

Congressional Delegation

Introduction

Michigan and Higher Education

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

It is no small coincidence that the founding date of the University of Michigan in Ann Arbor is the 1837, the same as that of our State.

To serve...perhaps the most unique theme of higher education in America...

For the bonds between the university and society are particularly strong in this country...

Our institutions are responsible to, shaped by, and draw their agenda from the communities that founded them...

Perhaps this is nowhere more apparent than in our State of Michigan and with its institutions...

For example, the founding principle of this institution, can be found in those familiar words from the Northwest Ordinance above Angell Hall:

"Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged."

And perhaps it was appropriate that Michigan a state with seemingly infinite resources of fur, timber, iron, and copper... a state of boundless confidence in the future... should play such a leadership role in developing the models of higher education which would later serve American society.

For while the University of Michigan was not the first of the state universities, it nevertheless is regarded as the model of the true public university, responsible and responsive to the needs of the people who founded and supported it, even as it sought to achieve quality equal to that of the most distinguished private institutions.

So too, our sister institution, Michigan State University, was really the primary stimulus for the Morrill Act and the prototype of the great land grant university that has served America so well...

The State of Michigan, through these institutions and others which have arisen since, has provided a model of how higher education serves society...

- i) through the education they provide for their citizens
- ii) through their production of the scholars, professionals, and leaders needed by society
- iii) through the research and scholarship necessary to generate new knowledge
- iv) through the public service they provide across a broad range of societal needs
- v) and through their role as independent and responsible critics of society, the status quo...

These institutions grew up with our State...responding to the every 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) The theme of the evolving role and nature of the University appears once again in Burton's address, since the Great War had just ended, and America was facing a future as a 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...

Yet the strength of our State, its capacity to build and sustain such extraordinary institutions, lies not in looking to the past, but rather in its ability to look to the future...to take the actions and make the investments in the present that would yield prosperity and well-being for its people for tomorrow...

Hence, as I assume the responsibilities of leading this institution, it seems both appropriate and important that we look ahead...to determine what the themes of our future will be...and how this institution must respond.

(Hence, now is not the time to congratulate ourselves on our past...but a time rather to look to the future...to determine the challenges before our society...and hence the challenges before our institutions)

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

Today our state faces new challenges that will call once again on the vast resources of its University.

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 have learned through the school of hard knocks, as we have fought and scratched and clawed our way back from the economic brink to achieve prosperity.

We have had 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.

The Bad News of the past several years...

Familiar Ills which dominate the headlines

The budget deficit

The trade deficit

Displaced workers

Marginal Industries

More serious

Trade deficits show little improvement despite a sharp drop in the dollar

Past areas of strength such as steel and durable goods manufacturing are declining

Even industries like semiconductors and computers are vulnerable to competition from abroad

Facts of life:

7-fold increase in international trade since 1970

Market for nearly all significant manufacturing industries has become world-wide

70% of goods we produce now must compete against merchandise from abroad

The bad news for Michigan is obvious...

Industries of great economic importance to our nation such as steel and automobiles have fallen victim to intense competition from abroad...

Plants have closed...our cities are filled with chronically unemployed...

In Michigan we no longer worry about nuclear war and and the bomb because we believe that

"The odds are greater that America will be bought up by the

Japanese than blown up by the Russians..."

What is happening?

The world economy is now in control
However, it is misleading to blame all our ills on
international competitiveness alone!
Something else is happening...

What is happening?

1) THE INTERNATIONALIZATION OF AMERICA

It will be a future in which America will become "internationalized"...
in which every aspect of American life 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...

Some signs...

Communications, travel, smaller world
Internationalization of commerce and industry...
Security and interdependence...
Nuclear weapons....

Some facts of life:

Market for nearly all significant manufacturing industries
has become world-wide
There is also the "3rd technological revolution"
The joining of computers and telecommunications into a
single yet differentiated system, that of the "wired nation"
and even the "world society".
1st TR was application of steam power to transportation and
to manufacturing
2nd was the spread of electricity and chemical processing.
The fact is, a truly domestic US economy has ceased to exist.
Today, imports and exports represent about 10% of GNP...
70% of goods we produce compete directly with foreign goods.
In slightly more than 5 years, US trade deficit has taken
us from the world's largest creditor to its largest
debtor nation.

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."

America will no longer take its know-how and apply
it to low-cost natural resources from third-world
countries, turn it into products, and then sell it
back to them--as we do in a hierarchical economy.
Rather, we'll be only one member in a global
dynamic economy with tremendous network
interdependency between countries.

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
Indeed, now that native fertility rates have stood since
mid-1970s at 1.8 (below replacement level of 2.0),
immigration promises to become the main determinant
of future population variability

America is evolving into the first true "world nation",
shifting rapidly away from Eurocentricity into a society
with strong ethnic ties to all parts of the globe--
with a growing focus on the nations of the Pacific Rim.
US is no longer self-sufficient or self-sustaining. We are not

immune to the shocks of the world society. We have never been more vulnerable.

2) DRAMATIC CHANGES IN THE STRUCTURE OF OUR ECONOMY

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.

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!!!

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 by 2000...

(We now estimate that GM will reach this point probably before 2000...)

In a very real sense, the blue collared--that is, low skilled--worker is disappearing rapidly!

Fundamental transformation underway in economy that is "likely to reshape virtually every product, every service, and every job in United States."

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.

A transition is occurring in which..

Intellectual capital has replaced financial and physical capital as key to economic development

As Erich Bloch, Director of the National Science Foundation puts it, we have entered a new age, an "Age of Knowledge in a Global Economy"

The challenge today is to develop an agenda to achieve and sustain prosperity in a new environment of intense international competition and rapid technological change.

3) THE NEW MAJORITY...

America is changing rapidly...

By 2020, one of three Americans will be a person of color.

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

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

There seems little doubt that America of the 21st century will probably be the most pluralistic, multicultural nation on earth...and perhaps in history...

Our nation will face a challenge of diversity and pluralism in the years ahead that will determine our strength and vitality .

Less than 15% of new people entering the labor force of the 1990s will be white males.

Put another way, unskilled minorities are a growing fraction of the workforce and unless their abilities are upgraded, the nation's overall skill level will not be sufficient for tomorrow's economy.

Presently minorities fill 21% of 115 M jobs.

Of the 21 M jobs appearing before 2000, 57% will be filled by minorities.

NOTE: We must make special efforts to expand participation by these groups...not just because that is good social policy, but because we cannot afford to waste their talents!

Clouds on the Horizon

Maintaining America's competitive edge requires attention to our traditional strength -- people and research -- and a strong offensive strategy based on these resources. Taxes, trade, and fiscal policies influence economic competitiveness. But in the long run, a strong base of science and engineering research and education is more important. Central theme is that education, broadly defined, will play a pivotal role in the coming economic transition and its impact on individuals. Previous economic transformations were closely associated with major public investment in infrastructure such as railroads, canals, electric networks, and highways. In the coming economic transition, an equivalent infrastructure will be an educated population.

WARNING SIGN 1: America is slipping

No question that we have lost lead in many areas
Industrial productivity and heavy manufacturing
Steel, durable goods, ...
Moreover, key activities such as product design, engineering, and software development increasingly are likely to be done overseas.
Whether automobiles or refrigerators, computers or microchips, nuclear power or energy transmission systems, the likelihood is increasing that the systems are assembled from components designed, engineered, manufactured, and shipped from all parts of the world.
US trade deficit is only a symptom of America's lagging competitiveness. It means that the US economy has been living beyond its means.
The most serious long term problem is low productivity growth, however. With productivity growing at less than 1% per year, the American standard of living is falling relative to those in most industrialized nations. Our wages are already below those in Europe and Japan.
Over the long haul productivity growth is the main determinant of trends in living standards, and no amount of fiscal ledgerdremain can obscure a basic weakness.
The necessity for lower wage growth in US is result of lagging US productivity--that is, a lower rate of growth in physical output per worker and a declining advantage in technology and quality.
To do this, all the major inputs into our economy--quality of workforce, amount of capital investment, level of technology, and skills of managers--must be as good as the equivalent inputs going into the economics of our major competitors.
Key input, however, is quality of the workforce.
Our principal competitors are simply producing workers better capable of absorbing modern production skills. The lack of these skills is preventing us from achieving the productivity gains that we should be getting.

WARNING SIGN 2: We are seriously underinvesting in R&D and Education

For over two decades, US investment in civilian R&D has

dropped while that of our competitor nations has risen rapidly. US investment in civilian R&D as a percent of GNP is now less than that of any other developed nation (and only 60% that of Japan and West Germany...)

Almost all growth has gone into military research (70% of federal R&D budget)

Support of basic research has dropped significantly (as has support of research in C&S)

We need a major commitment by the federal government and industry to research on understanding how people learn and to the development of new educational technologies.

"If the fraction of gross expenditures invested in research were the same for education as for the average privately owned business in the United States, about \$9 billion a year would be spend on educational research--60 to 90 times more than the present allocation"

Note: While midwestern states such as Michigan and Ohio have undertaken many important new initiatives, we still lag considerably behind areas such as California and New England in our investment in knowledge-based resources such as education. We've come a long ways in the past few years, but we still have one hell of a long ways to go.

WARNING SIGN 3: The S&E Pipeline Problem

Today, an unprecedented explosion of knowledge marks the onset of a new era. Since people are the source of new knowledge, we will rely increasingly on a well-educated and trained work forced to maintain our competitive position in the world and our standard of living at home.

Yet the US faces a S&E manpower crisis of unprecedented proportions

0. Indeed, today the United States awards the smallest proportion of university degrees in science and engineering of any industrialized nation!
1. Proportion of graduating seniors who major in science and engineering is smaller today that it was in 1970s (5%). Particularly severe drops in physical sciences and mathematics. (Fallen by 40% over past decade)
2. Per capita production of US engineers lowest among industrialized nations:
 - US: 72,000 (3%) (7 in 1,000 graduates)
 - Japan: 85,000 (21%) (40 in 1,000 graduates)
 - USSR: 300,000 (35%)

Japan has doubled its technical workforce in past decade...
 7 of 1,000 American students receive engineering degrees
 40 of 1,000 Japanese -- indeed, Japan with less than half the population is producing far more scientists and engineers!

President of Sony:
 "In US you produce 4 lawyers for every engineer.
 In Japan, we graduate 4 engineers for every lawyer!"
3. More than 60% of engineering PhDs are now foreign
 Indeed, foreign students account for nearly 85% of growth.
 It is bad policy to be dependent on an unpredictable resource and not to be able to meet more of our needs with American tealent.

But things are going to get MUCH rougher: NSF Study

1. Demand for S&E likely to go up
 - Population is growing
 - S&E share of workforce is growing
 - Industry is becoming more scientific
 - Most experts predict growth in S&E jobs

2. Supply will probably fall off dramatically simply due to demographics...
 - Number of 22 year olds is a major driving force in determining BS S&E degrees
 - Traditional source of S&E college students is declining
 - 25%-30% falloff in HS graduates by 1992
 - Assuming that same fraction (4.8%) choose to enter S&E, and assuming constant demand (very conservative), drop will be from 197,000 (83) to 152,000 in 1996; there will be a cumulative shortfall of 930,000 by 2010!
 - To put it another way, fraction of students choosing S&E majors will have to increase by 40% to maintain even present level of graduates.
3. Trends in Intended Majors:
 - But this situation may become even worse:
 - Over period from 1966 to 1987, proportion of students who intended to major in physical sciences has dropped from 3% to 1.3%; in mathematics, the decline was from 4% to less than 1%.
 - Recent trends in engineering also show softening. Applications to most engineering schools are down by 10-20% this year. (USC 30%)
 - Interest in computer science is always waning. Drop from 4% in 1983 to below 2% in 1987.
 - Note: dramatic increase in proportion of freshmen interested in business majors--now up to 25% and rising rapidly
 - Furthermore, the dropout rate is extraordinary...
 - From 8th grade through PhD, the half-life of students in the mathematics curriculum is one year!
 - That is, if we begin with 32 million students in junior high school, we lose 50% each year until only a few hundred attain the PhD.
4. Composition of college age population is also changing...
 - In 1966 44% of college freshmen were women; today 52%.
 - By 2020 30% will be composed of Blacks and Hispanics...
 - students who have not traditionally chosen S&E careers.
 - Indeed, by the turn of the century, over 50% of K-12 students will be Black or Hispanic.
 - Less than 15% of new people entering the labor force of the 1990s will be white males.
 - The fastest growing pool of youths has the lowest participation rate in college and the highest dropout rate in high schools -- not to mention the least likelihood to study science and math.
 - Furthermore, virtually none of the Black college freshmen who score highest on the SAT intend to major in mathematics or the physical sciences
 - Among engineering students, 70% complete school...
 - but completion rate among Blacks is 30%; Hispanics 40%.
 - Indeed, while Blacks and Hispanics account for 20% of total population, they account for less than 2% of scientists and engineers!
 - NOTE: We must make special efforts to expand participation by these groups...not just because that is good social policy, but because we cannot afford to waste their talents!

Conclusions:

- i) If we couple demographics with student preferences, we have got a timebomb on our hands...

- ii) Indirect effects, since smaller enrollments in S&E will mean less justification for investments in faculty and facilities...
- iii) We must act rapidly...
 First to plug up the leaks in the pipeline...
 Then, over the longer term, to adapt the education system in American to a changing population

WARNING SIGN 4: Undergraduate S&E Education

NSB Report:

"Serious problems, especially problems of quality, have developed during the past decade in the infrastructure of college-level education in the United States in mathematics, engineering, and the sciences."

"The NSB concludes that the NSF must become a strong leader of a nation-wide effort to enhance the quality of UGS&E education, an effort that will require participation by public and private bodies at all levels."

Engineering Education

At the UG level, concern is primarily one of quality rather than quantity. Extraordinary quality of students attracted to engineering has masked the decline in the quality of instructional programs.

Few academic institutions have taken steps to re-establish a balance between engineering enrollments and resources through major internal reallocation or limits and reductions of enrollments.

While American industry has been a driving force in the intense demand for engineering graduates, it has been slow to accept a corresponding responsibility for supporting engineering at a level adequate to meet this demand.

Finally, federal programs have tended to focus on K-12 and graduate level education and research, largely ignoring the fact that the critical limiting factors in the supply of engineering graduates are at the UG level.

Industry did the same by focusing support on graduate education and research that was more closely related to corporate interests.

Nature of the crisis:

1. Faculty shortages
 - 2,000 vacant faculty positions...
 - 50% foreign national
 - Things are only going to get worse...
 - greying of engineering faculty...
 - return of foreign nationals...
 - demographics coupled with declining student preferences...
2. Facilities
 - Few schools have managed to maintain either the quantity or quality of facilities necessary to respond to surging enrollments and sophisticated technology
 - Absence of federal programs to assist in construction
3. Instructional Laboratory Equipment
 - Deterioration in lab equipment is a national scandal
 - NSF surveys indicate that only 16% is state-of-the-art
 - Backlog exceeds \$4 billion...
 - Similar investment in computing environment...
4. Curriculum
 - Growing vocational focus of engineering curriculum as more and more specialization occurs
 - Inadequate exposure to engineering practice--particularly in areas such as design, synthesis, and systems integration
 - Inadequate exposure to practicing engineers due to research focus and limited industrial experience of faculty
 - Traditional approach to instruction along discipline line is unable to keep pace with intellectual evolution of engineering

practice which tends to be cross-disciplinary in nature
General concern that entry degree should be M.S. degree
Haddad Report:

"Today's four-year baccalaureate engineering curriculum is largely obsolete. It does not provide adequate depth in engineering subjects, adequate breadth in engineering science and mathematics, or adequate exposure to engineering practice. Furthermore, the largely vocational focus of most undergraduate programs deprives today's student, characterized by broader interests and career objectives than in the past, of the liberal education so necessary to adapt to technological change and assume leadership roles in our society."

NSF Study Groups:

"The NSF program should be designed to deliver a good 2x4 shot across the buttocks of engineering education..."

"NSF's role should be to encourage and support the intellectual effort necessary to restructure the curriculum and teaching methods in the light of present day and near future technical realities. This should be a process of "bottom-up" rather than "top-down" direction of a program from the federal level."

NSF Response to Date:

NSB Report recommend +\$42 M in FY88 and +\$92 M in FY89 targeted across a variety of programs in curriculum development, laboratory instrumentation, faculty development, and so on.

Yet, in the aftermath of the December deficit reduction actions:

+\$8 M in FY88

+\$18 M in FY89 (although this is still at risk)

Hence, despite the rhetoric from the NSF, we still have a very long ways to go...

WARNING SIGN 5: PhD Education: our Future Faculty

of 10,000 HS sophomores, fewer than 20 receive PhD's

Hence US PhDs will decline due to reduced BS graduates

Foreign PhDs are beginning to return...

US universities are becoming less attractive...

we've become complacent

Like balance of trade problem--we are building our

infrastructure (including faculty) on foreign nationals

All multinational companies are going after US-trained

foreign nationals to be based in their home countries

PhD shortage in faculty...

Compensation (in constant dollars) was constant from 1964 to 1984

It has gone up by 21% in past 5 years and will accelerate even

more rapidly as the real PhD shortages appear late in the 1990s

WARNING SIGN 6: Technological Illiteracy

We really haven't appreciated impact of technology.

Today we are witnessing an unprecedented explosion of knowledge.

Technology doubles every 5 years in some fields!

Graduates are obsolete by the time they graduate!

Technological change is a permanent feature of our environment

Examples of just the past few months:

i) hole in the ozone layer over Antarctica

ii) new supernova in the heavens

iii) new high temperature superconductor

iv) a new theory suggesting that all matter is composed of infinitesimal "superstrings" rather than point particles

Yet, at the same time public ignorance is extraordinary!

A recent NSF survey indicated that only 18% of those

asked said they knew how a telephone works -- and

only half of these gave the right answer.
Yet more than half of those surveyed indicated they
believed we were being visited by aliens from outer
space!

And yet, our education system has not responded...

Note: it is bad enough that...

10% of Americans are illiterate

25% now fail to complete high school

Scientific Literacy of K-12 Teaching Force

Only 30% have had college chemistry

Only 20% have had college physics

Less than 50% have had calculus or computers

International Association for Evaluation of
Educational Achievement (IEA)

Grades 4, 8, and 12

US was 8th of 17 for 4th graders

US was 14th of 17 for 8th graders

US was 11-13 of 17 for 12th graders

Bottom 25% of US students were scoring at
chance level, indicating that they were
scientifically illiterate

(Top scores were Japan, Korea, Hungary

"For a technologically advanced country, it would
appear that a reexamination of how science is
presented and studied is required...in the
United States."

More than half of all our high school graduates have not
had even one year of science.

Face it, gang:

The tragedy is not simply our poor showing relative to other
nations.

Science, mathematics, and computer literacy will increasingly
become a requirement for almost all employment.

We are condemning an entire generation to a lifelong
estrangement from the very technology that will
inevitably govern their lives.

WARNING SIGN 7: America's Work Force is Becoming Obsolete

The education of the Michigan workforce is inadequate
to the demands of the next century.

Each year, 700,000 drop out of HS and 700,000 graduate
without functional literacy;

1,000,000 immigrants must be added to this.

Hence each year we have 2.5 million persons
entering our complex economy annually with
limited language and work skills

Yet our adult functional illiteracy rate is 13%--our high
school graduate rate is down to 72%--and our high
school graduates perform poorly relative to students in
the rest of the world.

Michigan is undergoing dramatic change in industry...

Away from low-skill, blue-collar workers

The factory of the future will have NO low skill workers

Statistical quality control and just-in-time inventory
systems require production workers with mathematical
abilities that are far beyond the present level.

Unskilled labor will lose relevance in a world dominated
by microelectronics, computers, and automation.

An example: Expert systems

The "expert system" craftsman...

About 45% of the job growth between 1980 and 1986 was in
professional and managerial occupations, and

almost 50% of the new jobs created between 1983 and 1986 went to people with at least 3 years of college. Of the net increase of 25 M jobs to be created by 2000, 40% will be professional or technical positions; 58% will be marketing and sales, administrative or supervisory.

Serious concern:

1. The present generation of blue-collar workers does not have the formal education to be retrained!!!
2. Little sign that education system is adapting to this future.

Key input, however, is quality of the workforce.

Our principal competitors are simply producing workers better capable of absorbing modern production skills. The lack of these skills is preventing us from achieving the productivity gains that we should be getting.

In the past few decades we have neglected education's collective economic function. Whatever its individual payoff, it determines the human quality of the team on which every American plays.

It is bad enough to face the prospect of a significant fraction of our labor force becoming permanently unemployable because of an inadequate education. Do we want to condemn their children...OUR children...to a similar fate? Can we afford it?

The economic challenge, in simplest terms, requires upgrading the skills of 25 million American workers by 40% by the end of the century. A strong back and willing hands will no longer suffice.

Some observations:

Claim: We are rapidly becoming a nation of illiterates ... in science and technology, no longer able to comprehend or cope with the technology that is governing our lives. Public's knowledge and understanding of science has not kept pace with technology

In the past few decades we have neglected education's collective economic function. Whatever its individual payoff, it determines the human quality of the team on which every American plays.

If, in the final analysis progress depends on having the generations who follow us be smarter and better educated than we are, it is evident that we are sliding backwards rapidly!

The State of Michigan Response

What should be the response of Michigan to the challenge of change -- to the Age of Knowledge in a Global Economy...

The handwriting is on the wall...

Taxes, trade, and fiscal policies influence economic competitiveness. But in the long run, a strong base of science and engineering research and education is more important.

Maintaining Michigan's competitive edge requires attention to our traditional strength -- people and research -- and a strong offensive strategy based on these resources.

People -- not equipment or buildings -- are the source of creativity.

They generate the knowledge that makes the technological innovation possible. They are the workforce that makes society run.

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 the 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

Today our state faces new challenges that will call once again on the vast resources of its University.

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...
 - We've become a showplace: Bobby Inman, Governors,...
2. University's federal research increased by 25% each of the past two years to over \$200 million per year. Industrially sponsored research has increased by 50% Engineering research has more than doubled, to over \$40 million per year.
3. Research Excellence Fund has created nationally recognized centers in:
 - Complex manufacturing technology
 - NSF believes we now have best faculty in nation in these areas
 - Machine intelligence
 - Advanced electronics
 - Information technology
 - These programs already have attracted three major national research centers funded at \$27 M.
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 with schools like Stanford, Harvard, Yale, and Princeton
 - Professional Schools:
 - Law: 3rd
 - Engineering: 6th
 - Business: 7th
 - Medicine: 11th
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 reserach 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 5th in tax revenue, we rank only 32th in appropriations per student and only 37nd in percentage of total appropriations allocated to higher education.
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.

If we fail to increase the rate of investment, Michigan will not only risk falling behind other midwestern states, but regions such as California and New England will pull even farther ahead...and

We are being outspent by 30 - 40%
in state support per student...

Not simply by prosperous states like
California...but by neighbors such as
Indiana and Ohio!

pull our industry with them!

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

To stand still...to fail to make the investments in our research universities 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.

Importance of staying the course...

The renewed investment in higher education of recent years has taken extraordinary vision, courage, and determination on the part of state government, particularly during a period with many other competing demands and pressures.

However, it also seems clear that in the knowledge-intensive future that our state faces, we really have no choice but to sustain and increase these investments.

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

Michigan should not...indeed, it must not...rest until we have secured our position of leadership so critical to our state's future by restoring the capacity and competitiveness of our research universities.

The citizens of this state will demand nothing less!

The Dangers...

Is our state willing to make the investments necessary today...
to build the prosperity we desire for tomorrow?

Education always falls at the bottom of the list of social needs.

Even though surveys indicate public supports education, our elected public officials do not seem to listen. They prefer to fund roads or prisons or football stadiums rather than the education of our youth!

Is this because of an aging electorate?

Is it the "Me Generation" of the 1960s now growing up into mature Yuppiehood?

No. Rather it is the fact that for many years now we simply have not been willing to invest in our future...and the future of our children...

We have chosen instead to mortgage this future to pay for mistakes
make in our past.

Six-month planning horizon...desire for immediate results...inability

to identify the investments which have to be made today to yield the objectives for tomorrow.

The old T-shirt expression: "Eat dessert first, life is uncertain" reflects our present tax policy.

The attitude we have taken toward our most precious resource, our youth, is both callous and alarming.

I simply cannot accept the excuse that "we can no longer afford this investment in the educational opportunities we offer our youth".

To be sure, the immense social needs for welfare assistance, medical care, prisons, and all of the other programs that drain our tax dollars are compelling.

However, by choosing to meet these needs with resources taken away from our system of public education rather than through reforms in our tax structure or political system, we have in reality mortgaged our future by withdrawing the educational opportunities from our youth.

We seem to have forgotten the commitments that past generations of citizens have made to build educational institutions of exceptional quality -- institutions that have provided many of us for years with unsurpassed educational opportunities.

All human societies embody to endow their children with an enlarged and enriched culture, for transmission to their successors.

If it is not to be our young people and their work that will gain us a secure place among nations and our better life for our citizens, then what will it be instead? And if we fail to invest adequately in the successor generation, then what kind of caretakers of our heritage and theirs will they turn out to be?

We are a nation that has always believed deeply in generational improvement--in the prospect that things will be better for our children.

Americans must put aside their suspicions and answer that call, because the result of failure will be that 40 years from now a generation will stand where we are today and know that things are, for the very first time in history, worse than they were for their fathers and mothers.

At center of problem is inability to formulate and pursue a strategy of investment.

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

We simply must re-establish the importance of both our personal and public investments in education, in the future of our children, in our own future, at the local level if Michigan -- indeed, if our nation -- is to face the challenge of the age of knowledge.

Your Challenge...and Our Commitment