

THE CONCEPT AND ROLE OF A NATIONAL INNOVATION SYSTEM
(NIS) IN NATIONAL DEVELOPMENT

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I INTRODUCTION

National Innovation System (NIS) often means different things to different people. Although we all intuitively understand the phrase, it is necessary that the concept be made clear at the outset of this workshop so that discussions can take place within that framework. This presentation will define the way APCTT-ESCAP looks at NIS. This is by no means the only way that NIS can be viewed: there are many models and many approaches – some advanced and complex, some simplistic and straightforward. The approach that is going to be presented here is neither very academic nor very simplistic. It is a fairly sensible approach that would help us to look at the role that technology plays in sustainable socio-economic development of a country through its NIS.

II NATIONAL INNOVATION SYSTEM (NIS): AN OVERVIEW

The concept of NIS became popular in the early 1990s due to an intensification of interest in studying how the complex and interactive relationships among industry, research and development (R&D) institutions, government and academia could be harnessed to sustain innovation in companies. The term “company” or “firm” is being used here to denote a productive entity that adds value to the economy. It could be a large enterprise (LE), a small and medium enterprise (SME) or even a farmer with a specific set of operations.

The interest in NIS came about because experience suggested that in the economically advanced countries of Europe, North America and Asia, government research institutes, universities and the industry worked in close collaboration to promote innovation at company level and thus spur economic development. The role that the governments played in stimulating such interaction and collaboration attracted much interest in many countries, which wanted to understand the policies that promoted such interactions and replicate them. While the challenges are now different and the areas of emphasis have changed over the last two decades, the interest in NIS has continued unabated.

How do we define an NIS? As said earlier, there are several definitions for NIS, but here we will use a simple definition developed by United Nations ESCAP (ESCAP, 2005) – “A nation’s institutions and policies, governing or inducing the innovative activity of research, invention, development and adoption of new technologies.”

One of the lessons learnt – going by the experience of economically advanced countries, including Japan and Republic of Korea in Asia – is that there is no “single best” NIS model that any late-starter country can imitate. For instance, the evolution of NIS in the Republic of Korea was strongly influenced by government-identified “leader sectors” – such as shipbuilding, white goods, automobiles and steel – working as partners with large private sector firms to transform the nation into a “developed and knowledge-driven economy” through the use of technology. This was how NIS started in the Republic of Korea. At present, however, the scene is very different because an NIS cannot remain stagnant; it has to adapt and change according to global changes.

Similarly, it is possible to perceive distinct characteristics that have governed the evolution of NIS in other countries such as China, India and Singapore. In these countries too, NIS keeps evolving in response to global changes.

A key question that any country, especially a developing country, should ask is: How is NIS viewed in my country and what are the premises upon which it is based? For instance:

- Does it explicitly accept the role of technology and innovation as fostering inclusive and sustainable development? Does the NIS take into account all sections of the society, especially the rural poor and women? Does it promote environmentally sustainable, low-carbon model of economic growth?
- Does it explicitly try to leverage the knowledge and skills of its people, especially its youth, in promoting entrepreneurship?
- Does it accept the importance of a pragmatic “make-some, buy-some” strategy for competing and taking advantage of a global business setting?
- Does it identify selected areas of technology, which have the potential and therefore need to be specifically supported, for achieving long-term benefits?

III CONCEPTUALIZING AN NIS

The basic objective of an NIS is to stimulate the use of technology to achieve competitive and sustainable development. To conceptualize an NIS, it would be useful to start at the firm level because companies compete on the basis of customer value creation. Customer value can be seen as a function of the core value determinants of performance, delivery, flexibility and convenience measured against cost. To reduce this into a formula:

$$\text{Customer value} = \frac{f(\text{Performance, Delivery, Flexibility, Convenience})}{\text{Cost}}$$

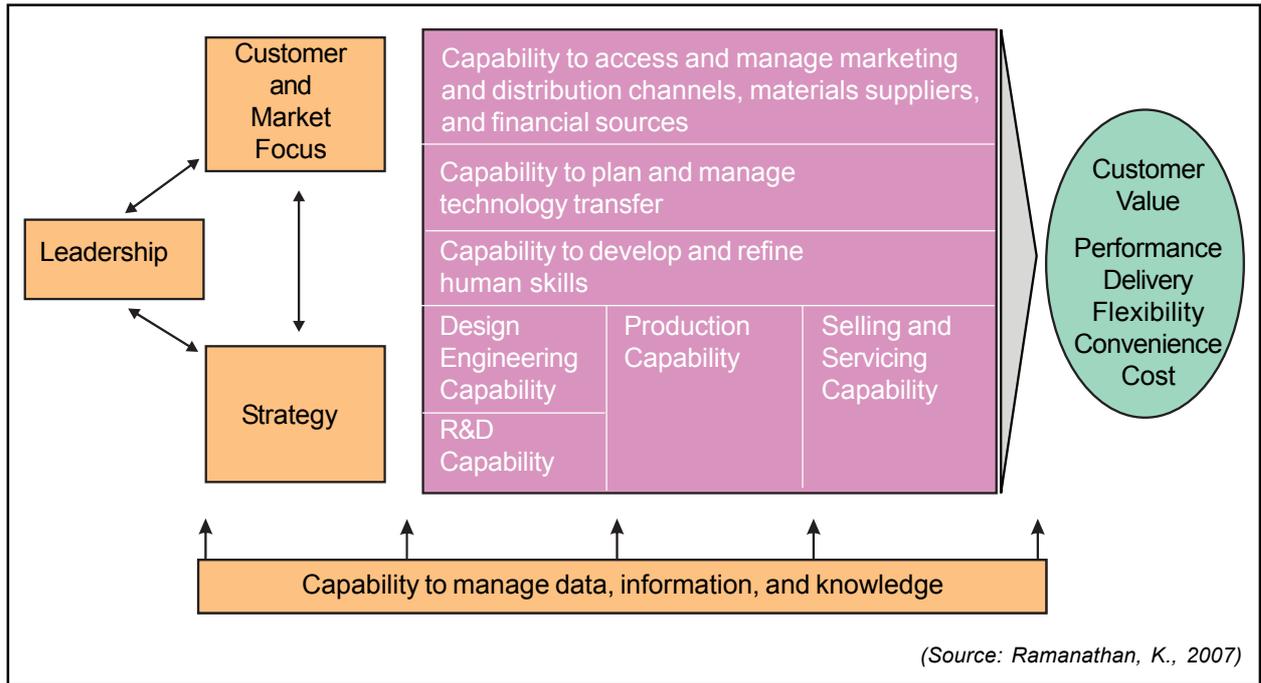
Performance is not limited to technical parameters; it embraces aspects such as quality, energy usage, environment-friendliness, etc. Delivery encompasses quickness and timeliness of product delivery. Flexibility, by and large, revolves around degree of customization possible. For instance, some computer companies allow a large degree of on-line customization of their products in terms of specifications. Ease of doing business with a company translates into convenience. To give an example, today, with the help of information and communication technologies, many products can be ordered and paid for on-line.

All these, however, need to be achieved at minimum cost. A high cost could offset the gains in terms of performance, delivery, flexibility and convenience. Thus, a firm that achieves a higher “f” at lower cost reflects a higher customer value. How can performance, delivery, flexibility and convenience be maximized and cost minimized? This is achieved through the use of technology.

A firm that can create more customer value than another, within the same market segment, will be the more competitive of the two. All firms, irrespective of whether they are LEs or SMEs, compete on the basis of customer value creation. In today’s global

business setting, companies need to deploy their technological capability strategically to enhance customer value and fully harness their growth potential. Figure 1 depicts the different types of capabilities that a firm would need to develop customer value creation through the use of technology.

Figure 1: Customer value creation through technological capability



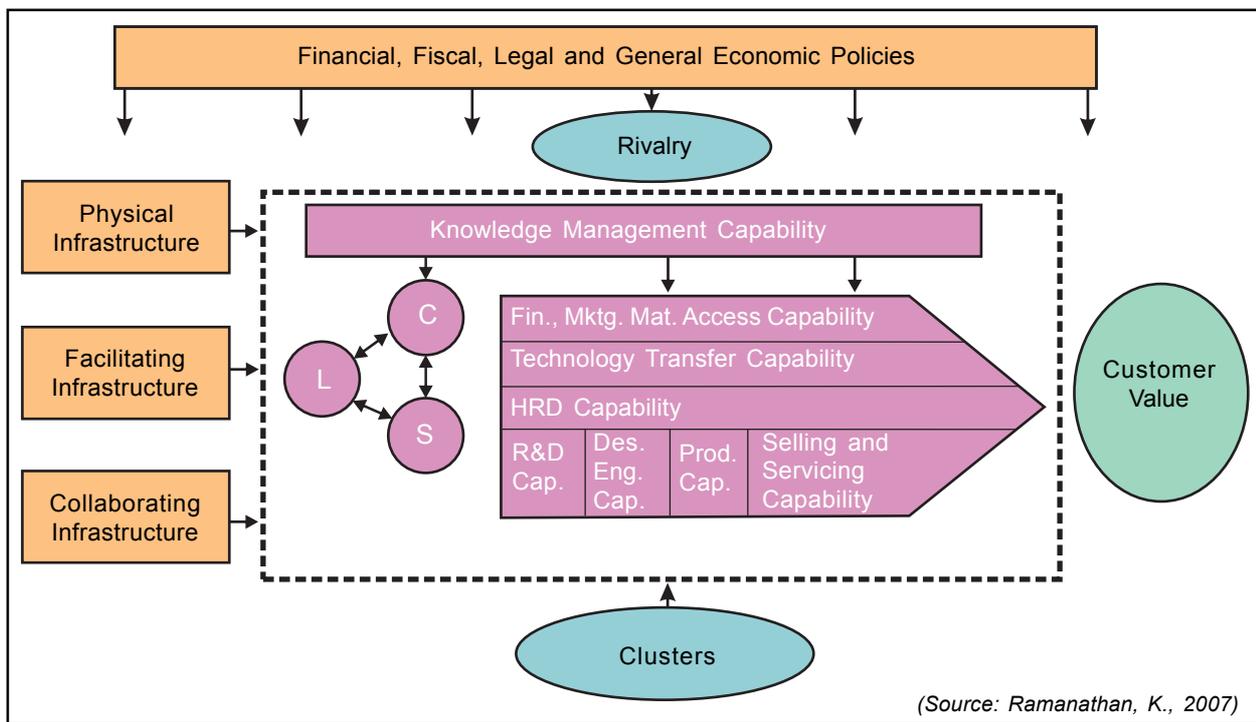
Some of the important capabilities required are identified in general terms – financing, marketing, material sourcing, human skill upgrading, technology transfer and so on. The technological capabilities include R&D capability, design & engineering capability, production capability, servicing capability, etc. Knowledge management capability involves effective management and use of data, information and knowledge to develop technological capabilities.

Even if a company wants to develop technological capabilities and apply them, it will be difficult to do so in the absence of a supportive NIS. The company will need the support of physical infrastructure such as roads, electricity, water and so on. Thailand, for example, is a country that realized this early and put in place basic physical infrastructure facilities, which helped the country recover fast from the harmful effects of the Asian crisis of the late 1990s. A facilitating infrastructure – comprising facilities such as investment promotion boards, venture capital companies, S&T information centres and technology transfer centres – is another requirement. Yet another fundamental need is for collaborating infrastructure, such as government research institutes, universities and design & engineering units. Figure 2 depicts how an NIS influences a company. It could be seen that leadership (L) interacts with corporate strategy (S) and customer need & market focus (C) to decide on the capabilities to develop.

A competitive environment is key to create customer value through technological innovations. If a firm has its assured market and no competition, the incentive to innovate

and develop would be largely absent. Therefore, the government needs to adopt policies that will stimulate market competition. Before the economic liberalization of the early 1990s, the Indian economy was a closed one and seller's markets were prevalent in most of the sectors. For example, in the case of cars and motorcycles, people had to buy whatever was being produced, as choices were limited. But when the economy opened up and competition came in through local efforts and imports, there was a spurt in terms of product choices and quality, and technology use and capability development improved. The Government of India supported these developments through adequate policy measures and infrastructure.

Figure 2: The influence of an NIS on a company



Governments must also put in place policies to develop clusters. For instance, Bangkok is known as the “Detroit of the East” because not only a host of major automobile companies manufacture cars in Bangkok, but also a large number of sub-contractors have set shops there, producing a range of automobile components, forming a cluster that functions well in a competitive environment.

How does the government manage the physical, facilitating and collaborating infrastructures? How does it stimulate market competition and cluster availability? All these are effected through fiscal, financial, legal and general economic policies.

Thus, an NIS has company at the core as the productive entity using technological capabilities to create customer value, and thereby adding value to the national economy, operating in a policy regime that stimulates infrastructure, competition and cluster availability. As said earlier, this is not the only model of an NIS, but this is a simple way of looking at an NIS that would help understand the more complex theories that are being put forward by some prominent scholars and researchers.

Based on the above conceptualization, a major role of an NIS is to foster the technological capability development of productive entities so that they can generate surpluses through customer value creation not only locally but also globally. Thus, a key task for a nation is to develop an NIS infrastructure complete with policies and policy instruments that will enable the elements of an NIS to synergistically and harmoniously work together to foster the sustained technological capability development of productive entities.

IV NIS POLICY FORMULATION: SOME IMPORTANT ISSUES

A. Common problems¹⁴

We often seek comfort in quantity without critically examining the quality of infrastructure, particularly the facilitating and collaborating infrastructures. Similarly, links between institutions and productive entities mean little unless these links are effective and achieve criticality. Another issue is the use of only input indicators for measuring achievements. This can be counterproductive, as inputs need not necessarily translate into intended outputs, required processes or desired impacts. Therefore, output, process and impact indicators are very much needed, though they are difficult to develop and use.

B. Major challenges

A major challenge is: how to use the momentum of the market to national advantage or how can the NIS foster market-oriented “inclusive” innovation? This is difficult because inclusive growth means taking care of the poor and the less privileged, and this is often not profitable. So, how to get private companies to involve in inclusive innovation?

Another challenge is the creation of a new group of high-tech companies to exploit growing global markets. Encouraging global technology leaders to do more R&D closer to Asian markets is another issue, as is exploiting the potential of new S&T development, such as nanotechnology, in new ways.

Obtaining whole-hearted and genuine political commitment from government for an NIS is often difficult. Governmental support has to come in real terms, particularly monetary support.

Nations as a whole are not innovating – though city regions within nations are – and this is a cause for concern. Innovation is not widespread. Why this trend? What are the barriers to nationwide innovation?

Taking advantage of global businesses is another aspect that needs to be examined. Is globalization of business detrimental or a mixed blessing? How can a country establish a “win-win” business relationship with global businesses? How can a country attract business partners who are committed to long-term relationships?

While numbers may be encouraging, is the nation producing the right type of quality skills? This is very important. For instance, Mr. Bhattacharya from the Tata Institute of

¹⁴ Sources: Leadbeater and Wilson, 2007; ESCAP, 2005

Fundamental Research, India, said: “The biggest bottleneck in Indian science is not money – it is a lack of people and a lack of ideas. The human resource crunch is the single biggest difficulty that India faces.” (In Leadbeater and Wilson, 2007). If this is the case with India, which has a billion people, what about smaller countries?

Creation of a supportive S&T culture is important. Such an S&T culture has to be open to global flows of ideas and people, and must be accountable to the civil society. Such a culture has to be a pervasive one for it to provide the right ambience that would promote innovation. For example, leaders in the Republic of Korea created a science movement in the country before setting off on an S&T-based development course. Researchers must feel the responsibility to solve the problems faced by the society.

Another key step is to foster innovation at all levels of entrepreneurship (including grassroots innovation) to avoid the widespread phenomenon of technologically capable large firms and weak small firms.

In a country, there would be different ranks of the society pulling in different directions. There would be some that emphasize inward looking development, while others support participation in global business. Entrenched decision-making systems might be the favourite of some, while others might talk of bringing about a change. Some see S&T development as necessarily elitist, while others argue for mass-based development. Some would advocate the hand of the state in S&T development, while others affirm private and social networks to be more effective. There is a need to cleverly balance these opposing forces, and this is a major challenge.

V CONCLUDING REMARKS

With respect to NIS development, much has been said over the past two decades on fiscal, financial and legal policies, policies that are needed to revamp the education system, those needed to strengthen R&D institutes, and so on. While these are important, in countries that are less developed, there needs to be a focused debate at the national level on what needs to be done to:

1. Create awareness at the national level on the importance of developing an NIS in a holistic way;
2. Create a culture that values innovation and technology-based development;
3. Encourage partnering approaches among business, R&D institutions, universities and government policy-making bodies; and
4. Ensure that innovation is inclusive and promotes social entrepreneurship (maximizes social well-being while maintaining a healthy level of financial well-being).

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