



Wisconsin's Biohealth Industry

2018 Economic Impact Report

BioForward
WISCONSIN

Impact Report Overview



Baker Tilly, LLP has been contracted by BioForward to provide an independent third-party analysis on the impact of the biohealth industry within the State of Wisconsin. The study reflects data from 2014 through 2017, the most recent year available.

This report presents findings analyzing the biohealth sector within the state and its 4 geographic 'zones'. BioForward has defined biohealth as the intersection of biotech, biopharma, medical device, diagnostics, healthcare systems, digital health, and research institutions. To accurately encompass this definition, information is provided on six core sectors of the biohealth industry:

- Bioscience-Related Distribution
- Drugs and Pharmaceuticals
- Research, Testing and Medical Laboratories
- Medical Devices and Equipment
- Digital Health
- Healthcare Providers

In addition to direct industry impact, BioForward asked us to analyze data on the manufacturing industry in Wisconsin supplying to the biohealth industry. This data was intended to analyze how Wisconsin's more traditional manufacturing base is impacted by the growth in Wisconsin's biohealth industry. Data was compiled in consultation with BioForward and WEDC. BioForward requested we evaluate biohealth industry related construction activity from 2013-2017. The report evaluates likely impacts to local employment, Wisconsin tax revenue, and economic outputs of this construction activity in the state. Baker Tilly conducted an assessment of biohealth patents applied for in the period of 2013-2015 and research and development funding that have contributed to the industry from 2015-2017 as well as an overview of international exports manufactured or produced within Wisconsin in the defined biohealth industry.

This report reflects a continuing refinement in methodology, scope and data sources compared to prior reports from BioForward. Therefore, direct comparisons between this report and previous publications, which remain factual in their own context, are not valid.

A detailed overview of the report methodology can be found in the appendix.

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On the cover (from top to bottom):
BTC Institute Teacher Course
Advocate Aurora
GE Healthcare - SIGNA Premier with AIR Technology
Exact Sciences

Executive Summary

Key Findings

- The biohealth industry directly supported an estimated **107,616 jobs** within Wisconsin in 2017. Overall the biohealth industry supported a projected 250,379 jobs from direct, indirect and induced activity. Looking at direct jobs in the biohealth sector in 2013 the baseline is anticipated to have been 91,985 direct jobs. This reflects growth of 15,631 positions, or a **growth of 17%**.
- The direct positions are high paying, with **median wages of \$89,026 per job, which is 1.63 times higher than the Wisconsin median wage** of \$54,610 based on current census data.
- **Direct labor income directly contributes a projected \$11.1 billion** to Wisconsin's economy and increases to \$18 billion from direct, indirect and induced sources.
- In 2017, the biohealth industry has an estimated **4,320 businesses** operating in Wisconsin.
- For 2017, the industry is estimated to have created more than **\$27.0 billion in direct annual economic output** and more than \$47.8 billion in overall economic output activity from direct, indirect and induced sources.
- Wisconsin firms' direct operations and sales activities are estimated to generate more than \$515.3 million in state and local taxes (including production related taxes and corporate taxes) annually. Overall, roughly \$1.3 billion in state and local taxes are anticipated to have been generated from direct, indirect and induced operations and sales activities.*
- The industry's **Wisconsin manufacturing supply chain has direct economic output estimated at \$13.3 billion annually** from companies located in the state that supply products to global biohealth firms. Wisconsin's manufacturing supply chain has overall economic output from direct, indirect, and induced sources projected at \$21 billion annually supplying products to global biohealth firms.
- More than \$2.5 billion in labor income attributed to these manufacturing supply chain firms and their 31,888 employees. The overall outcomes associated to the manufacturing supply chain reflect a multiplier effect that creates \$5.1 billion in anticipated labor income supporting 80,494 employees.
- The manufacturing supply chain is anticipated to contribute \$434.6 million in state and local production related taxes and over \$37.1 million in state and local corporate taxes from direct, indirect and induced sources.*
- Construction activities on the 612 biohealth industry projects identified that began construction between 2013 and 2017, reflect more than **\$2.4 billion in construction cost** and an estimated **11,611 direct construction FTE jobs**.
- This construction activity generated estimated overall activity, from direct, indirect and induced sources, of \$3 billion in economic output supporting 20,120 in FTE jobs and roughly \$1.07 billion in labor income.
- Construction activity supported \$11.6 million in state and local tax, including \$9.8 million in production related taxes and \$1.8 million in corporate taxes. Overall this activity is anticipated to have generated \$73.7 million in state and local tax, \$69.6 million in production related taxes and over \$4 million in corporate taxes from direct, indirect and induced sources.*
- Wisconsin has seen at least **\$3.3 billion in direct public and private research funding** sources in the biohealth industry from 2015 through 2017.
- **Biohealth related patent applications totaled 3431** from 2013-2015.

* Tax analysis does not include personal property taxes

Biohealth Industry Impact



Baker Tilly evaluated the economic and employment effects from Wisconsin firms within 29 NAICS code classifications that most closely align with the biohealth industry, as defined, identified and organized by BioForward into industry groupings. Reflected in the table below there are an estimated 107,616 direct jobs spread across the geography of the state that fit within these clusters.

A Review of the “Clusters” at a Glance:

Bioscience-Related Product Wholesalers

The Bioscience sector has an estimated 8,222 direct jobs providing annual labor income in excess of \$590 million. This industry segment is estimated to provide over \$1.66 billion in annualized direct economic output.

Drugs and Pharmaceuticals

Turning to activities in the Drugs and Pharmaceutical sector of the industry, direct jobs are projected at 4,824 and the industry provides for over \$4 billion in economic output directly.

Medical Devices and Equipment

Within the Medical Devices and Equipment sector has an estimated 11,550 direct jobs support economic output of roughly \$6.05 billion with labor income at roughly \$1.25 billion.

Research, Testing and Medical Laboratories

The Research Testing and Medical Laboratories sector is estimated to support 11,415 direct positions and his activity is anticipated to provide for over \$835 million in labor income and over \$2 billion in direct economic output.

Digital Health

The Digital Health sector drives roughly \$1.31 billion in annual labor income with a projected 12,133 direct jobs. This activity is anticipated to provide over \$3.2 billion in direct economic output.

Healthcare Providers

The Healthcare sector has an estimated 59,472 direct jobs and \$6.68 billion in annual labor income to stimulate the Wisconsin economy. This industry segment is estimated to provide over \$9.9 billion in direct economic output.

Biohealth Industry Clusters	2017 Jobs	Median Wage	Business Locations
1 - Bioscience-Related Product Wholesalers	8,222	\$83,372	581
2 - Drugs and Pharmaceuticals	4,824	\$100,797	86
3 - Medical Devices and Equipment	11,550	\$79,994	281
4 - Research, Testing and Medical Laboratories	11,415	\$82,510	531
5 - Digital Health	12,133	\$95,765	753
6 - Healthcare Providers	59,472	\$75,011	2,088
Grand Total	107,616	\$89,026	4,320

Economic Output

These businesses are estimated to create \$27.0 billion in annual economic output from their direct operations and sales (projected for 2017). Overall Wisconsin's direct biohealth economic output from all sources (direct, indirect and induced) is projected to be in excess of \$47.8 billion.

Jobs and Wages

Firms identified as directly operating within the biohealth industry are estimated to have 107,616 jobs in Wisconsin's economy as of 2017 with overall jobs from direct, indirect and induced sources projected at 250,379. The direct positions are high paying, with median wages of \$89,026 per job, which is 1.63 times higher than the Wisconsin median wage of \$54,610 based on current census data. These direct positions are located at more than 4,320 business locations within the state.

Direct labor income is estimated to annually produce \$11.1 billion to Wisconsin's economy through wages and benefits. Wisconsin's direct biohealth industry is anticipated to generate over \$18 billion in overall labor income from direct, indirect and induced sources.

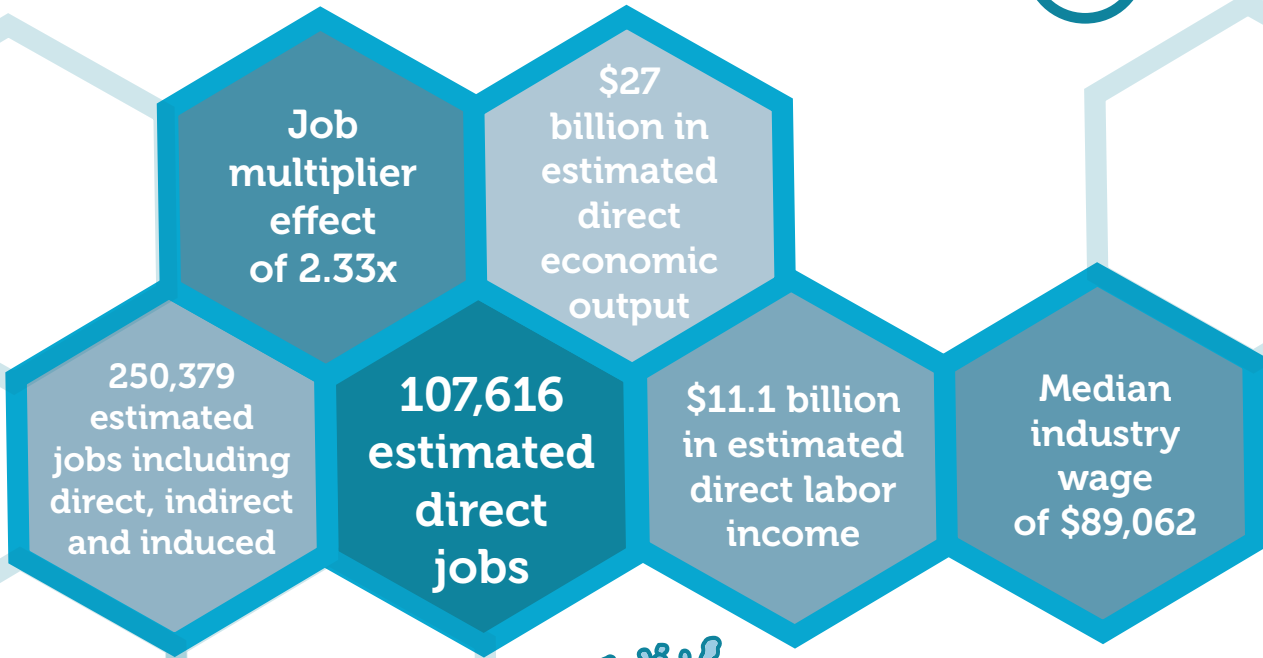
Taxes

Goods produced by Wisconsin firms that directly identify as part of the biohealth industry are estimated to create \$478 million in production related taxes (\$1.3 billion from direct, indirect and induced overall), with the added impact of an estimated \$36.9 million in direct state and local corporate taxes (\$82.6 million from direct, indirect and induced overall).*

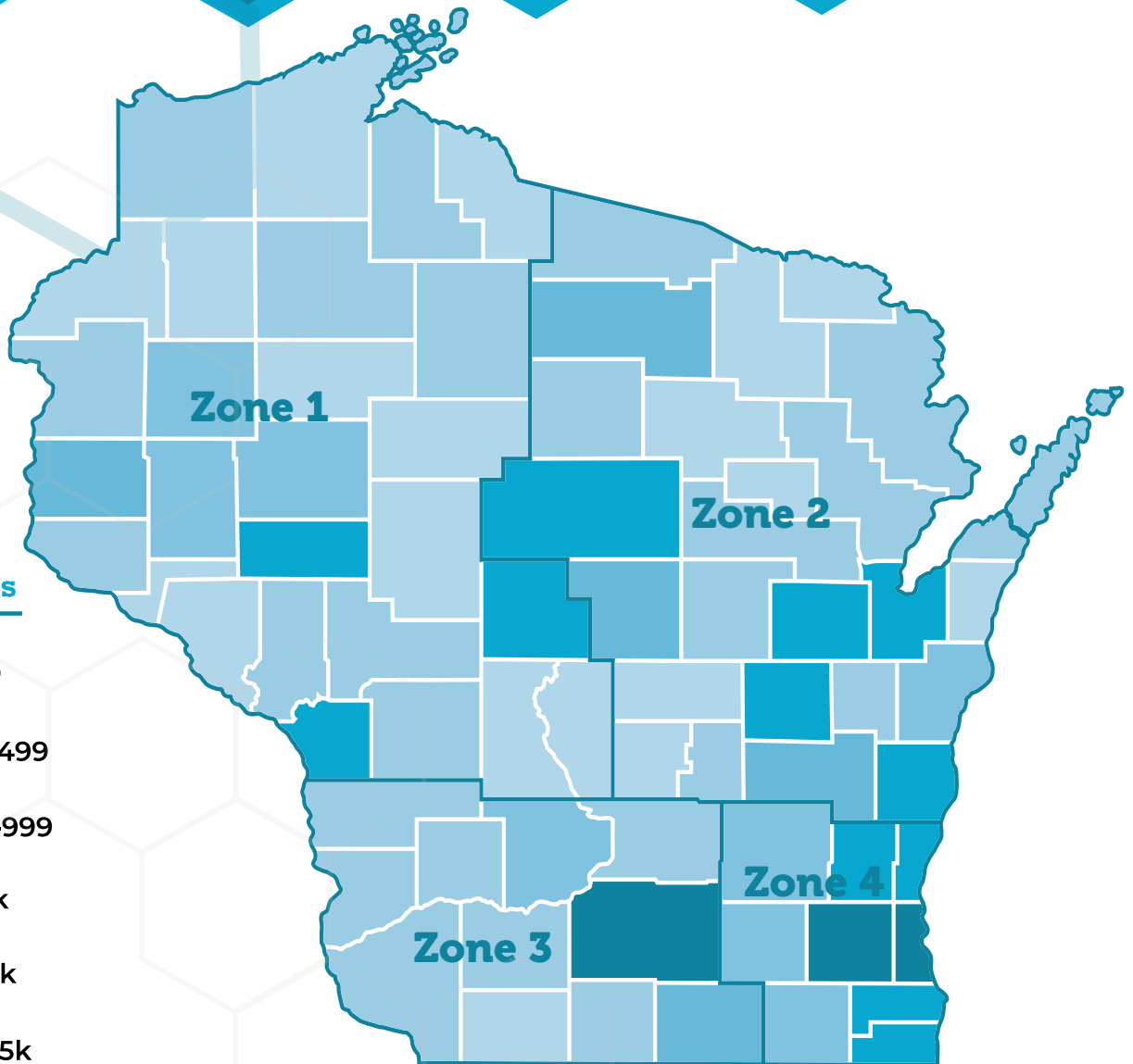
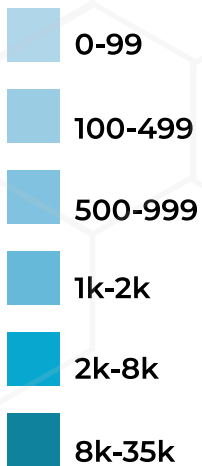


* Tax analysis does not include personal property taxes

Biohealth Industry Impact cont.



of Jobs



Promega (Zone 3)

Madison, WI

700 Est. Employees (1,200 Est. Worldwide)

Promega Corporation is a manufacturer of enzymes and other products for biotechnology and molecular biology with a portfolio covering the fields of genomics, protein analysis and expression, cellular analysis, drug discovery and genetic identity.



GE Healthcare (Zone 3 & 4)

Madison and Milwaukee, WI

6,500 Est. Employees

GE Healthcare provides transformational medical technologies & services that include medical imaging & information technologies, medical diagnostics, patient monitoring systems, drug discovery, biopharmaceutical manufacturing technologies, performance improvement & performance solutions services.

GE Healthcare



Exact Sciences (Zone 3)

Madison, WI

1300 Est. Employees

Exact Sciences Corp. is a molecular diagnostics company focused on the early detection of the deadliest forms of cancer. The company has exclusive intellectual property protecting its non-invasive, molecular screening technology for the detection of colorectal cancer.



Advocate Aurora (Zone 4)

Milwaukee, WI

32,000 Est. Employees

Aurora Healthcare is a not-for-profit health care system headquartered in Milwaukee and serving eastern Wisconsin. The system has 15 hospitals, more than 150 clinics, and 70 pharmacies. With 32,000 employees, including 1,800 employed physicians, Aurora is Wisconsin's largest home care organization.



Prevention Genetics (Zone 1)

Marshfield, WI

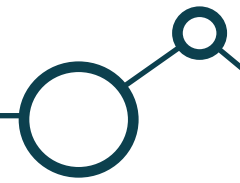
200 Est. Employees

Founded in 2004 and located in Marshfield, Wisconsin, PreventionGenetics is a CLIA and ISO 15189:2012 accredited clinical DNA testing laboratory. Prevention Genetics provides patients with sequencing and deletion/duplication tests for nearly all clinically relevant genes. These tests include our powerful and comprehensive whole exome sequencing test, PGxome™.

PREVENTION > GENETICS

DISEASE PREVENTION THROUGH GENETIC TESTING

Manufacturing Supply Chain Impact



The supply chain supporting the biohealth industry touches upon many deeply varied businesses located within Wisconsin. Working with BioForward, Baker Tilly undertook an analysis to estimate the impacts of product suppliers located within Wisconsin within 46 specific NAICS code classifications. Some of the classification codes have been reasonably discounted based upon partial participation in the industry. A more detailed analysis of this study's methodology can be found in the attached Appendix.

Economic Output

Direct economic output from these manufacturing supply chain firms is estimated at \$13.3 billion annually. The collection of Wisconsin companies that support biohealth firms are projected to contribute more than \$21.0 billion annually in economic output across all sources including direct, indirect and induced.

Jobs and Wages

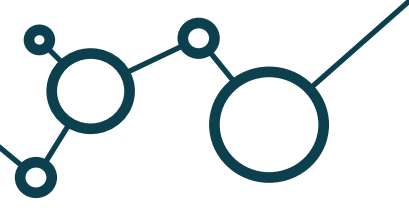
It is estimated that a total of 31,888 employees directly employed by companies that do business with biohealth firms. Additionally, 48,606 jobs from indirect and induced sources are estimated to be generated by supply chain firms throughout the state, for a total of 80,494 annually.

Labor income from wages and benefits to workers is estimated annually to create more than \$2.5 billion in wages and benefits from direct supplier firms located within Wisconsin, with \$5.1 billion from all sources including direct, indirect and induced.

Taxes

Goods produced by Wisconsin firms that serve the global biohealth industry are estimated to directly create \$112 million of state and local production related taxes annually (\$434.6 million from direct, indirect and induced sources), and the additional impact of an estimated \$22.5 million in direct state and local corporate taxes (\$37.1 million overall from direct, indirect and induced sources).*

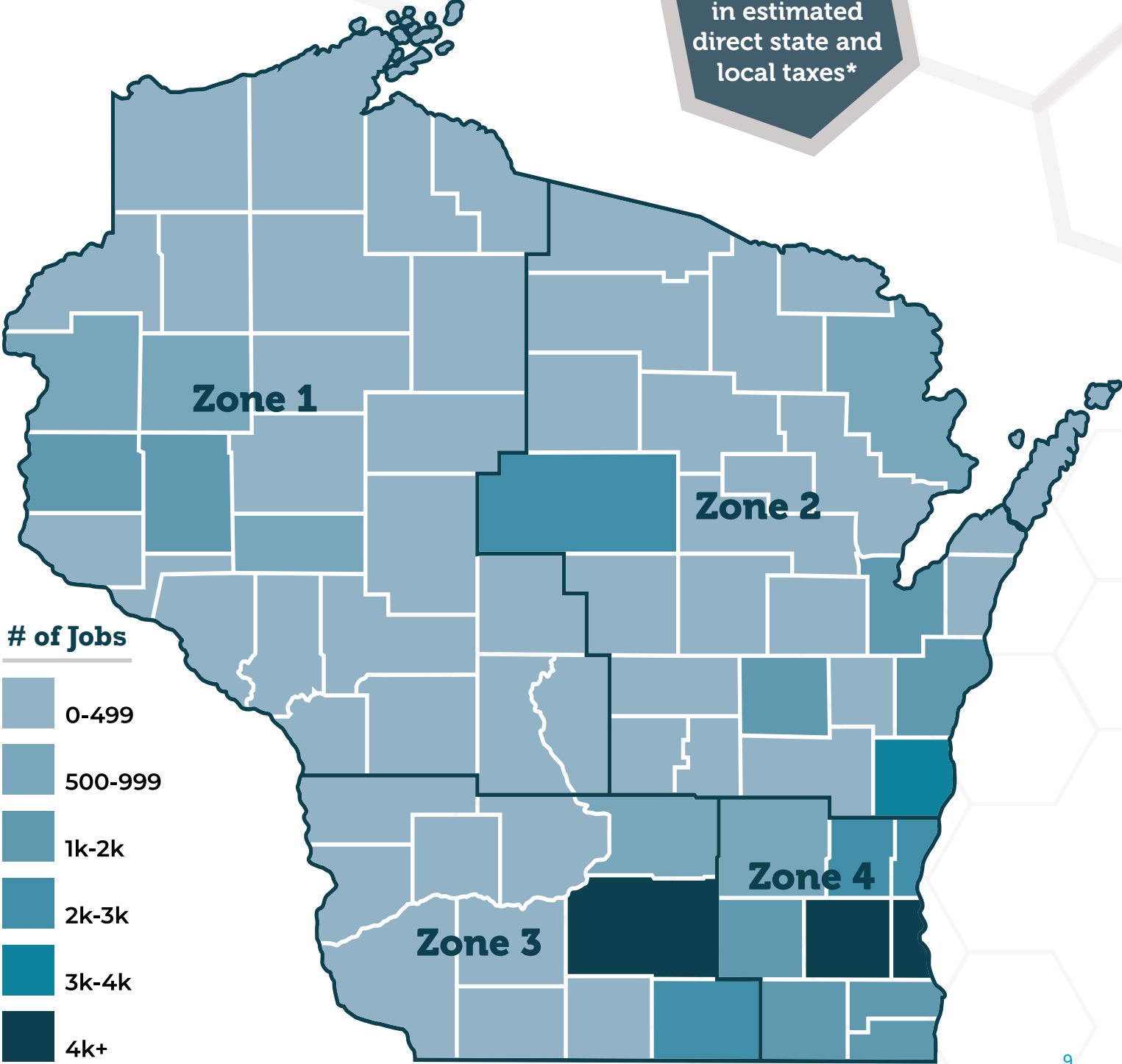
* Tax analysis does not include personal property taxes



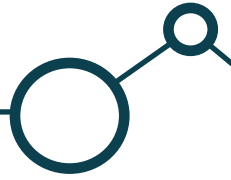
\$13.3 billion
in estimated
direct
economic
output

31,888
estimated
direct jobs

\$134.5 million
in estimated
direct state and
local taxes*



Manufacturing Supply Chain Impact cont.



Plexus (Zone 2) **Neenah, WI** **575 Est. Employees**

A global leader in complex product design, manufacturing, supply chain and aftermarket services in medical devices and life sciences, among other industries. In business since 1979 and headquartered in Neenah, Plexus has been partnering with companies around the world to transform their concepts into viable products and deliver them to the market.



Phillips-Medisize (Zone 1) **Hudson, WI** **450 Est. Employees**

Custom plastic injected molded products for the medical device & diagnostics, drug delivery, pharmaceutical & commercial.



Evco Plastics (Zone 2 & 3) **DeForest, WI and Oshkosh, WI** **385 Est. Employees**

Plastic injection molding, including tooling, product design, robotics & automation, large part molding and precision molding.



Scientific Protein Labs (Zone 3) **Waunakee, WI** **210 Est. Employees**

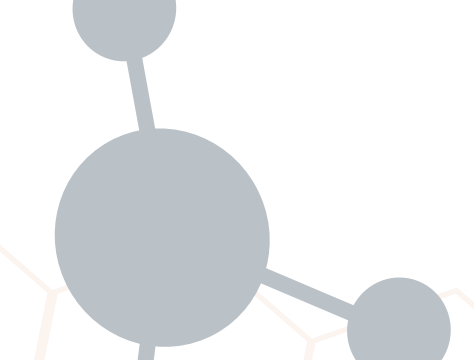
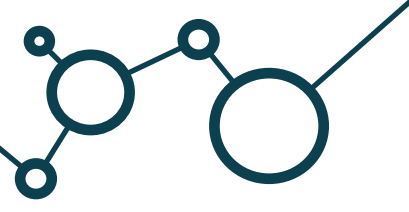
Leading global supplier of high quality active pharmaceutical ingredients (APIs), specialized in cGMP biopharmaceutical manufacturing. SPL also provides contract process development & cGMP manufacturing services, including heparin derivatives, natural products extraction, fermentation and purification.



Isthmus Engineering & Mfg. Cooperative (Zone 3) **Madison, WI** **70 Est. Employees**

Manufacturer of custom flexible automation machinery & equipment for the light & heavy industrial, medical, life sciences, solar, consumer products & automotive markets.





Alcami (Zone 4)
Germantown, WI
160 Est. Employees

Process development/scale up and clinical and commercial supply of Active Pharmaceutical Ingredients for customers worldwide.



Mathison Manufacturing, Inc. (Zone 4)
Waukesha, WI
29 Est. Employees

Contract metal fabrication, assembly & welding of components, enclosures & carts for the electronics, medical & mobile hydraulic industries, including laser cutting, punching, forming, finishing, fastener installation & full engineering services.



Columbus Chemical (Zone 3)
Columbus, WI
20 Est. Employees

Specialty custom blended, high-purity & cGMP chemicals for the electronics/semiconductor, food, pharmaceutical, medical device, energy & analytical laboratory markets.

AMS Micromedical (Zone 1)
Norwalk, WI
7 Est. Employees

Manufacturer of dental implants & surgical kits & drills & catheter components.

Graphic courtesy of Catalent

Vonco Products (Zone 4)
Salem, WI
125 Est. Employees

Advanced liquid-tight packaging & high-performance flexible packaging for the medical, food, retail & industrial segments, including promotional inflatables & bags.



Construction Impact

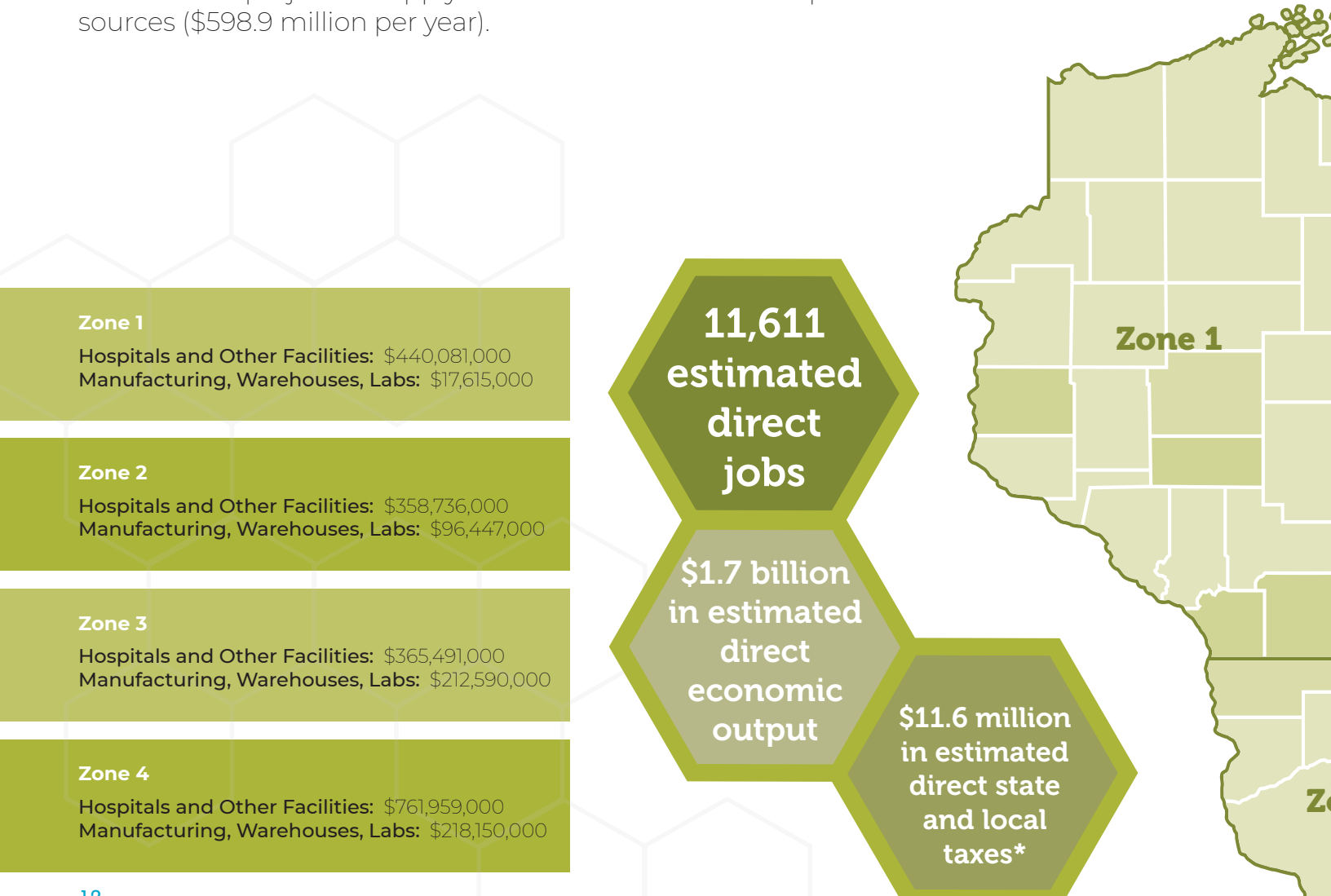


Across the state of Wisconsin, the impacts of biohealth businesses and research is interwoven as a vital part of many local economies, for large and small municipalities, urban and rural, and across a large variety of industries. Between 2013 to the end of 2017, 612 projects related to the biohealth industry have been identified as initiating construction, resulting in projects valued at more than \$2.4 billion in construction cost.

For the purposes of this analysis, community benefit and economic development impacts from construction have been derived as referenced in Appendix I.

Economic Output

Utilizing estimated hard costs for projects that initiating construction during the period of 2013-2017, approximately \$3.0 billion in total economic output is estimated to have been created based on direct project output of \$1.7 billion in spending and more than \$1.2 billion in additional projected supply chain-based economic output from indirect and induced sources (\$598.9 million per year).



Jobs and Wages

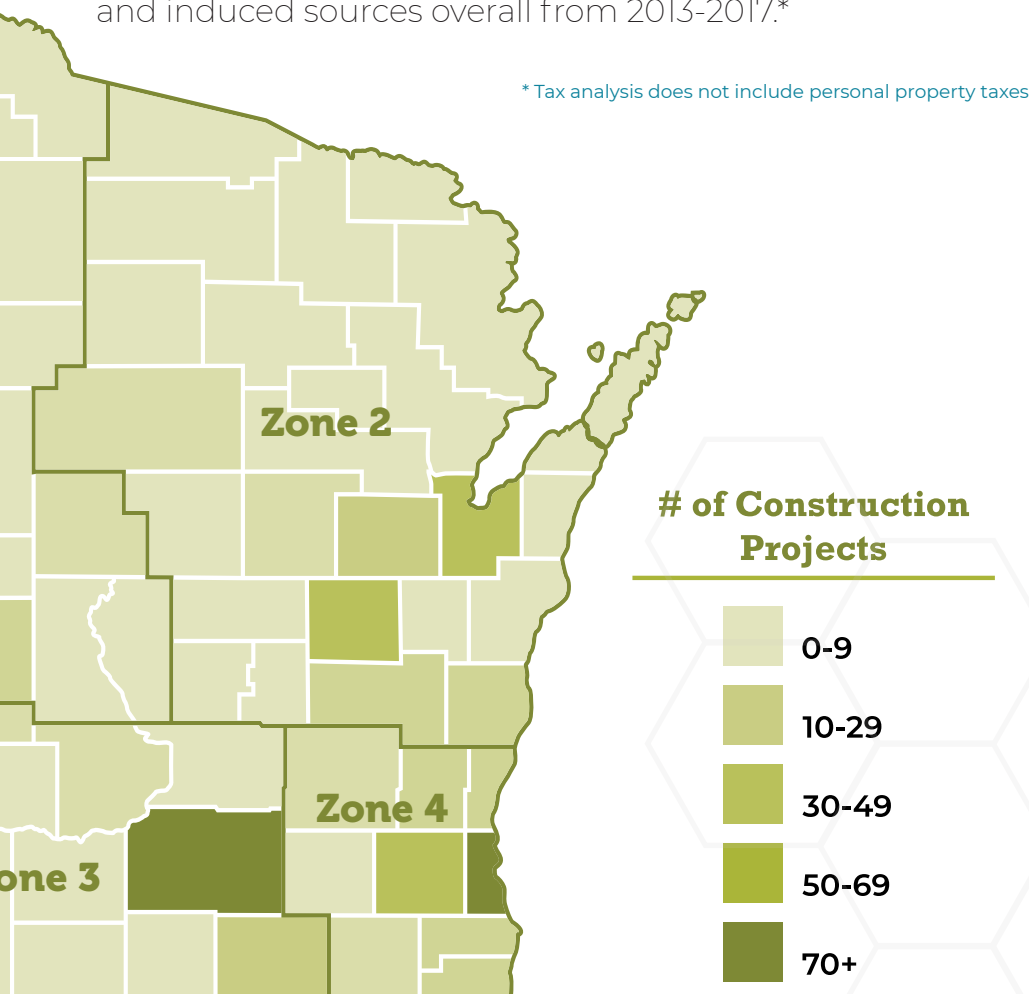
A total of 11,611 direct full time equivalent (FTE) on site jobs are estimated to have been generated from construction activities with total FTE construction jobs projected at 20,120 from all sources (direct, indirect and induced).

Labor income from construction wages and benefits to workers is estimated to have created roughly \$675 million in direct activity and more than \$1.07 billion from direct, indirect and induced sources.

Taxes

State and local taxes that can be attributed to direct effects stemming from construction activity at the 612 project sites are estimated at more than \$11.6 million from 2013-2017, and more than \$73.7 million from direct, indirect and induced sources overall from 2013-2017.*

* Tax analysis does not include personal property taxes



iMark Molding (Zone 1)
80,000 SF, \$18,000,000 (2015)

The expansion more than triples the size of the company's existing facility to meet current and future demand for its plastic injection molding molecular diagnostic and medical device products, including production, warehouse, office and shipping space.



SHINE Medical Technologies (Zone 3)
57,000 SF, \$20,000,000 (2017)

Initial proof-of-concept demonstration facility for future \$100 million manufacturing plant for radioactive isotope used to detect cancer and other fatal maladies utilizing nuclear medicine imaging.



Catalent (Zone 3)
22,000 SF, \$34,000,000 (2017)

A global provider of drug delivery technology and development solutions, the facility recently expanded adding office, manufacturing and lab space.



Froedtert Hospital Center (Zone 4)
165,000 SF, \$43,000,000 (2017)

Phase 2 expansion adds about 165,000 square feet to the existing 12 story building and is driven by the hospital's need to increase inpatient capacity.

Research Funding

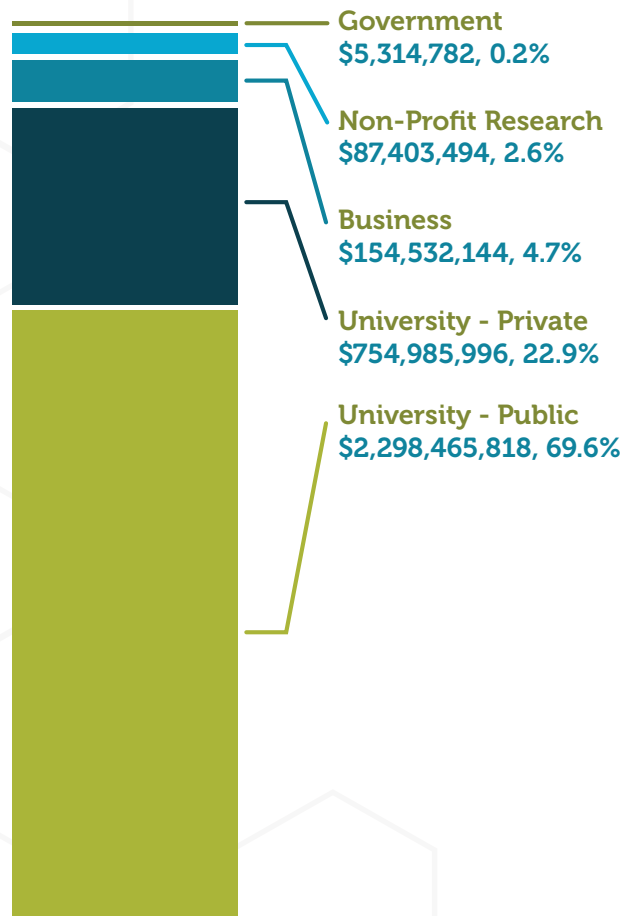


Wisconsin has seen combined investment from federal research grants and from private sources that underpins the biohealth industry's development. Across more than 41,000 federal grants, roughly \$42.8 billion in funds were obligated to Wisconsin during the period under review (2013-2017). For the purposes of research funding, a more limited analysis of funding was undertaken for the smaller, distinct period of 2015-2017 in order to present the data in more detail.

Active federal research grant funding authorization totaled more than \$3.3 billion over 2015-2017, of which more than \$1.74 billion continued to fund projects beyond 2017. While university-based research dominates the pool of grant recipients, private Wisconsin businesses received more than \$154 million in research grants, and non-profit research entities more than \$87.4 million.

University-driven research dominates the use of federal grant resources, with 12 Wisconsin campuses receiving grants totaling \$3.05 billion in federal grants since 2015, with nearly \$755 million divided across five private colleges and universities, and approximately \$2.3 billion funding research at seven University of Wisconsin system campuses.

Active Federal Research Grant Funding 2015-2017



Patent Activity



For Wisconsin's biohealth industry to continue its accelerated growth pace, it is reliant on access to talent and innovation. Patents related to this industry demonstrate that innovative research is being translated to patentable technology. R&D and patent activity significantly contribute to the success and health of growing and sustaining Wisconsin's biohealth industry.

This report evaluates patents on the basis of the number of discrete patent application filings that occurred for patent assignees located in Wisconsin, and for patents with inventors located in Wisconsin at the time of the application, who have no assignee listed on the patent applications, but whose patents are within Cooperative Patent Classification (CPC) codes with purposes that serve the biohealth industry. Patent applicants are not required to list an assignee on their application, and if one is later applied to the patent, the original filing records with the U.S. Patent and Trademark Office are not updated. Therefore, this analysis of patents explores both independent inventors and patents tied to specific Wisconsin-based assignees. Additionally, due to the years-long timeline involved in evaluating patents, we have limited our analysis to the years 2013-2015 to ensure comprehensive data is available for analysis.

On the whole, biohealth sector patents have averaged 16.7% of all patents filed within Wisconsin from 2013-2015, totaling more than 3,400 patents, and averaging 1,143 patents a year. As a whole, more than 20,590 patents were filed in Wisconsin across all industries. Patents associated with assignee companies or institutions located within Wisconsin represent 42.2% of all the biohealth patents, while patent applications with inventors in the industry located within the biohealth industry represent the balance of patents, with 1,980 patent applications.

Year to Year Change in Patents	Wisconsin as a Whole	Biohealth Sector
2013	7,557	1,253
2014	6,899	1,104
2015	6,137	1,074



BioForward previously commissioned a biohealth industry impact assessment for the state of Wisconsin for the period 2011-2013. This current report covers the industry from 2014-2017. Using an extrapolation of data currently available to discount for the effects of agriculture-related impacts to the marketplace that was included in the previous report, and adding a baseline for healthcare provider effects, a comparison was made possible.

Economic Output

Currently, direct economic output from the complete bioscience's industry is \$33.3 billion, with 81% of that coming from the biohealth industry, as analyzed within this report. The remaining 19% comes from agriculture-related sources.

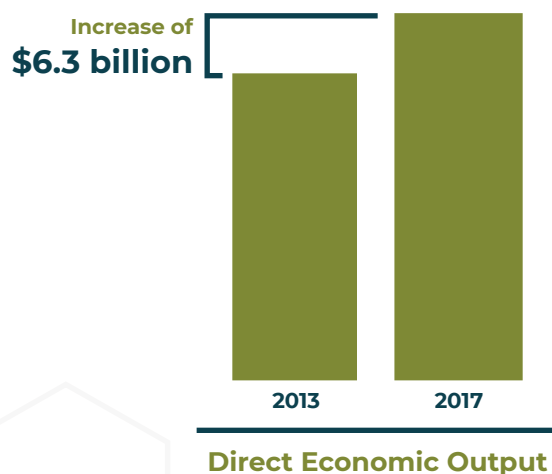
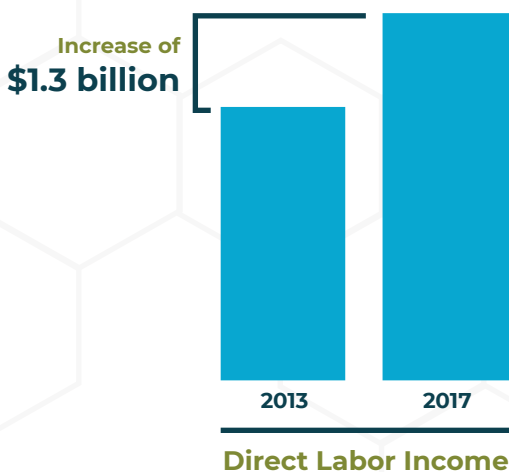
Excluding agriculture and including healthcare providers, it is estimated that in 2013 biohealth components of the bioscience industry created \$20.7 billion in direct economic output which by 2017 had growth of \$6.3 billion to nearly \$27.0 billion in direct economic output. Economic output from direct, indirect and induced sources rose from an estimated \$38.3 billion in 2013 to \$47.8 billion, or a growth of 24.8%.

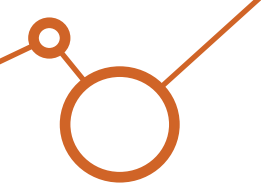
Jobs and Wages

Looking at direct jobs in the biohealth sector in 2013 the baseline is anticipated to have been 91,985 positions. For 2017, direct jobs for the sector are projected at 107,616. This reflects growth of 15,631 positions, or a growth of 17%.

Estimated direct labor income in the biohealth sector grew from \$9.8 billion in 2013 to more than \$11.1 billion by 2017. Based on all sources, with a baseline of \$14.5 billion in 2013 the industry has grown by 24% with a current estimate of labor income from direct, indirect and induced sources at \$18 billion in 2017.

WI Biohealth Industry Change 2013-2017



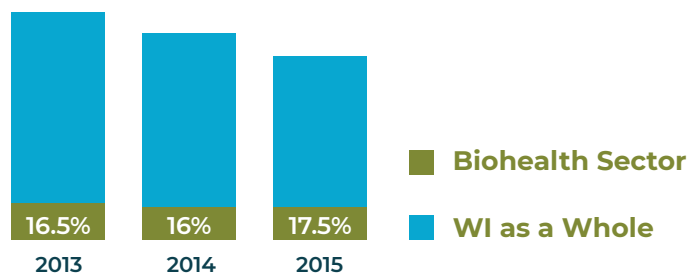


Patents

Within the patent and innovation environment, there have been some noticeable changes since 2013. While there has been an observed decrease in patents applied for by inventors in Wisconsin as a whole, the patent landscape is more robust around biohealth innovation within the state.

Biohealth related patents have held steady at approximately 17% of all Wisconsin patents filed over the period of 2013-2015, with overall patent applications statewide having fallen slightly since 2013. Biohealth patent applications have declined at a lower rate (14.3%) than non-biohealth patents for the state, which fell by a sharper percentage of 19.7% since 2013.

WI Year to Year Change in Patents



Wisconsin Biohealth Exports

Wisconsin has earned itself a position as a national leader in the biohealth industry and is known as a hub of innovation and invention in the field. Driven by a competitive manufacturing economy and robust university-driven research, the state ranks 12th nationally for international biohealth product exports, with the state multiplying its export growth three times over itself in the last 20 years, increasing exports by more than \$1.95 billion, from \$946.7 million in 1997 to more than \$2.9 billion in 2017.

WI International Biohealth Exports 1996-2017



Source: Wisconsin Economic Development Corporation, Division of International Business Development & U.S. Census bureau

Key Partners

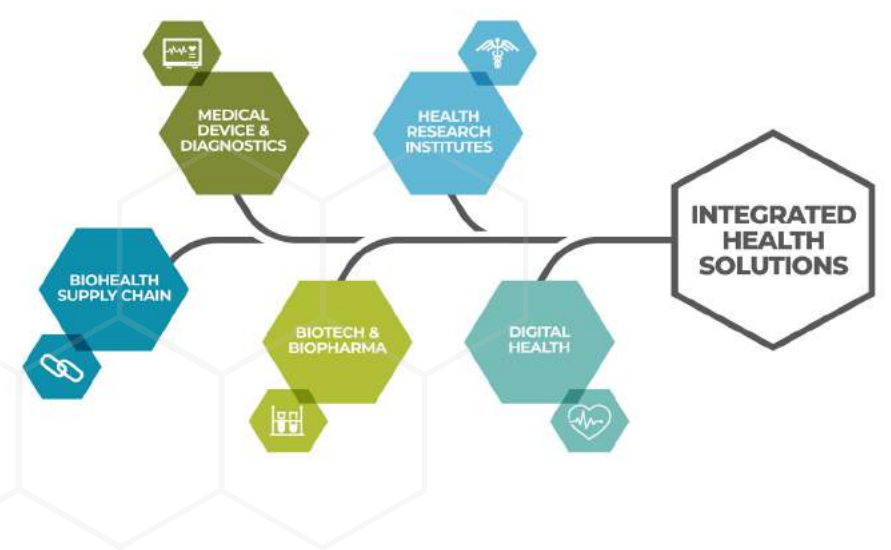


BioForward

BioForward serves as the independent voice of Wisconsin's biohealth industry, providing services and resources to support the growth of our industry throughout the U.S. and the world. BioForward is the only Wisconsin organization representing over 200 biohealth member companies including biotech, biopharma, medical device, healthcare systems, diagnostics, digital health, as well as research institutions, and service providers. BioForward's programs and memberships are designed to support members through business networking events, advocacy on behalf of the industry, exclusive rebates through our select savings program, and educational and speaker programming.



WISCONSIN'S BIOHEALTH INDUSTRY



Baker Tilly

Baker Tilly Virchow Krause, LLP (Baker Tilly) is a nationally recognized, full-service accounting and advisory firm whose specialized professionals connect with clients and their businesses through refreshing candor and clear industry insight. With approximately 2,700 employees across the United States, Baker Tilly is ranked as one of the 15 largest accounting and advisory firms in the country. Headquartered in Chicago, Baker Tilly is an independent member of Baker Tilly International, a worldwide network of independent accounting and business advisory firms in 141 countries, with 28,000 professionals. With offices across Wisconsin including Eau Claire, Appleton, Janesville, and Milwaukee, the firm has deep Wisconsin roots. Open since 1931, Baker Tilly's Madison office is the oldest and largest, with more than 275 current employees and 41 partners focused on clients in the construction/real estate, public sector, utilities, and manufacturing industries.



WEDC

The Wisconsin Economic Development Corporation (WEDC) is committed to creating and maintaining a business climate that allows firms to maximize their business potential. Working with more than 600 statewide partners, including regional economic development organizations, academic institutions and industry groups, WEDC supports community investment and business development efforts, advances industry innovation, engages global markets and develops initiatives to ensure a talented statewide workforce and economy.



Madison Gas & Electric (MG&E)

Madison Gas and Electric is an investor-owned utility that generates and distributes electric power and purchases and distributes natural gas in south-central Wisconsin. Supplying the energy to power 151,000 electric customers and heat and run industrial processes for 158,000 natural gas customers annually, MG&E is community driven and has been in existence for more than 150 years, supporting economic and business development for a strong and vibrant economy.



Kraemer Brothers

Kraemer Brothers was founded in 1948 with the values of integrity, a strong work ethic and high-quality craftsmanship. Still owned and operated in southwest Wisconsin by the Kraemer family, we perform general contracting services for commercial facilities. Kraemer Brothers has completed over 200 biotech projects in Wisconsin, totaling nearly 4.5 million square feet and resulting in unparalleled biotech construction expertise. Kraemer Brothers self-performs concrete, steel erection, masonry and carpentry which allows us to fast-track schedules and accurately budget.



Appendix I - Methodology and Resources

Methodology and Resources

The North American Industry Classification System (NAICS) is the standard used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. A total of 75 NAICS codes were selected by BioForward for Baker Tilly to complete the analysis on the direct and manufacturing supply chain activities within the report, with 29 NAICS codes considered the direct industry, as listed in Appendix IV. The balance of NAICS codes (46) were used in an analysis of manufacturing supply chain industry. A limited selection of NAICS codes were partially discounted according to discrete industry information provided by BioForward and WEDC to attribute for sectors whose companies are varied and serve divergent industries. Additional supply chain data was accessed through the EZ select data base through research conducted by BioForward and WEDC. Construction data was contracted from Dodge Data and Analytics proprietary database. Export data was sourced from the State Harmonized System database with agricultural codes removed from the subset.

Econometric modeling for direct, indirect, induced effects for the direct industry, supply chain, and construction activity were utilized with a combination of functions available with subscriptions to Emsi and IMPLAN software held by Baker Tilly.

Baker Tilly utilized publicly available federal grant data from the U.S. Treasury Department's USAspending digital database (<https://www.usaspending.gov/>). Additional data set components compiled for historical research investments were sourced through publicly available data sources, with assistance from the Grants Information Collection at UW-Madison's Memorial Library. Philanthropic donations are based upon IRS Form 990 reporting sources, and given their delay in public availability, this report utilized data for the three most recent years available, 2014-2016.

Patent data was sourced directly from the U.S. Patent Office, utilizing the USPTO's PatentsView digital database (<http://www.patentsview.org/>). This report evaluates patents on the basis of the number of discrete patent application filings occurred, versus the number of patent entries or number of grantors named on the patents, making a direct comparison across this report and others not immediately possible.

Agricultural products and research have not been included in the analysis, in comparison to previously commissioned national-level and Wisconsin-centric reports. Healthcare products, facilities, and research have been actively included as a component of the report.

Assumptions and Limiting Conditions

1. All information contained in the report which others furnished was assumed to be true, correct, and reliable. A reasonable effort was made to verify such information, but the author assumes no responsibility for its accuracy. This report was prepared in September, 2018 and has not been updated by Baker Tilly since such date.
2. An evaluation of the community impact for the subject is made as of a certain day. Due to the principles of change and anticipation and market variation, the community impact assessment is only valid as of the date of this analysis.
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Appendix II - Emsi Input-Output Methodology

About the Emsi Social Accounting Matrix

This study utilizes the Emsi Social Accounting Matrix. Emsi's multi-regional social accounting matrix (MR-SAM) modeling system is a "comparative static" type model in the same general class as RIMS II (Bureau of Economic Analysis). It relies on a matrix representation of industry-to-industry purchasing patterns originally based on national data which are regionalized with the use of local data and mathematical manipulation (i.e., non-survey methods). Models of this type estimate the ripple effects of changes in jobs, earnings, or sales in one or more industries upon other industries in a region. The Emsi model shows final equilibrium impacts -- that is, the user enters a change that perturbs the economy and the model shows the changes required to establish a new equilibrium. As such, it is not a "dynamic" type model that shows year-by-year changes over time.

Definitions

Initial Impact: This number represents the initial change in jobs, earnings, or wages as input by the user, and therefore does not include ripple effects. If a user has made the input terms of jobs, this figure will match exactly what the user entered. If in terms of earnings or sales, this number will represent the conversion to jobs from those other terms.

Direct Impact: The effect of new input purchases by the initially changed industries. This is the first round of impacts. This change is due to inter-industry effects.

Indirect Impact: The subsequent ripple effect in further supply chains resulting from the direct change. In more awkward terms, this shows the sales change in the supply chains of the supply chain, as a result of direct change. This is the second round of impacts. This change is due to inter-industry effects.

Induced Impact: This change is due to the impact of new earnings created by the initial, direct, and indirect changes. These earnings enter the economy as employees spend their paychecks in the region on food, clothing, and other goods and services. In other words, this figure represents the income effects on inter-industry trade.

Important Assumptions

Construction impacts are usually brief. When a new bridge or building is built in a region, the construction change in the region is not permanent. Changes in Emsi's model assume that the jobs added represent a permanent change to the regional economy. For this reason, it's important to look primarily at the impact to the supply chain in the region, rather than looking at the full impact of the construction project.

Other impacts, however, will continue past the construction. Operation of a new building represents a real change in the economy, but shouldn't be equated to the change in the construction industry.

Appendix III - IMPLAN Input-Output Methodology

About IMPLAN

This study utilizes IMPLAN, an economic modeling software that creates a model of the local economy and estimates the impact of a change in local spending on output, employment, and wages. Using total development cost data provided by the Developer and the identified area of impact, we quantified the economic impacts for Wisconsin's biohealth industry using IMPLAN. Purchases for final use (final demand) drive the IMPLAN input-output model.

Direct Impacts: Direct impacts are those impacts occurring in the impacted sector and related industries as a direct result of the activity generated by the project. This includes output, income, and employment generated from direct investments in the project.

Indirect Impacts: Indirect impacts are those created based on the local expenditures generated from the changes in inter-industry purchases (supplier to supplier) as they respond to the demands of the directly affected industries. This includes output, income, and employment effects arising from local spending for goods and services.

Induced Impacts: Induced impacts are estimated based on the increase in local incomes attributable to the project. This includes output, income, and employment effects on all local industries caused by the expenditures of household income generated by the direct and indirect impacts.

Output: Output estimates represent the estimated increase in total production for all industries in the region supported by the project - a measure of overall economic activity. Output can also be thought of as the increase in the value of total sales as "Gross Local Product".

Employment: Employment estimates represent the estimated total jobs created and supported by the project, on both a temporary and ongoing basis.

Construction impacts of the project arise from the activity of building the project, and occur only while the project is being built. When the project is complete, these construction impacts end.

Ongoing impacts such as the impact of the operations of the built facility are presumed to be "on-going" and are described on an annual basis.

Data Sources

Data used for IMPLAN software analysis includes the market area determined by the client. Data sources include North American Industrial Classification System (NAICS) codes; Regional Economic Information System Sectoring (REIS); Bureau of Labor Statistics Sectoring; Bureau of Economic Analysis Input-Output Sectoring; and, County Business Patterns; BLS CEW (Covered Employment and Wages program). The description of IMPLAN Methodology was adapted from the IMPLAN Version 2 Users Manual, 3rd edition, 2007.

Appendix IV - Utilized Direct Industry NAICS Codes

Bioscience-Related Distribution

423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
423460	Ophthalmic Goods Merchant Wholesalers
424210	Drugs and Druggists' Sundries Merchant Wholesalers
532283	Home Health Equipment Rental

Drugs and Pharmaceuticals

325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing

Medical Devices and Equipment

334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliance and Supplies Manufacturing
339114	Dental Equipment and Supplies Manufacturing
339115	Ophthalmic Goods Manufacturing
339116	Dental Laboratories

Research, Testing and Medical Laboratories

541380	Testing Laboratories
541714	Research and Development in Biotechnology (except Nanobiotechnology)
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)
621511	Medical Laboratories
621512	Diagnostic Imaging Centers

Digital Health

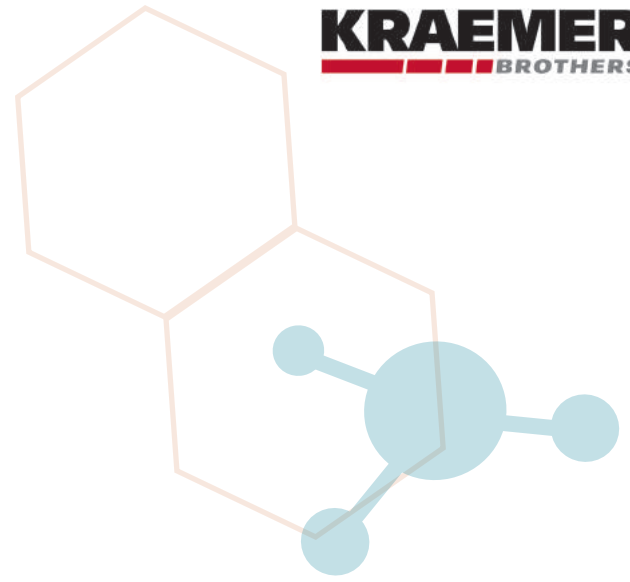
511210	Software Publishers
541511*	Custom Computer Programming Services
541512*	Computer Systems Design Services
541519*	Other Computer Related Services

Healthcare Providers

621111	Offices of Physicians (except Mental Health Specialists)
621491	HMO Medical Centers
621991	Blood and Organ Banks
621999	All Other Miscellaneous Ambulatory Health Care Services

BioForward

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