A NAS-NAE-IOE GUIRR Study

IT Forum

University President's Workshop

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Introduction

The National Academies (i.e., the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine) have a unique mandate to monitor and sustain the health of the nation's research universities as key elements of the national research enterprise and the source of the next generation of scientists, engineers, and other knowledge professionals.

This role becomes particularly important during periods of rapid change.

Of particular importance is the impact of information and communications technologies on the university.

Modern digital technologies such as computers, telecommunications, and networks are reshaping both our society and our social institutions. These technologies have vastly increased our capacity to know and to do things and to communicate and collaborate with others.

They allow us to transmit information quickly and widely, linking distant places and diverse areas of endeavor in productive new ways. They allow us to form and sustain communities for work, play, and learning in ways unimaginable just a decade ago.

Information technology changes the relationship between people and knowledge.

It is likely to reshape in profound ways knowledge-based institutions such as our colleges and universities.

While most believe the university will survive the digital age, few deny that it could change dramatically in form and character.

Knowledge is both a medium and a product of the university as a social institution. Hence it is reasonable to suspect that a technology that is expanding our ability to create, transfer, and apply knowledge by factors of 100 to 1,000 every decade will have a profound impact on the both the mission and the function of the university.

The NAS Study

It was from this perspective that last year the presidents of our National Academies launched a project to understand better the implications of information technology for the future of the research university.

The premise of the National Academies study was a simple one:

The rapid evolution of digital technology will present many challenges and opportunities to higher education in general and the research university in particular. Yet there is a sense that many of the most significant issues are neither well recognized nor understood either by leaders of our universities or those who support and depend upon their activities.

The first phase of the project was aimed at addressing three sets of issues:

1. To identify those technologies likely to evolve in the near term (a decade or less) which could have major impact on the research university.

2. To examine the possible implications of these technology scenarios for the research university: its activities (teaching, research, service, outreach); its organization, structure, management, and financing; and the impact on the broader higher education enterprise and the environment in which it functions.

3. To determine what role, if any, there was for our federal government and other stakeholders in the development of policies, programs, and investments to protect the valuable role and contributions of the research university during this period of change.

The steering group or Forum for this effort consists of several of your colleagues, including

Jerry Cohen	Shirley Kenney
Shirley Jackson	Nils Hasselmo

Over the last year our steering group has met on numerous occasions to consider these issues, including site visits to major technology laboratories such as Bell Labs and IBM

Research Labs and drawing upon the expertise of the National Academy complex.

This past January we pulled together over 100 leaders from higher education, the IT industry, and the federal government, and several private foundations for a two-day workshop at the National Academy of Sciences to focus our discussion. (This workshop was broadcast by the Research Channel and is now available through video-streaming from their Web servers.)

Beyond the insight brought by these participants, perhaps even more striking was their agreement on a number of key issues that frame the content of my remarks this morning.

Point 1: The extraordinary evolutionary pace of information technology will not only continue for the foreseeable future, but it could well accelerate on a superexponential slope.

Digital technology is characterized by an exponential pace of evolution(Moore's Law) in which characteristics such computing speed, memory, and network transmission speeds for a given price increase by a factor of 100 to 1000 every decade.

Put another way, over the next decade, we will evolve from "giga" technology (in terms of computer operations per second, storage, or data transmission rates) to "tera" and then to "peta" technology (one million-billion or 10^{15}).

For planning purposes, we can assume that within the decade we will have infinite bandwidth and infinite processing power (at least compared to current capabilities).

We will denominate the number of computer servers in the billions, digital sensors in the tens of billions, and software agents in the trillions. The number of people linked together by digital technology will grow from millions to billions.

We will evolve from "e-commerce" and "e-government" and "e-learning" to "e-everything", since digital devices will increasingly become our primary interfaces not only with our environment but with other people, groups, and social institutions.

Point 2: The impact of information technology on the university will likely be *profound, rapid, and discontinuous*–just as it has been and will continue to be for the economy, our society, and our social institutions (e.g., corporations, governments, and learning institutions).

It will affect our activities (teaching, research, outreach), our organizations (academic structure, faculty culture, financing and management), and the broader higher education enterprise.

For at least the near term, meaning a decade or less, we believe the research university will continue to exist in much its present form, although meeting the challenge of emerging competitors in the marketplace will demand significant changes in how we teach, how we conduct scholarship, and how our institutions are financed.

It is important that the university develop mechanisms to sense the changes that are being driven by information technology and to understand where these forces may drive the university.

Procrastination and inaction are the most dangerous courses for colleges and universities during a time of rapid technological change.

Universities must anticipate these forces, develop appropriate strategies, and make adequate investments if they are to prosper during this period.

Point 3:. It is our belief that universities should begin the development of their strategies for technology-driven change with a firm understanding of those key values, missions, and roles that should be protected and preserved during a time of transformation.

They should begin by addressing the most fundamental questions:

For example, how should the research university set priorities among its various roles such as
education of the young,
preservation of culture,
basic research and scholarship,
serving as a social critic,
and applying knowledge to serve society?

Which of its values and principles should be preserved, and which should be reconsidered, e.g.,
academic freedom,
a rational spirit of inquiry,
sustaining a community of scholars,
our commitment to excellence,
shared governance, and
tenure?

How will research universities define their students and faculty?

How should the research university address the rapidly evolving commercial marketplace for educational services and content, including, in particular, the for-profit and dot.com providers?

What policies does the university need to reconsider in light of evolving information technology (e.g., intellectual property, copyright, instructional content ownership, faculty contracts)?

Will new financial models be required? Beyond the need to implement a sustainable model of investment in information technology infrastructure, the intensely competitive marketplace for higher education services stimulated by digital technology will put at risk the current system of cross-subsidies in funding university activities.

Just-in-time lifelong learning and the growing desire to be educated anyplace, anytime are driving the demand for distance education. How should the university approach the challenges and opportunities of online distributed learning?

What is the role of universities with respect to the "digital divide", the stratification of our society–our world–with respect to access to technology?

Will more (or perhaps most) research universities find themselves competing in a global marketplace, and how will that square with regionally supported universities?

Conclusion

The digital age poses many challenges and opportunities for the research university.

While the university campus as a physical place, a community of learners, and a center of culture, is likely to remain at least for the near term, the nature of its activities, organization, management, and funding are likely to change quite rapidly and dramatically.

Emerging competitors in the commercial sector could threaten our current financial models.

We will be challenged to attract and retain outstanding students and faculty members in the face of competition from institutions with superior technology environments (including the commercial sector).

The status quo will certainly be challenged by this "disruptive" technology.

Yet, while the challenges will be significant, so too will be the opportunities to enhance the important role of these institutions in our society.

University leaders should approach issues and decisions concerning information technology not as threats but rather as opportunities.

Creative, visionary leaders can tap the energy created by such threats to lead their institutions in new directions that will reinforce and enhance their most important roles and values.

They can use digital technology to help their students learn more effectively, to help their faculty members to become better teachers and scholars, to enable their institutions to better serve society.

It is our collective challenge as scholars, educators, and academic leaders to develop a strategic framework capable of understanding and shaping the impact that this extraordinary technology will have on our institutions.