



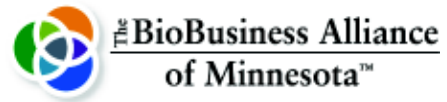
Minnesota's Competitive Position in the Biobusiness Technology Industries

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**the BioBusiness Alliance
of Minnesota™**



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Biobusiness 2010:

Minnesota's Competitive Position in the Biobusiness Technology Industries

A Report of Research and Analysis Conducted for the

BioBusiness Alliance of Minnesota

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Biobusiness 2010:

Minnesota's Competitive Position in the Biobusiness Technology Industries

*Report of the 2010 Statewide Assessment Project
for the BioBusiness Alliance of Minnesota*

Executive Summary

By late 2007, the most recent year for which national data from the U.S. Economic Census is available, the biobusiness technology sector in the United States consisted of over 36,500 establishments, almost 1.2 million paid employees, an aggregate annual payroll of over \$74 billion, and aggregate annual revenues of over \$450 billion. The biobusiness technology sector in the U.S. is substantial, dynamic and internationally prominent. In addition, the average annual wage in the bioscience technology sector, across all employment categories—at \$64,116—was about 55% greater than the average private sector wage.¹ Biobusiness technology is an important field of industry from the point of view of economic development across the nation; and it is a field in which many American states, and many regions and countries elsewhere in the world, are competing to gain a share of the high-value employment opportunities and revenue-generation advantages that it represents.

This report summarizes the results of the second statewide biobusiness assessment conducted for the BioBusiness Alliance of Minnesota. The results of the first assessment, conducted in 2005 and early 2006, was published in August 2006.² The primary goals of the 2010 statewide biobusiness assessment project were similar to those of the 2006 project: to provide a baseline assessment of biobusiness technology in Minnesota against

¹ These numbers cited here were calculated by Dr. Kelvin Willoughby using data from the 2007 U.S. Economic Census of the U.S. Bureau of the Census. The data exclude employment inside universities, hospitals and other not-for-profit organizations involved in biobusiness.

² For the full report and executive summary of the original statewide assessment project, see, *Biobusiness: Minnesota's Present Position and Future Prospects*, Report of the Statewide Biobusiness Assessment Project of the BioBusiness Alliance of Minnesota (St. Louis Park: BioBusiness Alliance of Minnesota, August 2006). That project was co-chaired under the auspices of the BioBusiness Alliance of Minnesota by Vincent Ruane and Kelvin Willoughby (Dale Wahlstrom, Chairman of the Board; Jeremy Lenz, Project Executive). The principle author of the 2006 report (which may be downloaded from the website of the BioBusiness Alliance, at www.biobusinessalliance.org) was Kelvin Willoughby.

which the state may be benchmarked; and, to provide thoughtful, well-researched recommendations to help guide the state in becoming more competitive in specific areas of biobusiness. An additional goal of the 2010 project was to document and analyze changes that have taken place in Minnesota's biobusiness technology industries—specifically, increases or decreases in key economic variables in the constituent industries, in comparison with changes in equivalent industries in the selected competitor states and in the nation as a whole—during the time that has passed since the date of the previous U.S. Economic Census in 2002.

Biobusiness is economic activity devoted to the development or commercialization of bioscience or bioscience-related technologies, products or services. In other words, biobusiness is technology-based economic activity that utilizes or is informed by biology. Biobusiness deals with the spectrum of enterprises from start-ups to established firms, together with associated infrastructure and support services (such as those provided by legal service firms, management consultants, marketing organizations, accountants, lobbyists, investors, regulatory affairs specialists, or specialized property developers). The focus of this assessment project, however, was on a narrower set of enterprises: those whose primary business is the development or commercialization of what may be labeled as “biobusiness technology.” *Biobusiness technology is technology devoted to the biological domain, as either a system of tools or as a field of application.* Put simply, biobusiness technology is technology focused on biology. It is the technological foundation of biobusiness.

The primary data source that has been drawn upon in this report for analysis of Minnesota's competitive position is the periodic Economic Census conducted by the U.S. Census Bureau, together with data from the various surveys of non-employers associated with the Economic Census. The Economic Census profiles American business every 5 years, from the national to the local level. The Economic Census is based on a new standard industrial classification system (the North American Industrial Classification System—“NAICS”), which was implemented for the first time in 1997. The most recent Economic Census data were generated at the close of 2007 and were released during 2010. Thus, the most recent census data available at the time of writing this report are 2007 data. This report also draws upon data from the two previous Economic Censuses, from 1997 and 2002, thus allowing us to conduct analysis over a period of ten years.

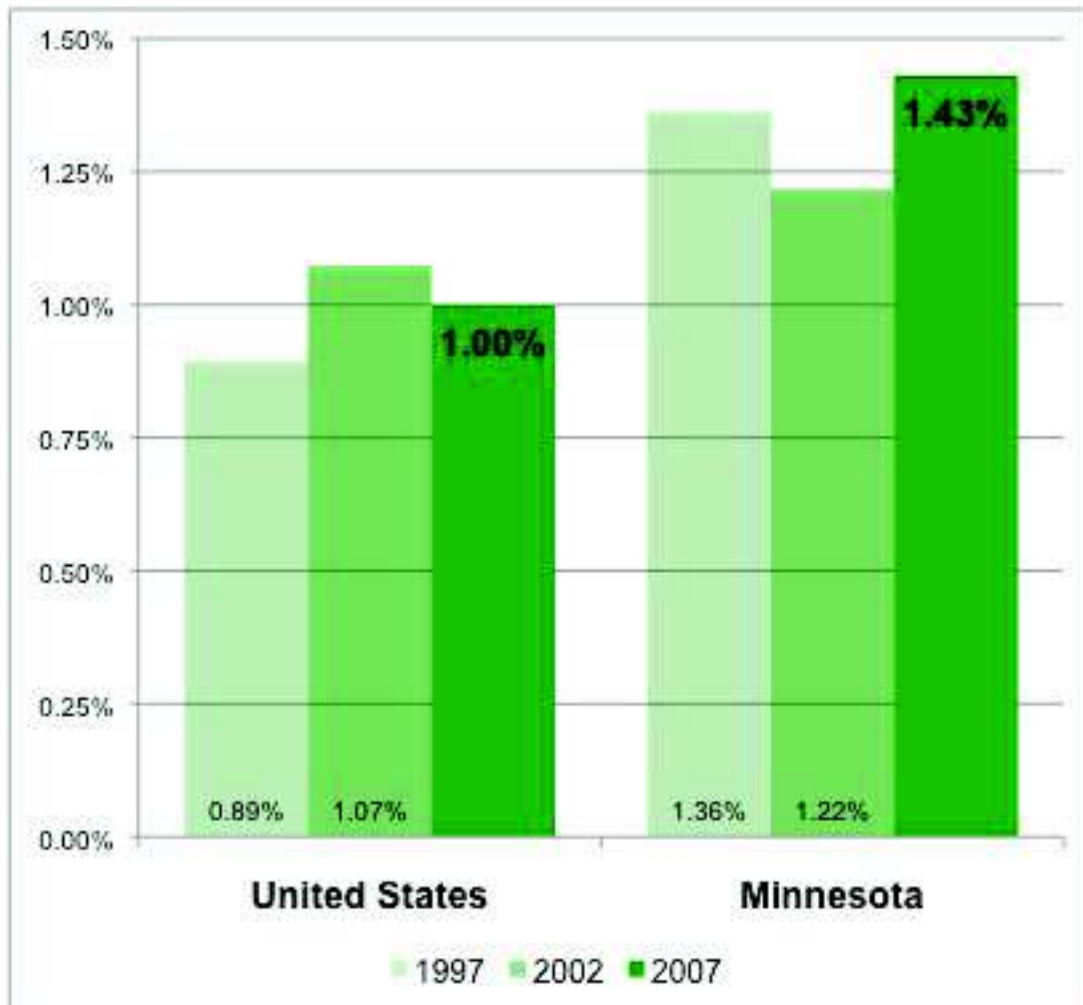
In this project a carefully selected set of NAICS codes was employed to act as a proxy for the overall biobusiness technology sector. The aggregated (i.e., “macro”) set of industries represented by those codes was labeled the “biobusiness technology industry,” and comprised five constituent industry segments, themselves also corresponding to a carefully selected set of NAICS codes: the medical devices industry, the R&D in the life sciences industry, the agri-bio and bio-industrial technology industries, the pharmaceuticals industry and the medical and diagnostic laboratories industry. Data for all five segments were included in the analysis; and detailed analysis was conducted for the first four of those segments.

Basic Findings and Overview of the Biobusiness Technology Industry

As shown in Figure 1, Minnesota's economy is more heavily oriented towards biobusiness technology employment than is the economy of the whole country. In fact, biobusiness technology employment in 2007, as a proportion of employment in all

industries, was 43% greater in Minnesota than in the nation as a whole. While the numbers have fluctuated over time, Minnesota remained consistently above the national norm throughout the previous decade. This means that Minnesota's future employment prospects are more dependent than most other states on what happens to its biobusiness sector. In short, more is at stake for Minnesota in biobusiness than is the case for most other states.

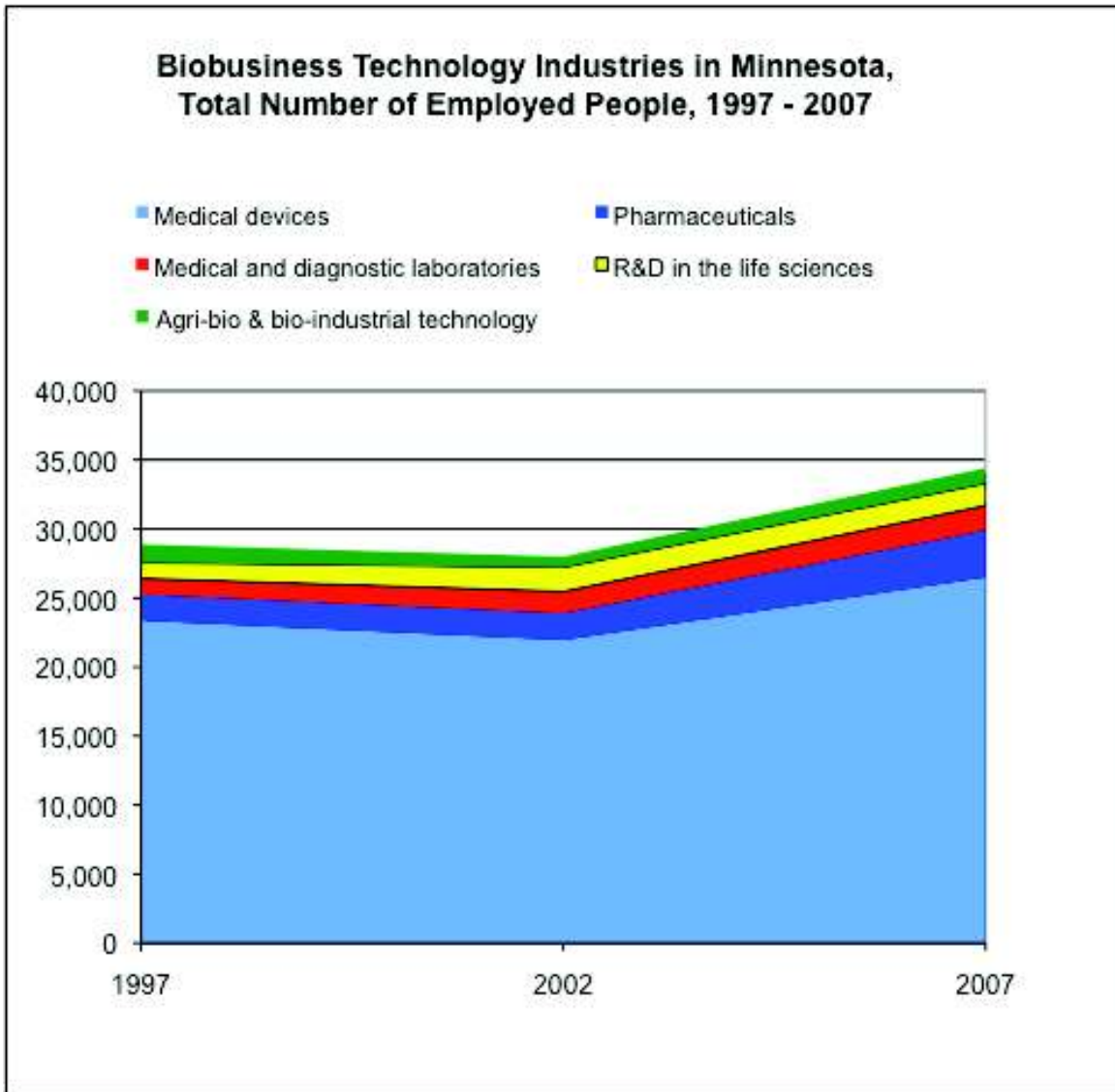
Executive Summary: Figure 1



Minnesota's biobusiness sector is also distinctive, due in large part to the extraordinary role played by the medical devices industry in the mix of biobusiness technology industries in the state. The percentage of biobusiness technology employment accounted for by the medical devices segment (77%) is more than twice as large in Minnesota than it is in the nation as a whole; and the ratio of Minnesota to the nation (in the percentage of biobusiness technology employment accounted for by the medical devices segment) increased from 202% to 231% during the decade leading to the most

recent Economic Census. Thus, medical devices not only play a dominant role in the state's biobusiness technology industry but the prominence of that role has been growing.

Executive Summary: Figure 2



What about the absolute size of Minnesota's biobusiness technology sector? By late 2007 the state was home to almost 34,500 biobusiness technology employees. Additionally, total biobusiness technology employment in Minnesota grew by over 20% during the preceding five years, signaling a significant improvement over the observed trend for 1997 to 2002 in the state. Those 34,500 biobusiness technology jobs in

Minnesota at the end of 2007 were associated with over \$2.1 billion in payroll and almost \$11 billion in revenue, spread over more than 670 enterprises in the state.³

Overview of Medical Devices

Since 2002, Minnesota has enjoyed an encouraging positive turnaround in its competitive position in the medical devices industry. By the end of the decade it was second only to California in the number of medical devices jobs and it moved in to the top position (above California) in terms of its productivity as a state in generating medical devices employment, taking in to account the relative size of its economy and the state of the industry and the general economy nationwide. Despite significant (and improving) competition from a number of other states, Minnesota managed to regain and build upon its competitive position in the medical devices industry.

While most of the other competitor states (including California) lost medical devices jobs during the second half of the decade, the number of jobs in Minnesota in this field actually grew significantly. During that period, while the nation as a whole lost more than 11,000 medical devices jobs in the aggregate, the number of people employed in medical devices enterprises in Minnesota grew by over 4,500 people.

Overview of R&D in the Life Sciences

“R&D in the life sciences” is the overarching label for research and development in biotechnology and research and development in other biology-related fields. It includes only R&D activities and not manufacturing activities.

The first statewide biobusiness assessment reported that between 1997 and 2002 Minnesota has been growing more slowly than the nation as a whole in employment in R&D in the life sciences. At that time the United States as a whole had enjoyed a growth of 149% in life sciences R&D employment during the previous half-decade whereas Minnesota's employment in the field had grown by only 52 percent. Since then, however, the situation has changed. During the half-decade following the previous Economic Census, total life sciences R&D employment in the United States dropped by about 19% and many states experienced painful drops much larger than that (e.g., New York experienced a 77% reduction). California experienced a reduction of 23 percent, following its previous rise of 134 percent. Minnesota managed to contain its reduction after 2002 to 8% only. In other words, Minnesota reversed its situation from being significantly below the national average prior to 2002, to being significantly above the national average after 2002, *vis-à-vis* employment growth in life sciences R&D.

Minnesota has apparently been doing something right during recent years, not just in the medical devices area, but also in the business of life sciences R&D.

Overview of Agri-bio and Bio-industrial Technology

Agri-bio and bio-industrial technology is technology directed primarily towards applications in biological systems exterior the human body. Agri-bio and bio-industrial

³ Source: Dr. Kelvin Willoughby, using data from the 1997 Economic Census, the 2002 Economic Census and the 2007 Economic Census of the U.S. Bureau of the Census.

technology may incorporate technical means from any field of technology, including biotechnology; but it must be directed towards applications in living systems or biology-related contexts. Agri-bio technology is focused on the application of biological technology in the field of plants and agriculture and bio-industrial technology is focused on the application of biological technology in industrial fields such as bio-materials, bio-processing, bio-energy, bio-based chemicals, food ingredients, and bio-remediation.

During the second half of the decade to 2007 employment in Minnesota in the agri-bio and bio-industrial technology industries increased by over 44% and the state's share of total national employment in the sector also rose. Ethanol production is the dominant sub-domain of Minnesota's agri-bio and bio-industrial technology industries.

While the recent performance of the state in this area is positive, not negative, the modest absolute scale of the growth compared with the growth that was enjoyed by some of the other states suggests that Minnesota may need to redouble its efforts. This may, for example, include identifying a niche (such as emerging technologies in ethanol production) where the state may have a chance to set the agenda in the nation. Nevertheless, notwithstanding the fact that a number of other states seem to have moved more aggressively than Minnesota in to the agri-bio and bio-industrial technology industry space during the last decade, it appears that Minnesota remains active in the area, leveraging some of its emerging capabilities in commercial life sciences R&D to develop new business models for innovation in agri-bio and bio-industrial technology. Some other U.S. states may be benefitting, in terms of employment generation, from Minnesota's efforts in this domain; but Minnesota's agri-bio and bio-industrial technology companies seem for now to be generating increased revenue for the state from their geographically dispersed activities.

Overview of Pharmaceuticals

While Minnesota is a relatively minor player in the US pharmaceuticals industry, the scale of the industry in Minnesota is growing. During the five years leading up to the most recent Economic Census, total pharmaceuticals employment in Minnesota grew by 76 percent and the state's share of national pharmaceuticals employment increased significantly. Minnesota increased its productivity in generating both employment and enterprises in the pharmaceuticals industry; and Minnesota's performance in pharmaceutical entrepreneurship was greater than what one would expect, all other things being equal.

Minnesota's percentage growth in pharmaceuticals employment was in fact the highest of the eleven competitor states included in the assessment. The growth in pharmaceuticals employment for the nation as a whole during that period was less than one percent, and some states—e.g., New Jersey, New York, Utah and Iowa—actually lost jobs. Minnesota's employment growth in this sector—modest though it is in terms of absolute numbers—should therefore be treated with some respect.

Overall, Minnesota performs relatively more strongly in pharmaceuticals entrepreneurship than it does in generating growth in pharmaceuticals employment. Nevertheless, having said that, the state's performance in the generation of new jobs in pharmaceuticals in recent years is very encouraging.

Conclusions

Figure 3 provides a summary of the empirical results of this project. The most important conclusion is that Minnesota increased its number of biobusiness technology jobs significantly during the five-year period between the two most recent Economic Censuses. During that time the state also increased its *productivity in generating biobusiness technology jobs relative to other states*. Minnesota managed to maintain its above-average level of competitiveness (measured by employment levels, weighted to take in to account the relative size of Minnesota's economy and the size of the biobusiness technology industry nationwide) continuously throughout the decade following 1997; and between 2002 and 2007 the state managed to significantly improve its relative position. In short, Minnesota managed to turn around its previous downward trend in biobusiness technology competitiveness into an impressive upward swing. The scale of the upwards shift in Minnesota's competitiveness, as indicated by its dynamic propensity for generating employment through biobusiness technology, was the greatest of any of the competitor states reviewed during the assessment project.

The salience for Minnesota, compared with other states (especially in areas of technological convergence) between the devices segment and other segments, was recognized in the previous statewide assessment report. As we enter the second decade of the Twenty First Century it appears to be imperative for Minnesota to enhance its capacity to leverage the strength of the medical devices segment of the biobusiness economy for the other segments. Accordingly, there may be value for enterprises in the other segments in the overall biobusiness technology industry to consciously seek further opportunities for leveraging the strength and momentum of the medical devices segment to their own advantage. Conversely, medical devices firms might find opportunities to further enhance their business by seeking ways to leverage innovations emanating from the other segments.

The leaders of Minnesota's impressive recent biobusiness technology resurgence might be able to energize their efforts to convert this resurgence in to a sustainable competitive advantage for the state through facilitating the enhancement of linkages between the medical devices segment and other segments of the biobusiness economy in Minnesota.

The first statewide assessment report for the BioBusiness Alliance of Minnesota ended with the following conclusion, regarding the biobusiness technology industries of Minnesota: *"... the biobusiness "train" has not yet left the station. However, we have discovered through our investigations that—metaphorically speaking—other states and other communities are busy investing in their own biobusiness "railway" systems, complete with tracks, stations, rights of way, new types of locomotives and new rail support services. Minnesota needs to plan and implement its next-generation "biobusiness rail system" with renewed vigor and urgency ... and in a manner that truly reflects the distinctive technological capabilities of the state. The dynamism, uniqueness and recently renewed growth of the employment and business activity in our state's biobusiness sector provides solid grounds for hope that the necessary steps can be taken to sustain Minnesota as a first-tier global player in the biobusiness fields where it can truly be among the best of the best."* This report of the second statewide assessment has shown that both the caution (about mounting competition from other states, amidst some faltering steps within the state) and optimism (about Minnesota's underlying capability to

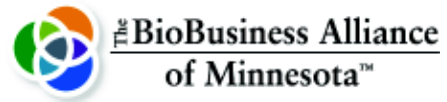
respond to the challenge) expressed in that first report were justified. Some of Minnesota's competitor states have continued to enhance their position in biobusiness technology since 2002 thereby threatening the comfort of Minnesota's incumbent biobusiness technology enterprises; but in the mean time Minnesota has also apparently managed to make real progress in planning and implementing its "next generation biobusiness rail system" (to continue with the metaphor employed in the previous report). The upward swing in Minnesota's biobusiness technology fortunes since 2002 may provide inspiration and grounds for hope to the state's current biobusiness leaders.

Executive Summary: Figure 3

**Overall Economic Trends, Biobusiness Technology Industries
(and the Macro-economy), Minnesota, 2002-2007**

Economic Variable	Medical Devices	R&D in the Life Sciences (excluding the academic sector)	Agri-bio and Bio-industrial Technology	Pharmaceuticals	Total Biobusiness Technology Industries	All Industries (in the macro-economy)
Number of employed people (in Minnesota)	Up	Down slightly	Up	Up	Up	Up slightly
Percentage of U.S. workforce	Up	Up slightly	Up	Up	Up	Down slightly
Number of Enterprises (in Minnesota)	Down	Up	Up	Down	Down	Up
Percentage of U.S. Enterprises	Up	Up	Down	Down slightly	Up	Down
Relative productivity in generating employment* 2002-2007	Up	Up	Up	Up	Up	Down slightly
Overall Competitiveness 2002-2007	Up	Up	Up slightly	Up slightly	Up	Stable
<i>Relative productivity in generating employment* 1997-2002</i>	<i>Down</i>	<i>Down</i>	<i>Down</i>	<i>Down</i>	<i>Down</i>	<i>Up slightly</i>
<i>Overall Competitiveness 1997-2002</i>	<i>Down</i>	<i>Down</i>	<i>Down</i>	<i>Stable</i>	<i>Down</i>	<i>Stable / Up slightly</i>

- As indicated by changes in the pertinent *Employment Density Index* over time.



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