizing the production system or introducing superior technology. These are the cases of the first-tier Bangkok auto parts suppliers, and the Penang and CALABARZON electronics part makers.
2. *Product upgrading.* Firms upgraded by moving into more sophisticated product lines (which can be defined in terms of increased unit values). These are the cases of Penang part makers and Bangalore aerospace firms.
3. *Functional upgrading.* Firms acquired new functions (or abandon existing function) so that they could increase the overall skills content of their activities. They might complement production with design or marketing, or move out of

low-value production activities. These are the cases of the Penang and, to a lesser extent, CALABARZON electronics part makers which upgraded from being Original Equipment Manufacturers (OEMs) to Own Design Manufacturers (ODMs), and some Bangalore aerospace firms which finally transformed to become Own Brand Manufacturers (OBMs).[1]

4. *Inter-sectoral upgrading*. Firms may apply the competence acquired in a particular sector to move into a new one. These are the cases of the Indian auto part makers which moved to aerospace and the Hanoi auto part makers which moved to home appliances and electronics (see Figure 1 for graphical illustration).

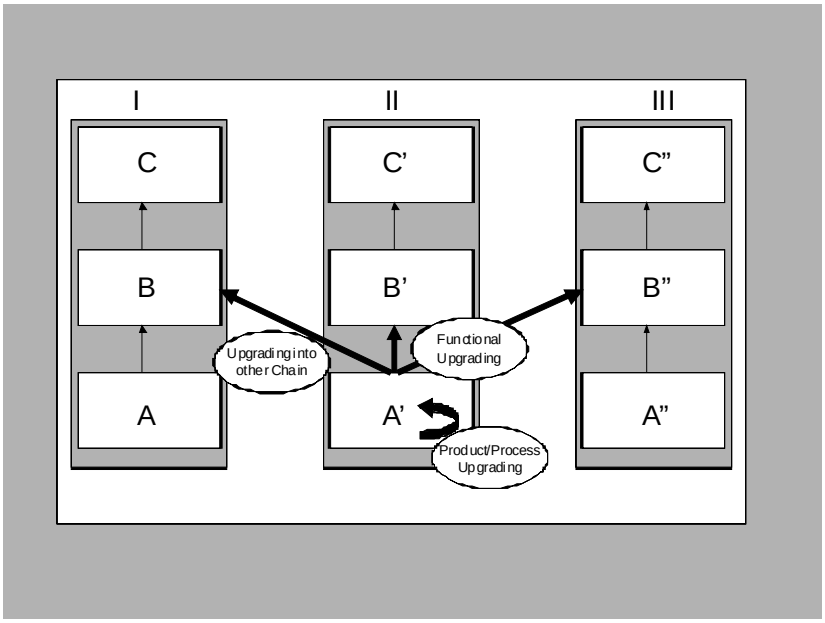

Figure 1: Different Strategies of Upgrading in Global Value Chains

The study also elucidated that agglomeration does matter for production linkages and technological upgrading, especially for less capable firms. However, in some cases, it is less important than linkages outside of an agglomeration. In these cases, production and knowledge linkages with capable and better managed MNCs located in other places

[1] OEM and ODM are specific forms of subcontracting. Under Original Equipment Manufacture, a firm produces a finished product in accordance with the precise specification of a foreign transnational corporation, which will market under a brand name via its own distribution channels. Under Own-Design Manufacturer (ODM), a firm carries out most or all of the product design. In the case of Own-Brand Manufacturer (OBM), a firm carries out product design and markets its products under its own brand.

are more important for the upgrading of local firms. A certain level of 'absorptive capacity' accumulated through in-house activities of local firms like R&D is necessary for both within- and across-agglomeration linkages leading to upgrading and innovation. The study also found that linkages with universities and public laboratories are less important. However, such linkages are more important for higher-capability firms like, for example, those having R&D capabilities since the interests and activities done in said firms and universities are more similar at that level.

The study draws up certain policy recommendations on the basis of the key findings both at the levels of national governments (ASEAN members) and of the ASEAN Plus Six.

Policy Recommendations for National Governments (ASEAN Members)

First, strengthening the 'absorptive capacity' of local firms is a key success factor in gaining benefits both from within- and across-agglomeration linkages. The study points out that one major obstacle that prevents firms from doing innovations and building up absorptive capacity is their perception of the costs and risks being too high. Government can help firms mitigate this obstacle through several policy options, ranging from tax incentives to financial incentives in the form of grants or soft loan to the provision of technical infrastructure. Government can choose to implement one or several of these options based on its preference and bureaucratic capacity in devising, implementing, monitoring and evaluating these policy options.

a) Tax incentives can be provided not only for firms doing R&D for innovation, but also for firms doing R&D for absorbing and upgrading external knowledge. They might also cover other non-R&D activities like design and engineering, which are very important for product and process upgrading where many ASEAN firms, as illustrated by the study, are quite weak.
b) Government financial incentives in terms of matching grants and/or soft loans targeting upgrading activities may be provided. The incentives can be given to both high-potential individual firms, and consortium of several firms (and, in some cases, with participation from universities and government research institutes). Providing incentives to the latter can help to create and reinforce

inter-firm production linkages and knowledge linkages with universities and public research institutes, as in the cases of Taiwan Province of China in the past. The choice of universities and public research institutes should be done through a careful and transparent selection process (for example, by neutral committees consisting of the relevant stakeholders) and through a vigorous evaluation of the results (for example, application of performance-based criteria where firms receiving incentives must be able to export within a limited period after receipt of such incentives, must be ensured).

c) Government financial assistance should be extended for the hiring of external experts to help local firms upgrade. Both the surveys and the case studies show that experts in both the technological and managerial areas are very useful in stimulating the process of upgrading of local firms. Government can help by *partially* funding the salary of these experts for a limited period at the beginning.
d) Government procurement is a measure that can promote business opportunities. Local firms do not only need financial incentives but also business opportunities for their incrementally innovative products. Government procurement can give them such business opportunities before they are further developed and accepted in private markets.
e) One of the obstacles for innovation, as gleaned from the surveys, is the lack of technological facilities like testing, quality assurance, and calibration centers. These facilities require a lot of investment and market mechanism alone may not provide them sufficiently. Government can step in by creating such facilities for the common uses of firms in the industry.

Second, enhancing linkages within agglomerations is essential for upgrading, as shown by the study. The following policy options can help to achieve this goal.

a) Developing and strengthening intermediaries like the PSDC in Penang's electronic agglomeration which link local firms with MNCs both in terms of production and knowledge flow must be encouraged.
b) Empowering regional/local actors like local governments, business/industrial associations, universities, research institutes and financial institutions will be helpful since there is too much centralization in several countries in the region.

Effective upgrading within agglomerations requires more active roles for local governments and agencies since they are both geographically and politically closer to the needs of local firms.

c) Designing and implementing programs using engineers from MNCs within agglomerations to train engineers and technicians of local firms in knowledge and skills is critical for upgrading. This is an effective way for upgrading, as clearly illustrated in the case of the Penang electronic agglomeration.

Third, as illustrated by the study, enhancing linkages outside agglomerations (between MNCs located elsewhere and local firms) is also very crucial for the upgrading of local firms. A few policy options for meeting this objective are provided here.

a) Government financial incentives in the form of partial funding for dispatching engineers from local firms for on-the-job training or working at the Headquarters of MNCs for a certain period must be encouraged.
b) Business matching programs between MNCs looking for future investment and potential local partners, as elaborated in the case of the PSDC, are valuable activities. This can be implemented by both the national and local governments.

Policy Recommendations for ASEAN Plus Six

At the level of the ASEAN Plus Six, several joint activities can be carried out, especially in terms of creating common institutional arrangements and policy platforms. Some of these include:

a) A database of experts, especially retired ones, in ASEAN Plus Six, classified by types of knowledge and skills in specific industrial sectors, should be created and updated annually. This requires additional work to identify critical knowledge and skills which should be promoted and which are necessary for upgrading and future international competition.
b) Region-wide experts exchange programs should be initiated afterwards To facilitate the programs, an ‘ASEAN plus Six Special Fund for Experts Exchange’ might be set up. Monitoring and evaluation of these programs are essential.

c) Streamlining of different national immigration procedures for professional experts must also be done.
d) Regional certification and accreditation of specific skills, knowledge and professional standards should be carried out. This will be a very useful basis for experts exchange programs.
e) A joint policy research on good practices relating to the strengthening of linkages within and across agglomerations in the ASEAN Plus Six should be carried out. Policy measures themselves should be subjects of serious studies both in terms of content and deployment procedures and mechanisms.
f) A joint policy research on good practices relating to promoting technology-based entrepreneurship in ASEAN Plus Six should also be carried out. Several governments in the region are trying hard to promote such entrepreneurship. It is the right time to have comparative studies to examine successes and failures of such policies.
g) Annual policy fora between high-ranking policymakers and policy researchers/experts in ASEAN plus Six should be encouraged. The fora should discuss key success and failure factors in devising and implementing policies as well as provide a venue for learning and sharing experiences from and with each other.