

Warning Redux:

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In 1995, one of us (Wulf) published an article³ in *Issues in Science and Technology* that raised questions about the possible impact of information technology on the research university. The purpose of the article was to provoke a dialog both on the campuses and among the various stakeholders of higher education. Since that time the authors have teamed with colleagues at the National Academies to try to understand and help universities prepare for a range of possibilities. This article is a brief update of the earlier one as well as a report on the results of our deliberations.

The premise of the 1995 article, and subsequent activities of the National Academies, was simple:

- The modern research university provides a range of functions that are incredibly important to our society, all of which are highly information intensive.
- Information technology will continue to become faster and cheaper at an exponential pace for the foreseeable future, enabling alternatives to the ways that universities have traditionally fulfilled their various functions – and possibly even to the university as provider of those functions.
- It would be naïve to assume that, unlike other businesses, the availability of these alternatives will not transform both the roles and character of the university.
- Precisely because of the importance of the functions provided by the research university, it behooves us to explore deeply and critically what sorts of changes might occur so that, if they do occur, we are better prepared for them.

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³ Wulf, Wm. A., “Warning: Information Technology Will Transform the University:”, *Issues in Science and Technology* 11(4), Summer: 46-52.

It's hard for those of us that have spent much of our lives as academics to look inward at the university, with its tradition and obvious social value, and introspect about whether it might change in dramatic ways. But, although its roots are millennia old, the university has changed before. In the seventeenth and eighteenth centuries, scholasticism slowly gave way to the scientific method as the way of knowing truth. In the early nineteenth century universities embraced the notion of secular, "liberal" education and began to include scholarship and advanced degrees as integral parts of their mission. After World War II they accepted an implied responsibility for national security, economic prosperity, and public health in return for federally funded research. Although the effect of these changes have been assimilated and now seem "natural", at the time they involved profound reassessment of the mission and structure of the university as an institution.

Today the university has entered yet another period of change driven by powerful social, economic, and technological forces. Of particular concern is the impact of rapidly evolving digital technology capable of transforming not only the fundamental activities of education and scholarship but moreover how the university is organized, managed, and financed. To better understand the implications for the research university, in February of 2000 the National Academies convened a steering committee that, through a series of meetings and a workshop, produced the report *Preparing for the Revolution*⁴. Subsequently, the Academies have created a roundtable process to encourage a dialog among university leaders and other stakeholders, and in April of this year held the first such dialog with Presidents and Chancellors of universities. What follows is derived from the workshop report as well as our own synthesis of the April dialog.

The first finding of the Academies' steering committee was that the extraordinary pace of information-technology evolution is likely not only to continue for the next several decades, but could well accelerate. One of the hardest things for most people to understand is the compound effect of this exponential rate of improvement. For the last four decades the speed and storage capacity of computers have doubled every 18-24 months; the cost, size

⁴ National Academies Press, 2002.

and power consumption have become smaller at about the same rate. As a result, a typical desktop PC today has more computing power and storage than all the computers in the world combined in the late 60's or early 70's! The important point is that, in thinking about changes to the university one must think about the technology that will be, not the one we have today – and that technology will be thousands of times more powerful while simultaneously thousands of times cheaper.

The second finding of the committee, in the words of Marye Anne Fox⁵, was that the impact of IT on the university is likely to be “profound, rapid and discontinuous”, affecting all of its activities (teaching, research, service), its organization (academic structure, faculty culture, financing, and management), and the broader higher education enterprise as it evolves toward a global knowledge and learning industry. If whatever changes happen were a slow evolution there would be time to adapt gracefully, but that is not the history of disruptive technologies. As explicated in Clayton Christensen's *The Innovators Dilemma*, when they are introduced, new technologies are inadequate to displace existing technology in existing applications, but then explosively displace the application as they enable a new way of satisfying the underlying need.

While it may be difficult to imagine today's digital technology replacing human teachers, as the power of this technology continues to evolve 100- to 1000-fold each decade, the capacity to reproduce all aspects of human interactions at a distance with arbitrarily high fidelity could well eliminate the classroom and perhaps even the campus as the location of learning. Access to the accumulated knowledge of our civilization through digital libraries and networks, not to mention massive repositories of scientific data from remote instruments such as astronomical observatories or high energy physics accelerators, is changing the nature of scholarship and collaboration in very fundamental ways. Each new generation of supercomputers extends our capacity to simulate physical reality to a higher level of accuracy, from global climate change to the biological function at the molecular level.

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The third finding of the committee suggests that although information technology will present many complex challenges and opportunities to universities, procrastination and inaction are the most dangerous courses to follow all during a time of rapid technological change. After all, attempting to cling to the status quo is a decision in itself, perhaps of momentous consequence. To be sure, there are certain ancient values and traditions of the university that should be maintained and protected, such as academic freedom, a rational spirit of inquiry, and liberal learning. But, just as it has in earlier times, the university will have to transform itself once again to serve a radically changing world if it is to sustain these important values and roles.

Following the publication of *Preparing for the Revolution*, the Academies formed a standing roundtable to facilitate discussion among stakeholders in the issues of the impact of IT on universities. Earlier this spring the roundtable had the opportunity to discuss these findings in a workshop with two dozen presidents and chancellors of major research universities. The conversation began with several presidents reviewing contemporary issues such as how universities can finance the acquisition and maintenance of digital technology and how they can manage the use of this technology to protect security, privacy, and integrity, issues that all too often presidents tend to delegate to others such as chief information officers. However, as the workshop progressed further to consider the rapid evolution of digital technology, the presidents began to realize just how unpredictable the future of their institutions had become. As Robert Berdahl, Chancellor of the University of California-Berkeley observed, presidents have very little experience with providing strategic visions and leadership for futures driven by such disruptive technologies.

Addressing this concern, Louis Gerstner, retired CEO of IBM, shared with the presidents some of his own observations concerning leadership during a period of rapid change. The IBM experience demonstrated the dangers of resting on past successes. Instead, leaders need to view information technology as a powerful tool capable of driving a process of strategic change, but only with the full attention and engagement of executive leadership—meaning university presidents themselves.

There early efforts of the National Academies suggest that for the near term, meaning a decade or less, the university as a physical place, a community of scholars, and a center of culture, will remain much as it is today. Information technology will be used to augment and enrich the traditional activities of the university, in much their traditional forms. To be sure, the current arrangements of higher education may shift. For example, the new knowledge media will enable us to build and sustain new types of learning communities, free from the constraints of space and time, which may create powerful new market forces. But university leadership should not simply react to threats but instead act positively and strategically to exploit the opportunities presented by information technology. As Gerstner suggested, this technology will provide great opportunities to improve the quality of our activities. It will allow colleges and universities to serve society in new ways, perhaps more closely aligned with their fundamental academic mission and values.

For the longer term, two or more decades from now, the future of the university becomes far less certain. Although the digital age will provide a wealth of opportunities for the future, one must take great care not simply to extrapolate the past, but instead to examine the full range of possibilities for the future. There is clearly a need to explore new forms of learning and learning institutions that are capable of sensing and understanding the change and of engaging in the strategic processes necessary to adapt or control it. In this regard, information technology should be viewed as a tool of immense power to use in enhancing the fundamental roles and missions of the university as it enters the digital age.