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The current transition in management of technology education: The case of Korea

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ABSTRACT

Although South Korea's MOT (management of technology) education was begun early in the country's industrialization process and is contributing significantly to the fast growth of the Korean economy, its unique features and value have not been well publicized in international society. Since 2008, Korean MOT education has undergone significant changes and entered into a new phase in its development. In this study, we explain how Korean MOT education has been developing in alignment with changes in Korean industry. We then describe some new directions which Korean MOT education is currently adopting. These new directions are transforming industry's innovation characteristics from process to product, from high-tech to high-touch, from productivity to creativity, from manufacturing to service, and toward increased entrepreneurial venture creation. To achieve these new transitions, Korean MOT education has employed three key principles: dual focus on innovation and entrepreneurship, multidisciplinary problem solving, and balance between theory and practice. New changes in program tracks, curricula, courses, student profiles, and organizational structure that are based on these three principles of Korean MOT education are also discussed.

1. Introduction

MOT education is an industry-oriented academic discipline aimed at fostering the development of professionals who can manage technology and innovation-related issues in a business or government setting (Badawy, 1998; Hang et al., 2009; Phan et al., 2009; National Academies 1987). Therefore, the development and evolution of MOT efforts in the mission, direction, program structure, curriculum, and targeted student group are highly interdependent with respect to the development of the corresponding industry in the region or nation where institutions responsible for MOT education are located. From this perspective, different MOT schools have been developing unique programs to reflect the industrial demands of their regions (Nambisan and Wilemon, 2003; Li-Hua and Khalil, 2006; Wong, 2009; Hang et al., 2009; Horwitch and Stohr, 2012). Previous studies have introduced some MOT programs and directions and have provided valuable insights and suggestions for strengthening MOT programs in other regions (Okutsu et al., 2004; Kameoka et al., 2007; Clarysse et al., 2009; Wong, 2009; Hang et al., 2009; Yanez et al., 2010).

South Korea's MOT education began early compared with other countries, such as the United States and Singapore, and it has contributed significantly to the rapid growth of the Korean economy, which is primarily based on manufacturing and innovation-based industries (Oh et al., 2011; Crotty and Lee, 2006; Lee, 2007; Kwak and Kim, 2014). However, South Korea's MOT education is not well known in international society because its unique features and development paths have not been widely publicized. In 2008, Korean MOT education underwent significant changes and entered a new phase in its development with respect to the new industrial phase that the Korean economy is undergoing. In that year, the Korean

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government began to invest heavily in MOT education to expand MOT human resources and to facilitate the transformation of Korean industry from being capital intensive to knowledge intensive (Song, 1977; Brittan, 1997; Lee and Lim, 2001; Oh et al., 2011; Lee, 2007). Consequently, many new MOT graduate schools have been established and are growing rapidly.

Therefore, an examination of the ways in which Korean MOT education is developing in tandem with the changes associated with this new Korean industrial phase would be meaningful. Three aspects of this examination make it particularly valuable. First, Korea has managed many iterations of MOT education in adapting to rapidly changing industry characteristics. The unprecedented rapid growth of the Korean economy in recent decades has witnessed a progression of various industrial phases in a short period (Hahm and Mishkin, 2000; IMF, 2004; Lee, 2007; Oh et al., 2011). The country's industrialization began in the 1960s and transformed its industry structure from labor intensive to capital intensive, inducing more internal and external investment in the 1970s and 1980s. Since the 1990s, industry has been transforming again, from capital-intensive to knowledge-intensive industries as well as from manufacturing to service-oriented industries (Amsden, 1989; Oh et al., 2011, 2014; Bank of Korea, 2004; Lee, 2007). During each phase, the Korean economy required different MOT-related human resources to facilitate industry development and structural transformation. Therefore, understanding how Korean MOT education has changed its paradigm to align with the transformation of industry structure can offer important insights for countries that are currently experiencing similar industrial changes, such as China, Brazil, Turkey, and Mexico.

Second, Korea has a relatively long history of training in MOT human resources. The industrial structure of the Korean economy largely consists of manufacturing and innovation-based enterprises (Lee and Lim, 2001; Kim and Lee, 2002, 2003; Oh et al., 2011, 2014; Lee, 2007), such as the automobile, petrochemical, steel, shipbuilding, and semiconductor industries. Consequently, MOT human resources have been one of the most important human assets for the economy since the early 1970s, when industrialization started to become more visible in the economy, although those human resources were not clearly identified and categorized as MOT at the time. Therefore, Korea's history of MOT human resource training, including idiosyncrasies in MOT education, may ease the path of development for MOT institutions in other countries.

Third, the paradigm shift in Korean MOT education has been underway since 2008. The new paradigm aims to foster new types of MOT human resources that will aggressively open and lead global markets. Understanding the Korean transition would therefore be particularly useful for such institutions in developed countries such as the United States, German, and Japan because their firms are directly competing with Korean firms to replace the catching-up strategy that some firms have supported in recent decades. The large number of Korean companies that are leading in global markets have been developing unique innovation strategies and demanding distinctive MOT human resources (Oh et al., 2011; Lee, 2007). Therefore, examining recent changes in Korean industry will provide useful information regarding the direction that MOT education must take in the coming decades to secure global industrial competitiveness.

Therefore, in this study, we discuss the development of Korean MOT education in conjunction with the development of Korean industry. We then introduce new directions that Korean MOT education is adopting to transform industry's innovation characteristics from process to product, from high-tech to high-touch, from productivity to creativity, from manufacturing to service, and toward entrepreneurial venture creation. With these new transitions, Korean MOT education is undergoing a paradigm shift based on three principles: dual modes of innovation and entrepreneurship, multidisciplinary problem solving, and a balance between theory and practice. We also introduce new changes in program tracks, curricula, courses, student profiles, and organizational structure that are based on these three principles of evolving MOT education.

2. MOT education and its current development worldwide

Management of technology (MOT) education links or integrates engineering, science and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational goals of organizations (National Research Council, 1987). Therefore, capabilities such as MOT enable firms to strategically align technological assets with a company's managerial direction and to achieve firm profitability and growth. As technological assets such as IT became more available to firms, MOT capability became more important for firm management beginning in the 1990s. In addition, the rise of a knowledge-based economy has brought greater attention to the management and commercialization of intellectual property, which is one of the core MOT agendas (Markman et al., 2008; Cho and Kim, 2014).

In response to these changes, education and related academic research programs in technology management have been emerging worldwide. Originating largely in the U.S. and a few Western European countries, MOT programs are now primarily found in engineering or business schools. In the U.S., universities started to produce MOT-educated engineers and scientists to respond to the 1980s manufacturing-oriented industrial needs (Reisman, 1994). In the 1990s, new information-driven innovation brought more attention to MOT education to produce engineers and scientists who are able to address integrated issues of technology and corporate management (Nambisan and Wilemon, 2003). As a consequence, the number of MOT programs increased from only 30 engineering management programs in 1976 to nearly 200 programs worldwide by 2001 (Santo, 2001). In addition, the emergence of new institutions, such as incubators, science/industry parks, research joint ventures, and technology alliances, has significantly affected technology management education (Phan et al., 2005). Correspondingly, MOT education emerged as mainstream business management during the 1990s and as an independent educational discipline worldwide (Nambisan and Wilemon, 2002).

MOT education provides a broad spectrum of courses, themes, and industry focuses and emphasizes several key themes and courses, including innovation management, technology strategy and marketing, R&D management, project management, entrepreneurship, new product development, and intellectual property management, among others (Atkinson and Correa, 2007; Horwitch and Stohr, 2012). Other traditional areas of management study, such as finance, accounting, organizational