Minnesota's Proposal to US WEST

I often refer to Minnesota as the "brainpower state." And I believe that, as you analyze this proposal, the U S WEST site selection team will understand my claim.

Minnesota has the highest high school completion rate in the country and the third highest college entrance exam scores. We have the largest urban university campus, the finest private college network and the best vocational-technical education system in America.

It is no coincidence that three of the world's five largest computer firms call Minnesota home, and another has a major facility in our state.

The Twin Cities metropolitan area, where more than half the state's population is centered, is the address of seventeen Fortune 500 companies, including a major banking system, the country's third largest airline company, and some of the world's most renowned manufacturers of high quality products.

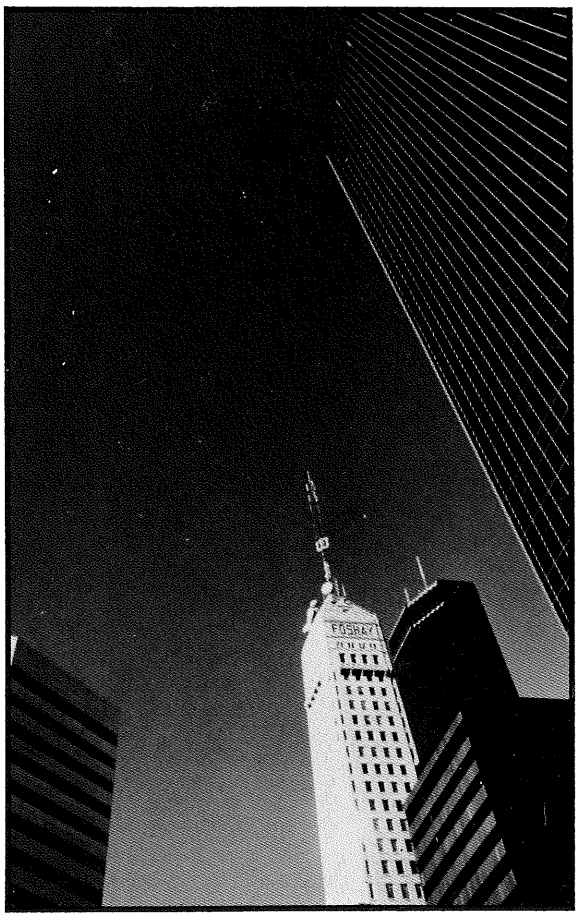
The fact that so many large, successful corporations started in Minnesota was not by chance. Minnesota has been a national leader in creative research and technology innovation since the 1890s, when development of a process for milling spring wheat led to the creation of corporate giants Pillsbury and General Mills. This tradition of technology research and development has resulted in more patents being issued to Minnesota residents than in all but four other states in the nation.

We have carefully developed responses to your questions about our state. No specific sites have been proposed because the number of excellent sites is so large. However, we are prepared to assist your team in the selection of a site and will begin that process at your direction.

I encourage you to closely examine our proposal. You intend to be "trailblazers" in telecommunications advanced technology. You will need to attract top-notch engineers, to have an environment conducive to research and, ultimately, to take your ideas to market. I am confident you will succeed in this endeavor in Minnesota.

Rudy Perpich
Governor

Executive Summary



Executive Summary

To succeed, U S WEST's Advanced Technologies must be situated in a metropolitan area which can assure the company of obtaining the quantity and quality of scientists and engineers it needs to develop the highly technical communications products and systems of the future. Such an area must possess the following characteristics:

- A vibrant network of research-driven and technology-intensive companies that creates a dynamic research environment in which the constant flow of ideas among professionals interacting in the research community stimulates innovation;

- A top-flight educational system able to produce, now and in the years to come, capable high school graduates ready to assume the challenges of further study in scientific and technical disciplines;

- A premier research university with demonstrated strength in engineering, computers and the physical sciences, and a solid history of cooperation with industry to develop and commercialize new technologies;

- A quality of life that will serve as a magnet to draw talented professionals from across the country and retain them, minimizing labor turnover and ensuring high levels of employee productivity.

Minnesota offers a degree of excellence in these areas unmatched by any other state in the country.

A TOP-FLIGHT EDUCATIONAL SYSTEM

Minnesotans have been committed to creating a quality system of public education for generations. The state consistently ranks among the top ten in educational spending per capita. As business decision-makers, you know the difference between expenditures and investments. Minnesotans consider public spending on education their most important investment in the future.

And those investments pay off: the state boasts the highest high-school graduation rate in the country, and the third-highest ACT scores.

A PREMIER RESEARCH UNIVERSITY

Similar results are evident at the University of Minnesota, one of the largest post-secondary institutions in the United States. The University is especially strong in areas of interest to U S WEST. According to ratings of faculty quality made by the National Research Council in 1982, Minnesota faculty ranked first among all universities in the 14 U S WEST states in electrical engineering, mechanical engineering and mathematics; second in physics; and third in computer science. In 1986, the University graduated the bulk of the state's 773 computer scientists and 342 electrical engineers. Statistics indicate that 50 to 70 percent of these students remain in Minnesota.

A TECHNOLOGY-INTENSIVE INDUSTRY NETWORK

Minnesota's list of technology-intensive firms reads like a Who's Who of high-tech: Cray Research, Control Data Corporation, 3M, NCR Comten, IBM, Honeywell, Medtronic, among them. Several of the largest are among the 17 Fortune 500 Manufacturing Firms headquartered here, more than are found in Colorado, Washington, Oregon and Iowa combined.

In all, more than 1,500 technology-intensive firms are based in Minnesota, employing more than eight percent of the state's work force. The state has significant representation in 28 of the 30 industries that the Brookings Institution defines as high-tech. In 1985, Minnesota's industrial community spent $1.7 billion in research and development, second highest in U S WEST's region and 11th nationwide.

These firms have drawn their professional staff not only from Minnesota's educational institutions, but have also attracted workers from throughout the U.S. As a recent *Wall Street Journal* article on the Twin Cities high-tech community put it, "Considered one of the nation's most livable cities, Minneapolis tends to attract and hold professionals. 'I suppose once their feet get frozen to the ground, they can't leave,'" said one Boston-based investor.

Minnesota's high-tech firms have discovered first-hand what the Corporation for Enterprise Development and SRI/Ameritrust found in recent studies of business climates in all 50 states: Minnesota's business environment is fertile ground for technology-intensive industries. The CED study ranked Minnesota second highest in the country, after Massachusetts, based on a list of 75 variables. Minnesota was the only state in the nation to rank in the top ten in each of three indexes in the SRI/Ameritrust study.

Minnesota's tax climate is also conducive to the growth of high-tech firms. The state's income apportionment formula weighs Minnesota sales 70 percent, giving a 15 percent weight each to property and payroll. As a result, firms with few sales in the state -- such as research facilities -- are able to minimize their tax bills. A state research and development tax credit will help U S WEST to virtually eliminate its corporate income tax liabilities in its first years of operation and to substantially reduce liabilities in the future.

AN OUTSTANDING QUALITY OF LIFE

Some states have natural beauty; others have cosmopolitan cities offering a wide array of cultural activities. Minnesota has both.

The Twin Cities metropolitan area has 951 of Minnesota's more than 15,000 lakes and offers a choice of five rivers for boating and canoeing opportunities. Forty-eight regional parks are in the metro area, containing 47,000 acres. Three of a total of 61 state parks are also within the region, adding another 14,000 acres for hiking, camping and fishing.

This is the same Twin Cities which Arthur Frommer picked in 1986 as one of the top ten vacation spots in the world, remarking that it "now has the distinction of being a cultural capital of the nation ranking second only to New York City."

Dozens of theaters are here, capped by the Guthrie Theater, one of America's premier regional playhouses. The Twin Cities also has two orchestras to choose from: both the Minnesota Orchestra and the St. Paul Chamber Orchestra are world-renowned musical organizations. The Walker Art Center has one of the finest modern art collections in the country, and regularly hosts outstanding international exhibits shown in only a handful of cities across the U.S.

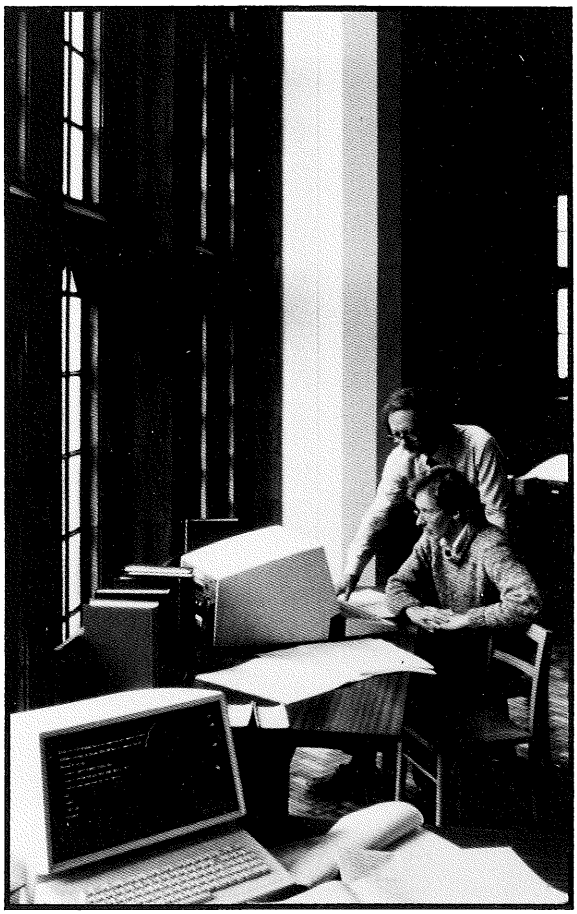
With the Minnesota Timberwolves now scheduled to enter the National Basketball Association in the 1989-90 season, the Twin Cities is one of only three metropolitan areas to have a team represented in each professional sport, including indoor soccer.

In short, whether one is seeking a night on the town or a night under the stars, the Twin Cities provides as great a range of quality cultural and recreational amenities as any city in the country.

As for the high state and local taxes you may have heard about, they've been lowered significantly in recent years. Taxes themselves tell only part of the story, because, as any business decision-maker knows, they are but one component of the bottom line. What really counts is the total cost of living: taxes, housing, food, health care, transportation, among others. We've done such an analysis comparing the Twin Cities with Seattle, Denver and Phoenix, and you might be surprised at the results: Minneapolis/St. Paul has the second lowest total cost-of-living of those cities..

We believe that Minnesota's excellent educational system, the high quality of scientific and technical research done at the University of Minnesota, the broad and deep network of high-technology firms operating here, and the state's outstanding quality of life make Minnesota the best candidate for the location of U S WEST's Advanced Technologies.

Education



Chapter 1 Education

At all levels, Minnesota's educational system ranks among the best in the country. It is capable of producing and attracting the high caliber of scientists and engineers necessary to ensure Advanced Technologies' success. The University of Minnesota is a premier research center, and is especially strong in key scientific and technical fields closely related to Advanced Technologies' areas of research.

1.1 What is the state's per capita expenditure on K-12 education? (5 years)

MINNESOTA'S PER CAPITA EXPENDITURE ON K-12 EDUCATION

FY 1982	$572.77
FY 1983	$575.89
FY 1984	$608.35
FY 1985	$656.70
FY 1986	$704.18

SOURCE: FY 1982 to FY 1984: National Education Association, *Rankings of the States;* FY 1985: Personal communication, National Education Association; FY 1986: Minnesota Department of Trade and Economic Development estimate based on total expenditures data from Department of Education.

1.2 What is the state's per capita expenditure on higher education? (5 years)

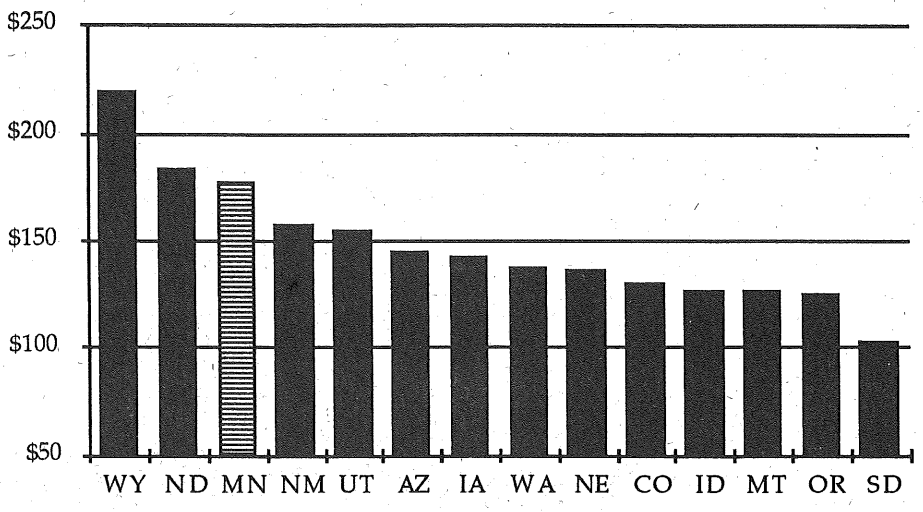
MINNESOTA'S PER CAPITA EXPENDITURE ON HIGHER EDUCATION

FY 1982	$133.24
FY 1983	$135.56
FY 1984	$147.42
FY 1985	$156.08
FY 1986	$166.83

SOURCE: State of Washington, Higher Education Coordinating Board, *Financial Support of Higher Education in Washington: A National Comparison,* selected years.

Figure 1A shows Minnesota's ranking on this measure compared with the other states in U S WEST's territory.

1A Per Capita State Appropriations for Higher Education, 1986-1987



SOURCE: *State Policy Data Book 1987.*

1.3 How does the state rank nationally on per capita expenditures? (Please provide both K-12 and higher education rankings.) (5 years)

MINNESOTA'S NATIONAL RANKING,
PER CAPITA EXPENDITURE ON EDUCATION

	K-12	*Higher Education*
FY 1982	6	8
FY 1983	7	12
FY 1984	8	8
FY 1985	NA	10
FY 1986	NA	9

NA: Not Available

SOURCE: K-12: National Education Association, *Rankings of the States*; higher education: State of Washington, Higher Education Coordinating Board, *Financial Support of Higher Education in Washington: A National Comparison*, selected years.

1.4 What is the source of public school funding at the elementary and secondary levels?

MINNESOTA'S K-12 FUNDING SOURCES, FY 1986

Local	46%
State	50%
Federal	4%

SOURCE: Minnesota Department of Education.

1.5 What is the state's average SAT score and ranking? (5 years)

MINNESOTA'S AVERAGE SAT SCORES

	Verbal	*Math*	*Total*
FY 1982	485	543	1028
FY 1983	482	538	1020
FY 1984	481	539	1020
FY 1985	481	537	1018
FY 1986	482	540	1022

SOURCE: Minnesota Department of Education.

No national ranking is available for Minnesota's SAT scores because Minnesota is one of 28 states where the ACT is taken by the majority of college-bound students. Nevertheless, Minnesota's average SAT score of 1022 in FY 1986 was 116 points above the national average for SAT states, according to the U.S. Secretary of Education's "Wall Chart." That score was also 87 points above the score of the first-ranked SAT state.

The "Wall Chart" also produces average scores and national rankings for ACT states, as shown below:

MINNESOTA'S AVERAGE ACT SCORES AND NATIONAL RANKING

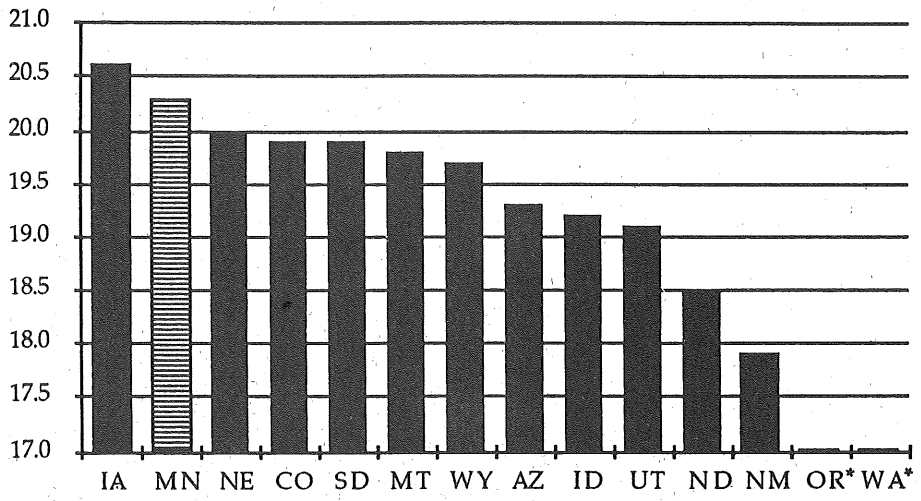
	Score	*National Ranking*
FY 1982	20.2	3
FY 1983	20.2	NA
FY 1984	20.2	2
FY 1985	20.2	3
FY 1986	20.3	3

NA: Not Available

SOURCE: U.S. Secretary of Education's "Wall Chart."

A comparison of Minnesota's ACT scores with those of the other U S WEST states is shown in Figure 1B.

1B ACT College Entrance Exam Average Scores, 1986



*No meaningful data available for Oregon and Washington

SOURCE: *State Policy Data Book 1987*

1.6(a) Please provide a source of funding breakdown for colleges and universities within the state.

FUNDING SOURCES FOR MINNESOTA COLLEGES AND UNIVERSITIES, FY 1985

	State & Local Appropriation	*Tuition*	*Gifts & Endowments*	*Government Grants*	*Other*	*Total Funding (Millions)*
Public	47.9%	19.4%	9.5%	9.7%	13.5%	$988.3
Private	0 %	50.9%	15.4%	21.2%	12.5%	$413.6

SOURCE: U.S. Department of Education, Center for Education Statistics, Post-Secondary Educational Statistics Division, "Percentage Distribution of Educational and General Revenues by Source and by Level of Institution for Minnesota" (Preliminary), FY 1985.

Included in the public sector figures above is the University of Minnesota system, with a total enrollment of 56,500 students at its main campus in the Twin Cities and branch campuses in Duluth, Morris, Waseca and Crookston; seven schools in the State University System, serving 55,000 students; and 18 Community Colleges, with an enrollment of 41,600. Seventeen private colleges in the state serve about 32,500 students.

The University of Minnesota's major campus, the largest urban campus in the country, is by far the major component of the public system. Funding sources for its Fiscal Year 1986 budget are shown below, along with those of its Institute of Technology, comprising engineering, physical sciences, computer sciences, mathematics and architecture.

	U of M Twin Cities		*Institute of Technology*	
	(millions)	*percent*	*(millions)*	*percent*
State Appropriations	$418.1	40.2	$38.5	52.8
Federal Research	72.2	7.0	22.0	30.2
Other Research	33.8	3.3	7.9	10.8
Other Federal	43.6	4.2	0.5	0.7
Other	470.5	45.3	4.0	5.5
TOTAL	**$1,038.3**	**100.0**	**$72.9**	**100.0**

SOURCE: Institute of Technology, University of Minnesota.

(b) Please briefly describe other sources of funding, including grants, foundation support, etc. List major research grants in computer science, electrical engineering and telecommunications disciplines.

The University of Minnesota has enjoyed extraordinary financial support from both corporate and private donors.

Current research grants in Electrical Engineering total $1.9 million, $1.1 million from federal sources and $.8 million from private sources. Current research grants in Computer Science total $2.2 million, $1.6 million from federal sources and $.6 million from other sources. The University's Institute for Mathematics and its Applications receives $1.3 million in grants from the National Science Foundation.

Listed below are major grants in Electrical Engineering, Computer Science, and other areas of concern to the telecommunications industry.

Faculty Member	*Project and Source*	*Amount*
ELECTRICAL ENGINEERING		TOTAL: $1,921,971
Van der Ziel, A	Quantum 1/F Noise in Solid State Devices in Particular HG1-X USDOD -- Army	43,000
Cohen, P. I.	Epitaxial Iron Films USDOD -- Air Force	$99,000
Kaveh, M.	Parameter Estimation with Distributed Sensors USDOD -- Navy	$109,223
Lambert, R. F.	Acoustical Structure of Porous Fibrous Materials NSF	$102,111

Schaumann, R.	Analog Active Filters NSF	$60,457
Wechsler, H.	Invariant Image Recognition of Brightness Optical Flow & Stereo Images NSF	$118,624
Champlin, K. S.	Distributed Microwave Nonlinearities in Semiconductors NSF	$68,522
Cohen, P. I.	Reflection High-Energy Electron Diffraction Studies of Epitaxial Growth NSF	$80,000
Khargonekar, P.	PYI: Synthesis of Robust Controllers for Lumped & Distributed Parameter Systems NSF	$37,500
Kaveh, M.	Wideband Array Processing for Multiple-Emitter Parameter Estimation NSF	$70,747
Van der Ziel, A.	Low-Frequency Noise in Solid State Devices NSF	$45,229
Ernie, D. W.	Properties of Gaseous Plasma-Mass Spectrometer & Light Spectrometer NSF	$73,993
Van der Ziel, A.	1/F Noise in Solid State Devices NSF	$58,003
Judy, J. H.	Wear Characteristics of Thin Film Materials Control Data Corp.	$100,000
Case, S. K.	3-D Vision System Cyberoptics Corp.	$139,796
Mohan, N.	Evaluation of Active Filter Concepts for HVDC Converters EPRI	$34,243
Cohen, P. I.	Epitaxial Magnetic Films Control Data Corp.	$36,552
Valois, A.	Research in the Areas of MBE Growth & Characterization of Materials 3M	$11,000
Warner, R. M.	Very Low Temperature Silicon Epitaxy Semiconductor Research Corp.	$47,469
Judy, J. H.	Investigation of TF Materials Suitable for Inductive Heads Control Data Corp.	$100,000
Kinney, L. L.	Printed Circuit Board Modeling Control Data Corp.	$95,429

Shur, M. S.	GaAs Device Characterization & IC Simulation Control Data Corp.	$62,404
Tuszynski, A. A.	Reducing the Risk of Burst Errors Control Data Corp.	$38,535
Ernie, D. W.	Study of Volume & Sheath Properties of RF & U Wave Plasmas IBM	$63,940
Robbins, W. P.	Engineering Services for Acoustic Microscope Subcontract Industrial Donors-MEIS	$5,000

COMPUTER SCIENCE TOTAL $2,201,021

Tripathi, Anand	Instrumentation Request for Research in Fault-Tolerant Distribution USDOD	$115,750
Thompson, William B.	Structure from Motion USDOD	$73,766
Rosen, J. Ben	Constrained Global Optimization for Large-scale Problems USDOD	$53,991
Thompson, William B.	Structure from Motion USDOD	$75,020
Ibarra, Oscar H.	Problems in Computational Complexity NSF	$64,480
Sahni, Sartaj K.	Algorithmic Study of Combinatorial Problems NSF	$47,346
Venkatesan, Shankar	Investigation of Network Flows NSF	$49,632
Rosen, J. Ben	Global Optimization for Large Scale Problems Using Vector Processing NSF	$57,653
Du, David H.	Studies in Associative Retrieval NSF	$80,552
Pong, Ting Chuen	Stereo Matching Using Topographic Structures NSF	$59,901
Thompson, William B.	Determining Spatial Organization from Visual Motion NSF	$40,750
Slagle, James R.	Expert Systems Questioning Procedures Based on Merit NSF	$82,235

Sahni, Sartaj K.	Experimental Research in Computer Algorithms NSF	$310,659
Gini, Maria L.	Symbolic & Qualitative Reasoning for Error Recovery in Robot Programs NSF	$112,112
Boley, Daniel L.	Large Matrix Eigenvalue & Singular Value Problems NSF	$68,998
Ibarra, Oscar H.	Systolic Systems & Automata-based Computational Complexity NSF	$74,179
Du, David H.	Studies in Layout Problems NSF	$80,116
Sahni, Sartaj K.	High Performance Solutions to VLSI CAD Problems NSF	$85,024
Du, David H.	Local Area Networks for Office Automation Northern Telecom, Inc.	$60,000
Du, David H.	How to Design Efficient ECAD Database Sperry Univac Corp.	$30,000
Berzins, Valdis A.	Logical Data Modeling Formalism to Support an ECAD Environment Control Data Corp.	$30,000
Carlis, John V.	Distributed Physical Database Design Sperry Univac Corp.	$57,983
Du, David H.	Local Area Networks for Office Automation Northern Telecom, Inc.	$40,000
Berzins, Valdis A.	Experimental Evaluation of Design Data Base & Implementation Control Data Corp.	$30,000
Shragowitz, Eugene	Multilayer PCB Layout Control Data Corp.	$40,703
Shragowitz, Eugene	Methods & Automatic Tools for Physical Design of VLSI Control Data Corp.	$81,224
Fox, David W.	Summer Supercomputing Workshop Institute for Defense Analysis	$212,000

CHEMICAL ENGINEERING AND MATERIALS SCIENCE		TOTAL: $8,833,119
Weaver, John	Electronic & Structural Interactions at Surfaces USDOD	$89,995
Franciosi, Alfonso	Microscopic Control of Interface Reactivity USDOD	$91,671
Weaver, John	Morphology & Electronic Structure of Buried & Lateral Metal Semiconductor Interfaces USDOD	$101,700
Weaver, John	Interface Properties, Processing, & Reliability USDOD	$100,000
Weaver, John	Cluster Formation & Evolution on Semiconductor & Insulator Surfaces USDOD	$121,643
Weaver, John	Structural & Electronic Properties of Epitaxial Overlayers NSF	$119,900
Jensen, Klavs F.	Experimental & Theoretical Studies of Chemical Vapor Deposition NSF	$63,100
Carr, Robert W.	Laser Equipment for CVD Studies NSF	$74,745
Macosko, Chris	Polyurethane & Polymer Reaction Injection Molding NSF	$156,641
Jensen, Klavs F.	Deposition of Microelectronic & Optical Materials Honeywell Inc.	$15,000
Tirrell, Matthew V.	Polymer Interface Phenomena IBM	$333,333
Jensen, Klavs F.	Polymer Interface Phenomena IBM	$333,333
Weaver, John	Polymer Interface Phenomena IBM	$333,333
MECHANICAL ENGINEERING		TOTAL: $5,245,543
Donath, M.	Robot Control & Artificial Intelligence Based CAD/CAM NSF	$62,500
Ramalingam, S.	A University-Industry Program in Computer-Integrated Manufacturing MTDI	$101,811

Starr, P. J.	A Simulation Based Decision Support System for Manufacturing Control Data Corp.	$75,000
Liu, B. Y. H.	Research Consortium on Particulate Contamination Control Various Private Donors	$160,000
Liu, B. Y. H.	Aerosol Filtration by Filters of Fine Fibers SUNY	$61,677
Ramalingam, S.	Computer Integrated Manufacturing Consortium Various Private Donors	$80,000
CHEMISTRY		TOTAL: $ 5,574,697
Gentry, W. R.	The Quantum Dynamics of Molecular Interactions NSF	$200,000
MATHEMATICS		TOTAL: $2,577,352
Fabes, E. B.	Problems in Partial Differential Equations & Real Analysis NSF	$38,337
Markus, L.	Control of Distributed & Hereditary Systems NSF	$47,955
McGehee, R. P.	Dynamical Systems, Morse Theory, & Mechanics NSF	$55,600
White, D. E.	Combinatorial Theory NSF	$20,800
Feshback, M. F.	Algebraic Topology NSF	$34,500
Markus, L.	Differential Equations & Dynamical Systems NSF	$77,700
Aronson, D. G.	Studies in Nonlinear Analysis NSF	$43,159
Miller, W. Jr.	Harmonic Analysis, Special Functions & Separation of Variable NSF	$29,243
Berger, T. R.	Topics in Finite Group Theory NSF	$38,400
Kenig, C. E.	Harmonic Analysis & Partial Differential Equations NSF	$23,891
Aronson, D. G.	Mathematical Sciences: Studies in Nonlinear Analysis NSF	$39,667

Luskin, M.	Mathematical Sciences: Numerical Analysis Partial Differential Equations NSF	$12,000
Stanton, D.	Mathematical Sciences: Combinatorics & Special Functions NSF	$35,850
Jain, N. C.	Mathematical Sciences: Probability Theory NSF	$143,300
Keynes, H. B.	Urban Mathematics Collaborative for Secondary Teachers Ford Foundation	$75,200
Keynes, H. B.	Urban Mathematics Collaborative for Secondary Teachers Ford Foundation	$112,700

PHYSICS & ASTRONOMY TOTAL: $5,193,432

Goldman, A. M.	Superconductivity of Thin Intermetallic Compounds USDOD -- Air Force	$127,609
Goldman, A. M.	URIP-Variable Temperature Superconducting Magnetometer/ Susceptometer USDOD -- Air Force	$63,750
Goldman, A. M.	Experimental Solid State & Low Temperature Physics USDOD -- Navy	$12,555
Goldman, A. M.	Tunneling & Transport in Ordered & Disordered Superconductor NSF	$222,000
Huang, C. C.	Studies of Thermal & Optical Properties of Liquid Crystals NSF	$97,400
Winckler, J. R.	Studies of the Magnetosphere by Artificial Electron Beams NASA	$129,465
Huang, C. C.	Characterization & Synthesis of Chiral Smectic C Materials for Fast Switching 3M	$44,776

1.7(a) How many colleges and universities offer postgraduate programs in the technical and scientific (nonmedical) disciplines?

(b) Where are the schools located?

(c) What are the disciplines?

UNIVERSITY OF MINNESOTA/TWIN CITIES, Twin Cities

	Master's	*Doctorate*
Agricultural Sciences		
Agronomy	X	X
Plant Breeding and Genetics	X	X
Soil Sciences	X	X
Food Sciences & Human Nutrition	X	X
Plant Pathology	X	X
Plant Pharmacology	X	X
Plant Physiology	X	X
Computer and Information Sciences	X	X
Engineering		
Aerospace, Aeronautical and Astronautical Engineering	X	X
Agricultural Engineering	X	X
Bioengineering and Biomedical Chemical Engineering	X	X
Electrical, Electronics and Communications Engineering	X	X
Geological Engineering	X	X
Industrial Engineering	X	X
Mechanical Engineering	X	X
Metallurgical Engineering	X	X
Mining and Mineral Engineering	X	X
Engineering Mechanics	X	–
Life Sciences		
Biochemistry and Biophysics	X	X
Botany	X	X
Cell Biology	–	X
Microbiology	X	X
Biometrics and Biostatistics	X	X
Mathematics and Statistics		
Mathematics	X	X
Statistics	X	X
Physical Sciences		
Astronomy	X	–
Astrophysics	–	X
Chemistry	X	X
Physics	X	X

UNIVERSITY OF MINNESOTA/DULUTH, Duluth

	Master's	*Doctorate*
Computer and Information Science	X	–
Biology	X	–
Chemistry	X	–
Physics	X	–

BEMIDJI STATE UNIVERSITY, Bemidji

Biology	X	–

MANKATO STATE UNIVERSITY, Mankato

Computer and Information Science	X	–
Industrial Technology	X	–
Mathematics	X	–
Chemistry	X	–
Physics	X	–

MOORHEAD STATE UNIVERSITY, Moorhead

Computer and Information Science	X	–

ST. CLOUD STATE UNIVERSITY, St. Cloud

Biology	X	–
Mathematics, General	X	–

COLLEGE OF ST. THOMAS, St. Paul

Computer and Information Science	X	–
Computer Technology	X	–
Manufacturing Technology	X	–

ST. MARY'S COLLEGE, Winona

Biology	X	–

SOURCE: Minnesota Higher Education Coordinating Board.

1.8(a) How many undergraduate degrees were awarded to students majoring in technical and scientific disciplines? (Please provide by discipline.) (5 years)

The number of degrees awarded in various scientific disciplines are listed in the tables below. A summary table of the number of degrees by major field is presented first, followed by tables listing disciplines in more detail.

(b) How many advanced degrees? (Please provide by discipline.) (5 years)

SUMMARY TABLE
SCIENCE, COMPUTER & ENGINEERING DEGREES CONFERRED IN MINNESOTA, JULY 1, 1981, THROUGH JUNE 30, 1986

	1981-82	*1982-83*	*1983-84*	*1984-85*	*1985-86*
AGRICULTURAL SCIENCES					
Bachelor's	131	131	112	146	92
Master's	50	53	60	32	51
Doctorate	19	23	23	26	33
COMPUTER AND INFORMATION SCIENCES					
Bachelor's	358	448	581	726	714
Master's	18	19	33	33	50
Doctorate	2	8	7	5	9
ENGINEERING					
Bachelor's	832	859	933	895	757
Master's	129	122	116	152	155
Doctorate	36	40	40	57	49
ENGINEERING AND ENGINEERING-RELATED TECHNOLOGIES					
Bachelor's	196	275	292	220	266
Master's	2	20	13	2	30
LIFE SCIENCES					
Bachelor's	816	808	804	777	854
Master's	75	92	81	54	69
Doctorate	55	51	65	51	73
PHYSICAL SCIENCES					
Bachelor's	549	577	603	608	555
Master's	29	45	35	50	48
Doctorate	32	27	48	38	53

SOURCE: Minnesota Higher Education Coordinating Board.

SCIENCE, COMPUTER & ENGINEERING DEGREES CONFERRED IN MINNESOTA, JULY 1, 1981, THROUGH JUNE 30, 1986

BACHELOR'S DEGREES	*1981-82*	*1982-83*	*1983-84*	*1984-85*	*1985-86*
AGRICULTURAL SCIENCES					
Agricultural Sciences, General	58	57	68	63	14
Food Technology	24	8	8	17	20
Agronomy	31	42	25	30	28
Horticulture Science	–	–	–	–	16
Plant Pathology	5	–	–	–	–
Soil Sciences, General	9	15	8	22	13
Soil Conservation	4	9	3	–	
Soil Sciences, Other	–	–	–	14	1
COMPUTER AND INFORMATION SCIENCES					
Computer and Information, General	358	448	581	709	694
Information Sciences and Systems	–	–	–	7	17
Computer and Information Sciences, Other	–	–	–	10	3
ENGINEERING					
Engineering, General	1	–	5	–	4
Aerospace, Aeronautical and Astronautical Engineering	50	53	77	85	77
Agricultural Engineering	24	11	21	17	13
Chemical Engineering	101	116	116	97	74
Civil Engineering	101	120	107	116	88
Electrical, Electronics and Communications Engineering	230	221	238	253	227
Geological Engineering	12	14	29	19	6
Industrial Engineering	18	22	21	22	26
Mechanical Engineering	270	280	301	262	241
Metallurgical Engineering	15	13	13	9	1
Engineering	10	9	6	3	–
Engineering, Other	–	–	–	12	–
ENGINEERING AND ENGINEERING-RELATED TECHNOLOGIES					
Electronic Technology	26	30	42	17	47
Instrumentation Technology	1	2	3	3	1
Industrial Technology	93	138	138	106	114
Mechanical and Related Technologies	14	19	17	12	8
Other	62	86	92	82	96

LIFE SCIENCES					
Biology, General	704	684	699	601	699
Biochemistry and Biophysics	29	33	32	43	37
Botany	5	1	3	4	1
Microbiology	39	36	25	32	29
Biometrics and Biostatistics	6	3	5	4	5
Marine Biology	6	9	6	11	5
Miscellaneous Specialized Areas	18	18	20	5	13
Entomology	4	2	4	–	–
Life Sciences, Other	5	22	10	67	65
PHYSICAL SCIENCES					
Physical Sciences, General	–	7	6	17	18
Astronomy	–	–	2	–	1
Astrophysics	2	–	–	4	4
Chemistry	280	266	304	304	265
Geology	94	149	133	82	97
Geophysics and Seismology	9	12	15	12	8
Earth Science	8	17	17	11	19
Physics, General	102	119	114	124	113
Physics, Other	2	4	2	1	1
Physical Sciences, Other	52	3	10	53	29
MASTER'S DEGREES					
AGRICULTURAL SCIENCES					
Agricultural Sciences, General	11	11	15	–	8
Animal Sciences, General	11	11	12	8	7
Animal Physiology	2	–	–	–	–
Food Sciences, General	7	13	13	–	–
Agronomy	5	4	6	5	7
Horticulture Science	–	–	–	8	12
Plant Breeding and Genetics	4	6	12	11	7
Soil Sciences	10	8	2	–	10
SCIENCES					
Computer and Information Sciences, General	18	19	33	33	50

ENGINEERING					
Aerospace, Aeronautical and Astronautical Engineering	13	6	5	6	3
Agricultural Engineering	6	5	4	8	12
Chemical Engineering	7	12	7	13	2
Civil Engineering	21	23	25	24	30
Electrical, Electronics and Communications Engineering	35	36	41	50	56
Geological Engineering	–	2	3	5	6
Industrial Engineering	3	1	3	3	5
Mechanical Engineering	31	31	24	32	35
Mining and Mineral Engineering	4	4	3	5	1
Engineering, Other	9	2	1	6	5
ENGINEERING AND ENGINEERING-RELATED TECHNOLOGIES					
Industrial Technology	2	–	2	2	–
Occupational Safety and Health Technology	20	–	11	–	30
LIFE SCIENCES					
Biology, General	17	25	22	7	17
Biochemistry and Biophysics	4	6	4	7	7
Botany, General	4	4	6	4	2
Plant Pathology	8	9	6	8	6
Plant Physiology	3	–	4	1	2
Cell and Molecular Biology	–	–	9	2	–
Microbiology	8	11	5	5	6
Anatomy	–	–	1	–	–
Biometrics and Biostatistics	7	10	6	10	7
Ecology	12	9	4	6	9
Nutritional Sciences	–	7	6	4	6
Zoology, General	1	1	–	–	3
Entomology	5	8	7	–	2
Genetics, Human and Animal	5	2	1	–	2
Pharmacology, Human and Animal	1	–	–	–	–

PHYSICAL SCIENCES					
Astronomy	1	–	2	3	3
Chemistry, General	5	15	8	19	1
Pharmaceutical Chemistry	1	–	–	–	–
Geology	15	11	10	4	6
Geophysics and Seismology	1	1	–	1	4
Metallurgy		10	4	3	–
Physics	6	8	11	14	10
Physical Sciences, Other	–	–	–	6	14
DOCTORATE DEGREES					
AGRICULTURAL SCIENCES					
Agricultural Sciences, General	5	2	6	4	6
Animal Physiology	1	–	–	–	–
Food Sciences, General	1	4	6	7	6
Agronomy	3	5	3	5	2
Horticulture Science	–	–	–	2	5
Plant Breeding and Genetics	5	10	6	8	10
Soil Sciences	4	2	2	–	4
COMPUTER AND INFORMATION SCIENCES					
Computer and Information Sciences, General	2	8	7	5	9
ENGINEERING					
Aerospace, Aeronautical and Astronautical Engineering	–	–	1	–	–
Agricultural Engineering	–	1	–	2	4
Bioengineering and Biomedical Engineering	1	–	2	–	1
Chemical Engineering	10	12	12	16	–
Civil Engineering	1	3	3	8	7
Electrical, Electronics and Communications Engineering	3	9	5	8	12
Geological Engineering	–	3	1	1	1
Mechanical Engineering	16	7	5	14	16
Metallurgical Engineering	2	–	–	–	–
Mining and Mineral Engineering	1	1	2	2	4
Engineering, Other	2	4	9	6	4

LIFE SCIENCES					
Biochemistry and Biophysics	5	12	9	11	13
Botany, General	1	1	–	–	–
Plant Pathology	2	4	1	7	4
Cell Biology	7	3	4	1	5
Microbiology	8	4	10	10	10
Anatomy	6	1	2	6	1
Biometrics and Biostatistics	1	–	1	3	4
Ecology	7	7	5	7	6
Nutritional Sciences	–	3	2	4	4
Zoology, General	4	1	4	–	1
Entomology	4	5	6	–	3
Genetics, Human and Animal	3	1	7	–	1
Pharmacology, Human and Animal	3	5	7	–	6
Zoology, Other	–	–	3	–	3
Life Sciences, Other	–	–	–	–	10
PHYSICAL SCIENCES					
Astrophysics	–	1	1	–	1
Chemistry, General	19	14	27	21	23
Pharmaceutical Chemistry	1	–	–	–	–
Geology	–	4	4	1	2
Geophysics and Seismology	1	–	2	1	1
Metallurgy	–	3	5	3	5
Physics	10	4	6	9	21
Physical Sciences, Other	1	1	3	3	–

SOURCE: Minnesota Higher Education Coordinating Board.

1.9 Please describe and quantify any programs to encourage women and minorities in the technical and scientific disciplines.

University of Minnesota and Institute of Technology: The University of Minnesota actively recruits women and minorities for its science and engineering programs. In 1985-86, minority students represented 2.4 percent of IT's undergraduate enrollment, while women students represented 18 percent.

There are several programs designed to encourage minorities in the technical professions. Project Technology Power, the minority affairs office in the Institute, works to identify and remove barriers which have discouraged Black, Hispanic, and American Indian students from entering the Institute of Technology. PTP provides programs and services at both pre-college and college levels to approximately 500 students per year.

The purpose of PTP's pre-college programs is to increase the number of minority students who are academically prepared to succeed in science and engineering. These programs include the Math Bridge program, for eighth-grade students, a Computer Camp for ninth-grade students, and a College Preparatory Skills program for students who have completed tenth grade. The majority of the more than 1,300 participants in these programs who have graduated from high school have entered college, and 30 percent are pursuing technical and business degrees.

PTP's college programs are designed to increase the number of professional minority engineers, computer scientists, and scientists by providing academic and career counseling, merit scholarships, tutoring, and summer internships.

In the Institute of Technology, the Society for Women Engineers provides support for women enrolled in the Institute's engineering programs.

Minority students and women in IT have essentially the same retention and graduation rates as non-minority and male students.

1.10 Please describe special education programs for the handicapped and gifted.

EDUCATION FOR THE HANDICAPPED

Minnesota has long had a solid commitment to the education of students with handicaps. The state has a strong handicapped education law, a caring legislature, and school administrators willing to invest time and money in students whose needs have been largely ignored in the past.

In Minnesota, all children who are handicapped and in need of special education are entitled to a free and appropriate education. Students must receive service regardless of the severity of the mental, physical or emotional disability, or other impairment or handicap. To the extent possible, students with handicaps must be educated with students who are not handicapped.

Minnesota school districts provide an array of programs serving all disability areas from birth through age 21 or until completion of a program. Special education programs are provided by individual school districts, special education cooperatives, and residential programs, depending on district size and/or location. Approximately 83,000 students receive special education services in the state.

Services range from placement in a regular classroom with the provision of monitoring, consultation, and curriculum modification, to direct instruction by a special education teacher, to placement in a residential facility with direct instruction.

Transition service represents another area of emphasis in Minnesota. Transition is the process which provides a planned exit of students with disabilities from public school programs into community life, work and/or further schooling. For students receiving special education services, transition needs are addressed beginning at the ninth grade level. Appropriate adult services are involved in the planning process as students exit school.

EDUCATION FOR THE GIFTED

Minnesota is a national leader in providing a wide variety of programs for gifted and talented students. The legislature has supported such services since 1979; currently, they are offered by 422 of 434 school districts. Last year, more than 55,000 students participated in gifted/talented programs, nine percent of the total student population.

Many options are offered in individual school districts. Students may spend concentrated periods of time working on independent projects. Others may participate in special classes during part of the school day, while some schools "cluster" gifted students in a regular classroom with a trained teacher of the gifted.

Accelerated classes are offered in many junior and senior high schools. Advanced placement classes offer high school students the opportunity to earn college credit. As a result of Governor Perpich's Post-Secondary Options program, high school juniors and seniors may take college courses, with tuition reimbursed by their local school districts. Seven school districts offer the International Baccalaureate program, which allows diploma candidates to complete one year of college while still in high school.

The Minnesota Legislature also funded a residential arts school for junior and senior high school students to begin operation in the 1987-88 school year. The Minnesota High School and Resource Center for the Arts will offer an exciting interdisciplinary curriculum to gifted/talented students in the arts.

Many summer school opportunities are also available to gifted/talented students. Students may register for a summer camp, enjoy an international language institute, attend seminars at a college campus, or participate in many summer school cooperatives for gifted/talented students.

Finally, quality programs for educating teachers of the gifted are offered by several colleges and universities in Minnesota. Organizations to support parents, teachers, and students have also been formed. The Minnesota Council for the Gifted/Talented and the Minnesota Educators of the Gifted/Talented provide valuable networks and educational services to parents, teachers, and students.

The University of Minnesota's Talented Youth Mathematics Program is a highly accelerated program for very talented mathematics students in grades 7 through 12. These students attend classes at the University for two hours each week. Those who complete the full five-year program receive 30 quarter-credits in mathematics at the undergraduate level. Students who finish the program but have not yet entered college can take upper-division mathematics courses at the University. Special lectures by scientists and engineers, as well as visits to university laboratories, are also part of the program.

In the Twin Cities, the Talented Youth Mathematics Program has 160 students enrolled in the first-year course, 80 in the second-year course, and 90 in the calculus courses of the college component. An additional 100 students are enrolled in first-year courses at four outreach sites, bringing the total number of participants in the program to 430 students. The outreach sites are located in Moorhead, St. Cloud, Owatonna, and Rochester.

1.11 How many (both numerical and percentile) scientific and technical graduates remain in the state? (5 years)

University of Minnesota and Institute of Technology: The Institute of Technology Placement Office conducts an annual survey of graduating seniors, which achieves a response rate of 50 to 60 percent. The percentages listed below of graduates with positions remaining in Minnesota are the actual percentages from survey respondents.

The first column in the table below shows the percentage of respondents remaining in Minnesota for the Institute of Technology as a whole, and for Electrical Engineering (EE) and Computer Science (CS) graduates in particular. The second column lists the number of graduates in each year; column three applies the survey response percentages to these totals to project the total number of graduates of the Institute of Technology remaining in the state.

INSTITUTE OF TECHNOLOGY GRADUATES REMAINING IN MINNESOTA, 1981-1986

	Unit	*% Remaining in Minnesota*	*BS Graduates*	*Projection of Graduates Remaining in Minnesota*
1981-82	ALL IT	55%	993	546
	EE	65%	230	150
	CS	64%	71	45
1982-83	ALL IT	59%	1099	648
	EE	60%	221	133
	CS	58%	85	49
1983-84	ALL IT	59%	1274	752
	EE	66%	238	157
	CS	69%	147	101
1984-85	ALL IT	53%	1274	675
	EE	58%	250	145
	CS	67%	189	27
1985-86	ALL IT	50%	1098	549
	EE	50%	202	101
	CS	66%	169	112

SOURCE: Institute of Technology, University of Minnesota.

These figures are consistent with those collected over the past two decades, which show that between 50 and 60 percent of IT graduates remain in Minnesota, as do between 55 and 70 percent of graduates in Electrical Engineering and Computer Science.

Several institutions in the State University System also provided information on the proportion of technical graduates that remain in Minnesota, as shown in the table below.

STATE UNIVERSITY TECHNICAL GRADUATES REMAINING IN MINNESOTA

University	*Year*	*Percent Remaining*	*Number Remaining*
Mankato State	1983-86	76%	653
Winona State	1986	70%	62
Bemidji State	1985-86	78%	190
Moorhead State	1986	57%	87
St. Cloud State	1982	75%	198
St. Cloud State	1983	79%	230
St. Cloud State	1984	73%	244
St. Cloud State	1985	70%	206
St. Cloud State	1986	80%	238

SOURCE: Minnesota Higher Education Coordinating Board.

1.12 Please briefly describe any programs of university-business cooperation, particularly in technical and scientific areas.

University of Minnesota and Institute of Technology: There are many programs of cooperation between the business community and the University of Minnesota, especially in the Institute of Technology, Carlson School of Management, the Institute of Agriculture, and Health Sciences. These include special post-baccalaureate educational programs as well as cooperative research projects. As of May 21, 1987, faculty members were working under 420 active grants from 197 different companies, with annual expenditures totalling almost $35 million. Samples of these industrial grants are listed above in response to question 1.6.

Described below are some of the larger relevant examples of university-business cooperation.

Institute of Technology (IT): In IT, there are many examples of such cooperation, including: cooperative educational programs in all of the engineering departments, in which more than 300 companies have participated; corporate graduate fellowships in such departments as Electrical Engineering, Chemical Engineering and Materials Science, and Computer Science; and faculty consultation with industry, an on-going activity in which a majority of IT's faculty participates.

Office of Research and Technology Transfer Administration (ORTTA): The University of Minnesota's Office of Research and Technology Transfer Administration (ORTTA) was created to promote the transfer of technology developed at the University to companies that will commercialize these technologies in a manner that will benefit the public. The return to the University is used to further fund research, and to reward the developers of the technology and their departments.
ORTTA negotiates and administers sponsored research agreements with industry, and provides advice and assistance to faculty, staff and students in regard to patents and relationships with industry. The office invites patent disclosures from faculty and staff,

evaluates items for commercial viability, seeks protection where warranted through patents and copyrights, and actively seeks licensees to commercialize the technology or concept. Currently, the office handles several hundred disclosures per year, files 30 to 50 patent applications and receives 20 to 30 patents per year. In 1986, more than 20 licenses or options to license were negotiated.

Microelectronics and Information Systems (MEIS) Center: The objective of the Microelectronics and Information Systems (MEIS) Center is to significantly strengthen teaching and research at the Institute of Technology and to improve technology transfer in these critical areas. Under the leadership of Control Data Corporation, four major corporations contributed $7 million over a four-year period to establish MEIS at the University. The Center has developed new teaching laboratories and courses, funded "seed research" programs which have resulted in large increases in federal grants, and established graduate fellowships in the participating departments. MEIS has also provided major grants for research in Intelligent Systems, III-V Compound Semiconductors and High-Speed Devices, Design Automation for Software Engineering, and Processor Array Concepts for Engineering. A board of directors consisting of industry and IT officials, and a technical steering committee of company engineering and research managers and IT faculty provides guidance for the Center.

Productivity Center: The Productivity Center was established by the Mechanical Engineering Department in 1983 with initial support from the 3M Company and subsequent legislative, university and industry funding. Thirteen faculty members, 100 graduate students and four departments currently are participating in its programs. The Center's applied research is focused on such areas as the automation of design and manufacturing, robotics, intelligent machines and computer integration. A consortium of local industries provides support and guidance for the projects. A series of symposia and workshops has been held to increase the involvement of small manufacturers.

Computer Network Project: This project will give faculty and students in the Computer Science department the opportunity to gain expertise in using the latest computer networking equipment and systems by allowing them to test such equipment at the prototype or beta-test stage. The initial undertaking will investigate Fiber Distributed Data Interface (FDDI) components and switching with the cooperation of U S WEST. Representatives of U S WEST have expressed interest in becoming involved in this activity because it could pave the way for 100 mbps communication among University computers. The project is scheduled to begin operations by October 1, 1987.

Minnesota Supercomputer Center (MSC): A major step forward in the state's capacity to serve the computing needs of industry and faculty was the establishment of Minnesota Supercomputer Center, Inc., in 1982. MSC is designed to provide academic, government and industrial researchers with leading-edge computational hardware, software and applications programs. MSC offers its users both CRAY and CDC/ETA architectures in a unique configuration unavailable at any other center in the country.

To make these systems accessible, MSC has pioneered the use of UNIX as a common operating system. A reliable, easy-to-use TCP/IP communications network connects a wide range of equipment at user sites. A background storage system is used (XFS) that appears to the user as an on-line UNIX file system. Regular training programs are offered to cover all aspects of systems and services at the Center.

The MSC user community includes Fortune 500 companies, such as General Electric's R&D Center at Schenectady, NY, researchers at the National Science Foundation and a large number of scientists and engineers at Minnesota and other universities. Timesharing services are made available to industrial users for their proprietary use.

The Minnesota Supercomputer Institute (MSI) is an academic research organization created by the University to provide supercomputing services to the faculty. Supported by an appropriation from the Minnesota Legislature, MSI has as its mission the encouragement and support of supercomputing among academic researchers throughout the Midwest. Research done at MSI is supported through its equipment acquisition programs, development work and user services staff.

MSC and MSI operations are housed in a new state-of-the-art facility in the Minneapolis Technology Corridor near the University.

The UNITE Program: The UNITE Instructional Television System provides opportunities for professional engineers and scientists to keep their technical knowledge current and even to earn master's degrees without leaving their place of work. One of the first programs of its kind in the country when it began in 1971, UNITE presently is one of the largest and most successful, with 400 to 500 students regularly enrolled.

Each quarter, UNITE broadcasts about 30 credit courses in electrical engineering, mechanical engineering, computer science, materials science, physics, and mathematics to more than 400 employees at two dozen industrial sites in the Twin Cities area and Rochester. Companies participating in the program include IBM-Rochester, 3M, Honeywell, Control Data, Cray Research, Medtronic, and Northern States Power. UNITE currently operates on four ITFS channels, which feature one-way video and two-way audio. A courier service is used to transmit homework and exams back and forth between companies and the University.

The courses broadcast by UNITE are part of IT's standard curriculum. A majority of graduate courses in Electrical Engineering and Computer Science are broadcast in a rotating schedule, enabling students to complete all coursework required for a master's degree in either discipline at their place of work. Students can also earn a master's degree in materials science and engineering through UNITE, a program added at the request of 3M in 1985.

The Institute of Technology is also a charter participant in the National Technological University (NTU), which broadcasts courses from 15 universities to industrial sites throughout the nation.

The University of Minnesota was one of the first six schools to receive a Ku-band satellite uplink/downlink to support its participation in NTU, through a grant from the National Telecommunications and Information Agency. The uplink is used to transmit IT courses in computer science, electrical engineering, and mechanical engineering to other parts of the country. The downlink is used to receive special non-credit engineering programs from other universities and from the Institute of Electronic and Electrical Engineers. These programs are then transmitted to the UNITE companies on a separate channel.

Minnesota High Technology Council: The Minnesota High Technology Council (MHTC) represents more than 170 technology-intensive companies and organizations that banded together in 1982 to promote the growth of technology-intensive industry

statewide. Among its priorities is to enhance the University's capabilities as a research institution. In pursuit of that goal, MHTC was instrumental in alerting the state legislature to the need to establish a new building to allow the Electrical Engineering and Computer Science departments to expand and modernize their research and instructional capabilities.

MHTC has five education committees which work directly with representatives from each of the education systems in the state, from K-12 to the Technical Institutes and the State University System. These committees provide a helpful link between the educational institutes and the high-technology industry.

1.13 Please briefly describe any programs of support training for high technology innovation.

University-Industry Student Intern Program: Industries in the metropolitan Twin Cities area have the enormous advantage of a highly qualified pool of technically trained temporary employees to draw upon, from the University to an assortment of private colleges and Technical Institutes. Many of the larger companies and research laboratories in the area have established formal student intern programs which provide for part-time employment of students during the school year and full-time employment during summer breaks. Both graduate and undergraduate students participate.

A study commissioned by the Minnesota High Technology Council in 1986 showed that 18 of 19 responding companies with more than 500 employees have active student intern programs. Firms saw the program's strength as not only making available to them a pool of relatively low-cost, highly motivated temporary employees, but also as giving them a substantial advantage in recruiting qualified employees after they graduate.

Center for the Development of Technological Leadership: The Institute of Technology recently received a $2.7 million endowment from Honeywell, Inc., for the establishment of a Center for the Development of Technological Leadership. The Center's educational and research programs have two major objectives. The first is to improve the leadership component of technology management. The second goal is to facilitate technology transfer between universities and the private sector, by studying approaches in other states and by implementing innovative techniques in Minnesota.

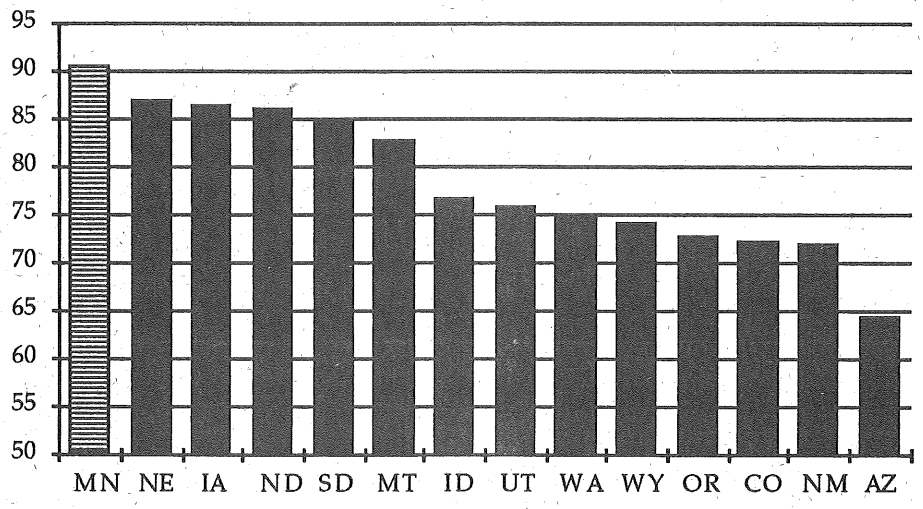
Minnesota Innovation Research Program: The Strategic Management Research Center in the University's Carlson School of Management launched a series of research studies in 1983 on the management of innovation. This has grown into a major program involving 36 faculty and doctoral students. Program support is funded by a major grant from the Office of Naval Research and by grants from AT&T, 3M, Honeywell, CDC, Cenex, Dayton Hudson, First Bank Systems, Bemis and many others.

Another innovative educational offering in the Carlson School of Management is a graduate course in which teams of students are taught market research and business planning by having them select product concepts from the Office of Technology Transfer of the University or from the Institute of Technology. Each team takes a concept, does real-world market research and develops a business plan under the joint guidance of a local venture capitalist and faculty in the marketing department.

EDUCATION - ADDITIONAL INFORMATION

Minnesota's commitment to a quality education system has produced results that have not been touched on in the answers above. One of those of which the state is most proud is our position as the state with the highest high school graduation rate in the country. In 1986, 90.6 percent of all high school students in Minnesota graduated, far above the national average of 70.6 percent. Figure 1C compares Minnesota's graduation rate with that of the other 13 states in U S WEST's territory.

1C High School Graduation Rate, 1986



SOURCE: *State Policy Data Book 1987*

Minnesota has also pioneered the use of modern technology as an educational tool in K-12 education. While many states jumped hastily on the technology bandwagon, perceiving computer literacy as an end in itself and not planning the integration of equipment into the curriculum until after it was purchased, Minnesota proceeded differently.

A legislative appropriation of $6.3 million funded a number of innovative initiatives. First, school districts received financial incentives to develop a technology utilization plan to ensure that integration would occur before hardware was purchased. Second, funding was made available to organize extensive teacher training on a regional basis. Courseware package evaluation was also institutionalized. Every six months a "High Quality Courseware List" is published after new courseware has been evaluated; school districts are reimbursed 25 percent of the cost of purchasing materials from the list. Funds were also appropriated to design customized courseware packages.

These mechanisms have enabled Minnesota to make the most effective use possible of new technology. While the state has the fourth highest computer/student ratio (at one computer per 21 students, almost twice the national average), that would not mean as

much if it were less prepared to utilize this equipment effectively. Minnesota's planning process for education technology was praised last fall in a report issued by the National Governor's Association Task Force on Technology, which called it a model for other states.

The most visible components of Minnesota's education technology innovations are 20 demonstration sites in school districts across the state. These display the use of many varied technologies in very different settings. Several school districts in rural parts of the state are using two-way interactive television to overcome many of the problems faced by small schools in isolated areas. These include reduced funding, declining enrollments, curtailed course offerings and staff shortages, particularly in specialized curriculum areas. By connecting several districts via interactive television, enough demand for such courses can be tapped to lower per-pupil costs of providing them to a reasonable level.

These systems range from supertrunk coaxial cable systems to microwave. In northern Minnesota, seven districts have banded together to form the Mid-State Educational Telecommunications Cooperative, which will be interconnected by means of fiber optic cable (with the participation of Northwestern Bell). Several systems also have satellite components.

Finally, recognition must be given to the important contribution made by Minnesota's private colleges to scientific education.

The 17 private colleges that form the Minnesota Private College Council have reputations as high-quality liberal arts colleges, Carleton, St. Olaf, St. Thomas and Macalester being among the best. Yet, these institutions are also at the very center of science education in Minnesota. Despite enrolling only 26 percent of the state's undergraduates attending four-year colleges, over the past four years the private colleges have conferred 52 percent of all undergraduate degrees awarded in the state in physics, chemistry and other physical sciences, 50 percent of all mathematics degrees, and 46 percent of all biology and other life sciences degrees.

Moreover, a large proportion of these students go on to attain graduate degrees in the sciences. A national study of private colleges conducted by Franklin and Marshall College in Pennsylvania found that Minnesota ranked sixth among all states in the number of students who went on to obtain PhDs in the sciences from 1920 through 1980. This finding attests to the strength of undergraduate science education in the state.

Quality of Life

Chapter 2 Quality of Life

Quality of life is Minnesota's most abundant resource. The state's scenic beauty offers residents an outstanding variety of opportunities for outdoor recreation. The Twin Cities also boasts a vast array of cultural and artistic activities. Minnesota has a safe, clean environment, and a strong sense of community.

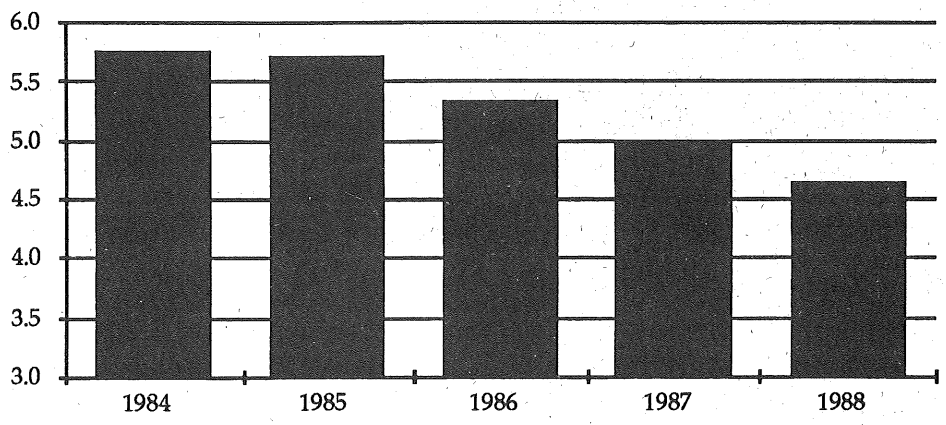
2.1 What is the state's national ranking for sales and income tax rates?

National rankings of tax rates can be misleading, especially in the absence of data regarding the base to which the tax applies. For example, Minnesota's state sales tax is six percent, a rate which is matched or exceeded by six other states. However, Minnesota's tax does not apply to food or clothing. Without knowing whether this is true of the sales tax in other states, it is impossible to say where the state really ranks. A more relevant question might be: How much would a family at a given income level pay in sales taxes for the same market basket of goods purchased in different states?

A study which uses this methodology is done annually by the city government of Washington, D.C. It measures tax burdens in the largest city in each state, rather than an average for the state itself. According to that study, the amount of sales tax paid by a family of four in Minneapolis with an income of $50,000 in 1986 was $486. Only twelve cities had a lower sales tax burden, none in the U S WEST territory.

Individual income tax rates have been lowered each year in Minnesota since 1984; legislation passed in the most recent session extended further reductions through 1988 (see Figure 2A). The Washington, D.C., study, based on 1986 rates, ranked Minnesota's income tax burden 12th in the U.S.

2A State Personal Income Tax Decline Per $1000 Gross Income
(Paid by family of four, with two wage earners and $50,000 gross income) (in percent)



SOURCE: Minnesota Department of Revenue.

2.2 What is the state's ranking on cost of living?

Cost of living comparisons are done by the American Chamber of Commerce Research Association. Participant cities, on a voluntary basis, report selected costs which are indexed quarterly. Minneapolis/St. Paul ranked eighth lowest among the 30 largest metropolitan areas on the overall cost of living index in 1984. More current information on all of the cities is unavailable. A more detailed discussion of living costs is presented in the additional material at the end of Chapter 3.

COST OF LIVING INDEX FOR THE 30 LARGEST METROPOLITAN AREAS, 1984

Ranking	*Largest Metropolitan Areas*	*Cost of Living Index*
1	Tampa-St. Petersburg	95
2	St. Louis	96
3	Cincinnati	98
4	Atlanta	101
5	Detroit	102
6	Philadelphia	102
7	Pittsburgh	103
8	**MINNEAPOLIS-ST. PAUL**	**103**
9	Milwaukee	106
10	Cleveland	106
11	Baltimore	106
12	Phoenix	107
13	Dallas	108
14	Riverside, CA	108
15	Houston	110
16	Miami	111
17	Denver	114
18	Boston	114
19	Seattle	114
20	Chicago	115
21	Nassau-Suffolk, NY	115
22	Los Angeles	128
23	San Diego	130
24	Washington, D.C.	131
25	New York	133
26	Oakland	133
27	Newark	133
28	Anaheim, CA	139
29	San Jose	140
30	San Francisco	153

SOURCE: American Chamber of Commerce Research Association, *Inter-City Cost-of-Living Index*, 1984.

2.3 *In the state's major metropolitan areas:*

(a) What is the tax (sales, property, etc.) climate?
(b) What is the cost of living?
(c) What is the availability of housing?
(d) What is the median price for a house?
(e) What is the crime rate ? (5 years)
(f) What is the quality of air and water?
(g) What is the per capita giving to charitable institutions?(5 years)
(h) Please quantify support for the arts, including theatre, symphony, dance, and the visual arts.

Minnesota has five major metropolitan areas: the Twin Cities, Duluth, Rochester, St. Cloud and Moorhead. Brief profiles have been developed for each of the cities covering the points of interest to U S WEST. Several features are common to all five areas:

•Water and air quality are consistently good throughout Minnesota. Water is an abundant Minnesota resource. We have ample water to meet our current needs and future residential and industrial growth.

•Assessed value of residential property is calculated in the same manner for all of these cities. The assessed value for the most recent tax year is equal to 18 percent of the first $64,000 of market value plus 29 percent of the value over $64,000.

•Property tax credits are also the same. Homeowners are credited with 54 percent of the gross tax on the first $68,000 of value, up to a maximum of $700.

•Based on an analysis of state and federal tax forms, estimates of charitable contributions made by Minnesotans are shown below. These figures include only charitable contributions taken as deductions (until 1982, only itemizers were allowed such deductions; in 1983 and 1984 non-itemizers were limited to deducting 25 percent of contributions up to $25).

ESTIMATED CHARITABLE CONTRIBUTIONS IN MINNESOTA, 1981-1985

	Per Tax Return	*Per Capita*
1981	$ 847	$169
1982	918	183
1983	984	215
1984	1,018	221
1985	1,109	249

SOURCE: Estimates based on federal and Minnesota tax return data supplied by the Minnesota Department of Revenue.

Minnesota corporations also are allowed to deduct charitable contributions from taxable net income on Minnesota corporate tax forms. Until 1984, only deductions of $500 or more were reported.

CHARITABLE CONTRIBUTION DEDUCTIONS TAKEN ON MINNESOTA CORPORATE AND BANK EXCISE TAX RETURNS

	Amount	*Number of filers*	*Average Deduction*
1981	$63,441,000	3,803	$16,682
1982	72,349,000	3,913	18,489
1983	62,711,000	3,831	16,369
1984	72,117,000	9,137	7,893
1985	80,582,000	9,686	8,319

SOURCE: Minnesota Department of Revenue.

Twin Cities: The Twin Cities is Minnesota's largest metropolitan area, consisting of the core cities of St. Paul and Minneapolis and surrounding suburbs, the largest of which is Bloomington. Mill rates for property taxes range from a low of 93.590 to 128.406. Mill rates in the largest cities are:

Minneapolis	111.258
St. Paul	127.170
Bloomington	105.816

St. Paul has no local sales tax. Minneapolis has a local tax of 0.5 percent on the state sales tax base and Bloomington has a 1.0 percent local sales tax.

New single-family and multifamily housing construction continues to be strong in the Twin Cities, particularly in the suburban areas. Vacancy rates for existing housing are 0.7 percent (3,203 units) for single-family and 6.3 percent (13,058 units) for multifamily. The following table presents median sales prices for housing.

TWIN CITIES MEDIAN HOUSING SALES PRICES, 1985

New Housing	Single-Family	$91,400
	Townhouse	68,900
	Condominium	65,000
Existing Homes	Minneapolis	$76,200
	St. Paul	72,600

SOURCE: Minnesota Housing Finance Agency, *Analysis of House Sale Prices in Minnesota,* October 1986.

Minneapolis/St. Paul compares favorably to other large metropolitan areas as a safe place to live. The Twin Cities had the ninth lowest crime rate per 100,000 population among the 30 largest metropolitan areas in 1982, according to the *Places Rated Almanac.* (Seattle ranked 19th, Denver was 21st and Phoenix 22nd.) For violent crimes, the Twin Cities was ranked third lowest.

Crime rates for Part I offenses, which include murder, rape, robbery, aggravated assault, burglary, theft and arson, have not increased from their level of five years ago, as shown in the following table.

TWIN CITIES PART I OFFENSES
(Rate per 100,000 population)

1982	*1983*	*1984*	*1985*	*1986*
6,207	5,522	5,204	5,719	6,027

SOURCE: Metropolitan Council, unpublished data.

A comprehensive five-year history of total per capita giving to charitable organizations is unavailable for individual communities.

However, the Twin Cities has an extensive charity network. From the United Way Campaign to community programs such as food shelves and church-based programs, Twin Citians can and do contribute.

United Way contributions are a good indication of the trend in giving. As the following history shows, total funds raised by the United Way have increased almost 50 percent over the last five years. Individuals and employees give the majority of these funds.

TWIN CITIES UNITED WAY CONTRIBUTIONS, 1982-1986

	Total	*Percent Corporate*	*Percent Employee*	*Percent Individual**
1982	$33,556,008	36.0	58.0	6.0
1983	$37,287,212	35.4	58.9	5.7
1984	$41,732,638	34.7	60.0	5.3
1985	$46,838,170	35.8	58.9	5.2
1986	$49,735,205	36.3	58.9	4.8

* Individual not associated with a corporation

SOURCE: Minneapolis and St. Paul United Way.

The Twin Cities has a reputation as a center for the arts in the Midwest. Among the outstanding organizations here are the Guthrie Theater, Minnesota Orchestra, the St. Paul Chamber Orchestra and the Walker Art Center.

Many opportunities exist for Twin Cities residents to support the multiplicity of arts organizations in the area. A study by the Metropolitan Council of nonprofit arts organizations quantified the level of financial support for the arts in 1985. Results of this study indicate a total spending level of nearly $190 million, as shown in the following table.

TWIN CITIES SPENDING FOR THE ARTS, 1985

Average Number of Organizations	*Direct Spending*	*Audience Spending*	*Total Spending*
Community Art 16	$7,455,600	*	$7,455,600
Dance 13	1,725,700	$11,275,000	13,000,700
Film/Video 11	11,827,900	6,765,000	18,592,900
Literature 11	408,400	*	408,400
Music 41	21,148,300	23,452,000	44,600,300
Radio 6	10,702,600	*	10,702,600
Service 22	14,039,700	*	14,039,700
Theatre 38	16,535,600	22,775,500	39,311,100
Visual 14	21,388,000	9,844,000	41,232,000
TOTALS 172	**$105,231,800**	**$84,111,500**	**$189,343,300**

*Audience data not applicable/collected

SOURCE: Metropolitan Council, *The Arts: A Regional Industry*, 1986.

Duluth: Duluth is Minnesota's second largest metropolitan area, with a population of 85,000. Situated on the shores of Lake Superior, Duluth is Minnesota's connection with the Atlantic Ocean via the St. Lawrence Seaway. As a city of great natural beauty, it has long been a tourist destination.

The mill rate for property taxes in Duluth is 174.096. The city has a variety of local taxes:

1.0% on state sales tax base
2.0% on some bars, restaurants and hotel/motel sales
3.0% hotel/motel excise tax

Housing in the city is readily available and very affordable. The average sales price of a single family home in 1987 is $44,000. Currently, there are 900 single-family homes for sale in the city. Multifamily rental units are also available.

According to the American Chamber of Commerce Research Association, Duluth's cost of living index was 93.3 in 1985, compared with a national average of 100.

In 1982, Duluth's crime rate was ranked 29th lowest among all 329 metropolitan areas in the U.S. As shown below, the 1986 crime rate in Duluth was substantially lower than the 1982 rate.

DULUTH PART I OFFENSES
(Rate per 100,000 population)

1982	*1983*	*1984*	*1985*	*1986*
5,320	4,396	4,398	4,534	4,574

SOURCE: City of Duluth.

Duluth has 20 nonprofit organizations focused on the arts and humanities, with a total budget of approximately $2.5 million annually. These include a symphony orchestra, musical and other theater groups, as well as several museums and art galleries. Annual attendance is estimated to be 1,010,000.

Moorhead: Situated in the Red River Valley which forms the border between Minnesota and North Dakota, Moorhead, the Minnesota portion of the Fargo/Moorhead metropolitan area, has a population of 30,294.

Neither Fargo nor Moorhead has a local sales tax. The mill rate for property taxes is 118.366 in Moorhead.

New and existing homes are available in the area. A total of 1,563 single-family homes were sold in 1986. The median sales price of a single-family home was $66,900; condominiums sold for an average of $59,270.

Rental housing is also available in a variety of types and sizes. Moorhead has experienced a residential building boom in 1986 and 1987; more than 3,400 units have been built since 1983. The local vacancy rate in the spring of 1987 was estimated to be 6.1 percent.

Fargo-Moorhead's crime rate ranked 33rd lowest among the 329 metropolitan areas in 1982. In 1984 the rate for Part I offenses in Fargo-Moorhead was 3,935 per 100,000 population.

Diverse cultural opportunities exist in Fargo-Moorhead and the surrounding area. Major art organizations include the Civic Opera, Community Theatre, Symphony Orchestra, Mahkahta Dance Theatre, Plains Art Museum and the Red River Dance and Performing Company. These organizations have an annual budget of more than $1.5 million. Attendance for the past five years has averaged 70,100.

Rochester: Home of the world famous Mayo Clinic, Rochester is in southwestern Minnesota. Health care delivery, medical research, and manufacturing have played a premier role in the development of this city of 54,000 people. It is the setting for IBM's largest domestic manufacturing facility.

Property tax mill rates in Rochester are 114.759. Rochester has a local sales tax of 1.0 percent on the state sales tax base and there is a local tax of 8.5 percent on liquor sales.

The City of Rochester estimates that 66 percent of the population lives in owner-occupied housing. About six percent of Rochester's 17,667 single-family units are actively listed for sale. The average listing price of a house in Rochester is $71,300, with an average sales price of $68,714.

Rochester's 1985 cost of living index was 102.1, according to the American Chamber of Commerce.

Rochester's crime rate is particularly low. In 1985, the rate for Part I crimes was 2,602.

Art, history, music and drama abound in Rochester, whose art organizations include the Symphony Orchestra, Chamber Orchestra, Art Center, Civic Theatre, Repertory Theatre, Symphony Chorale, Dance Theatre, Children's Theatre, and historical and medical museums.

The Rochester Symphony is recognized by the National Symphony and Orchestra League as one of the top 100 orchestras in the nation.

Support for these amenities is outstanding. The City of Rochester contributes $558,630 annually to music, arts and theatre, or three percent of its annual budget.

St. Cloud: This central Minnesota city is in one of the fastest growing regions in the state. Situated just northwest of the Twin Cities metropolitan area, St. Cloud is a city of 44,000.

Property taxes are paid on a total mill rate of 118.236. St. Cloud recently imposed a one percent food and beverage sales tax to fund construction of a new civic center.

During 1986, 847 residential properties were sold in the St. Cloud area, at an average price of $57,260. There are currently 703 residential units actively listed for sale.

The cost of living index in St. Cloud was measured at 97.5 in 1985.

The crime rate in St. Cloud in 1985 was 3,002 per 100,000 inhabitants for Part I offenses.

There are 55 arts-related organizations in the St. Cloud area. Nearly half of these groups have annual budgets of more than $25,000.

The Central Minnesota Community Arts Council annually raises approximately $100,000 for distribution to various arts organizations. The St. Cloud Allied Arts Fund is a non-profit organization established to encourage and support its members, consisting of seven music, dance, and theater companies. The organization has an annual budget of approximately $50,000 made up principally of contributions from area businesses.

The arts also receive substantial support at area universities and colleges. The Benedictine Arts Center and St. Cloud State University each have an arts budget in excess of $250,000, while St. John's University's Humphrey Center has an annual budget of $200,000.

2.4 *What is the per capita state support for the arts? (5 years)*

STATE SUPPORT FOR THE ARTS

	Amount Appropriated	*Amount Per Capita*
1983	$1,766,100	$.43
1984	2,198,105	.49
1985	2,265,160	.55
1986	2,502,961	.60
1987	2,755,083	.68

SOURCE: National Assembly of State Arts Agencies,
Annual Survey of Legislative Appropriations, 1987.

2.5 *What is the state's national ranking in support of the arts? (5 years)*

MINNESOTA'S NATIONAL RANKING ON STATE ARTS FUNDING

1983	23
1984	20
1985	21
1986	23
1987	22

SOURCE: National Assembly of State Arts Agencies,
Annual Survey of Legislative Appropriations, 1987.

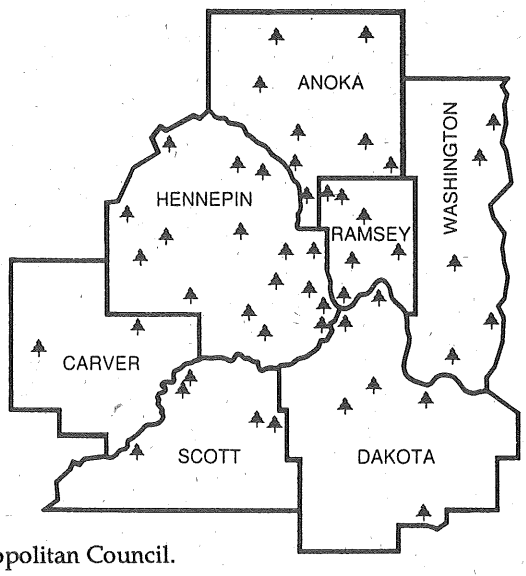
2.6*(a) Please describe the major forms of recreation within the state.*
(b) What is the proximity to metropolitan areas?
(c) What is the general access and availability?

As you might expect, trying to describe the recreational opportunities in a state known as the "Land of 10,000 Lakes" is a daunting proposition. Minnesota's great natural beauty and its public ethic fostering preservation and the maintenance of access to recreational areas have combined to create an unparalleled list of outdoor activities to choose from.

Let's start with the seven-county Twin Cities metropolitan area. Although the metro area contains more than two million people and has one of the lowest population densities among American metropolitan centers, only about 18 percent of the land is urbanized. Forty-three percent is cultivated, 20 percent is pasture and open, 11 percent is forested. There is plenty of room here to breathe, and it's only a short distance from the city.

If hiking, biking, camping, canoeing or fishing is your pleasure, you have a wealth of locations to choose from. There are 48 regional parks containing 47,000 acres in the metro area, with acquisition of an additional 11,000 acres planned (see Figure 2B). Three state parks are also within the region, comprising more than 14,000 acres.

2B Location of Parks in the Twin Cities Metropolitan Area



SOURCE: Metropolitan Council.

The state Department of Natural Resources has designated 2,800 miles on 19 rivers in Minnesota for canoeing and boating. Five of these are in the metro area, three of which – the St. Croix, the Rum, and the Crow Wing – have been designated Wild and Scenic Rivers.

Carlos Avery State Wildlife Management Area, located in the northeastern part of the metro area, contains only a portion of the 265,000 acres of wetlands in the region, where migrating ducks and geese concentrate.

The metro area also boasts approximately 100 miles of trails each for hiking, horseback riding, snowmobiling and cross-country skiing. It also contains six of the state's 30 downhill ski areas, but we wouldn't try to fool you: the Twin Cities' strongest suit with respect to downhill skiing is its 14 daily nonstop flights to Denver (see Question 4.3).

This list does not include recreational opportunities within the City of Minneapolis, which contains 6,400 acres of parks (1,500 acres of which are water), a 54-mile parkway system, and 36 miles of biking trails. Three of the city's largest lakes – Nokomis, Calhoun, and Harriet – are sailing lakes, and provide sailboat buoys and launches for use by city residents. Sailboat races are a regular weekend event.

The table below lists the number of other recreational facilities in the metro area:

NUMBER OF SELECTED RECREATIONAL FACILITIES IN THE TWIN CITIES

Facility	*Number*
Parks	1,125
Campgrounds	78
Campsites in Campgrounds	1,433
Marinas	113
Rental Watercraft at Marinas	1,325
Swimming Beaches	131
Tennis Courts	1,191
Baseball Diamonds	2,430
Golf Courses	80

SOURCE: Minnesota Department of Natural Resources, *Minnesota State Comprehensive Outdoor Recreation Plan*, 1985 (Draft).

The magnitude of Minnesota's recreational cornucopia becomes apparent when you consider that the foregoing represents a tiny fraction of the 13 million acres of publicly owned land in the state, more than 90 percent of which is located in the northern part of the state. Here are found the bulk of the 56 state forests (three million acres state-owned, 1.5 million acres state-managed), containing 61 campgrounds. Seven of the state's ten wildlife management areas (more than 200,000 acres) are also found here, serving as breeding and resting areas for migratory birds.

Perhaps the jewel of northern Minnesota's recreational areas is the Boundary Waters Canoe Area wilderness, located about four hours from the Twin Cities. Containing more than one million acres and extending for 150 miles along the Canadian border, the BWCA contains more than 1,000 lakes and hundreds of miles of rivers and streams. Half of the area is virgin forest, including the largest stand of virgin pine east of the Rockies. It is home to moose, timber wolf, black bear, deer and bald eagles.

There are no roads, shelters, electricity, trash cans or other amenities in most campsites in the BWCA. Most lakes are motor-free; access is by canoe and portages, allowing visitors to partake of the spirit of the French voyageurs who first explored Minnesota 200 years ago.

Descriptions of Minnesota's recreational amenities could go on and on: Chippewa National Forest, Voyageurs National Park, 13,000 miles of trails, 530 federal waterfowl production areas located in the western part of the state, 61 state parks (in addition to the three in the metro area, seven more are within a one-hour drive).... You get the picture. And because the opportunities are so numerous and so geographically dispersed, access is relatively easy. We think Minnesota offers a recreational bounty unmatched by any other state.

QUALITY OF LIFE - ADDITIONAL INFORMATION

It's hard to prove, of course, but the Twin Cities actually may have inspired the term "quality of life." Some journalist or economist – trying to reconcile the somber statistics on winter weather and the area's so-called remote location with data on its economic vigor and social stability–perhaps hit upon "quality of life" as the missing factor in a formula that wouldn't otherwise compute.

Whatever the origin, the term's comfortable fit with the style and spirit of life in the Twin Cities ultimately becomes as obvious to visitors as it is to residents.

Syndicated columnist Neal Pierce noticed it: "Search America from sea to sea and you will not find a state that has offered as close a model to the ideal of the successful society as Minnesota." (*The Book of America: Inside the 50 States*, 1983.)

Lawrence Ingrassia saw the economic roots: "Growing agribusiness and high-technology companies make Minneapolis a white collar town. And though a few neighborhoods are tattered, most are flourishing. Compared with other Northern cities, Minneapolis has no ghetto. In studies by urbanologists, Minneapolis comes up again and again as a fiscally and physically healthy city." (*Wall Street Journal*, Aug. 5, 1980.)

In June 1984, *Town and Country* put it this way: "Saint Paul, Minnesota, is neat and trim; there are no rings around this white-collar metropolis. Here and there frays from age and wear appear, but they tend to get tidied up with diligence, money and care–attributes Saint Paul claims in abundance."

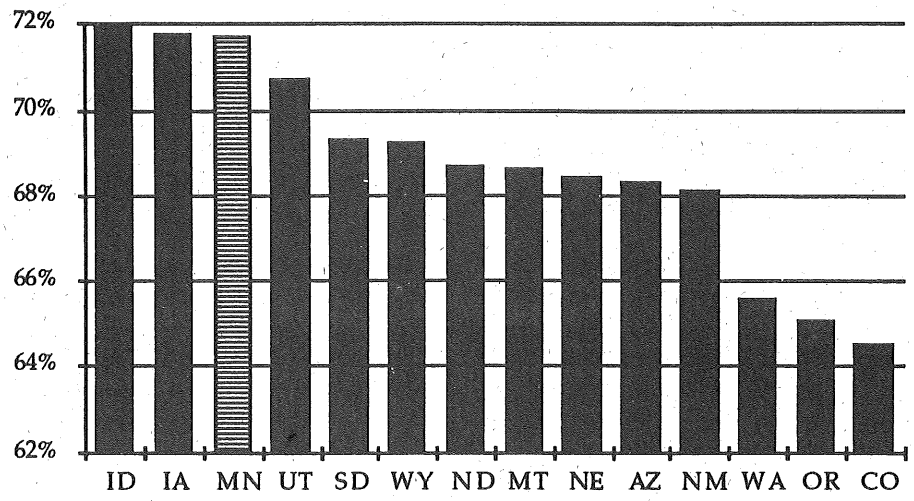
But the case for quality of life in the Twin Cities does not have to rest solely on the impressions of either surprised outsiders or convinced insiders. Statistical data, though always subject to interpretation, helps to fill in the details of the overall impression that the Twin Cities is indeed a good place to live.

THE SOCIAL BASE

Whether a stable social base is prerequisite to a superior quality of life is akin to the chicken-or-the-egg dilemma, but it would be unconvincing to argue that an area has a high quality of life if one could not also demonstrate a stable social base. In any society, the family is universally regarded as the social foundation. And in Minnesota, the foundation is solid. The state's divorce rate is among the lowest in the nation, ranking 48th. Teen-aged pregnancy, another key indicator of social health, is the lowest in the nation, at 7.9 percent of all births.

Family stability is also reflected in housing statistics. According to the 1980 U.S. Census, 71 percent of Minnesota residents owned their own homes. That was the sixth highest home ownership rate in the country and is due both to the tradition of home ownership established more than a century ago under the Homestead Act and to a homestead exemption feature in the state's real estate tax. Home ownership comparisons for the 14 states in the U S WEST service area are shown in Figure 2C.

2C Percent of Owner Occupied Housing, 1980



SOURCE: *State Policy Data Book, 1987.*

With such high ownership rates, it is not surprising to learn that people stay put. The 1980 census revealed that 56 percent of Minnesota's residents were living in the same home they had in 1975. The percentage was the 21st highest in the country, a figure that is better appreciated when compared with those in other states in U S WEST's region.

PERCENTAGE OF INDIVIDUALS LIVING IN SAME HOUSE, 1975-80

State	*Percentage*	*Rank*
MINNESOTA	56	21
Arizona	42	45
Colorado	40	47
Washington	44	44

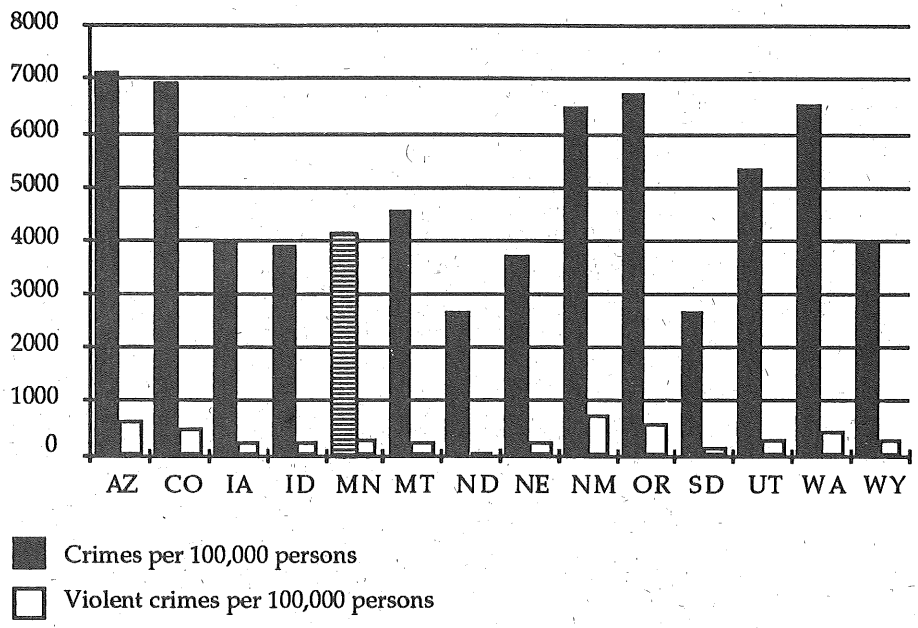
SOURCE: U.S. Department of Commerce Bureau of the Census, *Detailed Population and Housing Characteristics*, 1980.

Although they may also be classified as economic data, unemployment and labor-participation rates certainly offer an important clue to social stability. Minnesota ranks fourth in the nation in labor-force participation. At 5.3 percent in 1986, its unemployment rate was the 12th lowest in the country.

Two other economic statistics have clear implications for social stability. In 1979, only two percent of Minnesota's children under 18 were living below the poverty line, the third lowest in the country. With 9.5 percent of its entire population below the poverty line, the state was sixth best on that index.

Finally, crime rates are also an indicator of community stability. Figure 2D shows that Minnesota's rate of violent crimes is well below that of other U S WEST states with large metropolitan areas.

2D Crime Rates, 1985



SOURCE: *State Policy Data Book, 1987.*

COST OF LIVING

You've heard, no doubt, that Minnesota's state and local taxes are high compared with those of some other states. Well, it's the truth. But it's not the whole truth.

First, the Minnesota Legislature has lowered taxes significantly in recent years. Personal income taxes peaked in 1984. As a result of legislative changes they have declined every year since, and will continue to fall in 1987 and 1988. A family of four with a gross income of $50,000 will pay 19.5 percent less in income taxes in 1988 than it paid in 1984.

Second, because state and local income taxes are deductible from federal taxable income, higher state and local taxes mean lower federal taxes, and vice-versa. Some of the savings in low-tax states is simply siphoned off to the federal government rather than remaining in the taxpayer's pocket.

Third, and perhaps most important, taxes are only one component of the total cost of living. To simply compare state and local taxes of different locations and conclude from that analysis that one is more expensive (or cheaper) to live in than another merely brushes one very dubious assumption under the rug: namely, that all other living costs are equal among the places compared. That simply isn't the case.

To illustrate the point, we've done some research on the cost of living for a hypothetical two-earner, two-child family earning $50,000 in 1986. For comparison purposes, we've selected the three largest metropolitan areas in U S WEST's territory – Denver, Colorado;

Seattle, Washington; and Phoenix, Arizona – to match against living costs in the Twin Cities.

We start with state and local taxes. According to a study conducted by Washington, D.C., of 1986 taxes paid in the largest city in each state at different income levels, our hypothetical family would pay the amount shown in the first line of the table below in state income, sales, and property taxes. The Twin Cities has the highest state and local tax burden. The second line reports federal taxes in these cities. Federal deductibility of state and local taxes gives the Twin Cities the lowest federal burden, narrowing the gap with the other cities in total taxes.

TAX COMPARISONS AMONG SELECTED CITIES, 1986

	Twin Cities	*Seattle*	*Denver*	*Phoenix*
State & Local Taxes	$6,336	$3,107	$5,232	$3,324
Federal Taxes	$3,459	$4,308	$3,746	$4,193
Total Taxes	$9,795	$7,415	$8,978	$7,517
Amount Above (Below) Twin Cities	–	($2,380)	($817)	($2,278)

NOTE: Figures refer to a two-earner, two-child family earning $50,000.

SOURCES: State and local taxes: Government of the District of Columbia, Department of Finance and Revenue, *Tax Rates and Tax Burdens in the District of Columbia: A Nationwide Comparison*, May 1987 (preliminary); Federal taxes: Minnesota Department of Revenue.

We are now ready to proceed with the remainder of our cost of living analysis. The six categories in the table below were taken from the American Chamber of Commerce's *Inter-City Cost-of-Living Index*, which provided comparative cost indexes in each category for each city. The weights for each category in a household's total budget were derived from the *Consumer Expenditure Survey*, a detailed listing compiled by the Bureau of Labor Statistics of the amount of money spent on thousands of items by families at different income levels. Finally, for comparative housing costs, we used data provided by RELO, a major relocation service firm that collects quarterly statistics on housing costs in 77 metropolitan areas. These sources allow us to compare the costs of the same market basket of goods in different cities.

TOTAL COST OF LIVING COMPARISONS AMONG SELECTED CITIES, 1986

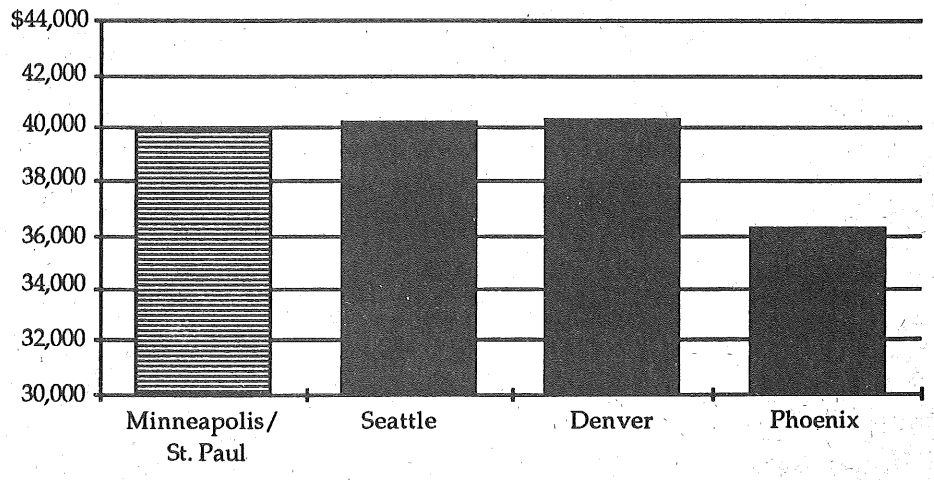
Cost of Living	*Twin Cities*	*Seattle*	*Denver*	*Phoenix*
Food	$ 4,241	$ 4,974	$ 4,495	$ 4,346
Housing	6,597	7,849	8,600	5,595
Utilities	2,428	1,262	1,697	2,259
Transportation	8,288	8,400	7,700	7,231
Health Care	911	1,349	977	1,157
Miscellaneous*	7,635	8,910	7,904	8,158
SUBTOTAL	$30,100	$32,744	$31,373	$28,746
ALL TAXES	$ 9,795	$ 7,415	$ 8,978	$ 7,517
TOTAL COSTS	**$39,895**	**$40,159**	**$40,351**	**$36,263**
Above (Below) Twin Cities	-	$ 264	$ 456	($3,632)

*Includes apparel, entertainment, personal services, alcoholic beverages.
Does not include personal insurance, pensions or savings and investments.

SOURCES: American Chamber of Commerce, *Inter-City Cost-of-Living Index*, 1986; U.S. Department of Commerce, Bureau of Labor Statistics, *Consumer Expenditure Survey*, 1984; housing costs from RELO, national relocation firm.

The Twin Cities has the lowest costs for food, health and miscellaneous items, while its costs for utilities is the highest of the four cities examined. When all living costs are totaled, including state and federal taxes, Minnesota's initial disadvantage vis-a-vis Denver and Seattle is completely wiped out: the total cost of living is actually slightly less in the Twin Cities, as shown in Figure 2E. Phoenix has the lowest total living costs of the four cities surveyed.

2E Cost of Living



Source: American Chamber of Commerce, *Inter-City Cost-of-Living Index*, 1986; U.S. Department of Commerce, Bureau of Labor Statistics, *Consumer Expenditure Survey*, 1984; RELO, national relocation firm.

So much for the cost of living. The rest of this chapter describes the quality of life taxes buy in the Twin Cities.

THE ECONOMIC BASE

As already noted, a favorable quality of life costs money. Other chapters in this report cover the money-earning, wealth-creating strengths of the Twin Cities area. Here, attention will focus on how some of that money is spent and some of that wealth invested in activities and institutions normally associated with quality of life.

Without doubt, Minnesota's Five Percent Club, composed of companies that donate five percent or more of pre-tax profits to charity, sets the pace in corporate giving for the entire United States. The club, which was formed in 1976 with 23 members, now includes 69 firms; another 41 Minnesota companies are donating two percent of pre-tax earnings to charity. The significance of these commitments is set in bold relief by a national average for corporate giving of less than one percent.

Visiting Minneapolis in 1977, John D. Rockefeller III told a business audience, "I have heard so much . . . about your remarkable Five Percent Club that I feel a bit like Dorothy in the Land of Oz. I had to come to the Emerald City myself to see if it really exists."

Contributions have not been limited to money. Companies have hired full-time managers to plan and direct their community affairs. Honeywell, Dayton Hudson and General Mills helped to rejuvenate inner-city neighborhoods; Control Data established new plants and a day-care center in the inner city; First Bank System set up a task force to deal with an epidemic of Dutch elm disease. Many companies are operating programs in employee assistance, education, and ridesharing.

A 1985 study by the Minnesota Council on Foundations revealed 33 independent and family foundations and 23 corporate foundations donating more than $500,000 per year to philanthropic activities. Giving by Minnesota foundations in 1984 totaled more than $200 million, or $48 per capita. Ranking 17th in population, Minnesota was ninth among the states in 1982 in the number of foundations, with 117.

From among the 1984 grants, the Minnesota Council analyzed awards totaling $131 million and reported that more than half of all grants went to education and social services. Nearly 20 percent went to the arts.

In 1984, the Minnesota State Arts Board received a presidential award in recognition of its exemplary partnership with Minnesota's private sector. The following fiscal year, grants from the Dayton Hudson Corporation, the McKnight Foundation, the Jerome Foundation, the Northwest Area Foundation, and other private groups increased the State Arts Board budget by $900,000.

The Minnesota Humanities Commission has won Merit Awards from the National Endowment for the Humanities in both of the years for which it was eligible. The award, which includes a substantial cash grant, is given to state commissions that have produced exemplary and innovative humanities programs.

The Twin Cities ranks second in live theaters per capita. The world-famous Guthrie Theater has been a standard-setter in the theater world for nearly three decades, but many other groups, professional and amateur, are also active. Among these are the

Children's Theatre Company, a nationally recognized leader in young people's theater, and the Great North American History Theater, a unique company that presents plays based on personalities and incidents from the region's past. The Cricket Theater, one of the cities' better known groups, recently moved into a newly restored theater at the edge of downtown Minneapolis.

The Minnesota Orchestra and the St. Paul Chamber Orchestra have full concert seasons. Both orchestras have homes in architecturally stunning and acoustically spectacular halls in the center of the two downtowns. The four-year-old Ordway Music Theatre in downtown St. Paul is also home to the Minnesota Opera Company and the Schubert Club, which has been promoting good music in St. Paul for 104 years.

The Twin Cities is also rich in jazz and contemporary musical talent. Residents can hear authentic New Orleans and Chicago-style jazz every weekend at the Hall Brothers Emporium of Jazz overlooking the confluence of the Minnesota and Mississippi Rivers. More contemporary sounds can be heard at Night Train, First Avenue, Rupert's, and dozens of other spots around the seven counties, where local groups inspired by such Twin Cities originals as Prince and The Jets hold forth.

In 1987, the senior vice president of MCA Records acknowledged that "Minneapolis/St. Paul has established itself as a premier city in the development of contemporary music." And Arthur Frommer has said, "The Twin Cities . . . now has the distinction of being a cultural capital of the nation ranking second only to New York City."

HEALTH CARE

When it comes to health care, Minnesota is clearly a national leader. The Mayo Clinic, 80 miles south of the Twin Cities, is world famous and still growing in prestige for research and teaching as well as patient care. The University of Minnesota Hospital is among the nation's leaders in transplant procedures and heart care.

Health-maintenance organizations (HMOs) have been in Minnesota since 1957, making it one of the first states in the country to venture into this now widespread system for containing health-care costs. More than 830,000 area residents are enrolled in the six major HMOs headquartered in the Twin Cities.

Treatment for alcoholism and other drug dependencies in Minnesota is among the very best in the country. The Hazelden Foundation and the Johnson Institute are nationally recognized for their work in chemical abuse treatment, and well established treatment programs are available in several Twin Cities hospitals.

Given such levels of investment and achievement, this final health statistic is hardly surprising: at birth, new Minnesotans can look forward to a life of 76.2 years, second only to Hawaii among the 50 states.

FUN AND GAMES

The 10,000 lakes, as local wags will affirm, are only those with names. The actual count is closer to 15,000 and the fishing is good. So good, in fact, that 41 percent of all Minnesotans, compared with 25 percent nationally, go fishing. The state has 2,824 public access sites, 2,044 marinas, and 2,084 resorts. What's more, data from 1,896 miles of assessed rivers and streams has shown that 83 percent of the mileage was fully fishable.

But anglers aren't the only people who can enjoy Minnesota outdoors. Campers, canoeists, hikers, bikers, and Sunday drivers will find three state parks and 48 regional and county parks within the metropolitan area. A marked bike trail – taking cyclists through woods and meadows, along Minnehaha Creek and the Mississippi, and around several of the city's many lakes – circles the entire City of Minneapolis.

Golfers can choose among 80 courses; tennis enthusiasts will find nearly 1,200 courts; for swimmers, there are 131 beaches; and softball players can run the bases on nearly 2,500 diamonds. And all of these are in the metropolitan area. Easy, efficient access to the rest of the state's lakes, rivers, ski slopes, bike trails and scenery is provided by the extensive state and local road system.

On the assumption that they also play who only sit and watch, the Twin Cities has plenty to offer the spectator. When the new National Basketball Association Minnesota Timberwolves take to the basketball court in their new arena in 1989, the Twin Cities will have an entry in every professional major league sport. Only three other metropolitan centers can make that claim.

The Timberwolves will join the Twins (baseball), the Vikings (football), the North Stars (hockey), and the Strikers (indoor soccer) to provide the Twin Cities with a rich variety of spectator sports. In 1991, golf enthusiasts will be able to drive out to Hazeltine on the west edge of town for the U.S. Open and, in 1992, the NCAA basketball final four will be in town. The ten-day U.S. Olympic Sports Festival will be held in the Twin Cities in 1990.

In its 1987 session, the Minnesota Legislature approved bonds for construction of national training centers in the Twin Cities for the amateur sports of ice hockey, soccer, track and field, cycling and swimming.

ABOUT THE WATER

The state's surface-water supply is well publicized on auto license plates that remind the world of the state's 10,000 lakes (an understatement, as already noted, but as Garrison Keillor has observed, Scandinavians are given to that sort of thing). The situation underground is less well known. The Twin Cities metropolitan area, for example, sits atop a bonanza of five bedrock aquifers that can supply well over a billion gallons per day. Current pumpage is less than 25 percent of the sustainable yield, a distinction that is the envy of many a locale ambitious for industrial growth.

A ten-year study by the Minnesota Pollution Control Agency showed that water quality has been consistently improving as a result of better waste treatment in the state. The Conservation Foundation ranked Minnesota first among all states in 1983 for the quality of its state environmental protection programs.

QUALITY AND 'SOCIAL MEMORY'

Compared to life at Thoreau's pond, of course, the cost of living in any of the cities rated here is high. In a modern metropolitan area, one does not buy an enviable quality of life at bargain prices. The amenities – whether personally purchased or communally provided – cost money. The range of such options constitutes a community's "infrastructure for quality."

In the Twin Cities, the range of options is extraordinarily wide. The infrastructure for quality is extensive and well maintained, and this is apparent to anyone with the time to look around. What is not so apparent are the tradition and practices of civic cooperation that make this range of options possible.

The infrastructure for quality is the outcome of community-based decisions that reflect care and mutual generosity – in other words, both a desire and a willingness to see time, money and other resources invested in public facilities and programs. Why such a desire? Why the willingness?

How the individual citizen feels about the way the community makes decisions depends primarily on his or her perceptions of two factors: 1) the legitimacy of the processes that produced the decisions, and 2) the adequacy of financial and other contributions from people at all social and economic levels.

It is the Twin Cities' high scores on these matters that explain their consistently high quality-of-life ratings by urbanologists. What William Ouchi said of Minneapolis applies to the entire metropolitan area:

"It is a community of people who are connected to one another, who place peer pressure on one another, who remember for 50 or 100 years who has been helpful in the past and who has not . . . . Many people are simultaneously active members of three or four . . . groups, siding with one interest group in one setting and against them in another, but knowing that they will be remembered for their deeds throughout the community."

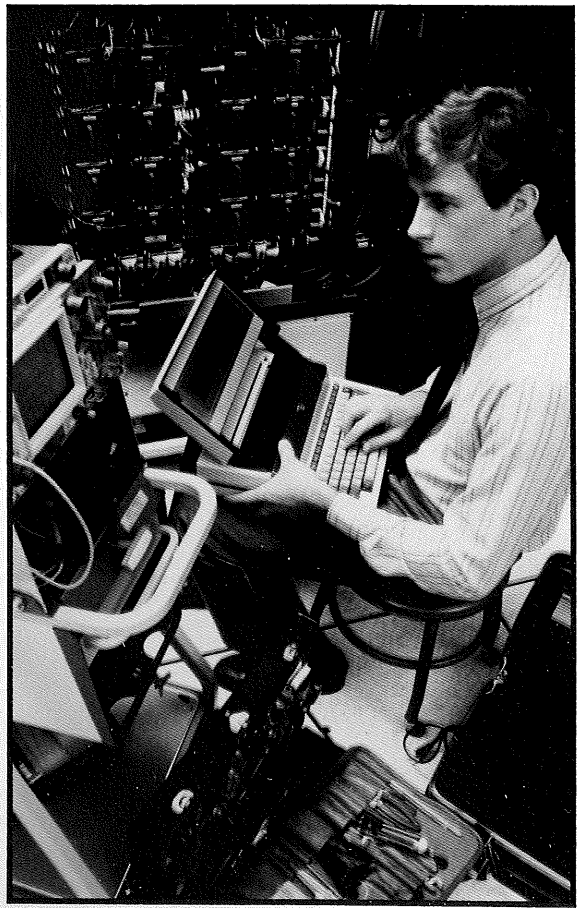
Ouchi calls this phenomenon "social memory." The statistics presented here demonstrate that the Twin Cities has invested heavily in its infrastructure for quality. But this data cannot be fully understood or appreciated apart from the pervasive influence of that social memory and the attitudes and activities that sustain it.

Social memory is not limited to the grand community projects, like convincing Sir Tyrone Guthrie to establish his new theater here, or revitalizing downtown Minneapolis, or supporting two major orchestras and five major-league teams or oversubscribing a $300 million endowment drive for a public university.

Social memory is also there when your neighbor gives your car a jump-start on a cold morning; it is there when lawns are mowed, sidewalks are shoveled and houses are painted; it is there when the bus driver smiles and the waiter catches your eye. Social memory is there in the little things that people do for each other, the little things supplying the mortar, holding the big things together.

In the final analysis, quality of life is other people. Granted, French philosopher Jean-Paul Sartre put "other people" in a very different role. But, then, Sartre never lived in Minnesota.

Business and Employment Environment



Chapter 3 Business and Employment Environment

Minnesota's healthy economy has posted faster growth rates than the nation over the last several years in many areas: manufacturing employment, total employment, income and construction activity. Labor force participation rates are among the highest in the country, while unemployment rates are among the lowest. Recent national studies have shown that Minnesota's business climate is one of the strongest in the country, particularly for firms in high-technology industries.

3.1 Please describe the current economic climate within the state.

The current economic climate of Minnesota can be described best by examining the most recent economic performance of the state. Minnesota's economy, built on a diverse industrial base, continues to show strength and vitality. High levels of income and manufacturing activity, along with faster than national employment growth, all attest to the sound economic climate of the state.

Minnesota's employment performance over the most recent post-recessionary period (1983-1985) has continued the trend of faster than national growth experienced during the 1970s. Total employment in the state grew by almost nine percent, compared with eight percent nationally. Three sectors – Services, Manufacturing, and Retail Trade – accounted for the majority of post-recession employment growth.

Statewide growth in Manufacturing, Transportation, Communications and Public Utilities, as well as Finance, Insurance and Real Estate (FIRE), outpaced that of the nation. Transportation, Communications, and Public Utilities and the FIRE sectors both grew almost one percentage point faster statewide than nationally.

Between 1983 and 1985, 29,000 new manufacturing jobs were added to Minnesota's economy. This represented an increase of 8.3 percent, almost twice the U.S. growth rate. In Minnesota these gains accounted for 20 percent of all new jobs added to the state's economy compared with 12 percent nationally.

The strength of the state's manufacturing sector did not diminish in 1986. A recent survey by Sales and Marketing Management found the Twin Cities' value of shipments of manufactured goods to be ninth highest among all metropolitan areas in the U.S. The Twin Cities was far ahead of the other major metropolitan areas in U S WEST's territory, as shown in the table on the following page.

VALUE OF SHIPMENTS OF MANUFACTURED GOODS, 1986

Metropolitan Area	*National Rank*	*Value of Shipments (billions)*	*Percent of U.S. Shipments*
TWIN CITIES	**9**	**$28.1**	**1.30%**
Seattle	27	$16.1	.75%
Phoenix	38	$10.7	.49%
Denver	45	$10.0	.47%

SOURCE: Sales & Marketing Management, *Survey of Industrial and Commercial Buying Power*, April 27, 1987.

With 1.3 percent of all U.S. manufacturing shipments, the Twin Cities area accounts for more than Seattle and Phoenix combined.

In other major sectors of the economy, Minnesota, along with the entire Upper Midwest, lagged behind national growth rates during the 1983-85 period. This was the case in Wholesale and Retail Trade, Construction and Services.

Downturns in mining and agriculture have affected the rural areas of the state outside the Twin Cities. While iron ore mining was once a very important industry to Minnesota, recent declines in the steel industry have forced massive layoffs in Northeastern Minnesota. This industry, which employed more than 17,000 workers in 1979, employed less than 9,000 by 1985. While no major employment gains are expected for mining in the short term, the state possesses vast quantities of taconite, copper, nickel, and cobalt that may be utilized in the future.

LABOR FORCE

The work ethic is alive in Minnesota, as shown by the state's historically high labor force participation rate. In 1985, Minnesota ranked fourth in the nation on this measure at 71 percent, and second only to Colorado of the states in the U S WEST service area.

Female participation rates are also very high in Minnesota. In 1985, the female participation rate stood at 62.9 percent. Only Alaska and Colorado, with rates of 63.3 and 62.9 percent, respectively, ranked as high or higher.

UNEMPLOYMENT

Minnesota's unemployment rates are among the lowest in the nation. In 1986, the average unemployment rate in the U.S. stood at seven percent, almost one-third higher than Minnesota's rate of 5.3 percent. Unemployment in the Twin Cities has been even lower, 4.2 percent in 1986, reflecting the exceptional health of the state's major metropolitan area.

MINNESOTA AND NATIONAL UNEMPLOYMENT RATES, 1985-1987

	1985	*1986*	*January 1987**	*February 1987**	*March 1987**	*April 1987**
Minnesota	6.0%	5.3%	6.4%	6.4%	6.1%	4.9%
Twin Cities	4.5%	4.2%	4.7%	4.8%	4.4%	3.7%
U.S. Average	7.2%	7.0%	7.3%	7.2%	6.9%	6.2%

*Not seasonally adjusted

SOURCE: Minnesota Department of Jobs and Training, "Minnesota Labor Market Conditions," May 1987.

PERSONAL INCOME

Personal income is another indicator of the strength of an economy. Minnesota's per capita income has exceeded the U.S. average each year since 1976. In 1986, per capita income in Minnesota, at $14,737, was second highest among the 14 states in U S WEST's service area. National rankings are presented below for Minnesota and the other three states with large metropolitan areas.

PER CAPITA PERSONAL INCOME AND NATIONAL RANK OF SELECTED U S WEST STATES, 1986

State	*Rank*	*Per Capita Personal Income*
MINNESOTA	14	$14,737
Colorado	11	$15,113
Washington	17	$14,498
Arizona	30	$13,220
U. S.		$14,461

SOURCE: U.S. Department of Commerce, *Survey of Current Business*, April 1987.

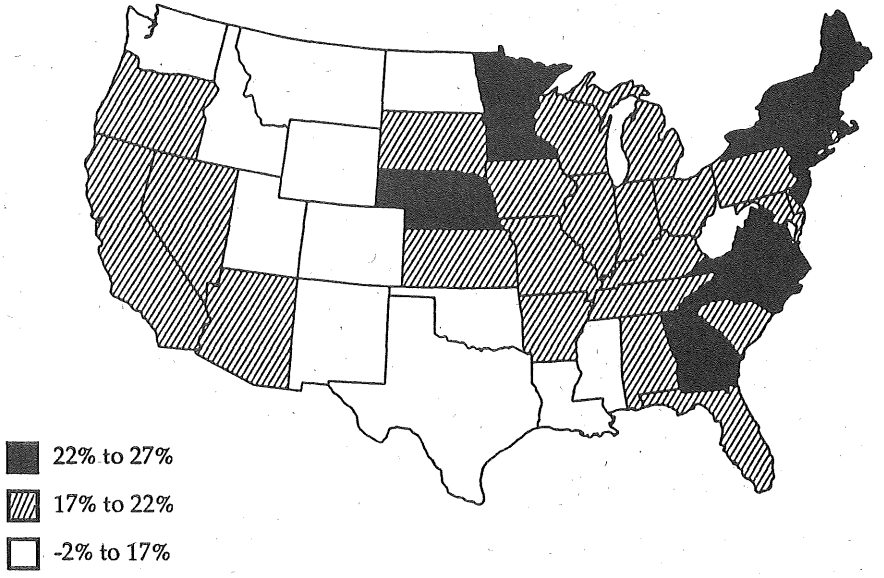
Minnesota's income growth over the 1983-86 period has also far outpaced income growth in these states, as indicated in the table below. Figure 3A shows that Minnesota is one of only two states outside the East Coast to experience rapid income growth during these years.

PER CAPITA PERSONAL INCOME GROWTH, 1983-1986

MINNESOTA	22.4%
Arizona	19.7%
Washington	14.5%
Colorado	14.0%
U.S.	19.6%

SOURCE: U.S. Department of Commerce, *Survey of Current Business*, April 1987.

3A Per Capita Personal Income; Percent Change from 1983 to 1986



SOURCE: U.S. Department of Commerce, *Survey of Current Business*, 1987.

CONSTRUCTION ACTIVITY

Construction activity, highly sensitive to both current and expected economic conditions and interest rates, is a good indicator of economic vitality.

The number of new private housing units authorized by building permits between 1983 and 1986 is shown below for the Twin Cities area and the nation. Residential construction value accounts for the majority of total value of construction undertaken in any given year.

NUMBER OF NEW PRIVATE HOUSING UNITS
AUTHORIZED BY BUILDING PERMITS, 1983-1986

	1983	*1984*	*1985*	*1986*	*Percentage Change 1983-86*
Twin Cities	24,810	26,698	28,611	31,246	+26%
U.S.	1,605,000	1,682,000	1,733,000	1,759,300	+10%

SOURCE: Metropolitan Council, "Residential Building Permits Issued in 1986: Twin Cities Metropolitan Area," March 1987.

Between 1983 and 1986 the number of new private housing units authorized for construction grew by 26 percent in the metro area, more than twice the average growth of housing units nationally. The largest proportion of these new housing units in the

Twin Cities area was constructed in the southern suburbs of Eagan, Eden Prairie, Burnsville, Plymouth, Maple Grove, and Bloomington, areas that have experienced rapid population growth in recent years.

Minnesota also experienced sharp growth in commercial construction activity, which accounts for the second largest share of total private building construction value. As shown below, the increase in the value of commercial construction permits from 1983 through 1986 was almost twice the national rate.

VALUE OF COMMERCIAL BUILDING PERMITS, 1983-1986
(millions)

	1983	*1984*	*1985*	*1986*	*Percentage Change 1983-86*
Twin Cities	$ 274.5	$ 389.4	$ 534.5	$ 630.4	+130%
U.S.	$40,978.0	$54,858.0	$66,929.0	*$68,192.0	+66%

*Estimated

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Value of New Construction Put in Place in the U.S. 1964-1985*, in Marlin Gilhousen, "Commercial Construction in the Twin Cities Metropolitan Area," Metropolitan Council, 1986.

The Twin Cities' impressive performance in construction during the past three years reflects confidence in the area's ability to provide continued strong economic growth.

CAPITAL AVAILABILITY

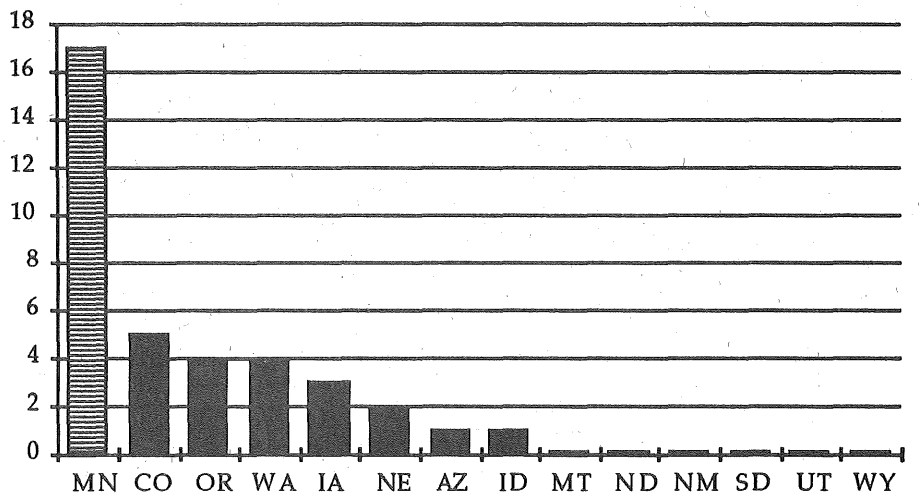
Capital availability is an important measure of a dynamic economy, for it enhances the ability of entrepreneurs to transform their ideas into products. Minnesota is recognized as a vibrant financial center. It ranks fourth among the 50 states in per capita assets of financial institutions ($18,435), almost 20 percent above the national average.

Venture capital is also accessible in the state. More than $75 million in venture capital funds ranks Minnesota 13th nationally in venture capital funds per capita.

FORTUNE 500 FIRMS

No description of the state's economic climate would be complete without recognizing the high concentration of Fortune 500 firms headquartered in Minnesota. The state boasts 17 of these industrial giants, all but one of which are based in the Twin Cities metro area. Honeywell, 3M, Control Data, Pillsbury, General Mills and Cray are among the large corporations that call Minnesota home. In comparison, the states of Washington, Colorado and Arizona combined count only ten such firms among them. Figure 3B shows the number of Fortune 500 companies in each of the U S WEST states.

3B Number of Fortune 500 Firms by State, 1986



SOURCE: *Fortune*, April 27, 1987.

Below is a list of Minnesota's Fortune 500 firms, their sales, location, and 1986 national sales rank. Four of Minnesota's firms are in the top 100.

MINNESOTA FIRMS ON THE FORTUNE 500
LIST OF INDUSTRIAL CORPORATIONS, 1986

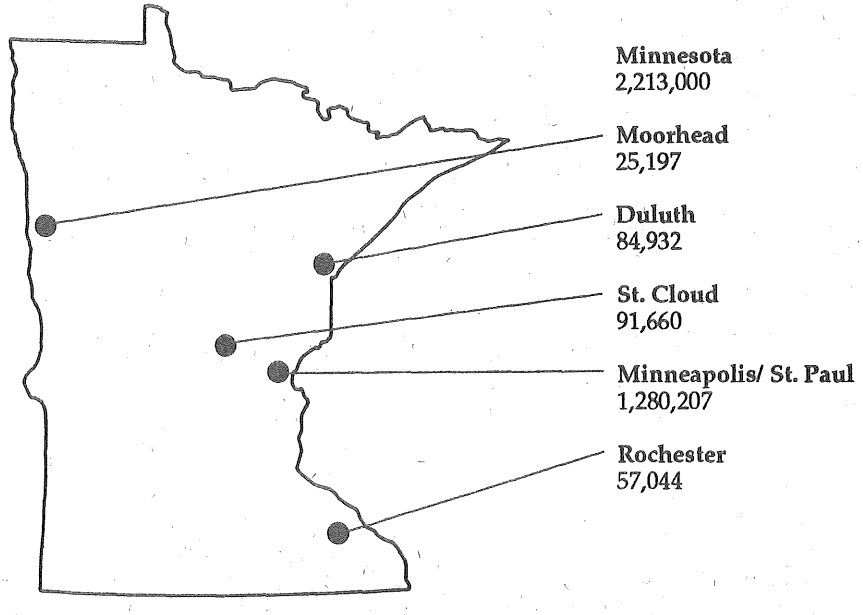
National Rank 1986 Sales	*Company*	*Location*	*1986 Sales (millions)*
39	3M	Maplewood	$8,602
52	Honeywell	Minneapolis	7,087
61	Pillsbury	Minneapolis	5,848
80	General Mills	Minneapolis	4,586
119	Control Data	Bloomington	3,346
167	Land O'Lakes	Arden Hills	2,215
181	George A. Hormel	Austin	1,960
240	International Multifoods	Minneapolis	1,355
260	Farmers' Union Central Exchange-Cenex	Inver Grove Heights	1,220
269	Minstar	Minneapolis	1,156
334	Deluxe Check Printers	Shoreview	867
335	Bemis	Minneapolis	865
352	Ecolab	St. Paul	813
411	Pentair	St. Paul	624
421	Cray Research	Minneapolis	596
431	Jostens	Bloomington	581
457	H.B. Fuller	Vadnais Heights	528

SOURCE: *Fortune*, April 27, 1987.

3.2 How is the state's labor force dispersed?

The regional distribution of Minnesota's labor force is presented in Figure 3C. Of the state's total labor force of 2.2 million, almost 60 percent, or 1.28 million, is located within the Twin Cities metropolitan region. An additional ten percent of the labor force lives in one of the state's other four metropolitan areas: Rochester, St. Cloud, Duluth, Moorhead. Less than one-third of the state's labor force resides in the smaller cities and rural areas of the state.

3C Labor Force Dispersion, 1986



SOURCE: Minnesota Department of Jobs and Training, *Minnesota Labor Market Review*, February 1987.

3.3(a) How many new jobs have been created? (5 years)
(b) In what fields?

On the next page is a table showing sectoral employment for the years 1981-1985 in Minnesota. The next-to-last column presents the number of new jobs created in Minnesota in this period by sector, and the last column presents the percentage distribution of these job gains.

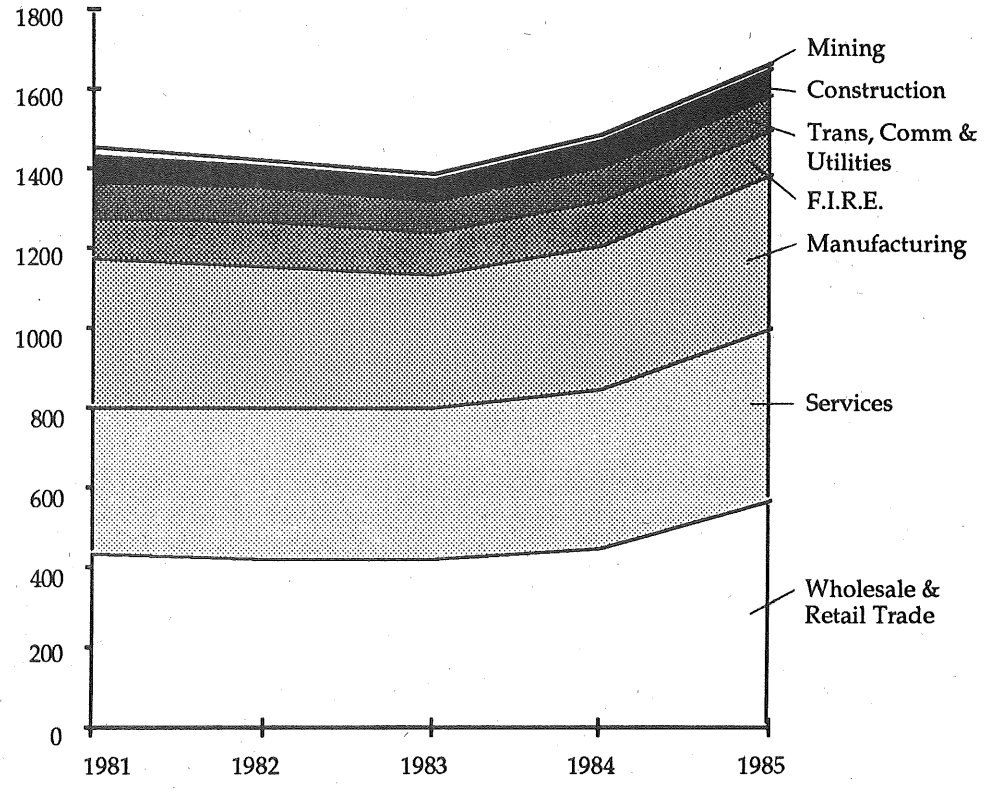
Total employment over this five-year period grew by 104,000, a seven percent gain. As was true at the national level, the vast majority (81 percent) of new jobs created during this period were in the Services and Retail Trade Sectors. New manufacturing jobs accounted for almost 11 percent of all new jobs, while the Finance, Insurance and Real Estate (FIRE) sector represented eight percent of new job growth over this period. Figure 3D presents these employment changes graphically.

MINNESOTA EMPLOYMENT IN MAJOR SECTORS, 1981-1985 (thousands employed)

	1981	*1982*	*1983*	*1984*	*1985*	*New Jobs Created 1981-1985*	*Dist. of New Jobs*
Total Nonagricultural Employment	1,467	1,435	1,403	1,506	1,572	+104	100%
Manufacturing	375	360	344	368	386	+11	11%
Mining	15	12	78	9	8	-7	–
Construction	74	64	60	65	66	-8	–
Transportation	51	51	51	54	57	+6	6%
Public Utilities	14	14	13	14	14	+.5	5%
Communication	19	19	17	18	19	–	–
Wholesale Trade	113	110	110	117	117	+4	4%
Retail Trade	315	309	304	322	337	+22	21%
F.I.R.E.	07	108	105	112	115	+8	8%
Services	370	380	381	410	432	+62	60%

SOURCE: U.S. Department of Commerce, Bureau of Census, *Minnesota County Business Patterns*, 1981-1985.

3D Recent Minnesota Employment Trends, 1981-1985
(In 1000s)



SOURCE: U.S. Department of Commerce, *Minnesota County Business Patterns*, 1981-1985.

3.4 What is the unemployment rate? (5 years)

AVERAGE ANNUAL UNEMPLOYMENT RATES

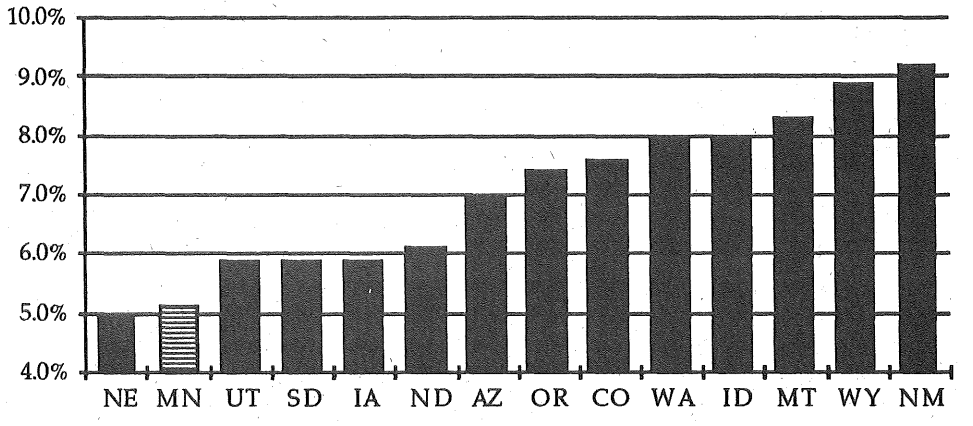
	1982	*1983*	*1984*	*1985*	*1986*
Minnesota	7.8%	8.2%	6.3%	6.0%	5.3%
Twin Cities	6.5%	6.8%	4.7%	4.6%	4.2%
U.S.	9.7%	9.6%	7.5%	7.2%	7.0%

SOURCE: Minnesota Department of Jobs and Training, *Minnesota Labor Market Review*, February 1987.

Minnesota's average unemployment rate has consistently been about 20 percent below that of the nation over the past five years, while the Twin Cities' rate has been more than one-third lower.

The state figures are also considerably below those of states with large metropolitan areas in U S WEST's service area, as shown in the table on the following page. Figure 3E compares the unemployment rates in all 14 U S WEST states.

3E Unemployment Rates in Selected States, November 1986



SOURCE: *State Policy Data Book 1987.*

UNEMPLOYMENT RATES, NOVEMBER 1986

State	*Percent*	*Rank*
MINNESOTA	5.1%	38
Washington	8.0%	13
Colorado	7.6%	16
Arizona	7.0%	20

SOURCE: *State Policy Data Book 1987.*

3.5 What industries are prevalent within the state?

Minnesota's economy is characterized by a diverse industrial sector and a natural resource base of timber, agriculture, and iron ore. The table below compares employment distributions in the major industrial sectors for Minnesota and the U.S.

DISTRIBUTION OF EMPLOYMENT IN MAJOR SECTORS, U.S. AND MINNESOTA, 1984

	Percent of Non-agricultural Employment	
	Minnesota	*U.S.*
Manufacturing	21.3%	20.5%
Mining	.5%	1.0%
Construction	3.9%	4.6%
Transportation, Communication and Public Utilities	5.0%	5.5%
Wholesale & Retail Trade	26.0%	23.4%
Finance, Insurance and Real Estate (F.I.R.E.)	6.0%	6.0%
Services	22.3%	22.0%
Government	15.0%	17.0%

SOURCE: *The Report of The Governor's Commission on the Economic Future of Minnesota,* 1987.

The state distribution of employment in these nine major sectors is very much like that of the nation. While Minnesota shows a slightly smaller representation in the construction and government sectors, it also shows a somewhat greater proportion of employment in the wholesale and retail trade sectors.

A more detailed industry analysis, however, points to some important differences between the state and national economies. Below is a table presenting Minnesota "location quotients" for detailed manufacturing industries. A "location quotient" simply measures the geographic concentration of industry employment in the state relative to that of the nation. A location quotient of 1.0, for instance, signifies that the proportion of employment in the industry statewide is similar to that in the nation; a location quotient of 2.0 means that the state employs twice the national average proportion of people in that industry.

MINNESOTA MANUFACTURING LOCATION QUOTIENTS, 1984

SIC Numbers	*Durables*	*Location Quotient*
24	Lumber & Wood	.9
25	Furniture & Fixtures	.5
32	Stone, Clay, & Glass	.8
33	Primary Metals	.4
34	Fabricated Metals	1.3
348	Ordnance and Accessories	8.9
35	Non-electrical Machinery	2.2
357	Office & Computing Machines	4.9
36	Electrical Machinery	.7
37	Transportation Equipment	.2
38	Scientific Instruments	2.1
39	Miscellaneous Manufacturing	.8
	Nondurables	
20	Food & Kindred Products	1.5
201	Meat Products	1.8
202	Dairy Products	2.5
204	Grain Mill Products	3.6
22	Textile Mill Products	.1
23	Apparel	.1
26	Paper & Allied Products	2.6
264	Converted Paper Products	5.7
266	Paperboard Mills	3.3
27	Printing & Publishing	1.6
275	Commercial Printing	1.8
28	Chemicals & Allied Products	.4
29	Petroleum Products	.5
30	Rubber and Misc. Plastics	.8
31	Leather Products	.5

SOURCE: *The Report of The Governor's Commission on the Economic Future of Minnesota*, 1987.

Many characteristics unique to Minnesota's economy are readily apparent from this table. First, the state possesses more than twice the national average concentration of employment in the non-electrical machinery sector. In Minnesota this sector is dominated by office and computing machines, which is almost five times more heavily concentrated in Minnesota than in the nation. Such a high concentration results from the cluster of major computer firms such as Control Data, Unisys, Cray Research, and others that have helped make Minnesota a "high-tech" center.

Another highly concentrated industry in Minnesota is ordnance and accessories production, which is dominated by firms such as FMC and Honeywell. Employment in this sector in Minnesota is nine times as concentrated as in the U.S. economy.

The state also possesses twice the average proportion of employment in the Scientific Instruments sector, which includes industries producing engineering, scientific and research instruments, as well as controls for residential and commercial environments. Honeywell is the major Minnesota firm in this industry.

Minnesota's high concentration in food products manufacturing reflects the state's agricultural base. Over half the state's acreage is devoted to agriculture. Similarly, Minnesota's rich forest lands, comprising nearly one-third the area of the state, are responsible for the state's high concentration in the paper industry. Especially concentrated in Minnesota are the converted paper products and paperboard mill industries, employing six times and three times, respectively, the national averages.

The printing and publishing industry in Minnesota has approximately 40 percent more employees than the national average. A high concentration of commercial printing activity in the Twin Cities responds to the strong demand for printed advertising materials.

STRUCTURAL GROWTH OF PREVALENT INDUSTRIES

A critical element in Minnesota's outstanding economic performance in recent years has been the high employment growth generated by those industries most heavily concentrated in the state. Statistics on employment growth between 1977 and 1984 for industries prevalent in Minnesota follows:

Fabricated Metals	5.0%
Ordnance	30.1%
Nonelectrical Machinery	30.7%
Office and Computing Equipment	64.2%
Scientific Instruments	27.6%
Food and Kindred Products	-8.8%
Paper and Allied Products	7.2%
Converted Paper Products	13.2%
Paperboard Mills	28.2%
Printing and Publishing	38.6%
Commercial Printing	32.0%

SOURCE: *The Report of The Governor's Commission on the Economic Future of Minnesota*, 1987.

As shown, with the exception of Food and Kindred Products, these industries have all shown strong growth over this period. High growth in these key Minnesota industries stimulates the expansion of many other related businesses in the state.

3.6 Please describe the general availability of worker training programs.

While educational levels of the Minnesota labor force have increased, changes in both technology and the mix of products and services have created demands for new workplace skills and made other skills obsolete. Minnesota has responded to these needs with a variety of programs that use classroom training, employer participation and on-the-job training. These programs are aimed at the unemployed and low-income populations. They include:

Minnesota Employment and Economic Development: Since this program was funded in 1983 at $100 million, it has helped 35,000 workers to find jobs. Individual participants can obtain a high school degree or equivalent and job readiness training. Participating employers receive a $4 per hour wage subsidy and $1 per hour benefit reimbursement.

Minnesota Job Skills Partnership: Funded in 1987 at $1 million, this program trains workers for jobs with specific participating firms. Unisys and Superior Paper are two recent participants.

Job Training Partnership Act: This federally funded, locally administered program offers training and temporary employment to low-income unemployed persons.

Project JOBS: Employers receive subsidies for hiring and training workers who are receiving unemployment compensation.

In addition to the programs described above, Minnesota has an extensive vocational education system that offers continuing job training and education programs throughout the state.

3.7 Please describe any laws relative to affiliated interest and the disallowance of funds and material flowing between firms and their affiliates.

During its most recent session, the Minnesota Legislature passed legislation significantly reducing state regulation of certain competitive telephone services. This legislation also affects affiliated transactions.

The new statute requires telephone companies to maintain for a period of three years records documenting transactions in excess of $50,000 with an affiliated company. When a telephone company has a proceeding before the Public Utilities Commission for approval of rates for noncompetitive services, the burden is on the telephone company to prove that any relevant affiliated transactions that occurred were reasonable.

The documentation required of the telephone company includes:

- the name of the affiliate;
- a description of the transaction or contract;
- the dollar value of the transaction or contract;
- in the case of goods and services purchased from an affiliate, any evidence of efforts made by the telephone company to secure the same service or good from a nonaffiliated supplier; and
- in the case of services provided to an affiliate, any evidence of the fair market value of those goods or services.

This section of the law applies to Northwestern Bell Telephone Company and any of its affiliates, including nonregulated companies and regulated companies that are a part of U S WEST. The purpose of this law is to ensure that the regulated company (NWB) pays fair and reasonable rates for the services that it receives from affiliates and that NWB receives fair and reasonable compensation for services rendered to any affiliates. These procedures are designed to assure that ratepayers are protected and that competitive markets are allowed to operate fairly.

Extensive Minnesota case law exists that covers affiliated transactions and, in particular, the transfer of Yellow Page assets, revenues and expenses from NWB to a nonregulated U S WEST company.

3.8(a) Regarding all telecommunications firms' assets, revenues and expenses, what percentage is currently: (1) Not subject to rate of return regulation; (2) not subject to pricing regulation; (3) allowed a significant degree of pricing flexibility?

It is impossible at this time to provide accurate percentages of regulated and unregulated assets, revenues and expenses. This is a result both of the newness of the legislation passed during the most recent session (it becomes effective August 1, 1987) and the fact that regulated companies themselves must choose whether or not they wish to be subject to it.

Many types of telecommunications firms are not subject to regulation in Minnesota. These include radio common carriers, cellular mobile carriers, microwave/satellite companies, private data channel providers, and value-added networks.

As defined by statute, those firms subject to regulation include all local telephone companies providing basic local telephone service, long-distance companies, resellers of long-distance services, shared tenant service providers, and coin-operated telephone service providers.

1) Not subject to rate of return regulation

State and federal actions over the past few years have removed many services from rate of return regulation. These include the provision and maintenance of inside wire, radio common carrier services (paging, mobile telephone service, cellular mobile telephone service) and the furnishing of telecommunications equipment by telephone companies.

Should companies decide to remain under current law, assets, revenues and expenses devoted to the provision of regulated services would be subject to rate of return regulation for all telephone companies with more than 30,000 customers.

When the new law takes effect, services will be classified into three categories: those which are noncompetitive, those which are subject to emerging competition, and those which are subject to effective competition. Services that are determined to be subject to emerging or effective competition will no longer be subject to rate of return regulation.

Such determinations will be made by the Public Utilities Commission after considering factors such as the number and availability of alternative providers of the service, market shares, barriers to entry, and others. For a service to be found subject to effective competition, alternative services must be available to more than 50 percent of a company's customers for that service; a threshold of 20 percent is required for a service to be deemed subject to emerging competition.

The statute provisionally classifies 23 services as subject to emerging competition, including inter- and intra-LATA private line, message toll and wide area telephone services.

2) Not subject to pricing regulation

Companies with more than 30,000 customers that elect to remain under current law must obtain prior approval from the Public Utilities Commission before making a rate change.

Under the new law, all services classified as subject to effective competition are exempted from price regulation.

3) Degree of pricing flexibility

Companies currently enjoy various forms of pricing flexibility, including rate ranges, price floors, individual case base pricing and service flexibility.

The new law takes significant steps in the direction of increased price flexibility. Services subject to effective competition have complete pricing flexibility, as they are unregulated. Flexibility has also been increased for services subject to emerging competition by greatly streamlining the process by which price changes are approved.

(b) How do you see future opportunities in this regard?

The implementation of the new law will significantly reduce pricing and rate of return regulation for telecommunications firms in Minnesota. If the market responds by offering effective competition for these services, regulation may ultimately be eliminated. The statute stands as a signal to all that both private and public forces in Minnesota are serious about developing a dynamic telecommunications market in the state.

3.9 What is the state's position regarding adjustments to federal taxable income as a starting point for state tax?

INDIVIDUAL INCOME TAX

Additions
- Non-Minnesota state and municipal bond interest
- State income tax deduction

Subtractions
- Exempt interest of qualified federal obligations
- State income tax refunds
- Dependent education expense deduction

CORPORATE INCOME TAX

Additions
- State or foreign income taxes
- Interest on federal, state or municipal obligations not already included
- Exempt interest dividends
- Windfall profits tax deduction
- Federal net operating loss deduction*
- Federal dividends received deduction*
- Mining losses not subject to Minnesota franchise tax

- Capital losses
- Federal charitable contributions*
- Exempt foreign trade income of a foreign sales corporation
- Percentage depletion
- Certain pollution control amortization deductions

Subtractions
- Foreign dividend gross-up
- Federal jobs credit salary expense
- Certain bank dividends paid to federal government
- Depreciation or depletion for certain intangible drilling expenses for prior years
- Capital loss deduction excluding carrybacks
- Expenses for exempt income taxable under state law
- Cost depletion
- Depreciation deductions for pollution control facilities

*Minnesota has separate allowances for N.O.L.s, dividends and contribution deductions.

Also, for corporations, modifications for ACRS deductions are required for property placed in service through 1987.

3.10 On what basis, if any, does the state provide tax credit incentives for investment in the state?

Research Credit: Corporations receive tax credit for research conducted in Minnesota equal to five percent of the first $2 million of qualifying expenses and 2.5 percent of expenses over $2 million.

According to the Minnesota Department of Revenue, the value of the research tax credit to U S WEST would be nearly $5 million in its first two full years of operations, and $500,000 every year thereafter, assuming $200 million in qualifying expenditures, and a five percent annual growth rate.

Enterprise Zone Credits: Specified property tax, sales tax and income tax credits are available for business expansion or new business investments in designated enterprise zone areas.

3.11 What is the state's position on unitary taxation?

Minnesota follows a domestic unitary method for corporate income tax purposes. Only firms incorporated in the United States are subject to the tax.

3.12 What is the state's method of apportionment?

Beginning in tax year 1987, corporations apportion income to Minnesota using a weighted formula of 70 percent sales, 15 percent property and 15 percent payroll.

3.13 Has the state undertaken any tax studies to determine the future course of tax policy and make recommendations to the legislature? If so, please provide available information.

The Minnesota Tax Study Commission was created by the legislature in 1983. Its mission was to conduct a comprehensive examination of the state's tax system and recommend policies to remove inequities, promote economic growth, improve Minnesota's competitive position and meet the state's future revenue needs.

After extensive study of economic and demographic trends, current tax laws and taxing options, the commission issued its report in December 1984. Six interrelated goals for Minnesota's tax system were adopted: 1) equity, 2) predictability, 3) simplicity, 4) neutrality in private decision making, 5) competitiveness with other states, and 6) political accountability.

Major recommendations for personal income taxes included reducing rates, conforming to the federal tax base, and complete tax indexing. Regarding sales taxes, the commission favored broadening the relatively narrow base rather than raising the rate. Property tax recommendations involved reducing the number of classifications and revising the current credit and refund programs. The commission's business tax recommendations primarily addressed very specific aspects of the existing tax code.

Minnesota has made substantial progress in enacting many of the commission's recommendations. First and foremost, the state has significantly reduced personal income taxes. Minnesota now largely conforms to the federal income tax base and the number of individual rates has been reduced to two. The sales tax and business tax bases have been broadened. The property tax system was simplified by reducing the number of classifications. Clearly, the direction of tax reform has been influenced by the tax study commission.

3.14 What restrictions, legislative or other, has the state placed on local jurisdictions' ability to levy taxes on income or gross receipts?

There is a statutory prohibition against enactment of local option income and sales taxes. Some cities have obtained special legislative approval to levy local sales taxes (e.g., Minneapolis, Duluth, Rochester).

3.15(a) Does the state centrally assess the nonoperating personal property of a utility?

No.

(b) Does the state exempt from central assessment the personal property used in a research and development facility?

Yes.

3.16 Does the state formally recognize technological and economic obsolescence for valuation purposes beyond standard depreciation tables?

Obsolescence is recognized in some situations for real property.

3.17 Does property used by a utility fall under a different assessment ratio classification than the same property used by a non-regulated company?

Real property: No.
Personal property of utilities: Yes.

Telephone companies are not classified as utilities for property taxation purposes. Specified personal property for certain utilities is taxed; however, personal property of telephone companies, as well as all non-utility companies, is exempt.

3.18(a) Are real and personal property tax abatements available from the state or are local negotiations necessary?

Local negotiations are necessary.

(b) Are abatements available statewide or only in designated areas of the state?

Abatements are acted upon at the county level.

3.19 Beyond abatements, is there any exemption for machinery and equipment used in a manufacturing or assembly operation?

All machinery and equipment are exempt.

3.20 How is software taxed?

Canned software is taxable for sales tax purposes. A 1987 law change subjects custom software to tax, but only to the extent of the sales price attributed to canned software inputs purchased by the customizer for resale.

3.21 Does the state attempt to assess software as personal property, or is there any legislative movement to extend ad valorem taxation to software?

No.

3.22 With regard to local assessment of personal property, does the state utilize assessment districts, or is it possible for a single facility to be subject to multiple assessments all requiring separate reporting and appeal, i.e., city, county, school district, etc.

Personal property is generally exempt.

3.23 Does the state value inventory any differently than equipment used in the regular course of business?

Inventory as well as machinery and equipment are generally exempt.

3.24 *Does the state tax the purchase of services?*

1987 legislation included certain services in the sales tax base. These include:

- Long-distance telephone services
- Building cleaning and maintenance services
- Detective and security services
- Car services (non repair)
- Laundry and dry cleaning (except coin-operated)
- Pet grooming
- Parking
- Health club services
- Lawn services

3.25 *Under state law, is there exemption from taxation for sales of personal property or enumerated services (such as telephone service) between entities of the same corporation within the state?*

If the entities are divisions of a corporation, transfers of property are exempt from sales and use tax. However, transfers of property between subsidiaries which are separate corporations are taxable.

3.26*(a)* *Does the state require uniformity regarding the transactions which are taxed under state law and those taxed under local ordinance?*

In the case of piggyback sales taxes, uniformity is the norm.

(b) Can a local jurisdiction provide for an exemption that does not exist under state law?

No.

(c) Are local transaction taxes administered by the state on behalf of the local jurisdiction, or must a corporation report directly to the local jurisdiction?

Both cases exist. Minneapolis and Rochester's sales taxes are state administered, while Duluth has local administration.

3.27 *Does the state provide relief, statutorily or administratively, from double taxation for a purchaser of property who decides to lease the property after accepting and paying for property as a purchase?*

No, leasing of personal property requires payment of sales tax.

3.28*(a)* *What is the status of the state's unemployment fund?*

All loans from the federal government were fully repaid in 1986.

(b) *Is it currently fully funded?*

Yes.

(c) *Have any actuarial deficiencies been noted?*

No.

BUSINESS AND EMPLOYMENT ENVIRONMENT – ADDITIONAL INFORMATION

For the past five years the business climate debate has been the premier public policy issue at the state and local level throughout the United States. Whether the topic at hand is taxes, education, workers' compensation or environmental protection, advocates of one policy or another structure their arguments in terms of the impact the proposed changes will have on the business climate – the extent to which an area is perceived to be attractive and hospitable to the enterprises which reside there.

An idea which receives less discussion is that the ranking of a business climate as "good " or "bad" depends very much on the type of business involved. As with any climate, a business climate can be conducive to the growth and nourishment of some plants, while at the same time being inhospitable to others possessing different characteristics. Not all plants thrive under the same temperature and moisture conditions.

The business climate debate comes at an epochal moment in America's – and, indeed, the world's – economic history. The basis of economic strength and competitiveness is shifting from standardized mass-production techniques based on low-skilled labor to methods of production stressing flexibility, adaptability to rapidly changing market demands, research and ingenuity. As one study put it, "Increasingly, the businesses that are succeeding in today's economy are those producing technology-intensive products and services that are changing so quickly that they are obsolete before they can be mass-produced . . . overseas . . . . "

A good business climate for traditional industries of the first type would keep taxes low by limiting investments in infrastructure, education and job training, and research, in the hopes of undercutting tax and wage rates in other areas. Conversely, a good business climate for emergent industries of the second type would recognize that competitiveness in the new economy depends on ideas – research, ingenuity, and creativity – and thus on attracting and developing the kinds of highly skilled people who produce them. This means long-term investments in education and infrastructure that are necessary to make full use of all the people who are part of an economy, as well as developing new partnerships between the public and private sectors of the economy to insure that government is responsive to the ever-changing business environment. These are the factors which are important in today's (and tomorrow's) economy, and which must be included in any attempt to measure an area's business climate.

Minnesota has chosen to create a good business climate for this innovative economy of the future. Governor Rudy Perpich has promised to make Minnesota "the brainpower state," and our description of Minnesota's educational system and research environment elsewhere in this application shows that this is no idle claim.

But you don't have to take our word for it. Recent national studies that compare the business climates of states with particular attention to the characteristics of the new economy have recognized Minnesota's achievements.

The Corporation for Enterprise Development's *Making the Grade: The Development Report Card for the States* (March 1987) calls for new measures of business environments that are more in line with today's economy. "The fundamental flaw of the traditional 'business climate' definition," the report states, "is simply that it applies to economic circumstances that for all intents and purposes, no longer exist. . . . Competing in this new economy demands an entirely new set of private and public actions and investments – a new economic environment – that the old definition of 'business climate' is simply too narrow and incomplete to measure."

The report grades states on four basic indexes: Performance (consisting of employment, income and quality of life variables), Business Vitality (competitiveness of existing businesses, entrepreneurial energy), Capacity (labor skills, education, research expenditures, capital resources and utilization, infrastructure, and amenities), and Policies (the extent to which state governments create stable and fair tax codes, allow for capital mobility, enhance technology and research, improve analysis and analyze potential barriers to economic development, invest in human resources and support community-based development). In all, more than 75 variables are measured to construct these indexes.

Minnesota emerges with A's in Performance (ranking fourth in the U.S.), Capacity (sixth) and Policies (third), and a B in Business Vitality (11th). Only Massachusetts fared better; only California did as well. The rankings of the 14 states in U S WEST's territory are shown in the table below.

CED STUDY: RANKING OF THE STATES IN U S WEST'S TERRITORY

	Performance Index		*Business Vitality Index*		*Capacity Index*		*Policy Index*	
State	*50-State Rank*	*Grade*	*50-State Rank*	*Grade*	*50-State Rank*	*Grade*	*50-State Rank*	*Grade*
MINNESOTA	**4**	**A**	**11**	**B**	**6**	**A**	**3**	**A**
Arizona	32	D	2	A	9	A	24	C
Colorado	20	B	5	A	4	A	30	D
Idaho	32	D	15	B	36	D	44	F
Iowa	29	C	41	F	25	C	15	C
Montana	36	D	37	D	24	C	30	D
Nebraska	13	B	31	D	34	D	30	D
New Mexico	43	F	13	B	22	C	27	D
North Dakota	26	C	38	D	27	C	47	F
Oregon	30	C	19	B	17	B	15	C
South Dakota	26	C	46	F	41	F	43	F
Utah	21	C	9	A	26	C	30	D
Washington	14	B	6	A	19	B	15	C
Wyoming	35	D	27	C	33	D	47	F

SOURCE: Corporation for Enterprise Development, *Making the Grade: The Development Report Card for the States*, March 1987.

The Ameritrust Corporation and SRI International report, *Indicators of Economic Capacity* (December 1986), also hits the traditional business climate indexes that focus heavily on labor costs and taxes while paying little attention to quality factors. Such measurements are, the report notes, "less suitable for many advanced-technology, high-innovation firms that have rapidly changing markets, require highly skilled and adaptable work forces (and the educational infrastructures to keep them that way) and need to offer a high quality of life to attract and retain top engineers, scientists and entrepreneurial managers."

The report constructs three indexes that attempt to measure states' ability to meet these new business requirements: Accessible Technology Indicators (science and engineering faculty quality, amount of university, state and industry research and development, number of patents issued), Skilled and Adaptable Labor Indicators (education levels and expenditures, enrollment in vocational schools), and Capital Availability Indicators (size of equity and venture capital, regulatory climate in banking). The study scores states on 27 individual variables.

Although the SRI/Ameritrust study is primarily aimed at comparing business climate among regions of the country, data on individual states is provided. We produced a state ranking simply by dividing each state's score on each variable by the U.S. average, and summing them (i.e., assigning each variable an equal weight).

This methodology ranks Minnesota eighth in the country on the Index of Accessible Technology Indictors, tenth on the Skilled and Adaptable Labor and ninth on Capital Availability. Minnesota is the only state in the country to rank in the top ten in all three indexes. The rest of the states in U S WEST's territory and their rankings are shown in the table below.

AMERITRUST/SRI STUDY: RANKING OF THE STATES IN U S WEST'S TERRITORY

State	*Accessible Technology* *50-State Rank*	*Skilled and Adaptable Labor* *50-State Rank*	*Capital Availability* *50-State Rank*
MINNESOTA	8	10	9
Arizona	7	2	33
Colorado	21	3	34
Idaho	45	36	40
Montana	32	18	47
Nebraska	3	16	29
New Mexico	29	25	28
North Dakota	37	39	31
Oregon	24	7	20
South Dakota	50	42	18
Utah	6	6	43
Washington	9	17	36
Wyoming	39	8	45

SOURCE: Ameritrust Corporation/SRI International, *Indicators of Economic Capacity*, December 1986.

None of the indexes constructed in these studies is perfect; data availability limits the collection of more meaningful measurements in some cases. Individual industries will always find some variables more important than others. Nevertheless, we believe that these studies are important in that they are concerned with the economy of the future rather than that of the past, and measure, albeit imperfectly, the relative capacity of states to enter and compete in that new environment. They indicate that Minnesota is well positioned for the future.

Most business climate studies focus on the outcome: income tax rates, expenditures per pupil, number of PhDs awarded. We think another important part of the business climate is the process by which those outcomes are produced. How are business climate issues resolved in Minnesota?

Public policy debate may be Minnesota's greatest indoor sport, not surprising for a state whose best known politician is Hubert Humphrey. Extensive debate does not mean inaction, however.

The call to reform state taxes in the early 1980s resulted in the creation of the Tax Study Commission in 1983, which undertook the most comprehensive analysis of the state's tax system in 20 years. An exhaustive list of recommendations was issued; unlike those of many similar commissions, they have not gathered dust in a library, but have served as the basis of the legislature's tax reform packages passed since 1985 and will probably continue to do so until the 1990s. Reforms of the personal income tax recommended by the commission and made into law include federal conformity, indexing, the 1985 $880 million tax cut, and tax simplification. The marginal corporate tax rate was also lowered by more than 20 percent.

Reform of the workers' compensation system has also been high on the list of business climate issues. Minnesota responded in 1983 by changing the underlying incentives in the system to lower the volume of claims and the proportion that went to litigation while maintaining benefit levels for the injured worker. By deregulating rates, the state encouraged price competition from other insurers, giving companies incentives both to shop around for a low-cost provider and to get serious about loss control. The litigation rate has dropped from 15 to about nine percent.

Unemployment compensation has also been a heated business climate issue. As was true in many states facing the volatile economy of the 1980s, Minnesota's unemployment insurance system was forced to borrow from the federal government to meet high unemployment levels. Those loans were fully repaid by 1986, resulting in a tax cut for all businesses. In 1987, the unemployment compensation law was significantly revamped. Maximum benefits were reduced by 40 percent by 1990, while the burden on employers who use the system most heavily was increased. The upshot is that 75 percent of the state's firms will see their tax burden reduced, ten percent will pay the same amount, while the top 15 percent of users will pay higher taxes.

These reforms, and many other public policy proposals, came up through what has been called Minnesota's innovative set of "permanent study and discussion institutions." A host of private non-profit organizations devoted to the study of public issues – such as the Citizens League, Minnesota Wellspring, the Minnesota Business Partnership – and similar privately sponsored forums – such as Spring Hill and other conference centers, the Minnesota Meeting – participate in on-going discussion of public issues. These

groups are often funded by business firms, which also partake in a long-standing Minnesota civic tradition by participating directly.

This network of permanent study groups, in contrast to the use of ad hoc commissions, may be important in helping to resolve issues. Some feel it gives the system a built-in capacity to follow up a proposal after the report is issued, through the legislative process and beyond. It also avoids the deadlock or incrementalism that ad hoc commissions often face because their membership is a delicately composed balance of representatives from several interest groups.

As a study of the state by the Committee for Economic Development put it, "Minnesota has a considerable ability to resolve issues." We think that's an important part of the business climate in today's rapidly changing business environment.

Those involved in working with Minnesota state government have recognized a greater openness to business concerns. Harold D. Field, Jr., Chairman of the Lawyers Committee for the Minnesota Council of the American Electronics Association, wrote recently, "In my judgment, based on frequent meetings during each legislative session, there has been a marked increase since the 1970s in the sensitivity of the Minnesota Legislature to the needs and concerns of the high-technology business community . . . . Urban and rural legislators alike now seem to recognize that Minnesota high-technology businesses must be able to compete throughout the world, and that Minnesota must maintain its competitive attractiveness for these companies."

The business climate debate may never be settled to everyone's satisfaction. What counts, however, is performance, and Minnesota's performance has been strong. As demonstrated throughout this proposal, Minnesota's economy is vibrant and growing, and is especially fertile ground for innovative, technology-intensive businesses serving national and international markets, such as U S WEST.

Evidence of this can be seen in the fact that 17 Fortune 500 companies have located their headquarters here, ranking Minnesota fifth in the country in such headquarters per million residents. It is also reflected in the state's low ratio of business failures to business starts, about half the national average, and in Minnesota's rank as the state with the sixth highest number of persons (per million population) on *Forbes'* list of the 400 richest Americans.

The vitality of the state's business environment can also be seen in recent actions by many of Minnesota's large established companies reaffirming their commitment to the state. For example, FMC Corporation, Honeywell and Valspar Corporation built new research and development facilities to complement their manufacturing operations. Computer firms such as Zycad Corporation, Network Systems Corporation, NCR Comten, and Cray Research added manufacturing capacity in the Twin Cities in the past few years. In 1985, the Ford Motor Company undertook a major retooling of its St. Paul manufacturing plant. In 1986, Ecolab built a new computer center and consolidated its headquarters operations in Minnesota. In all, these projects resulted in more than $450 million in new construction. That represents a strong vote of confidence in Minnesota's business environment by some of the state's largest firms.

Another clue is offered in a recent issue (June 1, 1987) of *Electronic Business* listing the 50 most profitable electronics companies in 1986, measured by profits as a percentage of revenues. Minnesota had four companies on the list (including those in first and third

places overall); only California and Massachusetts had more. In U S WEST's territory, Washington had two firms on the list, while Colorado, Oregon and Utah had one each.

Finally, the growth rate for Minnesota's high-technology industries between 1984 and 1985 also highlights the state's strength. Employment grew by 11 percent, compared with a ten percent gain in Colorado and a five percent loss in Arizona (data on Washington is unavailable).

The proof is in the performance.

Evidence of Minnesota state government's sensitivity to the needs of business was made apparent last month with the passage of one of the country's toughest anti-takeover laws in the wake of the Dart Group's hostile bid for Minneapolis-based Dayton Hudson Corporation.

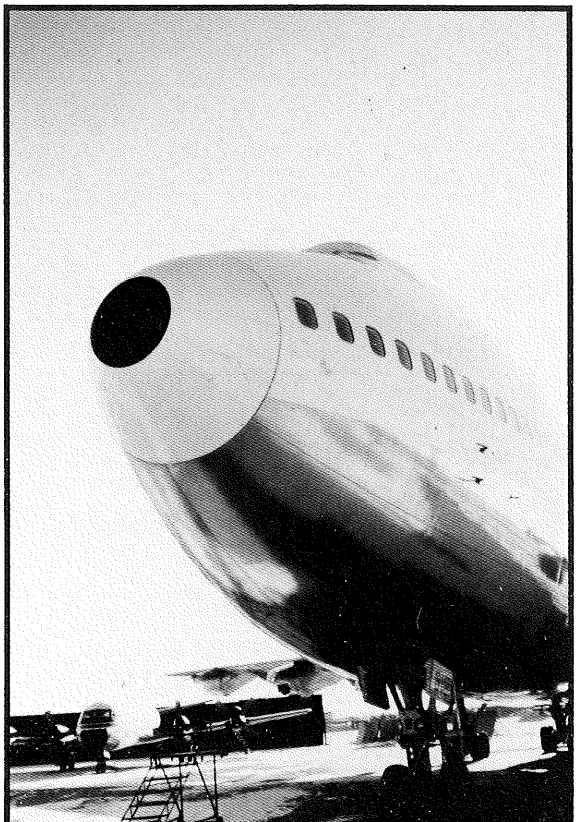
While the fact that the company has been a model corporate citizen for more than a generation surely explains part of the outpouring of public sentiment, a more basic emotion – "After all, Dayton's is *ours*" – played no small part in generating public support. A special session of the legislature called by Governor Perpich passed the law in record time.

That kind of public support for a local company usually comes under the heading "intangible," but it resulted in some very tangible benefits for companies incorporated in Minnesota. This is part of Minnesota's business climate, too. Minnesota takes care of its own.

As James J. Howard, President and CEO of Northern States Power Company, wrote, "The recent anti-takeover legislative action, spearheaded by the Governor, sends a strong message that Minnesota is not (despite some popular beliefs) an anti-business state and, in fact, may be on the new leading edge of understanding what needs to be done to support business development, and, most importantly, having the courage to do it."

4

Transportation



Chapter 4 Transportation

Minnesota's central location is a time-saving advantage for companies serving national markets. The Minneapolis/St. Paul airport is well connected with other cities in U S WEST's territory, all areas of the U.S. and other countries. On the ground, commuting in the Twin Cities metropolitan area is easier than in cities of comparable size because of the presence of two downtowns, low population densities, advanced traffic management techniques and a quality mass transit system.

4.1 How many airlines serve the state?

Minnesota is served by 13 major airlines and eight commuter/regional airlines.

4.2(a) How many flights to major metropolitan areas within the 14 U S WEST states originate and terminate daily at the state's largest airports?
(b) Of these which are direct flights?

Minneapolis/St. Paul International Airport serves 46 cities in U S WEST's territory, with 164 non-stop flights daily, plus 38 direct one-stops. An equivalent number of flights terminate here daily. These figures are shown by state in the table below.

DAILY FLIGHTS TO AND FROM MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT

State	*No. of Cities Served*	*Non-Stop Flights*	*One-Stop Direct Flights*
Arizona	2	5	4
Colorado	1	15	–
Idaho	2	–	10 *
Iowa	6	23	13
Minnesota	12	46	6
Montana	5	6	4
Nebraska	3	9	12 *
New Mexico	1	–	1
North Dakota	5	21	1
Oregon	1	3	1
South Dakota	6	18	4
Utah	1	7	–
Washington	2	11	4
Wyoming	1	–	1 *

* Connecting flights

SOURCE: Metropolitan Airports Commission.

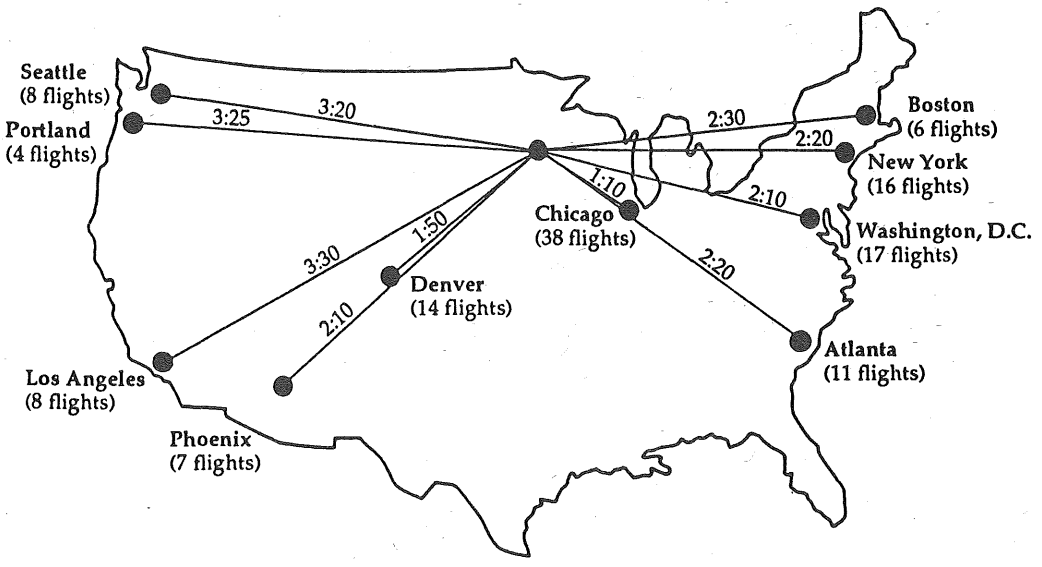
4.3(a) How many flights to major metropolitan areas within the United States originate and terminate daily at the airports?

(b) Of these which are direct flights?

A total of 385 daily flights originate and terminate at Minneapolis/St. Paul International Airport. Flights leaving the airport depart to 160 destinations daily. In 1986, more than 17 million passengers were served.

Figure 4A shows the number of direct flights and the flight time from the Twin Cities to major cities across the U.S. More detailed flight information is shown in the two tables on the following page.

4A Daily Direct Flights from Minneapolis/St. Paul International Airport to Selected Cities



SOURCE: *Official North American Airline Guide.*

DAILY FLIGHTS ORIGINATING FROM MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT

City of Termination	*Flight Time Hours:Min*	*Non-Stop Flights*	*One-Stop Direct Flights*	*Connecting Flights*
Atlanta	2:20	10	1	10
Boston	2:30	5	1	21
Chicago	1:10	38	–	–
Dallas	2:20	8	1	18
Denver	1:50	14	–	4
Detroit	2:30	11	8	11
Los Angeles	3:30	6	2	25
Miami	3:20	2	–	17
New Orleans	3:40	3	–	13
New York	2:20	14	2	29
Phoenix	2:10	4	3	13
Portland	3:25	2	2	10
St Louis	1:20	11	–	–
San Francisco	3:20	6	4	20
Seattle	3:20	8	–	8
Washington, D.C.	2:10	12	5	38

DAILY FLIGHTS TERMINATING AT MINNEAPOLIS/ST. PAUL INTERNATIONAL AIRPORT

City of Origin	*Non-Stop Flights*	*One-Stop Direct Flights*	*Connecting Flights*
Atlanta	10	2	15
Boston	5	1	17
Chicago	35	–	–
Dallas	8	–	16
Denver	14	–	2
Detroit	9	8	18
Los Angeles	7	2	21
Miami	2	1	18
New Orleans	1	–	18
New York	14	5	25
Phoenix	4	4	14
Portland	2	1	11
St. Louis	11	–	–
San Francisco	6	2	19
Seattle	8	1	10
Washington, D.C.	12	5	40

SOURCE: *Official North American Airline Guide,* May 1, 1987.

4.4 What is the general condition of major highways in the state?

The urban interstate system is the primary roadway network serving the Twin Cities metropolitan area. According to Federal Highway Administration statistics, 97 percent of Minnesota's interstate highways are in good condition, five percent above the national average.

4.5 What level of funding does the state currently use and plan for highway improvement?

On average, Minnesota spends approximately $350 million per year on state trunk highway construction and $110 million annually on highway maintenance.

4.6 Please describe the availability of mass transit, including types and area covered.

Regular route and paratransit services are available in all of the major metropolitan areas, including the Twin Cities seven-county metropolitan area, Duluth, Moorhead, Rochester, and St. Cloud. Transit services are also available in many of the small urban and rural areas of Minnesota.

Twin Cities Metropolitan Area: Six operators, one public and five private, provide regular bus route services in the Twin Cities metropolitan area. Key characteristics of Twin Cities transit services are depicted in the following table.

CHARACTERISTICS OF REGULAR ROUTE SERVICE PROVIDERS
TWIN CITIES METROPOLITAN AREA, 1985

	Public	*Private*
Number of routes	122	32
Fleet size	1,051	81
Vehicle-miles/year	28,346,000	1,315,900
Passengers per year	73,731,386	4,810,550
Number of employees	2,272	47

SOURCE: Minnesota Department of Transportation, The 1986 Minnesota Transit Report, January 1987.

Duluth: The Duluth Transit Authority operates 95 buses on 24 routes in the cities of Duluth and Proctor, Minnesota, and Superior, Wisconsin. Ridership in 1985 was 4.7 million.

Moorhead: Moorhead has a fixed-route system with six routes operating on a pulse system from a ground transportation center located in Fargo, North Dakota. Ridership was more than 255,000 in 1985.

Rochester: The City of Rochester contracts with a privately owned and operated company to provide regular route transit service. More than one million passengers were served in 1985.

St. Cloud: The St. Cloud Metropolitan Transit Commission operates 11 routes with 30-minute peak and 60-minute off-peak time intervals between stops. The service is used

primarily for work and school trips. Ridership is slightly more than one million passengers annually.

PARATRANSIT

Paratransit services are also available in the five metropolitan areas discussed above. They are demand-responsive transportation services, offering more flexible and personalized services than conventional fixed-route transit. Paratransit vehicles often have lower capacity than regular route buses and may be equipped with wheelchair tiedowns.

Several types of paratransit services are provided in the metropolitan area, including public and private shared-ride, demand-responsive services for elderly and disabled people, rideshare matching and vanpool programs, county and community paratransit programs, and volunteer driver programs.

Twenty small urban and 14 rural areas of Minnesota also have some form of public transit services. Services vary greatly from small fixed and flexible route systems to systems that are demand responsive.

4.7 What level of funding does the state currently use and plan for mass transit?

The 1987 Legislature appropriated $52.4 million for public transit during the next fiscal biennium (July 1987 through June 1989). The state share for public transit provides an average of 20 percent of total operating costs.

4.8 Please comment on the ease of commuting, including time and distance, and access between residential areas and work centers in major metropolitan markets.

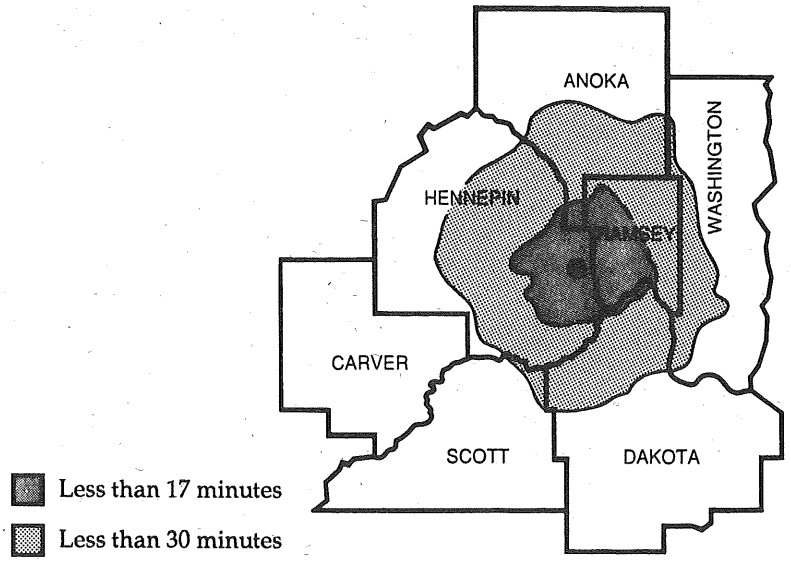
Transportation within the Twin Cities metropolitan area is easier than in most areas of comparable size. The extensive freeway system, moderate population densities and the presence of two central business districts have enabled the region to maintain high levels of mobility during both peak and non-peak hours.

The average work trip travel time in the metro area is 17 minutes, according to studies done by the Metropolitan Council. Approximately 77 percent of all work trips are completed in less than 30 minutes.

Figure 4B illustrates the relationship between travel time and distance in the metro region. It shows the size of the areas within 17 and 30 minutes of the University of Minnesota, which is centrally located in the region. An area of approximately 230 square miles lies within 17 minutes of the University, containing 34 percent of the region's population and 50 percent of its employment. The 30-minute zone covers more than 800 square miles. This larger area contains 81 percent of the region's population and 90 percent of all employment.

4B Twin Cities Area Commuting Times

Time measured from the University of Minnesota
1/4" = 4 miles



SOURCE: Metropolitan Council

This efficient transportation system is a result of the metro area's position as a national leader in managing urban traffic. The Twin Cities has the largest closed-circuit television system in the country for monitoring metropolitan traffic conditions. The Twin Cities metropolitan area is also ranked second nationally in the number of interstate ramps which are electronically metered. These comprehensive surveillance and control systems reduce vehicle delays and traffic accidents, smooth vehicle merging, and substantially increase the volumes that can travel on the state's urban interstates.

4.9 What is the general availability of rail and motor carrier shipping in the state?

Minnesota has significant motor carrier and trucking service capacity. The state is served by 3,600 intrastate carriers and 12,000 interstate carriers, 30 percent of the total number of interstate carriers regulated by the Interstate Commerce Commission.

The state also has one of the nation's first fully automated, centralized, one-stop truck administrative centers. Built in South St. Paul in 1986, the center efficiently handles all motor carrier registrations, permits and licensing.

Minnesota is served by three major railroads: Burlington Northern, Soo Line, and Chicago & NorthWestern. The Twin Cities is a center for rail freight and intermodal service. The 26,000-mile Burlington Northern system, the 6,000-mile Soo Line system and the 5,400-mile Chicago & NorthWestern system give Minnesota excellent rail access.

TRANSPORTATION - ADDITIONAL INFORMATION

Minnesota's geographical position in the center of the country makes it an ideal location for companies serving markets nationwide. In order to effectively exploit this geographic advantage, Minnesota has developed an air transportation system that brings nearly every major city in the continental United States within three hours' flight time of the Twin Cities.

For U S WEST, seeking to expand its markets nationally, with a large proportion of its subsidiaries and customers in the West and the Midwest, with ties to Bellcore in New Jersey, doing joint research with universities in varied locations, and drawing upon a nationwide labor pool of scientists and engineers, Minnesota's centrality greatly minimizes air time (and costs) for company personnel.

Minnesota's air connections with U S WEST's 14-state service area are extensive, with 164 flights daily. And the hours "gained" by crossing time zones on westward trips give you more time to do business.

Minnesota is also "well connected" with the rest of the world. Eighty-eight direct international flights leave from Minneapolis/St. Paul International every week, including 15 flights to the Orient.

Even though the Twin Cities is a major midwestern hub, airport overcrowding is not a serious problem. According to the Federal Department of Transportation, during the first four months of 1987, Minneapolis/St. Paul International averaged only 11 flight delays per 1,000 operations, 66 percent below the average for the nation's 22 largest airports. Moreover, compared with the same period in 1986, the Twin Cities had reduced the number of delays per 1,000 operations by more than 70 percent, the best improvement record of any airport surveyed.

This good service record is maintained through Minnesota's winters. Over the past five years, the airport has been closed only twice for snow removal: for 24 hours in 1984 and for less than five hours in 1983.

Timely service does not come at the expense of safety in Minnesota. Minneapolis/St. Paul International is rated by the International Federation of Airline Pilots Associations as one of the five safest major airports in the world.

Convenient access is another important feature of the airport. It is less than eight miles from both downtowns, a 20-minute freeway ride.

Corporate aircraft can also use any of Minnesota's 141 publicly owned airports, six of which are in the Twin Cities metropolitan area. Holman Field, also known as St. Paul Downtown Airport, is the most popular, situated on a bend of the Mississippi River only one and one-half miles from St. Paul's central business district. It is home to the air fleets of 3M, Apache Corporation, Carlson Companies, and many other Twin Cities firms. Over the past five years, the Metropolitan Airports Commission has spent $15 million on major improvements at this facility. This summer, a new 6,700-foot runway will be completed which can accommodate corporate jets and turbo-prop aircraft weighing up to 60,000 pounds.

Aircraft storage rates at the six Twin Cities airports are among the lowest of any metropolitan area in the U.S. New storage facilities are being constructed to meet the growing demands of private and corporate aviation.

The efficiency of the Twin Cities transportation system is no accident, but the result of a quarter-century of careful planning. The Metropolitan Council, established in 1967, was one of the first examples in the United States of a successful regional comprehensive planning agency. Its jurisdiction covers the seven counties of the Minneapolis-St. Paul area. By taking a regional approach to guiding growth patterns, the Council has been able to prevent the 270 local jurisdictions in the region from working at cross purposes, thereby improving efficiency and reducing waste. The region's integrated transportation system is one result.

These efficiencies have not been achieved by sacrificing safety. Minnesota has the second lowest rate in the country of fatal accidents per 100 million vehicle miles of travel.

Mass transit is an integral part of the Twin Cities transportation picture. One hundred twenty-two bus routes covering 960 square miles carry almost 74 million passengers annually in the region. Hennepin County, which contains the city of Minneapolis, is currently studying the feasibility of building a light-rail transit line from the inner ring suburbs to downtown Minneapolis.

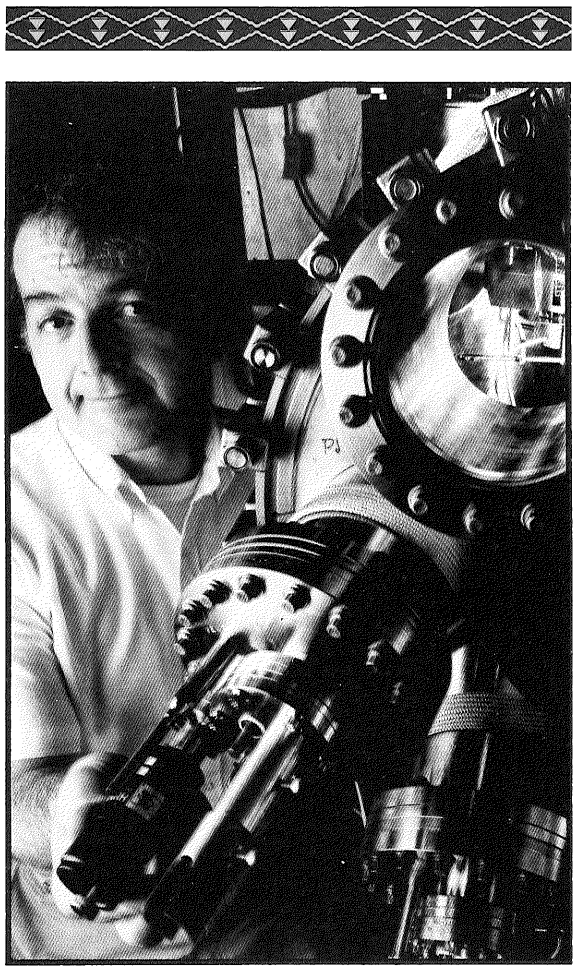
The quality of the Twin Cities mass transit system compares favorably with those of other metropolitan areas. Evidence is provided by the Comparable Transit System Survey, an innovative assessment tool developed a few years ago by the Twin Cities' own Metropolitan Transit Commission. The survey, published twice yearly, reports data on mass transit systems in 23 large U.S. cities. The ranking of the Twin Cities system in four areas – safety, reliability, efficient administration and cost – is shown in the table below.

RANKING OF TWIN CITIES MASS TRANSIT SERVICES AMONG THOSE OF 23 LARGE CITIES, JULY 1986

Area	*Measurement*	*Value*	*Rank*
Safety	Miles Between Vehicle Accidents	34,655 miles	3
Cost	Operating Expense Per Mile	$3.04	3
Equipment Reliability	Miles between Road Failures	4,355 miles	4
Equipment Reliability	Maintenance Work Hours per 1,000 Miles	22.11	4
Labor Reliability	Unscheduled Operator Absenteeism	6.9%	7
Efficient Administration	Administrative Employees/ Total Employees	20.7%	7

SOURCE: *Comparable Transit System Survey*, July 1986.

Technical Access and Initiatives



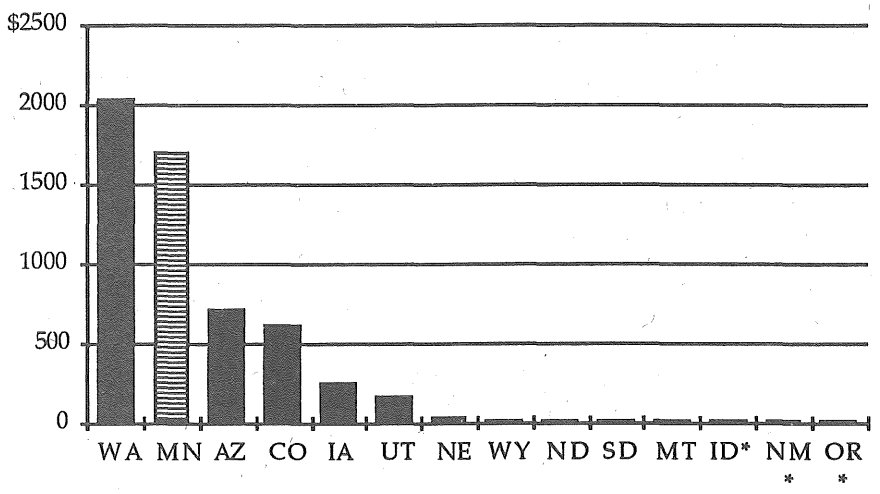
Chapter 5 Technical Access and Initiatives

Access to technology means being close to suppliers and customers and having a ready supply of both entry-level and experienced scientists; it means a community for both basic and applied research and the services necessary to support research activities. The depth, breadth, and quality of Minnesota's technological environment cannot be matched in the region.

5.1 Please provide a brief description of firms involved in research and development within the state, including type of industry and number of employees.

According to National Science Foundation estimates, in 1985 Minnesota businesses spent more than $1.7 billion on research and development, second only to Washington in the U S WEST region (Figure 5A).

5A Industrial Research and Development Expenses, 1985
(in millions)



* No figures available for Idaho, New Mexico and Oregon

SOURCE: National Science Foundation.

It is not surprising, then, that Minnesota is home to literally dozens of high-technology firms with major research components. They include computer and instrument manufacturers, chemical and electronics companies. They are Fortune 500 firms and among the fastest growing small firms in the nation. A list of Minnesota firms with major research operations follows.

Company	*Description of Products and/or Services*	*Employees*
HONEYWELL Minneapolis	• Designs, develops, and manufactures guidance systems and controls for military and commercial aircraft, space vehicles, missiles, naval vessels, and military vehicles. • Designs, develops, and manufactures micro-electronic and electromechanical components and products for residential, commercial, and industrial applications. • Designs, develops, and manufactures sophisticated commercial and industrial systems, both analog and digital computer-based, which are designed for data acquisition, monitoring, control, and management of customer processes and equipment. • Designs, develops, and manufactures products and services related to electronic data processing systems for business, government, and scientific applications.	94,022
3M COMPANY St. Paul	• Manufactures and markets a diversified group of products ranging from coated abrasives and pressure sensitive tapes to chemical, reflective, health care, electrical, magnetic, printing and photo products.	85,466
GENERAL MILLS Minneapolis	• Creates, manufactures and markets food items for consumers, restaurants and specialty retail.	62,056
CONTROL DATA Bloomington	• Provides general purpose computer systems, applications, maintenance, consulting, training and engineering needs of business, industry, and government. • Manufactures disk drives and tape drives for the computer industry principally through joint ventures with other companies. • Provides data base information and application services to those segments of business and industry which deal with transactions processing, marketing, and other commercial functions. • Other services include systems and applications provided to the health care industry, economic development services, and educational products and services.	44,308
MAYO FOUNDATION Rochester	• Provides comprehensive health care, medical research, and training services.	14,400

UNISYS St. Paul Mendota Heights Roseville	• Designs, develops, and manufactures advanced computers and information processing systems for national defense applications. • Designs integrated circuit components, develops fabrication processes and produces custom micro-electronic devices. • Renews previously owned Unisys computer systems and peripheral equipment for re-sale or re-lease. • Designs and manufactures advanced large-scale electronic computers for business, industry, government, education, and space exploration.	13,700
IBM CORPORATION Rochester	• Develops and manufactures small and intermediate-sized general purpose systems and related programming and low-end direct-access storage devices.	7,000
MEDTRONIC, INC. Minneapolis	• Designs, manufactures, and markets heart pacemaker systems, neurological systems, mechanical heart valves, and instrumentation for medical diagnosis and monitoring.	4,843
H. B. FULLER COMPANY St. Paul	• Manufactures specialty chemicals including adhesives, paints, sealants, waxes, and sanitizing chemicals.	4,400
FMC Minneapolis	• Manufactures ordnance products, special gunmounts, and missile launchers.	3,200
CRAY RESEARCH, INC. Minneapolis	• Designs, develops, manufactures, markets, and supports large-scale, high-speed computing systems.	3,180
NCR COMTEN, INC. St. Paul	• Develops, produces, sells, and services data communication processors, modems, and networking software for connectivity, control and management, and integrated network applications.	2,100
ROSEMOUNT, INC. Eden Prairie	• Manufactures instruments for measurement and control of temperature and pressure for aerospace and processing markets.	2,000
CPT CORP. Chanhassen	• Manufactures instruments for measurement and advanced office automation systems, including work stations, intelligent departmental resource processors, networking systems, shared mass storage equipment and a complete line of peripherals and supplies.	1,744
ADC TELECOM-MUNICATIONS, INC. Bloomington	• Designs, manufactures, and sells diverse electromechanical and electronic products for the telecommunications industry.	1,729

E. F. JOHNSON COMPANY Waseca	• Designs, manufactures, and markets a broad range of land mobile communications systems and products and electronic components.	1,500
TELEX COMM-UNICATIONS Minneapolis	• Manufactures professional audio, communications and audiovisual equipment, as well as a variety of instruments and systems for the hearing impaired.	1,300
MTS SYSTEMS CORP. Minneapolis	• Designs, manufactures, and markets systems for use in product development laboratories and in the factory to automate manufacturing processes.	1,161
LEE DATA CORP. Eden Prairie	• Provides a broad array of products in the work stations, departmental systems, and networking segments of the worldwide information processing market.	1,026
NETWORK SYSTEMS CORPORATION Brooklyn Park	• Designs, manufactures, markets and services high-performance data communication systems designed to create very high-speed computer and terminal networks.	908
ANALYSTS INT'L CORP. Edina	• Furnishes analytical and programming services to users and manufacturers of electronic data processing equipment. • Sells computer systems and software packages.	830
MICRO COMPONENT TECHNOLOGY St. Paul	• Supplies complex proprietary semiconductor handling and test equipment and production equipment for the automated assembly of microelectronic circuits.	675
PERKIN-ELMER CORP. Eden Prairie	• Manufactures analytical instruments and ultra-high vacuum equipment.	450
REPUBLIC TELCOM Bloomington	• Supplies alternative long-distance telephone services and specialized communications products.	400
VTC, INC. Bloomington	• Manufactures semiconductors.	400
FSI CORP.	• Supplies high-technology products and services to the semiconductor and related industries in the international market.	275
ZYCAD CORPORATION	• Designs, manufactures, and markets high-performance, special purpose processors which are used to increase engineering productivity in the development of complex integrated circuits and electronic systems.	200

5.2 Please describe any major government- or foundation-funded research projects being conducted within the state.

The firms described in Question 5.1 all have major research and development operations. Brief descriptions of the research being conducted by six of Minnesota's larger recipients of government research and development contracts follow below.

HONEYWELL

Honeywell's research and development funding for 1986 was $705 million, of which $460 million was funded by government contracts. More than 2,000 employees in Minnesota work on research and development within specialized centers and operating divisions. Their research is aimed at developing new technologies in such areas as microelectronics, artificial intelligence, sensors, and computer software and security.

Microelectronics: Honeywell is one of three companies participating in Phase 2 of the Defense Department's Very High Speed Integrated Circuit (VHSIC) program. The company was authorized to begin manufacturing bipolar 1.25 micron chips, and reached the midpoint in a four-year program to develop 0.5 micron circuits. In a complementary technology, Honeywell demonstrated an integrated gallium arsenide monolithic receiver chip, for which the product of the density and speed is about ten times better than any other circuit known to date.

Artificial Intelligence: Artificial intelligence projects include expert systems to help configure mid-range computers and to help diagnose and repair high-speed printers. In addition, an expert system embedded in a TDC system was installed at a major pulp-and-paper customer site. It contains the knowledge of the plant's most experienced operators, and advises employees about potential problems and corrective actions in plant operations. This prototype is expected to pioneer widespread use of embedded systems within Honeywell's industrial and building control systems.

For U.S. military aerospace application, Honeywell is developing a Flight Control Maintenance Diagnostic System that uses expert systems techniques to diagnose faults in complex flight control systems. The firm is integrating the troubleshooting know-how of maintenance experts into a system that can be used by operators with far less training. When this system is deployed, diagnosing and repairing system faults will be a faster and more accurate process.

Computer Software: Honeywell is developing engineering frameworks for electrical computer-aided design, software engineering, knowledge-based software engineering, and expert systems engineering that will reduce software cost and development time. These frameworks incorporate artificial intelligence techniques to provide aggressive, automated support for engineering processes, methods, documentation, and management. Under contract to the U.S. government, Honeywell developed ADA, the Department of Defense standard programming language.

Computer Security: The company is the acknowledged industry leader in computer information security. Honeywell research has produced the most advanced secure systems available, according to the National Computer Security Center's (NCSC) Trusted Computer System Evaluation Criteria. The company was recently awarded an NCSC contract to pursue this research for the federal government.

Sensors: Honeywell is an industry leader in advanced sensors, and is building on this lead with materials research and technology development for electro-optical, fiber-optic and integrated sensors. In aerospace and defense applications, Honeywell is exploring ways to enhance the performance of Ring Laser Gyros, which are highly accurate and reliable inertial measurement sensors. These components have been fitted in an inertial navigation system which has been selected as the Air Force Standard Navigator.

CONTROL DATA CORPORATION

Control Data Corporation (CDC) maintains a vigorous research and development program, and will invest in excess of $400 million in 1987 to develop high-speed computers and mass storage devices.

During 1987, CDC's federal government funding for research will exceed $100 million and will be directed primarily toward the areas of computer system architecture, advanced circuit technologies (CMOS and GaAs), logic design, advanced packaging and cooling techniques, and mass storage technologies.

Representative examples of equipment developed partially or wholly under government sponsorship include the following:

- AN/AYK-14(V), the Navy's standard airborne computer;
- AN/UYH-3(V), a fully militarized disk system patterned after Control Data's state-of-the-art commercial mass storage systems;
- CYBER 205/ETA-10, general purpose supercomputers employed by various government agencies to pursue state-of-the-art research in weather forecasting, nuclear reactor design, high-performance airfoil design, and other areas;
- 469R², a rugged and highly reliable fourth generation spaceborne computer that features a mean time to failure measured in hundreds of thousands of hours.

UNISYS (Sperry Burroughs)

Unisys employs a force of 12,000 workers in Minnesota to develop mid- and large-scale computer systems for commercial applications and for the U.S. government.

In 1986, $50 million of the firm's $450 million Minnesota operations was devoted to basic and applied research performed for the Department of Defense and other government agencies. Approximately one-half of this amount was for basic research.

Examples of basic and applied research work conducted in Minnesota include fiberoptic interconnect systems, integrated optics, super conductivity, data base engineering, expert systems, programmable signal processors, high-density packaging, advanced computer architecture, VLSI circuits and GaAs circuits.

FMC CORPORATION

FMC Corporation's average annual expenditure on research and development in Minnesota is $50 million, of which $40 million is from U.S. government contracts. FMC has an 800-employee Engineering Department, with 600 people dedicated to R&D activities. Examples of FMC's government-sponsored research include the following projects:

Generic Auto Loading System: FMC will develop an experimental prototype which demonstrates the potential of applying advanced technologies to ammunition loading systems.

Fire Control Analysis: A software program will be developed to help compare performance of the current PHALANX ship defense system with that which could be achieved using state-of-the-art methods and procedures in fire control processing.

Electronics: FMC is exploring ultra-high-speed data processing, fire control systems, weapon control systems, and advanced man-machine interfacing.

Artificial Intelligence: The company is investigating the uses of artificial intelligence to develop expert maintenance control systems.

MTS SYSTEMS CORPORATION

MTS Systems Corporation spent $6.1 million on R&D in 1986, largely through its Advanced Technology Development (ATD) Division. ATD has developed special expertise in integrating the technologies of industrial robots, vision systems, sensors, lasers, CAD/CAM man-machine interfaces, and factory communications into manufacturing technology and operations.

Presently, ATD is working with process researchers and technology developers to build machines that demonstrate the practical utility of research concepts in the technology of manufacturing. LARS and IRIS, funded by the U.S. government, are two demonstrations of this capability.

LARS, Laser Articulating Robotic System, is currently being developed for the U.S. Navy under a Man-Tech funded program, one of the largest totally integrated manufacturing technology efforts ever implemented. MTS is also developing 3-D, real-time weld seam tracking, A/I based adaptive weld process control, high accuracy robotic position sensing and control, and other advanced robotics technologies under this program.

IRIS, Intelligent Robotic Inspection System, provides automated high accuracy, fast 3-D metrology for final inspection and verification of a wide range of large and small machined parts profiles. This project represents a logical extension and further enhancement of the technologies being developed under the LARS program.

LARS and IRIS are the first major applications of an advanced software system called HOSE previously developed by ATD. HOSE is both a language and an operating system optimized for implementing real-time digital control and signal processing systems.

UNIVERSITY OF MINNESOTA AND INSTITUTE OF TECHNOLOGY

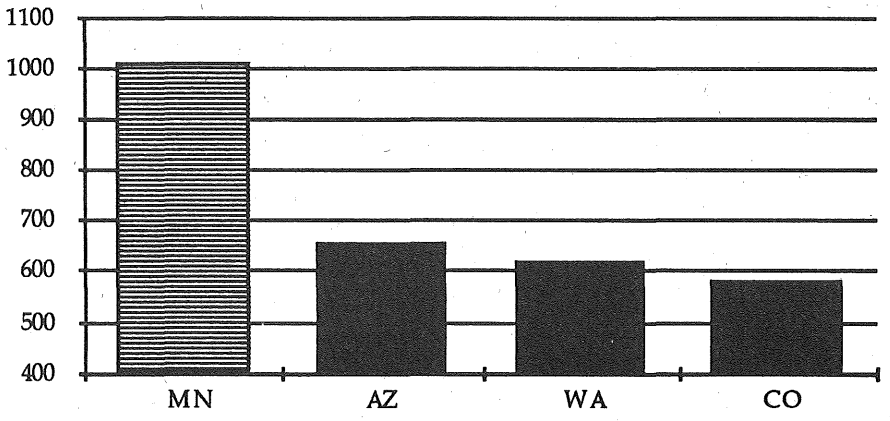
In Fiscal 1986, sponsored research expenditures for the University of Minnesota were $126 million, $96.5 million from federal sources (including $24.3 million in indirect funds), $2.2 million from state and local government sources, and $27.3 million from private sources. The University of Minnesota ranks tenth among the nation's public and private universities in total federal obligations and 14th in research and development obligations.

The University of Minnesota conducts large-scale research projects for all major federal funding agencies, including NIH, DOD, NASA, NSF, DOE and USDA. Major research projects are also sponsored by such corporations as 3M, Honeywell, Control Data Corporation and IBM. A list of university research contracts, many of them federally funded, is provided in the answer to Question 1.6 (b).

5.3 What factors weigh most heavily in favor of locating a research site in the state?

Since the 1890s, when the development of a new technology for milling spring wheat created our home-grown corporate giants, Pillsbury and General Mills, Minnesota has demonstrated its ability to support technology development and research activities. More recently, Minnesota has become the home of the nation's supercomputer industry and has been the scene of many of the world's leading high-technology breakthroughs, from gallium arsenide to the cardiac pacemaker. Minnesota ranks fifth in the nation in patents issued per million residents, and first in the U S WEST region in total number of patents, as shown in Figure 5B.

5B Total Number of Patents Issued, 1986



SOURCE: Public Affairs Office, U.S. Patent and Trademark Office.

The key factors which contribute to this environment of success for technological research include a well educated, highly trained work force, a strong academic research community, and a diverse and growing technology-intensive industry network.

These factors, coupled with sophisticated capital and venture capital firms and a long-term commitment by state government to promote research and build a top-quality education system, create an exceptional atmosphere for technology research, development and commercialization.

LABOR FORCE

Highly skilled scientists, engineers, and computer specialists are the one essential "input" to U S WEST's telecommunications research facility. Minnesota has a demonstrated ability to graduate large numbers of such technically trained personnel from its educational system, and to offer a quality of life attractive enough to keep them here, as well as to attract technical employees from other states.

Minnesota employed 176 scientists and engineers per 10,000 population in 1984, five percent above the national average. Technical employees in Minnesota in 1987 include: 7,200 electrical and electronic engineers, 6,758 electrical and electronic technicians, 9,040 computer programmers, 6,000 computer systems analysts and scientists, and 1,043 operations and systems researchers and analysts.

Minnesota colleges and universities educate a large number of engineers and scientists that are a prime source of entry-level employees for U S WEST. The table below compares the number of degrees awarded in electrical engineering and computer science in Minnesota with the three other states with large metropolitan areas in U S WEST's territory.

DEGREES CONFERRED AT ALL LEVELS, 1985-86

Field of Study	*Minnesota*	*Washington*	*Colorado*	*Arizona*
Electrical Engineering	342	452	348	447
Computer Science	773	423	438	356

SOURCES: Minnesota Higher Education Coordinating Board; Washington Higher Education Coordinating Board; Colorado Commission on Higher Education; Arizona Board of Regents.

The figures show that while Minnesota graduated about 55 fewer electrical engineers than the average for these four states, its production of computer scientists was 275 above average. The number of electrical engineering graduates in Minnesota is likely to increase in the near future as a result of the creation of two new engineering schools at Mankato and St. Cloud State Universities in 1984.

The Twin Cities area's ability to attract and retain highly skilled technical professionals was noted by Donald M. Sullivan, President of MTS Systems Corporation, a Minneapolis-based robotics company. (See Question 5.2 for a description of MTS's government funded research. The company was recently named one of the 50 most profitable electronic companies in 1986 by *Electronic Business.*)

"There is no question," Sullivan said, "that the greater Twin City metro area is a mecca for hardworking, middle-America born and educated technical (and non-technical) professionals. These employees do not readily move out of the area once in, nor do they skip from company to company. As evidence, MTS Systems' turnover rate for professionals is less than two percent per year, and that is not unusual at technology-intensive companies in this area."

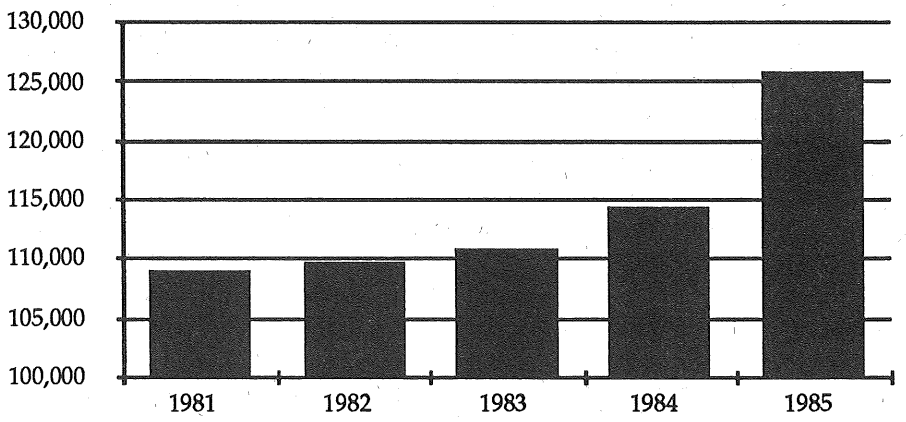
Similar sentiments were expressed in a recent (June 24, 1987) *Wall Street Journal* article concerning Minneapolis' stature as a prime lure for investors seeking promising small high-tech firms.

"Money managers say a relatively stable professional employment climate in Minneapolis makes it easier to keep track of investments here," the article stated. "Considered one of the nation's most livable cities," it continued, "Minneapolis tends to attract and hold professionals."

A TECHNOLOGY-INTENSIVE INDUSTRY NETWORK

Nearly 1,500 technology-intensive firms are located in Minnesota, employing more than eight percent of the state's work force in 1985. Statistics indicate that these firms are thriving here; employment grew by 11,000 between 1984 and 1985, an 11 percent increase (see Figure 5C).

5C Minnesota's High Technology Sector Employment



SOURCE: U.S. Department of Commerce, *Minnesota County Business Patterns.*

Minnesota's largest technology-intensive industries include computers, electronics systems, defense-related electronics and electro-mechanical systems, and medical and measuring instruments. The high-technology list includes several well-known Minnesota-based corporate giants, such as 3M, Honeywell, Control Data, Medtronic, CPT Corporation, the Mayo Foundation and Cray Research. Several large subsidiaries of out-of-state corporations are also located here, such as Unisys Corporation, Cardiac Pacemakers, IBM and NCR Comten.

Minnesota's technology-intensive sector is not only "deep" but "broad" as well. Of the 30 industries that the Brookings Institution identifies as technology-intensive, Minnesota has significant representation in all but two – oil and natural gas exploration and drilling, and space vehicle development and manufacturing.

This rich industry network helps to attract top-notch researchers and scientists and stimulates cross-fertilization of knowledge and techniques among firms, yielding a dynamic and highly competitive business environment. These high-tech industry leaders are also among the key consumers of U S WEST's products and major suppliers to U S WEST. Through such industry groups as the Minnesota High Technology

Council (see Question 5.7), industry members join together to maintain and enhance the state's sound environment for technology research and development.

ACADEMIC RESEARCH COMMUNITY

The University of Minnesota is not only a source of high quality employees but also a source of basic and applied research support for the industrial community. The University is a major center of both publicly and privately sponsored research across a broad range of disciplines, with annual research expenditures in excess of $125 million. It consistently ranks among the top five public universities in federal research obligations. The University's reputation for excellence in scholarship and research is a reflection of the quality of its faculty, which boasts many internationally recognized and respected scholars. These individuals anchor strong research groups, which in turn attract outstanding young faculty and graduate students to the University.

The University's Institute of Technology is Minnesota's principal resource for research in engineering, mathematics, and physical and computer sciences. The Institute has a faculty of approximately 400, who received their initial training at 100 different universities throughout the world. Their variety of backgrounds and talents enriches the Institute.

5D Ratings of Scholarly Quality of Program Faculty at Universities in the 14 U S WEST States

Rankings based on peer rating of faculty on a scale of 1 to 5

Electrical Engineering

University of Minnesota	**3.2**
University of Colorado	3.2
University of Washington	3.0
University of Arizona	2.9
Iowa State University	2.6

Mechanical Engineering

University of Minnesota	**4.1**
University of Washington	3.1
Iowa State University	3.0
Arizona State University	2.7
University of Iowa	2.6

Physics

University of Washington	3.9
University of Minnesota	**3.5**
University of Colorado	3.1
University of Arizona	3.0
University of Oregon	2.8

Mathematics

University of Minnesota	**3.9**
University of Washington	3.6
University of Utah	3.2
University of Oregon	2.9
University of Colorado	2.9

Computer Science

University of Washington	3.4
University of Utah	3.2
University of Minnesota	**3.0**
University of Arizona	2.1
University of Iowa	1.7

SOURCE: National Research Council, *An Assessment of Research - Doctorate Programs in the United States: Engineering, and Mathematics* and: *Physical Sciences*, 1982.

The Institute's faculty ranks fourth in the nation in the number of Presidential Young Investigators, which attests to its strength at the junior level. (Chapter 1 describes the Institute of Technology's research programs in detail.) Ratings of faculty quality made by the National Research Council in 1982 ranked Minnesota's faculty first among all universities in the 14 U S WEST states in electrical engineering, mechanical engineering and mathematics (see Figure 5D). Minnesota ranked second in physics, and third in computer science.

The Institute has enjoyed a close relationship with Minnesota's industrial research community, as detailed in Question 1.12. This vital link is demonstrated by the nearly $8 million in private research contracts awarded to the Institute and cooperative educational programs involving more than 300 companies.

The Institute of Technology Libraries are a critical resource, not only for the University's instructional and research programs but also for the state's extended research community in business and industry. The collection's holdings in engineering and the mathematical and physical sciences number more than 376,000 volumes and 4,000 periodicals.

Thus, Minnesota's combination of highly skilled people, high-technology industrial base, and academic research creates an exceptionally strong and dynamic foundation upon which to build a research facility. This combination of advantages and the state's demonstrated tradition of technology innovation simply cannot be matched in the region.

5.4 What technical and vocational programs are offered in the state?

Minnesota's extensive area vocational Technical Institute (TI) system is unsurpassed in the nation, enrolling a higher proportion of the student-age population than any other state. TI schools serve students at 30 campuses around the state. In 1985, approximately 38,000 students were enrolled full-time; an additional 283,000 students took part in extension programs.

In FY 1986, Minnesota TIs offered 198 programs of instruction, 97 of which were in technical and industrial specialties. The table on the next page lists courses of study of greatest interest to U S WEST, the number of campuses at which those programs are offered, and the number of graduating students in 1985.

SELECTED TECHNICAL COURSES OF STUDY AT MINNESOTA TIs

Course of Study	*Number of TIs Offering*	*1985 Graduates*
Computer Operator	4	123
Computer Programmer	6	175
Microcomputer/Microprocessor Controls Technician	1	34
Microcomputer Repair	2	11
Electronics Technician	15	675
Communications Electronics	1	18
Industrial Electronics	1	9
Electrical Design/Drafting	1	13
Electro-Mechanical Technician	3	105
Computer-Aided Printed Circuit Technician	1	NA
Laser Electro-Optic Technology	1	NA
Industrial Engineering	2	17
Industrial Instrumentation	2	58
Metrology/Precision Measurement	1	NA
Mechanical Drafting	16	209
Metallurgical Technician	1	5
Plastic Technology	1	28
Nondestructive Testing	1	71
Robotics	3	29

NA = Not Available

SOURCE: State Board of Vocational Technical Education, Minnesota Student Information System, *Class of 1985 KRA Final Report.*

In addition, Minnesota's community college system offers training in a number of technical fields. Associate degree programs in Drafting and Design Technology--CAD/CAM, Microprocessor Technology, Automated Manufacturing Engineering Technology, Computer Technology, Electronic Engineering Technology and Mechanical Engineering Technology prepare technicians for jobs in the complex, sophisticated world of high technology.

The community colleges also provide customized training, on-site, at the request of business and industry. Some examples of these special training programs include:

• Control Data, Ecolab, CPT, Cray Research and First Bank System were among 40 business organizations and ten nonprofit agencies serviced by North Hennepin Community College's Management Institute. NHCC has provided customized training to 21 firms and more than 600 employees during the past two years.

• Twenty Automated Manufacturing Engineering Technicians were graduated in 1986 from a Rochester Community College program initiated by IBM. An additional 220 IBM employees were served by the College through classes and teleconferences.

• More than 700 employees from such companies as FMC, Unisys, Federal Hoffman, Gresen Manufacturing, American Institute of Banking, and Onan were served by

communications, interpersonal relations, statistics and business classes provided on-site by Anoka-Ramsey Community College last year.

5.5 What is the general availability of software programmers and electrical engineers in the state?

Minnesota is headquarters to 17 Fortune 500 Manufacturers and, as discussed in Question 5.3, has a large and fast-growing high-technology sector. As a result, scientists and engineers are concentrated in Minnesota, which ranks 11th in the nation in scientists and engineers per thousand residents.

Specific estimates of Minnesota employment in selected occupations in 1986 are as follows: 7,200 electrical and electronic engineers, 6,758 electrical and electronic technicians, 9,040 computer programmers, 6,000 computer systems analysts and scientists, and 1,043 operations and systems researchers and analysts.

Graduates in computer sciences and electrical engineering provide an indication of the available supply of entry-level employees in the state. In 1985-86, 773 degrees in computer science and 342 in electrical engineering were conferred by Minnesota colleges and universities.

5.6 What advantages can the state provide to support a major centralized technical operations center or research and development facility?

The economic advantages offered by Minnesota as a place to conduct industrial research were discussed in Question 5.3. The specific public and private programs designed to foster technology business formation are discussed in Question 5.7. A package of possible incentives available to U S WEST is presented in Chapter 6. Other advantages offered by the state are presented below.

Corporate Tax System: There are several aspects of Minnesota's corporate income tax system that are especially advantageous for research and development firms. First, the income apportionment formula gives a 70 percent weight to Minnesota sales, and a 15 percent weight each to property and payroll. Firms with very little sales income in the state and large payrolls – such as research facilities – are able to minimize their tax base and, therefore, their tax exposure.

In addition, Minnesota has a research and development tax credit. The tax credit is five percent of a facility's increase in R&D expenditures above its three-year average, for the first $2 million, and two percent of any amount above $2 million. Assuming that $200 million of Advanced Technologies' budget qualifies for the credit, and that expenditures grow by five percent annually, the R&D tax credit is estimated to be worth nearly $5 million to U S WEST in its first two years of operation and $500,000 per year thereafter in reduced tax liability.

Tax Increment Financing: Minnesota's tax increment financing system allows counties and municipalities to use the incremental increase in property taxes resulting from new development to reduce the cost of land or site preparation costs for that project.

Assuming U S WEST's property is worth $50 million and the effective tax rate is two percent per year, the value of this program to U S WEST in NPV terms would be nearly $7 million. This amount is enough to virtually eliminate land acquisition and preparation costs.

5.7 Please describe any existing programs to foster new high-tech business development within the state.

Minnesota's public and private commitment to foster technology-intensive business development in the state is exemplified through six programs. Each brings business together with government in a cooperative initiative to stimulate business formation and technology development.

In 1984, to facilitate the growth of high-technology industries in Minnesota, the Minnesota Legislature, the City of Minneapolis and the University of Minnesota contributed $12 million to develop the Minnesota High Technology Corridor. The funds were used to build the Minnesota Supercomputer Center to serve as a major institution for technology transfer and an anchor facility for the Corridor.

The Corridor, funded and governed by state, local and private entities, seeks to attract and foster high-technology research and development companies. By creating a "high-service" environment and concentrating a number of high-tech firms in close proximity to one another and to the University, the Corridor seeks to stimulate technology/ knowledge transfer and spinoff businesses.

The Corridor adjoins the West Bank campus of the University of Minnesota. Major facilities in the High Technology Corridor include FMC's new 500-employee research facility, Canton USA's audio research and marketing headquarters and Control Data's Business Incubation Center, as well as the Supercomputer Center.

Supercomputer Center: A major step forward in the state's capacity to serve the computing needs of industry and faculty was the establishment of Minnesota Supercomputer Center, Inc., in 1982. MSC is designed to provide academic, government and industrial researchers with leading-edge computational hardware, software and applications programs. MSC offers its users both CRAY and CDC/ETA architectures in a unique configuration unavailable at any other center in the country.

To make these systems accessible, MSC has pioneered the use of UNIX as a common operating system. A reliable, easy-to-use TCP/IP communications network connects a wide range of equipment at user sites. A background storage system is used (XFS) that appears to the user as an on-line UNIX file system. Regular training programs are offered to cover all aspects of systems and services at the Center.

The MSC user community includes Fortune 500 companies, such as General Electric's R&D Center at Schenectady, NY, researchers at the National Science Foundation and a large number of scientists and engineers at Minnesota and other universities. Timesharing services are made available to industrial users for their proprietary use.

Minnesota High Technology Council: The Minnesota High Technology Council (MHTC) is a nonprofit association of businesses whose products and services are based on technology. MHTC's mission is to promote the continued growth of technology-intensive industries in Minnesota.

The MHTC works as a catalyst – bringing together government officials, educators, business organizations and concerned individuals – to create initiatives that will enable Minnesota and its high-technology industries to flourish. The members believe that such activities will ultimately expand employment, increase state revenues and build a stronger economy for the benefit of all Minnesotans.

Education was the focus of MHTC's 1986 programs. Through numerous activities, MHTC contributed to an awareness among state leaders and business groups of the urgent need for statewide expansion of science, math and technology-related education at all levels.

Science and Technology Resource Center of Southwest State University: Established in 1985 by the state legislature as a pilot project for regional development, the Science and Technology Resource Center (STRC) has already demonstrated its success in enhancing the economic development of southwest Minnesota. The Center uses the faculty, facilities and technical services of Southwest State University at Marshall to help entrepreneurs develop new products and processes with the potential for creating new jobs in the region.The Center has more than 60 active clients. It has developed an outreach network using area vocational Technical Institutes in the region.

Minnesota Cooperation Office: The Minnesota Cooperation Office (MCO) is a private nonprofit foundation established by Minnesota corporate leaders to help new businesses succeed in Minnesota. MCO staff provide selected businesses with an array of assistance services, including developing a business plan, hiring a management team, establishing a board of directors, and identifying capital resources. In order to qualify for MCO assistance a company must have a unique protectable product or service. Over the past three years, MCO has assisted 27 businesses, largely from high-technology industries, and has a success rate of 88 percent.

Greater Minnesota Corporation: The centerpiece of Governor Perpich's 1987 legislative package, the Greater Minnesota Corporation was created to promote jobs and economic growth through applied research, technology transfer and product development. It will form partnerships with groups in education, business, labor and agriculture to focus Minnesota's applied research and development efforts on new products, businesses and jobs for the industries of the future.

The Corporation is not a state agency, but a public corporation governed by an 11-member board of directors. It will establish a Research Advisory Board to provide scientific and technical advice on specific projects.

The Corporation's research activities will include financing applied research in partnership with private businesses, colleges, universities and other post-secondary education institutions in the state. Research assistance includes matching grants to post-secondary educational institutions and contract research with public or private research institutions. The Corporation may also construct, own and operate its own research centers. This on-site research capability will enable it to respond swiftly to changing priorities and emerging applied research needs. The Corporation may also establish up to four regional research institutes, each to be near a post-secondary educational facility.

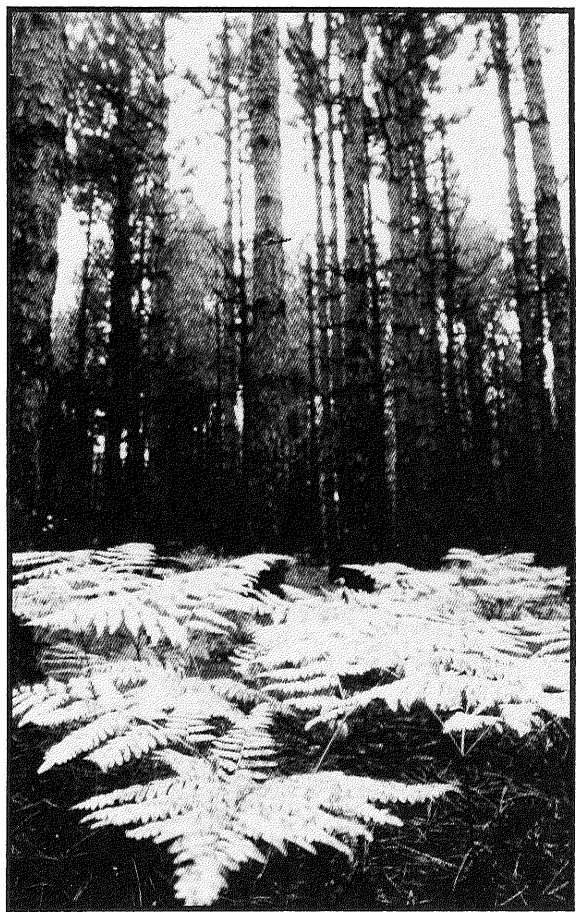
The Corporation's mission includes technology transfer and investing in new products and businesses. While equity investments can be made in existing or new businesses, they are likely to be concentrated on new products created by ventures which have

conducted research at the Corporation's research facilities. Such investments may include equity ownership of stocks, warrants, or convertible debt; participation as a limited partner in partnerships, including venture capital limited partnerships; and participation in joint ventures with private corporations.

The Corporation may also use other financing tools, including direct loans, insurance or loan guarantees, interest subsidies, and participations in loans made by other lenders.

To carry out its duties, the Greater Minnesota Corporation received an initial $12.5 million state appropriation, with up to $120 million earmarked for future funding.

Incentives



Chapter 6 Incentives

The Advanced Technologies research facility would greatly benefit Minnesota: it would further diversify and expand the state's high-technology sector; it would enrich the University's research environment; and it would significantly expand the state's tax base. Recognizing the value of these benefits, Minnesota proposes to seek legislative approval for an incentive package should U S WEST choose Minnesota as the site for its Advanced Technologies facility.

UNIVERSITY OF MINNESOTA'S COMMITMENT TO FOCUS PLAN

The University is now implementing a plan known as "Commitment to Focus." In most University colleges, undergraduate enrollment will be reduced and greater emphasis will be placed on graduate education and research. The University's objective is to improve the quality of undergraduate education while simultaneously strengthening graduate and research programs.

The state's objective in supporting Commitment to Focus is to make the most effective use of its higher educational resources by delineating the role of each of its institutions of higher education. The plan has been endorsed by other educational institutions within the state, both private and public.

Commitment to Focus and the Institute of Technology

The University's Commitment to Focus is consistent with the planning pursued at the Institute of Technology for the past five years. Although the University plans to reduce undergraduate enrollment in all other colleges on the Twin Cities campus, the number of undergraduate students in the Institute's programs will remain at present levels. Institute enrollment has doubled in the past ten years. A major portion of the increase has come in electrical engineering and computer science, which together account for 40 percent of the Institute's total undergraduate enrollment.

The University and the Institute believe that it is important to maintain undergraduate enrollments near present levels if the technology-intensive economy of the future is to be adequately fueled with the brain power it will need.

To that end, significant additional resources are proposed to be allocated to electrical engineering and computer science. Under this proposal, by 1991-92 the faculty in electrical engineering will be increased from 40 to more than 50 members. Computer science faculty will increase from 24 to 30. Additional resources will be allocated to the materials science program in the Department of Chemical Engineering and Materials Science. These plans presuppose an investment of approximately $4 million for equipment and $2 million for personnel in these departments. Infrastructure, especially technical support staff and equipment, will be strengthened in all departments.

These new investments in program are being reinforced with major capital outlays. During the past five years, the state has invested nearly $100 million in the Institute's

facilities, including $45 million for a new electrical engineering and computer science building now under construction and scheduled to open in the fall of 1988. The new building will include a large state-of-the-art microelectronics laboratory and an advanced data communications system, with interfaces to the University's new $21.5 million campus-wide communications system, which was recently purchased from a subsidiary of U S WEST.

A new civil and mineral engineering building was completed in 1983. Major renovations have begun in facilities used by chemistry and chemical engineering and materials science, and major additions and renovations are being planned for facilities used by mechanical engineering and architecture.

Opportunities for U S WEST Advanced Technologies

The several hundred research scientists and engineers associated with U S WEST's Advanced Technologies facility would substantially enrich the professional communities with which the University faculty and, especially, the Institute of Technology interacts. In view of this benefit, the University is prepared to make significant commitments to U S WEST. If Advanced Technologies comes to Minnesota, the University will propose to earmark funds to accelerate its development of the departments of electrical engineering and computer science. The Institute of Technology and the University would expand both departments as rapidly as possible.

Further, the Institute of Technology would invite representatives of U S WEST to work closely with them in the selection of new faculty in electrical engineering and computer science. Since a significant number of new positions committed to these units are not yet filled, the University, the Institute, and its departments are willing to direct their growth into areas of research and instruction that would assure a close and mutually profitable working relationship with U S WEST.

The cooperation being proposed includes the possibility of joint appointments to the University faculty for members of Advanced Technologies professional staff.

STATE OF MINNESOTA

Special Tax Incentives

It is in the state's best interest to attract and promote high-technology research as a long-term economic development strategy. Minnesota further recognizes the significant state revenue potential of the Advanced Technologies project. If Minnesota is selected as the headquarters of Advanced Technologies, a package of tax incentives will be negotiated and will be presented for approval to the 1988 Legislature.

In addition, local tax increment financing (discussed in Chapter 5, Question 6) is available to substantially reduce, and possibly eliminate, site costs for the facility.

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