Knowledge and Technology in the Wisconsin Economy: Shaping the New Wisconsin Economy

Prepared by

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Oct. 20, 2005

Introduction:

To be competitive in the New Global Economy, Wisconsin must expand and apply its knowledge and technology base. Knowledge and technology are two basic tools that lead to product innovation and new companies and industries.

The knowledge and technology base of a state can be measured in many ways. In 2002, the Wisconsin Technology Council (Tech Council) published *Vision 2020: A Model Wisconsin Economy*, which laid out several knowledge and technology measures and goals. The purpose of this paper is to report on the progress Wisconsin has made in reaching for those goals. This paper pertains specifically to the Wisconsin trends and milestones in the Knowledge and Technology sector of the *Vision 2020* report. We previously reported on the Knowledge Worker measures, and they were encouraging. The next report will address the Economic Output measures. The fourth update will analyze the Business and Finance trends in the state. All the benchmarks and milestones are contained in the table on page 45 of *Vision 2020*.

Overall, Wisconsin has made good progress in building its knowledge and technology base. In the sections below, we review measures related to patent activity, high-tech employment, and research and development.

Context for this Report:

The dot.com bust, the recession of 2001, the events of Sept. 11, 2001, and a very slow economic recovery have had a major influence on the Wisconsin and U.S. economies. Despite these factors, both the U.S. and Wisconsin economies began to show strong growth in early 2004 and high-tech businesses are emerging as high-growth areas.

Wisconsin's transition to the New Economy has tended to lag many other states. Some states, notably Minnesota, experienced robust growth in high-tech businesses in the mid-1990s and that growth has continued into the 21st century. Wisconsin's challenge is to build on its solid economic base and to expand its economy through investment and support in high-growth areas. While the private sector is leading this activity, Wisconsin's academic research institutions are also making substantial contributions. If the state's academic R&D activity was less than robust, Wisconsin would fall out of the top half of U.S. states in overall R&D spending. The R&D activity of Wisconsin's academic institutions is documented in the Tech Council's September 2004 report, *The Economic Value of Academic Research and Development in Wisconsin*.

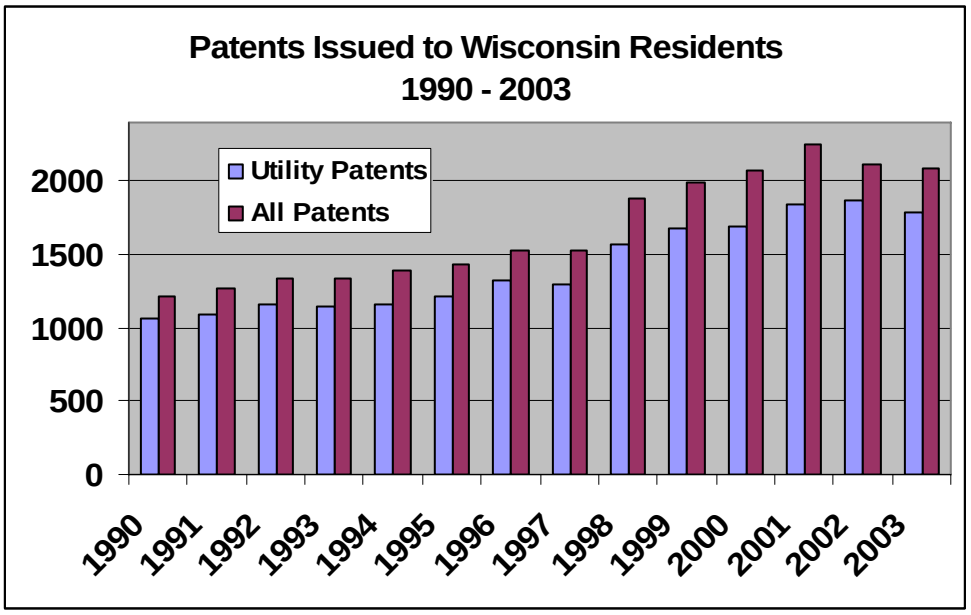
The basic tools to accomplish that growth are the knowledge and technology tools we report on below.

Patents

Patents represent the base of knowledge for future innovative products and services. Wisconsin has been home to a large number of inventors and has ranked favorably in the number of patents issued to Wisconsin residents and businesses.

The U.S. Patent and Trademark Office keeps data available from 1963 through 2003, indicating the number of patents issued to inventors in each state. A majority of the patents issued are utility patents, or "patents for invention." Other patent types include design patents, plant patents, reissue patents, statutory invention registrations, and defensive publications.

Wisconsin greatly increased the output of patents during the 1990s. The number of utility patents issued to Wisconsin inventors remained relatively steady throughout the early to mid-1990s, then sharply increased in 1998. From 1990-1997, the average number of utility patents issued to Wisconsin residents was slightly less than 1,200 per year. In 1998, 1,567 patents for invention were awarded to Wisconsin residents, and the number continued to rise for the next five years. The number of utility patents issued to Wisconsin residents peaked in 2002 with 1,864, then dipped slightly to 1,786 in 2003. Total patents in the state peaked at 2,253 in 2001, and were 2,082 in 2003. This slight downtrend mirrored a national trend in which total patents issued fell slightly in 2003.

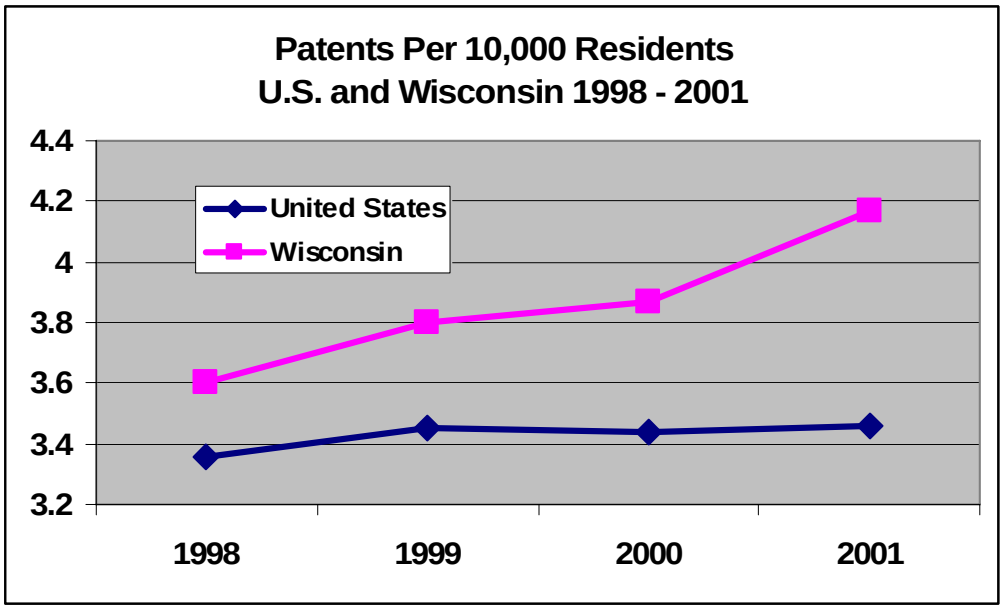


The State Science and Technology Institute compiles patent data and ranks states based on the number of patents awarded per capita. From 1998 through 2001 (the latest year for which data is available), Wisconsin has outpaced the national average. In 1998, Wisconsin ranked 16th in the nation, receiving 3.6 patents per 10,000 people, slightly ahead of the national average of 3.356. While the national figure has remained relatively static, Wisconsin has continued to widen the gap over the course of the next few years.

In 2001, Wisconsin ranked 13th in the nation with 4.168 patents per 10,000 residents, as compared with 3.458 at the national level.

	1998		1999		2000		2001	
	Patents	**Rank**	**Patents**	**Rank**	**Patents**	**Rank**	**Patents**	**Rank**
U.S.	3.356		3.450		3.437		3.458	
Wisconsin	3.600	16	3.802	13	3.867	13	4.168	13

Overall, Wisconsin has improved its position with respect to the number of patents. This promising base of knowledge is in many cases being used to create new products and companies that grow the Wisconsin economy.



High-Tech Occupations

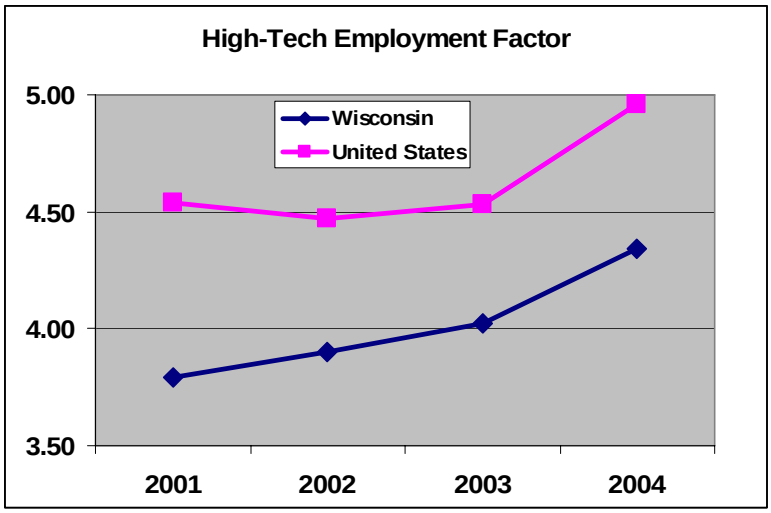
The presence of high-tech workers is an indication of the knowledge and technology expertise of a state's workforce. Calculating high-tech employment has been a difficult task as several different measures have been used to report high tech employment. In *Vision 2020* and in a paper called *High Tech Opportunities*, we reported on high-tech employment in Wisconsin. The substance of those reports is summarized in the Technical Notes section at the back of this paper.

The basic issue in counting high-tech employment has been whether to count high-tech occupations or to count the employment in high-tech industries. Under the former measure, an engineer employed by a food processor would count as a high-tech worker while he or she would not count using the high-tech industries measure since food processing is not classifies as a high-tech business.

In our view it makes the most sense to count high-tech occupations as an indicator of high-tech employment. In the *Monthly Labor Review* published by the Bureau of Labor Statistics in July 2005, the Office of Occupational Statistics and Employment Projections confirmed the specific list of occupations used to define high-tech occupations for purposes of their studies: computer and mathematical scientists; engineers; drafters, engineering, and mapping technicians; computer and information systems managers; life scientists; physical scientists; life, physical, and social science technicians; engineering managers, and natural science managers. This new definition encompasses 81 specific occupations in those categories. Analyzing occupational data according to this updated definition at both the state and national levels yields the following results:

	2001			2002			2003			2004		
	High Tech Emp.	**Total Employ-ment**	**High Tech Factor**	**High Tech Emp.**	**Total Employ-ment**	**High Tech Factor**	**High Tech Emp.**	**Total Employ-ment**	**High Tech Factor**	**High Tech Emp.**	**Total Employ-ment**	**High Tech Factor**
WI	102,022	2,691,950	3.79	104,898	2,692,560	3.90	108,254	2,691,360	4.02	116,843	2,689,160	4.34
US	5,813,680	127,980,410	4.54	5,701,330	127,523,760	4.47	5,770,330	127,420,170	4.53	6,353,730	128,127,360	4.96
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics												

Though not directly comparable to the data in the technical notes, it does appear that Wisconsin has improved its position with respect to the percentage of its workforce in high-tech occupations. In 1998, Wisconsin was 20 percent below the national average with respect to high-tech occupations. In 2004, Wisconsin is about 12 percent below the national average.



The improvement is encouraging but it must be noted that Wisconsin is still below the national average and will have to work hard to change its position as other states try to attract high-tech jobs. The role of academic research, according to the 2004 Tech Council report, greatly helps in this regard. The report states that academic research in

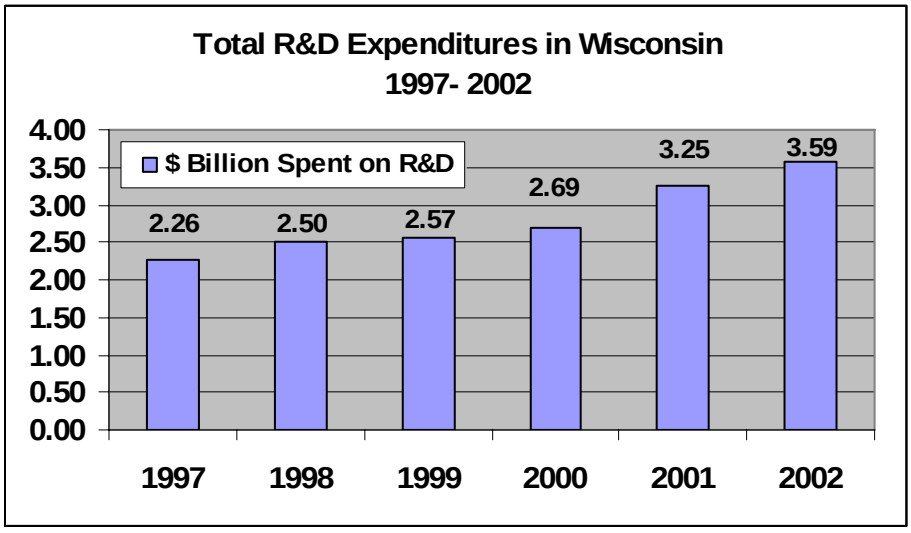
Wisconsin is responsible for almost 32,000 jobs, the vast majority of which are high-tech, well-paying positions.

Research and Development

Research and development (R&D) is the cornerstone for producing patents and then high-tech occupational opportunities. R&D spending is a key indicator of economic growth and vitality.

R&D spending in Wisconsin has risen steadily over the course of the last several years. According to data compiled by the National Science Foundation, in 2002 Wisconsin ranked 20th in the nation in private sector research and development capital spent per capita and 13th in the nation in academic R&D spending. Academic research funding in Wisconsin amounts to close to $1 billion dollars per year, as reported in *The Economic Value of Academic Research and Development in Wisconsin*. Wisconsin's total R&D spending in 2002 amounted to $3.6 billion dollars.

The $3.6 billion in Wisconsin R&D in 2002 exceeds the *Vision 2020* target of $3.3 billion in R&D spending by 2005. While the rate of increase in R&D spending is slowing nationally, preliminary data for Wisconsin for academic R&D spending in 2003 shows a nearly 10% increase over 2002. Maintaining the future growth rate in R&D will be difficult as more states compete for federal and private research funding.



Summary and Conclusions:

In a challenging economic climate, Wisconsin has made progress in many areas. Wisconsin has maintained or improved its position in patents, high-tech occupations and R&D spending.

Despite these signs of progress, the state must concentrate on improving its knowledge and technology base in the future. Key Wisconsin organizations -- such as the University

of Wisconsin-Madison, the Marshfield Clinic, the Medical College of Wisconsin, GE Healthcare and Kimberly Clark -- that are national leaders in patents granted should be supported and encouraged to expand that activity within Wisconsin.

For questions about the report, please contact

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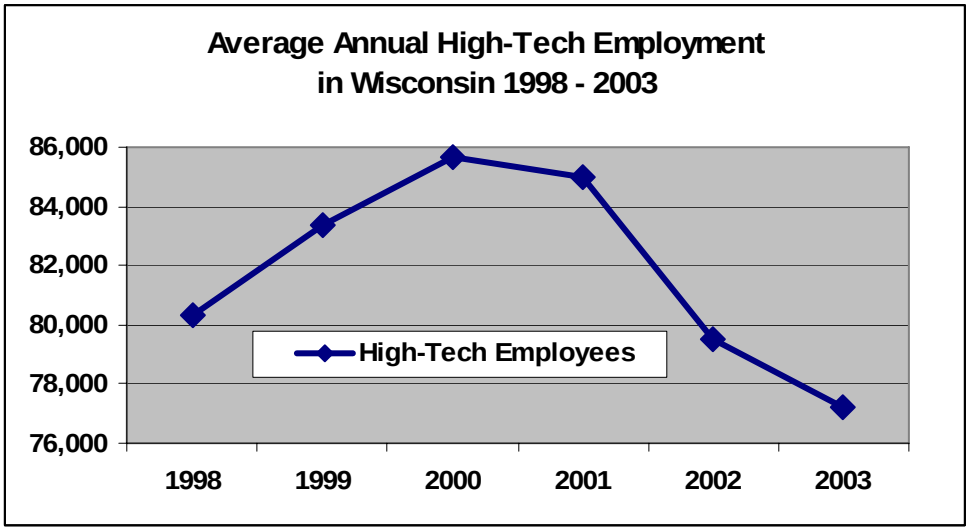
Technical Notes:

In *Vision 2020*, high-tech occupations were reported at 203,000 for the year 2000, with a projection of 210,000 for the year 2005. These figures were based on the total employment in the 31 key industries that are considered high-tech, according to the definition adopted by the U.S. Department of Labor's Bureau of Labor Statistics. This data would be difficult to update with any degree of certainty, as it was based on a specific subset of industries, as classified under the Standard Industrial Classification system. Since that time, the relevant data has been organized according to the North American Industry Classification System, and the two systems do not correlate directly. Moreover, this definition results in inflated figures, inasmuch as all non-high tech workers in those industries, including clerical and custodial staff, are included in the totals.

In *CyberStates 2005*, the American Electronics Association ranked Wisconsin 21st in high-tech employment with 77,228 high-tech employees, and average high-tech wages of $54,303, which rank Wisconsin 34th in the nation. Thirty-three of every 1,000 private sector workers in Wisconsin are employed by high-tech firms. From the period of 1998 through 2003 (the most recent year for which data is available), Wisconsin experienced a net loss of about 3,100 high-tech jobs, which represents a loss of 4 percent over the six-year period. While this may appear discouraging, the decline is consistent with national trends, as Wisconsin was ranked 21st in the nation all six years.



Approaching the issue by using occupational data rather than employment data, we reported high-tech employment in Wisconsin as follows in November 2001 in *Wisconsin High-Tech Opportunities*, a study conducted by NorthStar Economics, Inc. and published by the Wisconsin Technology Council:

1998	High-Tech Occupation Employment	Total Employment	High-Tech Occupation Employment Factor
Wisconsin	87,800	2,852,556	3.08
U.S.	5,387,010	140,514,000	3.83
Source: Wisconsin Department of Workforce Development, U.S. Bureau of Labor Statistics			

At that time, the Bureau of Labor Statistics definition of high-tech occupations consisted of 48 occupations generally listed under the titles of scientists, engineers, mathematicians, computer programmers, and assorted technicians. The above results were obtained by examining Occupational Employment Statistics (OES) data for 1998. Based upon 1998 figures, the Wisconsin high-tech occupation to total employment concentration factor was 3.08, versus 3.83 for the U.S., which is to say that about 3.1 percent of all Wisconsin workers were employed in high-tech occupations.