
Welcome

THE 10TH ASIA-PACIFIC S&T MANAGEMENT SEMINAR

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- Seminar Theme: Regional innovation policies for growth in the Asian Pacific Area: ”Regional Perspectives”
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Title of Presentation: Regional Innovation Policies for Growth in the Asian Pacific Area: Regional perspectives.

Presented by~

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Introduction

- Globalization trend.
- Localization.
- Complementary to each other.
- End-product: Glocalization.
- Title selection in 10th APST Management Seminar. Chain and sequence with the preceding years' themes.
- Varieties in the innovation policies of the countries in the region.

Innovation defined in new perspective and significance of innovation

- Creates competitiveness for survival of product in borderless economy.
- The basic thing is Technology.
- Balance in innovation policy for growth under the umbrella of WTO, IPR etc for sustenance.
- Innovation- Vital for future economic performance of the Region. USA GDP 9 times growth since 1870 for innovation.

Innovation Systems

- Interaction of a set of institutions sprung out of Government, social & market circumstances. Linkage to innovation system with other countries.
- Innovation system: central to growth in Asia Pacific region.
- True for developed countries in the Region as well as for middle-income and lower-income countries.

Innovation Systems Contd.

- Innovative capability- a cumulative process requiring deep foundation.
- Each country requires its skills &c and involves large investment.

What feeds innovation?

- Human creativity.
- Inputs: World class skills
  Expenditure on R&D.
  Capital Investment
  Foreign Direct Investment.

Organization for Innovation

- Organizational diversity and capability to translate innovation into products.
- Distinctive organizational attributes to reinforce technological advances.
- Asian Pacific- nature of organization- conservatism, Govt. directions, family ownership, discouraged organizational change.

Company Management of Research & Inter-firm collaboration

- Importance:
- Two objectives:
  - > Research collaboration
  - > Productive Management of the company's research assets.

Company Management of Research & Inter-firm collaboration

- Principal drivers of Innovation: From competition to cooperation.
- External collaboration plus substantive interaction of research with marketing, engineering, production and other departments.
- Enabling business environment: A step toward the development of innovative industrial capability.

Networked clusters

- Information, learning etc stimulated by the clustering of firms.
- Cluster- open to out side influence and global contacts.

Role of Competition Policy and Industrial organization in generating demand for Innovation

- Competition through openness to trade and FDI.
- Competition policy- straight forward.
- Competition policy trend USA- held down the barriers to entry.
- Asian Pacific much weaker-protection trend.

Intellectual Property Rights

- “Fuel of interest to the fire of genius”.
- Regime protecting IPR- minimal consequences for innovation in the Region.
- IPR becoming relevant to the performance of countries in the region for 3 reasons:

Intellectual Property Rights Contd.

a) Up-front research costs demand greater protection of IPR; checking piracy of the rising industries.

b) Foreign Partners of FDI assured an adequate IPR.

c) Emergence of the creative industries necessitates protection for growth.

Intellectual Property Rights Contd.

- The design of IPR strikes balance between-

  1. incentives to generate intellectual property.

  2. dissemination of new knowledge.

- Different means of protection: patent, copyright, trademark.

Bangladesh Scenario in the Region

- R&D works quite insignificant, allocations meagre- 0.4% of GNP.
- R&D and Innovation position in different sectors.
- Innovation culture in retrospect.
- Focus: Innovators into entrepreneurs.
- Growth of innovation culture.

Looking forward: 10 policy messages

- Country wise unique policy: A reality
- 10 policy messages can be pursued by all countries to varying degrees;

10 policy messages Contd.

- 1. Prudent debt management
- 2. Flexible exchange rate management
- 3. Regional coordination
- 4. Financial reform
- 5. Deregulation and incentives for innovations in services

10 policy messages Contd.

- 6. Legal reforms to support the market economy
- 7. Resources for innovation
- 8. Networks & clusters
- 9. Competition policies
- 10. Proactive public policies for innovation.


Thank You.

Regional Innovation Policy for Growth in the Asian Pacific Region

Regional Perspectives

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Introduction:

In the advent of the 21st century, new trend of increasing diversity is felt intensely with maturing globalization of the world order. Now globalization is getting strength from this diversity which is localization. Globalization process is not being able to ignore Govt. regulations, local culture, tradition, unique pattern of growth, invention & innovation, indigenous technology etc. These supplement globalization which is accelerated by information technology, UNO, WTO, ILO supervisions, advanced transport, Telecommunication, free trade etc. Regional union of countries, trend towards borderless state, transition of people in different parts of the world. About one billion km of optical fiber has been installed around the world. Using this for a trunk line network, a global communication network has been constructed. Local happenings are sometimes shaping the events of a country far away from the source. The end-product of these two extremes can be described as glocalization. This two-fold action is feeding & constituting each other.

Regional innovation policy for growth in the Asian Pacific Region is the outspring of localization & recognize the aspiration towards the formulation of global innovation policy for growth. APST Management Seminar is maintaining a chain & sequence of thought for the region in the selection of its theme. In the 8th seminar it highlights its theme on Industry-University-Government Collaboration for the innovating nations. In the 9th seminar, the theme was management cycle in strategic R & D Programs, i.e. how to bring the innovated output onto the market for human use. There should be a dynamic cycle of bringing the output of invention > innovations onto the market. This year the organization has contemplated a uniform policy of innovation and wants to evolve a regional policy of innovations for growth. It is one of the components of regional homonization which is necessary for uniform & steady growth of the countries in the region. I think there are local varieties in the development process in the countries of the region. There are also many varieties in terms of development of the countries in

the region. Some are developed, some underdeveloped & others undeveloped. These factors beget the growth of sundry innovation concepts in the countries of the region. For example, Japanese innovation policy for growth can in no way be similar to that of Bangladesh. Because Japan is far far developed than Bangladesh in all aspects particularly in technology. So Japanese innovation policy will be based on her that stage of invention & technology at which she attains.

Innovation defined:

Innovation is the conversion of new knowledge into new products and services. Innovation is about creating value and increasing productivity and therefore growing business. It is a spark that keeps organizations and people moving ever onward and upward. “Without innovation, new products, new services, and new ways of doing business would never emerge, and most organizations would be forever stuck doing the same old things the same old way”.

Significance of innovation:

Innovation creates competitiveness of a country which makes it survive in a borderless economy. The basic thing is technology. The more the technology is developed; innovation will be more set in motion & develop competence for survival. If regional innovation strategy is contrived new product will come out of the existing product according to customers’ demand under the umbrella of WTO & protected by intellectual property rights, then this may be a model for global innovation policy for growth. To develop this confidence governments should enhance investment in infrastructure, R & D, high technology venture creation etc. And internationally, regional governments should promote cooperation in fundamental research, environment & energy problems for an innovation has become vital for the future economic performance of much of Asian-Pacific region. In today’s intensely competitive, increasingly interdependent world, a necessary condition for rapid growth is the ability to harness technological knowledge creatively. In this context, Baumol observes, “Per capita GDP [gross domestic product] has increased almost nine-fold in the United States since 1870 by innovation carried out since 1870.

Innovation Systems

An innovation system is a “set of institutions whose interactions determine innovative performance”. Some of these institutions might be deliberately created by government; others might arise spontaneously from social and market circumstances. Whereas in the past it might have been appropriate to think of autonomous national innovation systems (and indeed most innovation systems have strong national characteristics), Today successful systems are distinguished by their openness and their links to innovation systems in other countries.

Innovation systems are becoming central to growth in Asian Pacific region not only for countries that have achieved income parity with the industrial West, but also for middle-income and even some of the lower-income countries that are still in the catch-up phase. For the higher income countries, close to or at the technological frontier, the growth potential inherent in the manufacturing and service industries in which they have acquired comparative advantage now rests on staying abreast of the latest technological developments elsewhere and producing a steady stream of innovations. With product cycles now measured in months rather than years, only a continuous flow of commercially successful innovations can assure the rents needed to sustain high levels of income. Countries & firms in the lead cannot afford to ease the tempo of innovation because any successful product immediately attracts imitators that rapidly erode profitability.

For the middle-and lower-income countries of the region, intensifying regional competition, particularly from China and global competition from South Asia & Latin America make it necessary to compete harder on the basis of price, quality and speed of delivery. At the same time, they need to augment this by developing the capacity to introduce product and design innovations starting in the industries that are their mainstay, for example, garments, agro-processing, toys, footwear, small consumer electronics and leather goods.

Innovation capability is a cumulative process requiring deep foundations. There is relatively little scope for leapfrogging. Each country of the region must build skills, institutions, experience, tacit knowledge, local networks, and international collaborative arrangements from the ground up. In certain areas, such as silicon wafer fabrication, memory chips, and flat-screen displays, it is necessary to make very large investments in production capacity.

Thus continuous investment- drawing on domestic and foreign sources- in innovation capability and production facilities is becoming an imperative for countries seeking growth in a competitive environment. A second dimension that differentiates the new innovation system is the centrality of collaboration among researchers and among firms because of the rising complexity of new technologies, which often require a fusion of several disciplines and large outlays on research, testing, certification and building of both experimental and production facilities.

The initiatives of researchers and the efforts of firms depend, in turn, on the evolving market environment and the policy cues provided by public agencies. Thus the working of the innovation system is closely linked to the mix of policies and institutions-many domestic but also foreign ones. In several fields, going it alone is a recipe for failure, and even the largest companies now seek alliances with their competitors or the acquisition of new firms with promising technologies.

What feeds innovation?

The key to innovation is human creativity. For a sufficient number of creative sparks to arise and produce positive economic outcomes, several inputs are needed: people with the appropriate world-class skills, expenditure on R & D, capital investment (including venture capital) that finances research and production facilities, and foreign direct investment (FDI).

Human capital

During the past 25 years, research on region consistently emphasized the role of human capital in promoting growth and frequently underlined the impressive contribution that national education policies made to the Asian Pacific region miracle. By moving quickly to provide virtually universal access to primary education, many Asian Pacific economies created a work force that facilitated the emergence of a light manufacturing sector, often with the help of foreign capital seeking either market access or, more recently, ways of reducing production cost. And many countries have made impressive progress in extending access to secondary and tertiary education.

Now Japan, the leader in East Asia, is being joined by a few economies that are seeking to key their growth and competitiveness to innovation. China, the republic of Korea, Singapore and Taiwan (China) all produce large numbers of graduates with science and technology degrees, but they still need to improve the quality of their skills, deepen the expertise in research centers, and institute the rigorous screening of research. The number of researchers and the increase in R & D spending in the region have yet to translate into a steady flow of innovations comparable to that in the advanced economies of the West.

Improving the quality of secondary-and tertiary-level science and technology skills, to encourage creativity and enlarge the fund of research expertise is a critical strand of innovation policy. A second strand is the augmentation of business, professional, and entrepreneurial skills.

Research and Development Spending

R & D spending complements human capital in the innovation system. It directly enhances the capacity for innovation and facilitates the assimilation of process and product technologies from overseas. At a later stage, as R & D intensifies and deepens the capacity for innovation, countries can start creating product innovations for the local market as a prelude to tackling global markets.

Although relatively little attempt has been made thus far to estimate the returns from R & D spending in the region, the evidence from Western countries suggests that private returns are high: in the 20 to 50 percent range. For Asian Pacific countries in the catch-up phase, the returns from R & D aimed at acquiring process technology and a modest degree of incremental innovation must be at least as high, if not higher.

in these countries, R & D contributes to productivity growth through various channels, including increasing the stock of knowledge, creating new scientific instruments & methodologies, training skilled stuff & graduate students, forming networks and simulating social interactions. At a more advanced stage of development, which China, Korea, Singapore, and Taiwan (China) are now approaching, countries can supplement applied R & D with basic research that broadens research capability, especially in the sphere of product innovation.

Most economies in Asia Pacific region invest much less than 1 percent of GDP in research and development, the exceptions being Japan, Korea and Taiwan (China),Australia and others so like.Simulating productive R & D spending is thus a challenge for these economies. The government is the main source of research funding in several countries of the region, including China & Malaysia and it provides nearly half such funding in most of the others, except Japan (where it accounts for 22 percent), Korea (where it is 18 percent, and Singapore, and so like (Dodgson 2000). But the private share of research funding is rising.

The Korean government successfully supports private R & D by giving tax credits, allowing accelerated depreciation, and encourages large firms to invest 0.5 to 1.5 percent of their sales in R & D.

Capital Investment

To fuel an innovation system calls for large investments in the physical infrastructure of research and in myriad specialized skills. But the investment does not end with the equipping of research facilities. The transition from innovation to production

is a costly process involving many refinements to the product innovation and advances in process technology both in gearing for production and in learning from the experience of producing. Increasingly complex technology and shorter product cycles are raising the costs of equipment and demanding continuous investment in new expertise. They are also hastening the obsolescence of expensive equipment, software, and skills. Some examples from the electronics industry can illustrate the scale of outlay required to remain at the cutting edge of technological change. Wafer fabrication, which is at the heart of chip making, is constantly in the throes of change, with producers moving to larger & larger wafer sizes to maximize the number of chips that can be etched. The most recent jump has been from 200 millimeter to 300 millimeter wafers, which raises yields 2.5 times. However, whereas the old fabrication factories cost between $1 billion and $ 1.5 billion, the new, larger establishments are priced at between $ 2.5 billion and $ 3.5 billion. Nevertheless, companies that are to remain in the technological race must invest in these monster facilities or risk falling behind in vital production knowledge and the associated incremental innovation that determines the productivity of such plants.

To afford the resources needed for innovation, production and training thus calls for high levels of savings. Asian Pacific countries are among the world's biggest savers, so a shortage of capital overall is not an immediate concern.

Organizing for Innovation

The flow of resources can influence the supply of innovation, but firms must still translate this innovation into products and process-related changes that add value in the marketplace. The remarkable achievements of leading European and U.S high-tech firms owe much to their ability to introduce new business models and to devise organizational forms that have proven to be flexible, focused, efficient and supportive of innovation. Organizational diversity has enabled firms to respond quickly to competitive pressures, to develop and market innovations, and to adapt their internal practices so as to stimulate innovative activity. Virtually every one of the leading firms is distinguished not just by its range of products or services but also by distinctive organizational attributes that reinforce technological advances. For example, flatter hierarchies in many high-tech firms have promoted flexibility, diffusion of information, experimentation and faster decision-making. The success of a firm as large as Microsoft depends on the suppleness of its organization.

In some parts of this region the business milieu and the nature of government direction have, by and large, discouraged organizational change, entrepreneurship and the development of fresh business models. Family ownership and a patriarchal management structure have remained the norms. While quite nimble is seizing opportunities & changing direction, Asian Pacific organizational models tend toward hierarchies that circumscribe initiative and innovation; employees are more likely to follow instruction than to show much enterprise.

More is needed than exposure to global competition. New business models are needed that induce transnational R&D collaboration and result in Asian Pacific companies such as Sony has achieved and Haier, Hyundai, and Samsung are attempting to emulate.

Company Management of Research and Inter-firm Collaboration

A firm's organizational structure has implications for its innovativeness: structure determines how the firm manages its own research and, in large firms, how it guides innovation and quality control in suppliers and affiliates. For leading firms in the region seeking to leverage research as a means to assure growth and enlarge market share, two objectives are paramount. One is research collaboration; the other is the productive management of the company's research assets.

Although competition among firms has long been viewed as one of the principal drivers of innovation, more recently competitors are finding it expedient to cooperate in product or process development even while they continue to compete in the market. A company-centered and purely local approach to innovation is no longer the most productive-or even a viable-approach. Awareness of developments in key markets, the presence of sentinel firms or offices in major production or research hubs, and collective efforts are often now the name of the game in successful innovation. Rugby and Zook note that some of the fastest growing and most profitable industries are finding open market innovation to be a critical new source of comparative advantage, an approach that uses tools such as licensing, joint ventures, and strategic alliances to bring the benefits of free trade to the flow of new ideas. For example, Tera Pak, one of the world's leading makers of packaging systems, was only able to devise a novel lightweight rectangular container by working closely with companies specializing equipment. Overseas research laboratories and partnerships with other auto companies and component vendors have been responsible for saving General Motors millions of dollars. Software developed in India helped to design an auto platform for the North American market and was instrumental in facilitating the reverse engineering of a European platform for the Indian market (Green and Zimmerman 2002).

Innovations are springing up throughout the industrial world, and it is impossible to predict when and where they will occur. Therefore, firms need to take a regional, if not an international, approach to networking in pursuit of innovation and to design business models and a management process that bolster their chances of benefiting.

While external collaboration and outreach are some of the dimensions of research management at the company level, there are others as well. They embrace the substantive interaction of research with marketing, engineering, and production departments; personnel policies to permit the periodic rotation of employees from other parts of the

company; creation of a research ambience that balances, detachment from day-to-day operations with awareness of commercial imperatives; development of a geographically dispersed portfolio of research centers drawing on talent in other countries; and efforts to nurture the research and design potential of a affiliated firms.

An enabling business environment is a step toward the development of innovative industrial capability. Realizing the potential of the market environment depends to a considerable degree on entrepreneurship in the firm. Harryson (2002) suggests that within organizations themselves, ranging from mature firms to recent start-ups, a number of entrepreneurial management skills can be vital for spurring innovation and providing strategic direction.

Networked Clusters

Information, learning, competition, and other pressures that induce innovation can be stimulated by the clustering of firms in urban centers. Where clusters result in the emergence of networked arrangements, demand is further reinforced as leading firms pull up others and force them to keep pace, not the least through technical assistance and the sharing of tacit knowledge. Only certain kinds of clusters spur innovation, and these are the ones where competition among closely matched rivals and from new entrants with fresh ideas is toughest. These are also the clusters that are the most open to outside influence and have the widest range of global contacts. But above all, innovative clusters need a stable, open, and fair environment in order to flourish. We now discuss this aspect of the transition to innovative economies.

The Role of Competition Policy & Industrial Organization in Generating Demand for Innovation

The supply of inputs is not enough to ensure that innovation will occur. Only competition-through openness to trade and FDI-can push firms to innovate as a matter of course and to see innovation as essential to their growth, if not survival. Competition policy, together with trade policy, provides an essential dose of dynamism and helps to build an innovative system equal to the challenge of globalization. The role of competition policy (and competition law) is straightforward: to encourage competitive pricing, facilitate entry by new firms and pressure producers to innovate & improve their technical efficiency.

In the U.S software sector, competition law (antitrust policy) has held down the barriers to entry and accommodated the growth of firms, while attempting to maintain contestability. In most of Asia Pacific countries, competition policy is much weaker, and only some economies have a comprehensive system in place-Japan, Korea and Taiwan (China)Australia and of such levels. Even where there are fewer and fewer barriers to entry as in Korea & Malaysia, governments still seek to protect firms from foreign competition in imitation of the Japanese model of 1950-80. This approach seemed to deliver results in some cases, possibly because domestic competition and protection from foreign competition combined to allow the emergence of national champions, akin to NEC, Sony & Toyota, capable of playing a global role, as Hyundai motor & Samsung Electronics do now.

Small & medium enterprises are increasingly viewed as the vehicles through which new ideas & technologies germinate and enter the industrial mainstream. In particular, small new start-ups have had a role in pushing the information technology industry into a higher orbit. In the OECD countries, but also in Korea & Taiwan, China, more R & D is being concentrated in small start-up laboratories and companies. Some of these launch new technology and are then taken over by bigger companies, while some upgrade their products & productivity, enter the export market, and become larger firms.

Intellectual Property Rights

Abraham Lincoln maintained that the patent system could encourage innovation because it added “the fuel of interest to the fire of genius”. But for economies in the catch-up phase of development-such as the regional economies except Australia & N2-the existence & enforcement of a regime protecting intellectual property had minimal consequence for innovation or the productivity of creative industries. Moreover, recent work by Song (2002) on Korea suggests that the accelerating rate of patenting is a reflection of investment in R & D and the competition between large Korean chaebols and their foreign competitors. It has little to do with Korea’s regime of intellectual property rights.

As we look ahead, however, the situation could change with the strength of intellectual property rights becoming far more relevant to the performance of Asian Pacific countries in certain areas for three main reasons. First & foremost, as growth comes to depend much more on innovation and on maximizing the fruits of innovation, encouraging innovation in industries with large up-front research costs demands greater protection of property rights. The creative industries, whose share in Asian Pacific economies is on the rise, suffer large losses because of rampant piracy. The support for the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement has solidified among the signatories of the World Trade Organization. A second, closely related, reason is that technology transfer through FDI, collaborative research and licensing, which necessarily supplements domestic R & D, can be sustained only if foreign partners are assured of an adequate regime of intellectual property rights.

Third, the emergence & commercialization of the creative industries particularly in many Asian Pacific countries have generated increasing domestic support for rules that protect writers, musicians, producers of software, the movie industry and other forms of entertainment. In China, for instance, pirated copies of music compact disc and movie DVDs are available at a fraction of the legal price within three to four days of release of the product. Without protection, creative efforts would be under supplied; by assigning exclusive rights and protecting these rights-which has a cost-society can benefit from the increase in creative effort.

The design of protection for intellectual property rights must strike a balance between giving enough incentives to generate intellectual property, and at the same time, allowing the dissemination of new knowledge. The very nature of knowledge calls for sharing information with widest possible audience, especially since the marginal cost of doing so is close to zero. Granting exclusive rights to knowledge hinders this social objective. With this in mind, the protection of intellectual property typically grants only temporary rights to the owner, after which time intellectual property is moved into the public domain.

Different means of protection are available, depending on the type of intellectual property in question. Here we discuss patent, copyright, & trademark protections, which we consider to be the most relevant for this region.

University-Industry Links:

An open environment with appropriate rights to intellectual property provides some of the economic and social conditions that can promote innovation. However, policies supportive of openness need to be supplemented by policies that deepen technological capability provided the requisite educational infrastructure in place. Once university-based research gathers momentum -frequently with public funding-the volume of research and its use by industry depend on the institutions governing the interaction between universities and businesses. Some argue that universities should not have too close a relationship with industry, for fear that the needs of industry will direct the research directions of universities, thereby undermining universities autonomy, limiting the scale of basic research , and narrowing its compass. But underutilizing the fruits of university research is wasteful from a social standpoint.

Policymakers in different countries may want to resolve these tradeoffs in different countries may want to resolve these tradeoffs in different ways. They have several pathways for encouraging business-relevant research in universities and for transferring intellectual property from universities to industry: licensing by universities, research collaboration between universities and industries, consulting by faculty members, and participation in business ventures.

Research Collaboration between Universities and Industries:

Co authorship between university faculties and university researchers has been rising in the United States. In 1981, 22% of industrial articles were co-authored in all the fields of engineering & science; by 1995, this figure has risen to 41%. Similar trends are apparent in Japan, where industry sources are submitting a growing number of articles to academic journals and nearly two-thirds of these articles are written jointly with members of university faculties.

Participation by Universities in business ventures:

Business ventures by entrepreneurial university researchers are beginning to catch on in countries such as Korea and Singapore. Asian Pacific government and universities may want to encourage this further, because entrepreneurial academics combined vision and creativity with focus and capacity to think laterally. Research in the United States shows that the participation of academic scientist in business can facilitate the transformation of scientific discoveries into commercially viable products, especially in firms where innovative skills are complimented by good management.

Achievement and the remaining agenda:

A wide gap still needs to be closed before the innovative capability of East Asian economics, other than Japan, Korea, and Taiwan (China), catches up to that of the United States and the Western European countries Clearly a modern innovation system is a construct that cannot be quickly cobbled together. Most East Asian countries have been working on parts of their innovation system for decades, but the more developed ones now need to recognize fully the interrelatedness of the many parts and to address on a broad front the supply issues, demand stimuli, and institutional prerequisites.

Intellectual property rights are receiving due recognition , but several countries have yet to appreciate their utility and to mobilize the apparatus to register and enforce them. Markets for technology also require more attention, again because the

volume of technology transfer , not to mention the pace of innovation , rests on the dependability and policing of agreements between transacting parties.

In other respects, however, governments and companies in the region have been more proactive. Korea, Malaysia, and Taiwan (China) have created a large number of research institutes, and few of these, such as the Industrial and Technology Research Institute in Taiwan, China, and the Korea Advanced Institute of Science and Technology, have proven highly effective. Government have also begun promoting R&D by providing tax incentives and research grants, although this has not always spurred genuine research, and spending on research in China is still modest. The creation of research consortia in Taiwan, China, has lent momentum to the development of the computer industry, as it has in Japan. Similarly, the setting up of science parks has attracted firms, although in most cases these have failed to give rise to high-tech activities. Most East Asian governments have sought to attract foreign direct investment, offering a range of inducements. But although they have drawn a large volume of capital to East Asia, the technological spillovers are still fairly limited, mainly because of the shortage of skills and innovation capability.

Over the coming decades, three sets of measures are likely to have the biggest effect on the productivity of innovation systems: those that affect the quality of secondary and higher-level training, those that bring together innovative firms in open, high-tech clusters that become part of international networks, and those that help the region to maximize the gains from information technology.

Bangladesh scenario in the region:

Bangladesh is a country which belongs to the group of least developed countries. R&D works which supplement and assimilate innovation are quite insignificant in this country. Only 0.4% of her GNP is allocated for R&D works whereas the international standard is minimum 1% of GNP. The allocation of GNP to R&D works in other countries of the region such as Australia, Japan, S.Korea and Taiwan (China) is much higher. The major S&T research institutions in Bangladesh are in the public sector. There are about 62 R & D organizations. Since the country's development in all sectors are not balanced & up to the standard & agriculture remains the single major contributor to GDP the collaboration between the R & D and market did not develop significantly. The S & T policy instituted a procedure for such collaboration. Besides universities & other private sectors institutions such as, Bangladesh council for scientific & industrial research BCSIR is the national institution for conducting R & D canalizing R & D output to market demand. The BCSIR has a pilot plant which is responsible for the testing of the processes and commercialization of research products.

Besides BCSIR, the Bangladesh Atomic Energy Commission is the other major national institutes for conducting scientific and technological research. BAEC conducts

research and provides services to medicine, food preservation and sterilization, biotechnology, tissue banking, non-destructive testing (NDT), clinical chemistry, nuclear safety, health physics and radiation control, electronics and isotope productions. Many of the above services are effectively utilized by public and private sector industries and importers to market their consumer products.

In the agriculture sector Bangladesh Agricultural Research Council (BARC) is the national umbrella institution for directing agricultural research. There are four research institutes, which are primarily responsible for development and dissemination of agro-technology in the country. These are:

BARI (Bangladesh Agricultural Research Institute)
BRRI (Bangladesh Rice Research Institute)
SRI (Sugarcane Research Institute)
BINA (Bangladesh Institute of Nuclear Agriculture)

BRRI evaluates the imported as well as locally developed rice varieties and recommends their adaptation by the farmers only after extensive on-firm trials. BARI performs this task for other crops. For jute, sugarcane and tea, the respective mono crop research organizations are responsible for assessment activities.

The agricultural research system in Bangladesh has attained a reasonably high level of expertise in almost all the fields of scientific investigation compared to other sectors. However, research and development capability in horticulture has not achieved the same degree of sophistication.

Efforts in commercialization and diffusion of indigenously developed agricultural technologies have been far more successful. Nearly 40% of the total rice production is obtained from cultivation of varieties released by the BRRI. Wheat has also found its place in the cropping pattern of farmers and its diffusion was made possible by BARI and Department of Agriculture Extension.

The innovation culture and motivation in Bangladesh has not been developed. Immediately after our independence in 1971 most of the industries have been brought under state ownership. So on the one hand the traditional management system has been distorted and the new system has not been well introduced. In this predicament of management and ownership crisis knowledge-based research-oriented product development atmosphere did not find the situation propitious. But gradually after 1975 the industries began to be handed over from Government to private ownership. FDI, strategic alliance and other aspects of globalization began to grow gradually but slowly. New sectors such as garments, fisheries began to dominate the economies. But basically our most of the industries are turn-key projects based on borrowed technologies from the western countries, Japan, China, India, Korea and others. An investor knows that by putting in money in a particular trade or business he can churn out profits soon. If one business is not profitable he can switch over to another, again by buying ready-made

technology from the West. Once he has the required management expertise he can produce and become a big company, by again purchasing any technology he wants. Such an entrepreneur has no need to conduct R&D; therefore he has no urge to initiate R&D.

However, sometimes due to pressure from scientists, the government and customers' demand due to free trade such industries have invested some money in R&D, but these never had a commitment from the heart, a commitment of success. This we have seen with quite a good number of projects where technologies developed by national institution for scientific and technological research was leased out to businessmen, and few of them have succeeded commercially. A public sector telephone manufacturing industry opened an R&D cell sometimes back. But it also closes down a few years later.

How to go about then?

We need a paradigm shift in Bangladesh to make a break through in the stalemate for rapid development of indigenous technology based industry. The appropriate path would be to turn the innovators into entrepreneurs at this early stage for R&D based industrialization in our country. When such industries mature and succeed they will know the value of R&D, how R&D can turn them into giants beating other industries based on imported technology. So they will invest enough funds for R&D, engage academia for R&D and will create necessary infrastructure which can translate scientific and technological inventions received from academia to successful industrial products. Only then we can think of a successful collaboration between industries, academia (R&D organizations) and government. We can develop a dynamic competence in ever producing new products.

Supportive measures should be provided by the government so that the techno entrepreneurs get necessary raw material at low cost, can get required funding in the form of soft loans when they have demonstrated certain level of success using their own resources and making appropriate regulations so that no officials from the taxation department get the opportunity to 'pounce' upon such technopreneurs. The existing government policies are applied for maximizing tax collection from such innovative small enterprises, utility providers do not count them as priority customer and many of the regulations put obstacle in the way of their growth. Besides, such innovators have to struggle with so many odds that their accounting and other formality as required under fiscal rules are difficult to meet accurately. This allows a government official, often a corrupt person, to threat him with dire consequences including closure of the company for any minor defaults. Many such talents turn towards import business and whole sale trading which are immensely profitable without the risks phased by budding entrepreneurs or producers of indigenous R&D based technology. In order to develop our innovation culture we can share the experience of human capital, fund management, capital investment, finances for research and production facilities and FDI of Asian

Pacific region. Other countries of the region may come forward with fund, technology and other aforesaid experiences to flourish our product in changing motions.

Looking forward: 10 Policy Messages-

Each country must pursue a different mix of policies appropriate to its income level, institutional development, recent history, and capacity to frame, finance and implement policies. Thus Japan's menu of policy choices is very different from Vietnam's. Here we offer 10 policy messages that all the Asian-Pacific economies can subscript to, albeit to varying degrees.

Prudent debt management: The crisis of 1997-98 taught Asia pacific and the world that a large volume of overall public and private debt is a source of vulnerability, especially when it includes a substantial share of short-term external debt not offset by exchange reserves. Prudent debt management, domestic and foreign, also needs to encompass a government's contingent liabilities, many of which are not transparent but can be highly destabilizing.

Flexible exchange rate management: Exchange rats should be managed so as to maintain a margin of flexibility (possibly with reference to a basket of currencies) appropriate for the size, openness, and trading relationships of the country.

Regional coordination: The diversity of the region would make a union difficult to achieve in the medium run, but countries can derive sizable gains by focusing their attention on areas-such as trade and financial regulation-where mutual interests are strong enough to overcome the barriers to coordination and harmonization.

Financial reform: Not just the Asian crisis but crises elsewhere have hammered home the costs of weak, underdeveloped, and unregulated financial systems. These are detrimental to growth and to stability. Countries can no longer afford to neglect the restructuring or recapitalizing of banks and the building of market and regulatory institutions. Reform of the financial system will entail relinquishing attempts by government or by business groups to direct the flow of resources from banks.

Deregulation and incentives for innovation in services: In many services there is a large and costly productivity and technology gap between Asian Pacific and leading Western countries. Much of the gap derives from Asian Pacific's multitude of regulations and low level of competition in service markets. Although the short-term adjustment could be painful, over the longer run the gains in growth and employment will more than offset any initial dislocations.

Legal reforms to support the market economy: Both financial reform and broader institutional strengthening will be crucially aided by measures that make the legal system an effective instrument for protecting rights and enforcing rules. The time has arrived to put legal reform at the center of the drive to transform the financial sector and corporate governance and to deregulate parts of the economy while suffering market discipline. We have emphasized throughout this study that the future performance of the region will hinge on the innovation system-an open innovation system that fully harness the potential of ICT. From this follow four further messages.

Resources for innovation: We cannot overemphasize the role of education and research infrastructure in determining the supply of innovation. Human and capital resources will be crucial, as will be mutually fruitful links between centers of research and the business community.

Networks & clusters: For innovative Asian Pacific firms, cooperation, networking, competition, and incentives are no less important. The cost and complexity of advanced research increasingly demand cooperation among players who each bring their own particular knowledge and capabilities to the venture. Commercially successful innovation requires small contributions by many partners and suppliers-even for relatively minor items such as eyeglass frames and toys.

Competition policies: The forces of demand must complement supply: firms must innovate if they are to survive, grow and make larger profits. Without the press of competition, the urge to innovate is almost certain to languish. Vigilant domestic, regional and global trade & competition policies are necessary to keep the system in high gear.

Proactive public policies for innovation: Innovators require incentives, such as tax concessions, assurance of intellectual property rights, stock option schemes for new start-ups, seed money from government and many others. A robust market system can provide some of the incentives, but government must at times be proactive in order to raise and sustain the pace of innovation.

These are the principal policy messages for Asian Pacific countries as they chart their courses into the twenty-first century.

THE END

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