# Quality Assurance through Innovation Policy:
## The Pedagogical Implications on Engineering Education

*Marlia Puteh, Universiti Teknologi, Malaysia*

*Kamsiah Mohd Ismail, Universiti Teknologi, Malaysia*

## ABSTRACT

*A number of countries are focusing on innovation to advance their economies up the value chain. Hence, a large emphasis is given to engineering education as activities that engage scientific development generally originate from the engineering field (Ashford, 2004). A country's innovation policy also determines educational reform as the education sector is a key player, holding holds the intellectual capacity and trained human resources to execute the transformation. In this regard, the engineering profession and accrediting engineering programs have repeatedly called for reform in the engineering education pedagogical approach. Despite debates over the effectiveness of outcome-based education, the prominent teaching methodology has always been attributed to the traditional approach of "chalk and talk" (Mills & Treagust, 2003). This study investigates the critical role of science, technology and innovation to a country's economy. It will also examine the extent to which the educational approach, particularly in the engineering education field, is coherent with the national system of innovation, exposing students with real perspectives for future workplace environment.*

*Keywords:* *Educational Reform, Engineering Education, Innovation, Pedagogy, Project-Based Learning, Quality Assurance*

## INTRODUCTION

*"For developed countries, innovation is the key to growth, prosperity and quality of life." (Carlson & Wilmot, 2006, p. 274)*

Countries around the world are engaged in strategic moves towards building a more innovative and vibrant economies. In this regard, Carlson and Wilmot (2006) proposed that these countries should rely on the innovation led economy which constitutes the creation and delivery of new customer value in the marketplace. Hughes (2005) provided an important warning when discussing the 21st century competitiveness strategy. According to Hughes (2005), the "health" of the economy inevitably shapes the focus and speed of innovation on the whole economy (p. 74). In a similar vein, Ertl et al. (2007) claimed that science, technology and innovation activities have initiated economic

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and social change to countries around the globe. Even the Americans have identified innovation as "…the single most important factor in determining America's success through the 21st century" (Council on Competitiveness, 2005, p. 7).

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), innovation is broadly defined to include not just new technologies but new services and new forms of managerial organization (Aylen &Marjoram, 2008). The Organisation for Economic Co-operation and Development (OECD), in addition, defined innovation according to the following four types of innovation; product innovation, process innovation, marketing innovation and organizational innovation (http://www.oecd.org). Despite the ambiguity of the term as it refers to both the process and the result of innovation (European Commission, 1995), the term ***innovation*** has shown a tremendous influence in the academic, societal and political arena worldwide. In lieu with this, UNESCO has outlined three basic assumptions underlying the notion of innovation i.e. innovation involves strategies from the national governments, innovation relates to scientific research, IT infrastructure and patents and innovation as a crucial concept in the economic domain. Carlson and Wilmot (2006) further identified the major roles of government policies, critical infrastructure of a country and cultural determination of its people to help construct an environment which fosters opportunities for innovation. The authors reflected on the Chinese and Indians work culture of 60 to 70 hours per week and the fact that these people are "…full of ideas, enthusiasm and energy" to "…surpass the United States and the rest of the world" (Carlson & Wilmot, 2006, p. 23).

Hence, Carlson and Wilmot strongly proposed that innovation is integrated into the basic curriculum to promote the culture of innovation. This tallied the recommendations made by the United States' National Council on Competitiveness. The Council argued for the "retooling" of curriculum by creating an "innovation culture" which provides students with exposures on open-ended problems, teamwork and cross-discipline project engagement at all levels from kindergarten to graduate education (Council on Competitiveness, 2005, p. 19). Using some of Carlson's and the National Council on Competitiveness innovative proposals, this paper analysed the extent to which institutions of higher learning contributes to the intellectual capacity and innovative human resource to help advance a country's economy. The following section will discuss the innovation performance of a few selected countries because understanding the relationship between science, technology and innovation is crucial in appreciating the unwavering impacts of these components to the economy.

## SCIENCE AND TECHNOLOGY AS INNOVATION INDICATORS

Many countries have engaged in efforts to strengthen their science and technological capacity by fostering innovation to improve their global competitiveness. Technological innovation commonly driven by government policies support the national development strategies and drives the industrial growth of a country. What are the innovation indicators of a country? The World Bank (http://www.worldbank.org/) measures of innovation activities include the following; high technology exports (% of manufactured exports and current US$), patent applications (residents and nonresidents), R&D expenditures, R&D researchers, royalty and license fees (payments and receipts), trademark applications (direct resident and nonresident), R&D technicians and the number of scientific and journal articles. According to Arundel (2007), "…R&D indicators were the most widely used and were considered to be the most valuable" (p. 51). Reporting on the dominance of these R&D indicators to the innovation policy making in Europe, Arundel attributed this development to the ongoing power of the linear model of innovation and the structure of innovation support programs which are currently implemented (Arundel, 2007).

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