

## Preface

Today our world has entered a period of rapid and profound economic, social, and political transformation driven by knowledge and innovation. Educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well being. It has become increasingly apparent that economic strength, prosperity, and social welfare in a global knowledge economy will demand a highly educated citizenry requiring a strong system of education at all levels. It will also require institutions with the ability to discover new knowledge, develop innovative applications of these discoveries, and transfer them into the marketplace through entrepreneurial activities.

Hence new strategies and investments are necessary to build the learning and innovation enterprises necessary for prosperity in a global, knowledge-driven economy. From California to North Carolina, Dublin to Bangalore, other states, regions, and nations are shifting their public policies and investments to support the new imperatives of a knowledge economy: knowledge creation (R&D, innovation, entrepreneurial activities), human capital (lifelong learning and advanced education, particularly in science and engineering), and infrastructure (colleges and universities, research laboratories, broadband networks).

There is another important theme that characterizes the emerging knowledge economy: the increasing connectivity enabled by modern communications and transportation economies is rapidly shifting the locus of economic and political power away from conventional geopolitical areas. Today's economic activities are no longer constrained by traditional geopolitical boundaries such as states and nations and instead span larger multistate or multinational regions with common economic, demographic, and cultural characteristics. Furthermore, the centers of economic and political activities within such regions have become large metropolitan concentrations, capable of building and sustaining the learning and innovation infrastructure necessary to power the knowledge economy.

The states and cities of the American Midwest, with their common history, demographics, economy, and culture, comprise just such a region. Today the American Midwest, the region that once powered the global economy, created the middle class, fed the world, and defended democracy, is floundering in a 21st century global economy driven by knowledge and innovation. The Midwest is having great difficulty in

making the transition from an industrial agricultural and manufacturing economy to a knowledge economy.

As a faculty member at the University of Michigan for the past four decades, I have spent most of my career at ground zero experiencing (and enduring) the collapse of the Michigan industrial economy. Although a nuclear scientist by training, teaching, and scholarship, my tenure as dean of engineering had given me a sense of just how profound the economic transformation of the Midwest was likely to be. As provost and then president, I presided over the University as it built the backbone of what was to become the Internet, (along with IBM and MCI), one of the most disruptive technologies driving the economic transformations of the past two decades. Through my service on the National Science Board and the National Academies, I realized that we were indeed entering an “age of knowledge in a global economy” (as my colleague, Erich Bloch, former Director of the National Science Board termed it) in which advanced education, R&D, and technological innovation would become the driving force behind a new world order. (Bloch, 1990)

During the past decade I have occasionally hoisted warning flags by authoring several reports on the changing nature of the State of Michigan. I have also joined with John Austin, Bruce Katz, Mark Muro, and their colleagues at the Brookings Institution on a series of studies of the Great Lakes region. At the national level I have led a major effort to understand the impact of information technology on higher education and served on the National Commission on the Future of Higher Education (the Spellings Commission). As co-director of the Glion Colloquium, an organization that brings together leaders of higher education from around the world to meet every two years in Switzerland, I have had the opportunity to compare notes and develop strategies on the changing international role of the research university. Hence it was natural that when Dick Longworth approached me on behalf of the Chicago Council of Global Affairs about developing one of their “Heartland Papers” on the state of higher education in the Midwest, my response would be affirmative.

My first inclination was to approach this task very much in the spirit of the California Master Plan, developed by President Clark Kerr of the University of California and his colleagues during a period of extraordinary economic and demographic change in 1960. Yet my own experience with both that state (where I was educated) and the University of California (where I have served as consultant from time to time) made it clear that while a “master plan” focused on higher education made sense in mid-20th century, today one must broaden

considerations to include all stages of education—K-12, higher education, workplace training, lifelong learning—indeed, “cradle to grave” learning needs, opportunities, and experiences. Furthermore, such a study would have to encompass all of the missions of the contemporary university—education, scholarship, engagement, health care, economic development, innovation, entrepreneurial activities, and, of course, traditional roles such as preserving and transmitting culture and serving as a social critic. Finally, while the California Master Plan was an extraordinary success, setting simple albeit challenging and compelling goals that would guide public higher education in the state for decades, today it is likely that a “strategic process” will be more important than a “strategic plan”. Here my experience with the Bologna Process currently transforming higher education in Europe would be invaluable.

Perhaps reflective of my background as a scientist and engineer, I have approached this task using a well-known technique in high-tech industry and government: *strategic roadmapping*. In roadmapping exercises, one uses expert panels to assess needs, then constructs a map of existing resources, performs an analysis to determine the gap between what currently exists and what is needed, and finally develops a plan or roadmap of possible routes from here to there, from now to the future. Although sometimes confused with jargon such as environmental scans, resource maps, and gap analysis, in reality the roadmapping process is quite simple. It begins by asking where we are today and where we wish to be tomorrow, then assesses how far we have to go, and concludes by developing a roadmap to get from here to there. The roadmap itself usually consists of a series of recommendations, sometimes divided into those that can be accomplished in the near term and those that will require a sustained effort.

Yet roadmap is just that, a set of possible directions to the future. Setting a direction is far from arriving at one’s destination. Moreover, reports that recommend major paradigm shifts are not spontaneously or miraculously implemented. The acceptance of and action upon the recommendations in an education roadmap for the Midwest would require active involvement and commitment from a variety of stakeholders—especially state policy makers and civic leaders. Without a regional commitment at all levels, e.g., government, business, labor, education, foundations, citizens, and media, long-term or sustained innovation on the scale of magnitude considered in this report could be achieved—unless, of course, revolution returns as an option to influence public policy. Hence the last sections of this report focus on suggesting the plans, processes, and tactics aimed at maintaining both course and

momentum toward the goals of the roadmap.

In summary, the key of this roadmapping effort is to shift the conversation in the Midwest region away from distracting issues such as how to save dying industries and outmoded practices and to focus it instead on the imperatives of a knowledge economy: lifelong learning, research and innovation, and knowledge infrastructure. Here our message is deceptively simple:

1. Knowledge and innovation are the drivers of the global economy today, and their importance will only intensify in the future.
2. Educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well-being.
3. While the characteristics of the American culture—a diverse population, democratic values, free-market practices, a predictable legal system—provide a fertile environment for innovation, history has shown that significant public and private investment is necessary to produce the key ingredients of innovation: new knowledge (research), world-class human capital (education), infrastructure (institutions, facilities, networks), and policies (tax, investment, intellectual property).
4. Although action at the state and national level will be important, the vision, power, and opportunity is shifting rapidly to major metropolitan areas at the regional level.

A half-century ago, during a period of similar demographic and economic challenge and opportunity, the state of California embraced a master plan for higher education that not only broadened the opportunity for a college education to all Californians but also created the finest university in the world, the University of California. As emphasized by one of the architects of that plan, Clark Kerr: “The future of California no longer depends upon the gold in the hills, or the fertility of the valleys, or the climate in Southern California producing Hollywood as a place that can operate all year round and a favorable place for artists, for actors and actresses to live. We can no longer count on the physical resources of the state. From here on out, our future depends upon how well we develop our human resources, how well we develop our research and development efforts, how well we develop the skills of our labor force as currently in electronics and biotechnology. So let me conclude with these

final words. As goes education, so goes California.”

Today the challenges and opportunities confronting the American Midwest demand a similarly profound vision and commitment. To paraphrase President Kerr: The future of the Midwest region no longer depends on our factories and farms or a labor force possessing physical strength and determination, but limited skills and education. Nor will our region’s remarkable natural resources, our forests and fertile fields, our rivers and inland seas, determine our future. From here on out, our future depends on how well we develop our human resources and how we create and apply new knowledge through innovation and entrepreneurial zeal. So let us conclude with final words: *As goes education, so goes the Midwest!*

## Chapter 1: Introduction

Today our world has entered a period of rapid and profound economic, social, and political transformation driven by knowledge and innovation. Educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well being. It has become increasingly apparent that economic strength, prosperity, and social welfare in a global knowledge economy will demand a highly educated citizenry requiring a strong system of education at all levels. It will also require institutions with the ability to discover new knowledge, develop innovative applications of these discoveries, and transfer them into the marketplace through entrepreneurial activities.

To provide our citizens with the knowledge and skills to compete on the global level, we must broaden access to world-class educational opportunities at all levels: K-12, higher education, workplace training, and lifelong learning. We must also build and sustain world-class universities capable of conducting cutting-edge research and innovation and producing outstanding scientists, engineers, physicians, teachers, and other knowledge professionals. We must build the advanced learning and innovation infrastructure necessary to sustain economic leadership in the century ahead.

Yet the traditional institutions responsible for education and innovation—schools, colleges, universities, research institutes, business, and industry—are being challenged by the powerful forces characterizing the global economy: hypercompetitive markets, demographic change, increasing ethnic and cultural diversity, and disruptive technologies such as information technology. Hence new strategies and investments are necessary to build the learning and innovation enterprises necessary for prosperity in a global, knowledge-driven economy. From California to North Carolina, Dublin to Bangalore, other states, regions, and nations are shifting their public policies and investments to support the new imperatives of a knowledge economy: knowledge creation (R&D, innovation, entrepreneurial activities), human capital (lifelong learning and advanced education, particularly in science and engineering), and infrastructure (colleges and universities, research laboratories, broadband networks).

There is a second important theme that characterizes the emerging knowledge economy: the increasing connectivity enabled by modern communications and transportation economies is rapidly shifting

the locus of economic and political power away from conventional geopolitical areas. As Thomas Friedman puts it, “The world is flat! Globalization has collapsed time and distance and raised the notion that someone anywhere on earth can do your job, more cheaply. Can we rise to the challenge on this leveled playing field?” (Friedman, 2005) Overburdened with legacy economic and political burdens, state governments are less and less influential in determining prosperity in the new economy. Even nation-states must accept the reality that in today’s economy, any region in the world can be a locus for knowledge work. In a wired, interdependent global economy that allows people to choose where to live and work and where to make goods and services, regions are now challenged to identify and nurture their unique economic advantages. Today’s economic activities are no longer constrained by traditional geopolitical boundaries such as states and nations and instead span larger multistate or multinational regions with common economic, demographic, and cultural characteristics. Furthermore, the centers of economic and political activities within such regions have become large metropolitan concentrations, capable of building and sustaining the learning and innovation infrastructure necessary to power the knowledge economy.

The states and cities of the American Midwest, with their common history, demographics, economy, and culture, comprise just such a region. The farms and factories built by pioneers and immigrants seeking the American dream transformed the Midwest into the industrial and agricultural heartland of the nation, the economic engine of the world, and the arsenal of democracy during the past century. In a sense, the Midwest became both the cultural heartland and economic engine of 20th century America.

So, more precisely, just what is the Midwest? In the narrowest sense it might be defined as the midsection of the nation: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa and Missouri. More broadly, one could add portions of other states that also rim the Great Lakes and line the Ohio and Mississippi watershed—notably western Pennsylvania and New York, West Virginia, and northern Kentucky—to create what might be termed the “Great Lakes-Midwest” region or instead move to further to the west by adding the Great Plains states of North and South Dakota, Nebraska, and Kansas. In fact, one might even cross national boundaries by adding the Canadian Great Lakes provinces of Ontario and Quebec to create an international region with remarkably common histories, geographies, economies, and cultures.

Although we will focus most of our attention on the more narrowly-

defined eight-state Midwest region as shown on the map, our analysis and discussion will at times adopt a broader definition of the “Greater Midwest” that broadens to include additional states from the Great Lakes and Great Plains regions.

### Some Symptoms of Our Plight

Today the American Midwest, the region that once powered the global economy, created the middle class, fed the world, and defended democracy, is floundering in a 21st century global economy driven by knowledge and innovation. The region is having great difficulty in making the transition from an industrial agricultural and manufacturing economy to a knowledge economy. A recent Brookings Institution study summarizes the state of the region as follows: “Still heavily reliant on mature industries and products, its aging workforce lacks the education and skills needed to fill and create jobs in the new economy. Its entrepreneurial spirit is lagging, hampering its ability to spur new firms and jobs in high-wage industries. Its metropolitan areas are economically stagnant, old and beat up, and plagued with severe racial divisions. Its landscape is dotted with emptying manufacturing towns, isolated farm, mining, and timber communities. It continues to bleed young, mobile, educated workers seeking opportunities elsewhere. Its legacy of employee benefits, job, and income security programs—many of which the region helped pioneer—has become an unsustainable burden, putting its firms at a severe competitive disadvantage in the global economy. And most important, the culture of innovation that made it an economic leader in the 20th century has long since vanished”. (Austin, 2008)

So what are the assets of the Midwest region as it looks to the future? Certainly the immense fresh water resources of the Great Lakes watershed and the region’s limited vulnerability to natural disasters such as earthquakes and hurricanes—although not storms, floods, and drought. So too its forests and fertile fields provide valuable natural assets—although its past wealth of timber, minerals, and wildlife have long ago been exhausted. Other characteristics are of more questionable value. For example current infrastructure of these states—both physical such as highways and industrial facilities and policies such as tax structure and public priorities—evolved to serve a manufacturing rather than a knowledge economy. Today this infrastructure represents more of a liability than an asset.

Yet it is with the most important assets driving the global economy where the Midwest region has the greatest challenge. Our world today



has entered an era in which educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well-being. Unfortunately, many of the workforce skills of the Midwest region are no longer at world-class levels, both because of aging and declining populations and because of the relatively low priority given to education by an agricultural and factory-based economy. Furthermore, the region has lost much of the zeal for risk-taking and innovation that led to its remarkable economic leadership in agriculture and industry in earlier times.

For years now the Midwest has seen its low-skill, high-pay factory jobs outsourced and replaced by low-skill, low-pay service jobs—or in too many cases, no jobs at all and instead the unemployment lines. (Glazer, 2010) If we look about, we see other states and regions, not to mention other nations, investing heavily and restructuring their economies to create high-skill, high-wage jobs in areas such as information services, financial services, trade, and professional and technical services. Yet in much of the Midwest—among its political leaders, its media and opinion makers, and its people—there is a deafening silence about the implications of a global, knowledge-driven global economy for the region's future. There is little evidence of effective policies, new investments, or visionary leadership capable of reversing the downward spiral of our industrial economies. (Power, 2009)

Leaders in both public and private sectors continue to cling tenaciously to past beliefs and practices, preoccupied with obsolete and largely irrelevant issues (e.g., the culture wars, entitlements, tax cuts or abatements for dying industries, and gimmicks such as casinos and cool cities) rather than developing strategies, taking actions, and making the necessary investments to achieve economic prosperity and social well-being in the new global economic order. Assuming that what worked before will work again, the Midwest today is sailing blindly into a profoundly different future. The prosperity of our farms and factories, once so dominant in a 20th century world, will not return.

Perhaps nowhere is this inability to read the writing on the wall more apparent than in the Midwest region's approach to the development of the skills, knowledge, and innovation necessary to compete in a global, knowledge-driven economy. Our strategies and policies aimed at providing our citizens with the education and skills, the innovative and entrepreneurial spirit, so necessary today for personal well-being and economic prosperity have been woefully inadequate, all too often political in character, and largely reflecting a state of denial about the imperatives

of the emerging global economy.

It may seem surprising that a region, which a century and a half ago led the nation in its commitment to building great public education systems aimed at serving all of its citizens, would be failing today in its human resource development. Indeed the guiding principle of the Northwest Ordinance of 1787 that shaped the new Midwest states preparing to enter the Union stated firmly that: "Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged." (Thorpe, 1909) During the early half of the 19th century, the religious revival movement known as the Great Awakening stimulated the efforts of religious denominations to establish hundreds of small religious colleges across the Midwestern United States that today have become some of the nation's finest independent colleges. The Morrill Act of 1863 put federal lands at the disposal of states to build the land-grant universities that would extend educational opportunity to the working class in the 19th and 20th centuries and today comprise the world's greatest concentration of comprehensive research universities. In the late 19th century, the public secondary schools first appeared in the Midwest both to provide the further education needed by an increasingly industrial society and to prepare students for further study at the university level, thereby defining and implementing the principle of universal educational opportunity for the nation.

Significantly, the strength of the Midwest—its capacity to build and sustain such extraordinary institutions—arose from the region's ability to look to the future, its willingness to take the actions and make the investments that would yield prosperity and well being for future generations. Yet today this spirit of public investment for the future has disappeared. Decades of failed public policies and inadequate investment now threaten the extraordinary educational resources built through the vision and sacrifices of past generations.

Beyond educational opportunities, there is another key to economic prosperity in today's global economy: technological innovation. As the source of new products and services, innovation is directly responsible for the most dynamic areas of the U.S. economy—estimated to have provided roughly 50% of America's economic growth since WWII. It has become even more critical to our prosperity and security in today's hypercompetitive, global, knowledge-driven economy. Our American culture—based on a highly diverse population, democratic values, and free-market practices—provides an unusually fertile environment for technological innovation. However, history has also shown that

significant public investment is necessary to produce the essential ingredients for innovation to flourish: new knowledge (research), human capital (education), infrastructure (facilities, laboratories, communications networks), and policies (tax, intellectual property).

Again, the irony of the region's plight today is that the Midwest led the world in technological innovation throughout much of the 20th century. The automobile industry concentrated in Michigan because of the skills of our craftsmen, engineers, technologists, and technicians and the management and financial skills of corporate leadership as the industry grew to global proportions. Modern agriculture and the commodity markets were defined in both the farm communities of the Midwest and great trading and manufacturing centers such as Chicago. While the workforce skills required by factory manufacturing required only minimal formal education, technological excellence and skillful management enabled Midwestern corporations to achieve global impact. Basic research was also key, funded both by industry in world-class laboratories such as the Bell Laboratories, the Ford Scientific Laboratory, and the General Motors Research Laboratory, by national laboratories in areas such as nuclear research and high energy physics (e.g., Argonne National Laboratory and Fermi National Laboratory), and by the emergence of one of the most formidable concentrations of outstanding research universities in the world.

Yet by the late 20th century, shareholders began demanding short-term strategies to increase quarterly earnings statements rather than longer-term investments in technology key to the future of industry. To be sure, cost-cutting, total quality management, lean manufacturing, and just-in-time supply chains enhanced productivity and competitiveness during the 1980s and early 1990s, albeit at the expense of hundreds of thousands of manufacturing jobs as companies restructured their workforces. Unfortunately, such restructuring also eliminated much of the corporate R&D function, constraining industry increasingly to technological progress at the margin rather than breakthrough technologies and innovations. This was compounded by management's increasing focus on near-term profits, even at the expense of longer-term market share. The Midwest's Washington influence was used more to block federal regulation in areas such as agricultural subsidies, emissions standards, and fuel economy than to attract additional federal R&D dollars to the region. Our leaders ignored the growing concerns about issues such as petroleum imports and global climate change, which would threaten the very viability of Midwest industry by 2000. And state governments were shifting public funding away from the support of higher education and

research and instead to the priorities of aging populations such as safety from crime (e.g., prison construction), social services (e.g., health care), and tax relief. As a consequence, at a time when other states and nations were investing heavily in stimulating the technological innovation to secure future economic prosperity, much of the Midwest was missing in action, significantly under-investing in the seeds of innovation.

## Strategic Roadmapping

So, what to do? That is the goal of this study: to develop a plan for building a learning and knowledge infrastructure for the Midwest region. The plan needs to address the life-long educational needs of its citizens and the workforce skills necessary to compete and flourish in a global, knowledge-intensive economy. In addition, we need to address how to build the sources of new knowledge, innovation, and entrepreneurial spirit necessary to create world-class companies and a world-class living environment.

Since advanced education and research provide the key human and knowledge resources critical to prosperity in the global economy, colleges and universities will play a central role in this effort. Yet this study differs from earlier education planning efforts such as the “master plan” for higher education developed by California in the early 1960s. Today any such effort must consider the educational needs of the region from a broader perspective that includes pre-college, lifelong learning, and workplace training activities, i.e., education from “cradle to grave”. The role of higher education in generating knowledge, enabling innovation, and stimulating entrepreneurial activities must similarly be examined not only from the perspective of both private enterprise and public policy but also within a context that extends beyond the region to encompass national and global concerns.

There are many approaches to such a study. Most common are strategic planning exercises, which progress through the usual sequence of proposing a mission and vision, then assessing available assets and challenges through an environmental assessment, stating goals, proposing strategic actions and a process of tactical implementation, and finally performing assessment and evaluation. In this study we have adopted a common technique used in industry and the federal government: *strategic roadmapping* (Garcia, 1997). In roadmapping exercises, one uses expert panels to assess needs, then constructs a map of existing resources, performs an analysis to determine the gap between what currently exists and what is needed, and finally develops a plan or

roadmap of possible routes from here to there, from now to the future. Although sometimes confused with jargon such as environmental scans, resource maps, and gap analysis, in reality the roadmapping process is quite simple. It begins by asking where we are today and where we wish to be tomorrow, then assesses how far we have to go, and concludes by developing a roadmap to get from here to there. The roadmap itself usually consists of a series of recommendations, sometimes divided into those that can be accomplished in the near term and those that will require a sustained effort.

To provide context, we begin Chapter 2 with an environmental scan of the imperatives of the global knowledge economy, where robust telecommunications connectivity has empowered billions of new knowledge workers to compete for jobs and prosperity, regardless of location or nationality, provided they have developed the skills and infrastructure.

In Chapter 3 we turn to a discussion of the Midwest today. We review both its knowledge assets and liabilities and assess why the region is having great difficulty in making the transition from a farming and manufacturing to a knowledge economy. In recent years Midwest states have led the nation in unemployment; the out-migration of young people in search of better jobs is severe; our educational systems are underachieving with one-quarter of the adults in the Midwest without a high school diploma and only one-third of high-school graduates college-ready. While the Midwest still has, at least for the moment, high quality system colleges and universities, including many of the nation's leading research universities, the erosion of public support over the past two decades and most seriously over the past several years has not only driven up tuition but put the quality and capacity of our public universities at great risk. Primary and secondary education is of equal concern, not so much because of funding, but rather because of poor achievement, particularly in the preparation of students for higher education.

In Chapter 4 we suggest a vision for the Midwest tomorrow as a region well-positioned for economy prosperity and leadership in the 21st Century global economy; a workforce characterized by world-class skills, innovation, and entrepreneurial zeal; and a knowledge infrastructure capable of generating new knowledge and economic opportunities through a strategic utilization of the very technology that is reshaping our world. Put another way, we suggest those skills, educational opportunities, and research and innovation assets needed by the region.

In Chapter 5, by comparing this vision with the current reality, we

can determine how far the Midwest must travel to reach a prosperous future. We can also identify the resource gap that exists between what we have now and what we will need for the future, between the obsolete institutions, policies and programs of today and the globally competitive resources the Midwest must build for tomorrow. (Note here that Chapters 4 and 5 might also be interpreted, respectively, as the “strengths and opportunities” and “weaknesses and threats” analysis of the popular SWOT approach used in corporate planning exercises.)

In Chapter 6 we conclude with the development of the Midwest Roadmap itself, a set of goals and strategies designed to move the Midwest region toward this future. Since building a 21st century learning and innovation infrastructure for a region will clearly involve multiple players—institutions, states, and the nation more broadly—this roadmap is developed in a layered fashion, setting out the goals and strategies for each of the key players and patrons.

In Chapter 7 we turn to the tactics, plans, and processes necessary to achieve the objectives set by the roadmap studies. Here we adopt both the approach of pulling the various roadmaps (national, regional, state, and institutional) into a “master plan” (similar to that taken by the California Master Plan) and suggest a process of continued engagement, action, and refinement to build and sustain momentum (similar to the Bologna Process designed to integrate higher-education strategies for the European Union).

Finally, in Chapter 8 we take a longer term perspective by considering bolder visions that exploit truly over-the-horizon opportunities and visions. To this end, we conclude this roadmapping exercise with a series of bolder proposals that would act as game changers to challenge and change the entire learning and innovation infrastructure of the Midwest region. Included in this consideration are new types of institutions and practices that depart quite radically from the status quo to create a culture of learning and innovation in the heartland of America.

### A Call for Leadership

In his recent book, *Caught in the Middle*, Richard Longworth portrays the challenge of regional economic development in a compelling way: “As the Midwest moves toward the future, leaving the past behind, the social disruption is going to be enormous. Hard decisions must be made. State governments, unsupported, cannot make them. Someone else must lead. But lead where. Globalization changes everything in economics and in life. Nothing remains the same. No real future exists except the future

that the Midwest creates for itself. New England and the South have already learned this. So have many regions inside the European Union. This future must be crafted regionally, by the Midwest acting as a single unit, not as a *mélange* of hostile states but as one region that shares not only a past but a future.” (Longworth, 2008)

To be sure, it is difficult to address issues such as building world-class schools and colleges, developing a tax policy for a 21st century economy, or making the necessary investments for future generations when the body politic and its political leaders seem determined to cling tenaciously to past beliefs and practices. Yet the realities of a flat world will no longer tolerate procrastination or benign neglect. For this effort to have value, we believe it essential to explore openly and honestly where the Midwest is today, where it must head for tomorrow, and what actions will be necessary to get there.

This report is aimed at several audiences. Certainly it is intended for leaders in the public sector (governors, legislatures, mayors, and other public officials), the business community (CEOs, labor leaders), higher-education leaders, and the nonprofit foundation sector. However, the report is also written for interested and concerned citizens who have become frustrated with the myopia that characterizes our public, private, and education sectors.

The goal is to transform what was once the farming and manufacturing center of the world economy into what could become its knowledge center. Put another way, while the Midwest region once provided the muscle for the manufacturing economy that powered the 20th century, now it must make the commitment and the investments necessary to become the brains of the 21st century knowledge economy. The Midwest region faces a crossroads, as a global knowledge economy demands a new level of knowledge, skills, and abilities on the part of our citizens.

While there are many components to transforming the American Midwest into a learning- and innovation-driven economy—tax policy, providing adequate social services, government restructuring, and, of course, political transformation—this report focuses particular attention on the role played by colleges and universities. In earlier critical moments in our nation’s history, public initiatives gave high priority to expanding educational opportunities as a route to prosperity, security, and social well being. The states took action to ensure universal access to secondary education. The Land Grant Acts in the 19th century extended college education to the working class. The G. I. Bill provided the returning veterans of World War II with college educations while the Truman

Commission proposed extending college opportunities to all Americans. And the partnership developed between the federal government and faculty researchers on the campuses created the American research university as a source of much of the basic research and innovation that powered the global economy in the post WWII years.

A half-century ago, during a period of similar demographic and economic challenge and opportunity, the state of California responded with a “master plan” that not only broadened the opportunity for a college education to all Californians but also created the finest university in the world, the University of California. As one of the architects of that plan, UC President Clark, emphasized: “The future of California no longer depends upon the gold in the hills, or the fertility of the valleys, or the climate in Southern California producing Hollywood as a place that can operate all year round and a favorable place for artists, for actors and actresses to live. We can no longer count on the physical resources of the state. From here on out, our future depends upon how well we develop our human resources, how well we develop our research and development efforts, how well we develop the skills of our labor force as currently in electronics and biotechnology. So let me conclude with these final words. As goes education, so goes California.”

Today the challenges and opportunities confronting the American Midwest demand a similarly profound vision and commitment. To paraphrase President Kerr: The future of the Midwest region no longer depends on our factories and farms or a labor force possessing physical strength and determination, but limited skills and education. Nor will our region’s remarkable natural resources, our forests and fertile fields, our rivers and inland seas, determine our future. From here on out, our future depends on how well we develop our human resources and how we create and apply new knowledge through innovation and entrepreneurial zeal. So let us conclude with final words: *As goes education, so goes the Midwest!*



## Chapter 2: Setting the Context: An Environmental Scan

Looking back over history, one can identify certain abrupt changes, discontinuities in the nature, the fabric, of our civilization. Clearly we live in just such a time of very rapid and profound social transformation, a transition from a century in which the dominant human activity was transportation to one in which communication technology has become paramount, from economies based upon cars, planes, and trains to one dependent upon computers and networks. We are shifting from an emphasis on creating and transporting physical objects such as materials, commodities, and energy to knowledge itself; from atoms to bits; from societies based upon the geopolitics of the nation-state to those based on diverse cultures and local traditions; and from a dependence on government policy to an increasing confidence in the marketplace to establish public priorities.

Each of these profound transformations in our world not only challenges the status quo but raises the requirements for skills, knowledge, and innovation in determining economic prosperity, security, and social well being. The coin of the realm in the brave new world of the 21st century has become *education*. Put another way, to prosper societies must accept the responsibility to provide all of their citizens with the educational and training opportunities they need, throughout their lives, whenever, wherever, and however they need it, at high quality and at affordable prices.

In this chapter we will review the major forces driving change in our world today and analyze their implications for education.

### The Knowledge Economy

Today the most highly developed and prosperous economies are shifting rapidly from the production of material- and labor-intensive products and processes to knowledge-intensive products and services. A radically new system for creating wealth has evolved that depends upon the creation and application of new knowledge and hence upon educated people and their ideas and institutions such as research universities, corporate R&D laboratories, and national research agencies where advanced education, research, innovation, and entrepreneurial energy are found. (Drucker, 1999, Glazer, 2010).

Unlike natural resources, such as iron and oil, which have driven earlier economic transformations, knowledge is inexhaustible. The more it is used, the more it multiplies and expands. But knowledge

can be created, absorbed, and applied only by the educated mind. The knowledge economy is demanding new types of learners and creators and new forms of learning and education. As a survey in *The Economist* put it, "The value of 'intangible' assets—everything from skilled workers to patents to know-how—has ballooned from 20 percent of the value of companies in the S&P 500 to 70 percent today. The proportion of American workers doing jobs that call for complex skills has grown three times as fast as employment in general" (*The Economist*, 2006).

Nations are investing heavily and restructuring their economies to create high-skill, high-pay jobs in knowledge-intensive areas such as new technologies, financial services, trade, and professional and technical services. From Paris to San Diego, Bangalore to Shanghai, there is a growing recognition throughout the world that economic prosperity and social well being in a global knowledge-driven economy require public investment in knowledge resources. That is, regions must create and sustain a highly educated and innovative workforce and the capacity to generate and apply new knowledge, supported through policies and investments in developing human capital, technological innovation, and entrepreneurial skill. Nations both large and small, from China to Finland, are reaping the benefits of such investments aimed at stimulating and exploiting technological innovation, creating serious competitive challenges to American industry and business both in the conventional marketplace (e.g., automobiles) and through new paradigms such as the off-shoring of knowledge-intensive services (e.g. Bangalore).

In the knowledge economy, the key asset driving corporate value is no longer physical capital or unskilled labor. Instead it is intellectual and human capital. An increasingly utilitarian view of higher education is reflected in public policy. The National Governors Association concludes that "The driving force behind the 21st Century economy is knowledge, and developing human capital is the best way to ensure prosperity." Some governors are even taking the courageous step of proposing tax increases to fund new investments in higher education, research, and innovation. (NGA, 2007)

## Globalization

Whether through travel and communication, through the arts and culture; or through the internationalization of commerce, capital, and labor; or through common environmental concerns, the United States is becoming increasingly linked with the global community. The liberalization of trade and investment policies, along with the revolution

in information and communications technologies, has vastly increased the flow of capital, goods, and services, dramatically changing the world and our place in it. Today globalization determines not only regional prosperity but also national and homeland security. A truly domestic economy has ceased to exist. It is no longer relevant to speak of the health of regional economies or the competitiveness of American industry, because we are no longer self-sufficient or self-sustaining. Markets unleashed by lowering trade barriers are by the instantaneous flows of knowledge, capital, and work. Such markets are creating global enterprises based upon business paradigms such as out-sourcing and off-shoring, a shift from public to private equity investment, and declining identification with or loyalty to national or regional interests. Our economy and many of our companies are international, spanning the globe and interdependent with other nations and other peoples. Worldwide communication networks have created an international market, not only for conventional products, but also for knowledge professionals, research, and educational services.

As the recent report of the National Intelligence Council's 2020 Project concluded, "The very magnitude and speed of change resulting from a globalizing world—apart from its precise character—will be a defining feature of the world out to 2020. During this period, China's GNP will exceed that of all other Western economic powers except for the United States, with a projected population of 1.4 billion. India and Brazil will also likely surpass most of the European nations. Globalization—growing interconnectedness reflected in the expanded flows of information, technology, capital, goods, services, and people throughout the world—will become an overarching mega-trend, a force so ubiquitous that it will substantially shape all other major trends in the world of 2020" (National Intelligence Council, 2004).

While once the Midwest achieved economic prosperity though applying mass production and organizational innovation to achieve the lowest costs in the nation, today it must competing with the low-cost workforces in the rapidly developing economies of Asia and Latin America. Simply improving the productivity of low-skill farms and factories are no longer adequate. Instead the Midwest will require an economy built on high skill, knowledge-based activities that will sustain America's high standard of living in a global market.

In such a global economy, it is critical that regions not only have global reach into markets abroad, but also have the capacity to harvest new ideas and innovation and to attract talent from around the world. Interestingly enough, higher education becomes a critical asset in

providing access to such global markets of commerce and human capital. American universities have long enjoyed a strong international character among their students, faculty, and academic programs. These institutions stand at the center of a worldwide system of learning and scholarship, providing powerful regional magnets to attract new talent, new industry, and new resources from around the world.

Yet globalization implies a far deeper interconnectedness with the world—economically, politically, and culturally—that goes far beyond the international exchange of students, faculty, and ideas and the development of international partnerships among institutions. It requires thoughtful, interdependent and globally identified citizens. And it requires the mastery of the powerful new communications technologies that are transforming modes of learning, collaboration and expression. Hence the same forces of globalization that are challenge our regional economies and cultures will also challenging our educational institutions—and particularly our universities.

## Demographics

America's population is changing rapidly. One of the most significant demographic trends is the aging of our population. The baby boomers are approaching retirement, and the number of young adults is declining. In the U.S., there are already more people over the age of sixty-five than teenagers in this nation, and this situation will continue for decades to come. More generally the populations of most developed nations in North America, Europe, and Asia are also aging rapidly, where over the next decade the percentage of the population over 60 will grow to over 30% to 40%. Half of the world's population today lives in countries where fertility rates are not sufficient to replace their current populations, e.g. the average fertility rate in the EU has dropped to 1.45, below the 2.1 necessary for a stable population. Aging populations, out-migration, and shrinking workforces are seriously challenging the productivity of developed economies throughout Europe and Asia. (National Intelligence Council, 2004; Baumgardt, 2006).

Yet here the United States stands apart because of a second and equally profound demographic trend: immigration. As it has been so many times in its past, America is once again becoming a highly diverse nation of immigrants, benefiting immensely from their energy, talents, and hope. Such population mobility is rapidly changing the ethnic character of our nation. In fact, over the past decade, immigration from Latin America and Asia contributed 53% of the growth in the United States population,

exceeding that provided by births.(National Information Center, 2006). Immigration is expected to drive continued growth in the U.S. population from 300 million today to over 450 million by 2050, augmenting our aging population and stimulating productivity with new and young workers. Because America is characterized by great diversity in geography, regional economics, and cultures, immigrants have an incredible array of choice (*The Economist*, 2009) The proportion of Americans who are foreign-born, at 13%, is higher than the rich-country average of 8.4%. In absolute terms, the gulf is much wider. America's foreign-born population of 38m is nearly four times larger than those of Russia or Germany, the nearest contenders. It dwarfs the number of migrants in Japan (below 2 million) or China (under 1 million).

Immigration is vital to growing a regional economy. Although one usually thinks of immigrants taking low-skill jobs in poorly paid services, manufacturing, and agriculture, in reality much of the immigrant population is very high skill. Today's immigrants tend to fall into two classes. At the top are scientists, doctors, engineers, and managers largely from Asia. At the bottom are the laborers, often poorly educated and largely Hispanic, who perform the very low skill jobs that keep our society functioning. Historically, immigrants and multinational populations have been the greatest contributors to urban population and growth, including growth in major U.S. cities over the past 20 years. They are the source of new enterprises, and they stimulate the innovative and entrepreneurial culture that creates diverse, multi-ethnic, urban communities that are attractive to talented, educated, and young residents. (Longworth, 2008)

The increasing diversity of the American population with respect to race, ethnicity, gender and national origin is both one of our greatest strengths and one of our most serious challenges as a nation. A diverse population gives us great vitality. However the challenge of increasing diversity is complicated by social and economic factors. Far from evolving toward one America, our society continues to be hindered by the segregation and non-assimilation of minority cultures, as well as a backlash against long-accepted programs designed to achieve social equity (e.g., affirmative action in college admissions). Furthermore, since most current immigrants are arriving from developing regions with weak educational capacity, new pressures have been placed on U.S. educational systems for the remedial education of large numbers of non-English speaking students.

The full participation of currently underrepresented minorities will be of increasing concern as we strive to realize our commitment to equity

and social justice. Yet the achievement of this objective also will be the key to the future strength and prosperity of America, since our nation cannot afford to waste the human talent presented by its minority and immigrant populations. If we do not create a nation that mobilizes the talents of all of our citizens, we are destined for a diminished role in the global community and increased social turbulence. Most tragically, we will have failed to fulfill the promise of democracy upon which this nation was founded.

## Technological Change

The new technologies driving such profound changes in our world—such as information technology, biotechnology, and nanotechnology—evolve at an exponential pace. For example, the information and communications technologies enabling the global knowledge economy double in power for a given cost every year or so, amounting to a staggering increase in capacity of 100 to 1,000 fold every decade. Computer scientists and engineers believe this trend will continue for the foreseeable future, suggesting that these technologies will become a thousand, a million, and a billion times more powerful as the decades pass. (Reed, 2005; Kuzweil, 2006). It is becoming increasingly clear that we are approaching an inflection point in the potential of these technologies to radically transform knowledge work. To quote Arden Bement, director of the National Science Foundation, “We are entering a second revolution in information technology, one that may well usher in a new technological age that will dwarf, in sheer transformational scope and power, anything we have yet experienced in the current information age” (Bement, 2007).

Beyond acknowledging the extraordinary and unrelenting pace of such exponentially evolving technologies, it is equally important to recognize that they are disruptive in nature. Their impact on social institutions such as corporations, governments, and learning institutions is profound, rapid, and quite unpredictable. As Clayton Christensen explains in *The Innovator's Dilemma*, while many of these new technologies are at first inadequate to displace today's technology in existing applications, they later explosively displace the application as they enable a new way of satisfying the underlying need (Christensen, 1997). If change is gradual, there will be time to adapt gracefully, but that is not the history of disruptive technologies. Hence organizations—and states, regions, and nations—must work to anticipate these forces, develop appropriate strategies, and make adequate investments if they are to prosper—indeed,

survive—such a period. Procrastination and inaction (not to mention ignorance and denial) are the most dangerous of all courses during a time of rapid technological change.

## Innovation

In its National Innovation Initiative, the Council on Competitiveness, a group of business and university leaders, highlights innovation as the single most important factor in determining America's success throughout the 21st century. "American's challenge is to unleash its innovation capacity to drive productivity, standard of living, and leadership in global markets. At a time when macro-economic forces and financial constraints make innovation-driven growth a more urgent imperative than ever before, American businesses, government, workers, and universities face an unprecedented acceleration of global change, relentless pressure for short-term results, and fierce competition from countries that seek an innovation-driven future for themselves. For the past 25 years we have optimized our organizations for efficiency and quality. Over the next quarter century, we must optimize our entire society for innovation" (Council on Competitiveness, 2005).

In terms of increases in new resources, economists estimate that 40 to 60 percent of our additional resources each year are due to research and development activity, particularly in American universities. Another 20 percent of the increased resources each year are based upon the rising skill levels of our population. In other words, 60 to 80 percent are really dependent upon education in terms of research and development and skills of the labor force (Augustine, 2005).

Of course innovation is more than simply new technologies. It involves how business processes are integrated and managed, how services are delivered and—more broadly—how public policies are formulated, and how markets and more broadly society benefit. However it is also the case that in a global, knowledge-driven economy, technological innovation—the transformation of new knowledge into products, processes, and services of value to society—is critical to competitiveness, long-term productivity growth, and an improved quality of life. The National Intelligence Council's 2020 Project concludes, "the greatest benefits of globalization will accrue to countries and groups that can access and adopt new technologies" (National Intelligence Council, 2004).

This study notes that China and India are well positioned to become technology leaders, and even the poorest countries will be able to leverage prolific, cheap technologies to fuel—although at a slower

rate—their own development. It also warns that this transition will not be painless and will hit the middle classes of the developed world in particular, bringing more rapid job turnover and requiring professional retooling. Moreover, future technology trends will be marked not only by accelerating advancements in individual technologies but also by a force-multiplying convergence of the technologies—information, biological, materials, and nanotechnologies—that have the potential to revolutionize all dimensions of life.

## The Implications for Education

The forces driving change in our world today—economies increasingly based upon the application of new knowledge and innovation, globalization, changing demographics, and rapidly evolving technologies—make clear why the keys to regional prosperity have become educated people, the capacity to generate new knowledge, innovation, and an entrepreneurial culture. These imperatives have important implications for education at all levels.

### The Educational Needs of 21st-Century Citizens

Historically, people have always looked to education as the key to prosperity and social mobility. Education in America has been particularly responsive to the changing needs of society during major periods of social transformation, e.g., the transition from a frontier to an agrarian society, then to an industrial society, through the Cold War tensions, and to today's global, knowledge-driven economy. Our schools, colleges, and universities evolved from the educational paradigms of the 18th century serving only the elite, to the public institutions of the 19th century serving the working class, and then once again to knowledge-intensive institutions of the 20th century such as the research university, critical to the economic prosperity, public health, and security of the nation. As our society changed, so too did the necessary skills and knowledge of our citizens: from growing to making, from making to serving, from serving to creating, and today from creating to innovating. With each social transformation, an increasingly sophisticated world required a higher level of cognitive ability, from manual skills to knowledge management, analysis to synthesis, reductionism to the integration of knowledge, invention to research, and today innovation, and entrepreneurship.

Now more than ever, people see education as their hope for leading



meaningful and fulfilling lives. The level of one's education has become a primary determinant of one's personal economic security. Just as a high school diploma became the passport to participation in the industrial age, today, a century later, a college education has become the requirement for economic security in the age of knowledge. In fact, the recent White House Task Force on the Middle Class concludes that "the most effective means of helping American families secure economic stability is increasing access and affordability to higher education" (Biden, 2010).

The hyper-competitive, global, knowledge-driven economy of the 21st Century is stimulating powerful forces that will reshape our society and our knowledge institutions. Today, a college degree has become a necessity for most careers, and graduate education desirable for an increasing number. The pay gap between high school and college graduates continues to widen, more than doubling from a 50% premium in 1980 to 130% today (College Board, 2005). Not so well known is an even larger earnings gap between baccalaureate-degree holders and those with graduate degrees. This should not be surprising given that in the knowledge economy, the key asset driving corporate value is no longer physical capital or unskilled labor but rather intellectual and human capital. In fact, there is an even more pragmatic way to look at the importance of advanced education. Today we invest about \$100,000 of public funds to produce a high school graduate (K-12). Yet statistics indicate that the careers available to those with only a high school diploma will never repay in state and local taxes the cost of their education. It is only at the bachelor's-degree level and above that the public can expect to regain its investment in education from tax revenues (Wiley, 2003).

Today over 80 percent of the new jobs created by our knowledge-driven economy require education at the college level (Glazer, 2009), and for many careers, a baccalaureate degree will not be enough to enable graduates to keep pace with the knowledge and skill-level required for their careers. The knowledge base in many fields is growing exponentially. In some fields such as engineering and medicine the knowledge taught to students becomes obsolete even before they graduate! Hence a college education will serve only as a stepping-stone to a process of lifelong education. The ability to continue to learn and to adapt to—indeed, to manage—change and uncertainty are among the most valuable skills of all to be acquired in college.

Yet many people—and most politicians—continue to think of a college education much as they envision secondary school, with young students listening to professors lecturing about history or economics. It

is important to challenge these old-fashioned perspectives with a dose of the current realities, e.g., students studying intricate subjects such as software engineering, biotechnology, neuroscience, or global supply chain management, since these are the disciplines of today preparing students for rewarding careers tomorrow. The skills of these disciplines are not mastered in the lecture hall but in the laboratory, surgery suite, or through international experience. Clearly such advanced education does not come cheap. But it also has never been more important.

Although a growing population will necessitate growth in higher education to accommodate the projected increases in traditional college-age students, even more significant will be the growing demand of working adults, who increasingly realize that in the high-performance workplace, without further education they are only one paycheck away from the unemployment line. Less than 20 percent of today's college students fit the stereotype of eighteen- to twenty-two-year-olds living on campus and attending college full-time. Today most college students are adults—in fact, one-quarter are over the age of thirty. A college degree has become key to a decent job in our knowledge-driven society, and most of today's students see a college education as critical to their future quality of life, the key to a good job, financial security, and well-being. Today's graduates will change careers many times during their lives, requiring additional education at each stage. Furthermore, with the ever-expanding knowledge base of many fields, along with the longer life span and working careers of our aging population, the need for intellectual retooling will become even more significant. Even those without college degrees will soon find that their continued employability requires advanced education.

### America's Higher Education Enterprise

To illustrate the stresses and strains imposed on education by these near term challenges, it is first useful to begin by summarizing the current state of American colleges and universities. Higher education in the United States is characterized both by its great diversity in colleges and universities and an unusual degree of institutional autonomy—understandable in view of the limited role of the federal government. As *The Economist* notes, "The strength of the American higher education system is that it has no system" (*The Economist*, 2005). In the United States our colleges and universities, both public and private, are relatively free from government control, at least compared to institutions in other nations. We have no ministry of higher education or national system of

education, relatively few federal regulations, and essentially no broad federal higher education policies.

### Characteristics of American Higher Education

The great diversity among institutions and missions

The balance among funding sources (public vs. private)

The influence of market forces (for students, faculty, resources, reputation)

The global character (international students, faculty)

The absence of a centralized system that leads to highly decentralized, market-sensitive, and agile institutions and mobile students and faculty

Supportive public policies (academic freedom, institutional autonomy, tax and research policies)

The research partnership among universities, government, and industry

The American university's constituencies are both broad and complex. Clients of university services include not only students but also patients of its hospitals; federal, state, and local governments; business and industry; and the public at large (e.g., as spectators at athletic events). To address this diversity—indeed, incompatibility—of the values, needs, and expectations of the various constituencies served by higher education, the United States has encouraged a highly diverse array of tertiary educational institutions to flourish. From small colleges to immense multi-campus universities, religious to secular institutions, vocational schools to liberal arts colleges, land-grant to urban to national research universities, public to private to for-profit universities, there is a rich diversity in both the nature and the mission of America's roughly 3,600 post-secondary institutions.

From an economic perspective, today the United States spends roughly 2.6% of its GDP on higher education (\$335 billion/year) (Duderstadt, 2008). Public sources provide 45% of this support: the states provide 24% (\$75 B/y) primarily through appropriations directly to public colleges and universities; the federal government provides the remaining 21% (\$70 B/y) through student financial aid, subsidized loans, and tax benefits (\$40 B/y) and research grants (\$30 B/y). Here it is important to stress that federal support of American higher education is primarily channeled to individuals (students and faculty research investigators) rather than to institutions. In contrast, the states play a more direct role in supporting and governing institutions, providing significant funding to their public

universities and imposing governance structures ranging from rigidly controlled systems (e.g., New York and Ohio) to strategic master plans (e.g., California and Texas) to anarchy and benign neglect (e.g., Michigan).

Over 55% of the support of American higher education (\$190 B/y) comes from private support, including tuition payments (\$95 B/y), philanthropic gifts (\$30 B/y), endowment earnings (\$35 B/y on the average), and revenue from auxiliary activities such as medical clinics and athletics (\$30 B/y). This very large dependence on private support—and hence the marketplace—is a major reason why on a per-student basis, higher education in America is supported at about twice the level (\$20,545 per year) as in Europe. There is a caveat here, however, since roughly half of this cost is associated with non-instructional activities such as health care, intercollegiate athletics, and economic development—missions unique to American universities. After subtracting the sources earmarked for nonacademic missions, one finds that the actual instructional costs of American higher education today are quite comparable to those of many European nations.

### Strained Budgets

Foremost on the minds of most university leaders these days are the devastating cuts in appropriations as the states struggle to cope with crushing budget deficits or the erosion of private support from gifts and endowment income associated with a weak economy. As the global recession has deepened, state after state began to project tax revenue declines and warn their public universities of deep budget cuts up to 20% to 30%. This retrenchment is on top of two decades of eroding tax support of public universities as the states have struggled with the shifting priorities of aging populations.

This reality is particularly important for the leaders of America's public universities. Today in the face of limited resources and more pressing social priorities, the century-long expansion of public support of higher education has slowed. While the needs of our society for advanced education can only intensify as we evolve into a knowledge-driven world culture, it is not evident that these needs will be met by further growth of our existing system of public universities. We now have at least two decades of experience that would suggest that the states are simply not able—or willing—to provide the resources to sustain growth in public higher education, at least at the rate experienced in the decades following World War II. In many parts of the nation, states will be hard pressed to even sustain the present capacity and quality of their institutions.

But the current financial challenges faced by public universities send a deeper message. Vital national needs for world-class performance in research and graduate training are no longer top state priorities. Yet this is a time when the strength, prosperity, and welfare of a nation demand a highly educated citizenry and institutions with the ability to discover new knowledge, develop innovative applications of discoveries, and transfer them into the marketplace through entrepreneurial activities. The state-based funding model of graduate training made sense when university expertise was closely tied to local natural resource bases—e.g., agriculture, manufacturing, and mining. But today’s university expertise has implications far beyond state boundaries. Highly trained and skilled labor has become more mobile and innovation more globally distributed. Many of the benefits from graduate training – like research -- are public goods that provide only limited returns to the states in which they are located; the bulk of the benefits are realized beyond state boundaries. Hence, it should be no surprise that many states have concluded that they cannot, will not, and probably should not invest to sustain world-class quality in graduate and professional education, particularly at the expense of other priorities such as broadening access to baccalaureate education. Today, not only is state funding woefully inadequate to achieve state goals, but state goals no longer accumulate to meet national needs. (Courant, 2010).

There is a growing sense that the balanced financial model that has sustained American higher education for the past several decades is also beginning to fray. Traditionally, the support of American higher education has involved a partnership among states, the federal government, and private citizens (the marketplace). In the past the states have shouldered the lion’s share of the costs of public higher education through subsidies, which keep tuition low for students; the federal government has taken on the role of providing need-based aid and loan subsidies. However today the tuition and fees charged for private universities are now beyond the capacity of most families (e.g., \$35,000/year for tuition and \$50,000/year including housing). The tuition levels at public universities are also rising rapidly. For example, at both the University of California and the University of Michigan, state residents pay \$12,000 a year while out-of-state students pay private tuition levels of \$35,000 a year. A Brookings Institution study has concluded: “the traditional model of higher education finance in the U.S. with large state subsidies to public higher education and modest means-tested grants and loans from the federal government is becoming increasingly untenable.” (Kane and Orzag, 2003).

## A Mature Enterprise

American higher education appears to be having difficulty responding to changes demanded by the emerging knowledge services economy, globalization, rapidly evolving technologies, an increasingly diverse and aging population, and an evolving marketplace characterized by new needs (e.g., lifelong learning), new providers (e.g., for-profit, cyber, and global universities), and new paradigms (e.g., competency-based educational paradigms, distance learning, open educational resources). (Bok, 2006) Furthermore, while American research universities continue to provide the nation with global leadership in research, advanced education, and knowledge-intensive services such as health care, technology transfer, and innovation, this leadership is threatened by rising competition from abroad, by stagnant support of advanced education and research in key strategic areas such as science and engineering, and by the complacency and resistance to change of the academy. (Levine, 1997; Callan and Immerwahr, 2008)

Of particular importance here was the National Commission on the Future of Higher Education (the Spellings Commission), launched in 2005 to examine issues such as the access, affordability, accountability, and quality of our colleges and universities. This unusually broad commission—comprising members from business, government, foundations, and higher education—concluded that “American higher education has become what, in the business world would be called a mature enterprise: increasingly risk-averse, at times self-satisfied, and unduly expensive. It is an enterprise that has yet to address the fundamental issues of how academic programs and institutions must be transformed to serve the changing educational needs of a knowledge economy. It has yet to successfully confront the impact of globalization, rapidly evolving technologies, an increasingly diverse and aging population, and an evolving marketplace characterized by new needs and new paradigms” (Miller, 2006).

More specifically, the Commission raised two areas of particular concern about American higher education: social justice and quality. “Today too few Americans prepare for, participate in, and complete higher education. Notwithstanding the nation’s egalitarian principles, there is ample evidence that qualified young people from families of modest means are far less likely to go to college than their affluent peers with similar qualifications.” (Students from the highest income quartile are ten times more likely to graduate with college degrees than those

from the lowest quartile!) “America’s higher-education financing system is increasingly dysfunctional. Government subsidies are declining; tuition is rising; and cost per student is increasing faster than inflation or family income. Furthermore, at a time when the United States needs to be increasing the quality of learning outcomes and the economic value of a college education, there are disturbing signs that suggest higher education is moving in the opposite direction. Numerous recent studies suggest that today’s American college students are not really learning what they need to learn” (Miller, 2006).

## The Challenge Before Us

We live in a time of great change—an increasingly global society, knitted together by pervasive communications and transportation technologies and driven by the exponential growth of new knowledge. It is a time of challenge and contradiction, as an ever-increasing human population threatens global sustainability; a global, knowledge-driven economy places a new premium on workforce skills through phenomena such as outsourcing and off-shoring; governments place increasing confidence in market forces to reflect public priorities even as new paradigms such as open-source technologies challenge conventional free-market philosophies; and the great disparity in wealth and power about the globe intensify geopolitical tensions and concerns about national security from ethnic conflict and terrorism.

Throughout the 20th century, both the United States and its Midwest have been leaders in the world economy. Democratic values and free-market practices, coupled with institutional structures such as stable capital markets, strong intellectual property protection, flexible labor laws, and open trade policies, positioned the region well for both economic prosperity and security. With a highly diverse population, continually renewed and re-energized by wave after wave of immigrants, the Midwest became the source of the technology and innovation that shaped the 20th century global economy.

There is a growing recognition throughout the world that in an intensely competitive, knowledge-driven global economy, prosperity, security, and social well-being requires both a highly educated and skilled workforce and institutions capable of discovering new knowledge, developing innovative applications of these discoveries, and transferring them into a global marketplace through entrepreneurial activities. This in

turn requires public investment in the ingredients of innovation—educated people and new knowledge—and the infrastructure to support advanced learning, research, and innovation. Put another way, it requires public purpose, policy, and investment to create a learning- and innovation-driven society.



### Chapter 3: The Midwest Today: Past Leadership and Present Challenges

The Midwest's frontier history has given it a priceless legacy of pioneering spirit, gritty courage, and self-reliance. Our ancestors made our farms and our factories the best in the world. The region's state and local governments believed in their people and invested heavily in their education and training, catapulting the region into a position of global leadership in innovation, productivity, and trade. There was broad recognition that it was our people—their character, knowledge, skill, and ability to innovate—that would give the region the competitive edge. A century ago, the Midwest led the nation in building institutions to provide such knowledge resources. State governments created great education systems aimed at serving all of their citizens, demonstrating a remarkable capacity to look to the future and a willingness to take the actions and make the investments that would yield prosperity and well being for future generations. Midwest companies invested heavily in R&D and technological innovation, working closely with the region's research universities. Our leaders understood well the importance of investing with both public tax dollars and private capital in those areas key to prosperity in an industrial economy. And the payoff was enormous, as the Midwest led the world in productivity, technology, and prosperity.

Yet today the region is struggling, overtaken by a fiercely competitive global economy and hindered by a culture of denial that seeks to restore the low-skill agricultural and industrial economies of the past at the expense of the investment needed to create a highly educated workforce and entrepreneurial culture for the future. Today the Midwest is experiencing a transition to a postindustrial society as fundamental as the transformation from a farming society to an industrial society a century ago, driven by the emergence of an economy based on knowledge—educated people and their ideas—and powered by breathtakingly rapid development of new technologies; the globalization of the world's economy and culture enabled by technologies of communication and travel; and the demographic changes in the American population bringing hitherto under-represented groups into a majority of the workforce.

A brief review of the characteristics and assets of the region today will serve as an appropriate starting point for the development of a roadmap to prosperity tomorrow.

## Characteristics of the Midwest

### Natural Features

The Midwest region is blessed with unique natural and environmental attributes and features that both enhance the area's quality of life, and have the potential to support vibrant economic development. Of course, the most distinctive natural features are the Great Lakes themselves. They contain one-fifth of the world's volume of freshwater, making the Great Lakes the single greatest freshwater resource on the planet. Their watershed includes one-fifth of the world's freshwater and 11,000 miles of coastline along with rivers, forests, and scenic and recreation areas that rival any of America's other coasts. With fast-growing coastal areas of the U.S. prone to natural disaster (the "North Coast" of the Great Lakes is decidedly not)—and many fast-growing sunbelt regions facing serious water scarcity issues—the Great Lakes are a tremendous asset for the region, and a vital resource for the entire country (Austin, 2006).

The region also includes both large forests in the north and tallgrass prairies in the south. Thousands of inland lakes complement the five Great Lakes. The region is home to the world's richest arable lands, making the Midwest the world's breadbasket. Although many of the forests have been leveled, the vast copper and iron ore deposits mined out, and the family farms replaced by industrial agriculture, the natural resources of the Midwest region are still immense. (Austin, 2006)

Given its abundant water, fertile land, and the fact that it is largely immune to hurricane and other natural disasters, this "hazard free" third, or "freshwater" coast of the continent can support economic and population growth other parts of the continent and world cannot. As significantly, people choose and prefer locations to live and work with scenic, environmental, and recreational amenities. The magical quality of water and other nature features are important factors in location desirability, and are a factor in the real choices people make for where to live, work, and locate a business.

### Demographics

The Midwest region has a significant population of 60 million people. Furthermore the population of the major metropolitan areas clustered in the Great Lakes region alone approaches 40 million, making it second only to the U.S. Eastern seaboard as a highly integrated, urbanized economic "mega-region." This has enabled it to become one of the largest

industrial production centers and consumer marketplaces in the world. (Austin, 2005)

The region has experienced slower population growth than the rest of the nation over the past two decades, both because of its declining economy and its relatively unwelcoming approach to immigration. More significant than population growth has been the aging of the region's population. Although in part due to the aging of the baby boomers, this has been aggravated by an anticipated loss of 12% in its 25- to 44-year old population from 2000 to 2025 as this group seeks new experiences and more dynamic regional economies in other regions of the nation. The aging population in the Midwest has other implications. Health care costs are increasing rapidly. Productivity is declining as retirements increase. Furthermore, an aging voter cohort is shifting the priorities for public funds to health care, retirement security, safety from crime, and tax relief rather than giving high priority to investment in the future through education.

A demographic characteristic with particular implications for the future of higher education in the region is the anticipated decline in the number of college age students over the next decade, anticipated to be as large as 20% in some states. Like many northern states, the Midwest is once again sliding down the backside of the post-WWII baby boom and bust cycle, in contrast to the southern and western states where immigration has provided the population growth to compensate for these cycles. Already many areas have had to downsize K-12 education, and as this decline propagates to college age students, it will present a formidable challenge to many colleges and universities in the Midwest.

### The Midwest Economy

The sheer size of the Midwest's region's economy is a huge asset. With over 32 percent of U.S. GDP, the region is one of the largest wealth generators and marketplaces in the world. And if it stood alone as a country it would be the 2nd biggest economic unit on earth, second only to the U.S. economy as a whole and larger than Japan, the rising powers of China and India, and the traditional heavyweights of Germany, France, and the United Kingdom. The Midwest is a national leader in fast-growing global trade, generating 30 percent of all U.S. merchandise exports. The region's exports dwarf that of the West and the Northeast, and are exceeded only by exports from the South. (Austin, 2008)

The Midwest had traditionally relied on two enterprises for a living—farming and heavy industry. It is both the breadbasket and foundry of

America—a cultural bellwether and engine of the American economy. Although the number of manufacturing firms and jobs in the Great Lakes region has declined considerably over the past several decades, the sector is still a major driver of the economy. Twenty percent of jobs in the region are in manufacturing, compared to less than 11 percent nationally. In fact, the region boasts 44 percent of the nation's manufacturing jobs, while its overall share of employment is just 37 percent (Austin, 2006).

Given its rich history of new industry creation and its number of globally connected firms, the region remains a decision and research and development center in key sectors of the economy. Over 30 percent of North American corporate headquarters, including 300 of the nation's Fortune 1000 firms, are located in the region, serving as the brains for new business, product, and technology development.

The major cities that factory-based agriculture and manufacturing have created have certain advantages in the new, knowledge-intensive and innovation-based economy if those advantages are properly exploited. Large and dense metropolitan areas are attractive to high-wage employers because firms tend to locate in places that are big enough to offer easy access to an educated workforce, to take advantage of the specialized suppliers that develop in response to the presence of similar firms; and to promote innovation, which in turn enables industry in that region to grow and prosper.

Today all of Midwestern states have been pulled into the maelstrom of globalization. The region faces many challenges transitioning from the industrial era, which it once dominated, to the knowledge age. It is still heavily reliant on mature industries and products, with a workforce ill prepared to obtain or create jobs in the new economy. Its landscape is dotted with hollowing city centers, emptying manufacturing towns, and isolated farm, mining, and timber communities, which continue to bleed mobile, educated knowledge workers. Yet many of our people and our institutional leaders are reeling from the transformation, on the defensive, desperately clinging to the past, to the habits and expectations of an earlier era when we were a leading agricultural and industrial power not just of America but of the entire world.

Perhaps the recent bankruptcies of General Motors and Chrysler should be viewed as harbingers of what is to come if the region continues to back into the future. In fact, the decline of the American automobile industry has been underway for decades, as management continued to resist change and ignore innovation while relying on a workforce with increasingly obsolete skills, protected by powerful unions demanding benefits inconsistent with the emerging global economy and by political

leaders determined to isolate the industry from the new imperatives such as emissions control and fuel efficiency (Longworth, 2008). While other nations developed industries for the 21st century that have now moved onto our shores, the leaders of the American automobile industry sought instead short-term profits based on products that were soon to become dinosaurs in the new world order. The Big Three were in many ways the poster children of the Midwest's failure to cope with global challenges—an aging industry with high costs, rusting factories, resistance to change, absence of innovation and imagination, crippled by incompetent management and reliant on a workforce educated for the industrial age but bereft of the skills needed to compete globally. As a consequence, it has now lost more than half a million Midwest jobs over the past decade, with Michigan and Ohio losing respectively 75% and 60% of their automobile jobs.

Today we find the Midwest midway through a several-decade-long transition from a region dominated by big companies, big unions, and big government to a new economy dependent upon thousands of small, dynamic companies competing in a broad spectrum of world markets. We are experiencing a transition from low-skill, high-pay jobs to high-skill, high-pay jobs; from a transportation industry to an information services industry; from the Industrial Age to the Age of Knowledge. We're learning the hard way that if we want to fully prosper in this new world, we must take the long view, invest in people and learning institutions—in making available life-long education and training, and similarly invest in research and the technological innovation it produces. The Midwest's major sectors—government, business, and labor—must be dramatically restructured to serve us better in the new century. The Midwest today faces fiscal collapse as we continue to fund our current needs and desires by shifting the cost to future generations.

The Midwest first has to recognize that its old low-skill, factory-based economy is dying, never to return. Yet today many of our towns, cities, and states continue to be plagued by an entitlement culture, and increasingly demoralized and hopeless as the low-skill jobs that once provided security and prosperity are swept aside by the global economy. To be sure, economic and social upheaval of the magnitude facing the Midwest is unprecedented. It challenges our basic assumptions about how we live our lives, it changes the rules in mid-game. It displaces and hurts far too many. But the almost certain consequence of this continuing widespread denial of and resistance to change would be to condemn the Midwest to a future of decline that would soon be irreversible.

## Workforce

The Midwest faces a particularly serious challenge in producing the human capital—the educated population, the knowledge workers, the scientists, engineers, and other professionals—that will enable it to compete. This is largely due to the region’s significant brain drain, its aging workforce, and the legacy of an industrial economy that once provided good jobs and wages without a college degree. Research by Glazer and Grimes shows that the most thriving regions and metropolitan areas are those with a high proportion of adults with four-year degrees that are creating and working in high-pay, knowledge-based industries such as information, finance and insurance, professional and technical services, management of companies, education, health care, and government (Glazer, 2010). The vulnerability of low-skill jobs in an increasingly knowledge-driven economy was made apparently in the recent “Great Recession”, in which 7.9 million jobs disappeared in fields with low educational requirements, compared to 400,000 in fields those that required more education. Today the states with the highest per capital income (e.g., Connecticut, New Jersey, Massachusetts, New York) have the highest percentage of college-educated workers (30% or greater), while those Midwest states experiencing declining prosperity are characterized by lower levels of college attainment (25% or less). (Glazer, 2010). Yet today the Midwest region is hampered by serious human capital deficits, reflected in a population that generally lacks the postsecondary degrees and credentials essential to succeed in the global economy.

Although the generous employee benefits, job security, and income practices negotiated that powerful labor unions negotiated with profitable companies over the years was instrumental in creating a prosperous middle class, it now has saddled the Midwest with costs that can no longer be supported by the current economy (*The Economist*, 2006) The impact of legacy costs such as pensions, health care benefits, and unemployment compensation have bankrupted many companies—including, of course, General Motors and Chrysler—and in turn swelled the welfare burdens of state governments. Ironically, it was just these generous benefits that also persuaded low skill factory employees that there was little reason to invest the time or effort in a college education, both for them and, unfortunately, for their children as well. If a high school diploma was all one needed to get an assembly line job making \$70,000 a year with generous health, pension, and employment contracts,

then why bother with more education. As a result, a culture developed over generations that no longer valued the importance of education either as a family responsibility or a public investment—a blue-collar mentality that today haunts much of the Midwest.

The overall lack of an educated workforce represents a significant challenge for the Midwest economy. While a high school education was sufficient for the 20th century industrial economy, today 80 percent of new jobs requiring some form of postsecondary education or training. Yet, only two Midwestern states—Minnesota and Illinois—rank high in the fraction of their populations holding a bachelor's degrees or higher. Low-skill (e.g., without college degrees) middle-aged and older workers make up the fastest growing share of the states' total population and available workforce, and constitute a larger share of Midwest state population than in the U.S. as a whole. The skills of many of these workers have already become obsolete. Many others are high school dropouts, uneducated, some virtually illiterate. They are totally unqualified for any job other than the ones they just lost. Similarly while the workforces of small Midwestern towns are comprised of hardworking high school graduates, they simply do not have the skills or education that the new economy demands and may be increasingly unemployable.

## Diversity and Social Inclusion

A distinguishing characteristic and great strength of the Midwest has been its growing commitment over its history to serve all segments of our pluralistic society. The region has never needed such inclusiveness and diversity more than today when differential growth patterns and very different flows of immigration from Asia, Africa, Latin America, the Caribbean, and Mexico are transforming our population. According to current projections, by the year 2030 current projections indicate that approximately 40 percent of all Americans will be members of minority groups, many—even most—of color. By mid-century we may cease to have any one majority ethnic group. By any measure, we are evolving rapidly into a truly multicultural society with a remarkable cultural, racial, and ethnic diversity.

Our rapidly diversifying population generates a remarkable vitality and energy in American life and in our educational institutions. At the same time, it gives rise to conflict, challenging our nation and our institutions to overcome at last our long history of prejudice and discrimination against those groups who are different, particularly and most devastatingly, those groups identified by the color of their skin.

Tragically, race remains a significant factor in our social relations and profoundly affects the opportunities, experiences, and perspectives of those discriminated against as well as those who discriminate. To change this racial and cultural dynamic, we need to understand better how others think and feel and to learn to function across racial and cultural divisions. We must replace stereotypes with knowledge and understanding. Slowly, we Americans are learning but there remains a great distance to go.

Furthermore, the impact of discrimination and lack of opportunities faced by ethnic minorities poses a particular challenge to the nation's ability to compete in a global knowledge-driven economy. The most rapidly growing component of the U.S. population, Hispanics and African-Americans, have the lowest college attainment (13% of Hispanics and 18% of African Americans hold a bachelor's degree compared to 31% of whites and 50% of Asians). (OECD, 2008; Katz, 2010)

## Communities

Although many imagine the Midwestern life to consist of small towns and cornfields, in reality over 80% of the region's population live in large metropolitan areas. Cities such as Chicago, Cleveland, Pittsburgh, Detroit, and St. Louis evolved first as trading and transportation centers and later as industrial concentrations (Longworth, 2008). Of course there is also a small town life in the Midwest; towns that once were market towns for farmers sprinkled across the townships established by the Northwest Ordinance. But today Midwest states such as Ohio, Illinois, Michigan, and Indiana are quite urban, with economies based on heavy manufacturing, with rural communities based primarily on farming largely only a memory. It is likely that with the continuing industrialization of agriculture, most small farming towns will continue to shrink and eventually disappear unless they are the location of a major food-processing plant or close enough to a metropolitan area to draw suburbanites.

Midwestern cities face a different challenge: to globalize their economies and cultures (through immigration) or slowly fade away. Chicago provides a good example of a city that has managed to turn the corner and enter the new economy based on global trade and business services, enabled by a growing knowledge workforce and a large immigrant population (30%). Detroit provides the case study for the other extreme, a city that has seen its population shrink from over 2 million to 800,000, with acre after acre of abandoned neighborhoods and empty factories, burdened by the legacy costs of entitlement practices that



can no longer be afforded, a deteriorating infrastructure, dysfunctional public schools, and unable to attract either young knowledge workers or immigrants (only 7%).

## Culture

Perhaps because of the farming cultures characterizing their pioneer and immigrant ancestors, Midwesterners have long taken pride in their self-sufficiency, seeking to sustain their communities with hard work and traditional values. In decades past there was a sense of generational responsibility, best illustrated by the strong investment in schools and colleges to provide their children with outstanding education opportunities. The Midwest was able to embrace the innovation and risk-taking of men like Ford, Durant, and Kettering as they built great the industries that provided the region with prosperity (Longworth, 2008).

Ironically, however, because of this wealth and prosperity a culture of expectation and entitlement evolved during the past century that turned the Midwest culture away from innovation and entrepreneurship. People and firms began to believe that prosperity would long endure, high wage jobs with great benefits would continue, without effort or education. Openness, engagement, and comfort with new ideas and people were not valued traits, nor was cooperation among cities, states, companies, and universities. Safety and the status quo were more prized than risk-taking and change. And as this new culture took root in the post WWII economic boom, the Midwest began its slow economic descent. The family farms vanished, the steel mills closed, and the automobile companies began to experienced strong competition from Asia. The decline of the Midwest economy dropped off precipitously with the Internet and the emergence of a truly global, knowledge driven economy, culminating in the bankruptcy of icons such as General Motors in 2009. Today this decline of the Midwest economy continues—yet, unfortunately, so does its denial of the changes required by the global imperatives.

In their panic to save their deteriorating cities, dying industries, and low skill yet well-compensated jobs, Midwest states have declared economic war on one another, launching a barrage of tax cuts and abatements to raid companies and jobs, even though these desperate efforts unbalanced their budgets and destroyed their capacity to invest in the future, e.g., in schools and colleges. The Balkanization of the Midwest intensified in an every state—and city—for itself. As Longworth summarizes the current situation “[today]... the industrial Midwest amounts to a wasteland of empty factories, corroding cities, and

crumbling neighborhoods. Most of the Midwest remains in denial. Other regions of the world, from New England to India, know they are in global competition and off and running. The truth is just beginning to dawn on much of the Midwest. Heavy manufacturing, the family farm, small towns...all going, going, gone..." (Longworth, 2008)

## Educational Resources

With their commitment to "an uncommon education for the common man," the settlers of the Midwest region built what was once arguably the strongest educational infrastructure in the nation characterized by outstanding schools, colleges, and universities. The region established nation's first secondary school systems, founded many of the nation's leading independent colleges, and created the land-grant public universities to educate the working class and further industry and commerce.

Yet today a global, knowledge-driven economy is continuing to raise the bar for educational achievement. The reality is that a bachelor's degree is already almost a mandatory credential for a job in the new economy, and soon advanced degrees—or at least lifelong learning—will become a necessity.

### K-12 Education: The Crippling Gap

Clearly the quality and performance of K-12 education is a very critical issue for the region. For example today almost half of all adults in Midwest states are currently hindered by a literacy level too low to function adequately in today's knowledge-driven society. One-fifth of Midwest citizens do not have a high school diploma, while only one-third of high school students graduate with college-ready transcripts.

There have been a few bright spots in several of the region's systems of public education, including the adoption by several states of some of the most rigorous requirements for K-12 education in the nation. Setting standards is a good start. Indeed, today, some areas may be coming closer to designing K-12 systems in which students, teachers, and parents know what is expected of them. Furthermore, while state initiatives such as charter schools and federal accountability measures ("No Child Left Behind") are having some impact, this are largely at the margin because of far more significant socioeconomic issues such as the deterioration of the family and community environment for learning and the student (and family) motivation for academic achievement. Too many parents

and citizens are still willing to accept less than the best for our children. Michigan's students now may be able to compete with children from Ohio, but they are far behind children in Asia and Europe—e.g., with the U.S. ranking 25th out of 30 developed nations in high school completion and achievement (OECD, 2010; Lingenfelter, 2009). Here part of the difficulty is the vast difference in standards and assessment measures used among the states.

Inadequate school preparation is compounded by poor alignment between high schools and colleges, which often creates an “expectations gap” between what colleges require and what high schools produce. Compared to the rest of the world, primary and secondary education in the United State is too thin, too brief, and not rigorous enough. The result is a high level of remediation by colleges (and by employers), a practice that is both costly and inefficient. The fact remains that throughout the Midwest too few citizens prepare for, participate in, and complete the educational programs capable of preparing them for the knowledge economy, especially those underserved and nontraditional groups who make up an ever-greater proportion of our population. More generally, the leakage from our current education pipeline from primary education through secondary school and college into knowledge-intensive employment is clearly unacceptable.

Of comparable importance is the teaching profession itself. It is here that higher education (and our society) simply must do a better job of attracting the best and brightest into teaching careers and providing them with the quality education, attractive pay, and support necessary for these important roles. In Singapore teaching is regarded as the most important profession. In the United States it is law, with teaching at the bottom, at least if compensation is any indication.

### Higher Education

It is at the level of higher education that the Midwest region may be at the greatest risk, since for too long it has taken its colleges and universities—perhaps the most critical assets of the knowledge economy—for granted. Many studies have highlighted the importance of higher education to the ability of regions to compete for prosperity in the global economy. Most agree that the single most important investment that regions—cities, states, nation-states— can make in their future is to invest in colleges and universities, since these will be the key source of an educated workforce, research and innovation, and entrepreneurial activity.

Of particular importance to the region's future is the presence of

perhaps the strongest concentration of flagship research universities in the world. At its core are the Big Ten universities, or more correctly, the C. I. C. (Committee on Institutional Cooperation) group, which consists of the eleven Big Ten universities plus the University of Chicago. (CIC, 2008) These twelve universities conduct more research, produce more scientists and engineers, doctors and lawyers, business executives and teachers, than any collection of universities in the world, including the University of California, the Ivy League, Oxford and Cambridge, and the other leading universities in Europe and Asia. When one adds to these institutions other leading research universities of the Great Lakes regions such as the University of Missouri, Washington University, Cornell, Carnegie Mellon, Pittsburgh, Case-Western Reserve, Iowa State, one has a significant fraction of the world's top research universities.

With 33 percent of the U.S. population, the Great Lakes states produces 38 percent of the country's bachelor degree holders, 36 percent of all science and engineering degrees, and 37 percent of all advanced science and engineering degrees in 2003—far outstripping any other region of the country. The region's research universities conduct over \$6 billion/year of R&D, enroll over 300,000 undergraduates and 76,000 graduate students, award roughly one-fifth of the nation's doctorates in fields such as engineering, chemistry, mathematics, and computer science. As the flagship universities of their states, these institutions already set the pace for broader educational activities, both at the post-secondary and K-12 levels. Each of these universities has built world-class excellence in unique areas (e.g., Illinois in computer technology, Minnesota in chemistry and chemical technology, Ohio State in materials science and technology, Michigan State and Penn State in agricultural technology, Wisconsin and Michigan in engineering, the natural and social sciences, and biomedical science, Northwestern in medicine and business administration, and Chicago in the humanities and sciences). (Hollis, 2007)

Midwestern universities are strong competitors for federal funds and use these federal dollars to educate students, perform cutting-edge research, and catalyze local economic development. In federal support for university R&D, Midwest universities capture 16 percent of total federal support for university R&D. Both the University of Michigan and the University of Wisconsin-Madison rank among the top ten recipients of federal R&D funds, and the breadth of the region's excellence can be seen by the presence of 11 institutions, at least one from each of the seven states, among the top 50 recipients.

Because of their land-grant traditions, Midwestern universities also

have a long history of public service and extension, not only within their states but throughout the world. These institutions are characterized by a long tradition of global outreach and international development that might enable them to coalesce into a true “world university”, reaching into all parts of the globe to open up new markets and access world-class human capital. Perhaps most important, there is a long-standing tradition of cooperation among these institutions. They work together on both regional and national agendas, merging library and research resources, and sharing curricula and instructional resources with faculty and students. Aggregating these “spires of excellence” by linking these institutions gives the region the world’s leading programs in a broad range of key knowledge areas.

The Midwest is also characterized by a concentration of many of the nation’s leading independent colleges, coordinated through organizations such as the Great Lakes College Association, and committed to providing undergraduate education of exceptional quality within the liberal arts tradition. These colleges have a remarkable record of sending their graduates on to further study at the graduate and professional level to become some of the nation’s leading scientists, physicians, lawyers, teachers, and public leaders.

The strong commitment of the Midwest states to broad access to higher education have led to an extensive network of regional universities and community colleges. Many of these evolved from specialized institutions such as the normal colleges focused on teacher education to become comprehensive universities with substantial offerings at the graduate level. The region’s community college have also evolved over time beyond their original role to provide young high school graduates with local access to professions requiring associate degrees or transitional curriculum to enable admission to baccalaureate programs offered by universities. Today these community colleges play a critical role in providing college level instruction to adults seeking to expand their skills and track the ever changing requirements of the workplace. Since independent colleges, regional universities, and community colleges play a critical role in extending college opportunities, they must be regarded an essential element of any educational strategy for the Midwest.

Although the region’s system of higher education is generally regarded as one of the nation’s best, today the region’s colleges and universities face serious challenges. Although the Midwest’s flagship universities and independent colleges have high graduation rates (80% and above), the rest of region’s higher education enterprise–community colleges, regional universities, for profit colleges–graduate fewer than

50% of their students (corresponding to roughly one million students who will enter college each year only to fail to graduate).

There continue to be signs that leaders of state governments still do not recognize the importance of their public colleges and universities as a strategic investment, either in the magnitude or the nature of the deployment of public funding relative to other states. The Midwest states today spend an average of \$5,700 a year on a public university student, significantly below the national average of \$6,900 and a statewide average of \$7,300 for each K-12 student (SHEEO, 2009). But even more disturbing is that after a massive prison building boom in the 1980s, today the Midwest spends almost 30% more on locking people up (corresponding to \$40,000 per inmate) than it does on educating them in our public colleges and universities, a truly tragic statement of the region's priorities. As yet another example of short-sighted thinking by state governments, although the federal government provided \$53.6 billion in FY2010 to stabilize state and local funding of critical public services such as education during the recent "Great Recession", most Midwestern states (including Illinois, Michigan, Wisconsin, Indiana, and Missouri) chose to spend less than 10% of these Educational Stabilization Funds on higher education. (Lingenfelter, 2009)

During much of this period, state universities have strained to hold tuition increases in check. In fact, when financial aid and inflation are included, the net tuition levels for public higher education in the region have actually declined over the past decade. (McPherson, 2010) But with the most recent cuts, in the wake of the damage to state budgets by the recession, the universities had no choice but to begin to raise tuition levels at double-digit rates. Perhaps indicative of the region's myopia concerning education, governors and state legislators continue to blast these tuition increases, pandering to the fears of students and parents, even as state government plans to cut higher education still further. Since state support is the key to enabling leading public research universities to enroll students from impoverished backgrounds, the erosion of state support and consequent increase in tuition has seriously degraded the capacity of these institutions to serve low income students (e.g., as measured by the declining percentage of Pell Grant students they enroll). (Haycock, 2009)

Today there are increasing signs that both the quality and capacity of Midwest's public universities are beginning to suffer, at just that moment when the challenges of a global, knowledge-driven economy have positioned our universities as among our most important assets. Student-to-faculty ratios and workloads have been increasing, eroding not only

the quality of classroom instruction but also constraining research university faculty from conducting the research critical to economic development in a knowledge economy increasingly dependent upon technological innovation. The logical although disappointing conclusion we can draw from these statistics is that the Midwest region needs and deserves a higher education system that is much better than state government is apparently willing to pay for!

Many of the Midwest's colleges and universities will face serious challenges from the anticipated decline in college-age students characterizing the region over the next two decades. While the increased higher education needs of adults in the workplace may balance the demand for higher education, much of this is likely to benefit more community colleges and for-profit institutions that are more experienced and efficient in adult education. The flagship public research universities are likely to compensate for the regional decline in college-age students by using their brand names to aggressively recruit more out-of-state and international students—likely charging them tuition at private levels to compensate for eroding state support. However, independent colleges and comprehensive public universities could well find themselves with declining enrollments that threaten their very existence.

## Research, Development, and Innovation

Although much of the culture of innovation that helped make the Midwest an economic leader has been lost, the region continues to possess strong and powerful assets needed to compete in today's economy, assets that, if built upon, could accelerate its transformation. The region remains the advanced manufacturing cockpit of the world, with the sector becoming more competitive, productive, and of better quality even as it employs far fewer people. At the same time, it is a globally significant center of new knowledge creation, talent, and innovation, with an unrivaled network of private and public research and higher education institutions; globally engaged businesses, cities, and civic institutions; a huge, strategically located marketplace; and unique water and natural resource attributes. Finally, as the pioneer in the creation of today's social welfare system, the Great Lakes states are an ideal laboratory for remaking public policy to more effectively and efficiently support economic success and security, helping workers adapt to a more unpredictable economic environment than that of the past.

Research and development is an integral part of the Midwest's regional economy (Koizumi, 2008). In 2004, the latest year for which comprehensive figures on industrial as well as federal R&D expenditures are available, \$53 billion was spent on R&D in these seven states, accounting for 18 percent of the national effort. This is roughly proportional to the Midwest's one-fifth share of the U.S. population. Private industrial firms dominate R&D in the Midwest. Of the \$53 billion in R&D performed in the Midwest in 2004, \$43 billion was funded by industry. Taken together, the Great Lakes states perform 29 percent of the nation's total public and private research and development (Koizumi, 2008). Working together, this public and private basic and applied research base contributes a significant share of both nations' new ideas and new intellectual property—cornerstones of productivity gains and new products and firms. For example, the Great Lakes states produce nearly a third of the nation's new intellectual property in the form of patents.

As in the nation as a whole, federal support of R&D in the Midwest has helped to build a strong R&D enterprise. This region received \$8.1 billion in federal R&D funds in fiscal year (FY) 2005, 7.3 percent of the national total. Of this amount, the largest share (\$3.9 billion) went to the region's universities, followed by industrial firms (\$1.8 billion), government labs (\$1.1 billion), and three federally funded research and development centers in Illinois and Iowa (\$670 million). Federal support for R&D has been especially important for the region's universities, which are world-class centers of excellence that not only perform research at the frontiers of knowledge but attract faculty and students from all over the world. Federal funds have also helped to sustain the region's privately funded R&D, through the support of graduate education of scientists and engineers at the region's universities who go on to staff industrial R&D labs and also through linkages between federal and private R&D, especially evident in the Midwest in the links between commercial agriculture and federally funded agricultural research.

New jobs in the Midwest are not going to be spawned by existing industry but instead will be created by entirely new activities, e.g., biotechnology, information technology and computer networking, lasers and ultra-high-speed technology, and an array of knowledge-intensive services such as systems integration and software development. These new jobs will be created by innovation based on research and development and requiring post-graduate education at the master's and doctorate level and the new companies entrepreneurs found on innovative technologies.



A recent study by the National Governors Association finds a growing awareness of these imperatives: “Governors realize that investments in research and development can spur not only new ideas, new products and new technologies, but can increase a state’s talent pool, economic bottom line and its success in national and global markets. Innovation can’t be left to chance—every state needs a clear strategy for success that applies lessons learned from their peers and from abroad.” (NGA, 2007) The study found that the most successful state strategies rely heavily on their core assets: their research universities and their proximity to industries.

From this perspective, it is clear that the most powerful economic engines in the Midwest are likely to be its world-class research universities. Research universities produce all three of the key ingredients in technology-based economic development: technological innovation, technical manpower, and entrepreneurs. Through their on-campus research, they generate the creativity and ideas necessary for innovation. Through their faculty efforts, they attract the necessary “risk capital” through massive federal R&D support (currently in excess of \$6 billion/year for the Midwest’s research universities). Through their education programs they produce the scientists, engineers, and entrepreneurs to implement new knowledge. They are also the key agent of knowledge transfer, both through traditional mechanisms, such as graduates and publications, and through more direct contributions such as faculty / staff entrepreneurs, the formation of start-up companies, strategic partnerships, and so on.

Yet despite its strong network of higher education institutions, the Great Lakes region has not been terribly successful spurring new firms, jobs, and industries. Overall, the region has not created enough jobs in high-wage advanced services industries to offset declines in factory jobs, and has struggled to commercialize and develop locally the fruits of its research products and innovations. But while once the hotbed of innovation, much of the region lacks the entrepreneurial, churning, change-oriented economic culture needed to translate ideas into jobs. Minneapolis-St. Paul is the only large Great Lakes metro that ranks among the top 20 percent of the nation’s most entrepreneurial areas.

The region’s lagging entrepreneurialism is likely a product of several forces. Low workforce education levels in the region and the continued outmigration of young talent could thus be hindering the development of new enterprises. Venture capital firms want to have their investments nearby and today is concentrated largely on the coasts, leaving a void in the middle part of the country. Ultimately, it may simply be that the Great

Lakes culture as it has evolved does not today promote or encourage entrepreneurial behavior. Openness, engagement, and comfort with new ideas and people are central features of innovative communities.

### The Writing on the Wall

Clearly any candid appraisal of the Midwest's current situation does not inspire confidence that the region is headed in the right direction. In *Alice Through The Looking Glass*, the Red Queen warns: "Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!" (Brown, 2007) And such is life in today's hypercompetitive global, knowledge-driven economy where only world-class products and services survive. What assets of the Midwest region are sufficiently world-class to compete, to run twice as fast, particularly if today's artificial barriers were removed (e.g., trade restrictions, tax subsidies, perhaps even time and space if Moore's Law continues to rule)? Our companies? The quality of our workforce? The quality of our business environment? The quality of our government? Our universities? Our weather? Or none of the above?

Certainly the natural assets of the Midwest region are immense positives—the Great Lakes, its fertile farmlands, the forests now re-emerging after a century of exploitation, and of course, the relative safety from natural disasters such as hurricanes or earthquakes (leaving aside the New Madrid fault for the moment). Its geographic location, at the center of one great nation and across the border from another, and its role as a transportation and telecommunications nexus for the world are also great assets.

However much of its civic infrastructure such as its transportation systems, urban infrastructure, and industrial facilities evolved long ago to serve a manufacturing economy that is now dying. The same can be said for its policy environment—state and local governments that originally evolved to serve regions drawn on maps long ago that made little geographic or economic sense and today have demonstrated an extraordinary resistance—indeed, incompetence—in adapting to the imperatives of a global, knowledge economy.

But perhaps the greatest weakness of the Midwest, its Achilles' heel, is its human capital, an aging workforce, inadequately educated and skilled for the global economy, addicted to entitlements and stability, resisting the key characteristics that will determine the future of the region, innovative skills, entrepreneurial zeal, immigration, risk, and

change. Today many have forgotten or ignored the remarkable history of the Midwest, the great creativity and innovation of wave after wave of immigrants who build the farms, factories, and cities that both sustained and defended a 20th century world, and who invested heavily and sacrificed so that their descendents could benefit from world-class educational opportunities and enjoy a life better than theirs.

Our under investment in advanced education, research, and innovation, coupled with short-sighted public policies and corporate strategies that further constrain efforts to build a high-skill workforce and generate the research, innovation, and entrepreneurial zeal necessary to achieve a knowledge economy, should be a matter of great concern to state leaders. The keys to economic growth in a global, knowledge-driven economy are a world-class workforce and a knowledge infrastructure capable of stimulating innovation. These are the assets that will save the Midwest region from becoming a backwater economy, providing a point of liftoff from which we can create new markets, processes, and skills.

Hence the primary challenge to the Midwest today becomes very much one of restoring an adequate balance between meeting today's desires of an aging population and investing in the state's future through building, reducing the legacy costs of an obsolete economy burdened with low skill workforce, and investing in building and sustaining a world-class learning and innovation infrastructure for tomorrow. The challenge to leaders is to develop visionary policies, outstanding institutions, and world-class infrastructure that will produce the knowledge workers, the educated professionals, and the new knowledge necessary to build and attract new knowledge-based industries capable of driving future economic growth. The goal is to transform what was once the agricultural and industrial engine for the world economy into what could become its knowledge center. Put another way, while the Midwest region once provided the muscle for the manufacturing economy that powered the 20th century, now it must make the commitment and the investments necessary to become the brains of the 21st century knowledge economy.

## Chapter 4: The Midwest Tomorrow: A Vision for the Future

Clearly the future of the Midwest states will be determined by the region's success in building a world-class learning and innovation infrastructure for its citizens. But just what is the nature of such a challenge? This can be most easily framed in terms of three important questions:

*1. What skills and knowledge are necessary for individuals to thrive in a 21st century, global, knowledge-intensive society?*

Clearly a college education has become increasingly mandatory for most careers in the knowledge economy, probably at the bachelors level, and for many, at the graduate level. Beyond this goal, a region should commit itself to providing high quality, cost-effective, and diverse educational opportunities to all of its citizens throughout their lives, since during an era of rapid economic change and market restructuring, the key to employment security has become continuous education.

*2. What skills and knowledge are necessary for a population (workforce) to provide regional advantage in such a competitive knowledge economy?*

Here it is important to stress that the concern is no longer competition among cities and states within the Midwest region for prosperity or with other states such as California or Texas. More serious is the competition from the massive and increasingly well-educated workforces in emerging economies such as China, India, and Central Europe.

*3. What level of new knowledge generation (e.g., R&D, innovation, entrepreneurial zeal) is necessary to sustain a 21st century knowledge economy, and how is this achieved?*

It has become increasingly clear that innovation is the key to global competitiveness in regions aspiring to a high standard of living. And the keys to innovation are new knowledge, human capital, infrastructure, and forward-looking public policies. Not only must a region match investments made by other states and nations in education, R&D, and infrastructure, but it must recognize the inevitability of new innovative, technology-driven industries

replacing old obsolete and dying industries as a natural process of “creative destruction” (a la Schumpeter) that characterizes the hypercompetitive global economy.

But such inquiries only scratch the surface. There are also deeper, critical questions: What does it mean to be “an educated person” in the 21st century? What does it mean to be “literate”? What will be our needs for the deeper purposes of academic institutions, such as their capacity to generate new knowledge, to preserve and transfer the cultural achievements of our civilization from one generation to the next, to serve as a constructive social critic, and to produce the human capital and innovation necessary for prosperity and security?

Clearly, the implications of a global, knowledge-driven economy for discovery-based learning and knowledge institutions—schools, colleges, and universities—are particularly profound. The knowledge economy is demanding new types of learners and creators. Globalization requires thoughtful, interdependent and globally identified citizens. New technologies are changing modes of learning, collaboration and expression. And widespread social and political unrest compels educational institutions to think more concertedly about their role in promoting individual and civic development. Institutional and pedagogical innovations are needed to confront these dynamics and insure that the canonical activities of universities – teaching, research, and engagement – remain rich, relevant and accessible.

### Implications for Workforce Development

Today and ever more so in the future, the knowledge content of jobs will determine their value and hence compensation increasingly at levels determined by a global marketplace. Highly educated, high-skill knowledge workers will become the backbone of the workforce of the most prosperous economies. The low- skill but generously compensated factory jobs that once powered the Midwest’s economy and sustained its middle class will disappear as these jobs continue to be off-shored to regions characterized by labor costs more competitive in the global economy. To be sure, Midwest industry will continue to manufacture products. But tomorrow’s factories will likely employ only a handful of workers, e.g., highly trained engineers to program the robots performing the tasks that once employed millions of the Midwest’s workforce. Instead most of the region’s manufacturing jobs will be in knowledge-intensive areas such as R&D, design, global supply chain management

and logistics, marketing, sales, and service. These are the high-pay jobs that will sustain the middle class, and they will all require not only a college education but furthermore a commitment to lifelong learning. (Glazer, 2010)

Yet what about those in the Midwest's current workforce whose education and skills have been swept aside by a hypercompetitive global economy? Here the region faces a serious dilemma. The reality is that the Midwest is no longer capable of supporting its current population with an economy based upon low-skill yet highly compensated manufacturing jobs that are rapidly being off-shored. It is clear that the legacy costs of the old entitlement culture can no longer be sustained without a dramatically restructured economy capable of generating wealth in the global, knowledge-driven economy.

Hence the most immediate priority of the Midwest region—its governments, cities, and towns—is to make the investments today that will create the knowledge and human resources capable of competing and prospering in a global knowledge-driven economy. But this will take time. We must first elevate our educational, research, and innovation resources to the world-class levels. Then we must utilize these assets to provide future generations with world-class education opportunities, innovative skills, and entrepreneurial spirit. The Midwest must take bold actions to recapture the resources necessary to upgrade the quality of its workforce, to provide its citizens with the educational opportunities and skills demanded by the global economy. Put more bluntly, the regions must shrink the burdens of a workforce no longer competitive in the global economy if it is to free up the resources necessary to invest in its future. It must downsize its public and private commitments and legacy costs (e.g., health care, pensions, corrections, social services) to levels more appropriate for a smaller population, particularly in those cities experiencing major economic decline and population loss. It must restructure its tax, expenditure, entitlement, and legacy cost structures to align with this “smaller but better educated” population.

How can we jump-start this process? It is estimated that the majority of new jobs created in the knowledge economy will require not only a college degree but also education in science and mathematics necessary to master the new technologies driving the global economy, e.g., computers, networks, biotechnology, and engineering. Yet today in the Midwest, less than one quarter of our workforce have such educational credentials or skills. Sadly, it is unrealistic to expect that the skills of much of our current workforce can be upgraded to world-class levels. The reality is those workers with skills and education no longer competitive in the global,

knowledge economy will face the choice of either accepting the few remaining jobs compatible with their skills at far lower compensation or migrating elsewhere to economies less burdened by entitlement cultures and legacy costs. Hence even if we are able to free up the resources necessary to invest in educational opportunity for our future workforce, we will still face the challenge of building a globally competitive workforce for today.

## Learning in the Digital Age

Today's students are citizens of the digital age. They have spent their early lives surrounded by robust, visual, interactive media—not the passive broadcast media, radio and television of our youth, but rather Wii's, iPhones, Facebook, and virtual reality. They are “digital natives”, comfortable learning, working, and living in the digital world, unlike those of us who are “digital immigrants” who are struggling to keep pace with digital technologies (Pensky, 2001). This is not an easy task for educators, who for the most part remain reluctant to embrace the new technologies in their teaching and hence are increasingly detached from today's students (Gura and Percy, 2005).

Today's students are no longer the people our current educational system was designed to teach. Rather they learn by experimentation and participation, not by listening or reading passively. They are indeed the “plug and play” generation. They embrace interactivity and demand the right to shape and participate in their learning. They are comfortable with the uncertainty that characterizes their change-driven world. These students will increasingly demand new learning paradigms more suited to their learning styles and more appropriate to prepare them for a lifetime of learning and change.

New knowledge media are forcing us to rethink the nature of literacy. We have seen the definition of literacy shift before in history, from the oral tradition to the written word to the images of film and then television and now to the computer and multimedia. Of course there are many other forms of literacy: art, poetry, mathematics, science itself, etc. But more significantly, the real transformation is from literacy as “read only, listening, and viewing” to composition in first rhetoric, then writing, and now in multimedia. Both young, digital-media savvy students and adult learners will likely demand a major shift in educational methods, away from passive classroom courses packaged into well-defined degree programs, and toward interactive, collaborative learning experiences, provided when and where the student needs the knowledge and skills.

Emerging technologies that enable social networking to form learning communities and immersive virtual environments for simulation and play facilitate the “deep tinkering” that provides the tacit knowledge necessary to “learn to be”, tools already embraced by the young if not yet the academy. In the language of the digital generation, learning has become “hanging out” (knowing), “messaging around” (playing), and “geeking out” (creating) (Ito, 2009; Brown, 2009).

From a broader perspective, our society increasingly values not just analysis but synthesis, enabled by the extraordinary tools of the digital age. Learning occurs not simply through study and contemplation but through the active discovery and application of knowledge. From John Dewey to Jean Piaget to Seymour Papert, we have ample evidence that most students learn best through inquiry-based or “constructionist” learning. As the ancient Chinese proverb suggests “I hear and I forget; I see and I remember; I do and I understand.” To which we might add, “I teach and I master!” (Brown, 2009)

## Lifelong Learning

Today, learning has become a lifelong activity since a changing world will demand that students continue to learn, through both formal and informal methods, throughout their lives. Of course, K-12, college, or even graduate and professional education was never intended to provide all of the knowledge needed for a lifetime. But in years past, most of the additional knowledge necessary for a career could be acquired informally, through on-the-job learning or self-study. Today, however, both rapid growth of knowledge and the multiple career transitions facing graduates demand a more strategic approach to lifetime learning. We need to rethink educational goals from this lifetime perspective. We should view K-12 and college as just steps—important step to be sure—down the road of a lifetime of learning. This would allow us to better match learning content and experiences with both the intellectual maturation and the needs of the learner.

The needs for lifelong learning opportunities in a knowledge society are manifold. The shelf life of education acquired early in one’s life, whether K-12 or higher education, is shrinking rapidly in face of the explosion of knowledge in many fields. Today’s students and tomorrow’s graduates are likely to value access to lifelong learning opportunities more highly than job security, which will be elusive in any event. They understand that in the turbulent world of a knowledge economy, characterized by outsourcing and off-shoring to a global workforce,



employees are only one paycheck away from the unemployment line unless they commit to continuous learning and re-skilling to adapt to every changing work requirements. Furthermore, longer life expectancies and lengthening working careers create additional needs to refresh one's knowledge and skills. Even today's college graduates expect to change not simply jobs but entire careers many times throughout their lives, and at each transition point, further education will be required—additional training, short courses, degree programs, or even preparation for new professions. And, just as students increasingly understand that in a knowledge economy there is no wiser personal investment than education, many nations now accept that the development of their human capital through education must become a higher priority than other social priorities, since this is the only sure path toward prosperity, security, and social well-being in a global knowledge economy.

In fact, we might even make the case that it is time for the nation to step up to its responsibility as a democratic society to enable all of its citizens to take advantage of the educational, learning, and training opportunities they need and deserve, throughout their lives, thereby enabling both individuals and the nation itself to prosper in an ever more competitive global economy. While the ability to take advantage of educational opportunity always depends on the need, aptitude, aspirations, and motivation of the student, it should not depend on one's socioeconomic status. Access to lifelong learning opportunities should be essentially a civil right for all rather than a privilege for the few if the nation is to achieve prosperity, security, and social well-being in the global, knowledge- and value-based economy of the 21st century.

Of course, establishing universal access to lifelong learning as a national goal would require not only a very considerable transformation and expansion of the existing education enterprise, but it would also require entirely new paradigms for the conduct, organization, financing, leadership, and governance of education in America. For example, most of today's colleges and universities are primarily designed to serve the young—either as recent high school graduates or young adults early in their careers. Yet achieving the objective of universal access to lifelong learning would expand enormously the population of adult learners of all ages. Traditional university characteristics such as residential campuses designed primarily to socialize the young with resources such as residence halls, student unions, recreational facilities, and varsity athletics would have marginal value to adult learners with career and family priorities. Such universal lifelong learning could change dramatically the higher education marketplace, providing for-profit institutions

already experienced in adult education with significant advantages. Furthermore it seems likely that the only way that such ubiquitous access can be provided to lifelong learning to adults with career and family responsibilities will be through technology-mediated distance learning.

One approach would be to utilize a combination of transportable education savings accounts and loans, perhaps indexed to future earnings much like Social Security by mandatory earmarking of a portion of an individual's earnings over their careers as a source of funds for their education. Here, in contrast to Social Security, which amounts to saving over a career for one's relatively unproductive golden years, instead one would be borrowing and investing on the front-end to enhance one's personal productivity and hence lifelong prosperity through future education. By making such lifelong learning ("LiLa's") savings accounts mandatory, again like Social Security, one would create a sense of ownership on the part of all citizens, thereby making it more likely that they would seek to take advantage of the educational opportunities provided by their account. A variation on this theme would be to access the capital markets by using the government (either federal or state) to borrow money at low interest rates to be loaned to students, and then provide strong tax incentives to employers to assist students in paying off these loans during employment. Note employer participation would bring another very important consumer to the table, since clearly employers (private or public) would want to demand high-quality learning experiences in disciplines of importance to their enterprise if they are going to pay off the student loans of their employees.

## A New Social Contract

As *The Economist* notes, the rise of the knowledge economy has driven the democratization of education, as an increasing fraction of the workforce will need to have access to postsecondary education. As knowledge has replaced physical resources as the driver of economic growth, schools, colleges, and universities have become the most important engines of the knowledge economy. This is happening throughout the world, not only in developed nations in North America, Europe, and Asia, but in all regions—developed, developing, and underdeveloped— aspiring to prosperity and security in an intensely competitive global, knowledge-driven economy. And here, market competition extends far beyond traditional business and trade to include

knowledge resources such as human capital, R&D, and innovation, all both key products and assets of learning institutions (*The Economist*, 2005).

But this raises an important challenge to balance the twin demands of mass access, necessary for a competitive workforce, and world-class quality, necessary to provide the new knowledge and innovation essential for a knowledge economy. As *The Economist* notes, “We already possess a successful model of how to organize higher education: America’s. That country not only has almost a monopoly on the world’s best universities, but also provides access to higher education for the bulk of those who deserve it.” State and federal governments play a more limited role in American higher education since almost two-thirds of the support for our colleges and universities comes from the private sector, e.g., tuition and philanthropy, rather than federal or state government. This creates a highly market-driven and diverse array of colleges and universities, evolving and adapting to serve the ever-changing and diverse needs of American society. To conclude, *The Economist* stresses: “There is no shortage of things to marvel at in America’s higher education system, from its robustness in the face of external shocks to its overall excellence. However what particularly stands out is the system’s flexibility and its sheer diversity.”

Key in the achievements of both excellence and access in American higher education has been the public university, which today educates 80% of all college students in this country while conducting 70% of its research. With an expanding population, a prosperous economy, and compelling needs such as national security and industrial competitiveness, the public was willing to make massive investments in higher education during the 20th century. While elite private universities have been important in setting the standards and character of higher education in America, it has been the public university that provided the capacity and diversity to meet our nation’s vast needs for postsecondary education.

Today, however, in the face of limited resources and more pressing social priorities, this expansion of public support of higher education has slowed. While the needs of our society for advanced education will only intensify as we evolve into a knowledge-driven world culture, it is not evident that these needs will be met by further expansion of our existing system of public universities. The terms of the social contract that led to these institutions are changing rapidly. The principle of general tax support for public higher education as a public good and the partnership between the federal government and the universities for the conduct of

basic research are both at risk, a consequence of the increasingly limited tax resources and the declining priority given higher education in the face of other social needs. (Zemsky, 2005; Newman, 2004)

Today, even as the need of our society for postsecondary education intensifies, we also find erosion in the perception of education as a public good deserving of strong societal support. States have joined the federal government by shifting priorities away from investment in the higher-education enterprise (appropriations to institutions) to investment in the marketplace for higher-education services (loans or tax benefits to students and parents). Whether a deliberate or involuntary response to the tightening constraints and changing priorities for public funds, the new message is that education has become a private good paid for by the individuals benefiting most directly—the students. This shift from the perception of higher education as a public good to an individual benefit has another implication. To the degree that higher education was a public good, benefiting all (through sustaining democratic values, providing public services), one could justify its support through taxation of the entire population. But viewed as an individual benefit, public higher education can become a highly regressive social enterprise since, in essence, the poor subsidize the education of the rich, largely at the expense of their own opportunities.

Even more fundamentally, as we enter the new millennium, there is an increasing sense that the social contract between educators and American society may need to be reconsidered and perhaps even renegotiated once again. *In an age of knowledge, it has become the responsibility of democratic societies to provide their citizens with the education and training they need, throughout their lives, whenever, wherever, and however they desire it, at high quality and at an affordable cost.*

Of course, this has been one of the great themes of education in America. Each evolutionary wave innovation in education has aimed at educating a broader segment of society, at creating new educational forms to do that—primary and secondary schools, public universities, land-grant universities, the normal and technical colleges, community colleges, and today's emerging generation of cyberspace universities. Our efforts to meet the educational needs of the 21st century are constrained, in part, by institutions, systems, policies, and politics which were determined by a 20th century industrial society.

But we now will need new types of educational institutions with new characteristics:

1. Like other social institutions, our schools, colleges, and universities

must become more focused on those whom they serve. They must transform themselves from faculty-centered to learner-centered institutions, becoming more responsive to what their students need to learn rather than simply what their faculties wish to teach.

2. Society will also demand that educational institutions become far more affordable, providing learning opportunities within the resources of all citizens. Whether this occurs through greater public subsidy or dramatic restructuring of the costs of higher education, it seems increasingly clear that our society—not to mention the world—will no longer tolerate the high-cost, low-productivity paradigm that characterizes much of education in America today.

3. In an age of knowledge, the need for advanced education and skills will require both a personal willingness to continue to learn throughout life and a commitment on the part of educational institutions to provide opportunities for lifelong learning. The concepts of student and alumnus will merge.

4. America's highly partitioned system of education will blend increasingly into a seamless web, in which primary and secondary education; undergraduate, graduate, and professional education; on-the-job training and continuing education; and lifelong enrichment become a continuum.

5. Already new forms of pedagogy are emerging: asynchronous (anytime, anyplace) learning that utilizes emerging information technology to break the constraints of time and space, making learning opportunities more compatible with lifestyles and career needs; and interactive and collaborative learning appropriate for the digital age, the plug-and-play generation. In a society of learning, people would be continually surrounded by, immersed in, and absorbed in learning experiences, i.e. ubiquitous learning, everywhere, every time, for everyone.

6. The great diversity characterizing higher education in America will continue, as it must to serve an increasingly diverse population with diverse needs and goals. But it has also become increasingly clear that our institutions must strive to achieve diversity within a new political context that will require new policies and practices.

It is clear that the access to advanced learning opportunities is not only becoming a more pervasive need, but it could well become a defining domestic policy issue for a knowledge-driven society. Higher education must define its relationship with these emerging possibilities in order to create a compelling vision for its future as it enters the new millennium. (Duderstadt, 2000, 2005)

## Innovation

The creativity, ingenuity, and courage of innovators will be critical to our nation and our region in the twenty-first century. As a superpower with the largest and richest market in the world, the United States has consistently set the standard for technological advances, both creating innovations and absorbing innovations created elsewhere. From Neil Armstrong's walk on the Moon to cellular camera phones, engineering and scientific advances have captured people's imaginations and demonstrated the wonders of science. In fact, groundbreaking innovation was the driving force behind American success in the last century. An endless number of innovations—from plastics to carbon fibers, electricity generation and distribution to wireless communications, clean water and transportation networks to pacemakers and dialysis machines—has transformed the economy, the military, and society, making Americans more prosperous, healthier, and safer in the process. (Duderstadt, 2005)

Future breakthroughs dependent on research and innovation will have equally powerful impacts. The innovations that flow from advanced education and research are not simply nice to have, like high-definition television; many are essential to the solutions of previously intractable challenges. Research in materials, electronics, optics, software, mechanics, and many other fields will provide technologies to slow, or even reverse, global warming, to maintain water supplies for growing populations, to ameliorate traffic congestion and other urban maladies, and to generate high-value products and services to maintain our standard of living in a world of intense competition. To meet these and other grand challenges, the Midwest must be an innovation-driven region that can capitalize on fundamental advances in life sciences, physical sciences, and engineering. (Branscomb, 2008)

Here it should be kept in mind that Midwest is very much part of a global economy in which research and development are performed worldwide. Our multinational corporations manage their R&D activities to take advantage of the most capable, most creative, and most cost-efficient engineering and scientific talent, wherever they find it. Smaller

firms without global resources are facing stiff competition from foreign companies with access to talented scientists and engineers—many of them trained in the United States—who are the equals of any in this country. Relentless competition is driving a faster pace of innovation, shorter product life cycles, lower prices, and higher quality than ever before.

To meet the demands of global competition, other states and nations are investing heavily in the foundations of modern innovation systems, including research facilities and infrastructure and strong technical workforces (Weber, 2009). Some of the innovations that emerge from these investments will be driven by local market demands, but many will be developed for export markets. As other regions develop markets for technology-laden goods and international competition intensifies, it will become increasingly difficult to maintain a globally superior innovation system. Only by investing in research and advanced education can the Midwest retain its competitive advantage in high-value, technology-intensive products and services, thereby encouraging multinational companies to keep their R&D activities in this country.

Colleges and universities have a long history of contributing to U.S. preeminence in technological innovation. Research universities are particularly critical to generating new knowledge, building new infrastructure, and educating innovators and entrepreneurs. The Land-Grant Acts of the nineteenth century and the G.I. Bill and government-university research partnerships of the twentieth century showed how federal action can catalyze fundamental change. In the past, universities dealt primarily with issues and problems that could be solved either by a disciplinary approach or by a multidisciplinary approach among science and engineering disciplines. To meet future challenges, however, universities will need a new approach that includes schools of business, social sciences, law, and humanities, as well as schools of science, engineering, and medicine. Solving the complex systems challenges ahead will require the efforts of all of these disciplines.

But there is yet another challenge. While our colleges and universities are experienced in teaching the skills of analysis, we have far less understanding of the intellectual activities associated with creativity. In fact, the current disciplinary culture of our curricula sometimes discriminates against those who are truly creative, those who do not fit well into our stereotypes of students and faculty.

Our educational systems may need to reorganize themselves quite differently, stressing forms of pedagogy and extracurricular experiences to nurture and teach the art and skill of creation and innovation. This

would probably imply a shift away from highly specialized disciplines to programs placing more emphasis on integrating knowledge. Perhaps it is time to rip education out of the classroom and place it instead in the discovery environment of the laboratory or studio or the experiential environment of practice.

By combining research with education, universities not only tap into the creativity of young people, but also train them in critical thinking, research methodologies, and solid engineering skills. Because of the high quality of the people and tools provided by American universities, industries have chosen to locate their facilities in the United States, and emerging industries have tended to cluster around major engineering research universities (e.g., Silicon Valley, Route 128, Research Triangle, etc.) where they have access to a continuous supply of technical talent. An academic campus is one of the few places where precompetitive, use-inspired, long-term basic research can be conducted without the constraints of quarterly earnings. In partnership with industry and national laboratories, universities can bring together experts from many disciplines to investigate problems related to agency missions or meet specific product/service goals. At the same time, university students can learn systems thinking and gain an understanding of market forces through internships and participation in research projects. No other institutions have the same capabilities.

In spite of severe fiscal constraints, many areas of the United States have recognized that research and technology-development capacity are key elements in restoring their economic prosperity in an intensely competitive, global, technology-driven marketplace. Leadership in innovation will require commitments and investments of funds and energy by the private sector, federal and state governments, and colleges and universities. The Midwest can and must take control of its destiny and conduct the necessary research, capture the intellectual property, commercialize and manufacture the products, and create the high-skill, high-value jobs that define prosperity in a 21st century knowledge economy. Fortunately it has the unique resources of the world's leading concentration of research universities (e.g., the CIC group) and the headquarters of made of the world's leading technology-based companies to build upon. Yet it is also clear that many of the most promising technologies—sustainable energy generation and transportation, biotechnology, nanotechnology, information services, water resources—make sense only if pursued aggressively on a regional basis.

Of course there are many approaches to building globally competitive economies built upon innovation. Some focus on restoring lagging



support for basic research and the need to reform science and engineering education. Others stress the importance of market forces in bridging the “valley of death” between basic research and commercial innovations. Yet throughout the world it has become clear that BOTH strong public investment and powerful market incentives are necessary ingredients for successful innovation-driven economies.

The Midwest region must recognize that a broad range of government policies directly affect the nation’s power to innovate: new technology investments, economic policy, trade strategy, government procurement, intellectual property, and standards policy. A major recalibration of private-sector thinking and government policies and priorities is in order. The way we think about networks of talent, the tools we have for building institutional skills and trust, the approach we take to competition in a world of process networks—all must be addressed. The temptation to revert to protectionism must be resisted. The growing importance of technically sophisticated, middle-sized firms that know how to cooperate and compete in a new world of peer-networked enterprises must be recognized and encouraged.

### A Society of Learning and Innovation

The themes that will govern the future of the Midwest are simple to state if challenging to address: the imperatives of the global, knowledge-driven economy, universal learning opportunities, the capacity and drive to continually innovate, and risk-taking rather than entitlement—and all sought on a regional basis. In particular, lifelong and life-wide access to advanced educational opportunities will become the defining domestic policy issue for a knowledge-driven society. This will clearly require the development of new paradigms for delivering education to even broader segments of our society, perhaps to all of our society, in convenient, high-quality forms, at a cost all can afford. Fortunately, today’s technology is rapidly breaking the constraints of space and time. It has become clear that most people, in most areas, can learn and learn well using asynchronous learning, that is, “anytime, anyplace, anyone” education. Lifetime education is rapidly becoming a reality, making learning available for anyone who wants to learn, at the time and place of their choice, without great personal effort or cost. With advances in modern information technology, the barriers in the educational system are no longer cost or technological capacity but rather perception and habit.

It is becoming increasingly clear that the dominant priority of a knowledge-driven society has become intellectual capital: the education

of our citizens, the support of their ideas, their creativity, and their innovation and entrepreneurial efforts. This will require new concepts, institutions, policies, and investments, articulated by the vision of society of learning and innovation. Hence the challenge is to set aside the usual constraints imposed by existing educational structures (e.g., schools and colleges, policies and politics) and instead begin with a clean slate to determine the lifelong educational needs of citizens in a global knowledge-driven society and how one might meet these needs. (Duderstadt, 2005; Brown, 2009)

This strategic roadmapping project aims at taking the first steps toward just such a vision in the Midwest region.

## Chapter 5: A Roadmap to the Midwest's Future

We now turn to the final phase of the roadmapping process by constructing a roadmap for the Midwest region. This is designed as an evolving plan to lay out the path the region must take to transform itself from the deteriorating agricultural and industrial economy of today to a vibrant learning and innovation culture for tomorrow, capable of competing in a global economy to provide our citizens with prosperity, social well-being, and security.

As stressed throughout this report, in a knowledge-intensive society, regional advantage is achieved through creating a highly educated and skilled workforce that is competitive on a global level. It requires an environment that stimulates creativity, innovation, and entrepreneurial behavior. It also requires supportive infrastructure—world-class schools and universities, research laboratories and cyberinfrastructure, tax and intellectual property policies. And it requires vision, commitment, and leadership in both the public and private sectors. In a sense, it requires building a culture of learning and innovation capable of prospering and thriving in a rapidly changing 21st century world. In this chapter we will focus on the goals and strategies, essentially suggesting the roads one must build, while in the next chapter the focus will be on tactics, plans, and processes—that is, how one can travel along these roads.

Since building a 21st century learning and innovation infrastructure for a region will clearly involve multiple players—institutions, states, and the nation more broadly, this roadmap will be developed in a layered fashion, setting out the goals, strategies, plans, and processes for each constituency. Of course, the roadmaps for each layer are strongly coupled to one another. National goals and strategies provide the foundation for regional, state, and institutional efforts. For example, if the federal government continues to inadequately fund graduate education and university research in key areas such as renewable energy and information technology, it is unlikely that the states and regions will be able to compensate sufficiently; consequently, their efforts to build innovation-driven economies will be crippled. As a more positive example, if college and university priorities can be shifted toward embracing more unique roles rather than imitating one another, then this might avoid the mission creep that frequently drives inefficiency, duplication, and costs. Finally, it is also clear that some roadmapping elements will be similar across all levels, such as the demands for high quality and public accountability.

We begin with a framework for the roadmaps by providing a

summary of the key findings detailed in earlier chapters and using these to develop a set of premises for the roadmap development. Although the roadmapping effort will be focused on post-secondary education because of its multiple missions of developing human capital, knowledge, and innovation, the linkages with and dependency upon K-12 education and the importance of lifelong learning will also be considered. We begin by summarizing the principal findings of the earlier chapters and stating the premises for the roadmapping exercise.

## A Framework of Findings and Premises

1. We have entered an era in which educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well-being. Hence the strength, prosperity, and leadership of a nation in a global knowledge economy will demand a highly educated workforce and hence depend upon a world-class system of education. An increasingly technology-dependent nation will also require world-class research universities, capable of discovering new knowledge, developing innovative applications of these discoveries through entrepreneurial activities, and educating those capable of working at the frontiers of knowledge and the professions.

2. Education has become a key determinant of one's personal standard of living and quality of life. In today's knowledge economy, the breakpoint between those who succeed in college and those who fail is perhaps the most critical decision point in one's life! In today's knowledge economy. As a consequence, in today's knowledge economy, it has become the responsibility of democratic societies to provide all of their citizens with the educational and learning opportunities they need, throughout their lives, whenever, wherever, and however they need them, at high quality and at affordable costs.

3. Yet access to educational opportunities has become increasingly stratified according to student financial circumstances, thereby undercutting the fundamental principles of equity in providing educational opportunities for a democratic nation. In particular, the provision of broad access to quality higher education should be viewed as a shared responsibility among colleges and universities that seek both quality and efficiency; students and other clients of higher education who act as informed consumers; the availability of private capital; and the commitment of federal, state, and local governments to provide adequate

and equitable financial support.

4. The core competency of the American economy is its capacity to innovate. While the characteristics of the American culture—a diverse population, democratic values, free-market practices, a predictable legal system—provide a fertile environment for innovation, history has shown that significant public and private investment is necessary to produce the key ingredients of innovation: new knowledge (research), world-class human capital (education), infrastructure (institutions, facilities, networks), and policies (tax, investment, intellectual property).

5. There are growing concerns about the nation's supply of scientists, engineers, physicians and nurses, teachers and other knowledge-intensive professionals both because of declining student interest (due in part to the weakness of K-12 education, the obsolete nature of university science curricula, and inadequate support of graduate education), anticipated retirements, and declining immigration (due to visa restrictions) at a time when other nations are rapidly increasing commitments in these areas.

6. While some elements of American education are clearly world-class such as its research universities, international comparisons raise issues about the relative quality and performance of our education enterprise more broadly. There are numerous valid concerns about student access, affordability, quality, performance, and responsiveness of various elements of the American education system that could threaten its capacity to serve the needs of the nation. Furthermore, even the best of America's academic institutions are characterized by complacency engendered by past reputation that could erode future innovation and excellence.

7. American education is a mature industry that has become risk-averse, complacent, and increasingly expensive. It is an enterprise that has yet to address the fundamental issues of how academic institutions must be transformed to enable them to adapt to changes driven by forces such as the emerging knowledge economy, globalization, rapidly evolving technologies, an increasingly diverse and aging population, and an evolving marketplace characterized by new needs (e.g., lifelong learning), new providers (e.g., for-profit, cyber universities), and new paradigms (e.g., distance learning, open educational resources).

8. Public policy alone is unlikely to be effective in stimulating the

educational enterprise to become more responsive to a rapidly changing world. Public funds at both the state and federal level will be limited for at least a generation by the priority given to the needs of an aging population, national security, and tax relief, and will likely be insufficient to meet the growing need for lifelong access to postsecondary education for the majority of our population.

9. American higher education is supported by a balance of public and private resources, roughly 45% public and 55% private. While public funds are likely to be constrained, the resources available in the private sector through capital markets and intergenerational wealth transfer will be very substantial, likely intensifying even further the market forces on colleges, universities, and other elements of the postsecondary education sector.

10. While it is only prudent to enhance the ability of the American education enterprise to face the challenge and opportunity presented by strong market forces, it is important to resist the tendency to portray higher education primarily as a private benefit rather than a public good. Restoring public trust and confidence in our schools, colleges, and universities is essential to enable critical roles such as producing the leaders of our governments, commerce, and professions; defending and propagating our cultural and intellectual heritage; challenging our norms and beliefs; creating and applying new knowledge to serve our society; and preserving those values and principles so essential to academic learning: the freedom of inquiry, an openness to new ideas, a commitment to rigorous study, and a love of learning.

## A Higher Education Roadmap for the Nation

To begin this layered set of strategic roadmaps for higher education requires at least some consideration of goals at the national level. Although this task requires an analysis of issues considerably beyond those characterizing the Midwest region, for completeness and context we have provided a sketch of just how national goals might be framed.

It is clear that the United States must demand and be prepared to support a world-class system of postsecondary educational institutions capable of meeting the changing educational, research, and service needs of the nation. Yet this goal faces many challenges, including

- an increasing stratification of access to (and success in) quality

- higher education based on socioeconomic status,
- questionable achievement of acceptable student learning outcomes (including critical thinking ability, moral reasoning, communication skills, and quantitative literacy),
- cost containment and productivity, and the ability of institutions to adapt to changes demanded by the emerging knowledge services economy,
- globalization,
- rapidly evolving technologies, an increasingly diverse and aging population, and
- an evolving marketplace characterized by new needs (e.g., lifelong learning), new providers (e.g., for-profit, cyber, and global universities), and new paradigms (e.g., competency-based educational paradigms, distance learning, open educational resources).

There is strong evidence that American research universities continue to provide the nation with global leadership in research, advanced education, and knowledge-intensive services such as health care, technology transfer, and innovation. Yet this leadership is threatened by rising competition from abroad, by stagnant support of advanced education and research in key strategic areas such as physical science and engineering, and by the complacency and resistance to change of the American research university.

To develop a roadmap at the national level, a series of objectives has been developed from the work of the National Commission on the Future of Higher Education in America (i.e., the Spellings Commission). These goals focus on several key areas: quality, innovation, access, coordination, research and graduate education, lifelong learning, and public purpose.

*Quality: The United States must demand and be prepared to support a world-class higher education system, leveraging market forces shaped by incentives, public-private partnerships, and requirements for evidence-based assessment of educational effectiveness to drive all elements of postsecondary toward higher quality, efficiency, innovation, and nimbleness.*

The nation should commit itself to building and supporting a postsecondary education enterprise (e.g., colleges and universities, proprietary schools, industry education training programs, and new paradigms such as distance learning and global universities) capable of achieving world-class standards in all important areas, e.g., quality,

learning outcomes, access, efficiency, innovation, and responsiveness to changing societal needs. While colleges and universities should be responsive to the projected needs of students, their employers, and the nation, it is also essential that they launch the major transformations of educational programs necessary to prepare students for a much different world, providing them with the knowledge and skills necessary for the jobs of tomorrow and the abilities to face future problems not yet even identified.

*Access: Access to higher education should receive the highest priority for public funding, whether through financial aid, state appropriations to colleges and universities, or tax policy (e.g., “tax expenditures”). Public funds should be targeted to those students with greatest need.*

The nation must address and remove factors that have created a strong dependence of access and success in higher education upon socioeconomic status. As a nation, we should aspire to the ideal where family income is nearly irrelevant to the ability of a student to attend the college or university best matched to his or her talents, objectives, and motivation. Yet many studies have revealed the degree to which access to higher education in America has become increasingly stratified according to student financial circumstances, thereby undercutting the fundamental principles of equity in providing educational opportunities for a democratic nation. Today even the most academically talented students in the lowest economic quartile are significantly less likely to have access to the benefits of higher education than the least qualified students in the top quartile—a situation clearly intolerable for a democratic society. Furthermore, to pay for college more students are borrowing larger amounts at higher interest rates than ever before. Debt burdens are not only influencing student career choices (e.g., students choosing high paying rather than socially-beneficial careers) but also discouraging many low income students from even attempting a college education.

Although both the states and the federal government have many objectives in providing public funding to higher education, e.g., regional economic development, public health, national security, or, more pragmatically, voter support, the widening gap between the educational opportunities available to affluent students and those of modest means compels us to recommend that access to higher education, regardless of socioeconomic circumstance, receive the highest priority for public funding. Publicly funded financial aid should rely primarily on need-



based rather than merit-based programs, with grants as the preferred mechanism for the lowest income quartile of students, while loans and tax benefits are the preferred mechanisms to assist students from more affluent backgrounds with access to postsecondary education and lifelong learning opportunities.

*Innovation: To support a national economy driven by innovation, the nation's colleges and universities must themselves embrace educational innovation, by developing new learning pedagogies, academic paradigms, and educational forms that are more responsive to national priorities. This will require a very substantial increase in the support of research and development associated with learning and education by the federal government and higher education institutions.*

Leadership in innovation—the transformation of knowledge into products, processes, and services—is critical to competitiveness, long-term productivity growth, and the generation of wealth and hence critical to United States prosperity and security. Institutions of higher learning must collaborate with industry and government to create a national educational climate and culture that enable innovation to thrive. Not only is this challenge our colleges and universities to provide the graduates capable of innovation and adaptation to change, but it also demands that American higher education develop and demonstrate the capacity for continuous innovation and quality improvement at both the institution and enterprise level.

*Research and Graduate Education: The erosion of state and private sector support of graduate education and research in recent years makes it apparent that it is time for the federal government to assume the lead responsibility for sustaining America's research universities at world-class levels.*

The United States must sustain the capacity of its research universities to achieve global leadership in key strategic areas such as science, engineering, medicine, and other knowledge-intensive professions while attracting talented students and faculty from around the world through adequate public and private investment and stimulating institutional innovation and change. Research universities, government, and industry should strive to create effective mechanisms for ensuring that the new knowledge developed on the campuses serves society through technology transfer, innovation, and entrepreneurial activities.

There are growing concerns that the scientific and technological

building blocks of the nation's economic leadership and national security are eroding at a time when many other nations are gathering strength. Federal support of R&D as a fraction of GDP has dropped in half over the past three decades (from 2% to less than 0.8% of GDP), while the nation's research portfolio has become heavily skewed in favor of biomedical research at the expense of research in physical science and engineering, keys to the nation's technological strength. Numerous studies have suggested that the nation's strategic and economic security is threatened by its current course, living on incremental improvements to past developments and gradually conceding technological leadership to international competitors. Instead it is critical the United States invest in the necessary research, producing the world-class graduates, stimulating the innovation, and creating the high-skill, high-value jobs that define a prosperous nation in a knowledge-driven global economy.

The federal government should restore a level of research funding adequate to support its most urgent priorities including national defense, homeland security, health care, energy security, and economic competitiveness, with special attention directed to physical science and engineering. Federal and state governments and industry should invest in upgrading and expanding university laboratories, equipment, and information technologies and meeting other infrastructural needs of research universities such that the national capacity to conduct world-class research in key strategic disciplines is sufficient to address national priorities. Government and industry should also invest in scholarships, fellowships, curriculum development aimed at enhancing student interest in science, mathematics, engineering, and technology at all educational levels, with particular attention given to encouraging the participation of women and underrepresented minorities, while recruiting talented students from around the world.

*Coordination: Coordination among the various components of the nation's educational enterprise, including K-12, higher education, workplace training, and lifelong learning, should be strongly encouraged and supported at all levels—national, regional, state, and institutional.*

In an assessment of higher education, *The Economist* once observed that, "America's system of higher education is the best in the world. That is because there is no system!" Yet it is also the case that the absence of coordination and articulation agreements can be a serious hurdle to students attempting the transition from one education level or institution to another. While competition among institutions is important,

particularly in a marketplace increasingly funded from private sources, so too is sufficient coordination to allow smooth, transparent transitions from one stage or institution to the next in a future increasingly dependent upon lifelong learning. Put another way, postsecondary education needs to be better coordinated and integrated vertically, while preserving strong market competition horizontally. In particular, colleges and universities need to work closely with K-12 education, aligning high school curricula with college standards and providing feedback to prospective students about their readiness for college work.

*Public Purpose: Higher education must take decisive action to address current concerns about quality, efficiency, capacity, and accountability if it is to earn the necessary level of public trust and confidence to enable it to pursue its public purpose.*

While higher education provides important private benefits to graduates, clients, and industry, in reality it is primarily a public good, created and supported by society to serve a public purpose. While market forces are likely to dominate public investment and public policy, at least for the foreseeable future, it is essential for higher education to retain its public purpose rather than simply responding to the market demands of the moment. After all, it has been a public good of immense importance throughout the history of the nation, and it must remain so. Here, however, it should be recognized and acknowledged that for higher education to regain the necessary degree of public trust and confidence, institutions will have to first listen more attentively to the concerns of its diverse constituencies (e.g., students, parents, employers, public and private patrons) and then respond to these concerns through bold institutional actions and transformation consistent with their public purpose.

## A Higher Education Roadmap for the Midwest Region

We turn next to the roadmapping process for the Midwest region. This is designed as an organic and evolving plan to suggest paths the region might take to transform itself from the deteriorating industrial and agricultural economy of today to a vibrant, knowledge-driven economy of tomorrow, capable of competing in a global economy and providing our citizens with prosperity, social well-being, and security. The key themes that augment the national agenda include the importance of regional integration (through coordination, mobility, and technology),

the globalization of higher education, the educational paradigm shifts required by a knowledge economy, and the role that its flagship research universities can play in both envisioning and creating the future of the region.

We begin with a simple premise: *the key to the Midwest's future lies with its people, with their skills, character, creativity, innovation, and entrepreneurial spirit.* Hence in the regional roadmap we have stressed setting and achieving higher goals in K-12 education and higher education, restoring adequate public investments in the region's schools, colleges, and universities, and facilitating the technology transfer and high-tech business startups aimed at creating the new industries that will eventually replace the Midwest's declining factory-based manufacturing industries. However even in the near term bold steps to begin to build the necessary knowledge-based workforce are both imperative and appropriate, although it will take time to achieve the necessary progress. Investing in building the necessary infrastructure will also be essential to support and sustain both innovation and workforce development. The challenge will be to provide world-class opportunities for lifelong education, training, and cultural enrichment to all of the region's citizens while demanding, achieving, and sustaining the region's educational institutions at the very highest level of excellence, efficiency, and accountability.

For the longer term, there can be no more compelling priority with a higher rate of return than an investment in our people through both public and private support of educational opportunities at all levels and throughout their lives. The Midwest must build and sustain a culture of learning and innovation. This must span the full range of educational opportunities, from pre-school to K-12 to higher education, to graduate and professional education, to lifelong learning. It must augment this with further public and private investments in institutions capable of generating new knowledge through R&D and then transferring this into innovative products, processes, and services in the global marketplace.

To be sure, this will be challenging, since it will demand substantial new investments, both in individuals (e.g., financial aid, vouchers) and institutions (appropriations, tuition, and philanthropy), that will almost certainly require new tax revenues. It will also require both the public and private sector to address those legacy costs (e.g., corrections, health care, retirement) that have become excessive and clearly out of line with the best practices of leading economies elsewhere. It will demand new standards for excellence and accountability for institutions, students, and families. It must both encourage and demand that our educational

institutions embrace the new paradigms for learning, knowledge creation, innovation, and entrepreneurship that are characterized by the world-class quality, ability, and accountability necessary to compete in the global economy. And it will require a restoration of the Midwest's historic commitment to rebuilding the social safety net for those caught in the inevitable maelstrom associated with the creative destruction of the global economy as new industries appear to replace the old.

Our first recommendations concern three important perspectives: *acting regionally while thinking globally; demanding regional collaboration instead of pointless competition; and thinking far more strategically.*

*Regional to National to Global: While it is natural to confine policy to state boundaries, in reality such geopolitical boundaries are of no more relevance to public policy than they are to corporate strategies in an ever more integrated and interdependent global society. Hence the Midwest's strategies must broaden to include regional, national, and global elements.*

*Competition to Collaboration: Midwestern states, governments, and institutions must shift from Balkanized competition to collaboration to achieve common interests, creating regional partnerships capable of responding to global imperatives.*

*Systemic and Strategic Perspectives: The Midwest needs to develop a more systemic and strategic perspective of its educational, research, and cultural institutions—public and private, formal and informal—that views these knowledge resources as comprising a knowledge ecology that must be adequately supported and allowed to adapt and evolve rapidly to serve the needs of the state in a change-driven world, free from micromanagement by state government or intrusion by partisan politics.*

Education policy at the state and local levels is usually far too fragmented, with widely differing perspectives and philosophies depending on its knowledge and learning infrastructure, e.g., K-12 responsible to local communities and state boards of education, public higher education largely the responsibility of politically determined governing boards, independent colleges usually quite autonomous, and an array of cultural organizations (museums, libraries), industrial resources (workplace training programs, corporate R&D), and informal learning opportunities largely out of sight, out of mind. In a similar sense, state funding of education tends to run on automatic pilot, determined more by the increasingly inadequate resources provided by obsolete tax

codes and burdensome legacy cost structures of most Midwestern states (e.g., based on a 1950s manufacturing and agricultural economy rather than a 21st-century knowledge-services economy) and driven more by political ideology and patronage than carefully designed as a strategic investment in the region's future. By elevating the dialog to the regional level, leaders of state, local, and metropolitan governments, higher education, business, industry, labor, and the public at large (through the media) can be challenged to view education and innovation from a far more systemic and strategic perspective and key to the Midwest's future.

Here we certainly do not intend to suggest that yet another layer of bureaucracy needs to be added upon those already imposed by state and local governments. Rather we believe that more policy attention needs to be given to the strategic evolution of education, research, and innovation resources in the region, freed from the tyranny of legislative committees and political election cycles and more responsive to the long-term needs of the Midwest region.

### Pre-College

We begin by addressing the primary concerns about pre-college education in the Midwest: the complex interplay of inadequate preparation, lack of information about educational opportunities, and persistent financial barriers that impede the ability of students to pursue their education to the advanced level required by the knowledge economy—particularly for low-income and under-represented minority students. Inadequate primary and secondary education not only deprives too many children of the knowledge and skills necessary to compete in the global, knowledge economy but it fails to prepare them adequately for further study at the postsecondary level necessary to provide the knowledge and skills essential both for a globally competitive workforce and personal quality of life.

While a detailed analysis of the necessary reforms in primary and secondary education are beyond the scope of this study, it is appropriate to mention several of the themes suggested by numerous other studies:

Universal access to quality early childhood programming for all four-year-old children and universal high quality (full-day) kindergarten

Development and acceptance of national standards for elementary and secondary education

Equitable, predictable, and durable support for K-12 education, albeit

accompanied by accountability for teaching quality and student performance

Strong support for teacher preparation and professional development

The pre-college recommendations that relate more directly to the goals of this regional education roadmap are as follows:

*All Students College-Ready: The Midwest region should set as its goal that all students will graduate from its K-12 systems with a high school degree that signifies they are college ready. To this end, all students will be required to pursue a high school curriculum capable of preparing them for participation in post-secondary education and facilitating a seamless transition between high school and college. State governments and local communities should provide both the mandate and the resources to achieve these goals.*

A high school degree should signify that a student is college and/or work ready. The effort is underway in a number of states including the Midwest to better align K–12 graduation standards with college and employers (e.g., the Race to the Top challenge program), but we are suggesting that the bar should be set even higher: All students enrolling in our K-12 schools should be prepared for further—indeed, *lifelong*—learning at the postsecondary level as an absolute requirement for the knowledge economy. No child—or school—should be left behind and forced to settle for anything less than a rigorous college preparatory education!

*Restructuring K-12 to Achieve World-class Performance: To achieve a quantum leap in student learning, Midwestern schools systems will have to restructure themselves to achieve world-class performance, including extending the school year (from 180 to 240 days), developing and implementing rigorous methods for assessing student learning; restructuring school organizations (including administration and governance), teacher qualifications, performance evaluation and incentives; and investing in state-of-the-art technology infrastructure.*

The Achilles heel of American education is at the level of primary and secondary education, as evidenced by the latest international rankings that place U.S. students at an abysmal 25th in math and 21st in science out of 30 developed nations. Although there is general awareness of these challenges, and numerous major efforts have been launched to address deficiencies (e.g., No Child Left Behind, Race to the Top, etc.),

progress remains elusive. Nevertheless, this issue must remain at the top of American priorities at all levels—national, state, regional, and local. Without significant improvement in K-12 education, the United States faces a bleak future in a global, knowledge-intensive society.

Key in this effort will be the adoption of rigorous nationwide—standards that set out the skills students should learn from kindergarten through high school, along with effective assessment methodology to monitor progress. Here recent efforts by the National Governors Association and Council of Chief State School Officers to promote clear, ambitious goals for what children should learn from year to year are an important step in the right direction (NGA, 2010).

*Social Infrastructure: Beyond the necessary investments in K-12 education and the standards set for their quality and performance, raising the level of skills, knowledge, and achievement of the Midwest's workforce will require a strong social infrastructure of families and local communities, particularly during times of economic stress. To this end, state and local governments must take action both to re-establish the adequacy of the Midwest's social safety net while engaging in a broad effort of civic education to convince the public of the importance of providing world-class educational opportunities to all of its citizens.*

As we have noted earlier, the Midwest's social priorities have become seriously distorted in recent years, placing more emphasis on locking people up or providing tax benefits to the affluent than investing in the educational opportunities and welfare of its citizens. A striking example is provided by those states and institutions giving priority to merit scholarship programs, which primarily channel state resources to economically advantaged students attending well-supported schools in affluent areas at the expense of the financial aid necessary to provide educational opportunities to the less fortunate. It is imperative that these merit-based programs be restructured with a strong need requirement if the state is to target public resources where they are likely to have the most impact on the Midwest's future workforce.

Furthermore, since the educational standards demanded by the global economy require strong families and communities in addition to schools, the Midwest must recommit itself to adequately supporting the necessary social programs and policies to enable all of its citizens—including those disadvantaged by economic dislocation or discrimination—to access educational opportunities. Although particularly challenging, such social safety nets are even more important during today's economic times.

Beyond the disturbing fact that many parents still do not understand



the imperatives of postsecondary education for the children's future, it is also clear that an aging population has yet to realize its generational responsibility to invest adequately in the Midwest's future. Higher education should partner with business to raise public awareness of the educational and social imperatives of the global economy and the necessary commitments that parents, citizens, and governments must make to secure their future.

Finally, it is essential to provide both students and parents with the confidence that they will have the ability to afford a college education if they make the effort to prepare themselves academically at the K-12 level. While some states such as California have accepted the responsibility to provide a college education for all citizens through a robust system of public community colleges, regional universities, and the University of California, others have looked to the private sector. Here the Kalamazoo Promise stands out as an example of a visionary philanthropic effort to guarantee the funding of a college education for all students graduating from the local high schools. A more ambitious federally-funded initiative of a similar spirit is the *Learn Grant* program, suggested by the Spellings Commission and described in more detail in Chapter 7 of this report.

*Higher Education Engagement with K-12: Higher education must become significantly more engaged with K-12 education, accepting the challenge of improving the quality of our primary and secondary schools as one of its highest priorities with the corresponding commitment of faculty, staff, and financial resources. Each Midwest college and university should be challenged to develop a strategic plan for such engagement, along with measurable performance goals.*

Although the quality of American higher education is heavily dependent upon the quality of K-12 education, most colleges and universities have limited their engagement with K-12 education to teacher training. A few have gone further to create and manage charter schools, much in the spirit of the clinical "university schools" characterizing schools of education in the past century. But most of higher education has largely viewed the challenges faced by K-12 education in America as somebody else's problem and tended more to criticize the quality of our schools and the preparation they provide to college-bound students than to work with them to correct their deficiencies.

In particular, higher education needs to become far more tightly coupled to primary and secondary education. Colleges and universities need to work closely with K-12 education, aligning high school curricula with college standards and providing feedback to prospective students

about their readiness for college work.

Since our schools hold the key to the quality of students entering postsecondary education, our workforce, and higher education itself, the Midwest's colleges and universities have a very strong and vested interest in becoming deeply engaged with K-12 education in the region. They also have a major responsibility, since the low priority many of our institutions have given teacher education, the misalignment of K-12 and college curricula and entrance standards, and the confusing signals they have conveyed to schools, students, and parents about the preparation necessary for success in college have at times made our universities more a part of the problem than the solution to quality in primary and secondary education. Among the possible elements are efforts to give a much higher priority to teacher education, elevating the status of schools of education to enable them to attract top college students; assisting both state agencies and secondary schools in aligning curricula with university admission and program requirements; developing methods to assess the progress of college-readiness for secondary school students; and launching major public awareness programs for secondary school students and parents so that they understand both the academic requirements and financial opportunities to attend college.

It is particularly important to develop programs that bring together secondary school and college faculties in peer-to-peer relationships. The federal government used to sponsor summer workshops on college campuses for K-12 teachers that helped in such efforts, particularly in key areas such as STEM education (science, technology, engineering, and mathematics). In the absence of such federal programs, state governments should consider assuming this role, perhaps in partnership with business and the philanthropic community.

Each of the Midwest's colleges and universities should be challenged to develop a high-priority strategic plan for engagement with K-12 education that is both university-wide (perhaps reporting directly to the president or provost of the institution) and characterized by measurable performance objectives. This is simply too important an activity to relegate to schools of education. It must involve the commitment of the entire institution.

*Linkages and Pathways: The Midwest must create clear pathways among educational levels and institutions, remove barriers to student mobility, and promote new learning paradigms (e.g., distance education, lifelong learning, workplace programs) to accommodate a far more diverse student cohort.*

The Midwest must greatly expand college participation and success by developing ways in which postsecondary institutions, K–12 school systems, and key policy makers can work together to create a seamless pathway between high school and college. Both students and the region could be well served by a higher degree of coordination, particularly in facilitating the transition among various sectors (e.g., K-12, community college, undergraduate, graduate, professional, lifelong learning) and elements (public, private, for-profit, corporate training) of education. The absence of coordination agreements can be a serious hurdle to students attempting the transition from one education level or institution to another. While competition among institutions is important, particularly in a marketplace increasingly funded from private sources, so too is sufficient coordination to allow a smooth, transparent transitions from one stage or institution to the next in a future increasingly dependent upon lifelong learning.

### Higher Education

*Demanding Zero-Defects Institutional Performance: All Midwestern colleges and universities should be challenged to achieve a zero-defects, total quality performance goal in which all enrolled students are expected to graduate in the prescribed period. This will require not only adequate financial, instructional, and counseling support but also strong incentives and disincentives at the individual and institutional level (e.g., basing public support on graduation rates rather than enrollments, demanding that faculty give highest priority to adequate staffing of required curricula, and setting tuition levels to encourage early graduation).*

Although there are many reasons for the low graduation rates characterizing American higher education (currently below 50% for 6-year baccalaureate graduation), it nevertheless represents a very serious challenge both in terms of human and economic cost. The region should simply refuse to tolerate such low performance on the part of students, faculties, and institutions. A region-wide effort should be launched to elevate graduation rates to world-class standards (e.g., that of Korea, now above 80%). This effort should involve state governments, the business community, and foundations (e.g., the Lumina Foundation's efforts to adopt the Bologna "tuning" process in the US). (Adelman, 2009) Institutions should be held accountable for graduation rates both through performance-based funding and public region-wide comparisons of both performance and mitigation efforts.

*Institutional Diversity: The Midwest should strive to encourage and sustain a more diverse system of higher education, since institutions with diverse missions, core competencies, and funding mechanisms are necessary to serve the diverse needs of its citizens, while creating a knowledge infrastructure more resilient to the challenges presented by unpredictable futures. Using a combination of technology and funding policies, efforts should be made to link elements of the Midwest's learning, research, and knowledge resources into a market-responsive seamless web, centered on the needs and welfare of its citizens and the prosperity and quality of life in the region rather than the ambitions of institutional and political leaders.*

It is increasingly apparent that the great diversity of higher education needs, both on the part of diverse constituencies (young students, professionals, adult learners) and society more broadly (teaching, research, economic development, cultural richness) demands a diverse higher education ecosystem of institutional types. Mission differentiation is key, since the availability of limited resources will allow only a small fraction of institutions to become globally competitive as comprehensive research institutions. A differentiated system of higher education helps to accomplish the goals of both enhancing educational opportunity and conducting research of world-class quality, but it assigns different roles in such efforts for various institutions. Enabled both by a multiple state character and its decentralized nature, the Midwest region has achieved such a highly diverse system, enabling it to focus significant public and private resources to create a small set (roughly two dozen) of world-class research universities, while distributing the broader roles of mass education and public service among a highly diverse collection of public and private institutions (roughly 400 in number), albeit with an inevitable tendency toward “mission creep”.

*Restructuring the Higher Education Enterprise: Serious consideration should be given to reconfiguring the Midwest's educational enterprise by exploring new paradigms based on the best practices of other regions and nations. For example, the current segmentation of learning by age (e.g., primary, secondary, collegiate, graduate-professional, workplace) is increasingly irrelevant in a competitive world that requires lifelong learning to keep pace with the exponential growth in new knowledge. More experimentation in both academic programs and institutional types should be encouraged. Academic institutions should be provided with greater agility—albeit accompanied by greater accountability—to adapt and evolve to address new challenges and opportunities.*

Much of the concern about the quality of higher education arises from the general education/transitional years, grades 11-14, when both the emotional and intellectual maturation of students occurs. The Midwest should experiment with new paradigms of post-secondary general education. An example is a reconfiguration of K-16 education so that secondary school grades 11-12 would be merged with community college and lower-division university programs focused on general education and socialization, much like the gymnasium system in Europe or the "college" system in Canada. This would allow research universities to focus on disciplinary, graduate, professional, and lifelong education, while general education and socialization would be provided by community colleges, regional universities, or independent colleges.

There is some evidence that the highly supportive, learning-intensive residential experiences offered by independent colleges may be the optimum learning environment for most young students. Liberal arts colleges seem to have the best success at this stage, providing both a nurturing and learning-intensive environment. Yet it is also the case that such colleges simply do not have the resources to provide the advanced learning opportunities of a major research university. The region should encourage affiliations between comprehensive research universities and liberal arts colleges. This could allow the students enrolling at large research universities to enjoy the intense, highly personal experience of a liberal arts education at independent colleges while allowing both students and faculty members at small colleges to benefit from the intellectual resources and research experiences occurring only on a large research campus.

Colleges and universities should be provided with greater flexibility and agility to adapt and evolve to respond to rapidly changing challenges and opportunities. Such evolution should be encouraged rather than constrained since it is a natural consequence of the increasing importance of knowledge and advanced education in the global economy. But institutions should be challenged to explore and embark upon such efforts only within a highly strategic and accountable process to avoid unnecessary mission creep.

*New Funding Paradigms: Alternative mechanisms for funding higher education should be explored, such as adopting a "reverse social-security" approach in which students pay for their education from future earnings, institutions align the funding of their multiple missions with key patrons, and new paradigms such as "learn grants" that provide strong incentives for early*

*learning by providing all students entering K-12 with 529 college investment accounts (see Chapter 8).*

Traditionally we have looked at a college education as a consumer good, requiring payment of the costs of tuition, room, board, and other expenses upon enrollment. Since these costs frequently exceed the resources that most students or families can generate during the actual period of enrollment, either savings or loan plans will play an increasingly important role in the future. To carry this one step further, perhaps as a society we should look upon a college education as we do our Social Security system. Perhaps we should restructure federal student loan programs to facilitate payment through payroll deduction, just as we do payment for Social Security programs. An alternative would be to use tax assessment strategies, using the Internal Revenue Service as the collection agency. The basic idea is to shift the burden for the support of higher education from the previous generation to the generation of students that benefit most directly, but at a time in their lives when they can afford these costs. In a sense, the 2010 budget reconciliation act that emphasized direct federal lending programs did just this through income-dependent repayment mechanisms. This program allows students to receive their education load funds directly from the federal government via their colleges and universities, thereby eliminating much of the cost and bureaucracy of the commercial loan industry. But equally significant is the fact that the direct lending program provided an opportunity to base repayment rates on future income and repayments collected through income tax withholding, thereby reducing much of the risk associated with financing a college education.

Such income-contingent loan repayment is designed not only to ease the debt burden on college graduates, but also to encourage them to consider careers in in fields of urgent national need such as teaching, public health, and community development. To alleviate the limitations of the American approach to income-contengent loan replayment, consideration might be given to adopting the highly successful Australian system, which is more dependent on income tax mechanisms and has been adopted by many other nations

*Expanding Educational Opportunities: The Midwest must recommit itself to the fundamental principles of equal opportunity and social inclusion through the actions of its leaders, the education of its citizens, and the modification of restrictive policies, if it is to enable an increasingly diverse population to compete for prosperity and security in a intensely competitive, diverse, and knowledge-*

*driven global economy.*

The increasing diversity of the American population with respect to race, ethnicity, gender and nationality is both one of our greatest strengths and one of our most serious challenges. A diverse population gives us great vitality. However the challenge of increasing diversity is complicated by social and economic factors. Far from evolving toward one America, our society continues to be hindered by the segregation and non-assimilation of minority cultures. Our society is challenging in both the courts and through referendum long-accepted programs such as affirmative action and equal opportunity aimed at ensuring social inclusion. The Midwest simply must recommit itself to achieving new levels of understanding, tolerance, and mutual fulfillment for peoples of diverse racial and cultural backgrounds both on our campuses and beyond. We need to shift our attention from simply ensuring access to educational opportunity to enabling success in achieving educational objectives.

### Workforce Development

*Lifelong and Life-wide Learning: The Midwest should explore bold new educational models aimed at producing the human capital necessary to compete economically with other regions (states, nations) and provide its citizens with prosperity and security. Lifelong learning will not only become a compelling need of citizens (who are only one paycheck away from the unemployment line in a knowledge-driven economy), but also a major responsibility of the region and its educational resources. Furthermore, formal learning experiences should be augmented by broader learning opportunities that take advantage of emerging technologies such as social networking and open education resources.*

In a global economy characterized by an accelerating production and application of new knowledge, lifelong learning has become a strategic imperative both for individuals and social institutions. The Midwest region must move rapidly to develop a visionary strategy for providing these opportunities both through expanding the missions of its existing educational systems and by encouraging new resources such as open universities and for-profit educational providers (charter schools, for-profit universities, virtual universities). Additional attention should be given to augmenting traditional formal learning programs with the broader opportunities provided by emerging technologies such as social networking (e.g., Facebook and Wikipedia), virtual reality (e.g., Second

Life), and gaming experiences (e.g., World of Warcraft).

*Community Colleges and Regional Universities: Key will be enhanced support of the efforts of community colleges and regional universities to integrate this new knowledge into academic programs capable of providing lifelong learning opportunities of world-class quality while supporting their surrounding communities in the transition to knowledge economies by developing additional professional programs more suited to the needs and interests of adult students.*

The region should recognize and support the efforts of community colleges and regional universities to adapt and evolve to serve the rapidly changing education needs of their communities. For example, it is clear that many community colleges are evolving into “polytechnics” capable of providing adult learners with advanced education in key professional disciplines at the baccalaureate level. Similarly regional universities may need to develop professional degree programs at the doctoral level to meet regional needs. Such an expansion of educational mission should be encouraged and supported as a natural consequence of an evolving learning and innovation society, although it should also be expected to provide high quality programs to address substantial demand rather than simply responding to an institutional desire for mission creep.

*For-Profit and Proprietary Providers: To meet the expanding needs of a knowledge-driven economy requiring lifelong learning opportunities, the Midwest should recognize the strategic importance of for-profit and proprietary higher education providers who not only have the capacity to access capital markets, but have developed successful paradigms for educating adult learners. Yet it is also important that the for-profit sector be held accountable for student success and employability.*

The for-profit higher education sector is evolving very rapidly to provide cost-effective programs for working adults in key disciplines such as business, health services, and information technology. For-profit universities now educate about 7% of the nation’s roughly 18 million students (with the University of Phoenix enrolling over 455,000). They are poised to capture students that public institutions are unable to accommodate. They should be viewed as an important resource for the region and encouraged as a key component of a public-private education marketplace.

*Immigration: Immigration is vital to transforming the Midwest economy,*



*as a source of both talent and energy and contributing to its innovation and entrepreneurship. The only immigration policy that will help the Midwest is one that opens the door as widely as possible.*

There is only one way to rapidly upgrade the quality of our workforce: immigration. The Midwest must simply set aside its xenophobic tendencies and embrace once again immigration as absolutely essential for its future prosperity—just as it has been, of course, for its past successes. We should remember that the Midwestern United States was settled and built by generation after generation of immigrants. In fact, nearly all Americans are descended from people who came from somewhere else in the past couple of centuries. They built our farms and cities, our companies and industries, providing our spirit and drive, shaping our culture and values, and establishing this region as the economic engine of the work.

Immigration is vital to growing a regional economy. Today immigrants are needed not only to help perform the work that must be done to keep the Midwest functioning, but to provide it with the knowledge workers and entrepreneurs so essential to its future. Historically, immigrants and multinational populations have been the greatest contributors to urban population and growth, including growth in major U.S. cities over the past 20 years. They are the source of new enterprises and stimulate the entrepreneurial culture that creates diverse, multi-ethnic, urban communities that are attractive to talented, education, and young residents. (Longworth, 2008; Lingenfelter, 2009)

Today immigrants are needed once again not only to do the work that must be done to keep the Midwest functioning, but to provide it with the knowledge workers and entrepreneurs so essential to its future. Fortunately, today the immigrants are coming again, to take the jobs offered by global cities. It is estimated that during the past two decades 25% of new U.S. ventures (and 50% of Silicon Valley firms) were created by immigrants. A disproportionate number of U.S. breakthrough inventions have come from immigrant inventors. And, of course, the massive flow of refugees from war-torn Europe during the 20th century brought many of the scientists and engineers who not only helped the Allies win WWII, but also have been the Nobel Prize winners and inventors sustaining American science and technology. (*The Economist*, 2009)

It is abundantly clear that cities and regions that are booming today all have large and growing foreign-born populations, for example New York and San Francisco at 35% and Chicago at 30%. Cities in trouble

do not—such as Detroit at 7.5%, Cleveland at 3%, Indianapolis at 3.5%, and St. Louis at 3%. In fact it might even be suggested that one way to assess whether a metropolitan area will be capable of surviving as a global entrepot in today's hypercompetitive economy is to consider its attractiveness to immigration. Unfortunately, with the exception of Chicago, most Midwestern cities face a serious challenge. (Longworth, 2009)

Yet there is another lesson here that can be learned from our neighbors to the north. One key reason that Canada fares better than the United States in international measures of college attainment is that it attracts a better-educated mix of immigrants. Although a larger share of Canada's population is foreign-born (20% compared to 12% in the U.S.), the regions of origin are much different. About 52% of US immigrants and 11% of Canadian immigrants come from Latin American, and about 14% of US immigrants and 37% of Canadian immigrants come from Europe. (*Chronicle*, 2009) People from Asia and the Middle East also account for a larger share of the Canadian immigrant stream. About a third of immigrants in the US over the age of 25 do not have a high-school diploma, compared to only 10% of Canadian immigrants.

In summary, immigration is vital to growing the regional economy and can increase innovation and entrepreneurship, grow talent, and transform the culture of the Midwest. The region needs all the immigrants it can get. This is true of more educated Asians, Europeans, and Africans but also true of poorly educated Latinos. The Midwest needs to speak with one voice in demanding that Midwestern needs for more workers and citizens are met. The only immigration policy that will help the Midwest is one that opens the door as widely as possible.

Hence the Midwest region should view immigration not only as an important asset but indeed as a vital one. To this end, it should seek to have its key metropolitan areas viewed as a test-bed for new immigration policies aimed at attracting highly skilled talent to the region. For example, it might seek to be able to provide green-card opportunities to all international students receiving advanced degrees in science, engineering, medicine, or other critically needed disciplines from the region's universities.

## Innovation

For the longer term, our vision for the future of the Midwest is shaped very much by the recognition that we have entered an age of knowledge in a global economy, in which educated people, the knowledge they

produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, social well-being, and national security. To this end, the regional roadmap pursues a vision of the future in which the Midwest builds a learning and innovation infrastructure capable of adapting and evolving to meet the imperatives of a global, knowledge-driven world. Such a vision is essential to create the new knowledge (research and innovation), skilled workforce, and infrastructure necessary for the Midwest to compete in the global economy while providing citizens with the lifelong learning opportunities and skills they need to live prosperous and meaningful lives in our state. As steps toward this vision, we recommend the following actions:

*Increased Investment in Innovation: The Midwest must invest additional public and private resources in initiatives designed to stimulate R&D, innovation, and entrepreneurial activities. Key elements would include reforming state tax policy to encourage new, high-tech business development, securing sufficient venture capital, state participation in cost-sharing for federal research projects, and a far more aggressive and effective effort by the Midwestern state's Congressional delegations to attract major federal research funding to the region.*

While the development of human capital is the primary responsibility of the region's educational institutions, the generation of new knowledge—R&D, innovation, entrepreneurial activities—and infrastructure will require a partnership among business, higher education, state and federal government. Just as state governments must begin to reinvest in the capacity of their public colleges and universities to produce knowledge workers and research, they must also provide strong incentives to re-establish longer-term R&D as a priority for Midwest industry. In particular the region should encourage and support private-sector investment in joint university-industry collaborative research (e.g., through tax credits) and assist in meeting the cost-sharing requirements for federally sponsored research grants and contracts. (Council on Competitiveness, 2005; Duderstadt, 2008)

While the political influence of the Midwest on the federal government will be essential. Midwestern Congressional delegations should be encouraged to work together to support legislation that provides strong federal tax incentives and policy support to stimulate increased industry investment in R&D. They should also be directed to play a far more active role in attracting federal research dollars to Midwest universities and industry and encouraged to see this role as one of their most important responsibilities. The Midwest Congressional representatives should also

seek committee leadership positions and influence necessary legislation to direct the establishment of major federal research centers in the Midwest.

State and local government must also play a stronger role in stimulating high-tech development. While the Midwest has the capacity to produce and attract the technologists and management necessary for startups, it is sadly lacking in adequate private capital—particularly venture capital—necessary for these activities. Here, state incentives should be provided for the investment of both private capital and public assets (e.g., state pension fund, suniversity endowment funds). States can also play a leadership role in encouraging the partnerships between large, established companies and new startups as well as coordinating university technology development programs and technology transfer activities.

Finally, there is a critical need to revise regional tax policies to be more supportive of small business startup activities. As in so many other areas such as education, the Midwest continues to be seriously constrained by obsolete tax systems, designed to favor 20th-century agricultural and factory-based manufacturing industries rather than a 21st-century knowledge economy. The region's tax codes must be modernized so that they does not penalize and stifle the growth of the emerging companies of the future to subsidize the dying industries of the past.

*Importance of Science and Engineering Education: The increasing dependence of the knowledge economy on science and technology, coupled with the Midwest's relatively low ranking in percentage of graduates with science and engineering degrees, motivates a strong recommendation to place a much higher priority on providing targeted funding for program and facilities support in these areas in state universities.*

Industries and firms, even those that are based in a more traditional economy, are organizing their work around technology. For example, to compete in a global economy, all companies today must be competent in using advanced information technology. Where will the human capital for such advanced technology deployment come from? In the old economy, workers often followed companies, so public policies such as tax abatements to attract large firms made sense. However, as knowledge workers become more important factors in production, today's companies are instead choosing to locate where knowledge workers already are. The implications for the Midwest with its relative weakness in the production of scientists, engineers, and technology, are extremely serious.

Advocates from nearly every industrial sector are calling on government to respond to the growing competitiveness challenge by increasing public investments in science and engineering education and basic research and development. (Barrett, 2004; Duderstadt, 2008)

The Midwest ranks relatively low among the states in the fraction of science and engineering degrees among its college-educated workforce. Moreover, because of their intensive capital needs for laboratory facilities and equipment, science and engineering programs tend to suffer comparatively more damage than less technology-dependent programs during periods of inadequate state appropriations such as the past several years. This is aggravated by the Midwest's inability to provide tax dollars for badly needed campus academic facilities for over two decades. Other states are making major efforts to increase their science and engineering workforce by making major investments in science and engineering education, particularly at the college level.

*Innovation Infrastructure: Providing the educational opportunities and new knowledge necessary to compete in a global, knowledge-driven economy requires an advanced infrastructure: educational and research institutions, physical infrastructure such as laboratories and cyberinfrastructure such as broadband networks, and supportive policies in areas such as tax and intellectual property. The Midwest must invest heavily to transform the current infrastructure designed for a 20th-century industrial economy into that required for a 21st-century knowledge economy. Of particular importance is a commitment by state governments to provide adequate annual appropriations for university capital facilities comparable to those of other leading regions. It is also important for both state and local government to play a more active role in stimulating the development of pervasive high-speed broadband networks, since experience suggests that reliance upon private sector telcom and cable monopolies could well trap the Midwest in a cyberinfrastructure backwater relative to other regions (and nations).*

The Midwest must invest heavily to transform the infrastructure for a 20th century manufacturing economy into that required for a 21st century knowledge economy. We have noted earlier the toll taken on higher education in the Midwest by the serious erosion in state support of its public colleges and universities. Of particular note here is the absence of any strategic plan for maintaining the capital facilities infrastructure of state universities, e.g., laboratories, libraries, and classroom facilities. When one considers that a rule of thumb for the renewal or replacement of university capital facilities is based on a 40 year amortization, the

benign neglect of public university capital needs by state government puts at great risk the capacity of these institutions to meet the growing needs of the state for advanced education and research.

Of equal concern here is the inadequacy of the new types of infrastructure required for prosperity in an era increasingly dominated by the rapid evolution of computer and communications technology. In the 20th century, public investments in transportation infrastructure such as the Interstate Highway System and international airports were the key to building and sustaining the Midwest's manufacturing economy. In the 21st century, cyberinfrastructure—computer resources, broadband networks, and digital libraries—have become the key infrastructure necessary to build and sustain a knowledge-based economy. Other regions and nations are investing heavily in the infrastructure necessary to support a competitive learning and knowledge environment. Greater bandwidth is crucial because it allows faster transmission of knowledge—important for business and for individuals who can then engage in distance education, telecommuting, and e-commerce. The Midwest should achieve a better balance between its investments of public funds in institutions (colleges and universities) and in infrastructure (the connective tissue linking institutions and citizens). (Atkins, 2010)

Today it has become clear that public action is needed to compensate for the inadequate effort of the private sector (telecoms and cable companies) to provide the necessary connectivity for the Midwest citizens and businesses. To wait for the private sector to respond while other states and nations rush ahead with publicly funded network infrastructures puts at risk millions of jobs in the Midwest as well as the necessary educational infrastructure.

*Research Universities and Innovation: The quality and capacity of the Midwest's learning and knowledge infrastructure will be determined by the leadership of its research universities in discovering new knowledge, developing innovative applications of these discoveries that can be transferred to society, and educating those capable of working at the frontiers of knowledge and the professions. Because of the importance of research and graduate education to the region's future, these universities should be encouraged to strike an appropriate balance between these activities, while undergraduate education remains the primary mission of the Midwest's other colleges and universities.*

The Midwest is fortunate to have a high concentration of globally prominent research universities. While these institutions enroll large numbers of students in high quality undergraduate programs, their

unique value to the region arises from their unusual capacity to conduct cutting-edge research and provide advanced education at the graduate and professional level, along with well-established programs of outreach and public service ranging from medical care to economic development. As the Midwest attempts to expand the number of college graduates, particularly during a period of limited resources, it is absolutely essential that the capability of its research universities for advanced training, research, and innovation be protected, since in the end, it will be the new knowledge produced on these campuses, along with the scientists, engineers, and other professionals trained at the advanced level, that will create the new jobs that the graduates from the Midwest's other colleges and universities will fill. (Weber, 2009)

*Technology Transfer: The Midwest's research universities should explore new models for the transfer of knowledge from the campus into the marketplace, including the utilization of investment capital (perhaps with state match) to stimulate spinoff and startup activities and the exploration of entirely new approaches such as "open source – open content paradigms" in which the intellectual property created through research and instruction is placed in the public domain as a "knowledge commons," available without restriction to all, in return for strong public support.*

Clearly universities have an important responsibility to transfer the knowledge created on their campuses into broader society to address its needs and priorities. Transferring university-developed knowledge to the private sector fulfills a goal of publicly funded research by bringing the fruits of research to the benefit of society. With this important technology transfer come increasingly close relationships between industry and universities.

The traditional models for such technology transfer involve establishing ownership of intellectual property through copyright or patent and then using licensing or startups, coupled with a strong entrepreneurial spirit and adequate venture capital, to stimulate economic development. This linear approach to technology transfer has several compelling success stories: Silicon Valley, Route 128, and the North Carolina Research Triangle.

While disclosure, patenting, and licensing intellectual property may be appropriate for some areas such as the product-orientation of biomedical research, it may not be an effective mechanism for very rapidly evolving areas such as information technology or instructional content. Today the increasing pace and changing character of knowledge generation (e.g.,

in digital forms), coupled with the hypercompetitive environment of a global, knowledge-driven economy, suggest that the Midwest should not rely entirely on catching up with other regions through conventional mechanisms, but should also explore entirely new models of technology transfer. (Weber, 2005, 2007, 2009)

So what other models might universities consider for technology transfer? One of the more interesting is provided by the “open source movement” in software development. In this model, a user community develops and shares publicly available intellectual property (e.g., software source code), cooperating in its development and improvement and benefiting jointly from its use. Perhaps the leading example is the development of the Linux operating system, now evolving as a major competitor to proprietary systems such as Microsoft Windows and Unix. This “gift economy” represents an emergent phenomenon offered freely by a community working together with no immediate form of recompense except for social capital intertwined with intellectual capital.

### A Higher Education Roadmap for the Midwestern States

Although many of the key actions that need to be taken at the state level to achieve prosperity and social well being in a global knowledge economy both echo and depend upon similar actions at the national and regional level, the particular roles that states play in governing and funding public education merit specific roadmap goals and strategies.

*Enhanced College Participation: The Midwestern states must commit to increasing very substantially the participation of their citizens in higher education at all levels—community college, baccalaureate, and graduate and professional degree programs. This will require a substantial increase in the funding of higher education from both public and private sources as well as significant changes in public policy. This, in turn, will require a major effort to build adequate public awareness of the importance of higher education to the future of the region and its citizens.*

As we have stressed throughout this report, the most urgent near-term challenge facing the Midwest’s higher education systems is the need to develop more enlightened policies and strategies that enable the states to invest sufficient public funds in their higher education systems while providing their academic institutions with the incentives and agility to respond to market pressures. In order to ensure sufficient investment, we need to follow the guiding principles of quality, access, diversity,



market agility, and accountability. It is only through an investment in knowledge resources and innovation—education, research, and the infrastructure to support them—that the Midwest will be able to compete in this global economy. Simplistic solutions that merely try to increase degree production without addressing quality or funding requirements are clearly both incomplete and inadequate.

However, it is important to acknowledge that the current tax bases of several Midwest states remain inadequate for this purpose. The tax revenues generated by economies based on dying industries, coupled with the reductions in tax rates implemented during the economic boom-times of the 1990s have created dysfunctional state budgets, no longer adequate to address current obligations such as K-12 education, corrections, and unfunded federal mandates such as Medicaid, while investing adequately in the Midwest's future. This is particularly the case during weak economic times that, without new investments, are likely to become both more frequent and more severe for the Midwest region. Yet the current inability of state governments to develop and implement tax policies and cost structures sufficient to fund the necessary investments to build 21st century knowledge economies gives us pause.

While flexibility in state budget and tax policy is always desirable, particularly during periods of major social change, we are convinced that investments in education, innovation, and infrastructure are simply too critical to be subject to the year-to-year pressures of dysfunctional state budget processes and electorates still embracing an entitlement mentality from the Midwest's industrial past. Hence we recommend seriously considering using dedicated tax revenue streams secure from tampering by partisan politics to fund public higher education and knowledge-generating activities such as research, innovation, and supporting infrastructure.

*Higher Education Funding in the Top Quartile: To achieve and sustain the quality of and access to educational opportunities, the Midwest states should each set an objective to move into the top quartile in their higher education appropriations (on a per-student basis).*

There is ample evidence that the Midwest's current investments in public higher education are simply inadequate, whether compared with other regions and other nations, or in light of the current and future challenges faced by the region. If the Midwest aspires to return to a position of national economic leadership, it follows that it must be prepared to invest adequately to create a workforce and stimulate the

innovation required for such economic prosperity in a global knowledge economy. In higher education, just as in other economic sectors, quality and access require adequate investment.

It is important to set appropriate benchmarks for critical investments such as public higher education. Moving into the top quartile of the states would require a 30% increase, while moving to the level of support provided in states with strong knowledge-based economies such as California, North Carolina, Texas, and Massachusetts, would require an increase of 40%. We recommend an intermediate objective of moving to the top quartile of the states by increasing state appropriations per student by 30% (beyond inflation) over the next five years, with possible further increases after that to allow the Midwest to compete with the leading high-tech states.

*Market-Smart Strategies: As powerful market forces increasingly dominate public policy, the Midwest's higher-education strategy should become market-smart, investing more public resources directly in the marketplace through programs such as vouchers, need-based financial aid, and competitive research grants, while enabling public colleges and universities to compete in this market through encouraging greater flexibility and differentiation in pricing, programs, and quality aspirations.*

As we enter a new century, there is an increasing sense that the marketplace is not only a more accurate measure of public priorities than the ballot box or public policy but also a more effective mechanism for allocating both public and private investments. For example, as the economic benefits of advanced education in a knowledge society soar, and higher education is increasingly viewed by society (and its elected governments) as a private benefit rather than a public good, it is important to allow market forces, in addition to public policy, to shape the learning enterprise. Hence at both the state and federal level, government is shifting public investment away from base support of institutions and instead into the marketplace through voucher systems, student financial aid programs, and competitive research grants. (Breneman, 2005; Duderstadt, 2004)

Yet this must be done in a sophisticated manner, else the most fundamental responsibilities of government will be abandoned. For example, economists have long known that the most effective way to achieve access to public higher education is through state or federal need-based financial aid programs since this targets limited tax dollars to those who most need assistance to attend college. Merit-based scholarship

programs and low tuition at public universities, while politically popular, deploy tax dollars primarily to benefit higher-income students who usually need little incentive or financial assistance in attending college. The same is true for those programs providing tax incentives for college expenditures, since these primarily benefit those with sufficient incomes to incur substantial tax liabilities. Since few citizens will pay sufficient state income taxes to cover the costs of educating their children in public universities (based upon the portion of state tax revenue going to support higher education), it becomes clear that merit-based scholarships, low tuition, and tax incentives represent an extremely regressive social policy—to put it bluntly, welfare for the rich at the expense of educational opportunity for the poor.

*Leveraging Federal and Private-Sector Investment: The Midwest should target its tax dollars more strategically to leverage both federal and private-sector investment in education and R&D. For example, a shift toward higher tuition/need-based financial aid policies in public universities not only leverages greater federal financial aid but also avoids unnecessary subsidy of high-income students. Furthermore, greater state investment in university research capacity would leverage greater federal and industrial support of campus-based R&D.*

Although public universities are state institutions, they are supported largely by resources other than state appropriations: private payments (e.g., tuition), federal support (e.g., student financial aid, research grants), gifts, and market-driven auxiliary activities (e.g., licensing income, executive education, intercollegiate athletics). Indeed, nationwide, 55 percent of the support for American higher education comes from private sources with another one-sixth from the federal government. Hence it is imperative that the Midwest strategically target its tax dollars to leverage both federal and private-sector investment in advanced education and research, compatible of course with fundamental objectives such as broad access to and quality of educational opportunities.

Efforts to constrain tuition levels at the region's public universities have the perverse effect of failing to capture the full benefit of federal financial aid programs, which have actually been designed to support, in part, the far higher tuition levels at private universities. Furthermore, low tuition levels provide unnecessary subsidies for those affluent families who clearly have the capacity to afford the costs of a college education, as evidenced by the fact that they frequently send their children instead to private colleges and universities with costs several times that of public universities.

It is also important here to remind readers that while efforts to constrain tuition during a period of eroding state support are politically popular, they can seriously damage institutional quality. When state governments cut appropriations per student at public universities by 25% to 40%, as several Midwest states have done over the past several years, institutions that have already optimized cost structures over the past two decades to accommodate earlier erosion in state support have only two options: increase tuition or reduce quality. Reducing the level of university activity (e.g., enrollments or research) is not an option for most, both because of their increasing dependence upon tuition and research grants and their sense of public responsibility to serve the needs of the state.

*Negotiating New Social Contracts: Key to achieving the agility necessary to respond to market forces will be modernizing the social contracts negotiated between the state government and the Midwest's public colleges and universities to provide them with enhanced market agility in return for greater (and more visible) public accountability with respect to quantifiable deliverables such as graduation rates, student socioeconomic diversity, and intellectual property generated through research and transferred into the marketplace.*

It is increasingly likely that market forces will dominate public policy and public investment in determining the future of most public universities, particularly as state support continues to become a smaller and smaller component of their revenue base. To micromanage or constrain the options of public universities during what might be a several-decade period of weakened public support could not only seriously damage their quality but also hinder their capacity to serve the public during this era of a market-driven higher-education enterprise. Hence leaders of state government and higher education should seek an appropriate balance between accountability to public purposes and the autonomy necessary to enable the flexibility to adapt to market forces. For example, there should be agreed-upon and measurable objectives to ensure public accountability, e.g., student enrollments, degree success rate, socioeconomic distribution of students, technology-transfer activities, and sponsored research funding, in return for state government respecting the constitutional autonomy of the institutions and the authority of their governing boards.

While the Midwest's public universities are legally owned by the citizens of their states, they are enduring social institutions with a duty of stewardship to generations past and a moral obligation and fiduciary

responsibility to take whatever actions are necessary to build and protect their capacity to serve future generations. Unlike governments that exist from election to election or companies facing quarterly earnings pressures, universities span generations, connecting the past with the future. Even though their actions might conflict from time to time with public opinion or the prevailing political winds of state government, most states provide their public universities with the capacity to set their own course to serve this public purpose. When it comes to objectives such as program quality or access to educational opportunity, university governing boards have always viewed these as long-term institutional decisions rather than succumbing to public or political pressures of the moment.

Such concerns have stimulated a reconsideration of the social contract between public higher education and state government, seeking to provide public universities with the agility they need not simply to respond to growing market forces, but to finance themselves increasingly from the marketplace as state support continues to decline as a proportion of their operating budgets. In return, state universities are willing to be held increasingly accountable for achieving measurable outcomes such as graduation rates, the socioeconomic character of their students, technology transfer, and other state priorities.

## A Roadmap for Colleges and Universities

A recurrent theme of this roadmapping exercise involves the need for change in higher education if our college and universities are to serve a rapidly changing world. Of course, the university as a social institution has always been quite remarkable in its capacity to change and adapt to serve society. Higher education has changed quite significantly over time and continues to do so today. Yet the forces of change upon the contemporary university, driven by social change, economic imperatives, and technology, may be far beyond the adaptive capacity of our current educational paradigms. We may have reached the point of crisis in higher education when it is necessary to reconstruct the paradigm of the university from its most fundamental elements, perhaps even to reinvent the university.

To this end, our roadmap proposes at the institutional level a prescription for enabling change.

*World-Class Learning: Colleges and universities should aspire to achieve world-class quality, nimbleness, innovation, efficiency, and the capability of*

*providing our citizens with the higher-order intellectual skills (critical thinking, moral reasoning, an appreciation of cultural and human values, commitment to lifelong learning, adaptive to change, tolerance of diversity) necessary for achieving national prosperity, security, and social well-being in a global, knowledge-driven society.*

*Preparation for Unknown Futures: While colleges and universities should be responsive to the interests of students, their employers, and the nation, it is essential that they should also strive to prepare their graduates for the unknown challenges of careers and citizenship of tomorrow by providing the higher-order intellectual skills necessary to cope with a future of continual yet unpredictable change (e.g., critical thinking ability, a commitment to lifelong learning, the ability to adapt to change, and the capacity to thrive in a world of increasing diversity).*

*Focused Missions, Cost Containment, and Efficiency: Colleges and universities should develop and demonstrate the ability (through the necessary changes in governance, leadership, management, and culture) to control costs, focus resources on well-defined missions, and achieve new levels of efficiency while enhancing both quality and capacity.*

*Assessment of Educational Objectives: It is time to challenge the academy to redefine the purpose and nature of a college education in today's (and tomorrow's) world and develop methods to assess whether these objectives are being achieved. This will require the development of more sophisticated tools to assess the achievement of the more abstract goals of a college education (e.g., critical thinking, communication skills, inductive/deductive reasoning, quantitative skills, cultural appreciation, systems thinking).*

*The Capacity for Change: The capacity for change, for renewal, is the key objective that academic institutions must strive to achieve in the years ahead—a capacity that will allow them to transform themselves once again as they have done so many times in the past, to become institutions capable of serving a rapidly changing society and a changing world.*

The remarkable resilience of institutions of higher education, the capacity to adapt to change in the past, has occurred because in many ways academic institutions are intensely entrepreneurial, transactional cultures. They have provided their faculty members with the freedom, the encouragement, and the incentives to move toward their personal goals in highly flexible ways, and they have done so through good times and bad.

The challenge is to tap this energy and creativity in efforts to transform our schools, colleges, and universities to better serve a changing world.

Yet this must be done within the context of an exciting and compelling vision for the future of our institutions. Rather than allowing them to evolve as unconstrained, transactional, entrepreneurial cultures, this process needs to be guided in such a way as to preserve their core missions, characteristics, and values. The challenge is to develop university communities where uncertainty is an exhilarating opportunity for learning.

A key element will be efforts to provide universities with the capacity to transform themselves into entirely new paradigms that are better able to serve a rapidly changing society and a profoundly changed world. We must seek to remove the constraints that prevent our institutions from responding to the needs of their social environments, to remove unnecessary processes and administrative structures, to question existing premises and arrangements, and to challenge, excite, and embolden the members of our university communities to embark on this great adventure. Those institutions that can step up to this process of change will thrive. Those that bury their heads in the sand, that rigidly defend the status quo or, even worse, some idyllic vision of a past which never existed, are at very great risk. Institutions that are micromanaged, either from within by faculty politics or governing boards or from without by government or public opinion, stand little chance of flourishing during a time of great change.

*Disruptive Forces: Many of the forces driving change in our world are not only disruptive in nature but quite unpredictable. In the face of such uncertainty, experimentation becomes a valuable strategy to explore possible futures of the university. Institutions should approach transformation as a learning process, preserving their most valuable traditions, understanding their immediate challenges, and launching experiments to help them better anticipate possible futures.*

But here institutions face a particular dilemma since the pace and nature of the changes occurring in our world today have become so rapid and so profound that social institutions such as the university have great difficulty in sensing and understanding the true nature of the changes buffeting them about, much less in responding and adapting adequately. Any process aimed at articulating and analyzing new models for the university must do so with the recognition that these models must themselves adapt to an environment of continual change.

*Alliances: Colleges and universities should place far greater emphasis on building alliances that will allow them to focus on unique core competencies while joining with other institutions in both the public and private sector to address the broad and diverse needs of society in the face of today's social, economic, and technological challenges. For example, research universities should work closely with regional universities and independent colleges to provide access to cutting-edge knowledge resources and programs.*

One of the ironies of the increasingly competitive global marketplace is the need to cooperate through alliances. This is an important approach that should also be adopted by higher education. Here the key is to encourage far more mission differentiation among institutions, where colleges and universities develop strong capacity in unique areas and then form alliances with other institutions, cooperating and sharing resources, to meet the broader needs of the state. For example, a state's flagship research universities will be under great pressure to expand enrollments to address the expanding populations of both college-age and adult students, possibly at the expense of their research and service missions. It might be far more constructive for these institutions to form close alliances with regional universities and community colleges to meet these growing demands for undergraduate education while protecting their unique capacity to conduct the graduate programs and cutting-edge research critical to an economy increasingly dependent on technological innovation. Another example would be alliances between research universities and independent colleges that take mutual advantage of the learning-intensive environment of the latter and the vast intellectual resources of the former.

*Engagement in Economic Development: In response to such reinvestment in the research capacity of the Midwest's universities, they, in turn, must become more strategically engaged in both regional and statewide economic development activities. Intellectual property policies should be simplified and standardized; faculty and staff should be encouraged to participate in the startup and spinoff of high-tech business; and universities should be willing to invest some of their own assets (e.g., endowment funds) in state- and region-based venture capital activities. Furthermore, universities and state government should work more closely together to go after major high-tech opportunities in both the private and federal sectors (attracting new knowledge-based companies and federally funded R&D centers)*



As we noted earlier, there are numerous examples in which universities have not only encouraged faculty, student, and staff participation in high tech startups, but also provided or attracted substantial investment capital for such activities (e.g., CONNECT in San Diego). This creates a virtuous cycle of economic growth and reinvestment in the subsequent waves of high-tech development. Furthermore, close cooperation between state government, industry, and research universities has also led to major success in attracting both high-tech industry and major federal investments (e.g., the Research Triangle and Centennial Campus in North Carolina, MCC and STC in Austin, and Silicon Valley in California). Leaders of Midwest state and local governments, industry, and higher education should recommit themselves to building and sustaining such partnerships for the long term, seizing on current opportunities such as alternative energy sources for the transportation industry (e.g., biofuels, hydrogen and hybrid technologies), nanoscale biotechnology, and information systems.

*New Financial and Governance Models: Public colleges and universities need to develop new financial and governance strategies better able to adapt to declining state support and 21st century imperatives.*

The past three decades of experience strongly suggests that the states are simply not able—or willing—to provide the resources to sustain growth in public higher education, at least at the rate experienced in the decades following World War II. In many parts of the nation, states will be hard pressed to even sustain the present capacity and quality of their institutions. Today, one might even conclude that America's great experiment of building world-class public universities supported primarily by tax dollars has come to an end. It could well be that the concept of a world-class, comprehensive state university might not be viable over the longer term. It may not be possible to justify the level of public support necessary to sustain the quality of these institutions in the face of other public priorities, such as health care, K-12 education, and public infrastructure needs—particularly during a time of slowly rising or stagnant economic activity.

The public university has always responded quite effectively to the perceived needs—and opportunities—of American society. Today these institutions are straining to balance public needs for greater access, high quality, and cost-effectiveness in a period of limited resources and political turmoil. The incompatibility of the demands placed upon the public university during a time of constrained resources could well erode

the quality, the public character, and the civic purpose of these important institutions. It seems clear that we need a new dialogue concerning the future of public higher education in America, one that balances both its democratic purpose with economic imperatives.

### The Last Mile (Or the First?)

While some may continue to debate, to suggest that the status quo will remain intact, to others the choice has become clear. We can either accept the risks and the uncertainties of attempting to transform the higher education enterprise to serve a society with new needs and new imperatives. Or we can wait for the market to reshape our institutions, perhaps even relegating them to a backwater role in the emerging global knowledge industry. Clearly embracing the status quo, treading water, also has very real risks. After all, there are many commercial sharks swimming just below the surface.

The learners of our future society will demand that their educational experiences prepare them for a lifetime of learning opportunities, fused both with work and with life. They will seek just-in-time and just-for-you learning through networked organizations. They will seek the integration of timeless and timely knowledge.

The systems of higher education that emerge in the decade ahead will almost certainly be far different from today's. Higher education will either transform itself or be transformed as financial imperatives, changing societal demands, emerging technologies, and new competitors reshape the knowledge enterprise, changing in the process how colleges and universities organize and deliver learning opportunities as well as how they structure and manage their activities. (Duderstadt, 2007)

## Chapter 6: Tactics, Plans, and Processes

Reports that recommend major paradigm shifts are not spontaneously or miraculously implemented. The acceptance of and action upon the recommendations in our Midwest roadmap require active involvement and commitment from a variety of stakeholders, especially state policy makers and civic leaders. Without a regional commitment at all levels, e.g., government, business, labor, education, foundations, citizens, and media, long-term or sustained innovation on the scale of magnitude recommended in this report cannot be achieved—unless, of course, revolution returns as an option to influence public policy.

A roadmap is just that, a set of possible directions to the future. But as Machiavelli reminds us, setting a direction is far from arriving at one's destination. Leaders in both the public and private sector require a more definitive operational plan that addresses key questions such as: What are the first steps to be taken? What policy actions are necessary? Are there follow-on studies that need to be commissioned? What about an ongoing process or framework to assess and sustain progress?

Furthermore, while our effort has focused on developing a roadmap for building a regional knowledge economy in the Midwest, it is clear that our vision and our recommendations are highly dependent upon issues at other levels, e.g., federal policy, market forces, and the global economy. Finally, we acknowledge that this roadmapping study has been stated in straightforward—sometimes even blunt—terms. To survive in the political environment of state (and federal) policy, it must be re clothed in more Machiavellian garb.

Of course the initial goal of this roadmapping effort is to shift the conversation away from distracting issues such as how to save dying industries and practices and to focus instead on the imperatives of a knowledge economy: lifelong learning, research and innovation, and knowledge infrastructure. Here our message has been deceptively simple:

1. Knowledge and innovation are the drivers of the global economy today, and their importance will only intensify in the future.
2. Educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess have become the keys to economic prosperity, public health, national security, and social well-being.
3. While the characteristics of the American culture—a diverse population, democratic values, free-market practices, a predictable legal

system—provide a fertile environment for innovation, history has shown that significant public and private investment is necessary to produce the key ingredients of innovation: new knowledge (research), world-class human capital (education), infrastructure (institutions, facilities, networks), and policies (tax, investment, intellectual property).

4. Although action at the state and national level will be important, the vision, power, and opportunity is shifting rapidly to major metropolitan areas at the regional level.

Since both wise investments and visionary policies are the longer-term keys to regional prosperity, it is important to lay out not only a plan for public, civic, business, and education leaders, the more specific the better, but also a process that can be sustained for the long term. Most important at the outset, public and private institutions at the local, regional, state, and federal level have to get their fundamental priorities and responsibilities aligned with the imperatives of a global, knowledge economy. They should strive to empower families, students, and workers with the resources and responsibilities to choose lifelong learning opportunities that best provide prosperity and security, including early childhood, K-12, postsecondary, and continuing education. The region must provide the infrastructure and the investments necessary to attract federal and private research funding and stimulate innovation and entrepreneurial activities. In these efforts it is critical to strategically blend public policy and market pressures to transform both the economy and culture of the Midwest into a vibrant enterprise of learning and innovation.

In this chapter we first explore some of these related areas and then suggest a series of practical steps that might be taken to move in the directions suggested by the roadmap. It is appropriate to begin with a quick review of approaches that have been taking in similar regional planning activities. First we begin with history.

### The Land-Grant Acts

Although of national scope, the Morrill Act of 1862 (and its subsequent “Land-Grant Acts”) is perhaps an appropriate place to begin. This act and its successors defined the democratic character of America’s public universities and added to their portfolio of activities both public service and eventually research. The Morrill Act put federal largess at the disposal of every state government and thereby helped to develop

a whole new network of institutions with a popular and practical orientation, the land-grant colleges, which today enroll more than 20% of all American college students.

What was distinctive about the Morrill Act was that the land grants were not literal gifts of land on which a state would build a college. Rather the act established a complex partnership in which the federal government provided incentives for each state to sell distant Western lands, with the states being obliged to use the proceeds to fund advanced instructional programs.

The land-grant college movement was a uniquely American approach to meeting the needs of a growing nation for a more democratic and utilitarian approach to higher education, providing both college opportunities for the working class while addressing the technology needs of agriculture and industry. Although Michigan and Wisconsin had already established the importance of the state university prior to the Civil War, the land-grant acts had great impact on the nation, stimulating the appearance of state colleges across the throughout the Midwest and across the nation that would eventually challenge the influence of the eastern colonial colleges. In a very real sense they achieved both the Jeffersonian goals of popular learning necessary for a democratic society and the practical utility necessary for a rapidly industrializing nation.

### The California Master Plan

Perhaps the most successful regional planning effort of the 20th century was the California Master Plan for Higher Education of 1960 that responded to the rapidly changing economy and demographics of that state in the post WWII. (Kerr, 2001) The California Master Plan began with a bold vision of providing universal access to higher education by creating a diverse system of public colleges and universities based on the University of California, the California State University System, and the California Community College System. By defining the unique role of each of these components, the Master Plan was able to provide a very unusual combination of world-class quality with broad access. Today most agree that the California Master Plan played a very critical role in providing the state with exceptional regional advantage, creating the strongest regional economy in the world. As *The Economist* observed: "The extraordinary growth in the California economy during the last half of the 20th century was due to many things: the development of California's infrastructure (aqueducts and freeways), the development of agriculture, and perhaps the most important factor for today's high-tech

California economy: the creation of a superb set of public universities” (*The Economist*, 2005).

The enduring strength of California’s Master Plan for Higher Education derives from its clarity of purpose. It defined state goals for higher education, assigned responsibility for achieving those goals, provided the necessary authority and resources, and by linking those goals to very visible and understandable commitments to the public, had a built-in mechanism of accountability. The overarching state goal was “to provide educational opportunity and success to the broadest possible range of citizens” at the postsecondary level. At the time, children of the postwar “baby boom” were reaching college age and vast increases in college enrollment were projected. Rather than devising ways to limit access to higher education, the Master Plan committed California to one of most extensive promises any state government has ever made to its citizens. The state chose to open up higher education to all Californians who wished to attend.

Equally important was delineation of a clear strategy to achieve this goal. The Master Plan differentiated the missions of each segment as a mechanism to contain costs and provide broad access to higher education. By distinguishing functions and admissions pools, the state reduced duplication of expensive programs and limited the number of high-cost institutions. High-cost graduate programs were limited in a way that both saved the state money and ensured their high quality. The state assumed responsibility for the costs of instruction and adopted a realistic policy for imposition of other fees. Student financial aid was expanded. All students could receive an education that was affordable.

Through generations of strong support and stewardship, today the Great Lakes states have a collection of flagship research universities not only comparable to but superior in many characteristics—quality, capacity, breadth, global presence—to those of the California institutions. But in addition it has many of the finest independent colleges in the nation. Hence it is natural to question whether a similar planning effort could be launched to weave these formidable assets into a strategy to build regional advantage. To be sure, working across state boundaries and politics poses certain challenges, although California faced similar challenges (North vs. South, urban vs. agricultural interests).

Yet it should also be added that the “Great Recession” of 2008-2009 has had a more devastating impact on higher education in California than almost any other state. The state’s direct spending on four-year universities has dropped almost a factor of two, from 11.1% of the general fund budget in 1984 to 6.2 % in 2009. At all levels, California’s public

universities are being forced to reduce enrollments and raise tuition, setting aside the principles of the Master Plan. Indeed there is great concern that the state's bold approach to organizing and funding higher education may no longer be viable in the face of a weakening economy, changing demographics, and political divisions. (Sacramento Bee, 2010)

## The Bologna Process

Europe's Bologna Process (and the related Lisbon Strategy) is a decade-long effort in which the ministers of education from dozens of countries have put in place a process of extended consultation and actions that have resulted in greater integration and cooperation among their national higher education systems. (Adelman, 2009) The process has gone a long way toward creating commonality and interchangeability among Europe's competing systems of higher education—and is being celebrated as a remarkable achievement in multinational reform. It was launched in 1998 when the ministers of education from Germany, France, Italy, and the United Kingdom issued the Sorbonne Declaration signaling their goal of achieving greater integration across European higher education. A year later, 26 European ministers of education meeting in Bologna, Italy followed up with a second, more inclusive communiqué spelling out their collective goal of increasing “the international competitiveness of the European system of higher education”.

The challenge these reformers tackled was a higher education environment that was too fragmented and too dependent on local customs to allow European universities to become major players in the emerging world-wide market for higher education. Two specific problems concerned those who gathered in Bologna in the spring of 1999. First, they wanted to ensure the comparability and transferability of university degrees across Europe; and second, they wanted company as each of their countries began experimenting with the increased tuition and fees that were becoming necessary to supplement, and perhaps in the future supplant, governmental appropriations.

Today 95 percent of European universities (and many in Asia) have adopted the Bologna academic structure of 3-year baccalaureate, 2-year master's, and subsequent PhD degree programs. The ongoing dialog established by the Bologna process has enabled faculty to focus more on what students learn and the student experience. The development of sophisticated quality-control agencies and mechanisms has harmonized degree requirements, so that degrees in the same field mean roughly the same thing across Europe. It has also prepared European nations for

the different task of better differentiating among profiles and missions of universities in their effort to build institutions with world-class reputations. Recent surveys have found strong support for the process, particularly in the Scandinavian, Baltic, and Eastern European nations, although some resistance remains in Britain, France, and Germany.

Of most interest to our Midwest roadmapping effort is the process of extensive consultation and cooperation over an extended period (now entering its second decade) that led eventually to major systemic change in European higher education. As Zemsky notes, everybody had a role. The Bologna Process was conceived from its beginning as a multiyear, decade-long process. It was a process explicitly linking six sets of key actors: ministers of education, university leaders, student leaders, leaders of international organizations, European Union bureaucrats, and policy thinktanks that helped to define the issues and shape the agenda. Unlike similar large-scale strategic efforts in the United States (such as the Spellings Commission), the underlying idea was to support and extend the value of the continent's universities rather than hold them up to public scrutiny. The Bologna Process was both disciplined and focused with a limited number of goals set with clear benchmarks leading to verifiable implementations. (Zemsky, 2009)

In many respects the challenges faced by the Midwest states are similar to those of the European Community. Like Europe, the Midwest is a region challenged by the fundamental economic transformations demanded by a global, knowledge-driven economy. It is characterized by an existing infrastructure of diverse institutions, practices, and policies, and a breadth of players from state governments to coordination agencies to governing boards to university leaders, faculties, and students. Hence it seems appropriate to consider along with a plan to achieve the objectives of the Midwest roadmap a Bologna-like process of extensive consultation among key players that might continue for a considerable time.

## A Process

History has demonstrated the difficulty of achieving structural, functional, and cultural shifts requiring major resource investments and reallocations and funding policy reforms. To ensure funding and implementation, leaders at the state, local, and institution level will likely need to own these reform plans and platforms, and they will need to be instrumental in their design. However they will also need to be advised, encouraged, and possibly even pressured by broader leadership groups.



One of the important products of this effort involves the identification of key policy issues, appropriate for the consideration of leaders in the public and private sectors. Examples might include the provision of community-based extracurricular learning opportunities in underserved communities (perhaps based on evolving technologies such as knowledge networks), better coordination of existing educational resources (K-12, higher education, industrial training, community learning centers), and state government responsibility for providing or stimulating the digital infrastructure necessary to build a 21st Century learning environment. Related to this would be an analysis of necessary investments from both the public and private sector.

So, where to next? The first step is to engage the attention and commitment of leaders from the various sectors of our society, e.g., business and industry, state and local governments, higher education, foundations, and the media. The region's research universities might serve as a brain trust perhaps working closely with other organizations such as the Brookings Institution, to join together to develop a detailed analysis of the economic and social challenges faced by our region as it grapples with the imperatives of a global, knowledge-driven economy, much as we have tried to do through the Midwest Roadmap. The media will play an important role in this effort by raising public awareness of just how much at risk our states will be if we remain trapped in the low-skill industrial economy while the rest of our world evolves into a knowledge economy.

Second, we need to form organizations to link together the leadership of various sectors. At the outset, we should form a steering group consisting of governors, mayors, CEOs, and university and foundation presidents. This might be a multi-state version of the government-university-industry roundtable groups that exist in other states such as California or at the national level through the National Academies. A coalition of the Federal Reserve Banks (Chicago, Cleveland, Minneapolis) could host this activity.

Third, someone is going to have to bankroll the early work to form these groups, perform the necessary analysis, and develop the roadmap to our future. Here our region is fortunate to have a number of important and influential foundations, e.g., MacCarthur, Spencer, Kellogg, Mott, Lumina, Lilly, and others that have invested in the welfare of our states in the past, and that could join together in investing in just such a multi-state effort for the future.

Fourth, there would need to be a corresponding roadmapping effort within each sector. For example, both state and local governments need to

do a better job in identifying and sharing information on “best practices”, both to provide new ideas to a political system all too frequently backing into the future, and perhaps to provide a political umbrella for the necessary action. Leaders of business and industry—and of course, their shareholders and the investment community—need to look beyond quarterly earnings and consider the longer-term impact of workforce quality, R&D and innovation, and regional prosperity on their future—indeed, their very survival, in the flat world of the knowledge economy.

Higher education should recommit itself to achieving world-class quality—not that every institution should strive to be a Stanford or Harvard—but community colleges and regional universities should focus on achieving world-class standards in serving their students and communities in a cost-effective fashion, while research universities should recognize that focusing to achieve excellence in key academic programs is more important in today’s hyper-competitive global economy than building yet another Taj Mahal complex on their campuses (succumbing to the “edifice complex”) or winning a national championship in a revenue sport

Our foundations need a similar challenge. While their impact on national and global agendas is important, they must remember that their wealth has been drawn from our region. Hence while their original benefactors may have long since passed away, there remains a fundamental responsibility to address the needs of our states, particularly during a time of great challenge.

The media should demand that its reporters and editors pay attention to the big picture, building both the capacity and commitment to understand and educate our citizens about the real challenges posed by our changing world and the sacrifices that they will be necessary both for their own long-term prosperity and security and that of their children.

And while we are talking about challenges, let us not forget the federal government. As we all are painfully aware, the national dialog has drifted far from the issues that really matter to our region and our nation for the longer term and instead tend to be distracted by narrow special interests or cultural wars. Yet perhaps the Great Lakes region has an opportunity to shift this debate. After all, if the coasts remain blue, while the south and west remain red, the roughly one-third of votes represented by the Great Lakes remain in play and could be used as the 2x4 to get Washington’s attention. If the region could unite to develop an agenda for what actions are necessary at the federal level to help its states and cities make the transition to a knowledge economy, then it could hold the feet of the candidates of both political parties to the fire, demanding they address

these issues rather than the distractions they currently use to manipulate public opinion and voters.

One possibility would be to establish a standing leadership task force, with sufficient authority, resources, and longevity to propose and achieve the necessary strategic policy and fiscal shifts. Such an effort would need to be animated by a new spirit of progressivism aimed at transforming the Midwest into a knowledge economy.

Key in any such effort is to build a network linking leaders in the public and private sector. Clearly this network would need to be involved in the development of the vision and the plan to gain participation and commitment. Elements of this leadership network would include: K-12 education, higher education, industry, labor, foundations, community leaders, state government, federal government, and media.

The membership of the task force might consist of leaders from both the public and private sector of the Midwest. Unlike other short-term studies, the task force would remain in existence for at least a decade to oversee the development, implementation, and success of the transformation agenda. It would be charged with sustaining continued interaction with key stakeholders, including college and university presidents, governing boards, and campus communities; local, state, and perhaps federal government leaders; the private sector (business, corporate, foundation); and the public. It is crucial to stress here the importance of leadership at the level of the governors, demonstrated through action and reflecting in budget requests and policy statements an understanding of the importance of quality, access, performance, and market flexibility in higher education—priorities that have been woefully absent for several decades. Although such planning activities are not unusual at the state level (e.g., ranging from the California Master Plan of the 1950s to the various K-12 planning efforts stimulated by groups such as the Business Roundtable in recent years), this proposed effort would be distinguished by an unusually broad vision of a society of learning characterized by pervasive educational opportunities for all citizens.<sup>s</sup>

To face the opportunities, challenges, and responsibilities of an increasingly uncertain future, the Midwest needs to rekindle the spirit of adventure, creativity, innovation, and boundless hope in the future that has characterized its history. It needs to restore sense of optimism and excitement about the future and a relish for change.

## Chapter 7: Over the Horizon: Paradigm Shifts and Game Changers

As we look even further into an unknowable future, the possibilities and uncertainties become even more challenging. How will wealth be created and value added in this global, knowledge-driven economy? While many regions (e.g., Bangalore, Shanghai) will prosper with exceptionally high-quality specialization in knowledge-intensive services and low-cost commodity manufacturing, the United States is unlikely to be competitive here, whether because of our high standard of living (and high wage) requirements or population limitations. Instead we will have to stress our capacity to innovate and create, derived from an unusually diverse, market-driven, democratic culture. Although we will still “make things”, we will do so by organizing the financial and human capital on a global level.

Such future challenges to the Midwest’s prosperity and social well-being call for bold initiatives. It is not enough to simply build upon the status quo, for example by doubling the number of post-secondary degree recipients or guaranteeing at a minimum a community college education for all. Instead, it is important that the Midwest consider bolder visions that exploit truly over-the-horizon opportunities and visions. To this end, we conclude this roadmapping exercise with a series of bolder proposals that would act as “game changers” to challenge and change the entire learning and innovation infrastructure of the Midwest region.

### Learn Grants

It is imperative as a matter of both social justice and economic competitiveness that the nation and the states address and remove those factors that have created a strong dependence of access and success in higher education upon socioeconomic status. America should aspire to the ideal where family income is nearly irrelevant to the ability of a student to attend the college or university best matched to his or her talents, objectives, and motivation. As a consequence of both the inadequacy and complexity of existing financial aid programs, many economically disadvantaged students (and parents) no longer see higher education as an option open to them but rather view it as a privilege for the more affluent. As a result, these students do not have the incentive to perform well in K-12 (nor do their parents have the incentive to support them); hence they fall behind early or dropping out of the college-bound ranks.

To address this alarming injustice and provide strong incentives for college preparation, we could provide all students with a 529-like college savings account, a “Learn-Grant” when they begin kindergarten. Although this account would be owned by the students (although invested in the equity market by the federal government or its agents), its funds could be used only for post-secondary education upon the successful completion of a high school college-preparatory program. Each year students (and their parents) would receive a statement of the accumulation in their account, with a reminder that this is their money, but it can only be used for their college education (or other post-secondary education). Beyond serving as an important source of financial aid, the Learn Grants would provide a very strong incentive for succeeding in K-12 and preparing for a college education, since the account would be something students own but would lose if they did not continue their education beyond secondary school (after some appropriate grace period).

The program might be funded from any number of sources, e.g., from a federal plus state match, the revenue from the auction of the digital spectrum (most analogous to the Land Grant Act), etc. Although the Learn Grants would be provided to all students when entering K-12 (in order to earn broad political support), they could be augmented with additional contributions from public, private, or parental sources during their pre-college years, based on need and / or performance. An initial contribution of, say, \$10,000 (e.g., \$5,000 from the federal government with a \$5,000 match from the states) would accumulate over their K-12 education to an amount that when coupled with other financial aid would likely be sufficient for a four-year college education at a public college or university. As to cost, if we assume roughly 4.5 million children enter K-12 each year (the estimate for 2010), then at \$10,000 per student, this would cost \$40 billion (\$20 billion each to the states and the feds). While this seems immense, it is about the cost of one year of K-12 education (or college education, on the average). It also should be compared to other public expenditures (Medicaid/Medicare, corrections, defense, and even student financial aid). From this broader perspective, it really doesn’t seem excessive when viewed both as an investment in social justice and the future of the nation! The proposed Learn Grant program would provide a powerful stimulus to building the world-class workforce necessary for America’s prosperity and security in an ever more competitive global, knowledge-driven economy.

An array of powerful economic, social, and technological forces is reshaping the very nature of the 21st-century university. The emergence of a global, knowledge driven economy has intensified the need for broad access to advanced education and training. The economic value of the knowledge produced by research universities continues to escalate. The rapid emergence of low-cost yet highly sophisticated technical services in large developing markets (e.g., India, China, Russia) has triggered a serious concern about the nature of university education necessary to sustain the high standard of living of wealthy economies. Yet even in the face of such trends, the aging populations of many developed nations are depending increasingly on market forces and private funding rather than public policy and tax support to determine the future of their higher education systems.

There is a strong sense that higher education, long international in participation, may now be in the early stages of globalization, through the efforts of an increasing number of established universities to compete in the global marketplace for students, faculty, and resources; through the rapid growth in international partnerships among universities; and through for-profit organizations (e.g., Apollo, Laureate) that seek to expand through acquisition into global enterprises. New types of universities may appear that increasingly define their purpose beyond regional or national priorities to address global needs such as health, environmental sustainability, and international development.

While universities must be responsive to the imperatives of a global economy and attendant to their local responsibilities, they must also become responsible members of the global community, that is, becoming not only universities in the world but also of the world. Yet the challenges facing our world such as poverty, health, conflict, and sustainability not only remain unmitigated but in many respects become even more serious through the impact of the human species—global climate change being foremost among them. The global knowledge economy requires thoughtful, interdependent and globally identified citizens. Institutional and pedagogical innovations are needed to confront these challenges and insure that the canonical activities of universities – research, teaching and engagement – remain rich, relevant and accessible.

Of particular interest is the way that such forces have stimulated a number of universities—and university organizations—to consider seriously expanding beyond the bounds of their nation-states to become universities both “in the world and of the world”, accepting a far broader responsibility to understand and serve both the social needs

and marketplace of the global community. Key in such strategies is the rapid evolution in information, communication, and transportation technologies, which are enabling entirely new global learning and knowledge structures. (Weber, 2007; Johnson, 2010)

To quote *The Economist* again, “the most significant development in higher education is the emergence of a super-league of global universities. This is revolutionary in the sense that these institutions regard the whole world as their stage, but also evolutionary in that they are still wedded to the ideal of a community of scholars who combine teaching with research. The great universities of the 20th century were shaped by nationalism; the great universities of today are being shaped by globalization. These top universities are citizens of an international academic marketplace, with one global academic currency, one global labor force, and increasingly, one global language, English. The emerging global university is set to be one of the transformative institutions of the current era. All it needs is to be allowed to flourish” (*The Economist*, 2005).

The Midwest has several universities clearly positioned to become truly global universities. They should be encouraged to evolve in this direction, since this would provide the region with important access to both global economic markets and talented immigrant populations.

### Hybrid Public/Private/State/National/Global Universities

At a time when the strength, prosperity, and welfare of a nation demand a highly educated citizenry and institutions with the ability to discover new knowledge, develop innovative applications of discoveries, and transfer them into the marketplace through entrepreneurial activities, such vital national needs are no longer top state priorities. The model of state-based support of graduate training made sense when university expertise was closely tied to local natural resource bases like agriculture, manufacturing, and mining. But today’s university expertise has implications far beyond state boundaries. Highly trained and skilled labor has become more mobile and innovation more globally distributed. Many of the benefits from graduate training—like the benefits of research—are public goods that provide only limited returns to the states in which they are located. The bulk of the benefits are realized beyond state boundaries.

Hence, it should be no surprise that many states have concluded that they cannot, will not, and probably should not invest to sustain world-class quality in graduate and professional education—particularly at the expense of other priorities such as broadening access to baccalaureate education. Today, not only is state support woefully inadequate to

achieve state goals, but state goals no longer accumulate to meet national needs. The declining priority that states have given to public higher education makes sense for them but is a disaster for the nation. The growing mismatch between state priorities and national needs suggests that it is time once again to realign responsibilities between the state and the nation for higher education and provide adequate resources to sustain American leadership.

Once more, it is time for the federal government to step in and provide the support necessary to keep our crucial graduate programs among the best in the world. Educating scientists and engineers, physicians and teachers, business leaders and entrepreneurs is vital to developing the human capital that is now key to national prosperity and security in the global, knowledge-driven economy. It cannot be left dependent on shifting state priorities and declining state support.

So how might this work? A new structure would distribute the primary responsibilities for the support of the nation's flagship public research universities among the states, the federal government, and private donors. The states, consistent with their current priorities for enhancing workforce quality, would focus their limited resources on providing access to quality education at the associate and baccalaureate levels, augmented by student tuition and private philanthropy. The federal government would become, in addition to a leader in supporting university research, the primary patron of advanced education at the graduate and professional level. Private patrons, including foundations and individual donors, would continue to play a major role in support of the humanities, the arts, the preservation of knowledge and culture, and the university's role in serving as an informed critic of society—all roles of great importance to the nation. Those functions would also continue to receive state support, because they are essential to high-quality baccalaureate education.

What matters now is that, more than ever before, America needs to develop a strategy for building and sustaining a system of research universities that is the best in the world. As the states inevitably play a declining role in the support of advanced education and research, it is time for the federal government to move beyond its policy of giving money only to individuals—students through financial aid and scholars through research grants. It must provide direct support to select institutions with the intent of sustaining those missions of advanced graduate-level training that are of particular importance to the nation. Most developed nations in Europe and Asia have developed this strategic approach to creating and sustaining selected research universities at



world-class levels. In fact, today the United States essentially stands alone in its failure to develop a national strategy for sustaining the quality of its research-intensive universities.

### The “No-Frills” University

In recent years there has been growing discussion about the possibility of accelerated three-year baccalaureate programs in U.S. higher education. In part this has been stimulated by the broad adoption by European universities of the three-year degree programs associated with the Bologna Process. But it has also been proposed as a way to reduce the cost of a college education, or as Senator Lamar Alexander puts it, viewed as “the higher ed equivalent of a fuel-efficient car”.

In fact, one might go even further and imagine introducing into American higher education streamlined universities more similar those in Europe. Unlike most European universities that enroll adult students directly in disciplinary majors after longer and more intense secondary educations, American colleges and universities have inherited from their British antecedents the mission of the socialization of young students. Not only does this require a very substantial investment in supporting infrastructure such as residence halls, community facilities, and entertainment and athletic venues, but it can also distract the university from its more fundamental knowledge-based mission. Nevertheless it has become the expectation of American parents that “college is the place where we send our children to grow up”.

In sharp contrast European universities focus their activities on teaching and scholarship for adult students. Entering students enroll in focused three-year discipline-based baccalaureate programs without the preliminary general education experience and socialization programs characterizing American universities. Students are expected to arrange for their own living and social activities, while the university focuses on its “knowledge and learning” mission, thereby avoiding many of the costs associated with socializing young students.

There have been numerous suggestions that the United States explore the “no-frills” approach of European universities by focusing the activities of some of their universities entirely upon teaching and scholarship for adult students, thereby greatly reducing costs and tuition. This would allow the universities to focus their extensive—and expensive—resources where they are most effective: on intellectually mature students who are ready to seek advanced education and training in a specific discipline or profession. It would relieve them of the

responsibility of general education and parenting, roles for which many large universities are not very well suited in any event. It might also allow them to shed their activities in remedial education, a rather inappropriate use of the costly resources of the research university. Focusing universities only on advanced education and training for academically mature students could actually enhance the intellectual atmosphere of the campus, thereby improving the quality of both teaching and scholarship considerably. Adult learners would be far more mature and able to benefit from the resources of these institutions.

Yet the quality and character of secondary education in the United States currently will not allow this for most students. Secondary education in Europe and much of the rest of the world is characterized by a more extended and intensive pre-college education, e.g., gymnasias, lyceums, colleges, which provide much of the general education preparation that currently comprises the first two-years of American college education. Hence a major shift to three-year baccalaureate programs or no-frills adult universities would likely require a major restructuring of secondary education in the United States more along the lines of Europe and Canada.

### The Open Source University

The information and communications technologies enabling the global knowledge economy, so-called cyberinfrastructure—the current term used to describe hardware, software, people, organizations, and policies—evolve exponentially, doubling in power every year or so and amounting to a staggering increase in capacity of 100 to 1,000 fold every decade. It is becoming increasingly clear that we are approaching an inflection point in the potential of these technologies to radically transform knowledge work. To quote Arden Bement, Director of the National Science Foundation, “We are entering a second revolution in information technology, one that may well usher in a new technological age that will dwarf, in sheer transformational scope and power, anything we have yet experienced in the current information age.” Many leaders, both inside and beyond the academy, believe that these forces of change will so transform our educational institutions—schools, colleges, universities, learning networks—over the next generation as to make them unrecognizable within our current understandings and perspectives.

Ironically, while we generally think in terms such as gigabit/sec networks and petaflop supercomputers, the most profound changes in our institutions may be driven not by the technology itself but rather

the philosophy of openness and access it enables— indeed, imposes—on its users. Of particular importance are efforts to adopt the philosophy of open source software development to create new opportunities for learning and scholarship for the world by putting previously restricted knowledge into the public domain and inviting others to join in both its use and development. MIT led the way with its OpenCourseWare (OCW) initiative, placing the digital assets supporting almost 1,800 courses into the public domain on the Internet for the world to use (Vest, 2006). Today, over 400 universities have adopted the OCW paradigm to distribute their own learning assets to the world, with over 7,000 courses now available online.

Furthermore, a number of universities and corporations have joined together to develop open-source middleware to support the instructional and scholarly activities of higher education. This technology is already used by hundreds of universities around the world (e.g. Moodle, 2007 and Sakai, 2007). Others have explored new paradigms for open learning and engagement, extending the more traditional yet highly successful models provided by open universities. There are increasing efforts to open up both data collection and scholarly publication by both individual institutions and university organizations, including the European University Association and the Association of American Universities, although commercial publishers continue to resist these efforts to block this through government regulation and litigation (Atkins, 2007).

To this array of open educational resources should be added efforts to digitize massive quantities of printed material. For example, the Google Book project is currently working with a number of leading libraries (26 at last count in 35 languages) around the world to digitize a substantial portion of their holdings (12 million volumes in 2010, with a goal of 30 million by 2020), making these available for full-text searches using Google's powerful internet search engines. It has recently negotiated with publishers to provide full-text access (beyond full-text searches) to the vast volume of "orphan" works no longer in print.

A number of United States universities (26 thus far) have pooled their digital collections to create the HathiTrust ("Hathi" means "elephant" in Hindi), adding over 400,000 books a month to form the nucleus (already at 6 million books) of what could become a 21st century analog to the ancient Library of Alexandria. While many copyright issues still need to be addressed, it is likely that these massive digitization efforts will be able to provide full text search access to a significant fraction of the world's written materials to scholars and students throughout the world within a decade.

Hence one might imagine the emergence of “open source” universities, committed to providing extraordinary access to knowledge and learning tools through open learning resources. In fact, some institutions might decide to remove entirely the restrictions imposed by intellectual property ownership by asking all of their students and faculty members to sign a Creative Commons license for any intellectual property they develop at the University (at first copyright but eventually possibly even exploring other intellectual properties such as patents). Perhaps this would even redefine the nature of a “public” university, much in the spirit of the “public” library!

## Learning Networks

Driven by information technology, the network has become more than a web that links together learning resources. It has become the architecture of advanced learning organizations. Information, knowledge, and learning opportunities are now distributed across robust computer networks, with over 4 billion people today estimated to have cell-phone connectivity and 1.2 billion with broadband access. Such widespread access, combined with the explosion in the availability of digital information and open learning paradigms such as the OpenCourseware initiative, makes it clear that the knowledge, the learning, the cultural resources that used to be the prerogative of a privileged few are rapidly becoming available anyplace, anytime, to anyone.

To this one should add the changing way that the “net generation” is using these new technologies to build social communities— instant messaging, blogs, wiki’s, virtual worlds, FaceBook, Twitter, Wikipedia. They have embraced and reshaped their lives with such highly interactive, social networking. Rather than access the vast knowledge resources provided through the open education resources movement through passive media such as books, this generation accesses knowledge and builds social communities through 3-D virtual reality environments such as Second Life, the World of Warcraft, and Croquet in which all of the senses are faithfully replicated to enable human interaction at a distance.

The impact on all social organizations has been profound. Business and industry are moving rapidly away from the hierarchy of the organizational pyramid to networked organizations of relatively autonomous components. The transactional culture of the now bankrupt General Motors should be contrasted with the relational approach of IBM to building global enterprises.

It is important to appreciate how profound this new network architecture is for learning organizations. Today's learners can learn anywhere, anytime, acquiring learning and knowledge from sources in any location. Today, learners are in command of what, how, where, and when they learn, and they will be increasingly in control of what they pay for the learning opportunity as well.

The implications of a networked learning architecture are manifold. First, it makes less and less sense for institutions to attempt to be comprehensive, to go it alone. Rather, the key will be forming alliances, sharing resources, specializing in what they can be really good at, and relying on other focused institutions to provide the rest. The fact learned through painful experience in business and industry is that only world-class, competitively priced products will succeed in a global marketplace. This does not mean that the largest, most prestigious institutions will necessarily be the most successful. Indeed, smaller, more focused, and more nimble institutions may be able to develop world-class learning services that could compete very effectively with traditional offerings.

### Learning Ecologies

John Seely Brown suggests that we might think of the contemporary university as an interconnected set of three core competencies: learning communities, knowledge resources, and the certification of knowledge skills. Social computing will empower and extend learning communities beyond the constraints of space and time. Open knowledge and education resources will clearly expand enormously the knowledge resources available to our institutions. And immersive environments will enable the mastery of not simply conventional academic knowledge but tacit knowledge, enabling our students to learn not only how "to do" but actually how "to be"—scholars, masters, professionals, whatever they wish! A fundamental epistemological shift in learning is occurring from individual to collective learning; from a focus on development of skills to instead dispositions, imagination, and creativity; and enabling the acquisition of both explicit and tacit knowledge.

In a rapidly changing world, innovation no longer depends only upon the explicit dimension characterizing conventional content-focused pedagogy focused on "learning to do". Rather, one needs to enable an integration of tacit knowledge with explicit knowledge. Emerging ICT technologies that enable social networking to form learning communities and immersive virtual environments for simulation and play facilitate the "deep tinkering" that provides the tacit knowledge necessary to "learn

to be”, tools already embraced by the young if not yet the academy. In a sense, learning has become a “culture”, in the sense of the Petri dish that is in a state of constant evolution.

Once we have realized that the core competency of the university is not simply transferring knowledge, but developing it within intricate and robust networks and communities, we realize that the simple distance-learning paradigm of the virtual university is inadequate. The key is to develop computer-mediated communications and communities that are released from the constraints of space and time.

The Future of the University?  
(Or something else...)

So what might we anticipate as possible future forms of the university? The monastic character of the ivory tower is certainly lost forever. Although there are many important features of the campus environment that suggest that most universities will continue to exist as a place, at least for the near term, as digital technology makes it increasingly possible to emulate human interaction in all the sense with arbitrarily high fidelity, perhaps we should not bind teaching and scholarship too tightly to buildings and grounds. Certainly, both learning and scholarship will continue to depend heavily upon the existence of communities, since they are, after all, high social enterprises. Yet as these communities are increasingly global in extent, detached from the constraints of space and time, we should not assume that the scholarly communities of our times would necessarily dictate the future of our universities. For the longer term, who can predict the impact of exponentiating technologies on social institutions such as universities, corporations, or governments, as they continue to multiply in power a thousand-, a million-, and a billion-fold?

But there is a possibility even beyond these. Imagine what might be possible if all of these elements are merged, i.e., Internet-based access to all recorded (and then digitized) human knowledge augmented by powerful search engines; open source software, open learning resources, and open learning institutions (open universities); new collaboratively developed tools (Wikipedia II, Web 2.0); and ubiquitous information and communications technology (e.g., cheap laptop computers or, more likely, advanced cell phone technology). In the near future it could be possible that anyone with even a modest Internet or cellular phone connection will have access to the recorded knowledge of our civilization along with ubiquitous learning opportunities and access to network-based communities throughout the world (perhaps even through immersive

environments such as Second Life).

Imagine still further the linking together of billions of people with limitless access to knowledge and learning tools enabled by a rapidly evolving scaffolding of cyberinfrastructure, which increases in power one-hundred to one thousand-fold every decade. This hive-like culture will not only challenge existing social institutions—corporations, universities, nation states, that have depended upon the constraints of space, time, laws, and monopoly. But it will enable the spontaneous emergence of new social structures as yet unimagined—just think of the early denizens of the Internet such as Google, Facebook, Wikipedia, ... and, unfortunately, Al Qaeda. In fact, we may be on the threshold of the emergence of a new form of civilization, as billions of world citizens interact together, unconstrained by today's monopolies on knowledge or learning opportunities.

Perhaps this, then, is the most exciting vision for the future of knowledge and learning organizations such as the university, no longer constrained by space, time, monopoly, or archaic laws, but rather responsive to the needs of a global, knowledge society and unleashed by technology to empower and serve all of humankind. And all of this is likely to happen during the lives of today's students. These possibilities must inform and shape the manner in which we view, support, and lead higher education. Now is not the time to back into the future.

### Whence and Whither the Revolution

Yet today university today looks very much like it has for decades—indeed, centuries in the case of distinguished European universities. They are still organized into academic and professional disciplines; they still base their educational programs on the traditional undergraduate, graduate, and professional discipline curricula; our universities are still governed, managed, and led as they have been for ages.

But if one looks more closely at the core activities of students and faculty, the changes over the past decade have been profound indeed. The scholarly activities of the faculty have become heavily dependent upon digital technology—rather cyberinfrastructure—whether in the sciences, humanities, arts, or professions. Although faculties still seek face-to-face discussions with colleagues, these have become the booster shot for far more frequent interactions over Internet. Most faculty members rarely visit the library anymore, preferring to access far more powerful, accessible, and efficient digital resources. Many have ceased publishing in favor of the increasingly ubiquitous preprint route. And, as we have

suggested earlier, student life and learning are also changing rapidly, as students bring onto campus with them the skills of the net generation for applying this rapidly evolving technology to their own interests, forming social groups, role playing (gaming), accessing services, and learning, despite the insistence of their professors that they jump through the hoops of the traditional classroom paradigm.

In one sense it is amazing that the university has been able to adapt to these extraordinary transformations of its most fundamental activities, learning and scholarship, with its organization and structure largely intact. Here one might be inclined to observe that technological change tends to evolve much more rapidly than social change, suggesting that a social institution such as the university that has lasted a millennium is unlikely to change on the timescales of tech turns, although social institutions such as corporations have learned the hard way that failure to keep pace can lead to extinction. Yet, while social institutions may respond more slowly to technological change, when they do so, it is frequently with quite abrupt and unpredictable consequences, e.g., “punctuated evolution”.

It could also be that the revolution in higher education is well underway, at least with the early adopters, and simply not sensed or recognized yet by the body of the institutions within which the changes are occurring. Universities are extraordinarily adaptable organizations, tolerating enormous redundancy and diversity. It could be that information technology revolution is more a tsunami that universities can float through rather a tidal wave that will swamp them.

An alternative viewpoint of the transformation of the university might be as an evolutionary rather than a revolutionary process. Evolutionary change usually occurs first at the edge of an organization (an ecology) rather than in the center where it is likely to be extinguished. In this sense the cyberinfrastructure that is now transforming scholarship and the communications technology enabling new forms of learning communities have not yet propagated into the core of the university. Of course, from this perspective, recent efforts such as the Google Book project take on far more significance, since the morphing of the university library from stacks to Starbucks strikes at the intellectual soul of the university.

Admittedly it is frequently the case that futurists have a habit of overestimating the impact of new technologies in the near term and underestimating them over the longer term. There is a natural tendency to implicitly assume that the present will continue, just at an accelerated pace, and fail to anticipate the disruptive technologies and killer apps that turn predictions topsy-turvy. Yet we also know that far enough into



the future, the exponential character of the evolution of Moore's Law technologies such as info-, bio-, and nano- technology makes almost any scenario possible.

Certainly the monastic character of the ivory tower is lost forever. Although there are many important features of the campus environment that suggest that most universities will continue to exist as a place, at least for the near term, as digital technology makes it increasingly possible to emulate human interaction in all the senses with arbitrarily high fidelity, perhaps we should not bind teaching and scholarship too tightly to buildings and grounds. So too, both learning and scholarship will continue to depend heavily upon the existence of communities, since they are, after all, highly social enterprises. Yet as these communities are increasingly global in extent, detached from the constraints of space and time, we should not assume that the scholarly communities of our times will necessarily dictate the future of our universities.

Even in the near term, we should again recall Christensen's innovators' dilemma, as these disruptive technologies, which initially appear rather primitive, stimulate the appearance of entirely new paradigms for learning and research that could not only sweep aside the traditional campus-based, classroom-focused approaches to higher education but seriously challenge the conventional academic disciplines and curricula. For the longer term who can predict the impact of exponentiating technologies on social institutions such as universities, corporations, or governments, as they continue to multiply in power a thousand-, a million-, and a billion-fold?

We have entered a period of significant change in higher education as our universities attempt to respond to the challenges, opportunities, and responsibilities before them. This time of great change, of shifting paradigms, provides the context in which we must consider the changing nature of the university..

Certainly the need for higher education will be of increasing importance in our knowledge-driven future. Certainly, too, it has become increasingly clear that our current paradigms for the university, its teaching and research, its service to society, its financing, all must change rapidly and perhaps radically. Hence the real question is not whether higher education will be transformed, but rather how . . . and by whom. If the university is capable of transforming itself to respond to the needs of a culture of learning, then what is currently perceived as the challenge of change may, in fact, become the opportunity for a renaissance, an age of enlightenment, in higher education in the years ahead.

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 the values and discipline of the educated mind. It has defended and propagated our cultural and intellectual heritage, while challenging our norms and beliefs. It has produced the leaders of our governments, commerce, and professions. It has both created and applied new knowledge to serve our society. And it has done so while preserving those values and principles so essential to academic learning: the freedom of inquiry, an openness to new ideas, a commitment to rigorous study, and a love of learning. There seems little doubt that these roles will continue to be needed by our civilization. There is little doubt as well that the university, in some form, will be needed to provide them. The university of the twenty-first century may be as different from today's institutions as the research university is from the colonial college. But its form and its continued evolution will be a consequence of transformations necessary to provide its ancient values and contributions to a changing world. (Rhodes, 1999)

## The Last Word

Today, the Midwest is in transition, struggling to retain the best of its social, cultural, and economic traditions while at the same time trying to reinvent itself for success in a very different economic milieu. Much of its current malaise reflects the passing of an agrarian and industrial economy that supported the region for a century. Part of it is the arrival of globalization and three billion new workers, most from Asia and Eastern Europe, each ready to do the heavy lifting and low-skill assembly-line work that once put bread on Midwestern tables. Part of it is the dawning of the knowledge economy in a region where a high school diploma used to buy a ticket to the middle-class life—and today is only the fare to poverty.

The Midwest must embrace, not hide from globalization and the emerging world economy. Yet it has become increasingly clear that it can thrive only if it meets its global challenges on a regional basis. It must cast aside 19th century political and social structures and 20th century entitlement cultures and practices and look to the future. New people, ideas, relationships, and resources, encouraged by a global outlook, are central to growing the regional economy, increasing innovation and entrepreneurship, attracting new talent, and transforming an insular culture.

As we stand at the beginning of a new century and a new millennium the Midwest must learning to live with change as a fact of life. It must

become woven into the fabric of our daily lives, in the way we work, relate to each other, and experience the world. We're learning the hard way that if we want to fully prosper in this new world, we must take the long view, invest in people, their education and skills, innovation and entrepreneurial efforts, and the institutions that enable these abilities, so critical to a region in the global knowledge economy.

Today a major expansion of educational opportunity could have a similarly extraordinary impact on the future of the nation. It is time to take bold action, completing in a sense the series of these earlier federal education initiatives, by providing all American citizens with universal access to lifelong learning opportunities, thereby enabling participation in the world's most advanced knowledge and learning society. The cities and states of the Midwest should accept a responsibility to enable all of their citizens to take advantage of the educational, learning, and training opportunities they need and deserve, throughout their lives, thereby enabling both individuals and the nation itself to prosper in an ever more competitive global economy. While the ability to take advantage of educational opportunity always depends on the need, aptitude, aspirations, and motivation of the student, it should not depend on one's socioeconomic status. Access to lifelong learning opportunities should be a right for all rather than a privilege for the few if the region is to achieve prosperity, security, and social well-being in the global, knowledge- and value-based economy of the 21st century.

The future belongs to those who face it squarely, to those who have the courage to transform themselves to serve a new society. Our challenge is to work together to provide an environment in which such change is regarded not as threatening but rather as an exhilarating opportunity to engage in the primary activity of a university, learning, in all its many forms, to serve our world as best we can.

Though we can never actually predict the future, we are not relieved of the responsibility of vision. Society is changing. We can either respond to these changes as active participants, constructing our own future, or we will find ourselves driven into the future by social forces beyond our control. The future is not yet written, but we should not wish it any other way. The excitement that comes with uncertainty and discovery draws us inexorably into tomorrow.

## References

- AAAS (American Association for the Advancement of Science). *Analysis of R&D in the FY 2010 Budget*. Washington, DC, 2009.
- Adelman, Clifford. *The Bologna Process for U.S. Eyes: Re-learning Higher Education in the Age of Convergence*. San Jose, CA: Institute for Higher Education Policy, 2009.
- Atkins, Daniel E. (chair). *Revolutionizing Science and Engineering Through Cyberinfrastructure*. Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure. Washington, DC: National Science Foundation, 2003.
- Atkins, Daniel E., John Seely Brown and Allen L Hammond. *External Review of the Hewlett Foundation's Open Educational Resources (OER) Program: Achievements, Challenges, and Opportunities*. Menlo Park, CA: Hewlett Foundation, February, 2007.
- Atkinson, Robert D. and Scott M. Andes. *Benchmarking EU and US Innovation and Competitiveness*. Washington, DC: The Atlantic Century, 2009.
- Augustine, Norman (chair). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. National Academies Committee on Prospering in the Global Economy of the 21st Century. Washington, DC: National Academies Press, 2005.
- Austin, John and Britany Affolter-Caine, *The Vital Center: A Federal-State Compact to Renew the Great Lakes Region*, Brookings Institution Metropolitan Policy Program, Washington, DC: Brookings Institution, 2005.
- Austin, John, John Burkhardt and James Jacobs. *Michigan Lt. Governor's Commission on Higher Education and Economic Growth*. Background Briefing for Commission Members, Lansing, MI, 2004.  
<http://www.cherrycommission.org/meetings.htm>
- Atkinson, Richard. "Opportunity in a Democratic Society: A National Agenda". *Cantor Distinguished Lectureship on Intellectual Diversity*. Ann Arbor, MI: University of Michigan, 2005.
- Baumgardt, Bengt. "Demographic Change and Higher Education". *Salzberg Seminars*, 2006.
- Bement, Arden L. "Cyberinfrastructure: The Second Revolution", *The Chronicle of Higher Education*, January, 2007.
- Bok, Derek. *Our Underachieving Colleges*. Princeton, NJ: Princeton University Press, 2006.
- Boulos, Michael. "Bill Gates and a Prescription for Michigan's Future". *President's Perspective*, Issue 4. President's Council of State

- Universities of Michigan, Lansing, MI, 2005.
- Branscomb, Lewis M. "Research Alone Is Not Enough", *Science*, Vol. 321, August 15, 2008.
- Breneman, David. "Peering Around the Bend: The Leadership Challenges of Privatization, Accountability, and Market-Based State Policy". *Association of Governing Boards*, Washington, DC, 2005.
- Breneman, David. *Are the States and Public Higher Education Striking a New Bargain? Public Policy Paper Series*. Washington, DC: Association of Governing Boards and Colleges, 2005.
- Brown, John Seely. "Minds on Fire", *Educause*, January / February 2009.
- Brown, John Seely and Paul Duguid. *The Social Life of Information*. Cambridge, MA: Harvard Business School Press, 2000.
- Catton, Bruce. *Michigan: A Bicentennial History*. New York, NY: Norton, 1976.
- Christensen, Clayton M. *The Innovator's Dilemma*. Cambridge, MA: Harvard Business School Press, 1997.
- Chronicle of Higher Education. "State Appropriations for Higher Education". *Chronicle of Higher Education*, January 11, 2008.
- Chronicle of Higher Education. "Gaps in Immigrants' Education Levels Play Into Canada's Edge over US Rankings, Researchers Say". *Chronicle of Higher Education*, November 5, 2009.
- CIC. *Collective Impact: 50 years of Strategic Collaboration*. Champaign, IL: Committee on Institutional Cooperation, 2008.
- Council on Competitiveness. *Innovate America: Thriving in a World of Challenge and Change*. The National Innovation Initiative, Washington, DC: Council on Competitiveness, 2005.
- Daniel, John S. *Mega-Universities and Knowledge Media*. London, UK: Kogan Page, 1996.
- Dolence, Michael G. and Donald M. Norris. *Transforming Higher Education: A Vision for Learning in the 21st Century*. Ann Arbor, MI: Society for College and University Planning, 1995.
- Douglass, John Aubrey. *From Chaos to Order and Back: A Revisionist Reflection on the California Master Plan at 50 and Thoughts about Its Future*. Berkeley, CA: Center for Studies in Higher Education, University of California, Berkeley, 2010.
- Drucker, Peter. "A Better Way to Pay for College". *Wall Street Journal*, A14, May 9, 1991.
- Drucker, Peter. "Beyond the Information Revolution". *Atlantic Monthly*, 284:4, October, 1999.
- Duderstadt, James J. (chair). *Engineering Research and America's Future: Meeting the Challenge of a Global Economy*. NAE Panel to Assess the

Capacity of the U.S. Engineering Research Enterprise. Washington, D.C.: National Academies Press, 2005.

<http://www.nap.edu>

Duderstadt, James J., Daniel E. Atkins and Douglas Van Houweling. *Higher Education Faces the Digital Age: Technology Issues and Strategies for American Colleges and Universities*. Washington, DC: American Council on Education, 2002.

Duderstadt, James J. (chair). *Preparing for the Revolution: Information Technology and the Future of the University*. Washington, DC: National Academies Press, 2003.

<http://www.nap.edu>

Duderstadt, James J., et al. "Cyberinfrastructure". A Special Issue of *Issues in Science and Technology*, Vol. XXII, No. 1. Washington, DC: National Academies Press, 2005.

Duderstadt, James J., William A. Wulf, and Robert Zemsky. "Envisioning a Transformed University", *Issues in Science and Technology*, 22(1), 35-41, Washington, DC: National Academy Press, 2005.

Duderstadt, James J. *A University for the 21<sup>st</sup> Century*. Ann Arbor, MI: University of Michigan Press, 2001.

Duderstadt, James J. and Farris W. Womack. *The Future of the Public University in America: Beyond the Crossroads*. Baltimore, MD: Johns Hopkins University Press, 2002.

Duderstadt, James. *Engineering for a Changing World*. Ann Arbor, MI: Millennium Project, University of Michigan, 2008.

Duderstadt, James J. *The View from the Helm: Leading the American University During an Era of Change*. Ann Arbor, MI: University of Michigan Press, 2007.

Duderstadt, James J., Aligning American Higher Education with a Twen<sup>ty</sup>-first-century Public Agenda". *Higher Education in Europe*, Vol 34, No. 3-4, 2009.

Duderstadt, James J., Mark Muro, and Sarah Rahman. *Hubs of Innovation: Leveraging the Great Lakes Research Complex for Energy Innovation*. Washington, DC: Brookings Institution, 2010. See also Duderstadt, et. al., *Energy Discovery-Innovation Institutes: A Step Toward America's Energy Sustainability*. Washington, DC: Brookings Institution, 2009.

*The Economist*. "The Brains Business: A Survey of Higher Education". *The Economist*, September 10, 2005.

*The Economist*. "The Search for Talent: The World's Most Valuable Commodity Is Getting Harder to Find". *The Economist*, October 2006.

*The Economist*. "Now for the Reckoning—Corporate America's Legacy Costs". *The Economist*, October 15, 2005.

- The Economist*. "Special Report: Blacks in America". *The Economist*, August 6, 2005.
- The Economist*. "Detroitosaurus Wrecks: The lessons for America and the car industry from the biggest industrial collapse ever". *The Economist*, June 4, 2009.
- The Economist*. "A Ponzi scheme that works". *The Economist*, December 19, 2009.
- Finley, Nolan. "Attitude May Make Michigan the New Mississippi". *Detroit News*, May 1, 2005.  
See also Finley, Nolan. *Detroit News*, December 9, 2007.
- Friedman, Thomas. *The World Is Flat: A Brief History of the 21<sup>st</sup> Century*. New York, NY: Farrar, Strauss, and Giroux, 2005.
- Friedman, T. *Hot, Flat, and Crowded: Why We Need a Green Revolution—and How It Can Renew America*. New York, NY: Farrar, Strauss, and Giroux, 2008.
- Garcia, M.L. and O.H. Bray. *Fundamentals of Technology Roadmapping*. Albuquerque, NM: Sandia National Laboratory, 1997.
- Gartner Consulting. *LinkMichigan*. E-3 Ventures, Lansing, MI: Michigan Economic Development Council, 2001. <http://medc.michigan.org/news/reports/economic/>
- Glazer, Louis. *A New Agenda for Michigan*. Ann Arbor, MI: Michigan Future, 2007.  
<http://www.michiganfuture.org>
- Glazer, Louis and Donald Grimes. *A New Path to Prosperity? Manufacturing and Knowledge-Based Industries as Drivers of Economic Growth*. Ann Arbor, MI: Michigan Future, Inc., 2004.
- Glazer, Louis and Donald Grimes. *Michigan's Transition to a Knowledge-Based Economy, Annual Progress Reports, 2008, 2009, 2010*. Ann Arbor, MI: Michigan Future, Inc., 2010.
- Glazer, Louis. *Young Talent in the Great Lakes: How Michigan Is Faring*. Ann Arbor, MI: Michigan Future, Inc., 2008.
- Haycock, Kati and Danette Gerald. *Engines of Inequality*. Washington, DC: Education Trust, 2008.
- Haycock, Kati. *Opportunity Adrift*. Washington, DC: Education Trust, 2010.
- Holdren, J. "The Energy Innovation Imperative: Addressing Oil Dependence, Climate Change, and Other 21<sup>st</sup> Century Energy Challenges", *Innovations*, 1(2), 3, 2006.
- Hollins, Harvey, Steven M. Webster and Cynthia Wilbanks. *What Michigan Needs to Compete: The University Research Corridor*. Lansing, MI: UM, MSU, WSU, 2006.  
<http://www.urcmich.org>

- IBM. *IBM Global Innovation Outlook*. New York, NY: IBM Corporation, 2006.
- Ikenberry, Stanley. *Uncertain and Unplanned: The Future of Public Higher Education*. , Policy Forum, Institute of Government and Public Affairs. Champaign, IL: University of Illinois, 17 (3), 2005.
- Ito, M., *Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning With New Media*. Cambridge: MIT Press, 2009.
- Ivacko, Thomas. *Michigan's Economic Transition: Toward a Knowledge Economy*. Center for Local, State, and Urban Policy. Ann, Arbor, MI: University of Michigan, 2007.
- Johnson, Rick. *The Globalization of American Research Universities: The Need for a Strategic Assessment and Global Framework*. National Academies presentation, January, 2010.
- K-16 Coalition for Michigan's Future. "Keeping the Public Colleges Afloat". *New York Times*, 2004. <http://www.michigank16.org>
- Kane, Thomas J. and Peter R. Orzag. "Funding Restrictions at Public Universities: Effects and Policy Implications" (working paper, Brookings Institution, Washington, DC, September 2003).
- Katz, Bruce. "Building a Long-Term National Stratetic Plan for Growth through Innovation", Brookings Institution Workshop, June 3-4, 2010.
- Kelly, Kevin. "Scan This Book!". *New York Times Sunday Magazine*, May 14, 2006.
- Kerr, Clark. *The Gold and the Blue: A Personal Memoir of the University of California, 1949-1967*. Volume One: Academic Triumphs. Berkeley, CA: University of California Press, pp. 172-190, 2001.
- Kerr, Clark. *Testimony before Joint Committee to Develop a Master Plan for Education: Kindergarten through University*. California Assembly, August 24, 1999.
- Koizumi, Kei. *The Future of Federal Research and Development in the Midwest: Trends and Indicators*. Washington, DC: American Association for the Advancement of Science, 2008.
- Kuhn, T. S. *The Structure of Scientific Revolutions*. Chicago, IL: University of Chicago Press, 1963.
- Kurzweil, Ray. *The Age of Spiritual Machines: When Computers Exceed Human Intelligence*. New York, NY: Viking, 1999.
- Kurzweil, Ray. *The Singularity Is Near: When Humans Transcend Biology*. New York, NY: Viking Penguin, 2005.
- Levine, Arthur. "Higher Education's New Status As a Mature Industry". *Chronicle of Higher Education*, A48, January 31, 1997.
- Lingenfelter, Paul. *Increasing Educational Attainment: National Imperative: Federal Actions*. MHEC Annual Commission Meeting, State Higher



- Education Executive Officers (SHEEO), November, 2009.
- Longworth, Richard C. *Caught in the Middle: America's Heartland in the Age of Globalization*. New York, NY: Bloomsbury, 2008.
- Longworth, Richard C. *A Midwest Marshall Plan? Well, Sort Of*. Global Midwest Policy Brief. Chicago, IL: Chicago Council on Global Affairs, 2009.
- McPherson, Peter. *Assuring That Public Research Universities Remain Vital*. Washington: Association of Public and Land-Grant Universities, 2010.
- Michigan Emergency Financial Advisory Panel. *Michigan's Defining Moment, A Report to the Governor*. Lansing, MI: Office of the Governor, 2007.
- Michigan State Board of Education. *Recommendations to Better Support Michigan's Education System: Revenues, Reforms and Restructuring*. Lansing, MI: State Board of Education, 2010.
- Milliken, William. "Anger, Bitterness, and Noise Leave Michigan In the Dust". *Mackinac Regional Conference*, Detroit Regional Chamber, June, 2005.
- Miller, Charles (chair). *A Test of Leadership: Charting the Future of U.S. Higher Education*. National Commission on the Future of Higher Education in America ("The Spellings Commission"). Washington, DC: Department of Education, 2006.
- Moe, Michael. *The Knowledge Web: People Power— Fuel for the New Economy*. New York, NY: Merrill-Lynch, 2000.
- NCPPHE, National Center for Public Policy and Higher Education. *Measuring Up 2008: The State Report Card on Higher Education*. San Jose, CA: NCPPHE, 2009.
- National Educational Technology Working Group. *The National Educational Technology Plan*. Washington, DC: Department of Education, 2010.
- National Information Center. "Population Projects-Percent Change from 2000 to 2005".  
<http://www.higheredinfo.org/dbrowser/index.php?level=nation&mode=data&state=0&submeasure=107>
- National Intelligence Council. *Mapping the Global Future, Project 2020*. Washington, DC: Government Printing Office, 2004.
- National Park Service. "Greenfield Village and Henry Ford Museum".  
<http://www.cr.nps.gov/nr/travel/detroit/d37.htm>
- National Science Board. *Science and Engineering Indicators*. Washington, DC: National Science Foundation, 2004.
- National Science Board. "State Indicators", *Science and Engineering Indicators*, Washington, DC: National Science Foundation, 2004.

<http://www.nsf.gov/sbe/srs/sein04/start.htm>

- Newman, Frank, Lara Couturier, and Jamie Scurry. *The Future of Higher Education: Rhetoric, Reality, and the Risks of Market*. San Francisco, CA: Jossey-Bass Publishers, 2004.
- New York Times Editorial, "Keeping the Public Colleges Afloat". New York Times, 2004.
- Northwest Ordinance, Article 3., printed in F. N. Thorpe, ed. *The Federal and State Constitutions, Colonial Charters, and Other Organic Laws*. Washington, DC: U.S. Government Printing Office, pp. 957, 1909.
- NRC, Committee on Developments in the Science of Learning. *How People Learn: Brain, Mind, Experience, and School*. National Research Council. Washington, DC: National Academy Press, 2000.
- NRC. *The Impact of Academic Research on Industrial Performance*. National Research Council. Washington, D.C.: National Academies Press, 2003.
- NRC. *How People Learn: Brain, Mind, Experience, and School*. Committee on Developments in the Science of Learning, National Research Council. Washington, D.C.: National Academy Press, 2000.
- Ohio 3rd Frontier Project. 2004. Pioneering the 3rd Frontier of Science and Innovation. Available online at: <http://www.ohio3rdfrontier.org/index.asp>
- OSTP (Office of Science and Technology Policy). *The American Competitiveness Initiative*. Washington, DC: U.S. Office of Science and Technology Policy, 2006.
- Paine, Thomas. *The Collected Writings of Thomas Paine (1791)*. New York, NY: The Library of America, 2003.
- Palmisano, Samuel J. "The Globally Integrated Enterprise". *Foreign Affairs*, May/June 2006.
- PCAST. *Sustaining the Nation's Innovation Ecosystems, Information Technology Manufacturing and Competitiveness*. President's Council of Advisors on Science and Technology, January 2004.
- Pensky, Marc. "Digital Natives, Digital Immigrants". NCB University Press, 9 (5), 2001.
- Peterson, Marvin W. and David D. Dill. "Understanding the Competitive Environment of the Postsecondary Knowledge Industry". *Planning and Management for a Changing Environment*, edited by Marvin W. Peterson, David D. Dill and Lisa A. Mets. San Francisco, CA: Jossey-Bass Publishers, pp. 3-29, 1997.
- Pew Center. *Investing in Innovation*. Philadelphia, PA: Pew Foundation and National Governors Association, 2007.
- Power, Philip, et. al. *The Center for Michigan: A Forum for Our State's*

- Future. <http://www.thecenterformichigan.net/>
- Prahalad, C.K. and Gary Hamel. *Competing for the Future*. Cambridge, MA: Harvard Business School Press, 1994.
- Raschke, Carl A. *The Digital Revolution and the Coming of the Postmodern University*. New York, NY: Routledge Falmer, 2003.
- Reed, Dan. "Computing for the Future: Release 2016". Chapel Hill, NC: Renaissance Computing Institute, 2006.
- Rothwell, Douglas. *Michigan Turnaround Plan*. Business Leaders for Michigan, September, 2009.
- Rhodes, Frank H. T. *The Creation of the Future: The Role of the American University*. Ithaca, NY: Cornell University Press, pp. 137-39, 2001.  
Rhodes is the former president of the first of the nation's truly public-private hybrids, Cornell University.
- Sacramento Bee*. "In cash-strapped state, how will we pay for public higher education?". *Sacramento Bee*, February 7, 2010.
- Sallee, Caroline M. and Patrick L. Anderson. *Michigan's University Research Corridor: Second Annual Economic Impact Report*. East Lansing, MI: Anderson Economic Group, LLC, 2008.
- Selingo, Jeffrey. "The Disappearing State in Public Higher Education." *Chronicle of Higher Education*, A22-A24, February 28, 2003.
- SHEEO. *State Higher Education Finance*. Washington, DC: State Higher Education Executive Officers, 2010.
- Stephens, Rick. "Running the Gauntlet: A STEM Ecosystem View", Testimony t House Science and Technology Committee, February 4, 2010.
- Stokes, Donald. *Pasteur's Quadrant*. Washington, DC: Brookings Institution, 1997.
- Suh, Nam. *On Innovation Strategies: An Asian Perspective*. Glion Colloquium VII, Glion-over-Montreux, 2009.
- Thomas, Douglas and John S. Brown, "Homo Sapiens, Homo Faber, and Homo Ludens: Living in a World of Constant Flux", in *University Research for Innovation*, VII Glion Colloquium. Paris: Economica, 2010.
- Vest, Charles M. *Clark Kerr Lectures, The University of California, Berkeley*. Berkeley, CA: University of California Press, 2005.
- Vest, C. M. (chair). *Final Report of the Secretary of Energy's Advisory Board Task Force on the Future of Science Programs at the Department of Energy*. Critical Choices: Science, Energy, and Security. U. S. Department of Energy, Washington, D.C., 2003.
- Weber, Luc and James J. Duderstadt, eds. *Universities and Business: Partnering for the Knowledge Society*, V Glion Colloquium. Paris: Economica, 2005.

- Weber, Luc and James J. Duderstadt, eds. *The Globalization of Higher Education*, VI Glion Colloquium. Paris: Economica, 2007.
- Weber, Luc and James J. Duderstadt, eds. *Innovation and University Research*, VII Glion Colloquium. Paris: Economica, 2009.
- Wiley, John. *Forward Thinking: The University and Wisconsin's Economic Recovery*. Chancellor's Report. Madison, WI: University of Wisconsin, 2003.
- Wulf, William A. "Warning: Information Technology Will Transform the University," *Issues in Science and Technology*, pp. 46-52, Summer 1995.
- Zemsky, Robert, William Massey and Gregory Wegner. *Remaking the American University: Market-Smart and Mission Centered*. New York, NY: 2005.
- Zemsky, Robert. *Making Reform Work: The Case for Transforming American Higher Education*. Rutgers, NJ: University of Rutgers Press, 2009.
- See also Robert Zemsky, "Will Higher Education Ever Change as it Should?". *Chronicle of Higher Education Commentary*, August 3, 2009.