1. Introduction: Why Invest in a Diverse Workforce?

As the National Science Foundation (NSF) celebrates its 50th anniversary in the year 2000, it is interesting to reflect upon the fact that the U.S. economy has enjoyed an unprecedented period of growth due in large part to a technological revolution that has spawned greater productivity and a host of new industries and jobs. However, in this climate it is possible to lose sight of the precarious nature of this prosperity and forget that the so-called "new economy" is critically dependent on—and thus vulnerable to any deficiencies in—the talents and knowledge of the available technical workforce.

Recent reports by the National Science and Technology Council {1} and the Commission for the Advancement of Women and Minorities in Science, Engineering and Technology (the "Morella Commission") {2} have eloquently identified the perils inherent in a society characterized by ethnic, gender, and socioeconomic disparity. While progress has been made over the past 20 years, the risk remains. As we enter the 21st century, U.S. jobs are growing fastest in areas that require knowledge and skills stemming from a strong grasp of science, engineering, and technology (see Figure 1-1) {3}.

In some areas—particularly computer and information technology—business leaders warn of a critical shortage of skilled U.S. workers, which threatens our ability to compete in the global marketplace. The business community is not alone in its need to develop and maintain a highly skilled domestic science, mathematics, engineering, and technology (SMET) workforce. Both academe and the federal government have a vested interest in finding ways to deepen the pool of science and technology educators and researchers.

At the same time, SMET workers remain overwhelmingly white, male, and without disabilities, and the available pool of talented women, minorities, and persons with disabilities remains significantly underutilized. Figure 1-2 shows the racial/ethnic distribution of the U.S. population in 1997 compared to the representation of these groups in the general workforce and the Science Education and Technology (SET) workforce {4}{5}{6}.

Persons with disabilities make up approximately 20% of the population, 14% of the overall U.S. workforce, and 6% of the U.S. SMET workforce {2}. As it turns out, if individuals from these underrepresented groups were represented in the U.S. SMET workforce in parity with their percentages in the total workforce population, the shortage would largely be filled.

More than ever, the nation must cultivate the scientific and technical talents of all its citizens, not just those from groups that have traditionally worked in SMET fields. According to Census Bureau projections {18}, non-Hispanic white males will decline as a fraction of the working-age (18–64) population from 37% in 1995 to 26% in 2050. Over the same period, the fraction of African Americans in the workforce will increase from 12% to 14%, that of Hispanic Americans will increase from 10% to 24%, and that of Asians will increase from 4% to 9% (see Figure 1-3). The end result is that currently underrepresented groups will increase from about a quarter of the workforce to nearly half (48%).

Figure 1-1: Projected Increase in Jobs Requiring SMET Skills
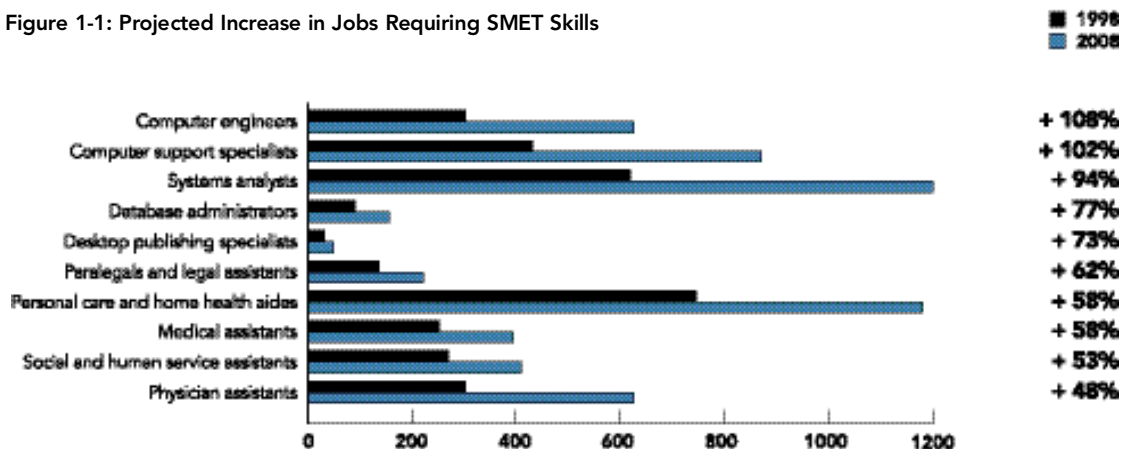
Source: Bureau of Labor Statistics, 1999, within *Land of Plenty*, Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, September 2000 {3}.
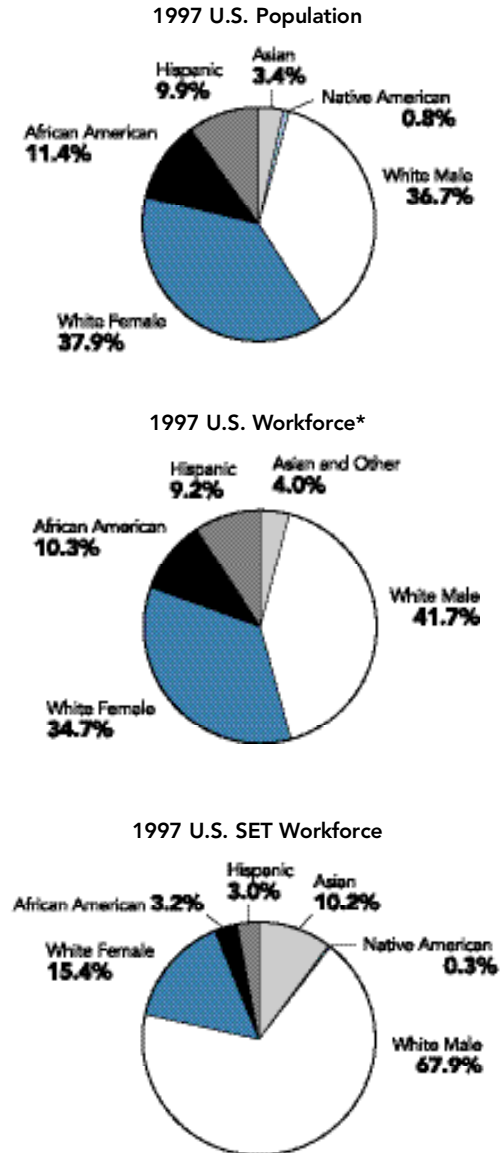
The current and projected need for more SMET workers, coupled with the fact that women, minorities, and persons with disabilities comprise an increasing proportion of the labor pool, demand policies, programs, and *resources* that support greater participation by these groups in SMET education and careers.

Studies have shown that appropriate investment in preparing a diverse workforce yields substantial economic benefits to the nation {7}{8}. A recent survey conducted by the American Management Association of more than 1,000 of its members found that heterogeneity—a mixture of genders, ethnic backgrounds, and ages—in senior management teams consistently correlated with superior corporate performance in such areas as annual sales, growth revenues, market share, shareholder value, net operating profit, worker productivity, and total assets {9}. In short, a culturally diverse workforce creates a competitive advantage.

If, on the other hand, the United States continues in its failure to prepare citizens from all population groups to participate in the new, technology-driven economy, our nation will risk losing its economic and intellectual pre-eminence. Significant evidence for this conclusion already exists. One California research group has estimated that the workforce shortage costs Silicon Valley high-tech companies approximately $3-4 billion annually {8}. Paradoxically, underrepresented minorities, who comprise nearly half of California's college-age population, make up less than 8% of the employees at these companies. Overall, women, minorities, and persons with disabilities together constitute a little more than two-thirds of today's U.S. workforce {2} {10}. Ironically, just when the U.S. economy requires more SMET workers, the largest pool of potential workers continues to be isolated from SMET careers. The imminent national need thus cries out for strategies designed to establish parity in the domestic SMET workforce.

NSF has recognized the serious nature of this predicament and taken steps to facilitate progress. In its response to the 1993 Government Performance and Results Act (GPRA) {11}, the Foundation articulated in its 2000-2005 GPRA Strategic Plan a performance goal of producing "a diverse, globally oriented workforce of scientists and engineers" {12}. This goal has been further reinforced in the 2000-2005 NSF Strategic Plan, which includes an outcome goal calling for "a diverse, internationally competitive, and globally engaged workforce of scientists, engineers, and well-prepared citizens" {13}.

Figure 1-2: Racial/Ethnic Distribution of U.S. Population and its Workforce, 1997

1997 U.S. Population

Hispanic 9.9%
Asian 3.4%
Native American 0.8%
White Male 36.7%
White Female 37.9%
African American 11.4%

1997 U.S. Workforce*

Hispanic 9.2%
Asian and Other 4.0%
White Male 41.7%
White Female 34.7%
African American 10.3%

1997 U.S. SET Workforce

Hispanic 3.0%
Asian 10.2%
African American 3.2%
Native American 0.3%
White Female 15.4%
White Male 67.9%

* The Asian and other category in this graph covers both Asians and American Indians

Source: Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering and Technology*, September 2000 {4}{5}{6}.
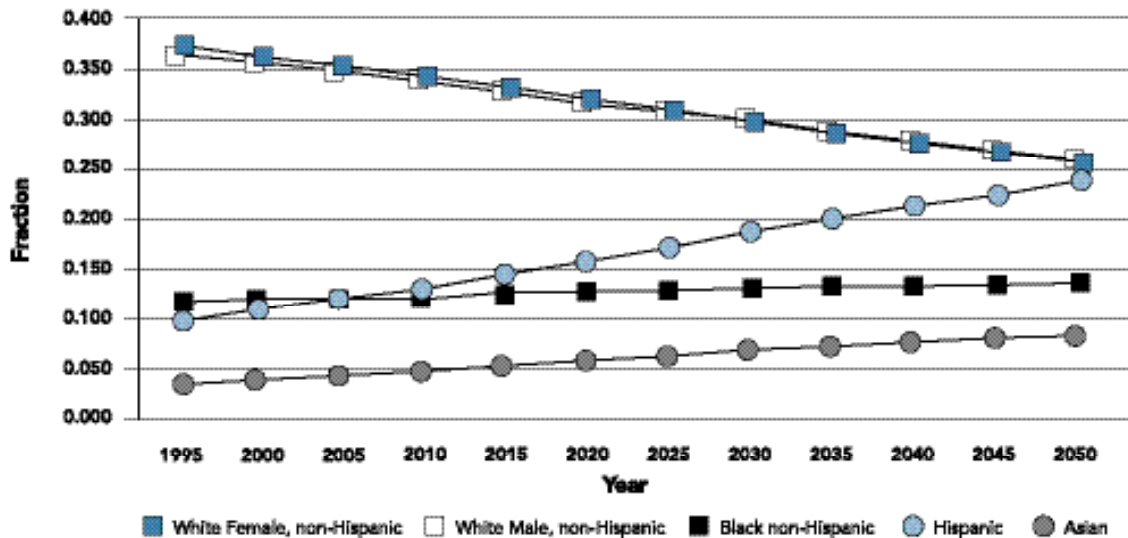
In preparation for the *2000 Biennial Report to Congress*, the NSF Committee on Equal Opportunities in Science and Engineering (CEOSE) has spent the past two years examining the barriers that exist for women, underrepresented minorities, and persons with disabilities at different stages of the SMET pipeline. CEOSE has conducted a comprehensive review of existing workforce and educational data, past reports, and current trends. We have also heard testimony from experts in the science and technology policy arena, educators, corporate executives, government officials, and non-profit sector leaders. The outcome is this report, which includes a carefully selected set of action-oriented recommendations and accountability measures.

Sections 2-4 of the report provide data describing the underrepresentation of women, minorities, and persons with disabilities in the various stages of the SMET pipeline, beginning with the pre-college grade levels and continuing through higher education to graduate programs. Sections 5-7 consider professional life in industry, academe, and the federal government; NSF is addressed specifically in Chapter 7. We discuss the barriers that impede women, underrepresented minorities, and persons with disabilities from becoming successful scientists, mathematicians, engineers, and technologists, and lay the groundwork for the recommendations for each pipeline stage. Section 8 concludes the report, provides recommendations, and suggests a mechanism of accountability by which the goals of the report may best be realized.

CEOSE strongly believes that if NSF is willing to make the investment in time and resources called for by these recommendations, the Foundation can achieve the goals articulated in its Strategic Plan and could serve as a catalyst to eliminate our SMET national workforce problems.

Figure 1-3: Population Projection for Ethnic and Gender Groups, Ages 18-64, 1995-2050

Source: Bureau of Labor Statistics, 1999, within *Land of Plenty*, Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, September 2000 {18}.