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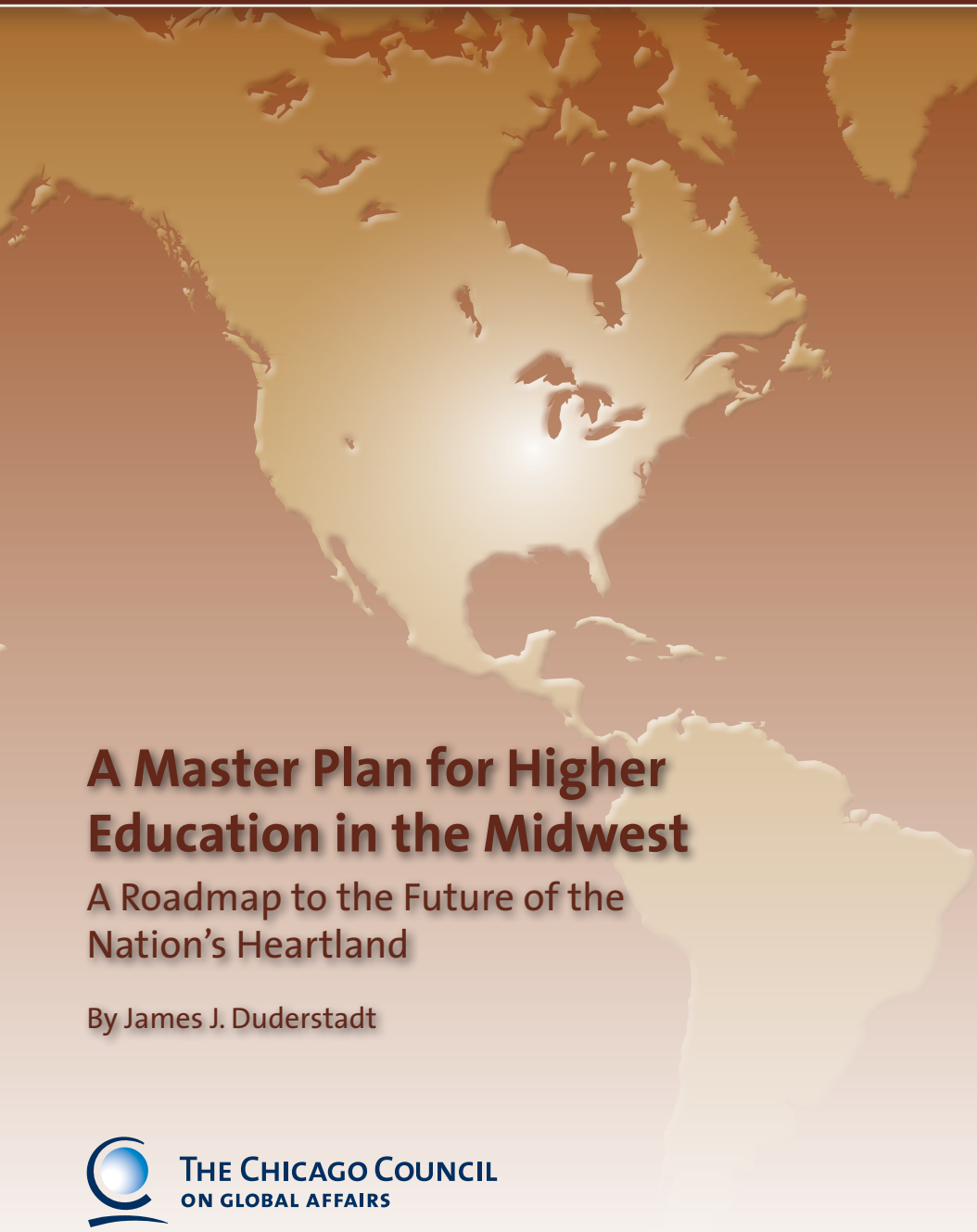
Heartland Papers



A Master Plan for Higher Education in the Midwest

A Roadmap to the Future of the Nation's Heartland

By James J. Duderstadt

The Chicago Council on Global Affairs

HEARTLAND PAPERS

A Master Plan for Higher Education in the Midwest:
A Roadmap to the Future of the Nation's Heartland

By James J. Duderstadt
Director, The Millennium Project
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The views expressed are strictly those of the author.

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The Chicago Council will sponsor the publication of a *Heartland Paper* when an issue arises that is critical to the Midwest region and national policy. Authors are expected to "benchmark" their findings against current policy in order to make explicit areas of agreement and disagreement. The authors are solely responsible for the published report. The Chicago Council takes no institutional position.

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About *Heartland Papers*

Heartland Papers are a monograph series devoted to helping the Midwest succeed in an era of globalization. Published by The Chicago Council on Global Affairs as part of the Global Midwest Initiative, *Heartland Papers* address issues that are vital to the future of the Midwest as it transitions from its industrial past. The views are those of the author(s), and The Chicago Council takes no institutional position. All statements of facts and opinions are those of the author(s).

In October 2008 The Chicago Council on Global Affairs launched the Global Midwest Initiative, a regional effort to promote interstate dialogue between government, business, and civic leaders about how best to respond to globalization. Through a series of conferences, seminars, and publications, including *Heartland Papers* and its Web site (globalmidwest.org), the initiative aims to serve as a resource for those interested in the Midwest's ability to navigate today's global landscape.

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Foreword

Of the many issues facing the United States and the Midwest in the twenty-first century, developing the region's human capital is one of the most urgent. The region must create, retain, and attract educated and engaged citizens in order to successfully compete in today's knowledge economy. Fortunately, the Midwest contains a wealth of institutions of higher education—local community colleges, liberal arts colleges, private universities, and huge state research universities—responsible for preparing this next generation of workers, leaders, and innovators. Unfortunately, for various reasons documented in this important *Heartland Paper,* the region risks falling behind.

With clarity and purpose, Dr. James J. Duderstadt shows that our system of higher education was created for the old industrial economy and is now outdated. If our region is to thrive and prosper in the new economy, this system must be reinvented and restructured to emphasize institutional cooperation and lifelong learning. Because an educated workforce is critical to competing in the new knowledge economy, it is essential that our leaders explore to collaborate and make best use of the rich resources our region offers. Dr. Duderstadt provides a roadmap to get us there.

This is the third report in The Chicago Council's *Heartland Paper* series, a set of reports based on original research that offer policy recommendations for regional success in a global economy. Through these reports and its broader Global Midwest Initiative, The Chicago Council focuses on the relationship of Chicago and the broader Midwest to the global economy, because the nation's future will be shaped by forces that affect its heartland.

Dr. Duderstadt is uniquely qualified to take on the challenge of reconceptualizing the role of the region's higher education institutions and offering strategies for moving forward. President emeritus and professor of science and engineering at the University of Michigan, he currently directs the university's Millennium Project, an initiative that explores how traditional higher education institutions can adapt to changing technology and global marketplace conditions. The Chicago Council is immensely grateful to Professor Duderstadt and his team for authoring this report.

The Chicago Council's Global Midwest Initiative team is also responsible for coordinating the final product. I especially want to thank the Council's senior fellow, Richard C. Longworth, whose book, *Caught in the Middle: America's Heartland in the Age of Globalism,*

led to the vision of this initiative and these reports. Rachel Bronson, vice president for programs and studies, Juliana Kerr Viohl, director of Global Chicago/Global Midwest, and Mia Luhtanen Arter, program coordinator, have guided and contributed to the development of the *Heartland Paper* series and the Global Midwest Initiative. I would also like to thank our editors Catherine Hug, Ellen Hunt, and Sahar Khan for their time and attention to detail.

The Chicago Council reserves special thanks for the Searle Funds of The Chicago Community Trust for its generous support of the Global Midwest Initiative. The commitment of community foundations to quality education and opportunity for all their citizens is a driving force behind the region's future success in the global economy.

Marshall M. Bouton
President
The Chicago Council on Global Affairs

March 2011

Preface

In his recent book, *Caught in the Middle*, Richard Longworth portrays the challenge to the Midwestern United States in a compelling way:

> Today, the Midwest region 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.

To achieve prosperity and security in a hypercompetitive global, knowledge-driven economy, the American Midwest faces the challenge of transforming 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 twentieth century, now it must make the commitment and the investments necessary to become the brains of the twenty-first century knowledge economy.

For the past four decades, I have experienced (and endured) this wrenching transformation at ground zero as a faculty member and then president of the University of Michigan. From this experience, as well as many others at the national and international level, I have become convinced of several imperatives of the brave, new world facing the Midwest: First, knowledge and innovation are the drivers of the global economy today, and their importance will only intensify in the future. Second, and as a consequence, 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. Third, 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 (e.g., research), world-class human capital (e.g., education), infrastructure (e.g., institutions, facilities, and networks), and policies (e.g., tax, investment, and intellectual property). And finally, I agree completely with Longworth and many others that while action at the state and national level will be important, the vision, power, and opportunity is shifting rapidly to the regional level driven by major metropolitan areas.

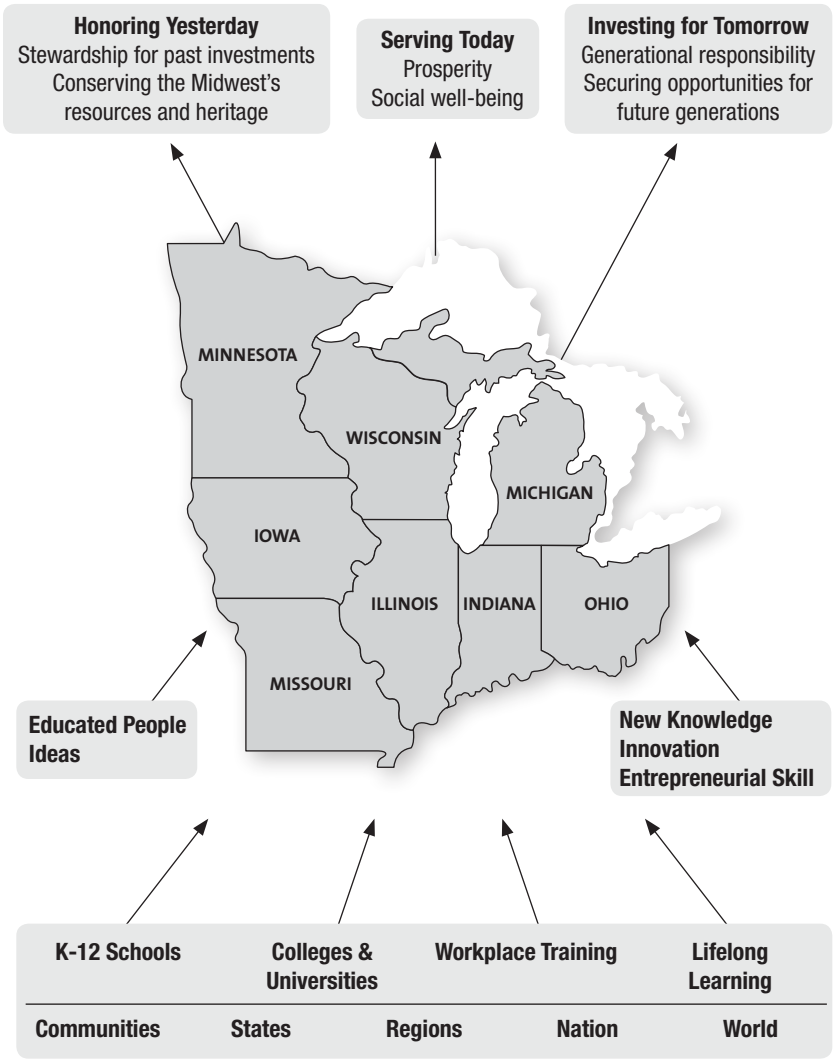
Hence when Richard Longworth approached me to prepare a report for the Chicago Council's *Heartland Papers* series on the role of higher education could play—indeed, must play—in the transformation of the Midwest region into a learning- and innovation-driven society, I was pleased to respond. My first 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 and the University of California made it clear that while a "master plan" focused on higher education made sense in the mid-twentieth 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 that is currently transforming higher education in Europe would be invaluable.

This report, then, should be viewed as one effort to develop not only a vision and plan to utilize the Midwest's rather considerable higher education assets to enable its transformation into a learning and innovation society, but as well to suggest both tactics and a process required to sustain this effort for the long haul.

Acknowledgements

Although the conclusions and recommendations in this report should be viewed as the responsibility of the author, the content has benefited immensely from assistance from many others: John Austin and Britany Affolter-Caine of the Brookings Institution whose seminal work on Great Lakes economic development has stimulated many of these efforts; Richard Longworth of The Chicago Council, who encouraged the development this *Heartland Paper*; Paul Courant and Edie Goldenberg, University of Michigan colleagues working on the future of public higher education; Lou Anna Simon, president of Michigan State University, who provided important feedback along with the concept of a "world grant" university; Barbara McFadden Allen of the Committee on Institutional Cooperation; Rick Detweiler and Greg Wegner of the Great Lake Colleges Association; and Mark Muro, who led the Brookings Institution effort to develop the innovation hubs proposal for the Midwest. The author would also like to acknowledge the efforts of and thank David Mickey-Pabello for his help in assembling key data characterizing the Midwest region.

For further discussion and documentation of the findings and recommendations in this *Heartland Paper,* one can find a more detailed report (in downloadable PDF format) on the Millennium Project website at http://milproj.dc.umich.edu/.


Honoring Yesterday
Stewardship for past investments
Conserving the Midwest's resources and heritage
Serving Today
Prosperity
Social well-being
Investing for Tomorrow
Generational responsibility
Securing opportunities for future generations
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Executive Summary

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 apparent that economic strength, prosperity, and social welfare in a global knowledge economy will demand a highly educated citizenry. It will also require institutions with the ability to discover new knowledge, apply these discoveries, and transfer them to the marketplace through entrepreneurial activities.

Today's economy no longer is locked within traditional geopolitical boundaries, such as states and nations. Instead, it spans 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. Yet, today the American Midwest, a region that once powered the global economy, created the middle class, fed the world, and defended democracy, is floundering in a twenty-first century global economy driven by knowledge and innovation. The Midwest is struggling to make the transition from an industrial agricultural and manufacturing economy to a knowledge economy.

One of the Midwest's most valuable resources critical to this transformation is its extraordinary array of colleges and universities—local community colleges, regional universities, independent liberal arts colleges, research universities, and for-profit providers. To help the Midwest position and use these remarkable assets, this report has applied a common planning technique, strategic roadmapping, to develop a higher education strategy for the Midwest region. Simply stated, the roadmapping process begins by asking where we are today and where we wish to be tomorrow, judges how far we have to go, and ends with a roadmap to get from here to there.

Building a twenty-first century learning and innovation infrastructure for a region clearly involves multiple players—institutions, states, and the nation more broadly. Furthermore while our focus is

the role played by higher education, this cannot be detached from other elements of the education continuum including K-12, workplace training, and lifelong learning. Hence our roadmap must span the entire education spectrum and its various patrons.

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 no more relevant 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.

Within these broad outlines, we suggest a number of reforms and recommendations, some obvious, some seemingly radical, but all aimed at reinvigorating Midwestern education and applying it to the recovery of the Midwestern economy.

At the K-12 level the Midwest must set high goals that *all* students will graduate with a high school degree that signifies they are not only either college- or workplace-ready but furthermore prepared for a world that will require a lifelong commitment to learning. This will require a significant restructuring of Midwestern schools, setting high standards for student and teacher performance, extending the school year, investing in modern learning resources, implementing rigorous methods for assessing student learning, preparing

and rewarding outstanding teachers, and managing and governing school systems in an accountable fashion. It will also depend upon sustaining a strong social infrastructure of families and local communities, particularly during times of economic stress. Finally, higher education must be challenged to become significantly more engaged with K-12 education. Each Midwest college and university should be challenged to develop a strategic plan for such engagement, along with measurable performance goals.

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. It will also require a renewed commitment to the fundamental principles of equal opportunity and social inclusion for the increasingly diverse population of the region.

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. To this end 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, etc.) is increasingly irrelevant in a competitive world that requires lifelong learning to keep pace with the exponential growth in new knowledge. Academic institutions should be provided with greater agility—albeit accompanied by greater accountability—to experiment, adapt, and evolve to address new challenges and opportunities. 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.

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 aligning 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.

The Midwest should encourage diverse missions for its colleges and universities. For example, research universities will play major roles in creating both the new knowledge and the scientists, engineers, and other knowledge professionals who are so critical for prosperity in a knowledge-driven global economy. Community colleges and regional universities will be essential in integrating 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. For-profit and proprietary higher education providers will play a key role in developing successful paradigms for educating adult learners. Independent colleges will continue to stress the important role of a liberal education in producing citizens for a rapidly changing twenty-first century world.

Beyond strengthening and focusing the existing education infrastructure of the region—its schools, colleges, and universities—it is clear that a changing world will demand these be augmented by new institutions addressing emerging needs. For example, the critical importance of increasing college degree attainment to levels required for a world-class workforce will require not only demanding dramatic improvements in the quality of our schools and colleges, but it will also require new institutions more capable of providing multiple paths to student access that adapt to diverse student learning styles and intellectual maturity. Here the German Gymnasium and British Sixth-Form college provide interesting paradigms to explore. Furthermore, the rapidly increasing skill and educational requirements of technical crafts and professions suggest the need for colleges focused on applied science and technology, such as the German Fachhochschulen or European polytechnic institutes. Lifelong learning requirements for adult retraining, upgrading of skills, and adaptive to rapidly changing markets—not to mention lifelong enrichment—can probably best be achieved by launching a regional analog to the British Open University or the Western Governors University.

Higher education also must play an increasing important role in driving much of the innovation necessary for global competitive-

ness of Midwestern business and industry. In particular, Midwestern research universities will play critical roles discovering new knowledge, developing innovative applications of these discoveries that can be transferred to society, while 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 missions should receive the highest priority for these world-class institutions, while undergraduate education remains the primary mission of the Midwest's other colleges and universities. 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 businesses; 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, state governments, and the region's congressional delegations 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).

What is really at stake today is building the Midwest's regional advantage, allowing it to compete for prosperity and quality of life in an increasingly competitive global economy. But today regional advantage is not achieved through politically popular devices, such as tax cuts for the wealthy, public subsidy of dying industries, or attempts to raid business from neighboring states. Instead it is achieved by creating a highly educated and skilled workforce. It requires public investment in the ingredients of innovation—educated people, new knowledge, and the infrastructure to support advanced learning and research. Put another way, it requires firm public purpose, visionary policies, and adequate investment to create a learning- and innovation-driven society.

I: Introduction

It is not the strongest of the species that survive, nor the most intelligent, but rather the ones most responsive to change.

– Charles Darwin

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. 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.

This world of an economy driven by education, knowledge, and innovation may be relatively new. But the Midwest already is behind. The purpose of this paper is to seek ways to close that gap and restore the Midwest to the status it enjoyed throughout the Industrial Era, as one of the economic engines of the world. 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 essential to creating the new jobs of the twenty-first century. 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 global 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 economy. From California to North Carolina, Helsinki 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 (e.g., R&D, innovation, and entrepreneurial activities), human capital (e.g., lifelong learning and advanced education, particularly in science and engineering), and infrastructure (e.g., colleges and universities, research laboratories, and broadband networks).

There is a second important theme that characterizes the emerging knowledge economy: the increasing connectivity enabled by modern communications and transportation technologies 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. 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. Instead, they 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 transformed the Midwest. The region's innovative and entrepreneurial spirit in key industries, such as agriculture, manufacturing, and transportation made the Midwest the geopolitical, cultural, and economic heartland of twentieth-century America.

But, more precisely, just what is the Midwest? It might be defined as those states in the midsection of the nation: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. More broadly, one could add portions of other states that also rim the Great Lakes

Figure 1 - One Definition of the Midwest

and line the Ohio watershed, notably western Pennsylvania and New York, West Virginia, and northern Kentucky, comprising the "Great Lakes-Midwest" region. Or we could add the Great Plains states of Kansas, Nebraska, and North and South Dakota. In fact, one might even cross national boundaries to add the Canadian Great Lakes provinces of Ontario and Quebec, creating 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, 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 twenty-first century global economy driven by knowledge and innovation. The region is hav-

ing 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)

The Midwest has many assets—the immense fresh water resources of the Great Lakes watershed, the region's limited vulnerability to natural disasters, such as earthquakes and hurricanes, its forests and fertile fields. Other characteristics have more questionable value. Its highways and factories, communications and urban infrastructure, and even its public priorities, evolved to serve a factory-based economy, not a knowledge economy, and today represent more of a liability than an asset.

Many of its workforce skills 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. Unhappily, the Midwest must reform and reinvent these assets to thrive in this economy.

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 (Glazer, 2010). Other states, regions and nations, from Europe to Asia, invest heavily in 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 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 the 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.

Perhaps nowhere is this inability to read the writing on the wall more apparent than in the Midwest region's approach to education. 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 nineteenth 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 nineteenth and twentieth centuries and today comprise the world's greatest concentration of com-

prehensive research universities. In the late nineteenth 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.

The strength of the Midwest—its capacity to build and sustain such extraordinary institutions—arose from its 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 and is estimated to have provided roughly 50 percent of America's economic growth since World War II (Augustine, 2005). It has become even more critical to our prosperity and security in today's hypercompetitive, global, knowledge-driven economy. But history shows that significant public investment is necessary to produce the essential ingredients for innovation to flourish: new knowledge (e.g., research), human capital (e.g., education), infrastructure (e.g., facilities, laboratories, communications, and networks), and policies (e.g., tax and 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 twentieth century. 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 and by one of the most formidable concentrations of outstanding research universities in the world.

Yet by the late twentieth century, the Midwestern economic picture had changed. Short-term planning cramped innovation. Restructuring led to the loss of hundreds of thousands of manufacturing jobs. The Midwest's Washington influence was used more to promote farm subsidies and to block federal regulation in areas, such as automobile emissions standards and fuel economy, than to

attract additional federal R&D dollars to the region. And state governments shifted 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 underinvesting 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, it needs 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 embracing pre-college, lifelong learning, and workplace-training activities—that is, 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.

This roadmapping effort begins in Chapter 2 by scanning the imperatives of the global knowledge economy. In Chapter 3 we discuss 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 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 develop the Midwest Roadmap for Higher Education itself, a set of goals and strategies designed to move the Midwest region toward this future. Finally, in Chapter 5 we turn to the tactics, plans, and processes necessary to achieve the objectives set by the roadmap studies. Here we consider 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).

A Call for Leadership

To be sure, it is difficult to address issues such as building world-class schools and colleges, developing a tax policy for a twenty-first 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 hypercompetitive, knowledge-driven global economy will no longer tolerate procrastination or benign neglect. For this effort to have value we believe that it is 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.

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. 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 Kerr, 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. (Kerr, 2001)

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 higher education, so goes the Midwest!

II: Setting the Context: An Environmental Scan

The trouble with our times is that the future is not what it used to be.

– Paul Valery

We are moving from a past century in which the dominant human activity was transportation to one in which communication technology has become paramount, from an economy based on 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 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 twenty-first century has become education.

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

The Knowledge Economy

Today 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. Nations are investing heavily and restructuring their economies to create high-skill, high-paying jobs in knowledge-intensive areas, such as new technologies, financial services, trade, and professional and technical services. From San Diego to Paris, 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. In the knowledge economy, the key assets driving corporate value are intellectual and human capital. And key to the availability of these resources are world-class schools, colleges, and universities.

Globalization

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. A truly domestic economy has ceased to exist. It is no longer relevant to speak of the health of state economies or the competitiveness of American industry, because we are no longer self-sufficient or self-sustaining. While once the Midwest achieved economic prosperity through applying mass production and organizational innovation to achieve the lowest costs in the nation, today it must compete with low-cost workforces in the rapidly developing economies of Asia and Latin America.

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 attract talent from around the world. 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.

Yet, globalization implies a far deeper interconnectedness with the world—economically, politically, and culturally—that goes 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 challenging our regional economies and cultures will also challenge our educational institutions—particularly our colleges and universities.

Demographics

Aging populations, out-migration, and shrinking workforces are seriously challenging the productivity of developed economies throughout Europe and Asia. Yet, here the United States stands apart because of another important 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. In fact, over the past decade, immigration from Latin America and Asia contributed 53 percent of the growth in the United States population (Frey, 2010). 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. Such population mobility is also rapidly changing the ethnic character of our nation. Yet, even without immigration the minority population in the United States will continue to grow for decades to come, rising to 42 percent by 2050. Minorities now comprise 40 percent of the Millennial generation of students now entering our colleges (Brownstein, 2010).

The increasing diversity of the American population with respect to race, ethnicity, and national origin is one of our greatest strengths, since such diversity contributes to our capacity to innovate and relate to a highly diverse global economy. But here American higher education faces a serious challenge, since the minorities comprising the most rapidly growing components of our population have traditionally had the lowest levels of college attainment. For example, the percentage attaining baccalaureate degrees for African Americans at 19 percent and Hispanics at 13 percent lag far behind those of whites at 33 percent and Asian Americans at 52 percent, a consequence of inadequate K-12 preparation, poverty, and discrimination (Chronicle, 2010). Our colleges and universities will not only have to dedicate a much greater effort but also develop new paradigms capable of serving rapidly growing ethnic minorities still burdened with inadequate K-12 preparation, impoverished backgrounds, and discrimination.

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, 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. 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).

Innovation

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 twenty-first century. "America's challenge is to unleash its innovation capacity to drive productivity, standard of living, and leadership in global markets. 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).

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 overall 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. It has been estimated that roughly 50 percent of the nation's economic growth over the past half century has been due to such innovation, much of it driven by the research performed by American universities.

The Implications for Education

These forces driving change in our world today make it 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. Our schools, colleges, and universities evolved from the educational paradigms of the eighteenth century serving primarily the elite, to the public institutions of the nineteenth century serving the working class, and then once again to knowledge-intensive institutions of the twentieth 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. 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 percent premium in 1980 to 130 percent today (College Board, 2010). Not so well known is an even larger earnings gap between baccalaureate-degree holders and those with graduate degrees.

Today over 80 percent of the new jobs created by our knowledge-driven economy require education at the college level (Glazer, 2009). For many careers, even a baccalaureate degree will no longer 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—and, indeed, to manage—change and uncertainty are among the most valuable skills of all to be acquired in college.

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. 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

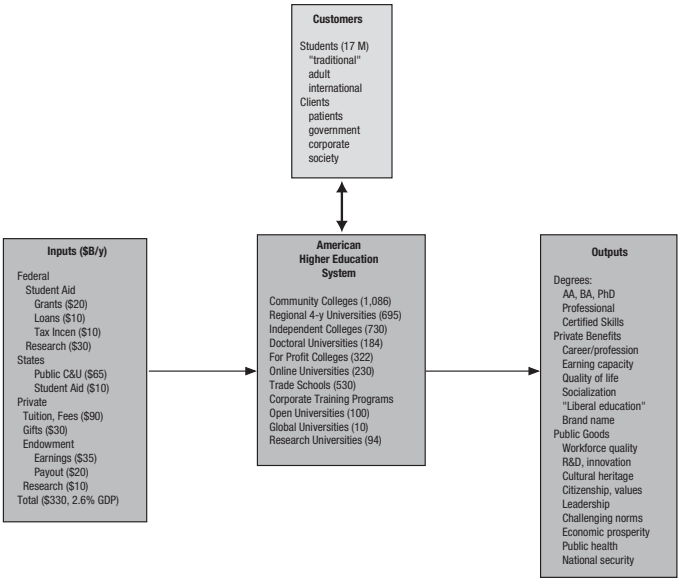
our aging population, the need for intellectual retooling will become even more significant. Even those without college degrees will soon find that their continued employability requires lifelong learning and advanced education.

To address this diversity 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.

Today the United States spends roughly 2.6 percent of its gross domestic product (GDP) on higher education ($335 billion/year). Public sources provide 45 percent of this support: the states provide 24 percent ($75 B/y) primarily through appropriations directly to public colleges and universities; the federal government provides the remaining 21 percent ($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 percent 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. But roughly half this cost is associated with non-instructional activities, such as health care, intercollegiate athletics, and economic development, missions that are 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.

Figure 2 - The American Higher Education Enterprise



Today in the face of limited resources and more pressing social priorities, the century-long expansion of support of higher education has slowed. Private colleges and universities have felt the impact of the Great Recession with declining private giving and plummeting endowments. Public universities are experiencing devastating cuts in appropriations as states struggle to cope with crushing budget deficits, while private universities are facing the erosion of private support from gifts and endowment income associated with a weak economy.

While the needs of our nation 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 colleges and 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.

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. Today, however, the tuition and fees charged for private universities are now beyond the capacity of most families (e.g., $40,000/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 $36,000 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).

Furthermore 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). To be sure, American research universities continue to provide global leadership in research, advanced education, and knowledge-intensive services such as health care, technology transfer, and innovation. But 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.

The National Commission on the Future of Higher Education (the Spellings Commission) 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).

III: The Midwest Today: The Challenge of Economic Transformation

The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise to the occasion. As our case is new, so must we think anew.

—*Abraham Lincoln,* signing the 1862 Morrill Act providing for the land-grant colleges.

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 the importance of investing both public tax dollars and private capital in areas key to prosperity in an industrial economy. The payoff was enormous. The Midwest led the world in productivity, technology, and prosperity.

Today the region is struggling, overtaken by a fiercely competitive global economy and hindered by a culture of denial that seeks to sustain 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.

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

Characteristics of the Midwest

The Midwest's assets include its 60 million people, with the population of the major metropolitan areas clustered in the Great Lakes region alone approaching 40 million. It is 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).

Yet, the demographics of the region pose a challenge. Midwest states lead the nation in out-migration, particularly among young adults seeking job opportunities. This coupled with a decline in birthrates and a large baby boomer population approaching retirement has led to declining productivity and increasing health care costs. It has shifted the allocation of tax dollars away from investments in the future through education and instead to priorities of an aging population, such as health care, retirement security, safety from crime, and tax relief.

Particularly important to higher education in the Midwest is the anticipated decline in the number of college age students over the next decade, anticipated to be as large as 15 percent in some areas (particularly Michigan, Minnesota, Ohio, and Wisconsin), in contrast to southern and western states where immigration has provided the population growth to compensate for these population boom-and-bust cycles. Already some areas have had to downsize K-12 education. As this decline reaches college age students, it will challenge many colleges and universities in the Midwest.

The sheer size of the Midwest region's economy is also 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. If it stood alone as a country it would be the second 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 leading European economics 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, dwarfing those of the West and the Northeast, and are exceeded only by exports from the South (Austin, 2008).

The Midwest traditionally relied on two enterprises for a living–farming and heavy industry. It was 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). 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.

Yet, today the Midwest has been pulled into the maelstrom of globalization and faces many challenges in transitioning from the industrial era, which it once dominated, to the knowledge age. It still relies 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. Many of its citizens and public are reeling from the inevitable economic transformation, on the defensive, desperately clinging to the past, to the habits and expectations of an earlier era when the region was a global agricultural and industrial power.

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. It is learning the hard way that if it wants to continue to prosper in this new world, the region must take the long view, invest in people and learning institutions.

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 of educated young people, its aging workforce, and the legacy of an industrial economy that once provided good jobs and wages without a college degree. Today 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 apparent in the recent Great Recession, in which 7.9 mil-

lion jobs disappeared in fields with low educational requirements, compared to 400,000 in fields that required more education. Today the states with the highest per capita income (e.g., Connecticut, Massachusetts, New Jersey, New York) have the highest percentage of college-educated workers (30 percent or greater), while those Midwest states experiencing declining prosperity are characterized by lower levels of college attainment (25 percent or less).

Although the generous employee benefits, job security, and income practices that powerful labor unions negotiated with profitable companies over the years were 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. These legacy costs have bankrupted many companies—including, of course, General Motors and Chrysler—and in turn swelled the welfare burdens of state governments. Ironically, these generous benefits also persuaded generation after generation of 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.

Today 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 United States as a whole. The skills of many of these workers have already become obsolete. Many others are high school dropouts, uneducated, and some are virtually illiterate. They are totally unqualified for any job other than the ones they just lost and, unfortunately, because of age and inadequate earlier educational opportunities, may no longer be trainable for the jobs of the emerging knowledge economy.

The impact of discrimination and lack of opportunities faced by ethnic minorities poses a particular challenge to the region's ability to compete in a global knowledge-driven economy. The most rapidly growing components of its population, Hispanics and African Americans, have the lowest college attainment: only 13 percent of

Hispanics and 18 percent of African Americans hold a bachelor's degree compared to 31 percent of whites and 50 percent of Asian Americans (OECD, 2008; Katz, 2010).

Many imagine Midwestern life to consist of small towns and cornfields. In reality over 80 percent of the region's population lives in large metropolitan areas. Cities such as Chicago, Cleveland, Detroit, Pittsburgh, and St. Louis evolved first as trading and transportation centers and later as industrial concentrations. 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 Illinois, Indiana, Michigan, and Ohio are quite urban, with economies based on heavy manufacturing and with rural communities based primarily on farming largely only a memory.

Midwestern cities face a difficult challenge: to globalize their economies and cultures 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 percent). 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 inability to attract either young knowledge workers or immigrants (only 7 percent).

Educational Resources

With their commitment to "an uncommon education for the common man," the settlers of the Midwest built what was once arguably the strongest educational infrastructure in the nation, characterized by outstanding schools, colleges, and universities. The region established the 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 raises the bar for educational achievement at all levels. Clearly the quality and performance of K-12 education is a critical issue for the Midwest region. Almost half of all Midwest adults are 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. Only one-third of high school students graduate with college-ready transcripts.

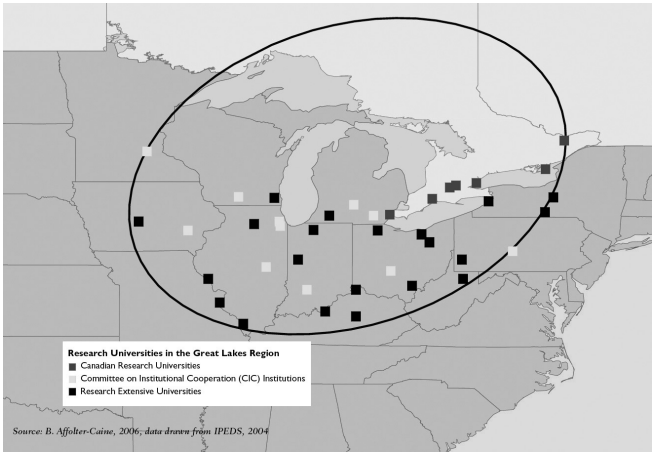
While state initiatives such the adoption of rigorous K-12 requirements, strong accountability standards, and freeing up the market with charter schools have had some impact, this is largely at the margin because of far more significant socioeconomic issues, such as the deterioration of the family and 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 their children. Michigan's students now may be able to compete with children from Ohio, but they are far behind children in Asia and Europe.

Inadequate K-12 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 States is too thin, too brief, and too lax. The result is a high level of remedial education required of colleges (and by employers), a practice both costly and inefficient.

The fact remains that throughout the Midwest too few citizens prepare for, participate in, and complete educational programs capable of preparing them for the knowledge economy. More generally, the leakage from our current education pipeline from primary education through secondary school and eventually to college and knowledge-intensive employment is clearly unacceptable.

Yet, it is at the level of higher education that the Midwest region may be at the greatest risk. For too long it has taken its colleges and universities—perhaps the most critical assets of the knowledge economy—for granted. Ironically, the Midwest has perhaps the strongest concentration of flagship research universities in the world. At its core is the CIC (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 and produce more scientists, engineers, doctors, 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 region, such as the University of Missouri, Washington University, Iowa State, Case-Western Reserve, Carnegie Mellon, Pittsburgh, Iowa State, and Cornell, the Midwest has a significant fraction of the world's top research universities.

Figure 3 - The Midwest's Research Universities



Source: Austin, 2008

With 33 percent of the U.S. population, the Great Lakes states produce 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, far outstripping any other region of the country. The region's research universities conduct over $9 billion/year of R&D, enroll over 300,000 undergraduates and 76,000 graduate students, and 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., University of Illinois in computer technology; University of Minnesota in chemistry and chemical technology; The Ohio State University in materials science and technology; Michigan State and Penn State universities in agricultural technology; University of Wisconsin and University of Michigan in engineering, the natural and social sciences, and biomedical science; Northwestern University in medicine and business administration; and The University of Chicago in the humanities and sciences).

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 tradition of global outreach and international development, reaching into all parts of the globe to open up new markets and access world-class human capital. Perhaps most important is a 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 Midwest region many of 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 has 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 colleges 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.

Yet, despite the extraordinary resource represented by the Midwest's colleges and universities, there continue to be many signs that they are rarely viewed as key strategic assets for the region's future. The Midwest states today spend an average of $5,700 per student for the support of their public colleges and universities—significantly below the national average of $6,900 and half that of leading states such as California and North Carolina. But even more disturbing is that, after a massive prison building boom in the 1980s, today the Midwest spends considerably 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.

Despite the growing importance of the research and advanced degrees (e.g., science, engineering, medicine, etc.) provided by the region's flagship public research universities, these too have experienced serious erosion in state support over the past two decades, with state appropriations now comprising less than 20 percent of their total operating budget. In fact the University of Michigan's state appropriation in 2010 has declined to less than 11 percent of its academic budget and 6 percent of its total budget, relegating the state to the position of the smallest minority stakeholder in the institution. Today the major public research universities in the Midwest are being forced by declining state support into following Michigan's evolution into "privately-funded but publicly-committed" universities.

The region's public universities have strained to hold tuition increases in check in spite of the erosion of state support. 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). Yet, as state support has declined still further, particularly during the recent recession, the quality and capacity of the Midwest's public universities are beginning to suffer. Student-to-faculty ratios and workloads have been increasing, eroding not only the quality of classroom instruction but also making it harder for faculty members to conduct the research critical to economic development. Declining state support has also had a serious impact on the ability of the Midwest's public universities to maintain strong financial aid programs, and enrollments of low-income students have declined significantly (e.g., as measured by the declining percentage of Pell Grant students) (Haycock, 2010).

The logical, although disappointing, conclusion: the Midwest region needs and deserves a higher education system that is much better than state governments apparently are willing to support.

Research, Development, and Innovation

New jobs in the Midwest are not going to be spawned by existing industry but instead will be created by entirely new activities, such as biotechnology, information technology and computer networking, and 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, requiring post-graduate education at the master's and doctorate levels.

R&D 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 Midwest 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 the nation's new ideas and new intellectual property—cornerstones of productivity gains, and new products and firms. For example, the Midwest states produce nearly a third of the nation's 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).

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, and its significant level of R&D, in recent years the Midwest 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. 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 Midwest metropolitan area 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; today those firms are concentrated largely on the coasts, leaving a void in the middle of the country. Ultimately, it may simply be that today the Midwest culture as it has evolved does not promote or encourage entrepreneurial behavior. Openness, engagement, and comfort with new ideas and people are central features of innovative communities, characteristics all too often ignored or resisted by those attempting to perpetuate the past.

The Writing on the Wall

Despite economic challenges and political myopia, the Midwest continues to possess powerful assets needed to compete in today's economy. It remains the advanced manufacturing cockpit of the world, with the sector becoming more competitive and productive, even as it employs 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.

Yet, clearly any candid appraisal of the Midwest's current situation does not inspire confidence. 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!" 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? 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?

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.

The Midwest's underinvestment 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 region today must restore an adequate balance between meeting the needs of an aging population and investing in the state's future through 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.

IV: A Higher Education Roadmap to the Future of the Midwest

The art of progress is to preserve order amid change and to preserve change amid order.

– Alfred North Whitehead

We now turn to the final phase by constructing a roadmap for the Midwest region. Of course, before we develop a map, we need to have a general sense of where we wish to go, that is, a vision for the future of the Midwest. Some guidance here can be found by answering three important questions:

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

Clearly a college education has become increasingly mandatory for most careers in the knowledge economy, probably at the bachelor's 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 a 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, and entrepreneurial zeal) is necessary to sustain a twenty-first century knowledge economy, and how is this achieved?

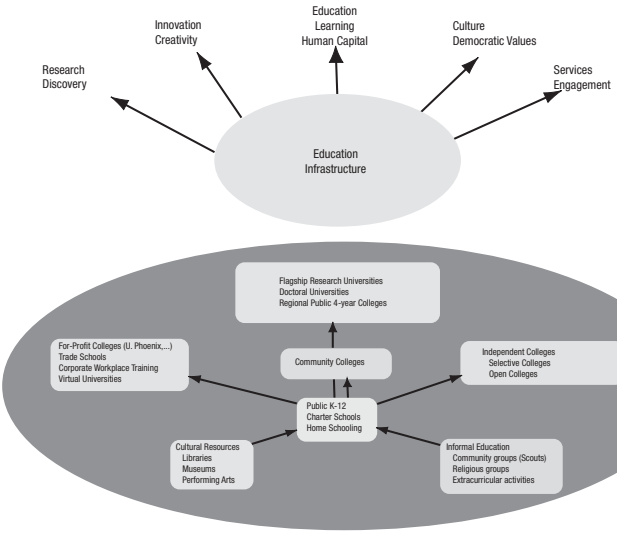
It has become increasingly clear that innovation is the key to global competitiveness in regions aspiring to a high standard of living. And the keys to innovation are new knowledge, human capital, infrastructure, and forward-looking public policies. Not only must a region match investments made by other 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" (à la Schumpeter) that characterizes the hypercompetitive global economy.

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.

A Vision for the Future of Higher Education in the Midwest

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,

Figure 4 - A "Learning Ecology" for the Midwest



in most areas, can learn and learn well using asynchronous learning, that is, "anytime, anyplace, anyone" education. Lifelong 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 a 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.

Stated in simple terms, the vision is to achieve a regional advantage for the Midwest in an intensely competitive, rapidly changing,

and knowledge-driven global economy. This will require creating a highly educated and skilled workforce that is competitive on a global level. It will require embracing a culture that values and stimulates creativity, innovation, and entrepreneurial behavior. It will require supportive infrastructure, such as world-class schools, colleges, and universities, research laboratories and cyberinfrastructure, and 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 twenty-first century world.

A Higher Education Roadmap for the Midwest Region

We now turn 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. Even in the near term, however, 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 demand-

ing, 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 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 (e.g., 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 entrepreneurism 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. K-12 is responsible to local communities and state boards of education. Public higher education is largely the responsibility of politically determined governing boards. Independent colleges usually are quite autonomous. Add to this an array of cultural organizations (e.g., museums and libraries), industrial resources (e.g., workplace training programs and corporate R&D), and informal learning opportunities largely out of sight, out of mind.

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 twenty-first century knowledge-services economy) and driven more by political ideology, patronage, and lobbying than as a strategic investment in the region's future. By elevating the dialogue 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.

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 underrepresented minority students. While detailed analyses of the necessary reforms in primary and secondary education are beyond the scope of this study, themes suggested by numerous other studies can be mentioned:

- 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 high goals that ALL students will graduate with a high school degree that signifies they are not only either college- or work-place-ready but furthermore prepared for a world that will require a lifelong commitment to learning. 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-place ready. The effort is underway in a number of states including the Midwest to better align K–12 graduation standards with college and employers, and 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). But we are suggesting that the bar should be set even higher: All stu-

dents 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 preparation for further college-level studies or success in the knowledge-driven workplace!

> **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 setting high standards for student and teacher performance, lengthening the school year, investing in modern learning resources, implementing rigorous methods for assessing student learning, preparing and rewarding outstanding teachers, and managing and governing school systems in an accountable fashion.*

Current international rankings 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.

> **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 reestablish 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 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 Midwest is to target public resources where they are likely to have the most impact on the region's future workforce.

Many parents still do not understand the imperatives of postsecondary education for their children's future. But 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. 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.

> **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 and should be encouraged to join in consortia to address the challenges of K-12 education.*

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 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 (science, technology, engineering, and mathematics) education. In the absence of such federal programs, state governments should consider assuming this role, perhaps in partnership with business and the philanthropic community.

> **Linkages and Pathways:** *The Midwest should create clear pathways among educational levels and institutions, remove barriers to student mobility, and promote new learning paradigms (e.g., distance education, lifelong and life-wide learning, social networking, and open education resources and collaboratives) 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 policymakers 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, and lifelong learning) and elements (e.g., public, private, for-profit, and corporate training) of education and the cooperation among the states.

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).*

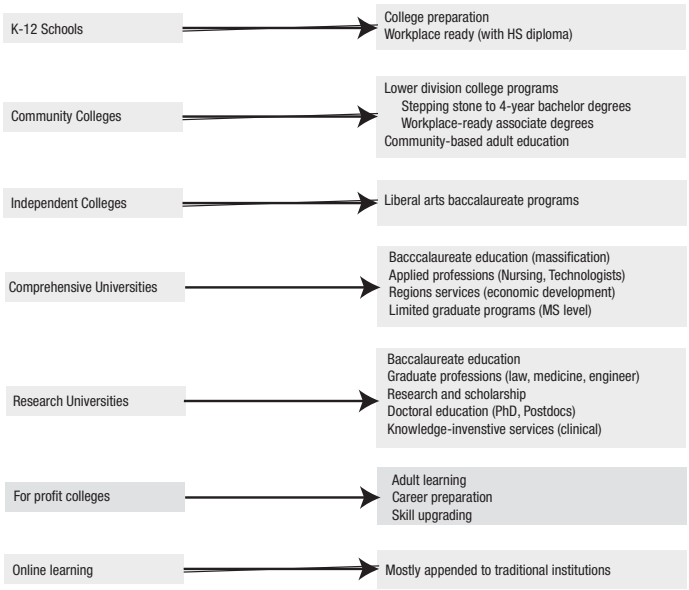
The low graduation rates characterizing American higher education (currently below 50 percent for a 6-year baccalaureate graduation) represent a serious challenge both in terms of human and economic cost. The region should simply refuse to tolerate such low degree attainment by students, faculties, and institutions. A region-wide effort should be launched to elevate graduation rates to world-class standards (e.g., that of Korea, now above 80 percent). 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 United States) (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.

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 twin goals of 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."

Figure 5 - The Current Core Missions and Competencies of the Midwest Education Enterprise



> **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, and 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.*

The environmental scan of Chapter 2 suggests the need for additional capabilities beyond those characterizing the current schools, colleges, and universities comprising the Midwest educational enterprise:

- A significant increase in baccalaureate degree attainment (50 percent or greater)
- Multiple pathways to advanced learning that adapt to diverse learning styles
- World-class training for the trades and technical professions
- Broader educational preparation for knowledge-intensive professions
- Lifelong learning for continual adult retraining and skill upgrading
- Lifelong learning for enrichment (particularly for seniors)
- More effective transfer of campus R&D to the marketplace
- Preparation for the unexpected and unimaginable

The Midwest should experiment with new paradigms of post-secondary general education. In particular, 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. For example, while modification of existing institutions have been proposed (e.g., allowing community colleges to offer baccalaureate degree programs in applied areas, such as nursing, or expanding online learning efforts of campus-based universities), these likely will yield only suboptimal solutions while possibly distracting current institutions from their more fundamental missions. Instead one should consider the introduction of new educational organizations with proven effectiveness from other parts of the world.

> **Adopting Best Practices from Abroad:** *Beyond strengthening and focusing the existing education infrastructure of the region—its schools, colleges, and universities—it is clear that a changing world will demand these be augmented by new institutions addressing emerging needs. Here the experience and practice of other nations should be considered as possibilities for the Midwest.*

The critical importance of increasing college degree attainment to levels required for a world-class workforce will require not only demanding dramatic improvements in the quality of our schools and colleges, but it will also require new institutions more capable of providing multiple paths to student access that adapt to diverse student learning styles and intellectual maturity. Here the Midwest might seriously consider adopting several of the highly successful models from Europe. For example, much of the concern about the quality of higher education in America arises from the transitional years of secondary and college education, grades 11-14, where the emotional and intellectual maturation of students is expected to occur within a general education curriculum. In Europe, students are provided with an additional one or two years of secondary education in rigorous college preparatory schools, such as the German Gymnasium and the British Sixth-Form college. This extension of secondary education not only reduces college attrition but it also eliminates the high costs of remedial and general education at the university level, allowing these institutions to focus on advanced instruction in the

disciplines. Furthermore, rapidly increasing skill and educational requirements of technical crafts and professions suggest the need for colleges focused on applied science and technology, such as the German Fachhochschule and European polytechnic institutes that have been successful in creating a world-class workforce in areas key to export-driven economies (e.g., heavy industry, advanced technology applications, and information services). Lifelong learning requirements for adult retraining, upgrading of skills, and adapting to rapidly changing markets—not to mention lifelong enrichment—can probably best be achieved by launching a regional analog to the British Open University or the Western Governors University that provide high-quality, accessible educational resources capable of meeting the lifelong learning needs of its population.

> **New Funding Paradigms:** *Alternative mechanisms for funding higher education should be explored, such as adopting a "degree tax" approach in which students pay for their education through differential taxing of 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.*

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. We could 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 by introducing income-dependent repayment mechanisms. This program allows students to receive their education loan 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 fields of urgent national need, such as teaching, public health, and community development. To alleviate the limitations of the American approach to income-contingent loan repayment, consideration might be given to the highly successful Australian loan repayment plans and the UK "degree tax" proposals, which are more dependent on income tax mechanisms.

> **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 an 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. The challenge of increasing diversity, however, 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.

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. As steps toward this vision, we recommend the following actions:

> **Increased Investment in Innovation:** *The Midwest should 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 reestablish 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).

The political influence of the Midwest on federal policy 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 government and 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.

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, university 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 twentieth-century agricultural and factory-based manufacturing industries rather than a twenty-first century knowledge economy. The region's tax codes must be modernized so that they do 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 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).

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 more than less technology-dependent programs during periods of inadequate state appropriations such as the past several years. 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, while the Midwest support of these critical activities has been stagnant over the past two decades.

> **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 (e.g., laboratories) and cyberinfrastructure (e.g., 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 twentieth-century industrial economy into that required for a twenty-first century knowledge economy.*

The Midwest must invest heavily to transform the infrastructure for a twentieth-century manufacturing economy into that required for a twenty-first 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 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 twentieth 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 twenty-first 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) (Edutech, 2010).

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 innovation 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 among 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 offer high quality undergraduate programs, their unique value to the region arises from their cutting-edge research and 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. 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.

> **Engagement in Economic Development:** *The research universities of the Midwest 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 governments 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).*

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 copyrights or patents 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. Yet, today the more intimate, nonlinear relationships between fundamental sci-

entific discovery, technology innovation, and market deployment demands new paradigms, such as the discovery-innovation institutes and innovation hubs recently being implemented to address critical national priorities, such as sustainable energy infrastructure (Duderstadt, 2010).

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).

The Challenges to 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. 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 twenty-first century knowledge economies gives us pause.

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).*

Moving into the top quartile of the states would require a 30 percent increase in support for higher education, while moving to the level of support provided in states with strong knowledge-based economies such as California, Connecticut, Massachusetts, and North Carolina, would require an increase of 40 percent. We recommend an intermediate objective of moving to the top quartile of the states by increasing state appropriations per student by 30 percent (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 pub-*

lic 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.

State investment in higher education must be approached in a far more sophisticated and strategic manner. 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 deductions 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 and research grants), gifts, and market-driven auxiliary activities (e.g., licensing income, executive education, intercollegiate athlet-

ics, etc.). 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. Indeed, many 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 percent to 40 percent, 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.

> **Changing State Higher Education Policies:** *Key to achieving the agility necessary to respond to market forces will be modernizing the policies that define the relationship between state governments 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, such as 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.

Such concerns have stimulated a reconsideration of the social contract between public higher education and state governments, 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.

The Challenges to the Midwest's 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. Today 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 a series of recommendations for the region's colleges and institutions designed to prepare and enable them for change:

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 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, etc.).*

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.*

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.*

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.*

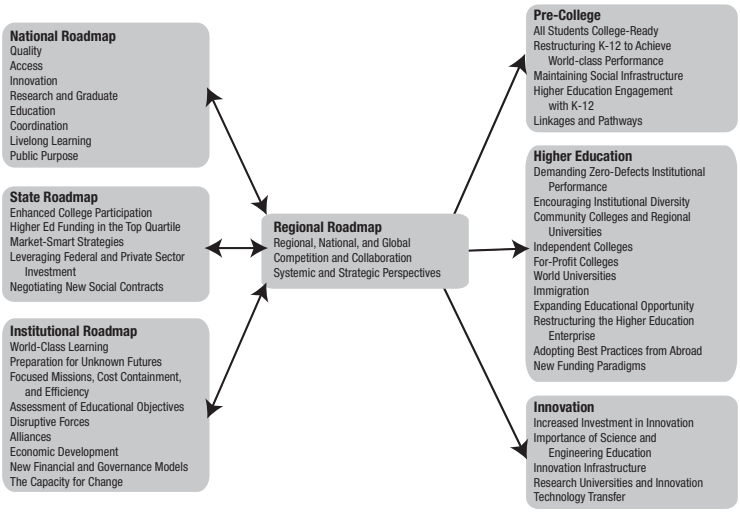
A Final Challenge

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 that should be 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. With each evolutionary wave, innovation in education has aimed at educating a broader segment of society, at creating new

Figure 6 - Various Levels of a Midwest Roadmap



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 twenty-first century are constrained, in part, by institutions, systems, policies, and politics which were determined by a twentieth-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 apparent 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.

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 great risks.

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.

V: Tactics, Plans, and Processes

There is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful of success, than to step up as a leader in the introduction of change. For he who innovates will have for his enemies all those who are well off under the existing order of things, and only lukewarm support in those who might be better off under the new."

—Niccolo Machiavelli, *The Prince*

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 education leaders, 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.

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?

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 obsolete practices and to focus instead on the imperatives of a knowledge economy: lifelong learning, research and innovation, and knowledge infrastructure. 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. It is appropriate to begin with a quick review of approaches that have been taking in similar regional planning activities. We begin with history.

The Land-Grant Acts

The federal 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 an extraordinary array of institutions with a popular and practical orientation, the land-grant colleges and universities, which today enroll more than 20 percent of all American college students.

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 several Midwestern states had already established state universities prior to the Civil War, the land-grant acts had great impact on the nation, stimulating the appearance of additional state universities 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 twentieth century was the California Master Plan for Higher Education of 1960 that responded to the rapidly changing economy and demographics of that state after World War II (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 twentieth 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 California Master Plan committed the state to one of most extensive promises any state government has ever made to its citizens by opening up higher education to all Californians who wished to attend.

Equally important was delineation of a clear strategy to achieve this goal. The California Master Plan differentiated the missions of each component of the state's higher education system—community colleges, the California State University system, and the University of California—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, doctoral education, and highly selective student admission (the top one-eighth of high school graduates) were limited to the University of California. The California State University system expanded to meet the needs for mass education (for students in the top third of high school graduates) at the baccalaureate level along with limited graduate programs in areas, such as teacher education. The community colleges provided low-cost educational opportunities at the associate degree level to all qualified applicants. The state assumed responsibility for the costs of instruction and adopted a realistic policy for imposition of other fees. Student financial aid was expanded so that 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. In addition, the Midwest 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 (e.g., North vs. South, urban vs. agricultural interests, etc.).

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 percent of the general fund budget in 1984 to 6.2 percent 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 growing recognition that the state's bold approach to organizing and funding higher education through the Master Plan may no longer be viable in the face of a weakening economy, changing demographics, and political divisions (Douglass, 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 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, twenty-six European ministers of education, meeting in Bologna, Italy, issued 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 most 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 dialogue established by the Bologna process has enabled faculty to focus more on what students learn and 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 to better differentiate 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 the Midwest is the process of extensive consultation and cooperation, now entering its second decade, which 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 effort. It was a process (rather than a plan) explicitly linking six sets of key actors: ministers of education, university leaders, student leaders, leaders of international organizations, European Union bureaucrats, and policy think tanks 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 Midwestern states are similar to those of the European Community. Like Europe, the Midwest is a region challenged by the fundamental economic transformations. 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 appro-

priate to consider 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 components of this effort involves the identification of key policy issues. 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 (e.g., K-12, higher education, industrial training, and community learning centers), and state government responsibility for providing or stimulating the digital infrastructure necessary to build a twenty-first century learning environment. Related to this would be an analysis of necessary investments from both the public and private sector.

Here the first step is to engage the attention and commitment of Midwest leaders from 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 through higher education collaboratives such as the Committee for Institutional Cooperation (i.e., the Big Ten) and national policy organizations such as the Brookings Institution, to jointly develop a detailed analysis of the economic and social challenges faced by our region. The media must convince the public of the risk our states face if they 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. 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 (e.g., in Chicago, Cleveland, Minneapolis) could host such activities. Existing higher education organizations spanning the Midwest region, such

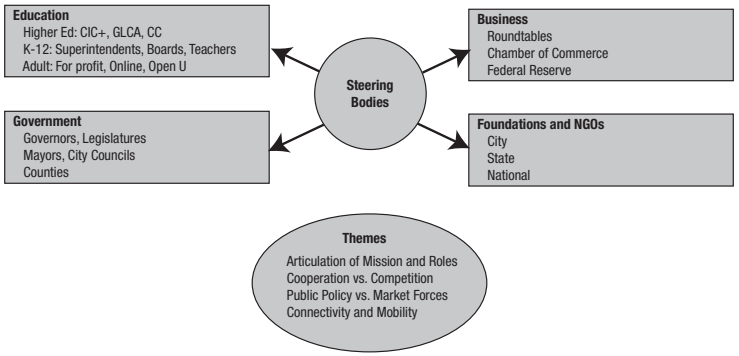
as the Midwest Compact and the Great Lakes College Association, should play key roles in linking colleges and universities to such leadership groups.

Third, someone must 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., MacArthur, Spencer, Kellogg, Joyce, Mott, Kauffman, 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 broader 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. Key in any such effort is a network linking leaders in the public and private sector. This network should 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. One might begin by establishing a standing leadership task force, with sufficient authority, resources, and longevity to propose and achieve the necessary strategic policy and fiscal shifts.

The membership of the task force might be 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 (e.g., 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

Figure 7 - A Possible Steering Framework



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 1960s to the various K-12 planning efforts stimulated by groups such as the Business Roundtable in recent years), this proposed effort would be distinguished both by its regional character and by an unusually broad vision of a society of learning characterized by pervasive educational opportunities for all citizens.

VI: Over the Horizon

The transition from a paradigm in crisis to a new one is, in effect, a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalizations as well as many of its paradigm methods.

—Thomas Kuhn, *The Structure of Scientific Revolutions*

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.

But there remain many other possibilities. Will increasingly robust communications technologies (always on, always in contact, high-fidelity interaction at a distance) stimulate the evolution of new types of communities (e.g., self-organization, spontaneous emergence, collective intelligence, and "hives")? Suppose info-bio-nano technologies continue to evolve at the current rate of 1,000 fold per decade. Can we really prepare today's kids for the world of several decades from now when technologies, such as neural implants, AI "mind children," stim-sim, and such may actually exist? During the twentieth century, the lifespan in developed nations essentially doubled (from 40 to 80 years). Suppose it happens again in the twenty-first century?

More generally, it is clear that as the pace of change continues to accelerate learning, organizations and innovation systems will need to become highly adaptive if they are to survive. Here, we might best think of future learning and innovation environments as ecologies that not only adapt but also mutate and evolve to serve an ever-changing world.

Such future challenges call for bold initiatives. It is not enough to simply build upon the status quo. Instead, it is important that we

consider more expansive visions that allow for truly over-the-horizon challenges and opportunities, game changers that dramatically change the environment in which our institutions must function. To this end, we conclude this roadmapping exercise both with some speculation about things that might happen—both near term with reasonable certainty and longer-term with considerable uncertainty—as well as a series of bolder proposals that would act as paradigm shifts in the very nature of the university.

Restructuring of the Higher Education Enterprise

Universities serve as the gatekeepers not only for the definition of the academic disciplines and membership in the academy, but as well as controlling entry to the professions that so dominate contemporary society. While there has been competition among institutions for students, faculty, and resources—at least in the United States—the extent to which institutions control the awarding of degrees has led to a tightly controlled competitive market. Furthermore, most colleges and universities serve primarily local or regional areas, where they have particularly strong market positions. As with most monopoly organizations, today's university is provider-centered, essentially functioning to serve the needs and desires of the faculty rather than the students they teach or the broader society that supports them.

Today this monopoly character is being strongly challenged, however. No university can control the growth of knowledge nor the educational needs of a society. Information technology is rapidly eliminating the barriers of space and time that have largely shielded campus activities from competition. As the need for advanced education becomes more intense, there are already signs that some institutions are responding to market forces and moving far beyond their traditional geographical areas to compete for students and resources. There are hundreds of colleges and universities that increasingly view themselves as competing in a national or even international marketplace. Even within regions, such as local communities, colleges and universities that used to enjoy a geographical monopoly now find that other institutions are establishing beachheads through extension services, distance learning, or even branch campuses. With advances in communication, transportation, and global commerce, several universities in the United States and abroad increasingly view themselves as international institutions, competing in the global marketplace.

Beyond competition among colleges and universities, there are new educational providers entering the marketplace. Sophisticated for-profit entities, such as the Apollo Group (i.e., University of Phoenix) and Laureate are moving into markets throughout the United States, Europe, and Asia. Already hundreds of Internet-based institutions are listed in college directories with over two million students enrolled in their programs, including major efforts, such as the Western Governors University. It has been estimated that today there are over one thousand corporate training schools in the United States providing both education and training to employees at the college level. Industry currently spends over $200 billion per year on corporate training. And, of course, the OpenCourseWare (OCW) movement and resources, such as iTunes U, are providing free access to Internet-based courses to millions around the world.

Although traditional colleges and universities enjoy competitive advantages based upon long-standing reputations and control of accreditation and credentialing, these could be eroded quite rapidly by the vast resources from capital markets that the industrial sector is capable of focusing on these efforts. Furthermore, the higher comfort level of industry with technology, intensely competitive marketplaces, strategic alliances, and rapid decision making could prove to be decisive advantages. Finally, with access to the vast resources of capital markets and unhindered by other social commitments or public governance, for-profit providers could cherry pick the best faculty and most attractive products (learning software, courses, or programs) from traditional educational institutions. The competitive threat is very real.

The faculty has long been accustomed to dictating what it wishes to teach, how it will teach it, and where and when the learning will occur. Students must travel to the campus to learn. They must work their way through the bureaucracy of university admissions, counseling, scheduling, and residential living. And they must pay for the privilege, with little of the power of traditional consumers. If they navigate through the maze of requirements, they are finally awarded a certificate to recognize their experience—a college degree. This process is sustained by accrediting associations, professional societies, and state and federal governments.

This carefully regulated and controlled enterprise could be eroded by several factors. First, the great demand for advanced education and training cannot be met by such a carefully rationed and controlled enterprise. Second, the expanding marketplace will attract new competitors, exploiting new learning paradigms, and

increasingly threatening traditional providers. And perhaps most important of all, newly emerging information technology has not only eliminated the constraints of space and time, but it is also transforming students into learners and consumers. Open education resources are providing learners with choice in the marketplace, such as access to learning opportunities, knowledge-rich networks and digital libraries, collections of scholars and expert consultants, and other mechanisms for the delivery of learning.

The evolution from faculty-centered and -controlled teaching and credentialing institutions to distributed, open learning environments is already happening. The new learning services are increasingly available among many providers, learning agents, and intermediary organizations. Such an open, network-based learning enterprise certainly seems more capable of responding to the staggering demand for advanced education, learning, and knowledge. It also seems certain not only to provide learners with far more choices but also to create far more competition for the provision of knowledge and learning services.

As a result, higher education is likely to evolve from a loosely federated system of colleges and universities serving traditional students from local communities to, in effect, a global knowledge and learning industry. With the emergence of new competitive forces and the weakening influence of traditional regulations, education is evolving like other "deregulated" industries, such as health care, communications, or energy. Yet, in contrast to these other industries that have been restructured as government regulation has disappeared, the global knowledge industry will be unleashed by emerging information technology as it releases education from the constraints of space, time, and the credentialing monopoly. And, as our society becomes ever more dependent upon new knowledge and educated people and upon knowledge workers, this global knowledge business will represent one of the most active growth industries of our times.

Many in the academy undoubtedly view with derision or alarm the depiction of the higher education enterprise as an "industry" or "business." After all, higher education is a social institution with broader civic purpose and not traditionally driven by concerns about workforce training and economic development. Furthermore, the perspective of higher education as an industry raises concerns that short-term economic and political demands will dominate broader societal responsibilities and investment. Yet, in an age of knowledge, the ability of the university to respond to social, economic, and

technological change will likely require a new paradigm for how we think about postsecondary education. No one, no government, is in control of the emerging knowledge and learning industry; instead it responds to forces in the marketplace. Universities will have to learn to cope with the competitive pressures of this marketplace while preserving the most important of their traditional values and character.

Lifelong Learning

The needs for lifelong learning opportunities in a knowledge society are manifold. The shelf life of education 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 reskilling 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 from time to time. 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.

Just as in earlier critical moments in our nation's history when federal initiatives expanded the role of education, such as the Land-Grant Acts in the nineteenth century to provide higher education to the working class, universal access to secondary education in the early twentieth century, and the G. I. Bill enabling the college education of the returning veterans of World War II, today a major expansion of educational opportunity could have extraordinary impact on the future of the nation. It is time for the United States 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 society.

Of course, establishing as a national goal the universal access to lifelong learning would require not only a very considerable trans-

formation and expansion of the existing postsecondary education enterprise, but it would also require entirely new paradigms for the conduct, organization, financing, leadership, and governance of higher 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.

Globalization

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 ensure that the canonical activities of universities—research, teaching, and engagement—remain rich, relevant, and accessible.

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.

As a new world culture forms, a number of universities will evolve into learning institutions serving the world, albeit within the context of a particular geographical area (e.g., North America). Many of our leading universities have evolved over time from regional or state universities to, in effect, national universities. Because of their service role in areas, such as agriculture and economic development, some universities have gone even beyond this to develop a decidedly international character. Furthermore, the American research university dominates much of the world's scholarship and research, currently enrolling over 450,000 international students and attracting faculty from throughout the world. In view of this global character, some of our institutions may evolve into a new paradigm, the world university.

Cyberinfrastructure

The information and communications technologies enabling the global knowledge economy—so-called *cyberinfrastructure*, the current term used in the United States to describe ICT hardware, software, people, organizations, and policies—are not only evolving exponentially, doubling in power every year or so, but changing dramatically in character. For example, information and communications services are increasingly delivered as a utility, much like electricity, from remote data centers and networks. Both hardware and software are now moving into massive network "clouds" managed by providers, such as Microsoft, Google, and Amazon. They provide not only global connectivity to organizations (e.g., corporations, governments, and universities) but also to individuals in rapidly changing forms, such as instant messaging, televideo, crowd sourcing, and affinity communities (Atkins, 2003). It is becoming increasingly clear that we are approaching an inflection point in the potential of these technologies to radically transform knowledge work. Many leaders, both inside and beyond the academy, believe that these rapid technologies 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.

Consider, for example, the changing nature of communication. When we think of digitally mediated human interactions, we generally think of the awkwardness of e-mail or televideo conferences. But as Dr. William Wulf suggests, "Don't think about today's teleconference technology, but one whose fidelity is photographic and 3-D. Don't think about the awkward way we access information on the network, but about a system in which the entire world's library is as accessible as a cell-phone." It is only a matter of a decade or so before exponentially evolving information and communications technology will allow human interaction with essentially any degree of fidelity we wish, perhaps even totally immersive in all of our senses as in the "sim-stim" (simulated stimulus) technologies envisioned by science fiction writers (Gibson, 1984).

To illustrate with an extreme example, if information technology continues to evolve at its present rate, by the year 2030, the thousand-dollar notebook computer will have a data processing speed and memory capacity roughly comparable to the human brain (Kurzweil, 2005). Furthermore, it will be so tiny as to be almost invisible, and it will communicate with billions of other computers through wireless technology.

For planning purposes, we can assume that by the end of the next decade we will have available infinite bandwidth and infinite processing power (at least compared to current capabilities). We will denominate the number of computer servers in the billions, digital sensors in the tens of billions, and software agents in the trillions. The number of people linked together by digital technology will grow from millions to billions. We will evolve from "e-commerce" and "e-government" and "e-learning" to "e-everything," since digital devices will increasingly become predominant interfaces not only with our environment but with other people, groups, and social institutions.

Open Knowledge Resources

Ironically, while we generally think in terms of terabit/sec networks and petaflop supercomputers, the most profound changes in our institutions may be driven not by the technology itself but rather by 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 OCW initiative, placing the digital assets supporting almost 2,000 courses into the public domain on the Internet for the world to use (Vest, 2006). Today, over 1,000 universities have adopted the OCW paradigm to distribute their own learning assets to the world, with over 15,000 courses now available online. New resources, such as Apple's iTunes U, are providing access to such open educational resources, with over 300 million downloads over the past three years.

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, already used by hundreds of universities around the world (e.g. Moodle and Sakai). Others have explored new paradigms for open learning and engagement, extending the more traditional yet highly successful models provided by open universities, such as Rice University's Connexion Project. 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. More recently major federal research agencies, such as the National Institutes of Health and the National Science Foundation, have implemented new requirements that both the data and publications resulting from their research grants be placed in the public domain on a timely basis.

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 (30 at last count in 35 languages) around the world to digitize a substantial portion of their holdings (15 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 U.S. universities (26 thus far) have pooled their digital collections to create the Hathi Trust ("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 twenty-first 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 access of a

significant fraction of the world's written materials to scholars and students throughout the world within a decade.

We should add into this array of ICT-based activities a few more elements: mobile communication, social computing, and immersive environments. We all know well the rapid propagation of mobile communications technology, with over 4 billion people today having cell-phone connectivity and 1.2 billion with broadband access. It is likely that within a decade the majority of the world's population will have some level of cell-phone connectivity, with many using advanced 3G and 4G technologies.

The University as an Emergent Civilization

So what might we anticipate over the longer term 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 exponential expansion of 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, such as Internet-based access to all recorded (and then digitized) human knowledge augmented by powerful search engines and AI-based software agents; open source software, open learning resources, and open learning institutions (e.g., open universities); new collaboratively developed tools (e.g., Wikipedia II, Web 2.0); and ubiquitous information and communications technology (e.g., inexpensive network applies, such as iPhones or iPads). 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 civi-

lization 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.

A Final Word

At the beginning of a new century and a new millennium, the Midwest must adapt to living with change as a fact of life. This change must become woven into the fabric of our daily lives, in the way we work, relate to each other, and experience the world. We must learn 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.

The future belongs to those who face it squarely, to those who have the courage to transform themselves to serve a new society. The challenge is to work together to provide the Midwest region with 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 one can never promise 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. 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 a sense of optimism and excitement about the future and a relish for change.

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.

About the Author

Dr. James J. Duderstadt serves as director of the University of Michigan's program in science, technology, and public policy as well as the Millennium Project, a research center studying the impact of rapidly evolving technologies on society. Prior to his current position, Dr. Duderstadt was the president of the University of Michigan from 1988 to 1996 and dean of the College of Engineering from 1981 to 1988. He has received numerous national awards for his research, teaching, and service activities, including the E.O. Lawrence Award for excellence in nuclear research and the National Medal of Technology for exemplary service to the nation. He currently chairs several major national study commissions in areas including federal and science policy, higher education, information technology, and engineering research.

For further discussion and documentation of the findings and recommendations in this *Heartland Paper,* one can find a more detailed report (in downloadable PDF format) on the Millennium Project website at http://milproj.dc.umich.edu/.

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