

The National Innovation Ecosystem:

a vehicle toward knowledge-based economy

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Abstract— The Gulf Cooperation Council (GCC) States are in the transition toward a new, knowledge-based economy. As these states diversify from a petroleum-based economy to knowledge-based industries, the countries' competitiveness and performance increasingly will depend on their abilities to foster an indigenous capacity for technological innovation. This paper presents a broad framework for a national innovation ecosystem (NIE) within each state separately which involves all economic, political and social institutions affecting learning, searching and exploring activities.

Keywords—innovation, knowledge-based economy, economic development, national innovation ecosystem

I. Introduction

As GCC states are moving towards more value-added economy, competitive advantages of those states of the future will reside in the creativity of their people and the capacity to create new knowledge and develop new applications of science and technology that can be marketed successfully to meet social and economic needs.

Worldwide, technology commercialization – the process of transferring technological developments from laboratories to the marketplace – has proved to be an effective instrument for promoting economic growth. There are several reasons for this. First, new businesses created, as well as established businesses expanded, on the basis of technological innovation have demonstrated the potential to grow rapidly and generate employment opportunities for the local economy. Second, successful commercialization efforts can catalyze organizational change and stimulate the culture of innovation throughout research organizations, ultimately leading to more productive scientists and engineers. Third, because technology commercialization subjects research and development efforts to market approval, R&D becomes more relevant to regional and national social and economic needs and thereby enhances its impact.

This paper presents designing and setting-up a framework for a national innovation ecosystem (NIE) within each of the six states separately which involves all economic, political and social institutions affecting learning, searching and exploring activities. It summarizes a number of priorities which have emerged in order to strengthen all major components of the NIE such as: Technology incubation and commercialization, Expansion of interaction with university and industry and Intellectual property (IP) management and assistance.

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II. Why Innovation?

Since the 1950s, a large proportion of economic growth resulted from factors related to technological change and innovation. In contrast, knowledge is the key ingredient in technological change and innovation. This interrelation between economic growth and knowledge from one side and innovation from the other encourages countries around the globe to nurture innovation and develop frameworks and mechanisms to strengthen the nation's innovation capacity.

Innovation is not a recent terminology. Schumpeter states that innovation is "Carrying out new combinations, such as the introduction of new good, the introduction of new methods of production, the opening of new market, the opening of a new source of supply, or the reorganization of any industry" [1]. Druker considered innovation as the specific instrument of entrepreneurship [2]. He defined innovation as the act that endows resources with a new capacity to create wealth. Druker looked at innovation as an act that endows resources with new capacity to create wealth or a discipline which can be learned and practiced, means to exploit change as an opportunity.

So innovation leads to new products, new services or new ways of improving the efficiency of traditional factors of knowledge-buildup modes, invention, commercialization and production. It can also result a new production and diffusion methods of knowledge, inventions, products/services; and/or Enhance the reach and richness of goods/services and knowledge to society.

Innovation has various types: business model innovation, process innovation, product/service innovation, systemic innovation, social innovation, position innovation and paradigm innovation. Innovation can also be radical or incremental. Radical innovation is essential as the existing knowledge obsolete and it is a necessity to come up with new knowledge to address the emerging challenges. In contrast, incremental innovation exploits an existing knowledge to builds up on.

Chesbrough looked at innovation as an open environment that welcomes external ideas as well as internal ones [3]. This enables an organization to innovation since not all the smart people work for that organization and it needs to work with smart people inside and outside. Beside, external R&D can create significant value and consequently internal R&D is needed to claim some portion of that value. This leads to that an organization does not have to originate the research to profit from it and should focus on building a better business model rather than getting to the market first. Open innovation allows an organization to profit from others' use of its IP, and in return buy others' IP whenever it advances that organization business model.

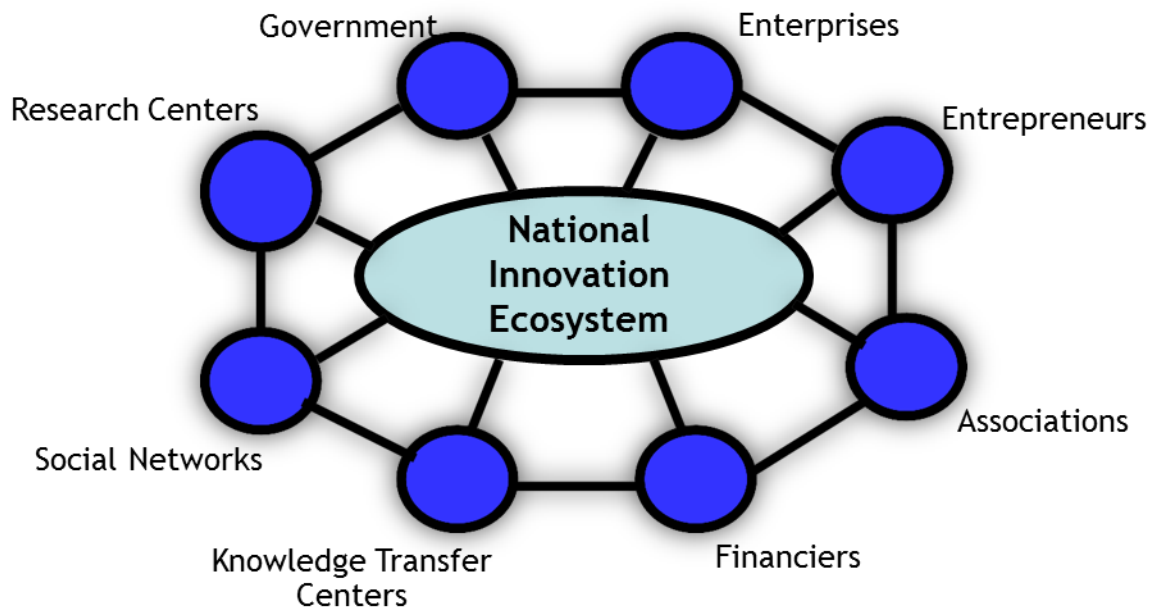


Figure 1. National Innovation Ecosystem

III. Defining the NIE Framework

Various theoretical frameworks have guided policy-makers as they pursued dedicated efforts to strengthen capacity for innovation-based economic growth. In parallel, individual nations have devised practical applications and structures designed to address the major challenges related to Science, Technology and Innovation oriented development.

A. Theoretical Constructs

As a foundation for defining a system that is appropriate on a country level, we examined 7i framework which is oriented towards countries that are at the early stages of entering innovation-based economic development [4]. The 7i framework consists of the following six main blocks: infrastructure, intellectual capital, integrity, incentives, interaction and institutional coordination, beside those block is innovation. The following illustrates the details below each block:

1. Infrastructure:
 - 1.1. Physical Infrastructure
 - Movement of goods and people (roads, ports and airports, etc.)
 - Schools, libraries, laboratories
 - 1.2. Digital Infrastructure
 - Affordable Instantaneous and global connectivity
 - Broadband and 'quadruple-play' is the standard
 - Bridging the digital divide
2. Intellectual Capital
 - 2.1. Education – universal access (pre-school to university)
 - 2.2. Training Research Personnel (HDR programs)
 - 2.3. Training and up skilling programs for industry
 - 2.4. Entrepreneurship development programs in Institutions of Higher Learning
3. Integrity
 - 3.1. Transparent processes
 - 3.2. Instilling good governance
 - 3.3. Best practices
 - 3.4. Global benchmarks
 - 3.5. Safety and Security
4. Incentives
 - 4.1. Access to public funded research (2%-4%of GDP).
 - 4.2. Policy to enhance resource to support R&D, patenting and commercialization.
 - 4.3. Fiscal and non-fiscal policies to encourage R&D activities among firms.
 - 4.4. Target policy to enhance resources (priority areas and target clusters).
 - 4.5. Private funding (Angel funds, VCs)
 - 4.6. Equity markets to fund technology and knowledge-intensive companies
 - 4.7. Innovation futures market
5. Interaction
 - 5.1. Communication between government agencies
 - 5.2. Communication between government agencies and private sector
 - 5.3. Communication to the general public and social groups
 - 5.4. Role of bringing organizations and knowledge centres – e.g. TEKES

- 5.5. Enhancing Industrial Clusters and regional Industrial clusters (as part of the Regional Innovation System)
6. Institutional Coordination
 - 6.1. Science Technology & Innovation Policy Council (General Policy Framework)
 - 6.2. Relevant ministries and agencies for STI formulation, regulating, financing and coordination
 - 6.3. R&D Center (RDC) facilitating and modulating institutions (technology transfer & advice agencies)
 - 6.4. R&D performers
 - 6.5. Knowledge & technology transfer centres
 - 6.6. Goods and service providers
 - 6.7. Chambers of Commerce
 - 6.8. Science Parks / technopoles
 - 6.9. Associations, Social Networks, Groups and NGOs

B. **Proposed NIE Framework**

Figure 1 shows NIE framework. This must be acceptable for both current and future challenges when considering economic development. Therefore, the basic items like infrastructure and education must be taken into consideration as most of GCC states are still building its ability to innovate. Simultaneously, the countries must learn from the experiences of other nations in this regard. We are listing below some remarks to three of the main pillars for such a framework.

1) **Infrastructure**

This is necessary for innovation. All innovation ecosystem frameworks emphasize on the importance of infrastructure in some respect. The types of infrastructure are more complex in countries with more advanced NIEs. While for those with nascent knowledge economies, building essential infrastructure may assume a greater role in the NIE framework. The three infrastructure sub-components necessary to build the proposed NIE are: physical infrastructure, digital infrastructure, and institutional infrastructure.

2) **Human Capital**

A principle of innovation-based economic growth is that such development needs a more knowledgeable and skilled workforce than for economies based on natural resources extraction. Therefore, a willingly available foundation of skilled workers is central to the NIE concept, as are the building blocks that make individuals ready to work functions. Three components of human capital are fatal: primary, secondary, tertiary and vocational education and training; workforce quality and composition; and specialized training for researchers and scientists.

3) **Innovation Capacity**

This refers to the systems available to support the transformation of a broad range of new ideas into marketable products, processes or services. Intrinsically, this pillar focuses on entrepreneurship of all types. Two components of innovation capacity are critical: business dynamism (i.e., entrepreneurship, startups, types of intra-enterprise innovation, enterprise competitiveness, and extent of involvement in medium- and high-technology sectors); and the nature and levels of innovative capacity (e.g., types and levels of research

output, mechanisms for and extent of technology transfer and diffusion, research commercialization, and firm-level innovation).

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