

## Chapter 9

# Women from Diverse Backgrounds in the Science, Technology, Engineering, and Math (STEM) Professions: Retention and Career Development

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### ABSTRACT

*The strength of the Science, Technology, Engineering, and Math (STEM) talent pool is a key factor for boosting innovation. This pipeline has been weakened substantially as emerging groups of STEMs, particularly White and minority women, have failed to enter STEM professions at the same rates as White males. Moreover, once women from diverse backgrounds overcome significant hurdles during the educational process, they depart the STEM workplace at alarmingly high rates. Some of the reasons for this phenomenon are discussed in this chapter, along with some solutions about how to decrease these departures. Additionally, ways to focus on the future needs of the changing demographics of the STEM workforce are reviewed. Ultimately, the goal is to offset STEM shortages in intellectual capital and mitigate brain drain and brain migration circumstances so that the U.S. can fully leverage the contributions of high-ability women from diverse groups, eventually benefitting innovation strategies.*

### INTRODUCTION

Science, technology, engineering, and math (STEM) professionals are critical to the innovative capacity and competitiveness of any nation, including the United States (Atkinson & Wial,

2008; U.S. Congress Joint Economic Committee, 2012). Even though there have been significant increases in some of the areas covered by the STEM professions, there is a projection of an overall shortfall of STEM talent in the U.S. (Herring, 2010; Partnership for a New American Economy, 2012;

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Wadhwa, 2012). Of ongoing concern is the fact that White and minority women (Hispanics/Latinas, African American, Native Americans) continue to be significantly underrepresented in terms of STEM undergraduate and graduate degrees or are underutilized (especially Asians/Pacific Islanders) within STEM occupations (National Academies, 2010; Wasem, 2012). Additionally, women from all demographic backgrounds who enter STEM careers end up leaving the field after fewer years of employment and at significantly higher rates than their male counterparts (Hom, Roberson, & Ellis, 2008; Sassler, Levitte, Glass, & Michelsmore, 2011; Sevo, 2009).

In this chapter, we take a career lifecycle approach to help guide a discussion about the reasons that could explain women's high attrition rates by examining factors that influence women from diverse backgrounds interest in STEM: (a) their early schooling, (b) their choice and persistence in STEM majors during their university experiences, (c) their decisions to join research and development (R&D) organizations, and (d) their experiences within STEM occupations. Of particular importance are the motives that guide professional choices along the career lifecycle. In addition to the emphasis on understanding some motives for entering and then leaving STEM jobs and even the profession in its entirety, the additional objectives of this chapter are to make recommendations and identify best practices related to attracting and retaining White and minority women in the STEM professions, as well as to propose avenues for future research.

We begin with an overview of why STEM is important to global competitiveness and why the increased participation of women in this field is critical. (As a note to readers, in this chapter we use the acronym STEM to refer to the general disciplines of science, technology, engineering, and mathematics.)

## **BACKGROUND**

### **STEM as a Driver of Global Competitiveness**

Scientific innovation has been estimated to account for approximately 50% of all U.S. economic growth in the last five decades (National Science Board, 2004a; 2004b). However, U.S. dominance in science and technology has been declining in the last 10 years (Dougherty, Inklarr, McGuckin, & Van Ark, 2007; Filippetti & Archibugi, 2011) as a number of countries, including emerging economies (especially China and South Korea) have made major strides in expanding their STEM capacities (Lee, 2010). For now, the U.S. remains a global leader in STEM, with total current investments in R&D more than double the next country's (China) and with the leading share of high quality research publications, patents, and incomes from intellectual property exports (Greenstone & Looney, 2011). There are many signs that other nations are challenging this dominance. For example, the proportion of worldwide R&D activities performed in the U.S. decreased from 37% in 2001 to 30% in 2013, while that in Europe has decreased from 26% to 22% (Battelle, 2013). Meanwhile, China has tripled the number of STEM researchers from 1995 to 2008, and South Korea doubled its STEM researchers from 1995 to 2006 (UNESCO Institute for Statistics, 2009). Correspondingly, the percentage of the world's R&D performed by Asian countries increased from 25% in 2001 to 34% in 2014 (National Science Board [NSB], 2014).

A broader view of global competitiveness is provided by the World Economic Forum's Global Competitiveness Report, which annually assesses the competitiveness of each nation in terms of 12 pillars that determine productivity and growth potential. These pillars include institutions, infra-

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