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The Information Age University?

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Introduction

As a preface to my comments today, I challenge you to consider the following questions. Do the information age technological changes now taking place have the potential to disrupt, or even destroy, the university as we know it? Do these changes have the potential to force restructuring of the land-grant system? My comments today will address these questions. In doing so, however, I will not address problems facing the land-grant system or the agricultural economics profession per se, other than those we face as a part of the overall system of higher education. Others are doing that or have addressed those more unique problems elsewhere. A major National Research Council (NRC) initiative is now examining the relevancy of the land-grant system in the context of today's society; the W. K. Kellogg Foundation has funded an initiative to facilitate positive change within the land-grant system (Warner); and Eidman, in his 1995 American Agricultural Economics Association presidential address, summarized key concerns and issues facing the agricultural economics profession and how we are responding to them. I contend that overlaying the NRC and Eidman concerns is a series of fundamental changes taking place that has the potential to drastically modify the higher education model as we presently know and understand it.

We can make an analogy between the im-

pending changes in higher education and the industrialization of agriculture. Urban, in his 1994 International Agribusiness Management Association presidential address, identified a number of forces driving this transformation. Two of these—recognition of the new role of the consumer and marked technological advances—are pertinent to the changes being predicted in higher education. Two things are happening. First, universities are entering an era in which the consumer (defined here as students and employers) will have considerably more influence and control over the range of products provided. Second, technology is rapidly revolutionizing the manner in which educational products are packaged and delivered.

I would like to address four critical areas. First, an overview of the information revolution in the context of other major transformations is essential. Secondly, I would like to address specific challenges to higher education. Next, I will question the ability of universities to become information age institutions of higher learning. Finally, I will briefly address implications for the land-grant system.

Information Age

It is increasingly difficult to read a newspaper or magazine article, watch the evening news, listen to the radio, or check your e-mail without being reminded, either explicitly or implicitly, of how the "information superhighway" has transformed our lives, or is about to do so. The term "information superhighway," popularized by Vice President Al Gore, is now commonplace terminology, even to the computer illiterate. In his book, *The Road Ahead*, Bill Gates notes that a distinguishing characteristic of this period in history is exemplified by

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the completely new ways in which information can be changed and manipulated, and the increasing speeds at which we can handle it. Technology is changing the way we handle information and, furthermore, this revolution in communications is just beginning.

Technological Change: A Historical Perspective

Futurists Alvin and Heidi Toffler have written extensively on information age changes taking place worldwide and the resulting strains placed upon conventional social, economic, and political institutions. They put the emerging information age revolution into perspective by comparing its impacts on society with previous technological revolutions.

Specifically, they categorize into three waves the major phases of social and economic transformation that have taken place over the past 10 millennia. The first of these, starting about 10,000 years ago, was the agricultural revolution, when humans moved from a traditional hunter/nomadic society to domesticated agriculture. In this First Wave, land and labor were the main factors of production. The Industrial Revolution, or the Second Wave, commencing roughly 300 years ago, transformed society from an agrarian state to an urban, factory-centered way of life (Dreifus). In the Second Wave economy, land is still valuable, but labor has become massified around machines and larger industries (Dyson et al.). A Third Wave, reflecting the civilization of the computer, satellite, and the Internet—beginning in the 1940s with the development of Harvard's Mark I and the University of Pennsylvania's ENIAC computers—ushered in the beginning of the information age (Norris).

Representing a major departure from the past when the more traditional land, labor, and capital dominated the economic scene, "actionable knowledge," encompassing data, information, images, symbols, culture, ideology, and values, is the central resource in Third Wave society (Dyson et al.). In a globally competitive economy, this knowledge resource may reside anywhere. Unlike land, labor (in a physical sense), and capital, which tend to be location specific, knowledge resources can be tapped from anywhere in the world with today's communications technologies. To illustrate this, Gates (p. 261) gives the example of an English-speaking Ph.D. in China bidding against colleagues

in London for consulting jobs in the U.S., Africa, or Hong Kong.

The First Wave of change, the agricultural revolution, evolved over thousands of years. The Industrial Revolution, while continuing into the present, essentially took 300 years. It is predicted the Third Wave will complete itself within decades (Toffler and Toffler). The rate at which change is occurring as the information age and its technologies are unfolding is unprecedented in all of history.

While often dramatic and cataclysmic, the societal, economic, and cultural changes that accompanied the previous two waves of technological advancement developed over a long enough span of time to allow cultural, social, and economic institutions to evolve with the technological advances. For example, the Industrial Revolution, starting in Great Britain at the end of the eighteenth century and spreading out over Europe, the U.S., and the rest of the world, was still evolving through the middle part of the twentieth century. The Industrial Revolution occurred in waves, thereby allowing other countries or regions of the world to learn and benefit from predecessors, even though they typically lagged in development. The phenomenal speed at which information age technologies are being developed is creating political, social, and economic problems compressed into ever shorter time frames. The window of opportunity in which politicians, decision makers, and individuals must make decisions and adjustments is becoming smaller and smaller. The Tofflers argue that Second Wave institutional structures are often ill-suited to deal with the nature, magnitude, and speed of societal and economic changes riding the Third Wave. For the Third Wave to "create a better, more civil, more decent and democratic future," we have to ascertain the relevancy of Second Wave economic, political, and social policies to Third Wave problems (Toffler and Toffler, p. 82). The implications are twofold: either Second Wave institutional structures will have to adapt or give way to new ones.

Which institutions will adapt and which will fail? A number of questions regarding education can be posited. How will education change? How will the institutions that have historically provided educational services change? The following quotation regarding the impact of information age technologies on higher education institutions sets the stage for the remainder of my comments:

Thus, while new communications technologies are likely to strengthen research, they will also weaken the traditional major institutions of learning, the universities. Instead of prospering with the new tools, many of the traditional functions of universities will be superseded, their financial base eroded, their technology replaced, and their role in intellectual inquiry reduced (Noam, p. 247).

Higher Education Challenges

In the context of the Tofflers' charge that many Second Wave institutions are becoming obsolete, the relevancy of the land-grant concept, an institutional response to problems endemic in the 1860s, is being questioned today. The issue of how well the land grants are responding to societal needs is a question of long-standing concern within this profession, and one currently being addressed by the National Research Council's Board on Agriculture. The preface of the NRC's initial report released last fall specifically addresses the relevancy question: "Since the system was designed to serve the public of yesterday, how is it adapting to changing times to serve the public of today and of the future?" (p. vii). The report notes that the agriculture of today is far different from that existing when federal legislation established the land grants in 1862 and 1890, and asks: "How does today's college of agriculture define its constituency and shape a new public service role in a modern context?" (p. vii). In essence, we should be asking the question, "If the current land-grant system did not exist today, what would we invent in its place today to address agriculture's problems?" A final report recommending public policy and institutional changes that can enhance the colleges' role in serving the national interest is to be issued this summer.

I argue that the "challenges or issues" confronting the land-grant system are at least partially propelled by ongoing "information age" changes that may completely redefine the university as we know it. At the root of these changes are fundamental challenges to a university system that have evolved over the last century. The university and the roles commonly attributed to it are facing Third Wave challenges that may lead to a restructuring of the entire nature of higher education.

Challenges are coming on at least three fronts,

not all of which are unique to information age developments, but they will become more important as information age changes ripple through society. These forces include (a) a demand for lifelong learning, (b) accountability in all facets of the tripartite mission of the university, and (c) new learning systems evolving from emerging technologies threatening the university's traditional monopoly position as a supplier of educational services. These three challenges are discussed in terms of higher education in general, but are particularly relevant to land grants, colleges of agriculture, and agricultural economics departments.

Lifelong Learning

Drucker emphasizes that "lifelong learning" will increasingly be mandated by a rapidly changing economy. Already, the fastest growing segment of education is within industry as it strives to keep its workforce up to speed (Reinhardt). The American Society for Training and Development estimates that by the year 2000, 75% of those in the workforce will need to be retrained if they are to maintain, or develop, the skills needed to function in the economy (Twigg). Prospects for an increase in the demand for educational services should be welcomed in a system that has witnessed shrinkage of its traditional 18- to 24-year-old market in recent years.

This increased emphasis on a more formalized lifelong learning process has implications for both the "student body" and the nature of the educational product to be delivered. The pool of potential students, including those seeking an initial degree, those seeking retraining, or those simply seeking specific skills, is markedly different from the traditional entering freshman class made up of recent high school graduates with an occasional nontraditional student. Students of the future will differ in several ways. First, they will include the diverse attributes already mentioned. Second, most of those wishing to retool or sharpen specific skills will have families, jobs or careers, and economic obligations that prohibit commuting or relocating to the university for that education. Third, the types of courses and training demanded will also differ. They will differ according to industry- or task-specific need and the point in the individual's career life cycle. While this description could fit any number of "po-

tential” students whose demands for education have been met with varying degrees of satisfaction over the years, it is now not only possible, but imperative, that these demands be met.

Drucker argues that the necessity for formalized lifelong learning at all levels is due to the transition from a Second Wave industrial economy to one based on knowledge services. Skills required for employment in the manufacturing sector, while often unique and specific, did not require high levels of education. People with limited educational skills were able to obtain well-paying jobs in the manufacturing sector—and they were able to readily find similar jobs at comparable earnings when plants closed or were restructured.

Whereas earlier generations of machines decreased the complexity of tasks, information technologies can increase the intellectual content of work at all levels (Zuboff). The present wave of restructuring and automation is effectively eliminating the “limited-education,” well-paying manufacturing jobs of the past which served as a means of entering the middle class for many Americans. A recent *Wall Street Journal* article related a manufacturer’s difficulty in finding adequately trained entry-level workers. The company’s spokesperson stated that “few of the thousands of applicants could do high school trigonometry or read technical drawings, and most didn’t show an aptitude for learning how to operate computer-controlled machines”—all of which were needed for “entry-level” positions (Narisetti, p. A1).

Referring to the new workplace, Zuboff writes that the transformation of information into wealth will require that more members of the workplace must be given opportunities “to know more and do more” (p. 204). How effectively are our educational institutions preparing this workforce? Drucker is concerned about the ever-widening knowledge gap between the information “haves” and the “have-nots,” and in general the poor educational skills of this nation’s high school graduates. What role will universities play in educating such a diverse workforce over the entire career life cycle?

Accountability

In an age when industrial restructuring is taken as a given, the public has begun “to ask why an elitist

academe should be exempt from reorientation toward greater customer satisfaction” (Wulf, par. 27 online). Like other sectors of the economy, the public university is being forced to reexamine its missions and to sharpen productivity measures. In this section, I address research and service accountability issues, followed by discussion of several facets of accountability with regard to teaching and learning.

Research and Service

The research and extension components of the university have long been acutely sensitive to the accountability issue. Experiment station and extension directors are constantly reminded by legislative budget committees and advisory groups of their expectations that research and extension programs benefit constituencies. As state support levels increase relative to federal support, accountability to state funding sources will become a growing issue. Concerns about accountability, like that reported in a recent issue of *The Chronicle of Higher Education*, are common. It was reported that a University of Nebraska Board of Regents member wanted to require that all research (being conducted at state-supported institutions) relate to Nebraska, arguing that a state university needed to be more “customer driven” and benefit the taxpayers of the state (Schoenberg). The board refused to act on a proposal to require all faculty research to relate directly to the state, but it did approve a plan that would urge faculty members to stress state needs.

In an era of increased accountability awareness, university administrators and scientists will be challenged to secure resources to deal with issues and problems of national or regional scope that state legislatures are reluctant to fund. Increasingly, it will be imperative that administrators and scientists be able to document that state funds are benefiting the state.

Teaching Effectiveness and Learning Outcomes

Accountability and productivity are current buzz words articulating the public’s frustration with the rising cost of college education, educational content, and the perceived emphasis on research over teaching (Wulf). Colleges boosted tuition more

than 200% in the 14 years ending in 1993, roughly double the rate of overall inflation (Laing). A year of college now absorbs 45% of median family income, up from 25% in 1980 (Laing).

Many people hold a perception of university professors summarized by a quote from Martin Anderson's *Imposters in the Temple*, in which he describes the nation's 530,000 professors as a "pampered caste in a semi-socialist system" (quoted in Laing, p. 29). More specifically, university tenure is increasingly seen by the public as an anachronistic institution that is contributing to the lack of productivity in higher education. The following analogy is reflective of how we are viewed:

What do Queen Elizabeth, Fidel Castro, Clarence Thomas, and Pope John Paul have in common? Lifetime jobs, regardless of their current contributions or future plans, with no provision for performance reviews or mandatory retirement. Just like tenured university professors (Helfand, p. B1).

Tenure, while often defended as a necessary prerequisite of academic freedom, can also restrict the flow of ideas and intellectual debate, leaving departments frozen in time (Helfand). Is tenure one of those Second Wave institutions that needs to adapt or get out of the way?

The rhetoric surrounding accountability in the instructional context is multifaceted, but two issues stand out. First is the concern or perception that overpaid college professors concentrate on research while leaving teaching to underpaid teaching assistants. A second issue deals with the questions of what an education should entail and whether universities are delivering such an education. The latter is discussed in terms of evaluation of individual teaching effectiveness and the overall effectiveness or value of the educational experience based on learning outcomes.

Teaching versus Research. Considerable attention has been directed at raising the educational mission of universities, as reflected in the following quote:

[T]he low priority assigned to 'teaching' performance as a criterion in the faculty recruitment and promotion process [continues to exist]—a bias that has persisted despite decades of presi-

dential exhortations and faculty reports extolling the importance of teaching. The explanation for the relatively heavy weighting of research performance is not hard to find. Research performance and reputation also constitute the dominant criteria for ranking departments and professional schools, as well as the universities themselves. The accepted method of ranking institutions based on research reputations of their faculties speaks much louder to the individual professor than do presidential exhortations to take teaching more seriously (Alpert, p. 10).

An example of this can be found in the *U.S. News and World Report's* annual ranking of colleges and universities. The college issue containing the rankings is among the magazine's best sellers, and a college guidebook based on the issue sold nearly a million copies last year (Shea). Until the *U.S. News and World Report's* most recent annual ranking, teaching was not a ranked category. Recognizing its lack of attention to teaching in previous surveys, the magazine's 1995 ranking of the nation's best colleges and universities added a category entitled "tops in teaching" to its traditional measures, which are more heavily weighted to research-based criteria (Winship and Ratner). Citing the difficulties of measuring quality of instruction and the lack of uniformly accepted measurement instruments, the ratings used were based purely on reputation (Winship and Ratner).

Have we done better in our own profession? To my knowledge, most rankings of agricultural economics departments have relied on number and quality of publications or citations (Beilock, Polopolus, and Correal). To the extent that academic programs are considered, it is typically in the context of whether or not doctoral or masters programs are offered and the number of graduates from these programs.

While many criticize the *U.S. News and World Report* rankings, we should recognize that the consumer, who it has been noted is spending sizable sums of money for education, is demanding this type of market information. It behooves us to heed the response of Claire Gaudiani, the president of Connecticut College: "Until we determine how we should evaluate ourselves, I think it's a bit inappropriate for institutions to complain so bitterly about an outside evaluation" (quoted in Shea, p. A54).

Until higher education comes forth with more quantitative measures, those based on "reputation" will continue to be used.

Teaching and Learning Outcome Effectiveness. I would argue that colleges of agriculture and departments of agricultural economics have demonstrated a strong commitment to quality teaching, advising, and curriculum development. While acknowledging that the means by which we evaluate quality and performance of instruction are less than desirable, we recognize its value and importance and address it.

Our challenge is to carry that commitment forward into the information age era. It is imperative that we evaluate our curricula for relevancy, and that we examine the pedagogy used in light of changes taking place in the world today. In recent years, increased emphasis has been placed on assessment measures, encompassing issues as disparate as student retention, time required to receive a degree, and learning outcomes. How effective have we been in dealing with the latter of these—learning outcomes? By what means do we determine the skills, attributes, and qualities students should possess upon completion of their program? How do we assure that the educational experience provides these elements? And finally, how do we ascertain how effectively students perform after graduation?

In light of the information explosion and the myriad of changes occurring in the food and fiber sector, we should be reassessing what a college education entails for our majors. While universities have always emphasized lifelong learning attributes such as critical thinking, quantitative reasoning, and communication skills, the information and knowledge explosion is forcing us to reexamine our curricula to assure that students leave the university with the capacity and desire to pursue a career of lifelong learning (Twigg).

The accountability issue of teaching and learning effectiveness directly relates to how we present or deliver this curriculum. Speaking to one aspect of our delivery mechanism two years ago at this meeting, Josef Broder remarked that he was struck by "the lack of imagination" in the manner in which material is presented in textbooks (p. 15). The capabilities for innovation in presenting pedagogy have burgeoned in the two years since Broder made those comments. The future of the textbook in the sense referred to by Broder is rapidly nearing an

end. I will come back to this later, but I mention it here simply to state that the standards by which we will be measuring and evaluating teaching in the future will be different. As students are exposed to "information age" courses and classrooms where "point-and-click" CD-ROM textbooks, the Internet, computer networking, and hypermedia instructional materials are standard fare, student expectations will almost certainly mandate that the low-tech classroom become obsolete.

At the teaching workshop held prior to the 1992 AAEA meetings in Baltimore, participants pointed out that there was a limited variety of "agricultural economics" textbooks and other instructional materials for many of the courses typically offered in agricultural economics and agribusiness curriculums. It was noted that the target audiences for these texts were not large enough for publishers to profitably offer a wider range of instructional materials. What impact will these new instructional technologies have on the instructional materials available for our courses? Will it limit further the range of instructional materials, or will there be economies in the development, reproduction, and distribution of these new products, thereby encouraging the development of a wider array of educational materials?

Alternative Delivery Mechanisms

Initially, I had labeled this section "distance learning," but that terminology limited the realities of what is really happening today. By way of example, I am sure many of you have seen the IBM commercial depicting an elderly man in a European country walking in a vineyard with his daughter and telling her that he conducted the research for his Ph.D. through an American university via the Internet. There is a not-so-subtle message here regarding the impending changes in education delivery systems.

Until recently, sending video tapes to different sites was the primary means of reaching distance learners. Facilitated by the power of information technology, classroom learning now extends beyond a single campus to sites virtually anywhere on the globe. Existence of affordable information technology giving us the opportunity of offering instruction anytime, to anyone, anywhere has provided new impetus to the changes in who, when, and where students learn (Twigg). The ability to de-

liver off-campus education to branch campuses, industry, adult education, continuing education, and into every home or office connected to a network portends significant changes in the way we think about the educational products delivered and educational institutions providing them.

A myriad of opportunities already exist. On-line education is being offered by for-profit organizations like the University of Phoenix and University Online (DeLoughry 1995). University Online's education courses are prepared by teachers and universities and then repackaged for on-line distribution and use ("Campuses Challenged by On-Line University"). By signing up the University of Massachusetts, George Mason University, and George Washington University, University Online is continuing to generate new students for its on-line products. The Electronic University Network (EUN) is offered via America Online (Stucky). EUN helps colleges go online and develop courses, provides the telecommunications interface, and recruits students. Transcripts are provided by the degree-granting institution and make no reference to distance learning or EUN. All institutions affiliated with EUN are accredited.

Another distance education institution, Magellan University, recruits faculty from all over the country, but the faculty members remain at their home institutions. Magellan, in effect, buys these faculty members' time to provide courses electronically to their students (Brand). Other examples include the Agricultural Satellite Network (AgSat), the Mind Extension University channel, and the all-electronic International University College (Noam).

Textbook publishers and researchers are already exploring the possibility of putting whole courses, even a student's entire curriculum, on CD-ROMs. Researchers at Indiana University envision "virtual textbooks" about the size of clipboards, containing lessons, review drills, and data banks on reference materials (MacKnight).

It is now technologically feasible for students to pick and choose courses from an assortment of mediums and, I might add, institutions. In several states, institutions already use technology to deliver courses and degree programs that originate elsewhere (Blumenstyk 1995). How long will it be before the interviewer will be asking, "Who did you have for agribusiness strategic management?" rather than "Where did you get your degree?" Trans-

scripts in the future are likely to reflect a degree program completed with courses from institutions around the world, offered by the "masters" in their respective areas and representing an assortment of delivery mechanisms. What does this mean with regard to educational diversity?

Previously perceived limits to the development and delivery of learning programs tailored to meet individual learning styles as well as content needs will be replaced with limitless possibilities to deliver educational products, allowing students to learn when and where it is convenient. One of the key implications of the emerging opportunities is that increasingly the student is not "tied to the university as a place" for education. As alternative instructional technologies evolve and credentialing systems are put in place, there will be a migration away from classic campus-based higher education (Noam).

The University as a Place

Noam (p. 247) traces the development of the modern university to three elements of scholarly activity: (a) the creation of knowledge and evaluation of its validity, (b) the preservation of information, and (c) the transmission of this information to others. Accomplishing each of these functions depends upon a set of technology and economics that together with history and politics gave rise to the institution we know as the university. You change the technology and the economics, and the institutions must eventually change. After remaining relatively stable for 2,500 years, Noam claims that our system of higher education is breaking down because today's production and distribution of information are undermining the traditional flow of information, and with it the university structure.

Also addressing the future of the university, Wulf states:

[W]ith the possible exception of teaching, . . . I believe that information technology obviates the need for the university to be a place. With powerful ubiquitous computing and networking, I believe that each of the university's functions can be distributed in space, and possibly in time (par. 32 online).

Will the university survive the challenges that Noam and Wulf argue threaten its very existence?

Sir Douglas Hague, in a 1993 *Forbes* interview, states, "For the first time in history, there are more clever people outside universities than inside. And they're doers" (quoted in Brimelow, p. 170). Hague makes this statement in the context that the service sector knowledge industries—information technology, financial advice, design, and research and development—now exceed the manufacturing sector in economic importance. With respect to his "doers" statement, Hague is critical of the lack of "vigor and innovativeness" in universities because they are hampered by "academic traditions, preconceptions, and institutions."

In a recent *Science* editorial, Danforth argues that in order to keep universities alive, those of us working in them must accept the responsibility to read the needs of the era and take personal responsibility for the success of our institutions. Our optimism as to how well faculty will rise to this occasion is tempered by examples I am sure we can all cite from our own campuses, supporting Hague when he says that universities are notoriously slow to change internally, whether it be curricula revision or restructuring. For example, my own university is considering a revised "core curriculum" document that has been two-and-one-half years in the making. In a recent forum on the proposed new curriculum, one faculty member noted, without any sense of irony, that given the importance of this issue, he felt that it should not be rushed into without further study.

Another reservation that might be added to dampen Danforth's view that faculty will be leaders in visualizing the future of the university concerns whether or not faculty are able to recognize and then accept the types of changes needed. Rent-seeking behavior is, after all, not unheard of on university campuses. Consider the state of Maine's effort at creating an eighth campus, one without buildings or professors, but with degree-granting authority, using only two-way televised classes (Honan). An article in the spring 1995 issue of *Cause/Effect* was heralding the Maine experience as an example of "technology toppling the ivory towers" (MacKnight, par. 42 online). Even before the previous statement appeared in print, the faculty on all seven (place) campuses objected and passed votes of no confidence with the chancellor on the grounds that he failed to "engage them in the planning" of the distance learning endeavor. Fur-

thermore, they were upset with the chancellor's proposal for having one academic dean serve two schools, publishing a common catalog for all seven campuses, and conducting exit examinations to determine how much students had learned. The president of the faculty union was quoted as saying, "We'll support it if it provides quality of education and doesn't put our positions in jeopardy" (Honan, p. A10). The chancellor has since resigned. Is this the "toppled ivory tower" alluded to by MacKnight?

The Maine example may serve as evidence of Hague's comment that universities are too deeply entrenched in tradition to respond to the challenges rushing toward them. To quote an often-used example of misdirected efforts, one wonders if the Maine faculty were simply rearranging deck chairs on the Titanic. In the Tofflers' context, a case can be made that the Maine scenario represents a situation where Second Wave institutions and responses are failing to adapt to Third Wave realities. Here the unique role of faculty involvement in university governance may prohibit universities from making appropriate responses to challenges.

What are the consequences of the Maine incident and other similar situations across the country? There is no way to know with certainty. But, I contend that prolonging debate or delaying action in today's environment of rapidly changing technology and societal institutions can have consequences that did not exist even 10 years ago.

One of those consequences is that state institutions of higher learning are facing competitive challenges that have not previously existed. Because of emerging technologies, education providers anywhere in the world can now compete for students wherever they reside. Technology is changing teaching, and the momentum behind distance education is growing. To quote Mingle, who has studied how to adapt public policy in higher education to reflect the changes allowed by technology: "If students want it [distance education], I can guarantee somebody will do it and somebody else will accredit it" (quoted in Blumenstyk 1996, p. A20).

The days when competition for students within a state takes place primarily between the land-grant and "that other" institution are rapidly coming to an end. The bottom line is that the Maine faculty, whose concerns that an electronic campus would create the potential for fewer professors teaching

courses throughout the system, thereby eliminating positions and/or departments, may indeed have been rearranging deck chairs on a sinking ship.

In the strategic management literature, "environmental scanning" is a term used to denote the process whereby management is on the lookout for challenges, threats, and opportunities that may impact its business or industry. It is likened to a ship's radar. Faculty who take Danforth's suggestion that they are the ones to save the university should be seeing a lot of interference on their radar screens.

Will the university survive as a place? Wulf thinks that it will, but just as farming has been transformed, so will go the university.

Implications for the Land-Grant System

The challenges and opportunities emerging out of a transition into the information age are numerous and far reaching. What will they mean to the land-grant system and departments of agricultural economics as we know them?

I suspect that few of us are on the cutting edge of the educational technology that is sweeping higher education. If we are to remain competitive in the educational arena, it is imperative we recognize that we cannot ignore instructional technology. Last year at these meetings, an excellent invited paper session initiated dialogue in this area. Schurle and Comer presented an overview of use of technology within the agricultural economics curricula; Monson demonstrated an alternative to the "chalk-and-talk" teaching mode that has been the predominant delivery system, essentially remaining unchanged for at least a century; and we saw a distance education delivery demonstration by Kendrick. These are simply the beginnings.

Examples of innovations are showing up daily. I encourage you to get on the Internet and look at what instructors around the country are doing. You will quickly get a feel for the innovations that are taking place in instruction, as well as the speed and magnitude of changes that are occurring. A recent survey based on 650 responses found that nearly 24% of classes were being held in computer-equipped classrooms (up from 15.8% the previous year), and 20% of courses were using electronic mail (up from 8% one year ago) (DeLoughry 1996).

Paralleling Cochrane's treadmill theory of tech-

nology adoption, Rogers argues that instructional technology has reached the critical mass that it needs to spread throughout higher education (i.e., we are moving from the stage of early adapters to the general population) (DeLoughry 1996). Being familiar with the fate of the "laggards," we can ill afford to delay making the investments necessary to keep our curriculums and instructional practices current.

Last year, Mike Monson was asked about the investment in hardware, software, and human capital that went into his hypermedia presentations. The costs are not small. How much will it cost to put the enabling technology in place, develop educational materials, and keep them current? Because we have done little to provide technical support to assist faculty on my campus, it is still the Cochrane innovator who is using cutting edge instructional technology.

My university does not appear to be alone. The same survey that showed increases in technology use indicated that only 22% of the institutions had a plan for purchasing new computers to replace outdated models, and that one in five institutions reported they were cutting back on technology purchases as well as reducing services in their information technology offices (DeLoughry 1996). It will be a major challenge for universities and departments of agricultural economics to stay abreast of the developments in technology.

These technologies offer opportunities to significantly impact student learning. The adoption of interactive tools that require students to solve problems and explore concepts on their own is going to shift the focus from the teacher and the physical classroom to the "learner." There will be a need for faculty to rethink their role in the learning process. The new paradigm will require that the instructor will function less as a source of knowledge and more as a coach in the learning process.

For a number of years, there have been predictions about the regionalization of land-grant universities (Warner). The technological developments that are occurring may overcome many of the problems created by physical separation. A major obstacle to cooperation among states has been the provincialism of state governments and the unwillingness to jointly fund programs. These traditional barriers to cooperation may be beginning to weaken. A recent agreement by the governors of 11

western states to explore the creation of a "virtual university" may serve as a model for other forms of "regionalization" ("Campuses Challenged by On-Line University"; Blumenstyk 1995).

Already we see consortia of universities come together to share courses and accept credits from among institutions within the consortia. Are there opportunities here for land grants to better serve clientele through consortia of institutions? As social scientists, our training gives us a different perspective on these issues from those of our physical science colleagues. What is our role in helping to form a vision of the future land-grant institution?

Concluding Remarks

As we think about the realm of possibilities that the information age is bringing, we must be careful not to allow current levels of technology to limit our visioning process. When talking about the information highway of the future, Bill Gates (p. 95) makes the analogy that today's Internet is what the Oregon Trail was in the mid-1800s. Hence, we need to be thinking "interstate" rather than Oregon Trail possibilities.

I will close my remarks with several caveats and apologies. It is not my intention to paint a dismal future of the universities in which many of us work. I recognize that as I have researched and studied this topic over the past months, I may have misinterpreted the literature leading me to draw Malthusian conclusions. I hope I will have encouraged you to heed Danforth's advice and "read the needs of the era and take responsibility" (p. 1651). Noam claims that the threats to the university will not arrive overnight, but they *will* arrive. There is time for the university and our profession to become Third Wave institutions and serve a vital and productive role as the information age unfolds. As a final remark, I quote from Noam:

People often overestimate the impact of technology in the short run, but they also underestimate it in the long term (p. 249).

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