Performance Measurement of Technology Ventures by Science and Technology Institutions

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INTRODUCTION

Developing and transitional economies are keen to advance their science and technology in augmenting social and economic progress so as to catch up with developed economies. While the concept of national innovation system gains significant interest among emerging economies, institutions for science and technological innovation have been established to nurture the growth and expansion of technology ventures (Freeman, 1995). Since the early 1980s, institutions in the USA, UK, Germany, France, and Japan have been established to stimulate their countries' economic development through technological innovation and advancements of their emerging industries. Local universities have been involved as well. For instance, Massachusetts Institute of Technology (MIT) in the U.S. developed its Industrial Liaison Program in 1948 (Liu & Jiang, 2001). In China, the University-Industry Cooperation Committee of Tsinghua University (UICCTU) was established in 1995, providing various collaborative services for the member companies including IBM, Motorola, Hitachi, and NEC (Liu & Jiang, 2001).

In recent decades, an increasing number of science and technology institutions (STIs) have been founded to pursue the development of high technology companies in partnership with enterprises with the aim of undertaking joint projects for the assessment of new technology ventures (De Coster & Butler, 2003). The growing importance of technological innovation in national economic development has been increasingly recognized. China, as a transitional economy, has stepped up its Research and Development (R&D) expenditures and advocates institutional collaboration with the private sector for innovation performance (Boeing, Mueller, & Sandner, 2016; Kafouros, Wang, Piperopoulos, & Zhang, 2016). Hong Kong, China's special administrative region, established its Innovation and Technology Bureau in early 2016 as an effort of the government to foster innovation and technology industry in collaboration with local universities and its Science Park.

However, challenges remain significant in performance measurement and management for STIs' effective development, given the intention to reduce the rate of failures among early-stage ventures. Prior studies looked into issues with managing performance of technology ventures (Ganotakis & Love, 2012; Li & Atuahene-Gima, 2001). These studies that focus on specific dynamics of growth and development from the standpoint of resources allocation process did not fully examine pertinent externalities. Externalities, such as market competitions, applications, and commercialization of emerging disruptive technolo-

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gies, would further complicate the environment and potential success of new technology ventures.

This chapter explores the dynamics between resources management and external landscapes as critical consideration in performance measurement and management of technology ventures. Based on an interdisciplinary literature review, a pertinent framework is developed with a set of monitoring areas and success indicators. The authors argue that STIs would have to utilize their expertise in specific clusters as intangible resources to assess product development and innovation capabilities as competitive strengths among the ventures. However, there could be limitation to the efficacy of a top-down, mechanical planning and control approach adopted by STIs to facilitate the innovative development of an emerging technology sector, given the constant dynamics of external markets.

BACKGROUND

Technology Monitoring and Assessment by STIs in Emerging Economies

STIs require a systematic corporate approach to monitor and assess the ongoing development of science and technology in order to capture the next big waves. At a country level, the concept of national innovation system is supported by the use of technology foresight techniques to strengthen its effectiveness among developed countries (Martin & Johnston, 1999). The use of a national innovation system is also advocated for the promotion and formation of partnership for effective technology development within a developing country (Hall, Bockett, Taylor, Sivamohan, & Clark, 2001). Bradford, Kinzey, and Gunn (1991) pointed out the importance of having a structured approach to monitor programs in both public and private sectors on a global basis. Their study also proposed a schematic to outline both internal and external aspects, as well as to keep abreast of technological changes in order to ensure a healthy development of an organization. Nevertheless, expertise is needed to provide in-depth and timely review of the associated technology sectors.

Lichtenthaler (2004) used a case study to outline a framework that demonstrates the need to assess technological change through structural, hybrid, and informal forms for coordinating technology intelligence processes. This framework is made of coordinative forms of technology intelligence at both company and technology levels. The dynamic environments of technology ventures, as investigated by Zahra and Bogner (2000), are highly crucial to the determination of these concerns' internal development and exploitation of technological resources, and therefore to their performance and even survival. Under such a competitive environment, technology ventures are pressured to develop new products, upgrade them, and strengthen R&D in a timely manner, especially under the highly competitive markets of developed economies.

However, STIs could be hindered by their internal bureaucracy and formal constraints while the external environment changes rapidly. As North (1990) noted in his examination of institutional performance,

The major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessarily efficient) structure to human interaction. But the stability of institutions in no way gainsays the fact that they are changing…. Institutions typically change incrementally rather than in discontinuous fashion. (p. 6)

In light of emergence of disruptive technologies, an institution could have neglected such changing externalities and missed an opportunity to counter swiftly.

Challenges in Nurturing Early-Stage Technology Ventures

The emergence of technology ventures creates positive effects in modern economic development fostering innovations of industries; however,