

PROMOTION OF NATIONAL INNOVATION SYSTEMS IN
THE ASIA-PACIFIC REGION: THE ROLE OF APCTT

By

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I NATIONAL INNOVATION SYSTEM

It is important to understand certain overarching characteristics of a National Innovation System (NIS) while considering innovation systems at national, sectoral and sub-regional levels. These characteristics are also important when we examine different innovation systems of different countries.

Elements of innovations have existed in different degrees in all countries even before the concept of an innovation system came into being: it is only that the interactions of these elements were not recognized and hence, they were never integrated into a system that would work together in the national context.

Why did the concept of NIS come into being? In the 1990s, the emergence of information and communication technologies (ICT) as a key enabling tool and as an important infrastructure component exerted a major influence on the technological advancement and economic development of nations. ICT also fuelled globalization of economies – globalization of manufacture, technology development, service providing, society and so on.

Globalization brought competition to our doors, and it became clear that if we don't participate, we would be left behind in the development race. Globalization spread competition within one's national boundaries as well as across national boundaries. To harness the forces of globalization and to sustain competitiveness in the marketplace, it became imperative to innovate. Innovation – the creation of knowledge or combination of existing knowledge to create new products and processes – became the way to move forward. This marked the emergence of NIS.

The term "National Innovation System" has its origin in 1987, when Christopher Freeman introduced it to describe the performance of the economically most successful country of the post-Second World War period – Japan – despite the setbacks it suffered during the war. From the 1990s NIS became a much-studied area, particularly by economists such as Michael Porter, Bengt-Åke Lundval and Stan Metcalfe.

A. Major characteristics of NIS

The major characteristics of an NIS that need to be considered are:

- Innovation and learning;
- Holistic and interdisciplinary;
- Historical background;
- Differences between NISs; and
- Interaction between elements of NIS.

1. Innovation and learning

A basic definition of "innovation" is *"the transformation of an idea into a product or a process"*, though the definition of the term would vary according to the context. It is

understood that all ideas will not be transformed into a product or process, and even if it does, the result need not be a success. This leads to the second aspect of the first characteristic – learning. An innovation system should have the facility to learn as much from failures as from successes. However, in many cultures, there is less tolerance for failures and hardly any allowance to learn from them. This is an important aspect to remember when designing an NIS. Thus, ‘innovation’ and ‘learning’ are the most important norms in an NIS.

2. Holistic and interdisciplinary

An NIS needs to be holistic and interdisciplinary. NIS is holistic in that it operates in a national context – the nation’s history, its economy, its culture, all these provide the backdrop. A comprehensive understanding of this backdrop is required to understand an NIS. The operation and governance of an NIS is interdisciplinary in nature, in terms of technology convergence as well as administration. NIS covers all the technologies that operate in the nation and draws from all ministries and departments, though the S&T ministry might take the lead in the design of an NIS. This understanding is very important for the effective design and successful operation of an NIS.

3. Historical background

Each country has its unique history: some were colonizers, while some were colonized; religion might have played a large role in one, while another would have chosen a secular path; the political governance in one might have been rigid, while flexible in another. Together, all these factors shape the people, the society and culture of a nation. This would have an indirect bearing on the innovation capability, nature of innovation, development and governance of NIS. It is also important to note that modern technologies have become an un-intended influencing factor in shaping the people, society and culture.

4. Differences between NISs

NIS is unique for each country because the manufacturing system, national investment in R&D, technology development and diffusion differ from one country to another. Hence, there is nothing called an optimal NIS. One can only say which NIS is more efficient and effective in comparison with others. One needs to adapt and evolve country-specific NIS.

5. Interaction between elements of NIS

The government, R&D institutions, academia and industries are the major actors in an NIS. Flow of information through the interaction of these actors is considered the lifeline of NIS, as innovation process involves combining new and existing knowledge. The level of interaction – the depth and breadth – between the various actors involved in the NIS will, to a large extent, determine the efficiency of the system. Only through extensive interactions can one know the strengths and weaknesses of a new system, and such knowledge is essential for the adaptation and fine-tuning of an NIS.

B. Key components of the NIS framework

The following are some of the major components of an NIS framework. All of these might not be present in all developing countries or, if present, might not have the required strength. One needs to understand and assess these components carefully before attempting to strengthen the NIS framework.

1. Promotion of national strategic R&D

There are three different definitions of the term 'strategic'. The first derives from defence requirements, the second from strategic trade theory and the third from the production chain. A common notion of threat is that a foreign country or firm could withhold the supply of essential equipment or know-how and thereby cause considerable economic damage. This is the main reason for almost every country that operates national R&D programmes and projects. However, with internationalization of technology, industries/governments have to position themselves in the global technology and value chains to access international markets and strengthen technological capabilities.

2. Human resources development

Technologies are normally embodied in people and institutions, and technologies come from scientists and skilled human resources. Human resource development, known to be one of the most cost-effective investments for a company or a country, is a very fundamental component in any NIS.

3. Creation of linkages between research institutions, academia and industry

Technological advancement proceeds through the interaction of key actors, such as government agencies, universities, industries, R&D institutions and S&T promotion agencies. They provide new opportunities for businesses to compete based on exploiting knowledge, skills and creativities to produce more valuable goods and services. Dynamic linkages between government-supported research institutions, academia and the industry increase knowledge flow, which will transform new ideas and knowledge into businesses and strengthen national innovation capabilities.

4. Commercialization of R&D results

This is a continuous challenge to all developing countries at different levels and varying degrees. New technologies and know-how that have been produced by the R&D institutes should be utilized by the industry to produce new products and services in a competitive manner. This would occur only under specific government policy settings with funding and market access mechanisms for innovators and technology developers.

5. Promotion of venture business

It is a core component that essentially requires intervention and facilitation by the government. The government should promote setting up of venture businesses by

providing technological and financial support and simplifying the start-up procedures. The role of private venture capital is important in augmenting transformation of viable ideas into businesses.

6. Establishment of technology parks and business clusters

Physical and virtual agglomeration of innovators and start-ups to nurture their innovation is a major element of NIS in harnessing innovation. Technology parks and clusters are aimed to provide shared facilities and services for a certain period, and once matured, the start-ups would move out to the market during their growth period. Performance of parks and clusters would depend on their ability to draw and nurture innovators and start-ups.

7. Awareness of latest S&T developments

It is imperative to enhance awareness of the importance and relevance of S&T and its current and potential contribution to the national economy and development of the country among the cross-section of the society to gain public and political support for technology innovation policies. This would also encourage students to pursue professional careers in S&T areas. In many countries of the Asia-Pacific region, the coverage of S&T developments tend to focus on those that appear in the international media originating mainly from the developed countries. Concerted efforts are needed to showcase the latest national S&T developments and achievements in the national media.

8. Promotion of women entrepreneurship

Women constitute a significant part of the workforce, especially in the field of S&T. However, women in both developing and developed countries still face various constraints, such as motherhood and family responsibilities, in developing a career in the area of S&T. Developing and maximizing the capabilities of women would benefit national scientific progress and the overall national economy.

9. Management of a sound S&T infrastructure

A sound S&T infrastructure is essential not only to develop high-quality human resources but also to retain the talented human resources within the country as well as to draw them from outside. It also includes support services to SMEs, such as testing and calibration, standards and quality, and technology and business intelligence, etc.

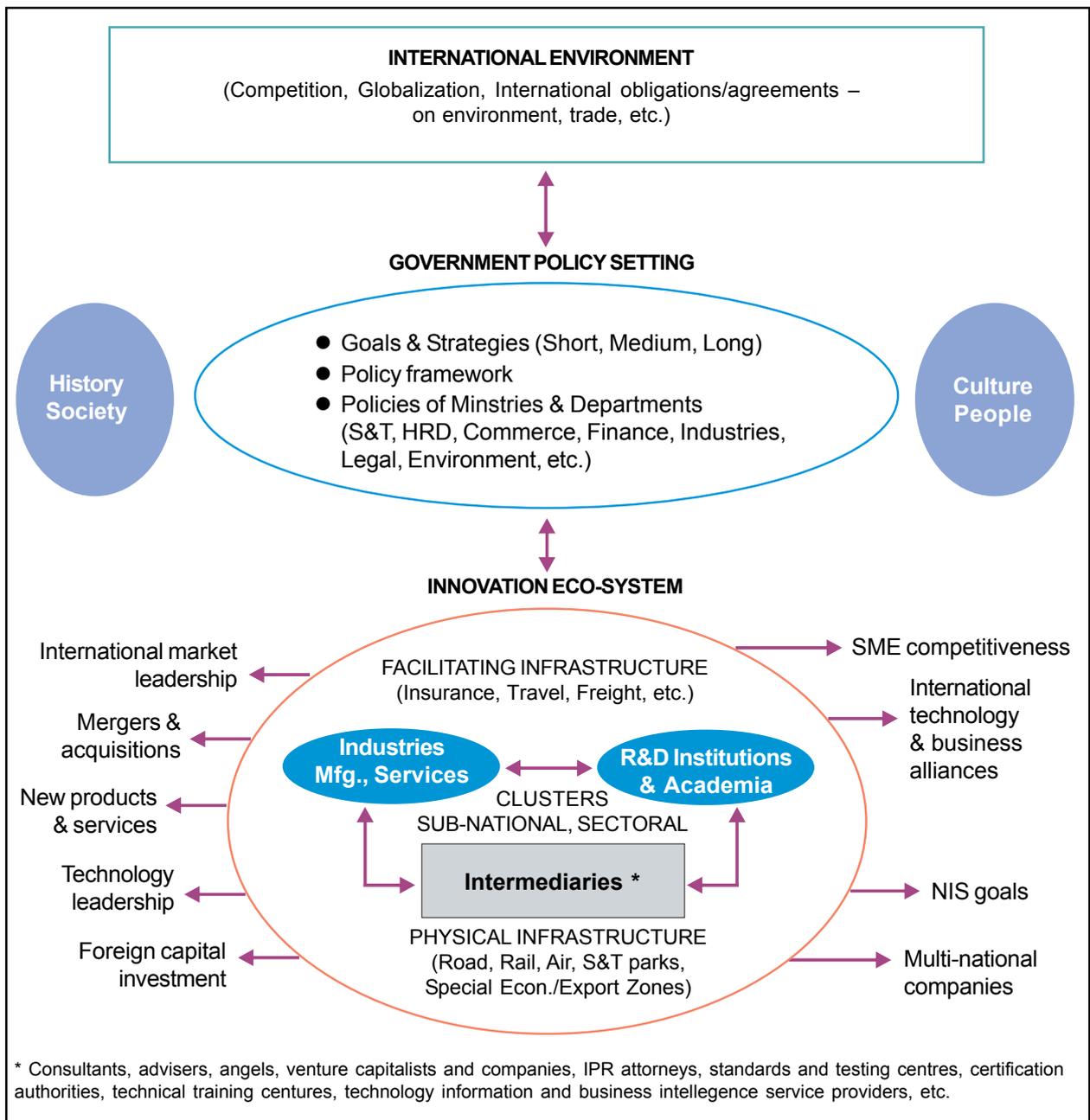
10. Introduction of a new institution and/or reformation of existing institutions

Only in a few countries, performance of institutions are professionally and periodically reviewed and restructured to meet the short, medium and long-term NIS goals. Many developing countries face political, economic and social limitations and challenges in restructuring the institutions. However, this is an essential element of NIS and it also helps meet the national developmental goals.

C. Operation of an NIS

An NIS does not function in isolation; it functions in an international environment that includes market competition, globalization effects, international obligations/agreements on environment and trade, etc. Governments adopt policies in response to bilateral and multilateral commitments, as much as domestic requirements. Thus, the international environment will drive a significant part of an NIS. The following diagram gives an overview of the functioning of an NIS.

Figure 3: Functioning of a National Innovation System



The government policy settings that address issues and strengthen major elements of the NIS framework would result in the development of a robust innovation system. The key NIS actors – the industry, R&D institutions, academia and intermediaries – dynamically cooperate and collaborate in creating knowledge and transformation of ideas into commercial processes and products. The intermediaries would include consultants, venture capitalists, IPR attorneys, standards and testing centres, and technology information and business intelligence service providers. The physical, facilitating and collaborating infrastructures would play a major role in the effectiveness of an NIS.

There are several outcomes that can be measured to gauge the success of an NIS. These include:

- Foreign capital investment;
- International market leadership;
- Mergers and acquisitions effected;
- Commercialization of new products and services;
- Technology leadership;
- Creation of multinational companies;
- Realization of NIS goals;
- International technology and business alliances; and
- Competitiveness of SMEs.

II PROMOTION OF NIS BY APCTT-ESCAP

A. Phase I (2005-2007)

APCTT-ESCAP formulated and implemented a project aimed at policymakers and key actors of NIS to enhance awareness of the concept and relevance of NIS, and enable them to develop policy frameworks and systems. It provided an opportunity to review existing policies and programmes from the context of NIS, and re-engineer/refocus them towards innovation, tailored to the needs of individual member countries. The project also identified challenges to be addressed in developing and practising innovation systems. This project was funded by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India.

As planned, an Asia-Pacific Forum on NIS for High-Level Policymakers and nine national workshops were held in eight countries: China, India, Indonesia, Islamic Republic of Iran, Pakistan, the Philippines, Sri Lanka and Thailand. They drew the participation of nearly 1,200 NIS key actors from these countries. At the national workshops, participants developed a set of recommendations, including appropriate policy mechanisms and support systems, relevant to the host country for promoting innovation and synergizing the knowledge, resources and overlapping mutual interest of industry, academia and R&D organizations.

An Internet desk study entitled “NIS in India – a case study” was carried out as a pilot-cum-demo version for other target countries to carry out similar studies. It contains Web resources on existing national policies and support systems of the Government of India. Other relevant information for the NIS Resource Centre (www.nis.apctt.org)

was also collated and compiled. The recommendations and presentations made by resource speakers and national experts constitute a major component of the Web-based NIS Resource Centre.

The common recommendations from NIS workshops were:

- To evolve and formulate, after due consultation and inter-ministerial coordination, an NIS policy framework with clear vision, strategies and priorities;
- To adopt a top-down, bottom-up or a combination of the two approaches for the development and governance of an NIS policy framework that includes clusters, as well as sectoral and sub-national innovation systems to exploit various competitive advantages of the country as a whole;
- To create and strengthen relevant infrastructure, institutional and support mechanisms, enhancing interaction and cooperation among different NIS key actors (government, industry and academia);
- To establish an appropriate framework to foster entrepreneurial and innovative activities with emphasis on venture capital mechanisms, technology and incubator parks; fiscal incentives to commercialize R&D outputs; and technology transfer liaison offices within NIS key actors;
- To develop and promote a new educational system that fosters at various levels (SMEs, public and private sector, engineering and technical institutes) technology-based innovation and entrepreneurship with emphasis on R&D and innovation management, technology transfer, industry-university collaboration, new venture start-ups and intellectual property rights; and;
- To facilitate and promote key NIS actors to build political and social capital, strongly committed to innovation and research based on entrepreneurial culture, trust, cooperation, interaction and learning.

B. Phase II (December 2010 to November 2013)

The three-year Phase II of the project, also funded by DSIR, would continue to promote the concept of NIS and its organic linkages with the sub-national and sectoral innovation systems by building on the accomplishments of Phase I. It will target 19 CSNs and other selected participating countries that were not covered under the first phase. The present workshop of five CSNs is the first event being organized under Phase II. A second Forum is planned for 24-25 November 2011 at Jakarta, Indonesia, wherein 13 countries would meet and discuss issues related to the governance of NIS.

Following this, 13 national workshops will be organized to address the generic issues of evolving and administering effective linkages among NIS key actors and country-specific NIS components. The approach of benchmarking and sharing of best practices of policy measures, support mechanisms and services would be introduced and promoted at the workshops and meetings. The project would also address the gender dimension of NIS by promoting a discussion of how NIS would differently affect men and women entrepreneurship.

The project will also organize training programmes on development and management of a national web-based NIS resource centre. Dissemination of information on innovations in selected industrial/application areas, and enrichment of contents of the Asia-Pacific on-line resource centres are the other activities planned.