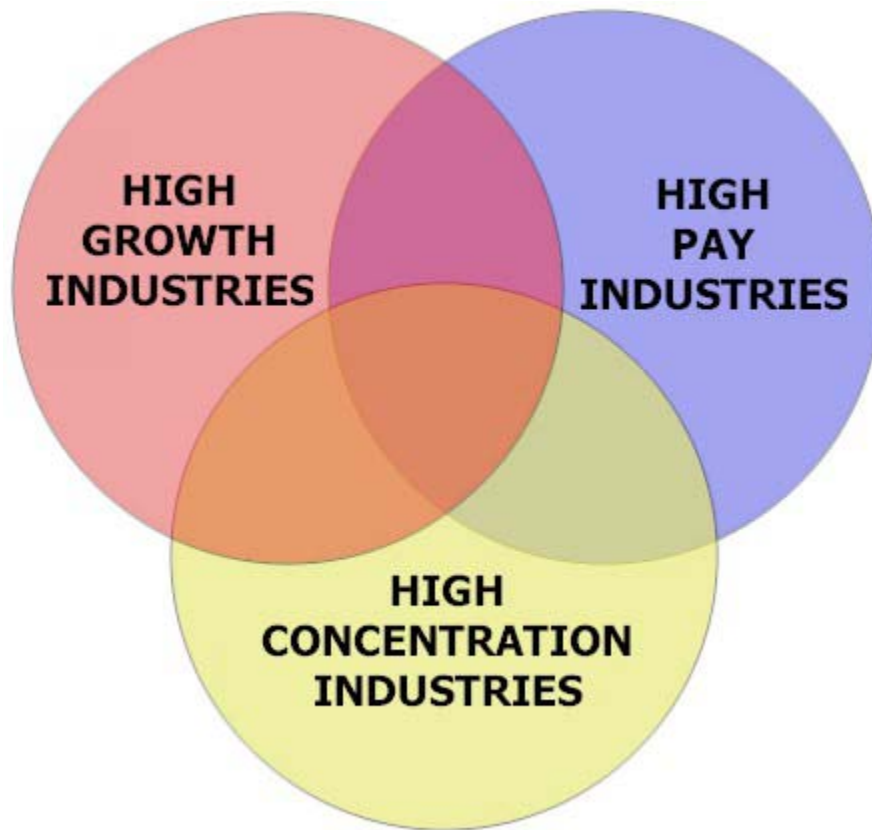


WISCONSIN

High-Tech Opportunities



Prepared for
Wisconsin Technology Council, Inc.

Authored by
NorthStar Economics, Inc.

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Dennis K. Winters, Vice President and Director of Research, NorthStar Economics, Inc., is the principal investigator and lead author of this study, with substantial contributions made by NorthStar Economics, Inc., principals, Dr. David J. Ward, President, and Alan J. Hart, Vice President, Director of Operations. Karyn Kriz, Research Assistant, was invaluable in gathering data and contributed to the writing and organization of the report.

The author accepts full responsibility for the accuracy of the data and results of this analysis.

Preface

This study focuses on high-tech industries as a driver for Wisconsin's economy. One of the primary objectives for advancing Wisconsin's economy is that of raising the per capital income level of the state's citizenry, now at 95% of the national average. The positive correlation between education and income is common knowledge. It is also widely understood that high-tech industries employ a larger share of highly educated workers than do most industries. This is, in fact, a *de facto* corollary to the definition of high-tech industries that is used through much of the existing body of work on the subject.

The intention of this report is to compare Wisconsin's high-tech industry economy with that of the nation as a whole. The goal of the study is to identify some of the promising high-tech industries in the state that would warrant further attention based on the opportunity vectors intersection of employment growth, pay levels, and high-tech occupational concentrations. This study is limited in its scope in that it only considers high-tech industries as the basis for state and national comparisons. Little attention is paid to comparing high-tech industries with non-high-tech industries. Obviously, other opportunities reside in the state and our recommendations are not to be considered all-inclusive or exclusive of other potential opportunities.

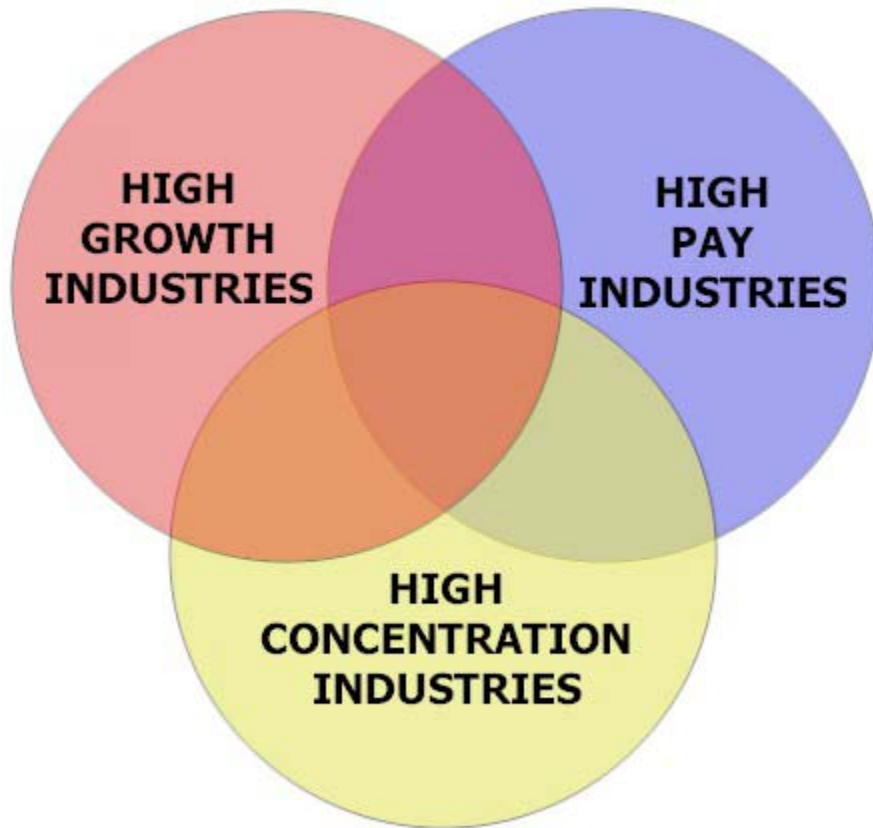
This study provides an essential benchmark and database of Wisconsin's current high-tech economy. Further analysis should be undertaken to determine what Wisconsin's economic structure should be ten, twenty, thirty years hence. Then the state's economic development strategy can be constructed and economic development initiatives can be implemented to achieve that structure. That analysis should include how high-tech industries mesh with all the other resources the state of Wisconsin has at its disposal, including natural, human, capital and creative resources.

Dennis K. Winters
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HIGHLIGHTS

This analysis identifies promising industries for high-technology economic development in Wisconsin. Industries that met the evaluation criteria of high employment growth, high pay levels and high concentrations of high-technology workers generated a super-intersection that holds great promise for Wisconsin economic development initiatives.

Super-Intersection of High-Tech Industry Promise



This Super-Intersection of high-growth, high-paying, and high-talent industries in Wisconsin yields a set of five high-tech industries, listed in the table below. These five industries present Wisconsin with the greatest opportunities for growth and economic development.

Fast Growing, High Paying, High Occupation Concentrations in Wisconsin

<u>Industry</u>	<u>Employment Growth Rank</u>	<u>Wage Rank</u>	<u>Occupation Concentration Rank</u>
Computer & Data Processing Services	2 nd	5 th	1 st
Industrial Organic Chemicals	3 rd	19 th	8 th
Industrial Inorganic Chemicals	7 th	10 th	21 st
Management & Public Relations Services	12 th	11 th	11 th
General Industrial Machinery	13 th	18 th	19 th

Source: The Bureau of Labor Statistics, The Department of Workforce Development

Wisconsin has the opportunity to grow a number of other promising high-tech industries that exist in the state. The high-tech industries in the state that also show promise based upon two-way opportunity vector intersections are listed in the following table.

Wisconsin High-Tech Industry Opportunities

<u>Industry</u>	<u>High Employment Growth</u> (≥ 20%)	<u>High Paying</u> (≥ 133%)	<u>High High-Tech Occupational Concentration</u> (≥ 9.0%)
Drugs	X	X	
Motor Vehicles & Equipment	X	X	
Electronic Components & Accessories	X		X
Communications Equipment	X		X
Household Audio & Video Equipment	X		X
Medical Equipment, Instruments & Supplies		X	X
Search & Navigation Equipment		X	X
Miscellaneous Chemical Products		X	X
Engines & Turbines		X	X
Engineering & Architectural Services		X	X
Special Industrial Machinery		X	X
Measuring & Controlling Devices		X	X
Paint & Allied Products		X	X
Electrical Industrial Apparatus		X	X
Plastics Materials & Synthetics		X	X
High employment growth is greater than 20% increase in employment over the 1991 to 1999 period. High-paying is average annual industry income is at least 133% of average annual Wisconsin worker income, \$29,607. High high-tech occupational concentration is the share of high-tech workers is at least 9% of all the industry's workers.			

Other Comparative Advantages

Still other Wisconsin industries show some unique traits that set them apart from their counterparts at the national level. This set of industries possesses some comparative advantages relative to national averages. The next table lists these industries and how they compared to the national situation.

Wisconsin Comparative Advantage High-Tech Industries

<u>Industry</u>	<u>Comparative Advantage</u>
Industrial Organic Chemicals	High growth in Wisconsin/Negative growth in U.S.
Agricultural Chemicals	High growth in Wisconsin/Negative growth in U.S.
General Industrial Machinery	High growth in Wisconsin/Negative growth in U.S.
Soaps, Cleaners, & Toilet Goods	Annual wages higher in Wisconsin than U.S.
Medical Equipment, Instruments & Supplies	Annual wages higher in Wisconsin than U.S.
Electric Distribution Equipment	Higher occupational concentration in Wisconsin than U.S.
Electrical Industrial Apparatus	Higher occupational concentration in Wisconsin than U.S.

Source: Bureau of Labor Statistics, Department of Workforce Development

The industries listed in the tables above deserve more attention as candidates for focused economic development initiatives. Wisconsin should foster the development of these industries through:

- Developing the cluster infrastructure surrounding these industries
- Encouraging capital investment in these industries
- Networking the financial resources supporting these industries
- Creating educational programs for entrepreneurs and workers in these industries
- Networking the supplier and customer base for these industries
- Assisting in the technology transfer to these industries and of these industries

Many of these initiatives are part of the strategic plan developed by the Wisconsin Technology Council.

Obviously, the high-tech industry list presented in this analysis is not an exhaustive list of opportunities for economic development initiatives. There are many emerging businesses that could become the foundations for entire new industry clusters in the state. Wisconsin would best be served by building the supportive infrastructure that will foster the creation and expansion of all businesses and industries that generate high-paying jobs in the state.

EXECUTIVE SUMMARY

The Wisconsin Technology Council (Council) is charged with promoting and supporting the creation, development and retention of science-based and technology-based businesses in Wisconsin. In order to carry out that task, the Council needs to gather information about the state of Wisconsin's high-tech or New Economy. The Council also requires a benchmarking of Wisconsin's New Economy to measure progress of the Council's initiatives.

NorthStar Economics, Inc. (NorthStar) reviewed the New Economy literature for the Council to find and compare high-technology industry definitions and measurement methodologies. The Bureau of Labor Statistics definition of high-tech industry was selected due to thoroughness of definition, availability of data for continued monitoring and the ability to compare Wisconsin data with other states. Federal and state data sources offer readily available, consistent, historical data sets for quantitative economic analysis.

By integrating employment, wages and occupational data, Wisconsin's high-tech industries that hold the most potential for future growth are identified. This study identifies a number of high-tech industries that meet two criteria for advancing Wisconsin's economy: 1) the industries are growing rapidly and, 2) those industries' workers are paid well.

Also integrated is an important third vector of high-tech occupational concentrations. This vector serves as a means through which to capture those industries that could add a relatively large number of well-paying jobs, thereby lifting Wisconsin's overall per capita income level.

Pay and Brain Drain

Wisconsin's opportunity vector intersection for high paying, high-tech occupations holds promise in the respect that the state employs a below national average number of high-tech workers and pays them less than the comparable national average salary. This is further evidence of Wisconsin's "Brain Drain" problem and one indication of its cause – less pay. It is also indicative of Wisconsin's concentration in manufacturing industries (second highest employment share in the nation and low on the spectrum of industry spending on research and development) instead of industries that spend heavily on research and development (Wisconsin companies invest \$1 billion dollars less annually on research and development than the national average).

The opportunities lie in increasing earning levels of high-tech workers and in increasing research and development investment in Wisconsin industries. Research and development infrastructure must be built and competitive wages must be paid if the state wants to attract more high-tech, highly-paid workers.

Promising High-Tech Industries

Wisconsin has the opportunity to enhance a number of promising high-tech industries in the state. The high-tech industries in the state that show the most promise based upon the opportunity vector intersections analysis conducted in this paper are listed in the following table. The industries listed in the table are portrayed by their intersection of two or three opportunity vectors.

There is a hierarchy in the table listing below. The industries listed first are located at the super-intersection of all three opportunity vectors: high employment growth, high-paying industries and high high-tech occupational concentrations. Industries subsequently listed in the table represent those industries that registered intersections of two of the opportunity vectors, their intersecting vectors are designated.

Wisconsin High-Tech Industry Opportunities

<u>Industry</u>	<u>High Employment Growth</u> (≥ 20%)	<u>High Paying</u> (≥ 133%)	<u>High High-Tech Occupational Concentration</u> (≥ 9.0%)
Computer & Data Processing Services	X	X	X
Industrial Organic Chemicals	X	X	X
Industrial Inorganic Chemicals	X	X	X
Management & Public Relations Services	X	X	X
General Industrial Machinery	X	X	X
Drugs	X	X	
Motor Vehicles & Equipment	X	X	
Electronic Components & Accessories	X		X
Communications Equipment	X		X
Household Audio & Video Equipment	X		X
Medical Equipment, Instruments & Supplies		X	X
Search & Navigation Equipment		X	X
Miscellaneous Chemical Products		X	X
Engines & Turbines		X	X
Engineering & Architectural Services		X	X
Special Industrial Machinery		X	X
Measuring & Controlling Devices		X	X
Paint & Allied Products		X	X
Electrical Industrial Apparatus		X	X
Plastics Materials & Synthetics		X	X
High employment growth is greater than 20% increase in employment over the 1991 to 1999 period. High-paying is average annual industry income is at least 133% of average annual Wisconsin worker income, \$29,607. High high-tech occupational concentration is the share of high-tech workers is at least 9% of all the industry's workers.			

Wisconsin's High-Tech Industry Structure

There are significant numbers of workers employed in Wisconsin's high-technology industries and in high-technology occupations. Of the thirty-one industries that are classified as "high-tech", Wisconsin employed workers in thirty of them in 1998, excepting Guided Missiles. Wisconsin employed 198,061 workers in high-tech industries in 1998. The state employed 98,800 workers in high-tech occupations in 1998.

Many employees in the thirty-one high-tech industries are not employed in high-technology occupations. Of the 198,061 workers employed in Wisconsin high-tech industries, 40,389, or 20.4%, were employed in high-tech occupations. By comparison, the U.S. employed 10,151,340 workers in high-tech industries, 2,740,800 of whom held high-tech occupation positions, a 27.0% share.

High-Tech Industry Employment

The Motor Vehicle and Equipment industry employed the most Wisconsin workers of the high-tech industries in the state, almost 23,000 in 1998. The Computer & Data Processing Industry is the second largest high-tech industry employer in Wisconsin, with 20,731 workers in 1998. The Computer & Data Processing Industry tops both the U.S. and Wisconsin list for both the number of workers employed and the concentration of employees in high-tech occupations, with high-tech occupation concentrations at about 50%. Motor Vehicles & Equipment is also in the top five for employment in both the state and the nation. However, very few Wisconsin workers in the motor vehicle industry are employed in high-tech occupations, only 6.6%.

Wisconsin possesses some strengths when compared against national high-tech industries. Electrical Industrial Apparatus, General Industrial Machinery, and Special Industrial Machinery rank in the top five Wisconsin high-tech industries in employment terms, but are nowhere near the top of the national list.

High-Tech Industry Employment Growth

The Computer & Data Processing Industry is at or near the top of the list for employment growth for Wisconsin (second, with 114% growth from 1991-1999) and the U.S. (first, at 135% growth). Employment growth in the Drugs and the Electronic Components & Accessories industries also rank in the top ten in both Wisconsin and the U.S. Wisconsin shows high employment growth in three other industries that don't appear in list of top five high employment growth industries for the U.S. They are Aircraft & Parts, Industrial Inorganic Chemicals and Electronic Components & Accessories, although the Aircraft & Parts and Industrial Inorganic Chemicals industries employment is small, each has less than a thousand workers in the state.

High-Tech Industry Pay

All but four of the high-tech industries pay Wisconsin workers significantly more than the state's 1999 average annual wage of \$29,607. The top two industries, Soaps, Cleaners & Toilet Goods and Medical Equipment, Instruments & Supplies pay more than double the annual average Wisconsin wage. The top twelve high-tech industries pay wages more than 150% of Wisconsin average annual wage. The Computers & Data Processing Services industry again registers in the top five of this category list.

Wisconsin and the United States share four of the top ten highest-paying high-tech industries. The remaining highest paying industries at the national level were among the lowest paying high-tech industries in Wisconsin. Conversely, the highest paying industries in Wisconsin, Soaps, Cleaners, & Toilet Goods and Medical Equipment, Instruments & Supplies, ranked near the bottom at the national level.

High-paying Occupations

The five highest paying, high-tech occupations in Wisconsin and the U.S. are shared. Three of the five are computer industry related. The caveat is that Wisconsin pays its high-tech workers significantly less than the U.S. average. Wisconsin high-tech workers are paid \$44,965 on average per year versus \$50,218 for the average U.S. high-tech worker, a 12% difference.

High-tech Occupational Concentrations

There are twenty-three industries in Wisconsin and twenty-seven industries in the U.S. that have high-tech occupation concentrations of at least 9.0%, three times the national industry average. Wisconsin and the U.S. share the same five high-tech industries that have the highest percentages of occupation concentration. The remaining industries that have high high-tech occupation concentrations are quite different when comparing Wisconsin to the U.S.

Intersection of High-Growth and High-Paying Industries

Eight high-tech industries are among both the highest employment growth (greater than 20% for the decade) and highest paying (greater than 133% of average annual Wisconsin wage) industries the in Wisconsin: Computer & Data Processing Services, Industrial Inorganic Chemicals, Petroleum Refining, Motor Vehicles and Equipment, Drugs, Industrial Organic Chemicals, Management & Public Relations Services, and General Industrial Machinery. These industries hold significant potential for high-tech industry development.

Fast Growing, High Paying Industries in Wisconsin

<u>Industry</u>	<u>Employment Growth Rank</u>	<u>Pay Rank</u>
Computer & Data Processing Services	2 nd	5 th
Industrial Organic Chemicals	3 rd	18 th
Drugs	4 th	14 th
Industrial Inorganic Chemicals	7 th	9 th
Petroleum Refining	9 th	6 th
Motor Vehicles & Equipment	10 th	4 th
Management & Public Relations Services	12 th	10 th
General Industrial Machinery	13 th	17 th

Source: Bureau of Labor Statistics, Department of Workforce Development

Intersection of High-Growth Industries and Occupational Concentration

There are eight high-tech industries in Wisconsin that demonstrate employment growth of at least 20% and have high-tech occupation concentrations of at least 9.0%. Four fast growing high-tech industries in Wisconsin are not listed in the chart below, because they had high-tech occupation concentrations under 9.0%, eliminating them from this intersection.

Fast Growing, High Occupation Concentration Industries in Wisconsin

<u>Industry</u>	<u>Employment Growth Rank</u>	<u>Occupation Concentration Rank</u>
Computer & Data Processing Services	2 nd	1 st
Industrial Organic Chemicals	3 rd	8 th
Electronic Components & Accessories	5 th	18 th
Communications Equipment	6 th	7 th
Industrial Inorganic Chemicals	7 th	21 st
Household Audio & Video Equipment	11 th	23 rd
Management & Public Relations Services	12 th	11 th
General Industrial Machinery	13 th	19 th
Source: Department of Workforce Development, Bureau of Labor Statistics		

Intersection of High-Paying Industries and Occupational Concentration

There are fifteen high-tech industries in Wisconsin that pay wages above 133% of the average annual Wisconsin wage and have high-tech occupation concentrations of at least 9.0%. This intersection allowed for the comparison of twenty highest paying, high-tech industries with twenty-three industries possessing the highest occupational concentrations.

High Paying, High Occupation Concentrations in Wisconsin

<u>Industry</u>	<u>Wage Rank</u>	<u>Occupation Concentration Rank</u>
Medical Equipment, Instruments & Supplies	2 nd	13 th
Search & Navigation Equipment	3 rd	4 th
Computer & Data Processing Services	5 th	1 st
Miscellaneous Chemical Products	7 th	9 th
Engines & Turbines	8 th	22 nd
Engineering & Architectural Services	9 th	2 nd
Industrial Inorganic Chemicals	10 th	21 st
Management & Public Relations Services	11 th	11 th
Special Industrial Machinery	12 th	14 th
Measuring & Controlling Devices	13 th	6 th
Paint & Allied Products	16 th	16 th
Electrical Industrial Apparatus	17 th	12 th
General Industrial Machinery	18 th	19 th
Industrial Organic Chemicals	19 th	8 th
Plastics Materials & Synthetics	20 th	15 th
Source: Bureau of Labor Statistics, Department of Workforce Development		

Super Opportunity Vector Intersection

The Super-Intersection of fast-growing, high-paying, and high occupational concentration high-tech industries in Wisconsin yields a set of five industries: Computer & Data Processing Services, Industrial Organic Chemicals, Industrial Inorganic Chemicals, Management & Public

Relations Services, and General Industrial Machinery. These five industries present Wisconsin with the greatest opportunities for growth and economic development.

Fast Growing, High Paying, High Occupation Concentrations in Wisconsin

<u>Industry</u>	<u>Employment Growth Rank</u>	<u>Wage Rank</u>	<u>Occupation Concentration Rank</u>
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Management & Public Relations Services	12 th	11 th	11 th
General Industrial Machinery	13 th	18 th	19 th

Source: Bureau of Labor Statistics, Department of Workforce Development

Other Comparative Advantages

Other Wisconsin industries show some unique traits that set them apart from their counterparts at the national level. This set of industries possesses some comparative advantages relative to national averages. The next table lists these industries and how they compared to the national situation.

Wisconsin Comparative Advantage Industries

<u>Industry</u>	<u>Comparative Advantage</u>
Industrial Organic Chemicals	High growth in Wisconsin/Negative growth in U.S.
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- Creating educational programs for entrepreneurs and workers in these industries
- Networking the supplier and customer base for these industries
- Assisting in the technology transfer to these industries and of these industries

Obviously, the high-tech industry list presented in this analysis is not an exclusive list, by any means, for the attention of economic development initiatives. Wisconsin would best be served by building the supportive infrastructure that will foster the creation and expansion of all businesses and industries that generate high-paying jobs in the state.

EXECUTIVE SUMMARY ONLY

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