Higher Education in the New Century:
Themes, Challenges, and Opportunities
Keynote Lecture
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Speakers:
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(Sasaki) Now I would like to introduce Professor Duderstadt.

(J. Duderstadt) President Matsuo, Vice-Minister Ono, Governor Kanda, Dr. Toyoda, it is a very unique honor and privilege for me to be able to address this distinguished group of leaders in higher education. It is also a particular honor for me to be on the program with Dr. Toyoda in this wonderful facility contributed by the Toyoda family. The University of Michigan has also benefited very significantly from the generosity of Toyota Corporation. In the United States, we have long had a saying that "what is good for General Motors is good for the country." But judging from your experience and from mine, I think we should say today instead, "what is good for Toyota is good for the world."

My topic this morning is, "Higher education in the new century." Clearly, we live at a time of great social transformation, a change from the predominant human activity of transportation in the twentieth century to perhaps communications in the twenty-first. From cars, planes, trains, to computers and networks. From physical items, such as energy and materials, to knowledge and bits. From the importance of nation-states to increasingly the importance of nationalism and the preservation of cultures. From the role of public policy in determining the future of our universities to the role of the marketplace. What is driving this is what you might call an "Age of Knowledge," in which educated people and their ideas have become key to the prosperity, the security, the social well-being of our nations and our world. It can be said that educated people and their ideas are the most valuable resources for twenty-first century societies and for their institutions.

This age is driving powerful forces in our society, in our world, that influence our universities. The themes of our time, include the exponential growth of new knowledge; the globalization of our societies through commerce and culture; the lifelong educational needs of citizens in an economy that is driven by knowledge and global in extent; the increasing diversity of our population, and the fact that many parts of our society and many parts of the world are currently underserved; the impact of new technologies that evolve at an unprecedented pace such as info, bio, nanotechnology; the compressed timescales, and the non-linear character of the way that knowledge moves from our campuses into the society that we serve. These themes create very powerful forces on universities, in terms of changing economics, the changing needs of our society, changing

technology, and rapidly growing market forces. The question before us is; will these forces drive evolution of higher education; will they drive revolution in our university, or could they lead to the extinction of the university as we know it?

Many of you may have seen the quote that the business sage Peter Drucker gave several years ago when he suggested that decades from now large university campuses such as Nagoya University and The University of Michigan may be relics, that universities will not survive. One of my colleagues, William Wolf, President of the United States National Academy of Engineering, suggested that if you think that an institution that has survived for a millennium cannot disappear rapidly, in many parts of the world the farm owned by a single family has effectively disappeared in just such a very short period of time. Frank Rhodes, President of Cornell University, put it this way, at a very similar forum held in Europe a year ago, when he noted that, "I wonder at times if we are not like the dinosaurs, looking up at the sky at the approaching comet and wondering whether it has an implication for our future." That is the topic I will address.

I would like to begin by sharing my own observations about the characteristics of the university of the twentieth century, universities such as Nagoya University and my university. Then I will discuss briefly the forces driving change in higher education, conjecturing about the nature of the university of the twenty-first century and how our institutions will face the challenge of transforming themselves to serve a new century and a dramatically changed world. Finally I will share with you some lessons in our American universities that we have learned through mistakes and some successes, and then leave you with some remaining, and I believe very important, questions.

The traditional roles of the university all revolve around the core of teaching and scholarship; we educate the young, we seek truth and create knowledge, we propagate our culture and values from one generation to the next, we sustain the academic disciplines and the professions, we constructively criticize our societies. At the core, our activities are characterized by critical thinking, analysis, moral reasoning and judgment. But in today's world, much more is asked of our universities. Around their peripheries, our universities are heavily involved in utilitarian roles such as economic development, technology transfer, healthcare, entertainment, national defense, and international development. Let me give you two specific examples from my own experience, 1) higher education in the United States, and 2) the University of Michigan.

Over the three centuries of the history of our country, our universities have changed very rapidly and very significantly, from the small colleges of a frontier nation to the large land-grant universities and technical colleges during the industrial age, to large university systems like The University of California, and now to the emergance of new institutions such as cyber universities, global universities, for-profit or commercial universities.

In the United States today, there are almost 3,600 colleges and universities, but just as significant, surrounding this core is a very large industry, a knowledge infrastructure involved in providing educational services. In our country, as in many of the nations represented at this symposium, a significant fraction of young people attend our colleges and universities (two-thirds), but a far smaller fraction actually receive degrees (25%). In the United States about 15 million students are enrolled in our universities, about 500,000 of them international. US$200 billion a

year are spent on our colleges and universities, but it is important to understand the role of government in our nation. Our federal government has no ministry of higher education, no national systems, no controls, and no policies. It provides US$50 billion a year of aid directly to students, and US$15 billion a year of research grants directly to faculty, but it does not provide funds directly to our universities, but rather channels federal grants to our people, our students and our faculty. State governments and regional governments provide direct support to our public universities and contribute an amount comparable to the federal government (US$50 billion), but with a great diversity in approaches, ranging from very large systems such as the State of California to what can only be called anarchy in the State of Michigan.

The American system is heavily influenced by the marketplace. American colleges and universities compete for everything: for the best students, for the best faculty, for funding, for winning athletic programs, for everything and everybody. My university competes not only with Berkeley, Harvard, MIT, Oxford, and Cambridge, but also with IBM and with Microsoft.

Let me now make some comments about my own university as further background. This is a picture of the city of Ann Arbor and The University of Michigan. The little part over on the upper left hand side is the city of Ann Arbor, and everything else is my university. It is one of the United States' largest universities with 50,000 students, a budget of US$3.5 billion a year, 3 million square meters of facilities, and with satellite campuses in Europe, Hong Kong, Korea, Brazil, and cyberspace. For many years we have been ranked among the top research universities in the United States, currently performing about US$600 million a year of research. We span essentially all academic disciplines and professional programs, with many of those offered on our campus, some offered through distance learning on four continents, and in fact, since the crew of Apollo XV, which landed on the moon, consisted entirely of Michigan graduates, they were able to plant the flag of our university on the moon, so you might view us as having one of the first interplanetary campuses.

We also are heavily involved in serving society. The hospitals in our university medical center treats over one million patients a year. We entertain hundreds of thousands of people on our campus and on television every Saturday afternoon, playing a different kind of a football than Japan and Korea have hosted for the world for the last several weeks. We are deeply engaged with industry. For example, like Nagoya, we have a very large global research center for Pfizer Corporation, and like Nagoya, we have a very important research center for Toyota Motor Corporation.

We are financed from a diverse variety of different sources. About one-tenth of our funding comes from our state government, the rest involve resources that we must raise ourselves. If you were to look at us as a corporation, we would have many business lines. We educate 50,000 students a year; we are a national research laboratory; we are a very large medical center; we are so large that we cannot buy insurance, so we have to have our own insurance company to insure our activities; we are involved globally; and we have a very large entertainment industry, known as the Michigan Wolverines, our football team.

So how are universities like this likely to be affected by the changes in our world? Let

me briefly consider the forces on a university today, the way that the needs of society are changing, the financial challenges faced by our institutions, the impact of technology and the impact of markets.

Society is changing in many developed nations such as Japan and the United States. The population of young adults is fairly stable, but there is an enormous growth in the needs of adults for learning throughout their lives. The high-performance workplace demands that people commit themselves to continued learning from cradle to grave, and universities must provide that. Students that were at one time passive recipients of our teaching are evolving into active learners and increasingly demanding consumers of educational services. We are shifting from “just-in-case” education, provided through degrees early in one's life, to “just-in-time” learning, when we provide education and skills when people need them, when they are in the workforce, to “just-for-you” learning, highly customized learning opportunities targeted to the needs of the student. We are becoming ever more diverse in every way: gender, race, nationality, socio-economic background. And of course, the global needs for learning are immense. Half of the world's population is under the age of 20. It is estimated today that 30 million people are ready for a college education but without universities to provide it, and that number will only grow. Sir John Daniels, former President of the Open University of the United Kingdom, put it this way: "In most of the world, higher education is mired in a crisis of excess cost inflexibility. The dominant forms of higher education in developed nations, based on campuses, high cost and with a limited use of technology, seem ill-suited to addressing the global education needs of the billions of young people who will require it in the decades ahead." It could be that the current paradigms that we have are no longer adequate for meeting the changing educational needs of our society.

Financial imperatives is the next theme. All of our institutions need more money than we are provided. As society asks us to do ever more, they are not always increasingly generous in their support of these activities. Our activities are expensive, particularly if we attempt to do them at high quality. In many nations there is a declining priority for public support in the face of other social priorities, such as the healthcare needed by an aging population. Furthermore, it is clear, at least in my nation, that our universities have great difficulty in changing the way that they perform their activities to manage their costs. Once again, perhaps the current paradigm for financing our universities is no longer viable.

Evolving technology is yet another repeated theme. This is a issue I am going to come back and look at it in more detail in just a moment. I will simply say right now that universities are knowledge-driven organizations, and any technology which affects knowledge is going to deeply affect institutions.

The final theme involves markets. As we find in the rest of our society, changing economics, changing social needs and changing technology create powerful market forces which in some cases can drive a restructuring, a reordering, of an economic sector. There are many of us who believe that we may be in the early stages of such a major restructuring of higher education in what one might call a global knowledge and learning industry.

Let me deal with the last two of these in more detail because I think these are very

important issues for forums such as this. The key themes of the digital age are well known to most of you. The extraordinary pace of the evolution of digital technology, the Internet, the way it tears apart the boundaries, erodes the constraints on our institutions, its pervasive character, the different ways that we handle information, knowledge, and the growing importance of intellectual capital, people, to physical capital, or financial capital in the new economy. The lives of many of you in this room have essentially spanned the entire history of digital technology. From the earliest computers, ENIAC, for example, which has the processing power less than the little chip in a greeting card that plays music-to the Japan Earth Simulator, currently the fastest computer in the world.

Over the last century, this technology has evolved exponentially, relentlessly, decade after decade, doubling in power every two years, then every 18 months, and today roughly every year. If you were to compare, for example, the history of computing against other organisms that think, including living organisms, you would find the Japan Earth Simulator has roughly the processing capability somewhere between a mouse and a monkey. But IBM is right behind; they are in the process of building a new computer called Blue Gene that will calculate protein folding, that will have a processing power of one million-billion operations per second. That is 50 times more powerful than the Japan Earth Simulator and is roughly the processing power of the human brain. To put it another way, you can depend on the power of digital technology increasing by roughly a factor of 1,000 decade after decade. It will be a 1,000 times more powerful in 10 years, a million times more powerful in 20 years, and a billion times more powerful in 30 years. We will see it in the processing speed available, the memory of our machines, the bandwidth for communication and in the networks. Bell Laboratories in the United States has an interesting motto: "Fiber to the forehead." That suggests perhaps there will be a more intimate coupling of the human mind into cyberspace.

The world of interaction with people has changed enormously: from text to pictures, to virtual reality and perhaps tele-presence and even neural implants, where the electronic contact with the machine world is actually coupled directly into the neural cortex.

The Internet is a good example. Already beyond human comprehension, it incorporates the ideas and mediates interactions among millions of people, 200 million today, perhaps over a billion in the year 2005, as more and more of the global economy depends on electronic interaction. At Michigan we were instrumental in helping to build the first Internet, and we are currently involved in a project called "Internet 2" exploring the next generation. Some other possibilities include “ubiquitous computing,” where computers disappear into the walls, the woodwork, your clothes, your body if they become smaller; agents and avatars software; emergent behavior-Stanley Kubrick's movie "2001" filmed 30 years ago suggested that computers may develop consciousness. Many of our scientists do not believe it, but if it happens it will likely happen in this century.

Will the future be dark as symbolized by the image of Morpheus from the popular recent movie "The Matrix," for example, or will it provide new opportunities? Well, universities, as I said, are involved in creating, preserving and applying knowledge. We already use this technology in our laboratories for our research to simulate reality, to collaborate. We use them in our libraries;

actually, the book is becoming less a document than a portal, a window to the knowledge of the world. What about education? Students themselves are beginning to drive it with their mere behavior. I work on The University of Michigan campus in a very futuristic facility known as the Media Union. It is a facility inhabited by thousands of students in a technology-intensive environment doing essentially anything they want to do. I look out through the windows of my office at these thousands of students and I realize that, although they are learning what we are trying to teach them, they are not learning in the way we did. After all, this generation is the first in our history that spent their entire lives immersed in a media-rich environment. They learn through interactivity, through participation, through experimentation. They multi-process. Sure, they can read and they can write, but they master other forms of communication. Bricolage is a French term, which means you put together various elements to achieve a solution, and that is what they do. They are the plug 'n' play generation, and those are the students that will drive change in our institutions.

For the last two years, I have chaired a National Academy of Sciences Committee trying to understand more about this. Our concern was that universities are not yet aware of the great impact this technology will have. The objectives are to look out far enough into the future, to understand what the technology is capable of, and then determine the impact potential for our institutions. I will not go through the details of this, but I do want to share several of the early conclusions with you.

As far out as our technologists can see, this exponential character of the evolution of the technology is likely to continue, 10 years, 20 years, 30 years and beyond. The impact of the technology on universities will be profound, rapid and discontinuous, just as it has been on the rest of our society and on all of our activities: teaching, research, service, how we are organized, how we are financed. For the near term, the decade ahead, universities will continue to look very much as they do today, although the market forces generated by these technologies will demand significant changes in what we do. Although we feel confident that information technology will continue its rapid evolution for the foreseeable future, it is very difficult to predict the impact of this on human behavior. Of course, that is the big unknown.

In summary, our taskforce has reached the conclusion that for a decade ahead, we anticipate that the technology will drive comprehensible change but change that will be rapid, profound and discontinuous. In the words of Clayton Christianson, it is a "disruptive technology." For the longer term, two decades and beyond, the future is much less clear. Who can foresee what the impact of digital technology a thousand or a billion-fold more powerful than today will be on universities or other social institutions? Jacques Attali, the noted French economist, put it well, I believe, in “Millennium, ” a book he wrote several years ago: "The impact of information technology will be even more radical than the harnessing of steam and electricity in the nineteenth century. Rather, it will be more akin to the discovery of fire by early ancestors, since it will prepare the way for a revolutionary leap into a new age that will profoundly transform human culture."

Let me turn to the second subject: markets, the restructuring of the higher education “enterprise.” That is a polite word that university presidents use, but maybe I should use the more

relevant word, "industry," instead, because that is in fact what we may be evolving towards. Changing social needs, financial imperatives, evolving technology, all drive markets. I mentioned earlier that universities compete, regionally, nationally, and increasingly globally for students, faculty, funds, for everything and for everybody. Over the last 20 years, we have seen several economic sectors: energy, transportation, healthcare, banking, restructured, driven by changing regulations and by technology. It could be that higher education will follow a similar path. A recent prospectus distributed to potential investors by a venture capital company put it this way: "We believe education represents the most fertile new market for investors in many years. It has a combination of large size (about the same size as healthcare), disgruntled users, low utilization of technology, and the highest strategic importance of any activity in which this country engages. Finally, existing managements are sleepy after years of monopoly." Where have we heard that before?

Well, how do you look at the contributions of a research university from the perspective of the marketplace? We produce people, we produce ideas, and we produce tools. One possible future is of a brave new world of commercial higher education. In fact, the knowledge industry in my country might look something like this: you have companies that produce hardware; companies that produce the connective tissue, the networks, producing software, solutions and content. And way down on the list after Time Warner, Disney and the dot-coms, is AAU, that is the Association of American Universities, our research universities. So maybe that is where we fit into this marketplace. That is our core competency, educated people, content and services. But other people are beginning to compete with us.

Consider a vision of the future of higher education in the United States, not from university leaders but from Accenture, one of the world's largest information services companies. They see a future higher education industry, about a US$30 billion a year industry, consisting of 30 million students, (twice the number we have now), 200,000 faculty facilitators (I am not sure whether these are advanced students, or teaching assistants, but I do not think they are faculty), perhaps 50,000 faculty content providers, and 1,000 celebrity faculty to be the “stars” in commoity products. This should be compared, I might add, to 800,000 faculty in the United States today.

Clearly, such a brave new world would drive major change. It would cause us to unbundle our activities. Some organizations might produce content, others might assess whether students learn it, others might provide diplomas, certificates. It could create a commodity marketplace for learning opportunities. Perhaps the mergers, acquisitions, hostile takeovers that have characterized other economic sectors would occur. New learning life forms might appear, such as a convergence of museums, entertainment companies, information technology companies. But it also could create a lowest common denominator of quality, in which low cost-performance overcomes the broader social functions of the university such as scholarship.

Lest that disturb you, there is another possible future, a society in which knowledge is recognized to be of immense importance, and therefore, democratic societies accept their responsibility to provide citizens with the education and training they need throughout their lives, whenever, wherever, and however they desire it, at high quality and at affordable cost. Now, that

renaissance future for higher education, while certainly possible, will probably require universities to be somewhat different in character than our current higher educational enterprise. Our institutions would have to become much more focused on those who we may serve, our students, rather than, focusing as we do today onour faculty. We would have to provide high quality education, but affordable education. Learning becomes a lifelong need and universities would need to be prepared to provide lifelong learning opportunities.

In such a future, the old ways that we divide up education between primary, secondary, undergraduate, graduate, workplace, will all blur together. Interactive and collaborative learning experiences, rather than the passive classroom and lecture will be demanded by the plug 'n' play generation: Asynchronous, anytime, anyplace, to anyone to Ubiquitous: every time, every place, to everyone. Learning opportunities that are pervasive throughout our society, diverse to meet the diverse needs of our citizens, but intelligent and adaptive, customized to meet their needs.

The key policy question is therefore, which of these two features is most likely. How can governments and societies determine this future. How do we balance the roles of market forces and the roles of public purpose in determining the future of our institutions? Can public policy and public investment shape market forces, so that the important traditions and values of our institutions are preserved, or will competitive and commercial pressures sweep over our institutions like a tsunami that overwhelms us with modest forces and leaves behind only a higher education enterprise characterized by mediocrity?

How do universities face these challenges; how do they transform themselves; how do they adapt to this future? A university like Nagoya University is a very complex institution involved not simply in a great complexity of disciplines, but in terms of diverse human activities. The pace of change is unrelenting, and yet the resistance to change on the part of higher education is generally very strong, indeed. In the United States we have a saying that universities change "one grave at a time." That is because we, of course, are dependent on faculty members with careers that last several decades. Our universities have long found it easier to do more and more, rather than to focus what they do by doing fewer things and doing them better. The governance of our universities in our country, and I suspect in most of the world, is a governance system that has evolved from decades and in some cases centuries past, during a much different time and a much different set of factors. It is antiquated and perhaps even irrelevant in the fast-paced era of change that we face today.

Let me share with you, as I begin to approach my final remarks, some lessons learned from my own experience in leading a major university in the United States. It is always important to begin with the fundamentals: what are the values of an institution, what are its most important roles? How would one balance, for example, the priorities among educating the young, or preserving and transmitting culture, basic research and scholarship, sustaining academic disciplines and professions, or criticizing society, which universities, of course, throughout history have done? What are our most important values? Academic freedom, the freedom to speak and to perform scholarship and to teach? An openness to new ideas? Rigorous study? I think most of us would agree those are all important. What about the role of faculty in governance? What about lifetime

employment security for faculty? Those too are values, yet they may also require trade-offs.

Diversity becomes very important. We must realize that our universities are increasingly serving not simply our regions and not simply our nation, but indeed the world, and the world is a highly diverse place. It is important when you look at education to look not at single institutions but to look at stratified systems of highly diverse institutions, all attempting to achieve excellence, but each with unique missions. It is essential to focus on missions that reflect not only tradition and unique roles but also core competencies, a term from the business world, where institutions can be world-class. One of my colleagues who I quoted earlier, Frank Rhodes, characterized the history of higher education in the United States for the last 50 years as "the Harvardization of higher education." That is, all institutions set Harvard or Oxford as the gold standard and attempted to be like these institutins, discarding their own unique character and diversity in a hopeless quest. But after all, the Harvard/Oxford model of spending more and more on fewer and fewer is not really a model that is particularly relevant to the world and the needs that we face.

Balance is also important, yet always difficult for universities -- balance between teaching, research and service; among the disciplines; between a liberal education, the academic disciplines and the professions; between undergraduate, graduate, professional education; between the sciences and humanities. As an example: in my country, perhaps because of an aging population, over the last decade there has been an enormous distortion in which over 90% of the increase in federal funding for research has gone into the biomedical sciences. In a sense, we have shifted funding dramatically away from science and engineering into the life sciences.

The governance of the university is yet another area of concern. I hesitate to say much because these issues are so shaped by the traditions and cultures of different societies. Some general issues, however, that need to be put on the table have to do with questions as to whether the public or their governments view the university as a public good benefiting everyone, or instead view education as an individual benefit, benefiting the individuals, the students, that receive it. Do governments view universities as a public investment for the future, or simply another expenditure, such as spending money on roads or buildings? Is the university a government agency or is it a social institution? In all of our societies, government is under increasing pressure to demand accountability, but the ways that they demand accountability, while perhaps appropriate for the Ministry of Transportation, may not work for universities. Shared governance, that is, where faculty, students, administrators, the public, everybody has to agree before anything happens, can lead to rigor mortis, paralysis. It can also lead to anarchy.

Some principles that we have found useful in the United States--and I hesitate even putting these before youup, because, as I say, they are culturally sensitive--are that we believe universities must have the capacity to control their own destiny. Here I mean not simply traditional values such as academic freedom, but the ability to control what they are and what they do, particularly during times of change. The second theme, “subsidiarity,” actually comes out of the economic theory behind the European Union, but what it really means is pushing authority down to the lowest possible level in universities and giving it to those people that actually have a responsibility to perform the fundamental roles of the university: to teach, and to do research. Centralization is a

very awkward approach to higher education during a time of change.

Who pays for our university? Governments? (That means the taxpayer.) Students, through fees? Research sponsors? Government and industry? Private donors? The marketplace? Two characteristics of our country, which we found of immense value during times of change are, first, a tax policy that regards universities as charitable organizations and therefore, enables them to receive private gifts free of tax. For that reason, many of the most eminent American universities gain about 20% of their support from gifts from individuals, corporations.

Second, for the last 20 years the United States has had a policy in which the ideas, the patents that come out of government-sponsored research, belong to the universities and can be exploited by those universities to generate resources, by licensing them to industry, by forming companies, which created highly entrepreneurial universities in which our faculties are very aggressively involved in generating the resources to achieve excellence. It has also created a certain dilemma in which some of our institutions, such as mine, which is a public university, has, in fact, become increasingly private-like in the way that we are financed. When I first came to our university in the 1960s, 70% of our support came from government. Today that number is 12%. During those 30 years, we have evolved from a state-supported, to a state-assisted, to a state-related, to a state-located university, and now I suppose, since we have distance learning on all of the continents, we remain only a state-abused institution.

Alliances is yet another strategy. In this world in which excellence in specialized areas, unique areas, becomes more and more important, alliances similarly become more and more important. We can no longer be all things to all people. We have to rely on alliances with other types of institutions, like and unlike, to expand our impact. Not simply alliances internationally, but alliances between different kinds of institutions, between research universities, perhaps polytechnics, liberal arts colleges. Broad alliances, the example of Erasmus-Socrates and the Bologna Declaration as Europe reorganizes education policy to encourage more in the way of alliances. Symbiotic relationships, between industry, government and higher education.

Experimentation is yet another strategy. In a time of great uncertainty, when the future is difficult to predict, the best strategy of all may be to try to understand the future by performing experiments to invent it. In order to do that, the campus culture has to change to encourage risk-taking, to encourage faculty and students, where creativity exists, to feel comfortable in trying to take bold steps, to encourage engagement at the grassroots among faculty and students and essentially ban the word "no" from the vocabulary of administrators and bureaucrats.

At Michigan this was the approach we took in the 1990s. We restructured ourselves financially to become predominantly privately supported. We began to emphasize the diversity of our institution and change dramatically the character of our student and faculty populations with respect to race, gender, nationality, any way that you can measure human diversity. We explored the concept of a "world university" by using distance learning technology to open up educational opportunities in Asia, Latin America, Europe, Africa. We were intimately involved in the management of the Internet in the 1980s, and now with Internet 2 we are going to explore the opportunity for a cyberspace university.

Today we are exploring yet another opportunity, I will just mention in passing. Many of you are aware of the so-called open source movement, characterized by the Linux operating system, in which the operating system is made available to all who can use it for their purpose, rather than sold to you one by one by Bill Gates at Microsoft. MIT stunned the world two years ago when they announced a very similar approach by putting their entire curriculum into the public domain, making it available for free to the world. At Michigan, we are working with them to provide the software tools to do that, which will also be provided for free to the world. It raises the interesting question; suppose a small group of the world's leading comprehensive universities were to place in the open domain for all use, for free, the digital resources supporting their entire curriculum--all their academic disciplines and professional programs, along with open source versions of the software tools and the platforms necessary to use these. That would be very threatening to the publishing industry, not to mention Microsoft, but nevertheless, maybe that is a possible experiment that should be tried.

The final lesson learned is to always remember the yin and the yang, that threats can also be opportunities. Issues and decisions concerning university transformation should be posed not as threats but rather as opportunities for our institutions. Once we agree that change is inevitable, we can use it as a strategic opportunity to control our destiny while preserving the most important of our values and traditions. After leading this process of transformation for over a decade, one of my colleagues handed me a note in which he had written on it a quote from Machiavelli's "The Prince," the medieval book on political intrigue and leadership in the Middle Ages. The quote is the following: "There is no more delicate matter to take in hand, no more dangerous to conduct, nor more doubtful of success than to step up as a leader in the introduction of change, for he who innovates will have for his enemies all those who are well off under the existing order of things, and only lukewarm support from those who might be better off under the new." I have learned that important fact of life, and other leaders trying to lead change will have to face that challenge, but nevertheless, institutions need to be led into the future rather than simply preserving the past.

The remaining questions: How do our institutions respond to the diverse educational and intellectual needs of a knowledge-driven society, as human capital becomes more important than physical and financial capital? Is higher education a public good, requiring public investment? Or is it a private good, to be funded primarily by the commercial marketplace? How do we balance these roles of the public purpose of our universities against market forces that will determine our future? Can public investment counter competitive and commercial market pressures, which are building on a global basis? And finally, what in this constellation of issues is the role of the research university? Should it be a leader in change, or should it instead be an institution which protects the traditions, and the values of the past? And perhaps the most important question of all: are we facing in the years ahead a period of evolution, of revolution, or of the possible extinction of the university as we know it today?

Let me end by providing my own answer to this last question. Our institutions, after all, are one of our civilization's most enduring legacies. For a thousand years the university has benefited our civilization as a learning community, where both the young and the experienced could

acquire not only knowledge and skills but as well the values and disciplines of the educated mind. Universities have defended and propagated our cultural and intellectual heritage, while challenging our society's norms and beliefs. They produce the leaders of our governments, our commerce and our professions. They have created and applied new knowledge to serve our society, and they have done so while preserving the values and the principles so essential to academic learning: freedom of inquiry, an openness to new ideas, a commitment to rigorous study and a love for learning.

Clearly, in an age of knowledge, higher education will flourish in the decades ahead. In a knowledge-intensive society the need for advanced education and knowledge will become ever more pressing, both for individuals and for our societies more broadly. Yet, it is also likely that the university as we know it today, or rather the current constellation of diverse institutions that comprise the higher education enterprise, will change in profound ways to serve a changing world. But of course, this is just as the university has done so many times in the past.

Thank you very much.

(Sasaki) (Japanese)

(Toyoda) (Japanese)

(Sasaki) (Japanese)