Copyright Warning & Restrictions

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted material.

Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a, user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use" that user may be liable for copyright infringement,

This institution reserves the right to refuse to accept a copying order if, in its judgment, fulfillment of the order would involve violation of copyright law.

Please Note: The author retains the copyright while the New Jersey Institute of Technology reserves the right to distribute this thesis or dissertation

Printing note: If you do not wish to print this page, then select "Pages from: first page # to: last page #" on the print dialog screen

III

ENVIRONMENTAL ANALYSIS

Introduction

Over the past several decades, the role of higher education has broadened dramatically. Today's colleges and universities are meeting challenges previously unimagined. They are serving not only their historically traditional clientele, but the underrepresented, the immigrant and the older adult. In addition, many universities appear to be shifting from basic to applied research because of rapidly developing technologies and issues of national competitiveness. And increasingly, they are addressing local, state and even national economic development needs. Higher education has indeed come to serve as a nexus point where numerous societal issues are addressed.

As a public, technological, urban university, NJIT has assumed these roles with particular enthusiasm. To perform them effectively requires a full understanding of the context in which the university operates. Environmental analysis is thus at the core of strategic planning. To prepare for the current planning cycle, trends at the national, state and local levels were studied. Trends at other higher education institutions were also analyzed. We examined our relationship with our colleagues in Newark, as well as with other colleges and universities statewide; we then looked at critical data for a comparable group of technological universities nationwide. A number of external factors were identified as likely to have a strong impact upon NJIT's future and these have been carefully considered in the planning process.

Demographics: The Implications of Workforce 2000

To increase the number of women and minorities pursuing careers in science and technology is a matter of equity and economics. By 1995, eight of the ten fastest growing occupations will be science and engineering-based. In the last decade of this century, the demand for jobs requiring scientific or technical skills will increase by 28%. By the year 2010, the United States could face a shortage of a half million or more technically trained professionals.

Overwhelmingly, the scientific and engineering workforce, and even more the U.S. science and engineering professoriate, have been white men. Yet, women and minorities will comprise approximately 75% of the new entrants to the workforce between now and the year 2000. That year, minorities will account for 30% of all U.S. eighteen-year-olds and 40% of the elementary and secondary school population.

Unfortunately, women earn only about 30% of all science, mathematics and engineering degrees although they constitute 52% of the population. For Blacks and Hispanics, the comparable figures are 8% and 20%. Higher education institutions, most especially those in the business of educating scientists and engineers, have a responsibility to recruit and effectively educate more students from these pools.

The Science and Engineering Pipeline: A Special Problem

United States students consistently rank near the bottom in international comparisons of

student performance in science and mathematics. Somewhere between the third and sixth grades, interest appears to diminish. By the time students are in seventh grade, half declare no interest in science at all. Clearly, well before they apply to college, students need to be motivated to consider study in science and engineering. The pipeline problem not only appears to be endemic to the United States, but is of epidemic proportions.

Not enough students are entering the scientific pipeline, and the pipeline leaks. More than 50% of college-bound high school seniors interested in careers in science and engineering do not complete degrees in these fields. Of every 4,000 seventh graders, only six will ultimately receive doctoral degrees in science and engineering.

While the pipeline problem is not unique among women and minorities, it is more severe. Participation and performance in science and mathematics are lower for these groups, owing to such factors as the absence of role models, negative stereotyping, perceptions of teachers and counselors, and school quality. Many high schools offer no courses in physics (30%) or chemistry (17%); urban schools that enroll large numbers of minority students have especially limited resources. If only in self interest, higher education has a responsibility to intervene.

International Competitiveness & the National Science Agenda

Yet another challenge to higher education is the decline of U.S. competitiveness in world markets. This development has been attributed to low domestic productivity, poor management, misdirected government policies, failure to commercialize existing technologies effectively, and a deteriorating educational system. Whatever the reasons, there is a growing realization that the United States is the target of foreign competition in an increasing number of industries. The result is a heightened awareness that the rapidity of technological developments calls for new approaches to competitiveness in which higher education must play a key role.

A reassessment of America's technology priorities is now happening on many fronts. Table 3.1 lists the critical technologies identified by the White House Office of Science and Technology Policy, the Department of Defense, the Department of Commerce and the Council on Competitiveness. As indicated, the broad areas of concern include materials, manufacturing, information and communications, biotechnology, air and surface transportation, and energy and the environment. A technological institution educating the scientists and engineers of the future and strongly emphasizing applied research in areas of importance to the State's and nation's economy must focus its efforts in these critical areas. As indicated by bold type in the table, NJIT is involved in a number of these technologies, in many instances rather significantly.

The Economy in a State of Crisis

As state after state reports its latest fiscal crisis, higher education has been among the hardest hit sectors. For New Jersey, the economic downturn followed a period of prosperity and special attention to education.

NJIT was able to make significant strides during the period of prosperity. Between fiscal years 1985 and 1989, the state appropriation to the university nearly doubled, making possible key faculty hires, laboratory modernization, major equipment purchases, and the development of new programs. As NJIT's reputation grew as a result of these activities, the state support could be leveraged to increase external funding. The last three fiscal years have been in marked contrast with the previous five-year upswing. A 30% decrease in state appropriations included actual and imputed dollars through underfunding of the university's Salary Program. As a result, we have curtailed a number of activities and, unfortunately, were forced to make some difficult personnel decisions. Every effort is being made to maintain the critical core of the institution. Informed by the planning process, allocation

Table 3.1
National Critical Technologies

OFFICE OF SCIENCE AND TECHNOLOGY POLICY NATIONAL CRITICAL TECHNOLOGIES	DEPARTMENT OF COMMERCE EMERGING TECHNOLOGIES	DEPARTMENT OF DEFENSE CRITICAL TECHNOLOGIES
MATERIALS		
• **Materials synthesis and processing**	• **Advanced materials**	• Composite materials
• **Electronic and photonic materials**	• **Advanced semiconductor devices**	• **Semiconductor materials and microelectronic circuits**
	• **Superconductors**	• **Superconductors**
• Ceramics • Composites • High-performance metals and alloys	} Advanced materials	} Composite materials
MANUFACTURING		
• **Flexible computer integrated manufacturing**	• **Flexible computer integrated manufacturing**	• **Machine intelligence and robotics**
• **Intelligent processing equipment**	• **Artificial intelligence**	
• **Micro- and nanofabrication**		
• **Systems management technologies**		
INFORMATION AND COMMUNICATIONS		
• **Software**	• **High-performance computing**	• **Software producibility**
• **Microelectronics and optoelectronics**	• **Advanced semiconductor devices**	• **Semiconductor materials and**
	• **Optoelectronics**	• **Photonics**
• **High-performance computing and networking**	• **High-performance computing**	• **Parallel computer architectures**
• High-definition imaging and displays	• Digital imaging	• Data fusion
• **Sensors and signal processing**	• **Sensor technology**	• **Signal processing**
• Data storage and peripherals	• High-density data storage	• **Passive sensors**
• **Computer simulation and modeling**	• **High-performace computing**	• Sensitive radars
		• **Machine intelligence and robotics**
		• **Photonics**
		• **Simulation and modeling**
• Computational fluid dynamics		
BIOTECHNOLOGY AND LIFE SCIENCES		
• **Applied molecular biology**	• **Biotechnology**	• **Biotechnology materials and processes**
• **Medical technology**	• **Medical devices and diagnostics**	
AERONAUTICS AND SURFACE TRANSPORTATION		
• Aeronautics		• Air-breathing propulsion
• **Surface transportation technologies**		
ENERGY AND ENVIRONMENT		
• **Energy Technologies**		
• **Pollution minimization, remediation, and waste management**		

Technologies in **boldface** identify areas of research activity at NJIT

decisions are designed to ensure that ground not be lost. We will continue to progress, although somewhat more slowly, along previously defined paths consistent with NJIT's mission.

The Newark Scene

Newark has in many ways epitomized the 20th century metropolis. It has been home to continuously changing immigrant populations, a cultural and market center, a victim of some of the most severe riots of the 1960's and now once again, a renaissance city. Many of its problems are among the worst in the nation — drug abuse, AIDS, crime and a troubled public school system. Not too long ago, however, Newark was named the most liveable city in the nation by the U.S. Conference of Mayors in recognition of its remarkable progress in recent years. Such corporations as The Prudential, Blue Cross and Blue Shield, New Jersey Bell, Public Service Electric & Gas, and Hartz Mountain have made major commitments to the city. Billions of dollars in new construction include not only large office buildings, but hundreds of units of housing and numerous commercial enterprises. The Newark Museum enjoys a national reputation, and a major performing arts center is in the architectural design phase. Newark International Airport is among the most modern and busiest in the nation.

NJIT, which began as a Newark-affiliated school, is fully committed to its role as an urban university, serving the local community as educator, technical consultant, economic developer, and colleague in an array of organizations and activities. In collaboration with the other public colleges and universities located in Newark, NJIT has been a key actor in the city's revitalization.

At times, NJIT's location is a challenge, particularly with respect to recruitment. But the university also benefits from its location, from the opportunity to work closely with its educational, corporate and community neighbors, and from its proximity to New York. The relationship is and will continue to be synergistic.

Other Higher Education Institutions: Trends & Relationships

Cooperative arrangements among higher education institutions have many benefits, especially in a broadened array of opportunities for students and faculty. NJIT has continuously sought ways to work effectively with other colleges and universities in New Jersey and beyond. There are research consortia, joint admissions, shared programs of instruction, interlibrary loan arrangements and community planning, to name a few. The number and scope of these activities is growing in recognition of the cost savings and, more importantly, an understanding that the sum of the parts is often much greater than the whole.

A formal agreement of cooperation between NJIT and Rutgers-Newark was signed and promulgated on both campuses in Spring 1991, thereby institutionalizing and further motivating a movement begun some years ago. Recent faculty interactions appear to be energizing departments at both institutions.

The Council for Higher Education in Newark (CHEN), a collaboration of the four public higher education institutions in the city, has been meeting regularly for more than a dozen years to address areas of common interest and plan cooperative initiatives. A 1987 plan commissioned by CHEN was the motivating force behind the development of an entire community now known as University Heights. Still more recent plans call for cooperative facilities development with a community college in the southern region of the State.

The community college movement over the past twenty-five years has had a significant impact upon NJIT. As the enrollment in two-year technology programs increased, the interest in baccalaureate programs in related fields grew. NJIT encouraged this interest, developing formal agreements of articulation, joint admissions agreements and technology-based consortia with community colleges throughout the State. As a result, more than half of NJIT's bachelor's degree recipients are community college transfers. The

Transfer Advisory Board to the New Jersey Department of Higher Education has cited NJIT as an exemplary institution for its encouragement and effective management of the transfer process. New approaches to interinstitutional cooperation will continue to be explored.

An awareness of the programs and progress of other technological institutions across the country is another important element in the planning process. A list of twenty comparable universities has been developed; it includes public and private institutions with a large technological component (Table 3.2). Data on the group are collected periodically and analyzed. Enrollment, degrees conferred, faculty distribution, student-faculty ratios, research expenditures, and faculty research productivity are among the variables examined. Over the past several years, NJIT's relative position has been improving in a number of areas. With respect to research expenditures per faculty, for example, we ranked seventeenth in 1986 and twelfth in 1991. Using ratios prepared by John Minter Associates, a more detailed analysis comparing NJIT with the twenty other institutions is being conducted. In approximately three dozen key data categories, NJIT compares favorably with the other universities. With the data grouped by academic and support areas, for example, NJIT's allocation of expenses (70% and 30% respectively) is at the average for the group.

The next chapters review institutional strengths and weaknesses and suggest future university directions in the context of this environmental analysis. The discussions are based principally on the work of eleven task forces. The document concludes with a plan that will take NJIT into the next century. It identifies strategic steps considered critical to educating professionals for leadership in a changing world.

Table 3.2

Comparable Institutions

California Institute of Technology
Carnegie Mellon University
Case Western Reserve University
Clarkson University
Drexel University
Florida Institute of Technology
Georgia Institute of Technology
Illinois Institute of Technology
Lehigh University
Massachusetts Institute of Technology
Michigan Technological University
Polytechnic University
Purdue University
Rensselaer Polytechnic Institute
Rice University
Stevens Institute of Technology
Texas A&M University
Texas Technological University
Virginia Polytechnic Institute and State University
Worcester Polytechnic Institute