Chapter 9
Engrafting Innovation and Leadership in Civil Engineering Education

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ABSTRACT

Innovation and leadership play a vital role in civil engineering discipline in an intense level of global competition. The role of civil engineers is crucial in building the nation. Researchers, construction managers, consultants, and construction executives are calling upon the academicians, educators, and technocrats to produce civil engineers with multidisciplinary and interdisciplinary skills with effective communication within a comprehensive economic and social framework. In order to meet the professional demands of civil engineers, formal leader development must be incorporated in civil engineering education. In this chapter, the necessity of engrafting the innovation and leadership in several domains of civil engineering education was highlighted.

INTRODUCTION

The term innovation is defined as the adoption or development of several new methods and techniques in the chosen field. Earlier, Intellectually talented and knowledgeable engineers with strong technical skills were sufficient for the needs of society. In 21st century, professional skills such as leadership and Innovation have become critical for graduating engineers entering in corporate world. The requirement for research and development projects is increasing as per the needs of the globalized world. By considering the civil engineering education in developing and developed countries under current trends, the leadership skills of the engineers for management of innovative projects is increasing drastically in recent years due to theoretic, practical and numeric education provided by the engineering department. Innovation is one of the most knowledge-intensive activities (Overall, 2015). Uddin et al.(2017) states that, effective leadership plays a significant role in promoting a supportive climate for exposing knowledge into organization innovation. The construction industry is one of the economic sectors worst

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affected by occupational injuries, severe and fatal ones in particular. More than 20% of the 3841 European occupational fatalities in 2015 occurred within construction (Eurostat 2017). Recent research into occupational safety indicate that the way leadership is executed may be imperative for how occupational risks are managed and occupational safety advanced, across economic sectors (Zohar 2002, 2010, Conchie 2013, Pilbeam et al. 2016). Transformational leadership has been identified as a promising component of effective safety leadership (Mullen and Kelloway 2009, Clarke 2013, Grill et al. 2017). Hofmann et al.(2017) argue that having a shared experience of leadership may be the prime aspect of the safety climate in workgroups and organizations. With the rapid development of the construction technology, the construction industry has become more knowledge-intensive, thus it became imperative to carry on innovation by the sustainability trends (Wen & Qiang, 2016). "Instead of providing a unique solution for the design team to accept or reject, the best engineers can map the design constraints in a productive way" (Ochsendorf, 2016). Cross-pollination and the tendency to work on multiple projects simultaneously, described by researchers Gruber and Davis as a 'network of enterprises' (Harford, 2016) has been found to be common practice amongst creative people. Additionally, the project success partially depends on the manager's leadership style Tabassi et al.(2016). Many of the universities located in Turkey offer classes on project management as part of their civil engineering curriculum. However, these classes focus on subjects which are deemed fundamental for the industry such as cost calculations, quantities, unit cost analyses and planning instead of focusing on developing leadership skills in graduates Yildizel et al . (2015).The path to a successful project is possible through better and quality leadership with an innovative approach. In this context, leadership plays a pivotal role in meeting the needs of civil engineering profession in an elevated global competition.

LITERATURE REVIEW & BACKGROUND

Engineering profession is often associated with extensive problem solving. Therefore the ability to solve problems creatively has been identified as one of the imperative competencies for graduating students by engineering associations worldwide (National Academy of Engineering[NAE] 2005). It has been reported that the traditional methods of teaching engineering students do not necessarily succeed in enhancing their problem solving and creativity skills (Belski et al.2013). It was also reported that significant differences exist in problem solving approaches of engineering experts and novices and that these differences need to be taken into account whilst developing and improving engineering curricula (Harlim & Belski, 2013]. Although creativity has been investigated extensively over the last 50 years, there are still significant differences between researches in the definition of creativity (Weisberg, 2006). Creativity researchers do not fully agree on the sources and prerequisites of creative performance. Some investigators suggested that creative performance in many domains requires gaining substantial domain knowledge (Sweller, 2009). Others advocated the importance of at least 10 year of extensive professional practice for attaining creative performance (Ericsson et al.1993). Research reports on differences between problem solving strategies deployed by novices and experts indicate that the conclusions drawn by investigators who researched with well-defined problems do not necessarily translate to the domain of ill-defined problems that are at core of the engineering profession (Cross, 2004).

Innovation was found to be essential to aspects of organizational performance, notably, operational effectiveness (Neely and Hii 1998), financial outcomes (Jansen et al. 2006), and market competitiveness (Daft 2004), and to the growth and development of the industry (Scott 2006) and of society as a whole