

Congressional Delegation

Introduction

As some of you may know, I am a scientist and engineer
by training and background...

I must also confess I tend to be one of those
people who lives more in the future than in
the present or the past...

I can remember that...

in the 1960s I was working out at Los Alamos
on nuclear rocket engines designed to
power the first manned mission to Mars...

in the 1970s I was working in an exotic
area known as laser-induced thermonuclear
fusion in which we were attempting to use
super high powered lasers to compress
matter to the incredible densities and
temperatures found in the center of stars..
and create tiny thermonuclear explosions
in the laboratory, hence providing a
limitless source of power...

in the 1980s I refocused my efforts on
building an Engineering College which I
believed could trigger a major economic
resurgence in this state...and lead
efforts to build world-class programs in
robotics, microelectronics, artificial
intelligence, while building new bridges
between the University and the private

sector

In the late 1980s as a member of the National Science Board, I have been working very hard with Erich Bloch and others to strengthen the science and engineering base of this country... with my particular focus on the development of the scientists and engineers we will need to keep our nation strong and

And, now, entering the 1990s, I find myself looking once again to the future, facing the challenge of helping to build a University able to serve our state and our nation in the 21st Century.

the model of a University for the 21st Century...

Themes of the Future

Think about it for a moment...

The students we are educating today will spend most of their lives in the 21st century...

Yet most of us...and our faculties...are products of the 20th Century...

Furthermore, the structure of the American university as we know it today is a product of the 19th Century!

And yet the American society we serve has changed dramatically during the past century and continues to change at an ever accelerating pace.

It is therefore both appropriate and important to ask the question:

Is the University as we know it today really prepared to

educate the citizens and serve the society of the 21st Century?

While it is always dangerous to speculate about the future, three themes seem very clear...the themes of pluralism, the internationalization of America, and, what might be called, "the Age of Knowledge"...

i) It will be future in which our nation becomes a truly multicultural society, with a cultural, racial, and ethnic diversity that will be truly extraordinary in the history of our civilization...

Let's look at the facts a moment...

America is changing rapidly...

By 2000, one-third of college age students will be from these groups...

By 2000, 47% of our school children (K-12) will be Hispanic or Black (25% today)

In the second half of 21st Century, Hispanics will become the

largest population group in America

Those groups we refer to today as

minorities will become the majority population of our nation in the century ahead...just as they are today throughout the world.

Some implications

During the 1990s, less than 15% of the people entering the labor force will be white males.

Because of the demographic decline in the college age population, America can anticipate a shortfall of almost one million scientists and engineers by 2010,

unless we can dramatically increase participation by
minorities and women

The shortage of educated graduates will be just as serious
in most other fields...

America of the 21st Century will be the most pluralistic,
multicultural nation on earth.

In this future, full participation of underrepresented minorities
will not be just a matter of equity and social justice.

It will be the key to the future strength and prosperity
of America, since our country cannot afford to
waste the human talent represented by its minority
populations.

America cannot afford the loss of this human potential,
cultural richness, and leadership.

If we do not create a nation that mobilizes the talents
of all our citizens, we are destined for a diminished
role in the global community and more tragically, we
will have failed to fulfill the promise of democracy
on which this nation was founded.

ii) It will be a future in which America will become "internationalized"...

in which every one of our activities must be viewed from
the broader context of participation in the global community...
as America becomes a "world nation", with ethnic ties
to every part of the globe...

1. The fact is, a truly domestic US economy has ceased to exist.
2. Market for nearly all significant manufacturing industries has become world-wide

3. In slightly more than 5 years, US trade deficit has taken us from the world's largest creditor to its largest debtor nation.
4. Jack Welch, CEO of GE, noted last November:
"Within the next 2 to 3 years, at most, the most important alliances will be forced in every significant global industry--medical, autos, defense, materials, and so on. Those who are slow to recognize the emergence of these global alliances or to act in forming them will find themselves locked out of the game as we enter the 1990s."

US is the destination of about half the world's immigrants
Probably 10 million this decade alone...

One-third of annual population growth is immigration

iii) It will be a future in which we rapidly evolve from a resource- and labor-intensive society to a knowledge-intensive society, in which intellectual capital...educated people and their ideas...become the keys to our prosperity, security, and well-being.

Our traditional industry economy is shifting to a new knowledge-based economy, just as our industrial economy evolved from an agrarian society at the turn of the century.

1. Industrial production is steadily switching away from material and labor intensive products and processes to knowledge intensive processes:

In a car, 40% materials, 25% labor...

In a chip, 1% materials, 10% labor, 70% knowledge!!!

2. Our nation's future has probably never been less constrained by the cost of natural resources. Future areas of growth are likely to come from the application of technologies that require few natural resources.
3. Increasing manufacturing production has come to mean decreasing blue collar employment!

In the 1920s, 1 of 3 was a blue-collar worker
today 1 in 6 and dropping fast
probably to about 1 in 20 within a couple of decades...

Indeed, UM economic studies suggest that less than 5%
of General Motors' work force will be unskilled labor
by the year 2000.

A transition in which..

Intellectual capital--brainpower-- is replacing
financial and physical capital as key to
our strength, prosperity, and well-being

Michigan and Higher Education

One of my predecessors stated very well the role of the University
in responding to these challenges before our society...

"The function of the State University is to serve the state
and through the state to serve the nation and the world."

It is interesting to note that the University of Michigan was
founded through action by Congress in 1817, 20 years
before our statehood.

And for the past 150 years, the University and the State of
Michigan have grown up together...with a strong partnership
between the people of the state and their university...
as the University responded to the

ever changing needs and aspirations of its people...

- i) First as it sought to tame the frontier
- ii) Then as it progressed through the industrial revolution
- iii) As America became a great world power
- iv) And then respond once again to the needs of a
surging population of the mid-20th Century...
the needs for economic development and diversification
in recent years...

And now, the vast resources of the University will be called
on once again to enable our people to prepare for a future
in which America becomes a pluralistic world nation,
more intensely dependent upon knowledge than ever before...

The view from Michigan... "the Rust Belt"...

While people generally look at the midwest as a relic
of America's industrial past, let me suggest that in
many ways, it can also be viewed as America's
future.

For it is in the industrial midwest...in Michigan...
that we have had to learn how to adapt to
a brave, new world of intense economic
competition...

We are learning to build new coalitions involving
the public and private sectors...state government,
education, business, industry, and labor...to
develop an agenda appropriate to secure the
future prosperity of this state.

We have also had to recognize that we must face
the challenge of change...as we make the

transition to a knowledge-based economy
in a world-wide marketplace.

The State of Michigan Response

As we look to the knowledge-intensive future of Michigan, we recognize as
have so many other states that it will be our great research universities
that will hold a key to our collective prosperity.

Importance of Research Universities

Importance of world-class research universities

Look around:

New England: --> MIT

Bay area-Silicon Valley --> Stanford & UCB

Southern California --> Caltech

Austin --> U. Texas

Why?:

Through research produce knowledge necessary for competitiveness

Produce talented professionals to implement new knowledge

Attract "risk capital" through massive federal R&D support

Key to knowledge transfer

Traditional: graduates, publications

Entrepreneurs

Startups

Development of Unique State-University Partnership

Universities must commit themselves to:

Strategically realigning activities into key thrust areas
of major importance to State...

Attracting leading scientists, engineers, and professionals
to staff these programs...

Developing new mechanisms for technology transfer...

State government must commit itself to:

Establishing higher education in general and the state's
research universities as a high priority

Providing seed resources to sustain key thrust areas

Developing novel institutions to act as catalysts in these activities

University of Michigan Actions

The University views itself as a partner with state and federal
government, business, industry, and labor in addressing
the needs of the State of Michigan.

Key:

Began to think and act strategically...how to better position ourselves
to better serve our state and its people

Hence, we chose as our thrust areas...

Complex manufacturing systems

Machine Intelligence

Advanced electronics and optics technology

Information Technology

Health Sciences

Applied Social Sciences

Other steps

1. Recruiting key engineers and scientists
2. Modifying ways we interact with outside world...
Strengthened interactions with industry
3. Intellectual property policies
4. Michigan Information Technology Network...

Cultural Changes

Reaffirmation of the importance of individual achievement,
of excellence...We have once again recognized the ability

of talented people to do great things -- if we will only get out of their way and let them!

Importance of establishing an intense, entrepreneurial environment...a no-holds-barred, go-for-it culture...in which individual initiative, achievement, and the quest for excellence are dominant elements

Already clear evidence of payoff...

1. Darling of the national press...

Hardly a week goes by without some reference to the phenomena occurring in "Automation Alley" ...from Warren to Ann Arbor... an area now clearly identified as the hot spot of action in technology for the next two decades...

California dreamin'

Places like Silicon Valley and Route 128 are buzzing about Michigan...we are now raiding their best talent...

2. University's federal research increased by 25% each of the past two years to over \$20 billion per year.

Industrially sponsored research has increased by 50%

Engineering research has more than doubled, to over \$40 million per year.

3. By focusing our resources, we have managed to create national centers of excellence in key areas such as

Complex manufacturing technology

Machine intelligence

Advanced electronics

Information technology

4. Beginning to win a few...

Howard Hughes Research Institute

DOD URIs (lion's share)

High Speed Electronics and Optics (Army)

Ship Propulsion and Hydrodynamics (Navy)

Expres

NASA Center of Excellence for Space Commercialization

National Center for Manufacturing Science

NSFnet

NASA ERC (Remote Sensing)

IBM/DEC/Apollo/Apple/Northern Telecom/....

Many other smaller activities

Several other major initiatives presently brewing...

too early to announce, however

5. National Image

U.S. News and World Report...

UM was ranked 8th in the nation in the

quality of its UG education-- UM

and Berkeley were only public

universities in the top 10...along

.head 4 - with schools like Stanford, Harvard/

Yale, c

d Princeton
heyd 3 + Professional Schools:

Law: 3rd

Engineering: 6th
hd 4 - Business: 7th

Medicine: 11th

For Michigan students, we have become the best bargain in higher education.

6. Confidence in University, buoyed by the new priority given by higher education by the state, have enable use to attract to our faculty many of the world's leading scholars and teachers, scientists and engineers.
7. And, at the same time, the University has continued to leverage the state's investment, attracting \$2 from outside the state for every \$1 in state appropriation. Moreover, activities of our graduates and applications of our research have an impact on state's economy that totals in the billions of dollars.
8. The growth of a \$4 B industry in industrial automation in the Detroit-Ann Arbor corridor has been traced directly to UM!
9. In 8 states bordering the Great Lakes, there are 16,000 companies producing high text equipment, including robotics, optics, biomedicine, computer software, and electronics.

BUT, Michigan's efforts have just begun...

We still have far to go to counteract the crippling deterioration of public support experienced in the 1970s and 1980s.

1. While Michigan ranks 8th in the nation in number of high school graduates and college students per capita, it has fallen to the bottom third in both tax dollars, per college (32) student and support of higher education as a percent of tax revenue (37). Indeed, in the ratio of allocation of

tax dollars to enrollment per capita (which is a measure of the importance of higher education in the state budget relative to (Eeed), we have fallen to 46th in the nation!!!

2. SRI Study suggests that we presently are underinvesting by as much as 30% in the knowledge infrastructure necessary to secure our state's future leadership and prosperity.
3. Of course, we are also aware that our state also ranks at the bottom in receiving our fair share of federal support...

Intense international competition, turbulent markets, rapid technological change present new challenges to our future.

And the infrastructure necessary for strength and prosperity in the 21st Century will not be roads or cities or electric networks...rather it will be an educated population...

And we will have to invest in the development of human resources as never before.

To stand still...to fail to make the investments in education... in our people... so necessary for tomorrow...is to lose the race for future prosperity and well-being of our citizens.

We really have no choice but to forge ahead, to pick up the pace, and to increase these investments in order to secure once again the position of leadership to which our state has long been accustomed.

A different way to look at it:

The Investment in Human Capital...

The real issue here is not the investment in education...

it is the priority, they will not become a sufficiently productive workforce to keep the checks coming to those who retire in future years!!!

By 2000, there will be only (three workers to support each retiree...and one of these will be minority!

Look at it c

other way...which is the better investment...

\$3000/y to keep a preschool kid on track

\$5000/y to achieve a strong X-12 education

\$10,000/y to sustain strong college education

or \$30,000/y to put someone in jail...

Importance of staying the course...

During a period with many other competing demands and pressures, it takes courage and vision to invest in education...that is to invest in the future.

But this is what we must demand of ourselves.

After all, generation after generation before us were willing to sacrifice for their children's future...in fact, to invest in providing us with the extraordinary opportunities we have today.

Can we do any less?

Or will we become the first generation in the history of America to leave our descendants worse off than we are?

It seems clear that in the knowledge-intensive future that Michigan and the nation faces, we really have no choice but to sustain and increase these investments.

The most highly leveraged expenditures we can make are those on the young.

Should examine our patterns of national expenditures more carefully, with an eye to how they treat human resources and favor the future.

To quote Business Week...

"In a \$4 trillion economy with a \$1 trillion federal budget, there is surely room for some shifts in

spending...away from plant and equipment and toward workers; away from the aged and toward the very young; and even away from guns and toward people."

In the long run it will be our investments in the most important resources of all, in education and research... that is, in people and their ideas, that will determine our future prosperity and well-being.