

**Assessing the Economic Impact of Incubators on the Commonwealth of  
Massachusetts: The Case of Massachusetts Biomedical Initiatives**

A MAJOR QUALIFYING PROJECT

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## Abstract

This project examines Massachusetts Biomedical Initiatives' (MBI) economic impact on the national, Massachusetts, and Worcester economies, provides recommendations for the development of future economic reports, and offers projections for MBI's current and future impacts. The study collects both primary and secondary data on MBI tenants via surveys, interviews, and previous studies. This project team subsequently uses the information in concurrence with a software platform to generate estimates on the economic impact of MBI through fostering the success of its tenants. Coupled with the additional information on venture capital investment on firms similar to MBI's tenants, our further analysis provides a more complete picture on the economic contribution of MBI by incorporating potential investment that MBI's tenants are able to raise. Finally, we offer some suggestions in order to improve the process that MBI or other incubators implement to better gauge the activities of their tenants. Our study can be used to educate the government, other incubators, and general public about the role of life science incubators, and their contribution to the economy.

## Executive Summary

As the United States economy continues to recover from the recent recession, the development of new businesses is tremendously important. During the peak of the recession, unemployment rose to approximately ten percent. Therefore, the ability of incubators to develop start-up seeds into self-sustaining and prosperous companies plays a critical role in aiding the recovery of the United States economy. These new companies open up doors for employment, revenue, and investment within the United States. The communication of the impact these incubators have on the recovery plays an important role at gaining the acceptance from the government, investors, and general public as a means of using incubators to revive economies.

This report focuses on Massachusetts Biomedical Initiatives (MBI) impact on the National, Massachusetts, and Worcester economy. MBI is an incubator with three locations in Worcester, Massachusetts that provide equipment, space, and other services to start-up Life Science companies. The equipment, space, and services that MBI provide allow companies to cut costs and prepare themselves for becoming independent, and improving the chances of a company's success. As MBI has seen over fifty tenant companies leave their doors since they have started, Kevin O'Sullivan President and CEO of MBI was curious as to the role MBI plays in the economy. MBI reached out to WPI in order to develop a more accurate economic study and analysis of their impact on the surrounding community.

Prior to developing an economic snapshot for MBI, a vast amount of research has been done to gauge how fast the Biotechnology industry is growing, and the role that it played in the National, State, and local economies. Several studies specifically those done by Ernst and Young and the Massachusetts Biomedical Council gave data on employment,

growth rates, revenue, investment, as well as other aspects of the economy. While these were all helpful, they did not provide the methods by which we can replicate for our study on MBI. Therefore, interviews with professionals with experience in the development of their own economic studies become necessary.

We conducted multiple interviews with numerous professionals; those of particularly great help were with Peter Abair of the Massachusetts Biomedical Council, Tracy Kitts of NBIA, Jack Healy of MassMEP, Frances Day of the Implan Group, and Mark Tepper of the Boynton Angels, among others. The interviews provided the methods, tools, and economic factors used by these professionals, and gave us a sense of how to start developing a model for MBI.

After the concept of creating the model was laid out, a tremendous amount of data was collected from Judy Cocaine at MBI to be used for the development of the model. The data collected was then checked for validity in order to make sure the proper data is used to generate the report. After our calculations were verified, they were input into Implan for further analysis by their unique software system, which is widely used in many national, state, and local government branches. The Implan software generates the total value added, direct, indirect, and induced impacts as well as tax impacts of MBI.

Once the results from Implan were received, analysis of the data was applied to ensure the numerical impact is reasonable. Finally, the data from Implan software, MBI, and previous studies could be used to develop projections of MBI's impact in terms of employment and the total value it provides to the community in economic output. The use of actual data and projections can be used to educate the government, other incubators,

start-up companies, and the general public on the role Massachusetts Biomedical Initiatives has on the economy and the aid it provides to its recovery.

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# 1. Introduction

## 1.1 Overview of Biotechnology

### 1.1.1 What is Biotechnology?

Biotechnology has been around for thousands of years in many different formats. It began with fermentation of many foods and drink, which dates as far back as within the society of ancient Egypt and biblical references. By the mid 1970's, nearly 4000 years later, the focus of biotechnology had shifted from agriculture to DNA and genetics. Every day, biotechnology research is finding new cures for different diseases and generating newer and better antibiotics and prevention tools. With such growth and so many different aspects, it's no wonder that over 180,000 people were working for U.S. Biotechnology companies in the year 2006 (Hacking, 7). Biotechnology job opportunities are growing, even in a time of economic downturn at the national level.

### 1.1.2 Economic Impact of Biotechnology at a National Level

Even in today's up and down economy, the biotechnology sector is one of rapid growth and development. According to the Department of Labor, biological technician jobs were expected to grow by 28.2 percent between 2004 and 2014. The same study also found that the increase in job growth for biological scientists for that same period was projected to be 17 percent. An additional study by Ernst & Young in 2000 states that the revenue provided by publicly traded biotechnology firms made up \$47.8 billion of the United States economy up from \$32 billion in 2002 (Ernst, 1-10). This number of over \$47.8 billion is a significant contribution to the United States economy, especially in terms of job growth for the future. Additionally, states which have large amounts of

biotechnological jobs, such as California, New York, New Jersey, and Massachusetts, have fared better during the recession or at least helped keep the unemployment numbers lower than they would have been without the biotechnology industry.

### **1.1.3 Economic Impact of Biotechnology within the Commonwealth of Massachusetts**

As stated earlier, biotechnology plays a tremendous role in our nation's economy; this is especially true in the state of Massachusetts. Since 2001, Massachusetts has seen a 52.5% growth rate in its biotechnology sector, is currently first nationally in terms of research and development employment, and makes up 5 percent of the entire global drug development pipeline. Additionally, for the year of 2010, the Massachusetts payroll biotechnology companies totaled \$4,615,364,513, with an average salary of \$95,628 (Masochini). To put that number into perspective, the total GDP of the Massachusetts economy is approximately \$377 billion. The biotechnology industry is a catalyst of growth for the Massachusetts economy and as the industry continues to grow the need for resources and services to help young startup companies increases.

### **1.1.4 Incubator Definition**

In order for Massachusetts to maintain its growth and success within the biotechnology sector it uses several methods. One effective method Massachusetts uses is to support incubators, which help grow smaller biotechnology companies. The use of incubators is growing more common across the nation and Massachusetts. In 2005 alone, incubation programs in North America provided employment for more than 100,000 people and generated annual revenue of about \$17 billion ("Mass Bio"). The job of these incubators is to provide space and equipment to smaller startup companies who cannot

afford to purchase the equipment on their own. Only paying for rent and not having to purchase and maintain equipment lowers the startup costs of the company. This allows them to focus on the project at hand rather than running a small business. While the economic impact of biotechnology in Massachusetts has been measured in many studies, the impact of the incubators themselves has not been thoroughly studied. Our study could aid in future studies of the economic impact for all incubators across the Commonwealth.

#### **1.1.5 Overview of Massachusetts Biotechnology Incubators**

Massachusetts is seeing a growing number of Biotechnology Incubators emerge in the state as the state looks for more ways to boost revenue and job growth in the local economy. Some of the smaller biotechnology incubators include BioSquare, Massachusetts Biomedical Initiatives, and the Venture Development Center at UMass Boston. A more common theme that is beginning to develop is to have schools that have biology or biomedical programs provide space to these incubators. This program provides students with the opportunities to work within a lab, while the incubator receives space to lease to startup companies. In addition to UMass Boston, Boston University and Worcester Polytechnic Institute have also participated in leasing space to incubators in BioSquare and MBI respectively. The collaboration between universities and incubators dates back to the start of incubators in the 1970s. Incubators developed out of warehouses nearby MIT, which hosted space to young scientists who needed equipment and space to do their research (Brenitz, 2006). Currently there are more than 52 incubator locations registered with the Massachusetts Biotechnology Council.

Today, many of the incubators today are located around the Cambridge/Boston area as well as Middlesex County. In terms of the local economy the Biotechnology industry is mostly populated in Middlesex County. Middlesex County accounts for over 16,000 of the approximately 27,000 Massachusetts biotechnology employees in research and development field alone (MBC 2011). The biotechnology incubators play a large role in developing Massachusetts leading biotechnology sector. However, although there are many biotechnology specific studies for Massachusetts the economic impact of the biotechnology incubators in Massachusetts is still somewhat unknown.

## 1.2 Overview of MBI

### 1.2.1 What is MBI?

Massachusetts Biotechnology Research Institute (MBRI) was founded in 1984 by MBI's board of trustees as a non-profit organization with the purpose of helping Massachusetts' economy. They planned to achieve this goal by growing new companies to form new employment opportunities. By 1999, the company's direction had changed so much so quickly that the name was adjusted to Massachusetts Biomedical Initiatives (MBI) to cover all of the evolving industry within both Biotechnology and Biomedical realms (Ngo, 3).

### 1.2.2 What does MBI do?

The three facilities MBI maintains can be found at Barber Avenue, Biotech Three, and Gateway Park. The Barber Avenue facility houses laboratories, offices, a conference room, and a kitchen. They also offer shared equipment and cold rooms to tenants. Biotech Three, located at One Innovation Drive in Worcester, has similar amenities, and is located directly across the street from the UMass Medical School. This incubator plays a key role in facilitating technology transfer from academic research to commercial application (Holoynia, 5).

MBI's site at Gateway Park is a partnership with WPI, and, in particular, the Bioengineering Institute. This incubator, which is positioned on the ground floor of the newly constructed building, will specifically identify and capture academic and science related research and transfer these discoveries into commercial based companies and jobs.

Through these three facilities, MBI lowers barriers to success for emerging companies by providing cost-effective, high quality laboratory space and support services.

Outside of laboratory space, MBI also provides but is not limited to such conveniences as maintenance and cleaning, autoclaves, glass washer, and centrifuges. The laboratory space also provides the most up-to-date facilities for research in the life sciences. Administrative services, including staff members who handle standard business operations, are also available. Since the startups renting laboratory spaces don't have to spend time on the clerical side of their business, tenants are able to concentrate on their research and development.

One service that stands out in particular is MBI's expertise. MBI's long-standing success within the industry allows them to effectively mentor and consult for the start-up companies in their facilities. This helps the clients achieve the goals they have set for themselves. If tenant companies go public or are sold, MBI seeks a negotiable one percent equity agreement. The MBI Board of Trustees set up this endowment with the purpose of using this equity to help develop their laboratory space and shared equipment. Through continued development, this program helps encourage the growth and success of future Biotechnology start-ups.

Mentoring and consulting also comes in the form of common service providers. Since MBI has long standing relationships with several service providers such as lawyers and accountants, tenants have the ability to use these services with much ease. These other companies are much more willing to work with familiar companies and respect established relationships. This is also true to networking as well. Since tenants are within the same walls as many other similar corporations and presenting regularly to the Board of

Directors, most of whom are in the industry, they are building their network for after their company graduates from MBI. Many times, your network is invaluable (O'Sullivan).

### 1.2.3 MBI's Strategic Plan

In order for us to provide the best economic model for MBI, we must keep in mind their strategic plan. Focusing on the strategic plan will allow us to choose the appropriate metrics for the model as well as create a model of which every metric is meaningful for MBI. As we decide upon what metrics to use we must focus on the four goals of MBI as are stated in their strategic plan:

1. Establish a value proposition for prospective tenants;
2. Outline actions to assure the mission could be accomplished;
3. Ensure financial viability of MBI; and
4. Develop metrics and track progress.

Currently, MBI has prospective tenants present their one year plan for their science, business, and financials before accepting them and allowing the company to move into MBI's lab space (O'Sullivan). This pre-requisite covers the first, second, and third goals of the strategic plan. The metrics and progress, however, are not compared by MBI, but are tracked for such purposes as explaining to third parties how the incubator is doing as a whole entity.

Our economic model will improve upon the third and fourth goal, as we will be choosing the proper metrics to measure the impact of MBI locally and across Massachusetts. This should help open up the eyes of prospective investors and public

funding as MBI looks to expand, therefore improving upon the third goal.

Not only must we focus on improving the third and fourth goals above, but we must make sure that our model is relevant to MBI's Mission statement below:

*The Massachusetts Biomedical Initiatives (MBI) is a private, non-profit economic development organization dedicated to job creation throughout Massachusetts by promoting the birth and growth of start-up biomedical companies that are committed to developing innovative ways to improve health care. MBI offers support to creative entrepreneurs in developing sound scientific and business plans. Through MBI's Incubator facilities located in Worcester, MBI lowers barriers to success for emerging companies by providing cost-effective and high quality laboratory space and support services. MBI is committed to collaborating with the academic and business communities, and local and state governments, to promote Massachusetts as an international leader in the biomedical industry ("Massachusetts Biomedical Initiatives")*

The mission statement will allow us to make sure that our metrics are appropriate for MBI and their business model. According to Imran Nasrullah of the Massachusetts Biotechnology Council, the life sciences industry faces five main obstacles: finance, innovation, scientific development, management, and collaboration. In terms of finance and collaboration, capital must be used to the highest level of efficiency, and MBI is looking to collaborate with more than just academic institutions. They are also looking to work with big pharmaceutical companies, established biotechnology companies, and disease



foundations, as much of corporate funding must be approved by big pharmaceuticals. Scientific development and innovation refer to the finding the most talented companies with innovative products, as products require more lab space than service companies. Management is referring to the fact that project managers are emerging from MBI, but company managers are not. Luckily, MBI has knowledge, leadership, focus, flexibility, and the ability to learn from the past and to strive for improvement in the future. All of these will assist them in overcoming the challenges stated previously. Developing an economic model for MBI would be particularly helpful in improving their ability to track progress, demonstrate their value to prospective tenants, gain funding through grants, and to compare themselves to their competitors.

#### **1.2.4 MBI's Tenants**

MBI currently houses 14 companies throughout its 3 locations. These companies range in size from 1 employee up to as many as 38 employees in some more rare occurrences. Tenants are start-up companies within the realm of life sciences, whether it is biology, biochemistry, biomedical engineering, bio-mechanics, or anything else of the sort. They seek out MBI as an incubator to utilize their equipment, reducing their initial investment by multiples.

#### **1.2.5 How MBI is Funded**

Since its' founding, MBI has invested over \$8 million of public funding and \$50 million of private funding into technology-driven companies. From this investment, MBI has created over 50 companies and has grown to three incubation centers. Companies MBI supports spent over \$50 million last year in payroll to approximately 2,000 employees, and

have raised approximately \$600 million in additional financing. Between the years of 2000 and 2011 alone, MBI graduated 35 successful companies, leading to approximately 400 new jobs and \$100 million total economic impact. In comparison to the national average for the life sciences in general, MBI is funded as follows:

**Table 1: MBI Funding**

	Life Sciences	MBI
Revenue	36%	50%
State Subsidy	26%	15%
Licensing fees	38%	35%

In general, North American incubators are generally funded in the following ways:

- 31 percent are sponsored by economic development organizations
- 21 percent are government sponsored
- 20 percent are funded by academia
- 8 percent are funded by various other organizations
- 8 percent have more than one type of sponsor
- 4 percent are for profit incubators
- 8 percent have no sponsor

(NBIA)

**1.3 National Business Incubator Association**

The National Business Incubator Association (NBIA) is an association dedicated to providing more than 1,900 incubators with the information, education, and network they need to maintain a successful incubator by ensuring that the startup companies within the incubators continue to thrive and grow. NBIA’s Mission is to help increase entrepreneurial success and individual opportunity by providing incubators with the necessary information

on incubator management and development. NBIA also assists incubators by organizing conferences, conducting research, producing publications, and consulting with governments and corporations to develop the best standard of approaches for business incubation (About NBIA, NBIA.org).

#### **1.4 The Massachusetts Biotechnology Council**

The Massachusetts Biotechnology Council is an association of over 600 biotechnology companies, universities, and academic institutions dedicated to advancing cutting edge research. Mass Bio drives innovation by creating a forum for the biotechnology community and educating policy makers to influence the advancement of economic interests for both individual companies as well as the whole biotech sector (“Mass Bio”).

#### **1.5 Contributions**

The main objective of the major qualifying project is to develop an economic model that depicts the impact that Massachusetts Biomedical Initiatives (MBI) has upon the Commonwealth of Massachusetts as well as local economies. One of MBI’s strategic goals is to better assess their impact and outcomes. In that regard, we wish to provide a customized model to measure Massachusetts Biomedical Initiative's impact based upon metrics relevant to their own business model and strategic plan. The development of this model will help educate the general public as well as inform policy makers and politicians about MBI’s economic impact, especially in terms of revenue and job creation. Finally, this study will be particularly helpful as there are a wide variety of studies that have measured the

macro-economic impact of the biotechnology sector nationally or within a state, but very few if any have been done before that focus specifically on life science incubators within Massachusetts.

## 1.6 Angel Investing

An angel investor is any individual who provides capital for a local start-up company in exchange for ownership equity. An angel group is made up of a number of angel investors who come together to collectively research and pool their capital. Usually angel groups will meet either monthly or quarterly to gather their resources and capital. Angel groups usually invest locally as they prefer to be involved in the company and the decision making process by serving on the board.

Angel groups' review committees generally only accept anywhere from 10-20% of the applicants for due diligence. The angels will research those who will make it to this stage by conducting reference checks, competitive analysis, and a review of the intellectual property. Finally those who are approved will be allowed to present to the Angels. While the final companies are being selected, a lead member will negotiate a term sheet. Or a Series A document, or what venture capitalists use for their first round of funding. This document includes liquidation preferences, board seats, and anti-dilution clauses (Tualli, 2008).

## 2. Literature Review

### 2.1 Overview of Incubators

Dating back to the late 1950s, the incubator model was designed to aid startup companies survive and grow by providing them with resources and services ("Business Incubation FAQ."). The main goal of an incubator is to help startups prosper. Successful tenants within incubators lead to job creation, stimulate local business, and create economic growth. The resources provided by incubators include various types of space, equipment, technology, or any other assets that aid a company's operation. Incubators often assist young companies in the transition from the idea stage to a self-sufficient graduate. According to NBIA, in 2005 alone, incubators assisted more than 27,000 startup biotech companies nationally. These companies provided full time employment to more than 100,000 workers, and generated revenue of over \$17 billion in that year. In addition, research has shown that for every \$1 of public subsidy, \$30 of local tax revenue is generated ("Business Incubation FAQ."). As more and more startups look for the resources provided by incubators, the number of incubators also increases.

Today there are approximately 7,000 incubators worldwide and over 1,400 in North America alone ("Business Incubation FAQ."). This number is up dramatically from just the 12 that were in place in North America in 1980 ("Business Incubation FAQ."). Part of the reason behind this rapid growth is the wide array of types of incubators that are out there today. Approximately 54 percent are mixed use, 39 percent are technology focused, and the rest focus on manufacturing, niche service, or other types of business ("Business

Incubation FAQ.>"). As incubators become increasingly flexible in terms of what they can provide, and the types of startups they can help, incubators become a more sought out entity.

## 2.2 Types of Biotechnology

Biotechnology comes in many forms ranging from biology, to biochemistry, biomechanics, biomedical engineering, and bioinformatics just to name a few. They vary greatly due to the different applications they offer, and often have a lot of overlap within different realms of research and industries.

Biology tends to revolve around different cellular philosophies and theories. Since Biology is the root of all the other topics, it can be very broad and cover many different opportunities. Cell cultures, genetics, and plant life are just a small sampling of directions in which biology can extend.

Biochemistry is chemistry applied to biology. Biochemistry often looks at chemical reactions between cells, or how biology is manipulated for new research solutions branching into pharmaceuticals or medical needs.

Biomedical devices within biomechanics are often much more engineering based because they are instrumentation rather than science. Any type of device used in hospitals for use on a patient can be considered biomedical. Biomedical also divides into tissue engineering for scar tissue regeneration or grafting for surgeries. As the number of incubators continues to grow across the nation, the more support there is for new types of biotechnologies to develop.

## 2.3 National

### Biotechnology and Incubator Economic Reports

As the biotechnology sector and the use of business incubators continue to grow more and more studies have come out documenting the economic impact of the two. The economic impact of incubator numbers in section found in section 2.1 were the result of two studies published by the National Business Incubation Association. The numbers found in section 2.1 above demonstrate the growth, economic impact, and allocation of the incubator industry on a national and worldwide level. In addition to incubator studies, many studies have been done to measure the economic impact of the biotechnology field in the United States. Some of the more helpful reports we found were Ernst and Young's *The Economic Contributions of the Biotechnology Industry to the U.S.*, Susanne Huttner's *Knowledge and the Biotechnology Economy: A Case of Mistaken Identity*, and GianCarlo Moschini's *Economic Benefits of Biotechnology Innovations in Agriculture*.

The Ernst and Young study does a tremendous job of breaking down the direct and indirect impacts of the biotechnology industry as well as showing the federal, state, and local tax revenue generated by the industry. This study found that in 1999, biotechnology generated 437,400 jobs in the United States of which 150,800 were generated directly by biotechnology companies. Also found in this study was that the biotechnology industry had produced \$47 billion in additional revenues and \$10 billion in tax revenues across federal, local, and state governments.

The study done by Susanne Huttner helps explain what factors have led to growth in the biotechnology sector. Some of these factors include the increase in government

funding for research and development done by entrepreneurial companies, added venture capital, and continued education and research in biotechnology fields.

The final report shows how biotechnology innovations in agriculture have led to an economic impact. One such example is how the use of biotechnology to develop stronger plants has led to increased production of tractors and other farming equipment.

These studies provide concrete numbers and examples of the impact biotechnology and incubators have had on the United States economy. The numbers help demonstrate the magnitude of the impact while the examples help explain how that impact was made.

#### **2.4 Massachusetts Incubators and Biotechnology Studies**

Recently the Massachusetts Biology Council presented a snapshot of the Biotechnology Industry in Massachusetts. Within the study growth, economic impact, and employment numbers are given to show the Massachusetts biotechnology industry's contribution to the United States industry as a whole. Some of the examples of the growth of the Massachusetts biotechnology industry are it has seen a 52.5% growth since 2001 and is expected to have grown 3.9% for 2010. In terms of economic impact, the industry within Massachusetts has generated a payroll of \$4,615,364,513 for 2010 alone and employs 48,647 workers. Also, in terms of research and development employment is number one and accounts for 10% of U.S. and 5% of the World's drug development pipeline. This snapshot shows the contribution that the biotechnology industry in Massachusetts plays to its own economy as well as the national economy.



## 2.5 Worcester and MBI Specific Economic Studies

A particular up and coming part of the biomedical industry is happening in Worcester County of Massachusetts. The number of companies has grown from 111 to 162 from 2004 to 2008, and the number of employees has increased from 7,576 to 16,441 (MQP, 2008). Additionally, according to a 2008 study done by WPI students, the economic impact during the same timeframe, more than doubled increasing from \$925,000,000 to \$2,179,764,221 (MQP,2008). The same study found that Worcester County companies holds a 15% and 16% market share of Massachusetts' biomedical companies and employees respectively. This study also projected Massachusetts to have a 5.1 billion dollar impact in 2010 and 9.1 billion in 2012. Another study done by WPI students found that Worcester has a large student population and helpful business resources and that an incubator could help connect these two groups and provide aid to potential startup businesses and promote economic growth in the area (MQP, 2008). These studies help promote Worcester and central Massachusetts as an area where the biomedical and incubator industry could see potential growth in the future.

## **3. Methodology**

### **3.1 Introduction**

Collecting data and researching methods used in previous studies is critical to the development of any study. To develop the model best for MBI interviews, secondary and primary data, Implan Software, and various calculations and validity checks were used. The interviews provided the methods of industry professionals who had experience conducting their own economic studies. The primary data was used to develop MBI's data through the use of Implan software. After receiving the data several calculations and validity checks were done to deem the data generated accurate. Finally, the secondary data was used to compare MBI's impact to those from national and state-wide studies. All of these factors were used to develop a complete study for MBI.

### **3.2 Interviews & Secondary Data**

We used personal interviews for qualitative research. Interviews provide many benefits such as gathering the interviewees' insights on the subject, expanding one's understanding of the subject, validating previously obtained information, as well as identifying possible areas of improvement (Rubin 1995). All of this information is particularly helpful as Kevin O'Sullivan, CEO of MBI, stated that he wants a complete model and was open for suggestions for the future.

Personal interviews also help collect secondary data, which is any information that is gathered by anyone other than the original user or developer of that data. This is in

contrast to primary data, which is gathered by a user and has never been collected in that same format before (Bishop 2007). One of the largest benefits of secondary data is that it saves the researcher time in collecting their own data, especially when the data is in the qualitative form. This type of data is particularly essential to those analyzing social or economic change, as conducting new surveys that can capture data from past events is impossible. Secondary data is essential to our survey, as MBI wishes to predict their current and future impacts, and this can be only be done by analyzing data from the past.

### **3.3 Full-Time Equivalent Calculation**

The type of survey that is utilized to find MBI's Full-Time Equivalent is a non-probability sampling. MBI's Full-Time Equivalent consists of the salary, equipment, and the benefits provided to the tenants by MBI and their companies. The equipment is included as it plays a significant role in the costs saved by the companies, as it is front end loaded. Non-probability sampling is surveying a group of non-random individuals. In our case, our survey is non-probability because the tenant companies were a pre-defined group, and there wasn't a choice in who to interview or not since no other set group had the same experiences that we were looking for, or were under the MBI umbrella. In MBI's development of the FTE numbers, it is non-random due to the fact that they are using companies' FTE numbers that they have direct contact with (Mellenbergh 183-209). Even though the companies selected for the FTE survey are non-random, we did organize for a mixture of large and small companies to accurately estimate an FTE number that will have the ability to represent MBI based on their size range and different types of tenant companies.

### 3.4 Arithmetic Mean Calculations

Arithmetic mean calculations are utilized in our data calculations with some of the employment numbers. It is appropriate to use this method for representing future trends using historical data. In order to most accurately portray growth or plateau trends in a tenant company where only two reference years were available with a couple of years between, this was the most effective method available.

The arithmetic mean finds the average value between a series of numbers based on finding the difference between the two values, and dividing by the number of observations. This is often used when trying to find a midpoint, but can also be used to find several midpoints. In the event that you have a start and end, but need to create quartiles, you would find the distance between the two given points, and divide by 3 to find the increments between your new reference points. For example, if we are given 1 and 10 and want to find the mean, we would have  $(10-1)/2 = 4.5$ . If we're trying to find quartiles, we would use  $(10-1)/3 = 3$ . This would put our points at 1, 4, 7, and 10.

### 3.5 Validity Check for Sample

From the original 71 companies that have been current or past tenants of MBI, validation of whether or not their employment numbers can be used in our study is necessary. Of the 71 tenant companies, 21 are either out of business or were bought out by a larger corporation, so we did not have their information to use. From the remaining fifty, we needed to assess the reliability of the reporting done, and how applicable the data was to our study.

One discrepancy found was in how companies account for their summer interns, or part time researchers funded by state grants. Since interns are only around for three to four months of the year, employers can misconstrue how many employees the company truly has in terms of full-time salaries, benefit wages, and advancements in company growth. Due to interns and researchers who utilize grant funds for their payment, employers may misrepresent how much money is allocated to Full Time Equivalent (FTE) in terms of benefits and salary wages.

One company in particular, Blue Sky Biotech, Inc. had employment numbers that fluctuated greatly in their annual report. When questioned about this, the company offered to complete a more detailed survey recognizing those employees who were full-time, part-time, and interns, as well as whether or not interns were paid. Unfortunately, the second survey did not allow for part-time employees to indicate whether or not they were paid or unpaid. Since this information was not specified on the survey, Blue Sky was excluded as a tenant from the final data input, since the final employment numbers cannot be calculated in comparable terms as other tenant companies.

### **3.6 Implan Software**

Implan software was first developed by Scott Lindall and Doug Olson in 1993 and is commonly utilized by economics professionals to develop projections and ideas about the direction of a company or market (Lindall, 2012). Some of the main projections completed using Implan are accounting matrices and multiplier models of local economies (Lindall, 2012). According to Jack Healy “This software uses historical data such as employment numbers, investment dollars, and revenue dollars to project the growth of the industry or

company as well as future job growth". Healy also stated "These numbers can then give information regarding ancillary assistance, tax contribution growth, and other similar data that result from a growing industry". Another feature specific to Implan is its ability to produce secondary data at the state, county, or city level economies (Lindell, 2012). One such example is that Implan uses all available government data to generate data for use of industries and companies to project their impact (Alward, 2012). This capability is particularly useful, as MBI wants to know their company's economic impact on Massachusetts, Worcester County, and the city of Worcester.

### **3.6.1 North American Industry Classification System Codes in Implan**

In order to successfully use Implan, each company must be classified into the category of business to which it pertains. Since Implan's implementation in 1997, the North American Industry Classification System (NAICS) has been the standard used by statistical software companies across the US ("U.S. Census Bureau"). NAICS has become the acceptable practice across the board for any published works pertaining to business economy.

As different sectors perform and grow differently, NAICS breaks down into more specific sectors, such as life sciences, biotechnology, and construction. Each sector is recognized by its six-digit code, which has its own algorithm attached via the software in use ("U.S. Census Bureau"). Each software package may be reviewing different aspects of the sector, whether that is job growth, monetary growth, or spin off ratios. As a result, the NAICS code may be attached to countless different algorithms with many different types of related information, depending on the particular task at hand. Since NAICS codes are

primarily related to financial data and economic models, it is not uncommon to see this information also sought out in the realm of stock tracking, as can be noted in section 4.6.

## 4. Analysis

### 4.1 Data Collection

In order to track current and past tenants, MBI maintains a database that records hire and release dates for employees during their time at a tenant company. MBI also contacts graduate companies are also contacted regularly to obtain their current employment numbers. These files were given to us during our research stages. Unfortunately, not all of the employees' information was updated, so we utilized LinkedIn to fill in the blanks.

LinkedIn is a valuable networking tool in today's technology driven world. Not only do many professionals use it to stay in touch with past colleagues, but also to upload their resume in case a potential future employer is a friend of a friend, and might stumble upon their page. We used LinkedIn to fill in information in incomplete files. This proved to be highly successful, and we found the large majority of missing data in terms of start and end dates of employees of current or past tenants.

Using employee tracking information, we broke down each tenant company into their own employment record since 2007. Employment trends over the past five years are necessary to successfully use Implan. There were several scenarios in which we had a number of employees from the year in which the company graduated, and their current employee number, but were missing for the years between. In this case, we built arithmetic mean projections in order to estimate employment numbers for the years in the

middle. Table 2 demonstrates how many years of data (between 2007 – 2012) were available to us from each of the 50 successful tenant companies surveyed.

**Table 2: Number of Years of Employment Data Available for Tenant Companies**

<b><u>Number of Years of Data Available (2007-2012)</u></b>	<b><u>Number of Companies</u></b>
1	1
2	18
3	10
4	7
5	6
6	8

One discrepancy that is not demonstrated in the above information is that there are 22 companies that did not even exist in 2007 excluding them from even possibly having six years of data. Many graduate tenants only had 2012 employment numbers and numbers from the year they graduated, giving us only two points of reference.

For investment numbers, we interviewed Mark Tepper, a representative from the Boynton Angels, which is an angel-investing firm in Worcester. Mark is on the biotechnic side of the organization. Mark shared the typical process a company would go through to seek funds from their firm, as well as acceptance rates and investment offerings from the past four years that they have been around.



## 4.2 Sample Description

Our sample began with 71 companies that were, or currently are tenants of MBI. Of these 71 companies, 21 companies are no longer in business, or have been bought out by larger corporations, bringing our sample size to 50 companies. These 50 companies have a range of different employment sizes, starting years, and realms of biotechnology. The largest employer is Biomedical Research Models with 50 employees, and quite a few companies with only one employee.

In terms of the past five years prior to 2012, we counted how many tenants graduated in which years. We did this to assess how the economic climate of 2008 affected graduation rates, and to determine how many tenants were in-house during this same time period. Table 3 demonstrates our findings:

**Table 3: Number of Successful Graduate Tenants Per Year**

<u>Graduation Year</u>	<u>Successful Number of Companies that Graduated</u>
2007	1
2008	4
2009	2
2010	23
2011	4

One very obvious trend is that 2010 was a very good year for graduating tenants out of MBI. While there is no concrete evidence for why this may be, we formed our own speculation based upon market trends that are demonstrated in section 4.6. These

observations lead us to believe that the return of the market offered more fuel for tenants that were holding out on graduating during that 2008 recession. The theory that companies were holding out from graduating in 2008 and 2009 until the recession was over was not validated when we looked at trends in companies graduating each year. We found that two to five companies were graduating each year starting in 2003, and there was no true pattern to the graduation rates outside of the spike in 2010.

One thing that we found did affect the graduation rates in 2010 is that Gateway Park, MBI's third location that is a WPI-owned research facility opened in late 2007. Since the average MBI tenant stays between two to three years, it would be only natural that there would be a spike in 2010 since so many more tenants were offered space in this new building in late 2007.

#### **4.3 Annual Investments in MBI Graduates**

After our interview with the Boynton Angels regarding investing interest within the biotech realm, we focused on a median investment amount of \$375,000. As was previously mentioned, only 2 in 18 proposals are selected to be invested in each year. This equates to 11% of proposals. These proposals need to prove a barrier to entry against competitors in order to even be considered. Once a tenant graduates from MBI, it can be presumed that they have some sort of patent or means by which they are doing well in their market, so they would be considered if they apply for funding.

Using the number of graduated companies each year in the past five years, as was previously mentioned, we multiplied by the 11% of graduates each year receiving \$375,000, we found the investment per year. (Table 4):

**Table 4: Annual Angel Investments in MBI Graduates**

<b><u>Graduation Year</u></b>	<b><u>Number of Graduates</u></b>	<b><u>Investment Dollars</u></b>
2007	1	\$41,250
2008	4	\$165,000
2009	2	\$82,500
2010	23	\$948,750
2011	4	\$165,000

#### **4.4 Judy Cocaine and Employment Numbers**

One of the three factors that Jack Healy of MassMEP advised us to obtain to create a proper economic analysis of the company was job growth. In order to do this we worked with Judy Cocaine, an MBI employee who tracks graduate and current tenants. Judy had been periodically contacting graduate and current tenants to determine how many employees are working for each company, what their employees' status are in regards to full and part time, and what kinds of services the companies are using.

The number of jobs created is critical to our analysis as it shows obvious growth in the company if the number of employees is increasing. The number of employees is also critical to calculating the impact on the local and statewide economy because it allows us to determine what the personal income is of each employee and determine what they are giving back to the state in taxes and consumption. Since the tenant companies are start-ups and are often focusing more on research rather than developing the company there are virtually no sales during this company's developmental phase. The minimal amount of sales

means that most MBI's impact on the local and state governments comes from employees' personal incomes rather than taxes on companies' incomes.

The second piece of information we need in order to use the software is the number of full time and part time employees differentiated because of the difference in benefits. The problem presented by this was that many of the jobs in the query sent to us by Judy did not yield any information regarding the pay level of each employee, or the number of hours worked by each employee. Additionally, some of the employees listed on the query were actually interns who were being paid either by a Massachusetts life science grant or receiving credit from their school or university. These three problems could potentially greatly skew MBI's impact data. Therefore further investigation into these numbers had to be done by Judy as she surveyed several companies and received feedback on whether their employees were full-time, part-time, or an intern.

The next piece of information required for the Implan software is the revenue or sales profits made by the company. Life sciences start-up companies typically are not selling a product, but are primarily completing research for a larger corporation. This left us with no information to input for certain companies, and can negatively impact the results the algorithm provides.

The last piece of information needed for the Implan software is the total investments made into the tenants of MBI over the last 5 years. Since many of the tenants will not share their income statements or investor information, we spoke with The Boynton Angels, an angel investment firm in Worcester to gain a better understanding of the capacity of angel investing in the life sciences.

## 4.5 The Boynton Angels

The Boynton Angel is a Worcester County based angel-investing group, with industry experience in more than 15 different fields. Some of their main fields of expertise are biotechnology, consumer products, energy, manufacturing, software, real estate, aeronautics, legal services and telecommunications (boyntonangels.com). The Boynton Angels possess tremendous experience with startups as more than two thirds of their members have invested in Angels in more than 25 different start-ups and over eighty percent of the members have experience managing their own company.

The Boynton Angels are generally looking for startups who can meet the following expectations:

- A strong management team, an inventive, pragmatic concept and strategic positioning in the market place.
- A return on our investment in a 5 to 7-year period.
- Investments between \$100,000 and \$500,000 and syndicated deals with other Angel groups are typically considered.
- Location within a 2 hour radius of Central Massachusetts (Worcester)
- Can prove that they will very likely see profit within 12 to 18 months
- Seeking no more than \$2M with minimal follow-on funding
- 5-7 years to liquidity with the potential to generate a strong ROI
- Clear market need and value proposition
- Exceptional management with domain experience
- Strong intellectual property position

- Preferred Stock

Those who are selected by their Screening Committee are invited to present to the Boynton Angel members at a monthly meeting. The members make their own individual investment decisions. If there is significant interest in a startup, the due diligence process is performed by a "deal captain" chosen by the group (boyntonangels.com).

Mark Tepper, a representative of the Boynton Angels, provided insight on the investment process, which start-ups go through in addition giving an idea of what may make a tenant success post-MBI. The investment component is critical as it plays a large role in the growth of startups and provides these companies with a future in terms of sales, employment, investment, and other metrics which all impact the economies of the commonwealth, Worcester county, and the city of Worcester.

#### **4.6 Investment Information**

The recession starting at the end of 2007 was one of the biggest economic downturns since the Great Depression. During this time the unemployment rates soared as high as 10% as businesses tried to cut costs in order to continue operating (Figure 3). While many sectors and most industries had their difficulties, the biotechnology and pharmaceutical industries weathered the economic downturn better than most. This section will analyze how the biotechnology and pharmaceutical sector have grown nationally and in Massachusetts, and how MBI specifically performed during the recession and the reasons for their success.

The chart below displays the performance of two biotechnology exchange traded funds from March 19<sup>th</sup>, 2007 to March 19<sup>th</sup> of 2012 in comparison to the NASDAQ and S&P 500 indices. The exchange traded funds were selected as they are composed of a “basket” of stocks. The two exchange traded funds selected were the SPDR S&P Biotech ETF (XBI) and the NASDAQ Biotechnology Index Fund (IBB). The XBI and IBB funds are designed to replicate the returns of the biotechnology and pharmaceutical sector on the NASDAQ and S&P indices. The top 10 holdings in each fund are shown in Tables 5 and 6 below. These two funds are useful in viewing the performance of those corporations who are publically traded in the biotechnology and pharmaceutical industries.

**Table 5: XBI S&P SPDR ETF holdings (finance.yahoo.com)**

<b>Top 10 Holdings (38.69% of Total Assets)</b>		
<b>Company</b>	<b>Symbol</b>	<b>% Assets</b>
Regeneron Pharmaceuticals, Inc.	REGN	5.49
Amylin Pharmaceuticals, Inc.	AMLN	4.57
Dendreon Corporation	DNDN	3.95
Medivation, Inc.	MDVN	3.75
Vertex Pharmaceuticals Incorpor	VRTX	3.70
Alexion Pharmaceuticals, Inc.	ALXN	3.60
Incyte Corporation	INCY	3.49
ARIAD Pharmaceuticals, Inc.	ARIA	3.45
CEPHEID	CPHD	3.43
Gilead Sciences, Inc.	GILD	3.26

**Table 6: IBB Ishares ETF holdings (finance.yahoo.com)**

Top 10 Holdings (52.73% of Total Assets)		
Company	Symbol	% Assets
Amgen Inc.	AMGN	8.17
Alexion Pharmaceuticals, Inc.	ALXN	7.06
Celgene Corporation	CELG	6.20
Regeneron Pharmaceuticals, Inc.	REGN	6.09
Gilead Sciences, Inc.	GILD	5.17
Biogen Idec Inc.	BIIB	4.76
Teva Pharmaceutical Industries	TEVA	4.73
Perrigo Company	PRGO	4.10
Vertex Pharmaceuticals Incorpor	VRTX	3.39
Mylan Inc.	MYL	3.06

Traders often use news events such as new drugs coming to market, an increase in jobs, as well as other such events focusing on the growth potential of a company or industry in making trading decisions. Therefore these funds represent the expected growth of these industries. Figure 1 demonstrates how the NASDAQ and S&P biotechnology and pharmaceutical funds preformed significantly better than both the S&P 500 and NASDAQ over the past five years even with the recession at the end of 2008.



Figure 1: XBI, IBB, NASDAQ, and S&P 5-year Chart (finance.yahoo.com)

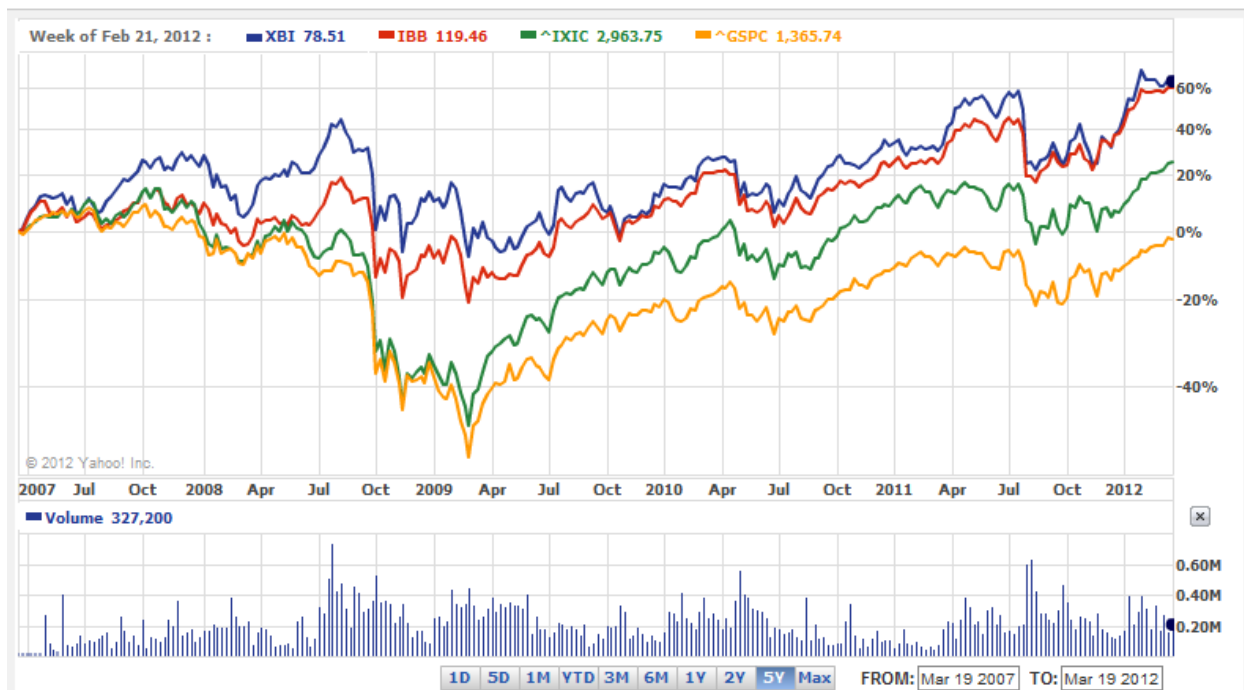


Figure 2 below is a comparison between the two biotechnology and pharmaceutical ETFs (XBI and IBB) versus two technologies sector ETFs (XLK and IXN). Both XBI and XLK holdings are within the NASDAQ index and both IBB and IXN ETFs whose holdings are exclusively on the S&P index. Figure 2 demonstrates how the Biotechnology ETFs and sector fared against the technology ETFs over the past five years. Figure 2 depicts that the Biotechnology ETFs have greatly outperformed those in the technology industry. This news is positive as it demonstrates an industry growing faster than the economy during a time of recovery. If the industry is and has performed well than investors will be more likely to invest in smaller biotechnology startups.

Figure 2: XBI, IBB, IXN, and XLK 5-year Chart (finance.yahoo.com)



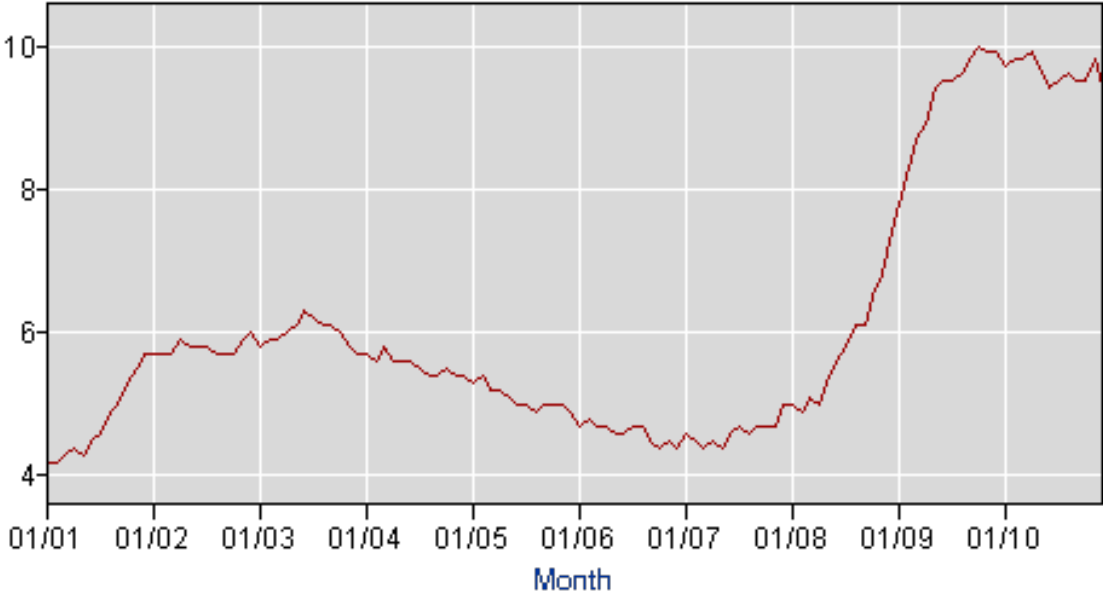
Recent news has been split in regards to funding for biotechnology startups. According to a *Washington Post* article from March 19<sup>th</sup>, 2012 the funding from venture capitalist to small biotechnology has been reduced greatly in recent years. The article went on to state that venture capital was down to \$3.92 billion down from \$6.17 billion in 2007. The tough economic environment and poor returns from stock offerings are cited as the reasons for the decrease in the availability of funding (Harrison). However, an article on March 15<sup>th</sup>, 2012 from the *Scranton Times Tribune* cited the U.S. Department of Commerce as having offered \$1 million to the Jessup Business Park Technology incubator. In regards to the event SLIBCo President, Austin Burke stated that, "The technology incubator facility is another tool to help build an entrepreneurial culture and create job opportunities" (Falcheck). This contradiction in articles shows not only the uncertainty at the macroeconomic level but also the uncertainty in the industry.

#### 4.6.1 Peter Abair Industry Analysis

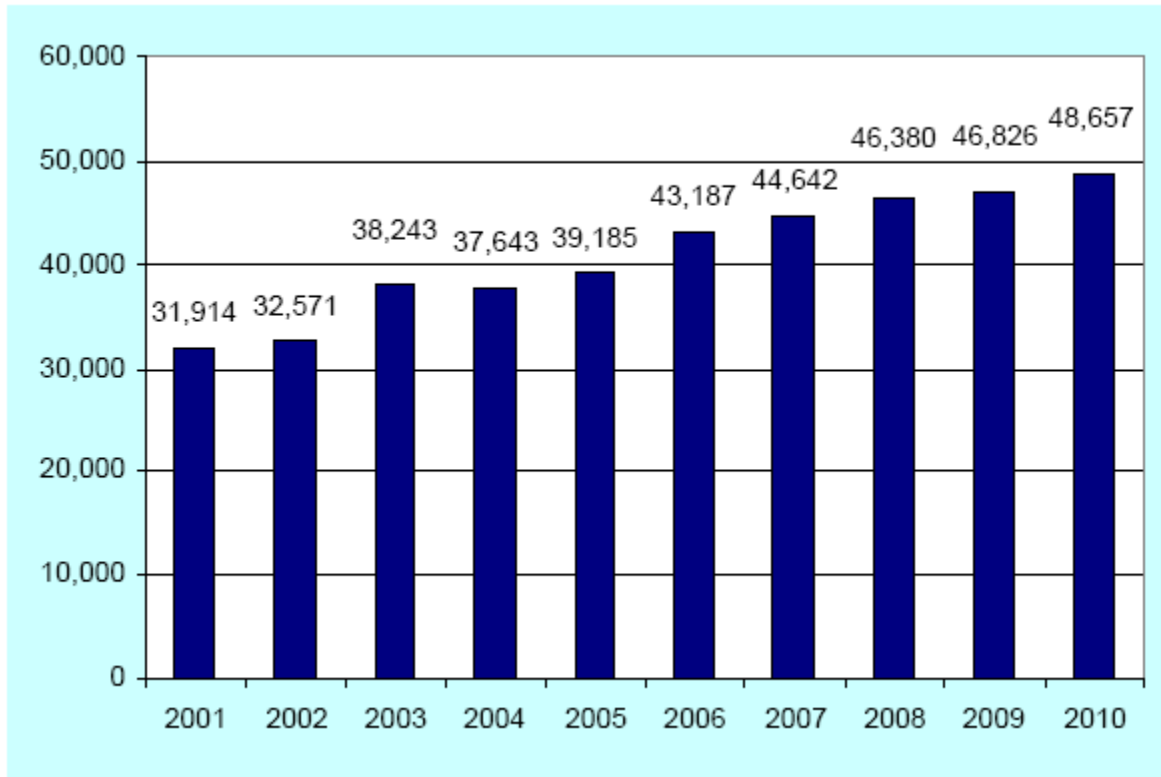
Despite the uptrend in national unemployment from the beginning of 2007 until the end of 2009, the Massachusetts BioPharma industry continued to see growth in employment at this time. Figure 3 from the Bureau of Labor Statistics below shows United States unemployment rates from the beginning of 2001 through 2010. The chart shows a steady increase in unemployment from the beginning of 2007 until it peaked at approximately 10% at the end of 2009. According to a study done by Peter Abair of the Massachusetts Biotechnology Council, there are several examples of the Massachusetts BioPharma industry creating the jobs even during the time of the recession.

Figure 3 shows the number of BioPharma employees in Massachusetts each year from 2001 through a projection for 2010. The Massachusetts BioPharma industry has seen a 52.5% growth in employment since 2001. The lowest growth rate in employment from 2001 was 1% in 2009 but quickly recovered to a projected 3.9% growth rate for 2010. One factor that may be responsible for the high growth rates in Massachusetts BioPharma sector is the fact that in 2010, Massachusetts received 23.1% of all biotechnology venture capital in the United States (MBC, 2011). Additionally, the percentage of investments at the start-up and seed stage was at a higher percentage in 2010 than in 2002 or 2006 (MBC, 2011). All of this information supports the theory that incubators such as MBI play a critical role in creating jobs in Massachusetts and should continue to see more success in the future

Figure 3: Bureau of Labor Statistics Unemployment Rate 2001-2010



**Figure 4: Massachusetts Biotechnology Council # of BioPharma Employees in MA 2001-2010**

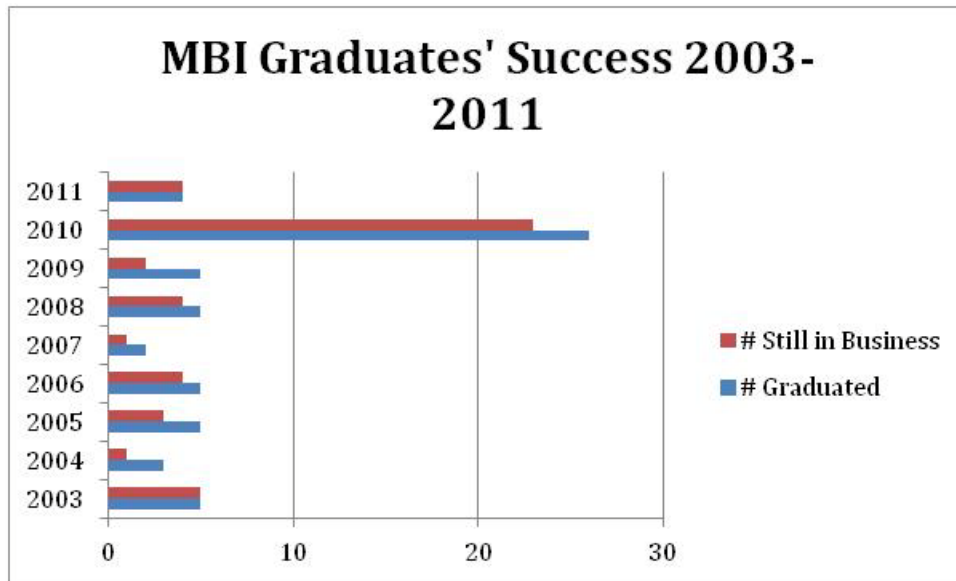


#### 4.6.2 MBI's Recession Performance Analysis

Similar to that of the national and Massachusetts biotechnology and pharmaceutical sectors, MBI and their graduates' success was not greatly affected by the recession. Figure 5 below shows the number of graduates MBI had each year (Blue) and the number of graduates currently still in business (Red). In Figure 5 there is no correlation between the success rates of graduates with that of the recession although the number of graduates did spike in 2010 as did unemployment in the US. Figure 5 also does not correlate with the numbers of Massachusetts BioPharma employees. However, the chart does show potential for growth as the number of graduates peaked in 2010. As time goes on, data will prove if MBI is indeed producing more successful companies, if 2010 was just an outlier, or the opening of WPI's Gateway Park in 2007 really was the correlation. Data shows that the

industry is growing nationally and statewide, and this provides hope for the growth of national, statewide, and local economies as well as MBI moving forward.

**Figure 5: MBI Graduate Success Rates**



#### **4.7 Jack Healy, Director of Operations, MassMEP and Implan**

Jack Healy, the current Director of Operations for MassMEP, has used the Implan software before for manufacturing facilities, and offered to let us use the software for this study. Implan is the gold standard for economic projections in industry. After speaking with him and his associate Kim Healy, we were informed of the types of data they would need for the software.

We were told we would need employment numbers over the past 5 years, investment dollars, and revenue dollars. We collected the employment numbers through surveys conducted by MBI, estimated investment dollars based upon mathematics related

to our interview with an angel investing firm, but lacked revenue since many of the tenant companies are research oriented rather than sales oriented.

Once these numbers were collected, we sent our data to Kim Healy at Mass MEP to input into the Implan software. The results that came back gave us better insight into the support that these companies give to the state in the form of job growth, tax dollars, and ancillary support dollars to vendors used.

## 4.8 Analysis and Comparisons

When gathering our data and numbers, we found that looking at other incubators' projections, and how they formulated them was not very helpful, but it did give us a better idea of what our numbers should look like. We gathered data from Maryland state incubator studies as well as some performed in New York and Missouri. Based on the information, numbers, and detail from their projections, we were able to establish means for our own comparisons, and determine what information would be most valuable to us throughout the project.

### 4.8.1 Analyzing Current Tenant Employment numbers

Once we received the employment numbers from MBI, we went through their records and made charts with the numbers of employees in a given year. While organizing the numbers, we realized that the numbers of employees was skewed because there was no designation between full time, and part time employees, nor between paid and un-paid workers.

We began breaking down the FTE that was established at the start of our project by our sponsor. Based on a survey of various companies, the Life Science FTE was established at approximately \$150,000. Based on the Central Massachusetts Life Science Employment Comparison, mid-range salary for a full time life sciences employee is \$50,000 ("Employee benefits and research institute"). That being said, we had to break down the other \$100,000. According to the Employee Benefit Research Institute, in December 2010 benefits for employees sat at approximately 30.3% of total compensation packages. If \$50,000 is approximately 70%, then we can calculate that benefits are approximately  $(50,000/.7=)$  \$21,500. Looking at the average benefit costs, we now calculate equipment costs to be approximately  $(150,000-50,000-21,500=)$  \$78,500.

When we realized the difference between different types of employees would be a major factor, we spoke with Judy Cocaine of MBI to have companies fill out a more specifically detailed survey. Once we received the new survey results, we updated our numbers giving full-time employees a rate of 100% of the Full Time Equivalent (FTE) at \$150,000. Part-time is put at approximately \$ 125,000 based upon benefits for part time staying at \$21,500, half of full time salary at \$25,000 and equipment at \$78,500. Interns do not receive benefits, so their FTE is approximately \$103,500 for the \$78,500 of equipment, and \$25,000 in salary. Unpaid interns are at approximately \$78,500 for equipment.

One discrepancy is that interns are often only with the company for the summer, and only technically probably earn 1/3 of an annual salary assuming that they work May through August. Because of the fraction of time, the method of distributing equipment allocation becomes slightly more complicated. Based upon the survey that Judy of MBI distributed, we found that many of the current paid interns are funded through a



Massachusetts Biotechnology grant, which means that companies are not actually funding any of their salary themselves. While we cannot verify that this is the case with *every* intern, we do know that intern FTE will actually not come into play in our final numbers because of the lack of paid interns that exist within current tenant companies.

## 5. Results

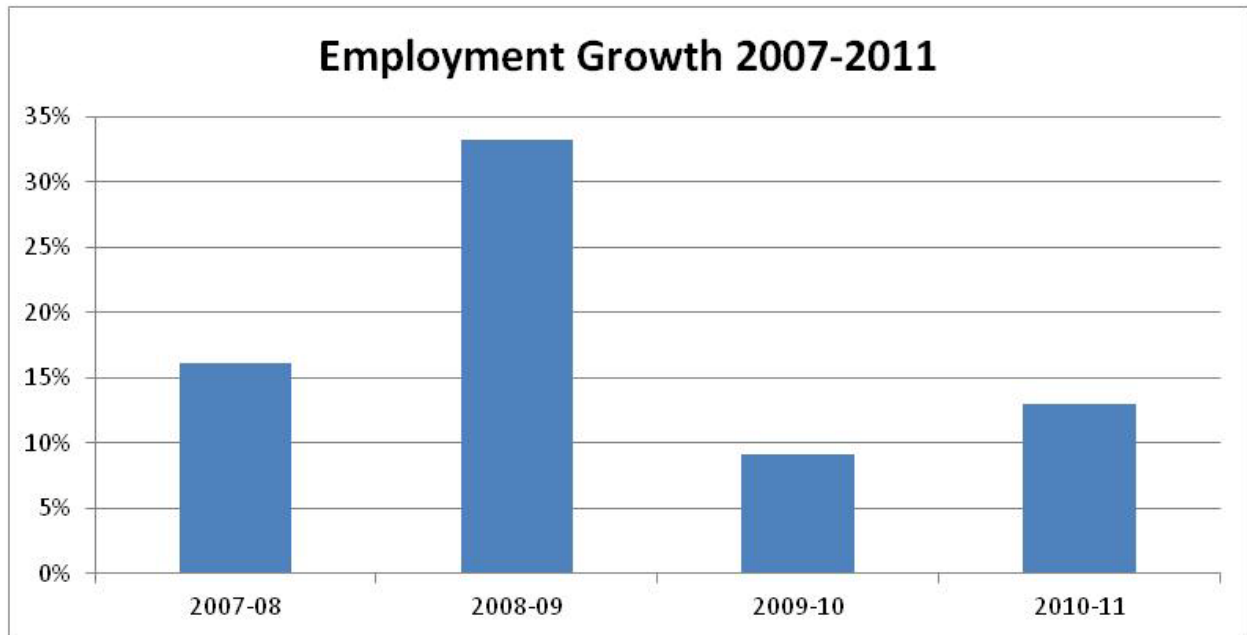
### 5.1 Growth Rate Projections

An essential piece of the model was generating an employment growth rate for MBI in order to analyze how fast they themselves, their tenants, and graduate companies are growing. Through the use of previous studies of the biotechnology sector at a national and state level, and analyzing MBI's employment numbers, three growth rates were developed.

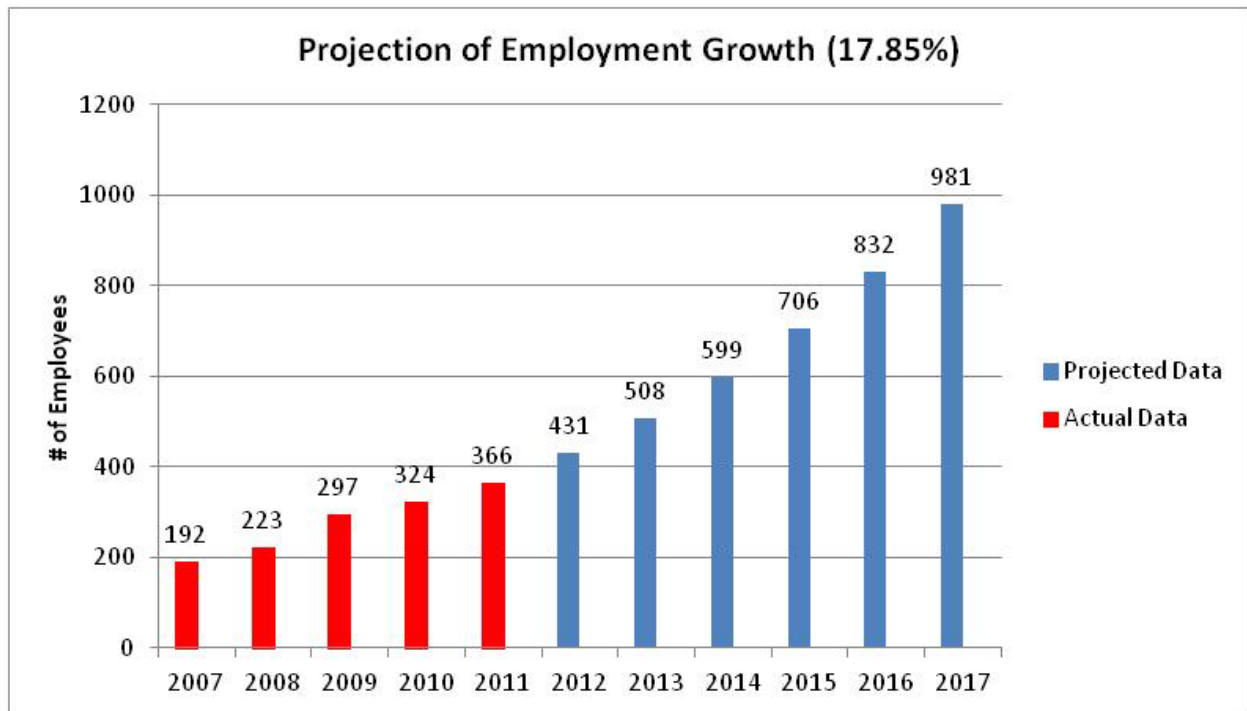
Figure 6 demonstrates the growth rates MBI has experienced from 2007 to 2011 using employment data collected by Judy Cocaine of MBI. The average growth rate during the same time period was 17.85%, which was used to develop Figure 7, a projection of the number of employees MBI will have through 2017. Due to the fact that Figure 7 was developed only using five years of employment data, Figure 8 was developed to incorporate the Massachusetts Biomedical Council employment data from 2001-2010 which saw an average growth rate of 5.25% per year, bringing the projected growth rate down to 11.55%.

While Figure 8 takes into account how the Massachusetts biotechnology sector and economy may affect MBI's growth, it does not consider the national biotechnology sector, and changes in the national economy. Because of this, Figure 9 with a projected growth rate of 10.65%, was developed using data from a May of 2000 study done by Ernst & Young entitled *The Economic Contributions of the Biotechnology Industry to the U.S. Economy* and a 2005 report *The Economic Impact of the Biotechnology and Pharmaceutical Industries in New York* by Alan G. Havesi. The development of these three projections will allow MBI to choose which growth rate they think is the most appropriate for them moving forward.

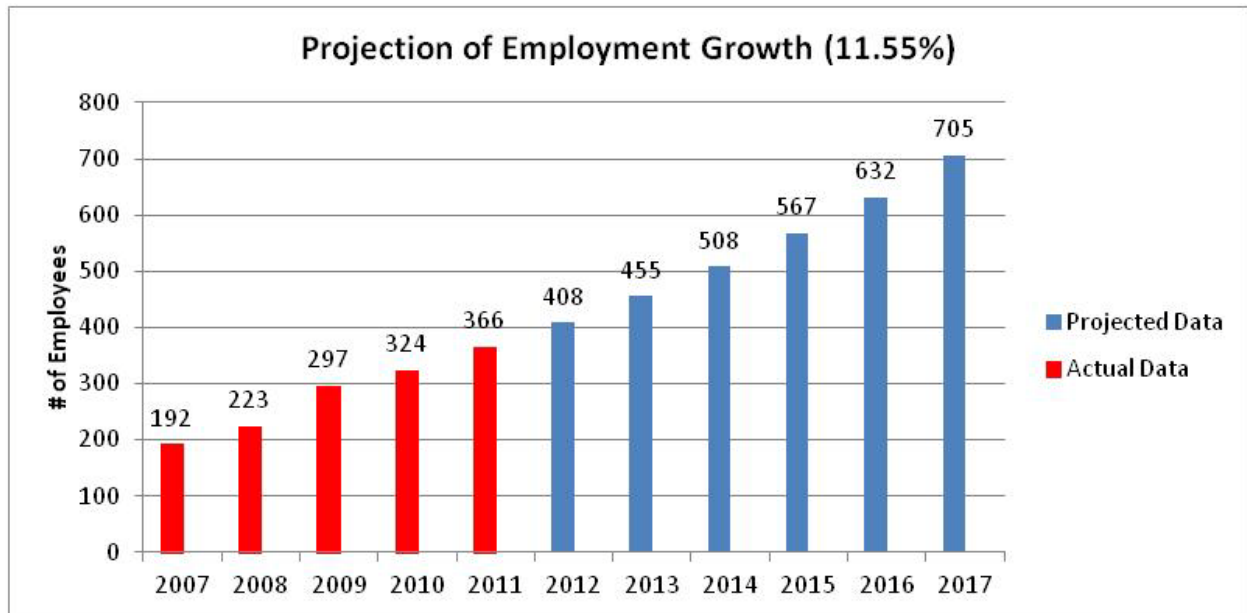
**Figure 6: Massachusetts Biomedical Initiatives Employment Growth 2007 - 2011**



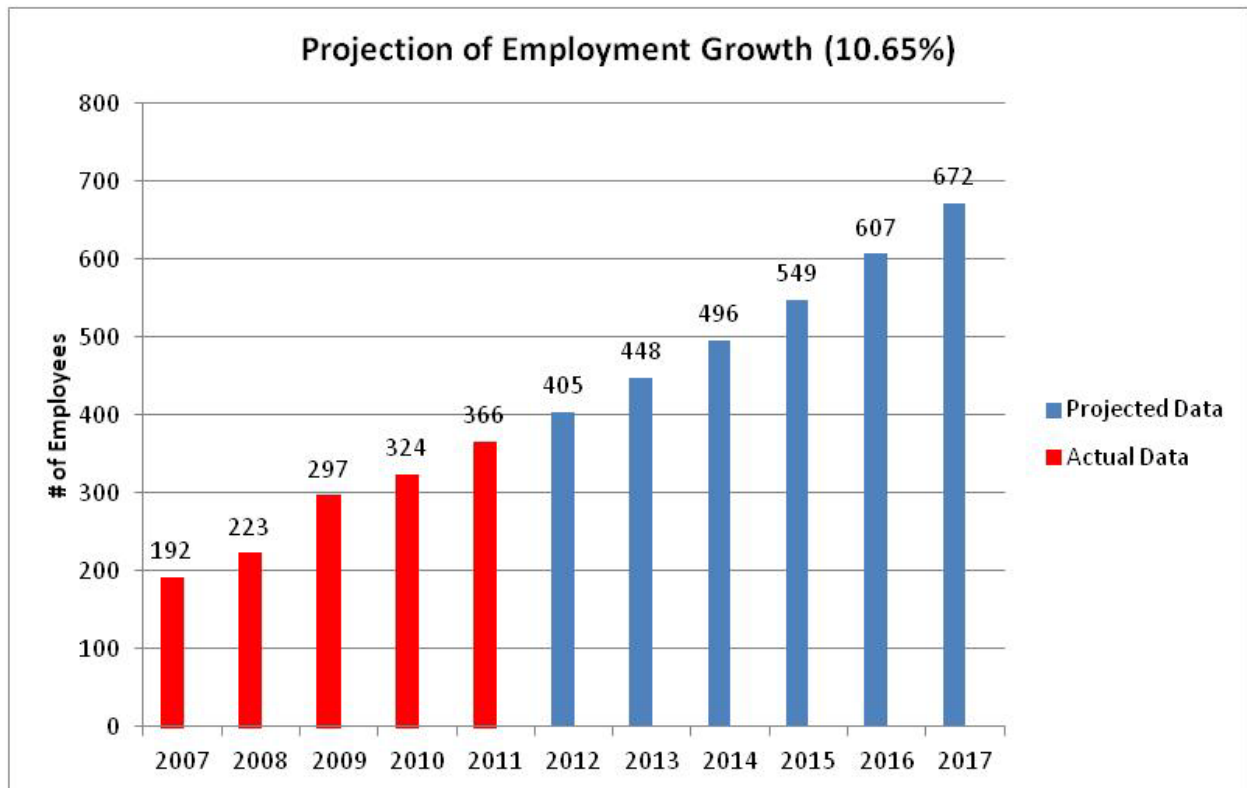
**Figure 7: Projection of MBI's Employment Growth 2012-2017 (17.85%)**



**Figure 8: Projection of MBI's Employment Growth 2012-2017 (11.55%)**



**Figure 9: Projection of MBI's Employment Growth 2012-2017 (10.65%)**



## 5.2 Implan Results

Utilizing all of the employment data collected surrounding MBI's past and current tenant companies during the year 2011, Implan was able to take this information and output much valuable information. Jayme Holland, Director of Planning and Evaluation for Time Wise Management Systems was able to explain how the software worked, and what the output meant for our project with MBI.

Based upon Implan, there are several major sectors that are heavily influenced by MBI. These sectors include, but are not limited to:

- Pharmaceutical Preparation Manufacturing
- Biological Product
- Surgical and Medical Instruments
- Wholesale Trade Businesses
- Scientific Research and Development
- Offices of Physicians, Dentists, and other Health Practitioners
- Private Hospitals

Monetary influence and output came back in the format of direct, indirect, and induced support. Direct support is on the companies whom interacted directly with MBI's tenants. Indirect support is on the purchases made as a result of MBI's tenants, but not necessarily directly related to, such as particular clothing for work, or spending money on more leisure and entertainment activities because you have more disposable income as opposed to living a more cost-aware lifestyle. Induced costs are those induced directly by one of MBI's tenants, whether that be shipment of their products through a parcel service, or materials needed being purchased.

While each sector was impacted differently, Appendix J and K more clearly show what the impacts are on the Federal Government in terms of taxes and income. The final impact summations for 2011 are shown in Table 7:

**Table 7: 2011 Implan Impact Summary**

Direct Effect	\$58,241,920
Indirect Effect	\$30,695,424
Induced Effect	\$30,387,136
Total Effect	\$119,324,416

## 6. Recommendations

### 6.1 Employee Tracking

MBI currently houses between ten to twenty tenant companies at any given point in time. Tenant companies submit lists of employees to MBI so that security access may be granted to each of them, and this list is maintained and updated as the roster changes due to employee turnover. Unfortunately, this system does not inform MBI of their work load status, i.e., whether employees are full time, part time, or interns. Another missing component that is crucial to similar studies is whether or not the employees are paid, as well as how much if they are.

It would be efficient to have a survey that goes along with hiring paperwork that simply verifies their fulltime or part time status, as well as whether or not they are paid. One aspect that might get a little messy is when an employee is an intern or part time, but then is offered a full time position, or switches between unpaid and paid positions. To mitigate this lapse of information, a semi-annual assessment by companies to verify and update their employment information would help to correct any incorrect or missing data, as well as provide a clearer picture of the hiring patterns.

Having a semi-annual employment update would be subjective depending on the months chosen to consistently survey during. While a monthly survey would be much more precise, very few young startups hire that often. Semi-annual allows for hiring periods just after college graduation and intern hiring, as well as the second survey around

New Years to see the differences when there are not interns in the company in winter months.

### **6.1.1 Graduate Tenant Employee Tracking**

Current tenants are presumably much easier to track down for a five minute survey pertaining to their number of employees, but graduate tenants pose a very different situation that may require extra efforts via phone calls and mail. Since it is not as simple as walking down a hallway any more, and many tenants leave the immediate neighborhood vicinity after graduation, it is not always as easy to get them to feel the need to answer your questions.

Some companies once they have graduated may also feel as though employment numbers might be considered proprietary information – especially if they are or plan to become a publicly traded entity in the near future. Others may feel as though they do not owe it to MBI to fill out any requested information, and some may just not exist any more due to unforeseen circumstances in which they had to declare bankruptcy.

For those graduates who do answer the survey, it would be the same exact specifications – Number of current fulltime, part-time, and interns, as well as whether or not they are paid. For regulatory purposes, semi-annual with the same time period distribution as current tenants would be maintained so as to be able to track growth rates and projections both in comparison to those tenants currently with MBI, as well as in comparison to other graduates.

For those companies that graduate after such a tracking system has already been implemented in the current tenants, they would not notice any difference, and will already



be in the mindset that this is a normal procedure that has “always been done this way”. This is not a terrible mindset to have when you are trying to keep a consistent pattern. For those who claim, “We never had to do this before”, this will be another bridge to cross. While the survey will only take minutes to fill out, for many of these young companies, that can be a huge time commitment if they only have two employees.

## 6.2 Software Availability

Startups that are current tenants to MBI are all in the stage of looking for more investments to support their growth and development plans. This process often requires applying to a number of grant programs through the state as well as applying to Angel Investment companies mentioned earlier. In order to demonstrate growth potential and rate of return in order to promote the approval chance, having commonly accessible tools such as the Implan software would be highly valuable to all the parties involved.

NBIA as the primary association for incubators should also support this opportunity for access to software that will allow the tenants of their incubators to promote themselves and their economic growth opportunities. As the national entity, they should be encouraging their members to utilize such resources to move forward, and therefore should offer opportunities to access these tools.

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## 8. Appendices

### Appendix A: Interview with Peter Abair of MassBio 11-14-2011

Questions from MassBio's Industry Snapshot 2011:

1. What year span was used for the data from the U.S. Census, County Business Patterns and MassBio formula and analysis?

We usually present employment data going back to 2000. Going back prior to the late 1990's is problematic because of how the information was gathered by the federal government. In our most recent Snapshot, we present the decade from 2011-2020. Here's the LONG explanation to our formula:

***How do we get to the 48,647 employment number?*** MassBio relies on data from two sources.

For the years 2001-2009, MassBio derives its industry numbers from the County Business Patterns data of the U.S. Census Bureau. County Business Patterns "basic data items are extracted from the Business Register, a file of all known single and multi-establishment employer companies maintained and updated by the U.S. Census Bureau. Data for single-establishment companies are obtained from various Census Bureau programs, such as the Annual Survey of Manufactures and Current Business Surveys, as well as from administrative record sources."

Because there is a 1.5 year time lag in the provision of CBP data, for the year 2010 as in past years, MassBio used a formula to estimate the growth or decline rate in industry employment based on data from the state's ES-202 data. MassBio then applied this growth rate to the 2009 aggregate industry employment number generated from County Business Patterns (CBP) data. MassBio has used this formula in recent years with a high degree of accuracy. Our 2009 projection, for example, was only 106 jobs in variance from the final actual number revised for 2009.

***What is considered "biopharma" employment?***

Using the North American Industry Classification System (NAICS), by which both the CBP and ES-202 data is reported, MassBio has determined that several NAICS classifications can be considered part of the biotechnology and pharmaceutical industry. However, only in certain cases can the industry claim 100% of any one NAICS code. Therefore, MassBio determined that a percentage of some industry classifications could be used in estimating overall industry employment. In some cases, the percentage determination for certain industry codes was based on reports developed by other organizations.

2. How was the BioPharma Payroll number calculated?

We use County Business Patterns for this as well. Using the same proportional formula for determining how much total payroll to use. All of our CBP data are from:  
<http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl>

3. Why did you choose payroll as oppose to revenue to show the industry impact

We like revenue as a metric in some cases. However, we face two issues. A great many biopharma companies are not publically traded and provide no access to revenue figures. So, at best, we could present aggregate revenue numbers for only the public companies. In addition, we have a number of companies that are global firms with headquarters based outside of Massachusetts. We then face the issue of how to represent the revenue of such companies. So, the payroll, at least, captures all how much both public and private companies (and other industry employers) are spending on payroll. The payroll number is also easy to find at the Census.

4. Why did you choose the metrics you used for economic models? (Payroll, Job growth, job concentration, and venture capital)

We use payroll and job growth to demonstrate impact on the regional economy. Job concentration (location quotients) is a well established metric used by economists to determine the strength of an industry in an area versus other. From our Snapshot: “**Location Quotients** measure the concentration and strength of an industry in a region versus the nation as a whole. Location Quotients of more that 1.0 mean that the industry enjoys a greater concentration in a region versus the nation as a whole.”

Access to venture capital is very important to many early- and mid-stage companies in our industry. Increasing VC means that we have good technologies in development, good entrepreneurs leading start-up companies, and our industry is still and attractive place for such investment. Declining VC dollars would indicate the opposite. So, VC trends present a good indicator on the long-term health of the industry – especially in a cluster that depends on innovation and constant generation of new ideas on technologies.

5. Besides Payroll, job growth, job concentration, and venture capital are there any other metrics you studied that you did not put within the snapshot? Are there any metrics you wish you could have used within your study but had a difficult time finding?

We look at federal funding for basic research, specifically National Institutes of Health funding. The NIH dollars lead to new technologies that are transferred to the private sector for development and commercialization. Declining NIH funds would have a negative impact on the national and local industry.

6. What other studies have you done besides the 2011 snapshot? Any Incubator specific studies?

Our Economic Development Advisory Group (EDAG) took a stab at the incubator question. I will send that information under separate cover. We have also focused on workforce development issues.

7. Do you know of any studies or resources that were particularly helpful to developing your presentation besides the QCEW and NIH?

A note on QCEW and County Business Patterns. For reasons I will never know, there is no one in the federal government willing to tell me which data is better to use in generating employment numbers. So, this is a cautionary note. We have used CBP for generating the employment figures for the industry in Massachusetts for several years. Frankly, I was taught in grad school to use CBP for such a use. However, because our formula is very “Massachusetts specific” it is not easy to do

the comparative analysis with other states. So, that is where our use of QCEW comes into play. Because the Bureau of Labor Statistics provides such a great web-based tool: [http://data.bls.gov/location\\_quotient/ControllerServlet](http://data.bls.gov/location_quotient/ControllerServlet) to get comparative information on location quotients for specific NAICS, we have taken to using it for the apples to apples comparisons among states.

However, it QCEW and CBP don't match. Their data sources are similar but not the same. So, we use one for one purpose and the other for another. Its is not as clean as we'd like, but, as our football coach says, "It is what it is".

For some very good studies on the pharma industry visit:

<http://www.northeastern.edu/clms/publications/phrma-research-reports/>

I use their reports when we need to convey the impact of our industry on other industries. Specifically, Report 1 (I recall) present multiplier effects of pharma industry jobs on jobs in other industries.

## Appendix B: Interview with Tracy Kitts of NBIA 11-21-2011

1. Do incubators across the nation generally used the suggested NBIA metrics or if they developed metrics of their own to demonstrate their impact.

A large number of incubators use their suggested metrics and put their own additional spin on them. Additionally, Kitts stated that some incubators choose to beyond these snapshot and accumulated by providing their data to implant collected using the NBIA tools to companies such as MIG Inc. to do further economic analysis or by doing further economic analysis themselves.

2. What does the economic analysis done by the MIG Inc. (Implan Group) generally consist of?

The economic analysis done by MIG Inc. generally consists of spinoff ratios, input/output data or other information that demonstrates how the incubators impact extends beyond that of the impact of their current and graduate companies. Incubators who attempt this more in depth analysis generally come out with numbers that were not strongly backed by additional data and often would get in criticized by the press and policy makers reviewing the data which they had come up with. One such example is a San Jose incubator who included a graduate company who had moved outside the city limits of San Jose in their snapshot and accumulated impacts and was criticized heavily by local politicians who stated that graduate company was not contributing to the city's tax revenue and therefore should not be included within the economic impacts published by the incubator. NBIA does not suggest incubators come up with the spinoff ratios themselves and to leave it to professionals such as those at MIG Inc. to do so as an error in your numbers could lead to public doubt in your incubator as well as across the incubator community. This information is also posted on our website in the following:

*Although employment and other multipliers are readily available from the federal government, they are intended to be used by individuals trained in applying them correctly, often with specific software (such as IMPLAN). Attempting these extrapolations yourself could result in error and eventual public doubt about your reporting standards and methods. Seek the advice of a government official, university researcher, or private consultant trained in performing economic impact analyses.*

*Calculations of return on public investment in business incubation are not simple math problems. They must take into consideration investments in the program over time, expenditures that may be covered by a parent organization (such as a public university) and therefore not reflected in actual incubator expenses, and a host of other factors. Again, don't attempt these calculations on your own. Consult a professional who will help you tabulate data you can tout with confidence. (Measuring Economic Impact, NBIA.org)*

If you wish to show spin off numbers without calculating the return on public investment, the ratios provided by the Quarterly Census of Employment and Wages or the States development department may be of help. Another idea maybe to track the failed graduates of the incubator and to look into why these companies were unsuccessful. A success is any company still within business five years after graduating from a given incubator.

The following data reflects the success rates of NBIA members:

*Historically, NBIA members report that 87 percent of all firms that have graduated from their programs are still in business – and about 84 percent of those graduates remain in the incubator’s community.*

*According to the U.S. Small Business Administration, only 44 percent make it past four years.(Measuring Economic Impact, NBIA.org)*

From the data above the came up with two alternative possible projects for MBI if the economic analysis was deemed to be too risky:

- Compare MBI’s success rates and economic impacts to other incubators nationally, statewide, and locally
  - Depict MBI’s impact on Worcester Polytechnic Institute by researching the number of projects, co-ops, internships, and jobs were provided to WPI and their students by the Incubator and their current and graduate clients
3. You mentioned that a San Jose based incubator recently has come under some scrutiny for publishing snapshot and accumulated impact results that included an incubator that had since moved out of the city’s limits. If there are no compliance issues, we were wondering if you knew the name of the incubator or knew of any news articles criticizing their impact reports.

I would prefer not to give the incubation programs by name. San Jose was just one example of the type of scrutiny your numbers will come under. There are lots of stories like that.

4. We were also wondering if you could give us a list of reasons or examples of what generally goes wrong when incubators try to develop these spinoff numbers themselves. I know you mentioned accuracy of the numbers as one of the reasons but we were trying to provide as much information as we can to our advisor.

Here are things that go wrong in the reporting:

1. Using multipliers that aren’t well accepted in the economic development community.
2. Making comparisons to data sets that were collected during a different time period or in a different way. For example, you collect data from your client companies for the last twelve months and then compare those outcomes to perhaps state data from five years ago.
3. Making assumptions about causality. For example, making statements because you assume one bit of data is wholly dependent on another bit of data.
4. Equation or math errors.
5. Using data sets or multipliers that aren’t appropriate for your program’s service area.



Another good argument to contract with an independent group to create your economic impact report is that they are **\*independent\*** and don't have a stake in the outcome. It'll give your report a lot more credibility.

One point. I wasn't suggesting that you couldn't, or shouldn't, calculate the indirect impacts of the program. I was just suggesting that you would need expert (someone that understands how to do economic impact modeling) direction in how to do it and that your final numbers should be reviewed by that expert as well.

## Appendix C: Interview with Frances Day of Implan Group 11-23-2011

1. How long did it take to develop the method of running these calculations?
2. Who developed this method?

The method IMPLAN uses for making calculations has developed in several stages. The input-output model is based on a methodology developed by Wassily Leontief. The current version of the software originated from the United States Forest Services in the 1970's, and has gone through several iterations since then. MIG Inc. took over the software and data creation in 1996, and the most recent version of the software was released in 2009. Data sets are upgraded annually and the 2010 data set will be released in early December.

3. Are these impact numbers generally created using the Implan software or done using other methods?

At this time the IMPLAN software is required to create and run impacts with the IMPLAN data sets.

4. If the Implan software was used to calculate these numbers do you know of anyone within the central Massachusetts who is an expert in using the Implan software/method?

EDR Group in Boston certainly does a lot of work with our software and data sets, but I'm not sure if that is close enough for you. Many universities use our software, so you might try contacting another university to see if they could help you, or we do have a consultants list available on our site. All IMPLAN users are able to register as consultants, so none of them are endorsed over any other.

5. How much does the Implan software cost for local, state, and national levels?

The data cost varies with the size and level of granularity that you would like to be able to examine. I have attached a link to our 2010 price list for your convenience:  
[http://implan.com/V4/index.php?option=com\\_docman&task=doc\\_download&gid=211&Itemid=7](http://implan.com/V4/index.php?option=com_docman&task=doc_download&gid=211&Itemid=7) If you need pricing on Congressional District state or national packages please let us know. We provide the software at no additional cost with your data purchase. The software and data licensing allow for 5 installations /users to access the software and database.

6. Would you be willing to share a report of an incubator company with these spin off jobs, ancillary dollars, etc.?

[http://www.google.com/url?sa=t&rct=j&q=business%20incubator%20implan&source=web&cd=4&ved=0CDAQFjAD&url=http%3A%2F%2Fwww.marylandtedco.org%2Ftedcoprograms%2Fdocuments%2FFinalTEDCOReport11207.pdf&ei=oVrNTrHbH4yJtwef5\\_Va&usg=AFQjCNF7VxJhhKrEMn1WeXKrcJTjXhrw&cad=rja](http://www.google.com/url?sa=t&rct=j&q=business%20incubator%20implan&source=web&cd=4&ved=0CDAQFjAD&url=http%3A%2F%2Fwww.marylandtedco.org%2Ftedcoprograms%2Fdocuments%2FFinalTEDCOReport11207.pdf&ei=oVrNTrHbH4yJtwef5_Va&usg=AFQjCNF7VxJhhKrEMn1WeXKrcJTjXhrw&cad=rja) Generally a number of studies can be found by typing key words into Google. In this case I found this link with "business incubator implan".

7. How do you know your calculations are accurate? What sources do you use to establish credibility of your calculations?

There are many factors that go into understanding and successfully running an impact analysis outside of just using our software. It is important for the user of the software to understand the definitions of the terms in the software, that the user is entering valid information that is meeting the same definitions and standards of the software and that in turn these are understood regarding the results that are taken out of the software.

The data sources used to build IMPLAN are based primarily on BEA and Census data :

[http://implan.com/V4/index.php?option=com\\_multicategories&view=categories&cid=241:datainformation&Itemid=10](http://implan.com/V4/index.php?option=com_multicategories&view=categories&cid=241:datainformation&Itemid=10) (please note the folders at the top, as well as, the links at the bottom of the

page). IMPLAN has wide spread usage and has been used to produce a number of fine impact analyses over a large number of years. This too may be of interest to you:

[http://implan.com/V4/index.php?option=com\\_docman&task=doc\\_download&gid=168&Itemid=7](http://implan.com/V4/index.php?option=com_docman&task=doc_download&gid=168&Itemid=7)

## Appendix D: Discussion with Kevin O'Sullivan of MBI

On Tuesday, November 22<sup>nd</sup> we conducted a conference call with Kevin to present to him the message of caution we had received from NBIA as well as our difficulty in finding spin off numbers and input output data besides those from the Bureau of Economic Analysis and from the Quarterly Census. We elaborated on how we thought that these numbers were at too vague of a level generally only depicting the impact of a broad sector of the economy. From this Kevin decided that we should still focus on developing a method to measure the economic impact but to keep the impact confined mainly to that of MBI and their current and graduate tenants. Additionally, Kevin stated that if we wish to publish spin off numbers that they should be heavily supported by those of other studies such as the BEA or Quarterly Census. In order to gauge how broad our economic analysis of MBI should go we decided to contact the Advanced Technology Development Center at Georgia Tech as well as UMASS Boston and BU's incubators to develop an idea of how broad incubators are going with their economic analysis.

## Appendix E: Nina of the Advanced Technology Development Center at Georgia Tech

Dear Nina,

Hi my name is Peter Roberto I am a senior at Worcester Polytechnic Institute in Massachusetts. My partner, Victoria Brown and I are conducting a study on the ways of which Incubators/Startup Accelerators measure their economic impact at a national, state wide, and local level. We know that start up accelerators generally measure their impact based on the number of jobs, revenue, payroll, etc. created by the start up themselves and the current and local tenants of the accelerator. With that being said we were heard from a representative at NBIA that your accelerator has developed an economic model to calculate spin off jobs, ancillary dollars, etc. created from the jobs of ATDC tenants. For example for every 10 jobs that an ATDC tenant grows each year there are 2 more jobs created in the shipping industry. If it is true that your ATDC has developed a method of doing these calculations, we have a list of questions that we were curious about.

1. How long did it take to develop the method of running these calculations?
2. Who developed this method? Was it Georgia Tech Students or Professors?
3. What type of software is used to run these calculations is it Implan or another economics software?
4. Would you be willing to share a report with these spin off jobs, ancillary dollars, etc.?
5. How do you know your calculations are accurate? What sources do you use to establish credibility of your calculations?

I don't know if were the correct person to go for with these questions but if you could refer us to the correct source it would be extremely helpful.

Thank you for your time,

Peter Roberto

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Charles Ross  
Just FYI  
Nina  
Begin forwarded message:  
Roberto,

Thanks for your inquiry. We have periodically performed an economic impact analysis for the ATDC incubator using the Implan software. To date, we have not independently validated the model's predictions and would be interested in any methods that you have explored in this area. Please feel free to give me a call to discuss.

Charles Ross

**Appendix F: Current MBI Tenants from Judy Cocaine**

*"World Class Incubators for World Class Science"*



**MBI Incubator and Related Life Science Companies**

February, 2012

**Current MBI Incubator Company Tenants: 14**  
**Current Number of Employees approximate: 95**  
**Current Annual Economic Impact: \$11 million**

**Gateway Park, 60 Prescott Street, Worcester, MA 01605**

<u>Company</u>	<u>Number of Companies</u>	<u>Number of Employees</u>
BioTechnic Products, LTD		10
Blue Sky Biotech		38
Onnesion, Inc.		2
Targeted Cell Therapies		1
Sub-total	4	50

**Union Street Labs, 55 Union Street, Worcester, MA 01608**

Biofluent Labs		2
Janus Biotherapeutics		4
Matrigen, LLC		5
VivoPath		8
Sub-total	4	19

**Barber Avenue, 100 Barber Avenue, Worcester, MA 01606**

AC Chemtek, Inc.		2
CellMosaic, LLC		2
EpigenDx		10
Microbac Laboratories, Inc.		6
Welgen, Inc.		5
ZATA Pharmaceuticals		1
Sub-total	6	26
Total New Companies & Jobs	14	95



*"World Class Incubators for World Class Science"*

## **Massachusetts Biomedical Initiatives** **Life Science Company Formation &** **Job Creation Report**

### **A Decade of Progress Report**

**400 Total Number of Established Jobs  
Includes Current & Graduate Incubator Tenants**

**\$100M Total Economic Impact (approximate)**

#### **GRADUATE COMPANIES:**

- ❖ **Fifty-seven (57) graduate companies have left our MBI laboratory facilities**
- ❖ **Of the fifty-seven (57) graduate companies, forty-three (43) companies (75%) are successfully operating today of which 80% are located here in Massachusetts**

#### **CURRENT INCUBATOR TENANTS**

- ❖ **Fourteen (14) current tenant incubator companies operate today within MBI's three Worcester facility locations @ Gateway Park, Union Street, Barber Avenue**
- ❖ **Over ninety-five (95) current employees work at our three business incubator sites**
- ❖ **Current annual economic impact of \$11M to our local economy**
- ❖ **Four (4) new start-up companies have joined MBI in 2011:**

*Biofluent Labs (Union Street)*  
*Janus Biotherapeutics (Union Street)*  
*Onnesion, Inc. (Gateway Park)*  
*VivoPath (Union Street)*

**Forty-Three (43) Successful Graduate Tenant Incubator Companies (75%) Since  
2000**  
**Average Length of Stay: 31 months**

<b><u>COMPANY</u></b>	<b><u>OCCUPANCY PERIOD</u></b>	<b><u>CURRENT LOCATION</u></b>
Attogen	6/10 - 1/1/12	Beverly
CytoVera, Inc.	6/10 - 12/11	Woburn
Tarpon Biosystems, Inc.	4/10 - 12/11	Bio 3 - Worcester
Olaf Pharmaceuticals	3/11 - 12/11	Bio 3 - Worcester
Averica Discovery Services Inc.	6/07 - 12/11	Bio 3 - Worcester
Antigen Targeting Consulting Service, Inc.	9/09 - 12/11	Bio 3 - Worcester
Biocytogen	1/09 - 12/11	Bio 3 - Worcester
Convergent Dental LLC	11/10 - 11/11	Natick
Nemucore Medical Innovations, inc.	10/10 - 5/11	Worcester
•Ravissanics, Inc.	2/11 - 5/11	
Surfacine Development Company	2/11 - 3/11	Texas
GlycoSolutions Corp.	10/01 - 1/11	Marlboro
•Nanogreen Solutions Corporation	4/10 - 10/10	
VivoPath, LLC	11/08 - 5/10	Worcester
Wesagen, Inc.	11/05 - 5/10	Morocco
Hypromatrix	2/02 - 5/10	China
Reality Unlimited	4/09 - 4/10	Cambridge
BioFlash Partners, LLC	12/09 - 4/10	Worcester
Connective Orthopaedics, Inc.	2/09 - 1/10	Woburn
•Acotrix, Inc.	5/08 - 1/10	
•Northeast BioScience, Inc.	8/08 - 8/09	
REM	11/04 - 3/09	Worcester
•NOVAGENESIS	7/03 - 2/09	Finland
Entegriion, Inc.	1/08 - 12/08	North Carolina
•Profoldin Protein Folding Services	2/06 - 2/09	
Technical Innovation Center, Inc.	4/03 - 12/08	Worcester
Coley Pharmaceuticals Group	5/07 - 5/08	sold to Pfizer
Ostroff Consulting	10/05 - 5/08	Worcester
Eden Research	10/05 - 5/08	Oxfordshire, UK
Antigen Express, Inc.	6/95 - 6/07	Worcester, Biotech Three
•Consistent Cardiogram Corporation	6/06 - 3/07	Worcester
Performance Indicator	3/04 - 3/07	Topsfield/Westford
•Total ReCORD Labs	11/04 - 5/06	Affiliated with New World
Intelligent Bio-Systems, Inc.	6/05 - 12/06	Waltham
NOMIR Medical Technologies, Inc.	3/05 - 10/06	Waltham
MSM Protein Technologies, Inc.	10/05 - 10/06	Medford
Avatar Pharmaceuticals, Inc.	3/02 - 6/06	Marlboro
GenomeQuest Inc. formerly Gene-IT	9/02 - 12/05	Westboro
KeraCure/Mass Micro Labs, Inc.	7/03 - 11/05	Cambridge
•Gene-Home, Inc.	2/05 - 9/05	Boston
•PolyGenyx	1/02 - 6/05	
DXA Resource Group, Inc.	11/02 - 2/05	Westboro
•New World Labs	7/03 - 11/04	Canada
Bioinformatics.org	8/03 - 9/04	Hudson
•J-QUE Biologics, Inc.	9/02 - 2/04	
••Biomedical Research Models, Inc.	11/00 - 10/03	Worcester
••Beckman-Coulter, Inc.	10/01 - 10/03	New York
Spring Bank Technologies	10/02 - 8/03	Marlboro
Bioheart, Inc.	11/01 - 1/03	Florida
Verax Biomedical Incorporated	10/01 - 1/03	Biotech 5
Insight Neuroimaging Systems	5/01 - 6/02	Worcester



- Stereochem, Inc.
- Origenix Technologies
- Center for Computational Molecular Biology
- Grove Instruments formerly VivaScan Corp
- t.Breeders/ViaCell
- PerkinElmer
- Agilux Labs

3/00 - 5/02  
09/00 - 4/02  
1/00 - 2/02  
2/99 - 7/01  
3/96

MBI  
West Boylston  
Cambridge bought by

Worcester

• *no longer in business*  
•• *existing Co's*  
••• *Virtual Company*

**Appendix G: 2012 Current Tenant Employment Number Audit from Judy Cocaine of MBI**

	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>A Chemtek Inc.</b>	1	1	1	2	2
<b>BioFluent Labs, Inc.</b>	0	0	0	2	2
<b>BioTechnic Products, LTD</b>	3	12	15	14	10
<b>Blue Sky Biotech, Inc.</b>	18	32	36	54	29
<b>CellMosaic, LLC</b>	0	2	3	2	1
<b>EpigenDX</b>	0	2	2	3	3
<b>Janus Biotherapeutics</b>	0	0	0	4	4
<b>Matrigen, LLC</b>	0	0	3	5	5
<b>Microbac Laboratories</b>	0	6	12	16	16
<b>Onnesion, Inc.</b>	0	0	0	2	2
<b>Targeted Cell Therapies LLC</b>	3	3	1	1	1
<b>VivoPath, LLC</b>	4	7	6	2	1
<b>Welgen, Inc.</b>	0	2	3	2	2
<b>ZATA Pharmaceuticals, Inc.</b>	0	1	1	1	1

## Appendix H: Interview with Mark Tepper of the Boynton Angels

### 1. What is the process that you go through to decide who receives funding?

People apply by submitting applications through the Boynton Angels website or Gust.com:  
Many of people find the Boynton Angels from:

- Word of Mouth
- References from other angel groups

After applying a screening committee reviews applications and chooses those which are the most appealing based on their selection factors. The committee will then call entrepreneur to run a back check on their story and location. Generally, there are about two presentations in front of the Angel group per month with 10-30 applicants each month.

### 2. What factors are important to you in making your decisions?

- Clear market need and value proposition
- A strong management team, an inventive, pragmatic concept and strategic positioning in the market place.
- Exceptional management with domain experience
- Strong intellectual property position
- Area of technology is one that the Boynton Angels have an area of expertise in
- Companies are proprietarily owned 99% of the time.
- Cannot require more than \$3M total for either exit stage or entrance (usually won't give up to that much)
- Entrepreneurs don't need to be experienced in running a company or business but should know their market well

### 3. What is the average amount of entrepreneurs receive?

- 500K-2M Funding Gap is generally the funding gap which the Boynton Angels are helping to fill
- ¼ to ½ million max usually for most angel groups
- Typically not needing all \$3 M at once
- Usually only need ½ M to get started
- Refer entrepreneur to other angel groups also after accepting

### 4. What is generally, the investment time frame?

- 5-7 years to liquidity with the potential to generate a strong ROI
- Don't usually invest in Pharmaceuticals which take longer - primarily invest in medical devices.

## **5. How much do you invest as a whole?**

- 500k- 1M per year

## **6. What are your expectations of those who you invest in?**

Depending on how much money we invest, we ask for board seat if amount of money contributed by the Boynton Angels is high enough  
Typically don't invest in an area where we don't have someone internally who has some strong experience

- Invite entrepreneurs back to tell us about their company
- Some issue quarterly or annual reports
- "Don't want to run the business, just support it"

## **7. What happens if they do not meet your expectations?**

**How do you cash out?**

**When company is sold or goes public?**

The Boynton Angels have only been in operation 4 ½ years, haven't really had any liquidity events yet.

It's unusual for companies to go public in this market - most likely is a trade sale  
More commonly companies build up value in assets, and bigger company looks to take them out

In case of a liquidity event the Boynton Angels generally receive preferred stock for their investments and would get paid first in event of liquidity

## **8. What do you do to promote the success of selected companies?**

Many of those who hold memberships are from local business people who are credited investors and are interested. Looking for a way to stay involved and invest their money from past experiences. Prior entrepreneurs who want to give back like to get involved.

## **9. How do you calculate the risk of companies?**

The Boynton Angels use no official metrics but look at risk management information and evaluation. No numerical process.

## **10. What is your success rate?**

Have only been in business for 4 ½ years therefore they have not experienced a cash out yet. However only 2 startups they have invested in have gone bankrupt so far out of the 9 or 10 total companies. Statistically speaking for Angel groups as a whole 2 out of 10 will be home runs, 4 will break even, and rest will go belly up.

**11. Are your tenants generally coming out of incubators or pre-incubators?  
Do you help fund them go into incubators?**

It depends, however the Boynton Angels have not funded any “Seeds” and have only participated in “continuing funding”. Incubators generally offer a cost effective way to rent space and equipment. However many of those in incubators are working on a project to develop a product and a start-up would need to show barriers to entry and intellectual property in order to receive funding. The Boynton Angels look for businesses where you can prove you will gain customers and ramp up revenues.

**Miscellaneous Information**

- Multiple levels hiring people out sourcing goods
- Bluesky is a biotechnology service provider and may know more about the types of services these biotechnology companies use while they are in incubators.
- The Boynton Angels provide no assistance services. However they like to have strong domain experience to help, but it's mostly connections and networking, promoting, and will give some input if knowledgeable in area
- See 2 companies a month, but don't run over the summer (9 months) (18 companies per year) invest in approximately 2 to 3
- Last 4 years invested in 9 or 10 companies - a few more than once when they're looking for additional money and support
- About 3/18 per year receive funding a year
- If there are members interested and they can find someone super interested, they can take it separate and look more into it and report back with ideas. 6 to 7 followed for this process
- 25 members total, \$15,000-25,000 per member on average
- Boynton angels has a lot of IT experts, but only a couple Biomechanics specialists so they don't have a lot focused in the biomechanic field

## Appendix I: Employment Distribution

	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
A Chemtek Inc.		1	1	1	2	2
Antigen Express, Inc.	15	13	11	9	8	7
ATCS, Inc.			2	2	2	2
Attogen, Inc.	3	1	1	1	1	1
Avatar Pharmaceutical Services, Inc.	19	19	19	19	19	19
Averca Discovery Services, Inc.	2	2	5	7	7	5
Biocytogen			1	2	2	2
BioFlash Partners, LLC			8	8	9	10
BioFluent Labs, Inc.				2	2	2
Bioheart, Inc.	7	7	7	7	7	7
Bioinformatics.org	2	3	4	5	6	7
Biomedical Research Models, Inc.	23	28	33	38	44	50
BioTechnic Products, LTD		3	11	12	10	10
Blue Sky Biotech, Inc.	10	24	42	45	65	36
CellMosaic, LLC			2	3	2	1
Coley Pharmaceutical Group	2	2	2	2	2	2
Connective Orthopaedics			4	4	5	7
Convergent Dental				2	2	2
CytoVera, Inc.				4	4	2
DXA Resource Group, Inc.	3	3	3	3	3	3
Eden Research	3	3	2	2	1	1
Entegion, Inc.		4	4	4	4	4
EpigenDX	1	1	5	4	5	4
Gene-IT	10	15	20	25	30	35
GlycoSolutions Corporation	4	3	4	7	7	6
Hypromatrix, Inc.	3	1	1	1	1	1
Intelligent Biosystems, Inc.	5	7	10	13	15	17
IT/LSG	2	2	2	6	4	1
Janus Biotherapeutics					3	3
Mass Micro Laboratories, Inc.	4	4	4	4	4	4
Matrigen, LLC				3	5	6
Microbac Laboratories			6	6	6	4
MSM Protein Technologies, Inc.	12	10	8	6	5	4
Nanogreen Solutions Corporation				1	1	1
Nemucore Medical Innovations, Inc.				2	2	2
NOMIR Medical Technologies, Inc.	5	5	4	4	3	3
Olaf Pharmaceuticals					4	4
Onnesion, Inc.					2	2
Ostroff Consulting	1	1	1	1	1	1
Performance Indicator	15	18	21	24	27	30
Reality Unlimited, LLC			1	1	1	1
REM, Inc.	3	3	3	3	3	3
Surfacine Development Company					1	1

<b>Targeted Cell Therapies LLC</b>	3	3	3	1	1	1
<b>Tarpon Biosystems, Inc.</b>			2	7	5	4
<b>Verax Biomedical Incorporated</b>	8	8	8	8	8	8
<b>VivoPath, LLC</b>		4	7	6	7	7
<b>Welgen, Inc.</b>	1	0	2	2	2	5
<b>WesaGen, Inc.</b>	1	1	1	1	1	1
<b>ZATA Pharmaceuticals, Inc.</b>			1	1	1	1

## Appendix J: Implan Tax Output Data

**Federal  
Tax  
Impact**

Copyright 2012 Minnesota  
IMPLAN Group, Inc.

Institution Receipts	Transfer Type	Description	5001	6001	8001	10000	13001	Total
11,001	15014	Social Ins Tax- Employee Contribution	\$3,287,340	\$507,929				3,795,269
11,001	15015	Social Ins Tax- Employer Contribution	\$3,324,498					3,324,498
11,001	15017	Indirect Bus Tax: Excise Taxes			\$394,240			394,240
11,001	15018	Indirect Bus Tax: Custom Duty			\$183,601			183,601
11,001	15019	Indirect Bus Tax: Fed NonTaxes			\$303,068			303,068
11,001	15026	Corporate Profits Tax					\$1,986,538	1,986,538
11,001	15027	Personal Tax: Income Tax				\$7,210,257		7,210,257
11,001	99999	Total Federal Tax	\$6,611,838	\$507,929	\$880,909	\$7,210,257	\$1,986,538	17,197,471



## Appendix K: Implan Overall Impact Summary

**Impact Summary**    WPI.impdb    Copyright 2012 Minnesota IMPLAN Group, Inc.

ImpactType	Output	Employment	LaborIncome	TotalValueAdded
Direct Effect	\$114,432,376	295.0	\$35,364,204	\$58,241,920
Indirect Effect	\$51,111,496	247.2	\$19,234,298	\$30,695,424
Induced Effect	\$49,344,148	314.1	\$17,336,574	\$30,387,136
<b>Total Effect</b>	<b>\$214,888,016</b>	<b>856.3</b>	<b>\$71,935,072</b>	<b>\$119,324,416</b>

## Appendix L: Implan Results - Employment

<b>Employment</b>		Copyright 2012 Minnesota IMPLAN Group, Inc.			
Sector	Description	Direct	Indirect	Induced	Total
<b>0</b>	<b>Total</b>	<b>295.0</b>	<b>247.2</b>	<b>314.1</b>	<b>856.3</b>
39	Maintenance and repair construction of nonresidential structures	0.0	7.8	1.2	9.0
107	Paperboard container manufacturing	0.0	0.5	0.1	0.7
108	Coated and laminated paper, packaging paper and plastics film manufacturing	0.0	0.2	0.1	0.2
113	Printing	0.0	1.6	0.5	2.1
114	Support activities for printing	0.0	0.1	0.0	0.1
127	Plastics material and resin manufacturing	0.0	0.1	0.0	0.2
132	Medicinal and botanical manufacturing	0.0	0.2	0.0	0.2
133	Pharmaceutical preparation manufacturing	14.0	0.7	0.2	14.9
134	In-vitro diagnostic substance manufacturing	0.0	0.0	0.0	0.1
135	Biological product (except diagnostic) manufacturing	7.0	0.3	0.0	7.4
299	Institutional furniture manufacturing	7.0	0.0	0.0	7.0
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	19.0	0.3	0.0	19.3
319	Wholesale trade businesses	15.0	14.2	9.4	38.6
320	Retail Stores - Motor vehicle and parts	0.0	0.4	5.8	6.2
321	Retail Stores - Furniture and home furnishings	0.0	0.1	2.1	2.2
322	Retail Stores - Electronics and appliances	0.0	0.1	1.9	2.1
323	Retail Stores - Building material and garden supply	0.0	0.2	4.1	4.3
324	Retail Stores - Food and beverage	0.0	0.5	12.7	13.3
325	Retail Stores - Health and personal care	0.0	0.2	4.3	4.5
326	Retail Stores - Gasoline stations	0.0	0.1	1.8	1.9
327	Retail Stores - Clothing and clothing accessories	0.0	0.2	6.5	6.7
328	Retail Stores - Sporting goods, hobby, book and music	0.0	0.1	3.0	3.1
329	Retail Stores - General merchandise	0.0	0.3	6.6	6.9
330	Retail Stores - Miscellaneous	0.0	0.2	4.7	4.9
331	Retail Nonstores - Direct and electronic sales	0.0	0.3	4.6	4.9
332	Transport by air	0.0	0.3	0.7	1.0
333	Transport by rail	0.0	0.2	0.1	0.3
334	Transport by water	0.0	1.0	0.0	1.0
335	Transport by truck	0.0	1.6	1.5	3.2
336	Transit and ground passenger transportation	0.0	0.9	1.0	1.9
337	Transport by pipeline	0.0	0.0	0.0	0.0

338	Scenic and sightseeing transportation and support activities for transportation	0.0	1.8	0.6	2.4
339	Couriers and messengers	0.0	4.4	1.2	5.6
340	Warehousing and storage	0.0	1.5	0.6	2.1
341	Newspaper publishers	0.0	1.9	0.6	2.6
342	Periodical publishers	0.0	1.1	0.3	1.4
343	Book publishers	0.0	0.1	0.2	0.3
344	Directory, mailing list, and other publishers	0.0	0.4	0.1	0.5
345	Software publishers	0.0	0.4	0.1	0.5
346	Motion picture and video industries	0.0	0.7	0.9	1.6
347	Sound recording industries	0.0	0.0	0.0	0.0
348	Radio and television broadcasting	0.0	1.5	0.4	1.8
349	Cable and other subscription programming	0.0	0.2	0.1	0.3
350	Internet publishing and broadcasting	0.0	1.5	0.3	1.8
351	Telecommunications	0.0	3.1	2.1	5.2
352	Data processing, hosting, ISP, web search portals and related services	0.0	0.6	0.7	1.3
353	Other information services	0.0	2.1	0.2	2.4
354	Monetary authorities and depository credit intermediation activities	0.0	5.5	3.5	9.0
355	Nondepository credit intermediation and related activities	0.0	0.8	1.4	2.1
356	Securities, commodity contracts, investments, and related activities	0.0	2.9	4.7	7.6
357	Insurance carriers	0.0	2.7	5.2	7.9
358	Insurance agencies, brokerages, and related activities	0.0	1.5	2.5	4.0
359	Funds, trusts, and other financial vehicles	0.0	0.1	1.0	1.1
360	Real estate establishments	0.0	18.1	13.3	31.4
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	0.0	0.0
362	Automotive equipment rental and leasing	0.0	0.4	0.4	0.8
363	General and consumer goods rental except video tapes and discs	1.0	0.4	0.5	1.9
364	Video tape and disc rental	0.0	0.0	0.3	0.3
365	Commercial and industrial machinery and equipment rental and leasing	0.0	0.4	0.1	0.5
366	Lessors of nonfinancial intangible assets	27.0	0.2	0.1	27.3
367	Legal services	0.0	8.9	4.1	13.0
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	7.9	2.1	10.0
369	Architectural, engineering, and related services	10.0	6.8	1.2	18.0
370	Specialized design services	0.0	0.9	0.2	1.1
371	Custom computer programming services	0.0	0.5	0.1	0.7
372	Computer systems design services	0.0	3.4	0.7	4.1
373	Other computer related services, including facilities management	0.0	0.6	0.1	0.8
374	Management, scientific, and technical consulting services	0.0	11.5	1.5	13.0
375	Environmental and other technical consulting services	1.0	2.2	0.3	3.4
376	Scientific research and development services	192.0	8.4	0.5	200.8

377	Advertising and related services	0.0	6.3	1.5	7.8
378	Photographic services	0.0	0.3	0.2	0.5
379	Veterinary services	0.0	0.1	1.2	1.2
380	All other miscellaneous professional, scientific, and technical services	0.0	2.1	0.3	2.3
381	Management of companies and enterprises	0.0	13.5	1.7	15.2
382	Employment services	0.0	19.1	5.6	24.7
383	Travel arrangement and reservation services	0.0	0.9	0.4	1.3
384	Office administrative services	0.0	2.7	0.6	3.3
385	Facilities support services	0.0	0.2	0.0	0.3
386	Business support services	0.0	4.5	0.8	5.3
387	Investigation and security services	0.0	2.8	1.6	4.4
388	Services to buildings and dwellings	0.0	17.4	4.4	21.8
389	Other support services	1.0	1.0	0.3	2.3
390	Waste management and remediation services	0.0	1.1	0.8	1.8
391	Private elementary and secondary schools	0.0	0.0	4.7	4.7
392	Private junior colleges, colleges, universities, and professional schools	0.0	0.1	8.0	8.1
393	Other private educational services	0.0	0.1	3.9	4.0
394	Offices of physicians, dentists, and other health practitioners	0.0	0.0	16.0	16.0
395	Home health care services	0.0	0.0	4.4	4.4
396	Medical and diagnostic labs and outpatient and other ambulatory care services	0.0	0.0	4.8	4.8
397	Private hospitals	0.0	0.0	21.3	21.3
398	Nursing and residential care facilities	0.0	0.0	9.9	9.9
399	Child day care services	0.0	0.0	4.2	4.2
400	Individual and family services	0.0	0.0	5.6	5.6
401	Community food, housing, and other relief services, including rehabilitation services	0.0	0.0	2.6	2.6
402	Performing arts companies	0.0	0.6	1.6	2.2
403	Spectator sports companies	0.0	0.4	0.7	1.1
404	Promoters of performing arts and sports and agents for public figures	0.0	0.8	2.0	2.8
405	Independent artists, writers, and performers	0.0	0.3	0.2	0.4
406	Museums, historical sites, zoos, and parks	0.0	0.0	0.6	0.6
407	Fitness and recreational sports centers	0.0	0.5	2.0	2.4
408	Bowling centers	0.0	0.0	0.1	0.1
409	Amusement parks, arcades, and gambling industries	0.0	0.0	1.8	1.8
410	Other amusement and recreation industries	0.0	0.2	1.8	2.0
411	Hotels and motels, including casino hotels	0.0	0.3	0.3	0.5
412	Other accommodations	0.0	0.0	0.1	0.1
413	Food services and drinking places	0.0	10.4	32.8	43.2
414	Automotive repair and maintenance, except car washes	0.0	1.8	3.6	5.5
415	Car washes	0.0	0.1	0.4	0.6

416	Electronic and precision equipment repair and maintenance	0.0	0.7	0.3	1.0
417	Commercial and industrial machinery and equipment repair and maintenance	0.0	1.8	0.3	2.1
418	Personal and household goods repair and maintenance	0.0	0.6	0.4	1.0
419	Personal care services	0.0	0.0	3.5	3.5
420	Death care services	0.0	0.0	0.5	0.5
421	Dry-cleaning and laundry services	0.0	0.5	1.4	1.9
422	Other personal services	0.0	0.3	1.5	1.8
423	Religious organizations	0.0	0.0	0.3	0.3
424	Grantmaking, giving, and social advocacy organizations	0.0	0.0	2.9	2.9
425	Civic, social, professional, and similar organizations	0.0	5.7	5.3	11.0
426	Private household operations	0.0	0.0	7.3	7.3
427	US Postal Service	0.0	3.0	1.5	4.6
428	Federal electric utilities	0.0	0.0	0.0	0.0
429	Other Federal Government enterprises	0.0	0.1	0.2	0.3
430	State and local government passenger transit	0.0	0.9	0.9	1.8
431	State and local government electric utilities	0.0	0.1	0.0	0.1
432	Other state and local government enterprises	0.0	1.5	2.2	3.7

## Appendix M: Implan Results – Labor Income

### LaborIncome

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Sector	Description	Direct	Indirect	Induced	Total
<b>0</b>	<b>Total</b>	<b>35,364,201.1</b>	<b>19,234,298.1</b>	<b>17,336,571.0</b>	<b>71,935,070.4</b>
31	Electric power generation, transmission, and distribution	0.0	245,371.8	149,146.4	394,518.3
32	Natural gas distribution	0.0	54,214.2	33,381.7	87,595.9
33	Water, sewage and other treatment and delivery systems	0.0	4,601.0	9,054.8	13,655.7
38	Construction of other new residential structures	0.0	1,139.6	1,665.1	2,804.8
39	Maintenance and repair construction of nonresidential structures	0.0	549,862.6	86,781.6	636,644.3
113	Printing	0.0	117,865.6	32,468.5	150,334.2
133	Pharmaceutical preparation manufacturing	2,356,134.5	109,866.4	37,354.9	2,503,355.8
134	In-vitro diagnostic substance manufacturing	0.0	8,111.2	6,716.4	14,827.6
135	Biological product (except diagnostic) manufacturing	1,358,562.4	67,750.3	1,010.2	1,427,322.9
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	92,114.3	541.1	152.6	92,808.0
297	Nonupholstered wood household furniture manufacturing	0.0	4.9	2,984.8	2,989.7
298	Metal and other household furniture manufacturing	0.0	125.9	287.0	413.0
299	Institutional furniture manufacturing	459,450.1	724.4	88.4	460,262.8
300	Office Furniture	0.0	60.9	54.1	115.0
301	Custom architectural woodwork and millwork manufacturing	0.0	182.3	69.1	251.4
302	Showcase, partition, shelving, and locker manufacturing	0.0	1,598.6	255.1	1,853.7
303	Mattress manufacturing	0.0	18.1	1,595.2	1,613.3
304	Blind and shade manufacturing	0.0	16.3	107.7	124.0
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	2,586,635.3	43,357.2	3,995.7	2,633,988.0
306	Surgical appliance and supplies manufacturing	0.0	15,103.8	5,312.4	20,416.2
307	Dental equipment and supplies manufacturing	0.0	4.2	299.4	303.7
308	Ophthalmic goods manufacturing	0.0	4.4	1,573.4	1,577.9
309	Dental laboratories manufacturing	0.0	5.5	2,185.9	2,191.4
310	Jewelry and silverware manufacturing	0.0	0.2	40.1	40.2
311	Sporting and athletic goods manufacturing	0.0	84.3	6,343.8	6,428.1
312	Doll, toy, and game manufacturing	0.0	71.7	3,087.8	3,159.5
313	Office supplies (except paper) manufacturing	0.0	137.6	180.3	317.9
314	Sign manufacturing	0.0	9,234.3	2,145.2	11,379.4
315	Gasket, packing, and sealing device manufacturing	0.0	1,508.2	587.0	2,095.2
316	Musical instrument manufacturing	0.0	591.5	929.9	1,521.4

317	All other miscellaneous manufacturing	0.0	1,094.5	2,989.9	4,084.4
318	Broom, brush, and mop manufacturing	0.0	206.2	809.1	1,015.3
319	Wholesale trade businesses	1,503,240.0	1,426,790.9	941,728.3	3,871,759.5
320	Retail Stores - Motor vehicle and parts	0.0	22,364.9	337,294.9	359,659.9
321	Retail Stores - Furniture and home furnishings	0.0	3,885.8	90,169.2	94,055.0
322	Retail Stores - Electronics and appliances	0.0	5,809.3	88,330.3	94,139.6
323	Retail Stores - Building material and garden supply	0.0	8,807.1	195,894.0	204,701.0
324	Retail Stores - Food and beverage	0.0	15,206.9	378,152.1	393,359.0
325	Retail Stores - Health and personal care	0.0	6,497.0	170,884.8	177,381.8
332	Transport by air	0.0	27,247.2	51,491.2	78,738.4
333	Transport by rail	0.0	21,995.4	13,608.0	35,603.4
334	Transport by water	0.0	81,001.7	3,258.7	84,260.4
335	Transport by truck	0.0	105,638.2	100,575.8	206,214.1
336	Transit and ground passenger transportation	0.0	28,294.4	29,158.4	57,452.7
337	Transport by pipeline	0.0	1,982.3	1,863.9	3,846.2
338	Scenic and sightseeing transportation and support activities for transportation	0.0	119,226.5	38,740.3	157,966.8
339	Couriers and messengers	0.0	165,285.2	46,001.3	211,286.5
340	Warehousing and storage	0.0	87,510.7	35,457.7	122,968.4
341	Newspaper publishers	0.0	128,669.2	41,197.7	169,866.8
342	Periodical publishers	0.0	109,763.4	29,524.8	139,288.2
343	Book publishers	0.0	10,294.3	15,597.1	25,891.5
344	Directory, mailing list, and other publishers	0.0	39,640.6	9,703.5	49,344.1
345	Software publishers	0.0	56,190.4	20,275.5	76,465.9
346	Motion picture and video industries	0.0	27,372.8	35,186.6	62,559.4
347	Sound recording industries	0.0	223.8	1,615.6	1,839.4
348	Radio and television broadcasting	0.0	154,623.1	39,849.3	194,472.4
349	Cable and other subscription programming	0.0	24,479.8	9,284.0	33,763.9
350	Internet publishing and broadcasting	0.0	164,169.8	37,989.4	202,159.2
351	Telecommunications	0.0	308,246.3	209,828.1	518,074.4
352	Data processing, hosting, ISP, web search portals and related services	0.0	59,529.5	70,832.4	130,361.8
353	Other information services	0.0	242,040.5	25,010.2	267,050.7
354	Monetary authorities and depository credit intermediation activities	0.0	600,776.0	389,497.6	990,273.6
355	Nondepository credit intermediation and related activities	0.0	93,825.7	167,886.8	261,712.5
356	Securities, commodity contracts, investments, and related activities	0.0	567,420.7	914,852.4	1,482,273.1
357	Insurance carriers	0.0	298,792.3	569,751.9	868,544.3
358	Insurance agencies, brokerages, and related activities	0.0	134,373.8	232,969.0	367,342.8

359	Funds, trusts, and other financial vehicles	0.0	9,883.6	199,199.5	209,083.0
360	Real estate establishments	0.0	773,900.4	565,827.3	1,339,727.6
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	0.0	0.0
362	Automotive equipment rental and leasing	0.0	20,437.8	19,953.0	40,390.8
363	General and consumer goods rental except video tapes and discs	55,384.5	22,741.8	28,100.4	106,226.8
364	Video tape and disc rental	0.0	0.0	5,884.0	5,884.0
365	Commercial and industrial machinery and equipment rental and leasing	0.0	34,366.5	12,232.3	46,598.8
366	Lessors of nonfinancial intangible assets	2,004,533.4	16,630.9	3,823.6	2,024,987.9
367	Legal services	0.0	858,810.4	390,149.7	1,248,960.1
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	614,055.6	163,023.6	777,079.3
369	Architectural, engineering, and related services	914,421.0	621,426.4	108,602.2	1,644,449.9
370	Specialized design services	0.0	60,558.4	14,523.6	75,082.0
371	Custom computer programming services	0.0	63,040.5	15,361.0	78,401.5
372	Computer systems design services	0.0	354,493.4	72,646.1	427,139.6
373	Other computer related services, including facilities management	0.0	143,997.1	31,780.4	175,777.4
374	Management, scientific, and technical consulting services	0.0	1,398,590.6	187,840.7	1,586,431.3
375	Environmental and other technical consulting services	111,642.0	243,658.6	27,995.0	383,295.6
376	Scientific research and development services	23,852,328.0	1,038,361.3	57,026.6	24,947,716.0
377	Advertising and related services	0.0	503,301.3	115,829.4	619,130.6
378	Photographic services	0.0	7,897.1	6,699.3	14,596.4
379	Veterinary services	0.0	3,190.2	47,568.4	50,758.6
380	All other miscellaneous professional, scientific, and technical services	0.0	180,277.9	23,918.3	204,196.3
381	Management of companies and enterprises	0.0	1,819,117.9	234,441.3	2,053,559.0
382	Employment services	0.0	775,387.1	226,423.2	1,001,810.3
383	Travel arrangement and reservation services	0.0	63,233.2	25,274.4	88,507.5
384	Office administrative services	0.0	257,067.0	56,695.2	313,762.2
385	Facilities support services	0.0	17,166.8	2,338.5	19,505.2
386	Business support services	0.0	247,052.0	45,143.1	292,195.0
387	Investigation and security services	0.0	92,774.5	52,591.9	145,366.4
388	Services to buildings and dwellings	0.0	577,962.7	147,748.8	725,711.6
389	Other support services	69,755.7	67,194.7	20,091.8	157,042.1
390	Waste management and remediation services	0.0	80,669.4	58,076.5	138,745.8



## Appendix N: Implan Results – Total Value Added

### Total Value Added

Sector	Description	Direct	Indirect	Induced	Total
<b>0</b>	<b>Total</b>	<b>58,242,013.9</b>	<b>30,695,442.0</b>	<b>30,387,187.4</b>	<b>119,324,641.9</b>
31	Electric power generation, transmission, and distribution	0.0	895,801.1	544,502.3	1,440,303.4
32	Natural gas distribution	0.0	127,094.8	78,257.1	205,351.9
33	Water, sewage and other treatment and delivery systems	0.0	7,911.4	15,569.8	23,481.2
38	Construction of other new residential structures	0.0	1,207.3	1,764.0	2,971.3
39	Maintenance and repair construction of nonresidential structures	0.0	578,514.8	91,303.6	669,818.5
40	Maintenance and repair construction of residential structures	0.0	11,232.9	129,071.6	140,304.5
132	Medicinal and botanical manufacturing	0.0	52,966.6	932.0	53,898.6
133	Pharmaceutical preparation manufacturing	6,451,857.0	300,849.8	102,289.7	6,854,997.0
134	In-vitro diagnostic substance manufacturing	0.0	8,328.9	6,896.7	15,225.6
135	Biological product (except diagnostic) manufacturing	2,829,869.5	141,123.0	2,104.3	2,973,096.8
136	Paint and coating manufacturing	0.0	3,600.6	1,248.3	4,848.9
137	Adhesive manufacturing	0.0	5,475.1	1,502.6	6,977.7
138	Soap and cleaning compound manufacturing	0.0	4,203.9	4,944.8	9,148.7
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	98,299.1	577.4	162.9	99,039.4
245	Electronic connector manufacturing	0.0	464.6	41.7	506.3
298	Metal and other household furniture manufacturing	0.0	222.0	505.8	727.8
299	Institutional furniture manufacturing	853,906.8	1,346.3	164.2	855,417.3
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	3,347,794.3	56,115.7	5,171.6	3,409,081.0
306	Surgical appliance and supplies manufacturing	0.0	23,959.6	8,427.1	32,386.8
319	Wholesale trade businesses	2,572,252.3	2,441,437.5	1,611,427.9	6,625,118.0
320	Retail Stores - Motor vehicle and parts	0.0	27,929.4	421,214.0	449,143.4
321	Retail Stores - Furniture and home furnishings	0.0	6,260.2	145,265.4	151,525.6
322	Retail Stores - Electronics and appliances	0.0	7,129.6	108,404.8	115,534.4
323	Retail Stores - Building material and garden supply	0.0	14,278.2	317,587.5	331,865.7
324	Retail Stores - Food and beverage	0.0	23,350.9	580,672.1	604,023.1
325	Retail Stores - Health and personal care	0.0	10,215.7	268,693.3	278,909.0
326	Retail Stores - Gasoline stations	0.0	7,407.3	175,324.9	182,732.2
327	Retail Stores - Clothing and clothing accessories	0.0	13,328.0	357,520.6	370,848.6
328	Retail Stores - Sporting goods, hobby, book and music	0.0	5,411.7	119,798.8	125,210.4
329	Retail Stores - General merchandise	0.0	11,913.2	284,889.1	296,802.3

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330	Retail Stores - Miscellaneous	0.0	8,596.2	178,644.7	187,240.8
331	Retail Nonstores - Direct and electronic sales	0.0	26,686.0	410,022.1	436,708.1
332	Transport by air	0.0	35,566.3	67,212.4	102,778.7
333	Transport by rail	0.0	51,256.0	31,710.8	82,966.8
334	Transport by water	0.0	155,080.4	6,238.9	161,319.4
335	Transport by truck	0.0	140,898.1	134,146.0	275,044.1
336	Transit and ground passenger transportation	0.0	40,235.1	41,463.6	81,698.7
337	Transport by pipeline	0.0	2,863.8	2,692.8	5,556.6
338	Scenic and sightseeing transportation and support activities for transportation	0.0	154,713.0	50,271.0	204,984.0
339	Couriers and messengers	0.0	269,256.8	74,938.1	344,194.8
340	Warehousing and storage	0.0	119,752.3	48,521.4	168,273.7
341	Newspaper publishers	0.0	150,929.0	48,324.9	199,253.8
342	Periodical publishers	0.0	138,104.5	37,148.2	175,252.8
343	Book publishers	0.0	19,174.5	29,051.6	48,226.1
344	Directory, mailing list, and other publishers	0.0	100,436.9	24,585.7	125,022.6
345	Software publishers	0.0	108,303.3	39,079.7	147,383.0
346	Motion picture and video industries	0.0	42,525.8	54,665.2	97,191.0
347	Sound recording industries	0.0	592.8	4,279.9	4,872.6
348	Radio and television broadcasting	0.0	123,578.2	31,848.4	155,426.7
349	Cable and other subscription programming	0.0	34,686.1	13,154.8	47,840.8
350	Internet publishing and broadcasting	0.0	537,191.4	124,307.8	661,499.2
351	Telecommunications	0.0	832,460.7	566,668.9	1,399,129.6
352	Data processing, hosting, ISP, web search portals and related services	0.0	89,029.3	105,933.4	194,962.8
353	Other information services	0.0	641,905.7	66,328.5	708,234.2
354	Monetary authorities and depository credit intermediation activities	0.0	1,575,451.3	1,021,403.1	2,596,854.3
355	Nondepository credit intermediation and related activities	0.0	146,253.4	261,698.2	407,951.6
356	Securities, commodity contracts, investments, and related activities	0.0	577,977.5	931,873.1	1,509,850.8
357	Insurance carriers	0.0	549,513.8	1,047,839.9	1,597,353.4
358	Insurance agencies, brokerages, and related activities	0.0	171,462.8	297,271.6	468,734.4
359	Funds, trusts, and other financial vehicles	0.0	5,752.2	115,933.2	121,685.4
360	Real estate establishments	0.0	3,650,772.3	2,669,215.0	6,319,987.5
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	4,141,249.5	4,141,249.5
362	Automotive equipment rental and leasing	0.0	42,527.2	41,518.4	84,045.6
363	General and consumer goods rental except video tapes and discs	61,084.8	25,082.5	30,992.6	117,159.9
364	Video tape and disc rental	0.0	0.0	9,073.6	9,073.6
365	Commercial and industrial machinery and equipment rental and leasing	0.0	61,027.7	21,722.1	82,749.8

366	Lessors of nonfinancial intangible assets	19,791,546.0	164,203.5	37,752.3	19,993,502.0
367	Legal services	0.0	1,110,565.8	504,519.8	1,615,085.5
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	737,401.3	195,770.3	933,171.5
369	Architectural, engineering, and related services	927,557.3	630,353.6	110,162.4	1,668,073.5
370	Specialized design services	0.0	87,684.1	21,029.1	108,713.2
371	Custom computer programming services	0.0	66,284.3	16,151.4	82,435.7
372	Computer systems design services	0.0	290,449.1	59,521.6	349,970.8
373	Other computer related services, including facilities management	0.0	184,537.6	40,727.7	225,265.3
374	Management, scientific, and technical consulting services	0.0	1,609,514.6	216,169.4	1,825,684.0
375	Environmental and other technical consulting services	136,762.1	298,483.3	34,294.1	469,539.5
376	Scientific research and development services	21,024,826.0	915,271.8	50,266.5	21,990,362.0
377	Advertising and related services	0.0	612,236.3	140,899.6	753,135.8
378	Photographic services	0.0	12,417.1	10,533.7	22,950.8
379	Veterinary services	0.0	3,501.4	52,209.1	55,710.5
380	All other miscellaneous professional, scientific, and technical services	0.0	883,578.5	117,228.7	1,000,807.2
381	Management of companies and enterprises	0.0	2,434,581.5	313,760.0	2,748,341.5
382	Employment services	0.0	836,158.1	244,169.2	1,080,327.3
383	Travel arrangement and reservation services	0.0	125,272.9	50,071.7	175,344.6
384	Office administrative services	0.0	341,157.6	75,241.1	416,398.6
385	Facilities support services	0.0	18,700.5	2,547.4	21,247.9
386	Business support services	0.0	332,002.7	60,665.9	392,668.6
387	Investigation and security services	0.0	107,939.6	61,188.8	169,128.4
388	Services to buildings and dwellings	0.0	706,626.9	180,640.2	887,267.1
389	Other support services	146,258.8	140,889.0	42,127.0	329,274.8
390	Waste management and remediation services	0.0	129,072.9	92,923.7	221,996.6
391	Private elementary and secondary schools	0.0	0.0	179,524.5	179,524.5
392	Private junior colleges, colleges, universities, and professional schools	0.0	4,653.8	438,872.1	443,526.0
393	Other private educational services	0.0	3,996.6	139,120.1	143,116.6
394	Offices of physicians, dentists, and other health practitioners	0.0	9.8	1,636,152.3	1,636,161.9
395	Home health care services	0.0	0.0	252,526.9	252,526.9
396	Medical and diagnostic labs and outpatient and other ambulatory care services	0.0	506.5	559,855.2	560,361.7
397	Private hospitals	0.0	16.6	1,703,823.4	1,703,839.9
398	Nursing and residential care facilities	0.0	0.0	441,027.2	441,027.2
399	Child day care services	0.0	0.0	174,112.5	174,112.5
400	Individual and family services	0.0	0.0	206,177.4	206,177.4
401	Community food, housing, and other relief services, including rehabilitation services	0.0	0.0	65,516.4	65,516.4

402	Performing arts companies	0.0	10,278.0	27,675.7	37,953.8
403	Spectator sports companies	0.0	35,006.8	56,812.4	91,819.2
404	Promoters of performing arts and sports and agents for public figures	0.0	11,031.1	27,583.8	38,614.9
405	Independent artists, writers, and performers	0.0	20,129.4	11,760.2	31,889.6
406	Museums, historical sites, zoos, and parks	0.0	0.0	38,602.6	38,602.6
407	Fitness and recreational sports centers	0.0	10,256.5	44,382.2	54,638.7
408	Bowling centers	0.0	11.9	3,267.9	3,279.9
409	Amusement parks, arcades, and gambling industries	0.0	88.5	84,915.5	85,004.0
410	Other amusement and recreation industries	0.0	9,541.6	100,122.3	109,663.9
411	Hotels and motels, including casino hotels	0.0	23,052.4	20,898.6	43,951.0
412	Other accommodations	0.0	573.4	3,880.5	4,453.9
413	Food services and drinking places	0.0	384,321.5	1,207,875.0	1,592,196.4
414	Automotive repair and maintenance, except car washes	0.0	124,339.8	244,962.2	369,302.0
415	Car washes	0.0	6,660.1	19,436.6	26,096.7
416	Electronic and precision equipment repair and maintenance	0.0	129,862.1	47,219.8	177,081.9
417	Commercial and industrial machinery and equipment repair and maintenance	0.0	248,368.5	47,501.6	295,870.1
418	Personal and household goods repair and maintenance	0.0	63,652.1	43,777.1	107,429.1
419	Personal care services	0.0	0.1	149,210.6	149,210.7
420	Death care services	0.0	0.0	27,173.1	27,173.1
421	Dry-cleaning and laundry services	0.0	22,582.5	69,344.6	91,927.1
422	Other personal services	0.0	30,955.0	159,069.1	190,024.1
423	Religious organizations	0.0	0.0	20,701.4	20,701.4
424	Grantmaking, giving, and social advocacy organizations	0.0	833.0	61,082.4	61,915.4
425	Civic, social, professional, and similar organizations	0.0	111,098.2	102,365.6	213,463.8
426	Private household operations	0.0	0.0	72,064.8	72,064.8
427	US Postal Service	0.0	234,292.8	119,592.0	353,884.8
428	Federal electric utilities	0.0	0.0	0.0	0.0
429	Other Federal Government enterprises	0.0	10,437.8	24,644.5	35,082.3
430	State and local government passenger transit	0.0	3,828.7	3,945.6	7,774.3
431	State and local government electric utilities	0.0	7,858.2	4,742.1	12,600.2
432	Other state and local government enterprises	0.0	178,807.2	261,255.6	440,062.8

## Appendix O: Implan Results – Output

Output		Copyright 2012 Minnesota IMPLAN Group, Inc.			
Sector	Description	Direct	Indirect	Induced	Total
<b>0</b>	<b>Total</b>	<b>114,432,367.6</b>	<b>51,111,495.3</b>	<b>49,344,151.3</b>	<b>214,888,013.4</b>
31	Electric power generation, transmission, and distribution	0.0	1,238,906.1	753,054.8	1,991,960.9
39	Maintenance and repair construction of nonresidential structures	0.0	1,040,458.1	164,209.5	1,204,667.6
133	Pharmaceutical preparation manufacturing	20,669,012.0	963,794.9	327,692.8	21,960,498.0
134	In-vitro diagnostic substance manufacturing	0.0	25,467.0	21,087.6	46,554.7
135	Biological product (except diagnostic) manufacturing	8,692,794.0	433,501.7	6,463.9	9,132,759.0
243	Semiconductor and related device manufacturing	0.0	62,424.1	16,230.5	78,654.7
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	241,183.9	1,416.7	399.7	243,000.3
299	Institutional furniture manufacturing	1,914,423.5	3,018.3	368.2	1,917,810.0
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	6,938,817.5	116,308.5	10,718.8	7,065,845.0
319	Wholesale trade businesses	3,886,743.8	3,689,078.8	2,434,911.8	10,010,735.0
334	Transport by water	0.0	554,066.3	22,290.3	576,356.5
335	Transport by truck	0.0	255,946.3	243,680.8	499,627.1
336	Transit and ground passenger transportation	0.0	58,447.7	60,232.4	118,680.1
337	Transport by pipeline	0.0	8,798.1	8,272.8	17,070.9
338	Scenic and sightseeing transportation and support activities for transportation	0.0	165,046.1	53,628.5	218,674.6
339	Couriers and messengers	0.0	349,605.9	97,300.4	446,906.3
340	Warehousing and storage	0.0	149,983.9	60,770.7	210,754.6
341	Newspaper publishers	0.0	301,909.9	96,666.4	398,576.3
342	Periodical publishers	0.0	338,509.4	91,054.4	429,563.8
343	Book publishers	0.0	41,355.4	62,658.3	104,013.7
344	Directory, mailing list, and other publishers	0.0	197,602.1	48,370.6	245,972.7
345	Software publishers	0.0	212,935.0	76,834.6	289,769.6
346	Motion picture and video industries	0.0	114,654.8	147,383.9	262,038.7
347	Sound recording industries	0.0	3,049.4	22,016.6	25,065.9
348	Radio and television broadcasting	0.0	258,149.1	66,529.9	324,679.0
349	Cable and other subscription programming	0.0	264,021.8	100,130.8	364,152.6
350	Internet publishing and broadcasting	0.0	1,497,229.6	346,463.6	1,843,693.3
351	Telecommunications	0.0	1,803,028.5	1,227,349.5	3,030,378.0
352	Data processing, hosting, ISP, web search portals and related services	0.0	179,308.1	213,353.5	392,661.6

353	Other information services	0.0	1,339,196.1	138,379.9	1,477,576.1
354	Monetary authorities and depository credit intermediation activities	0.0	2,174,989.5	1,410,098.3	3,585,087.8
355	Nondepository credit intermediation and related activities	0.0	208,638.8	373,327.6	581,966.4
356	Securities, commodity contracts, investments, and related activities	0.0	935,366.8	1,508,092.0	2,443,458.8
357	Insurance carriers	0.0	1,081,369.0	2,062,007.9	3,143,376.8
358	Insurance agencies, brokerages, and related activities	0.0	240,928.7	417,707.2	658,635.9
359	Funds, trusts, and other financial vehicles	0.0	23,707.3	477,811.7	501,519.0
360	Real estate establishments	0.0	4,696,453.0	3,433,751.3	8,130,204.5
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	6,192,422.5	6,192,422.5
362	Automotive equipment rental and leasing	0.0	89,927.6	87,794.5	177,722.1
363	General and consumer goods rental except video tapes and discs	88,545.3	36,358.2	44,925.2	169,828.8
364	Video tape and disc rental	0.0	0.0	17,467.3	17,467.3
365	Commercial and industrial machinery and equipment rental and leasing	0.0	142,271.0	50,639.7	192,910.7
366	Lessors of nonfinancial intangible assets	35,211,804.0	292,139.9	67,166.3	35,571,112.0
367	Legal services	0.0	1,724,233.1	783,303.2	2,507,536.5
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	1,019,580.6	270,685.1	1,290,265.8
369	Architectural, engineering, and related services	1,430,845.0	972,380.3	169,935.9	2,573,161.3
370	Specialized design services	0.0	138,123.5	33,125.8	171,249.3
371	Custom computer programming services	0.0	87,520.1	21,325.9	108,846.0
372	Computer systems design services	0.0	308,945.5	63,312.0	372,257.6
373	Other computer related services, including facilities management	0.0	186,289.1	41,114.3	227,403.4
374	Management, scientific, and technical consulting services	0.0	2,258,233.8	303,297.0	2,561,530.8
375	Environmental and other technical consulting services	211,424.3	461,433.3	53,016.1	725,873.8
376	Scientific research and development services	34,929,168.0	1,520,568.4	83,509.3	36,533,244.0
377	Advertising and related services	0.0	1,050,883.4	241,849.5	1,292,732.9
378	Photographic services	0.0	18,095.3	15,350.6	33,445.9
379	Veterinary services	0.0	6,974.8	103,999.9	110,974.7
380	All other miscellaneous professional, scientific, and technical services	0.0	1,700,210.6	225,575.2	1,925,785.9
381	Management of companies and enterprises	0.0	3,600,603.8	464,032.6	4,064,636.3
382	Employment services	0.0	996,656.4	291,036.8	1,287,693.3
383	Travel arrangement and reservation services	0.0	201,221.6	80,428.5	281,650.0
384	Office administrative services	0.0	473,039.7	104,327.2	577,366.9
385	Facilities support services	0.0	27,108.7	3,692.8	30,801.5
386	Business support services	0.0	504,128.7	92,118.0	596,246.7
387	Investigation and security services	0.0	152,537.5	86,470.4	239,008.0
388	Services to buildings and dwellings	0.0	1,238,914.4	316,712.7	1,555,627.0
389	Other support services	217,606.3	209,617.0	62,677.2	489,900.5

394	Offices of physicians, dentists, and other health practitioners	0.0	13.4	2,242,469.3	2,242,482.8
395	Home health care services	0.0	0.0	364,706.8	364,706.8
	Medical and diagnostic labs and outpatient and other ambulatory				
396	care services	0.0	846.5	935,689.8	936,536.3
397	Private hospitals	0.0	28.7	2,949,569.8	2,949,598.5
398	Nursing and residential care facilities	0.0	0.0	593,744.3	593,744.3
399	Child day care services	0.0	0.0	255,504.1	255,504.1
400	Individual and family services	0.0	0.0	297,307.6	297,307.6
	Community food, housing, and other relief services, including				
401	rehabilitation services	0.0	0.0	106,939.8	106,939.8
413	Food services and drinking places	0.0	661,156.6	2,077,933.8	2,739,090.3
414	Automotive repair and maintenance, except car washes	0.0	195,962.6	386,066.4	582,029.0
415	Car washes	0.0	11,607.1	33,873.7	45,480.8
416	Electronic and precision equipment repair and maintenance	0.0	200,409.7	72,872.0	273,281.8
	Commercial and industrial machinery and equipment repair and				
417	maintenance	0.0	369,923.3	70,749.6	440,672.8
418	Personal and household goods repair and maintenance	0.0	114,632.4	78,839.0	193,471.4
425	Civic, social, professional, and similar organizations	0.0	301,310.0	277,626.3	578,936.3
426	Private household operations	0.0	0.0	73,144.9	73,144.9
427	US Postal Service	0.0	262,714.1	134,099.3	396,813.3
428	Federal electric utilities	0.0	0.0	0.0	0.0
429	Other Federal Government enterprises	0.0	9,634.9	22,748.8	32,383.7
430	State and local government passenger transit	0.0	40,598.1	41,837.7	82,435.8
431	State and local government electric utilities	0.0	20,692.3	12,486.9	33,179.3
432	Other state and local government enterprises	0.0	458,144.9	669,396.3	1,127,541.1

## Appendix P: Implan Results – Employee Compensation

### Employee Compensation

		Copyright 2012 Minnesota IMPLAN Group, Inc.			
Sector	Description	Direct	Indirect	Induced	Total
0	Total	29,037,195.9	16,493,726.9	15,396,406.2	60,927,328.5
31	Electric power generation, transmission, and distribution	0.0	172,045.4	104,575.8	276,621.2
32	Natural gas distribution	0.0	41,098.0	25,305.6	66,403.6
33	Water, sewage and other treatment and delivery systems	0.0	3,296.9	6,488.3	9,785.2
38	Construction of other new residential structures	0.0	896.5	1,309.9	2,206.4
39	Maintenance and repair construction of nonresidential structures	0.0	495,020.2	78,126.2	573,146.4
40	Maintenance and repair construction of residential structures	0.0	3,832.5	44,037.3	47,869.8
113	Printing	0.0	113,635.5	31,303.3	144,938.7
133	Pharmaceutical preparation manufacturing	2,220,965.0	103,563.5	35,211.9	2,359,740.3
134	In-vitro diagnostic substance manufacturing	0.0	7,793.2	6,453.1	14,246.3
135	Biological product (except diagnostic) manufacturing	1,294,826.1	64,571.8	962.8	1,360,360.8
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	91,996.9	540.4	152.4	92,689.7
299	Institutional furniture manufacturing	442,211.3	697.2	85.1	442,993.6
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	2,323,264.8	38,942.6	3,588.9	2,365,796.0
306	Surgical appliance and supplies manufacturing	0.0	13,773.2	4,844.4	18,617.6
318	Broom, brush, and mop manufacturing	0.0	187.6	735.9	923.5
319	Wholesale trade businesses	1,411,337.6	1,339,562.4	884,154.6	3,635,054.8
320	Retail Stores - Motor vehicle and parts	0.0	22,039.3	332,384.3	354,423.7
351	Telecommunications	0.0	307,076.7	209,031.9	516,108.6
352	Data processing, hosting, ISP, web search portals and related services	0.0	56,399.8	67,108.5	123,508.3
353	Other information services	0.0	237,793.9	24,571.4	262,365.3
354	Monetary authorities and depository credit intermediation activities	0.0	552,186.2	357,995.6	910,181.8
355	Nondepository credit intermediation and related activities	0.0	86,417.1	154,630.4	241,047.5
356	Securities, commodity contracts, investments, and related activities	0.0	489,583.5	789,355.6	1,278,939.1
357	Insurance carriers	0.0	286,607.8	546,517.8	833,125.5
358	Insurance agencies, brokerages, and related activities	0.0	129,321.3	224,209.2	353,530.4
359	Funds, trusts, and other financial vehicles	0.0	5,958.2	120,085.6	126,043.9
360	Real estate establishments	0.0	353,852.4	258,714.6	612,567.0
362	Automotive equipment rental and leasing	0.0	17,233.6	16,824.8	34,058.5
363	General and consumer goods rental except video tapes and discs	46,665.9	19,161.8	23,676.9	89,504.6



364	Video tape and disc rental	0.0	0.0	4,964.3	4,964.3
365	Commercial and industrial machinery and equipment rental and leasing	0.0	29,825.3	10,616.0	40,441.2
366	Lessors of nonfinancial intangible assets	1,890,015.0	15,680.8	3,605.2	1,909,301.0
367	Legal services	0.0	670,440.9	304,575.1	975,016.1
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	479,788.5	127,377.5	607,165.9
369	Architectural, engineering, and related services	718,535.9	488,305.9	85,337.7	1,292,179.6
370	Specialized design services	0.0	47,421.6	11,373.0	58,794.6
371	Custom computer programming services	0.0	53,306.7	12,989.2	66,295.9
372	Computer systems design services	0.0	311,301.4	63,794.8	375,096.3
373	Other computer related services, including facilities management	0.0	60,835.3	13,426.4	74,261.7
374	Management, scientific, and technical consulting services	0.0	1,083,030.1	145,458.7	1,228,488.8
375	Environmental and other technical consulting services	86,872.2	189,598.5	21,783.8	298,254.5
376	Scientific research and development services	18,457,008.0	803,487.3	44,127.3	19,304,622.0
377	Advertising and related services	0.0	398,077.9	91,613.3	489,691.3
381	Management of companies and enterprises	0.0	1,819,433.5	234,481.9	2,053,915.5
382	Employment services	0.0	707,118.6	206,487.9	913,606.5
383	Travel arrangement and reservation services	0.0	55,481.1	22,175.9	77,657.0
384	Office administrative services	0.0	231,754.9	51,112.7	282,867.6
385	Facilities support services	0.0	15,021.3	2,046.2	17,067.5
386	Business support services	0.0	209,508.0	38,282.8	247,790.8
387	Investigation and security services	0.0	81,611.4	46,263.9	127,875.3
388	Services to buildings and dwellings	0.0	486,501.2	124,367.8	610,869.1
389	Other support services	53,497.1	51,533.0	15,408.8	120,438.8
390	Waste management and remediation services	0.0	75,118.5	54,080.2	129,198.7
391	Private elementary and secondary schools	0.0	0.0	170,272.9	170,272.9
392	Private junior colleges, colleges, universities, and professional schools	0.0	4,233.2	399,210.7	403,443.9
393	Other private educational services	0.0	3,135.3	109,139.0	112,274.3
394	Offices of physicians, dentists, and other health practitioners	0.0	6.8	1,133,430.4	1,133,437.1
395	Home health care services	0.0	0.0	163,294.5	163,294.5
396	Medical and diagnostic labs and outpatient and other ambulatory care services	0.0	232.8	257,314.1	257,546.9
397	Private hospitals	0.0	15.7	1,616,739.8	1,616,755.5
413	Food services and drinking places	0.0	254,488.5	799,826.0	1,054,314.5

## Appendix Q: Implan Results – Proprietor’s Income

### ProprietorsIncome

		Copyright 2012 Minnesota IMPLAN Group, Inc.			
Sector	Description	Direct	Indirect	Induced	Total
0	Total	6,327,004.6	2,740,571.2	1,940,165.0	11,007,740.6
20	Extraction of oil and natural gas	0.0	35,083.0	20,913.3	55,996.3
31	Electric power generation, transmission, and distribution	0.0	73,326.4	44,570.6	117,897.1
32	Natural gas distribution	0.0	13,116.2	8,076.2	21,192.4
33	Water, sewage and other treatment and delivery systems	0.0	1,304.1	2,566.5	3,870.6
39	Maintenance and repair construction of nonresidential structures	0.0	54,842.4	8,655.5	63,497.9
40	Maintenance and repair construction of residential structures	0.0	3,801.0	43,675.7	47,476.7
132	Medicinal and botanical manufacturing	0.0	2,122.2	37.3	2,159.5
133	Pharmaceutical preparation manufacturing	135,169.5	6,302.9	2,143.0	143,615.5
134	In-vitro diagnostic substance manufacturing	0.0	318.0	263.3	581.3
135	Biological product (except diagnostic) manufacturing	63,736.2	3,178.5	47.4	66,962.1
136	Paint and coating manufacturing	0.0	96.7	33.5	130.2
137	Adhesive manufacturing	0.0	196.7	54.0	250.7
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	117.4	0.7	0.2	118.3
299	Institutional furniture manufacturing	17,238.8	27.2	3.3	17,269.3
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	263,370.5	4,414.6	406.8	268,191.9
306	Surgical appliance and supplies manufacturing	0.0	1,330.6	468.0	1,798.6
319	Wholesale trade businesses	91,902.4	87,228.6	57,573.7	236,704.6
320	Retail Stores - Motor vehicle and parts	0.0	325.6	4,910.6	5,236.2
321	Retail Stores - Furniture and home furnishings	0.0	273.3	6,342.0	6,615.3
322	Retail Stores - Electronics and appliances	0.0	246.8	3,753.0	3,999.9
323	Retail Stores - Building material and garden supply	0.0	380.9	8,471.4	8,852.2
324	Retail Stores - Food and beverage	0.0	821.2	20,420.4	21,241.6
325	Retail Stores - Health and personal care	0.0	164.7	4,331.7	4,496.4
326	Retail Stores - Gasoline stations	0.0	1,108.7	26,240.8	27,349.5
327	Retail Stores - Clothing and clothing accessories	0.0	491.8	13,192.8	13,684.6
328	Retail Stores - Sporting goods, hobby, book and music	0.0	311.9	6,904.4	7,216.2
329	Retail Stores - General merchandise	0.0	114.7	2,742.7	2,857.4
330	Retail Stores - Miscellaneous	0.0	1,286.1	26,726.8	28,012.9
331	Retail Nonstores - Direct and electronic sales	0.0	1,171.3	17,996.4	19,167.7
332	Transport by air	0.0	469.4	887.1	1,356.6

333	Transport by rail	0.0	-55.9	-34.6	-90.5
334	Transport by water	0.0	1,075.8	43.3	1,119.0
335	Transport by truck	0.0	19,635.8	18,694.8	38,330.5
336	Transit and ground passenger transportation	0.0	217.4	224.0	441.4
337	Transport by pipeline	0.0	382.1	359.3	741.5
338	Scenic and sightseeing transportation and support activities for transportation	0.0	22,989.0	7,469.8	30,458.8
339	Couriers and messengers	0.0	4,021.9	1,119.4	5,141.3
340	Warehousing and storage	0.0	936.9	379.6	1,316.5
341	Newspaper publishers	0.0	1,930.3	618.1	2,548.4
342	Periodical publishers	0.0	1,446.0	389.0	1,834.9
343	Book publishers	0.0	146.9	222.6	369.6
344	Directory, mailing list, and other publishers	0.0	588.8	144.1	732.9
345	Software publishers	0.0	1,524.0	549.9	2,073.9
346	Motion picture and video industries	0.0	639.6	822.2	1,461.8
347	Sound recording industries	0.0	0.0	0.0	0.0
348	Radio and television broadcasting	0.0	34,259.8	8,829.4	43,089.2
349	Cable and other subscription programming	0.0	8,649.9	3,280.5	11,930.4
350	Internet publishing and broadcasting	0.0	3,061.1	708.3	3,769.4
351	Telecommunications	0.0	1,169.7	796.2	1,965.9
352	Data processing, hosting, ISP, web search portals and related services	0.0	3,129.6	3,723.9	6,853.5
353	Other information services	0.0	4,246.6	438.8	4,685.4
354	Monetary authorities and depository credit intermediation activities	0.0	48,589.8	31,502.0	80,091.8
355	Nondepository credit intermediation and related activities	0.0	7,408.5	13,256.5	20,665.0
356	Securities, commodity contracts, investments, and related activities	0.0	77,837.2	125,496.9	203,334.1
357	Insurance carriers	0.0	12,184.6	23,234.2	35,418.8
358	Insurance agencies, brokerages, and related activities	0.0	5,052.6	8,759.8	13,812.4
359	Funds, trusts, and other financial vehicles	0.0	3,925.4	79,113.8	83,039.2
360	Real estate establishments	0.0	420,048.0	307,112.7	727,160.8
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	0.0	0.0
362	Automotive equipment rental and leasing	0.0	3,204.2	3,128.2	6,332.3
363	General and consumer goods rental except video tapes and discs	8,718.6	3,580.0	4,423.6	16,722.2
364	Video tape and disc rental	0.0	0.0	919.7	919.7
365	Commercial and industrial machinery and equipment rental and leasing	0.0	4,541.2	1,616.4	6,157.5
366	Lessors of nonfinancial intangible assets	114,518.3	950.1	218.4	115,686.8
367	Legal services	0.0	188,369.5	85,574.5	273,944.1
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	134,267.1	35,646.1	169,913.3
369	Architectural, engineering, and related services	195,885.1	133,120.5	23,264.5	352,270.1
370	Specialized design services	0.0	13,136.9	3,150.6	16,287.4

371	Custom computer programming services	0.0	9,733.8	2,371.8	12,105.7
372	Computer systems design services	0.0	43,192.0	8,851.3	52,043.3
373	Other computer related services, including facilities management	0.0	83,161.8	18,353.9	101,515.7
374	Management, scientific, and technical consulting services	0.0	315,560.5	42,382.0	357,942.5
375	Environmental and other technical consulting services	24,769.8	54,060.1	6,211.2	85,041.1
376	Scientific research and development services	5,395,319.5	234,874.0	12,899.2	5,643,092.5
377	Advertising and related services	0.0	105,223.4	24,216.0	129,439.4
378	Photographic services	0.0	1,690.2	1,433.8	3,124.0
379	Veterinary services	0.0	700.3	10,442.0	11,142.3
380	All other miscellaneous professional, scientific, and technical services	0.0	39,768.6	5,276.3	45,044.9
381	Management of companies and enterprises	0.0	-315.7	-40.7	-356.4
382	Employment services	0.0	68,268.4	19,935.3	88,203.7
383	Travel arrangement and reservation services	0.0	7,752.0	3,098.5	10,850.5
384	Office administrative services	0.0	25,312.1	5,582.5	30,894.5
385	Facilities support services	0.0	2,145.5	292.3	2,437.7
386	Business support services	0.0	37,544.0	6,860.3	44,404.3
387	Investigation and security services	0.0	11,163.0	6,328.1	17,491.1
388	Services to buildings and dwellings	0.0	91,461.5	23,381.0	114,842.4
389	Other support services	16,258.6	15,661.7	4,683.0	36,603.3
390	Waste management and remediation services	0.0	5,550.9	3,996.3	9,547.1
391	Private elementary and secondary schools	0.0	0.0	4,220.5	4,220.5
392	Private junior colleges, colleges, universities, and professional schools	0.0	116.2	10,959.1	11,075.4
393	Other private educational services	0.0	79.3	2,759.6	2,838.8
394	Offices of physicians, dentists, and other health practitioners	0.0	1.7	277,480.9	277,482.6
395	Home health care services	0.0	0.0	35,522.0	35,522.0
396	Medical and diagnostic labs and outpatient and other ambulatory care services	0.0	55.6	61,505.4	61,561.0
397	Private hospitals	0.0	0.1	5,646.9	5,646.9
398	Nursing and residential care facilities	0.0	0.0	15,967.1	15,967.1
399	Child day care services	0.0	0.0	3,971.1	3,971.1
400	Individual and family services	0.0	0.0	6,993.5	6,993.5
401	Community food, housing, and other relief services, including rehabilitation services	0.0	0.0	3,070.2	3,070.2
402	Performing arts companies	0.0	2,040.7	5,494.9	7,535.6
403	Spectator sports companies	0.0	2,921.8	4,741.8	7,663.5
404	Promoters of performing arts and sports and agents for public figures	0.0	1,874.2	4,686.4	6,560.6
405	Independent artists, writers, and performers	0.0	7,120.4	4,159.9	11,280.3
406	Museums, historical sites, zoos, and parks	0.0	0.0	9,325.7	9,325.7
407	Fitness and recreational sports centers	0.0	287.9	1,245.9	1,533.9

408	Bowling centers	0.0	0.5	123.5	123.9
409	Amusement parks, arcades, and gambling industries	0.0	6.4	6,098.5	6,104.8
410	Other amusement and recreation industries	0.0	292.4	3,068.1	3,360.5
411	Hotels and motels, including casino hotels	0.0	1,156.5	1,048.5	2,205.0
412	Other accommodations	0.0	16.4	110.7	127.1
413	Food services and drinking places	0.0	7,391.0	23,228.8	30,619.8
414	Automotive repair and maintenance, except car washes	0.0	21,620.4	42,594.5	64,214.9
415	Car washes	0.0	1,024.1	2,988.6	4,012.7
416	Electronic and precision equipment repair and maintenance	0.0	19,472.1	7,080.4	26,552.5
417	Commercial and industrial machinery and equipment repair and maintenance	0.0	24,697.8	4,723.6	29,421.4
418	Personal and household goods repair and maintenance	0.0	3,165.6	2,177.2	5,342.7
419	Personal care services	0.0	0.0	15,417.3	15,417.3
420	Death care services	0.0	0.0	1,443.2	1,443.2
421	Dry-cleaning and laundry services	0.0	2,402.0	7,375.9	9,777.9
422	Other personal services	0.0	2,113.9	10,862.9	12,976.8
423	Religious organizations	0.0	0.0	58.7	58.7
424	Grantmaking, giving, and social advocacy organizations	0.0	13.3	972.2	985.5
425	Civic, social, professional, and similar organizations	0.0	1,254.2	1,155.6	2,409.8

## Appendix R: Implan Results – Other Property Type Income

### OtherPropertyTypeIncome

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Sector	Description	Direct	Indirect	Induced	Total
0	Total	21,677,680.6	9,482,202.1	10,089,793.8	41,249,674.7
20	Extraction of oil and natural gas	0.0	50,041.7	29,830.3	79,872.0
25	Mining and quarrying stone	0.0	4,026.6	1,480.2	5,506.8
31	Electric power generation, transmission, and distribution	0.0	503,595.8	306,104.9	809,700.7
32	Natural gas distribution	0.0	53,796.0	33,124.2	86,920.2
33	Water, sewage and other treatment and delivery systems	0.0	2,826.1	5,561.7	8,387.8
38	Construction of other new residential structures	0.0	55.1	80.6	135.7
39	Maintenance and repair construction of nonresidential structures	0.0	22,493.3	3,550.0	26,043.3
40	Maintenance and repair construction of residential structures	0.0	3,556.5	40,866.4	44,422.9
113	Printing	0.0	42,036.5	11,579.8	53,616.3
133	Pharmaceutical preparation manufacturing	4,026,320.3	187,747.1	63,834.5	4,277,901.5
134	In-vitro diagnostic substance manufacturing	0.0	138.3	114.6	252.9
135	Biological product (except diagnostic) manufacturing	1,438,872.6	71,755.3	1,069.9	1,511,697.9
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	2,102.9	12.4	3.5	2,118.7
299	Institutional furniture manufacturing	388,305.9	612.2	74.7	388,992.8
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	724,862.3	12,150.1	1,119.7	738,132.1
306	Surgical appliance and supplies manufacturing	0.0	8,721.4	3,067.5	11,788.9
319	Wholesale trade businesses	528,358.6	501,488.3	330,998.6	1,360,845.4
320	Retail Stores - Motor vehicle and parts	0.0	73.5	1,108.5	1,182.0
321	Retail Stores - Furniture and home furnishings	0.0	944.3	21,911.5	22,855.8
322	Retail Stores - Electronics and appliances	0.0	135.3	2,057.0	2,192.3
323	Retail Stores - Building material and garden supply	0.0	2,175.4	48,388.2	50,563.7
324	Retail Stores - Food and beverage	0.0	2,751.0	68,408.6	71,159.6
325	Retail Stores - Health and personal care	0.0	1,677.0	44,109.3	45,786.3
326	Retail Stores - Gasoline stations	0.0	2,586.5	61,219.2	63,805.7
327	Retail Stores - Clothing and clothing accessories	0.0	3,869.0	103,784.2	107,653.2
328	Retail Stores - Sporting goods, hobby, book and music	0.0	904.4	20,019.9	20,924.2
329	Retail Stores - General merchandise	0.0	1,147.1	27,431.8	28,578.9
330	Retail Stores - Miscellaneous	0.0	981.1	20,389.0	21,370.1
331	Retail Nonstores - Direct and electronic sales	0.0	13,549.5	208,183.3	221,732.7
332	Transport by air	0.0	4,704.9	8,891.3	13,596.2

333	Transport by rail	0.0	27,938.7	17,284.9	45,223.6
334	Transport by water	0.0	63,250.2	2,544.6	65,794.8
335	Transport by truck	0.0	32,382.4	30,830.6	63,213.0
336	Transit and ground passenger transportation	0.0	10,329.4	10,644.8	20,974.3
337	Transport by pipeline	0.0	263.6	247.9	511.6
338	Scenic and sightseeing transportation and support activities for transportation	0.0	19,692.3	6,398.6	26,091.0
339	Couriers and messengers	0.0	86,023.6	23,941.6	109,965.3
340	Warehousing and storage	0.0	31,420.0	12,730.8	44,150.8
341	Newspaper publishers	0.0	18,909.9	6,054.6	24,964.5
342	Periodical publishers	0.0	26,107.5	7,022.5	33,130.0
343	Book publishers	0.0	8,554.0	12,960.3	21,514.3
344	Directory, mailing list, and other publishers	0.0	59,338.3	14,525.3	73,863.6
345	Software publishers	0.0	50,155.9	18,098.0	68,253.9
346	Motion picture and video industries	0.0	13,975.4	17,964.8	31,940.2
347	Sound recording industries	0.0	354.5	2,559.2	2,913.7
348	Radio and television broadcasting	0.0	-33,830.1	-8,718.7	-42,548.7
349	Cable and other subscription programming	0.0	8,363.8	3,172.0	11,535.8
350	Internet publishing and broadcasting	0.0	363,905.8	84,208.9	448,114.8
351	Telecommunications	0.0	410,391.7	279,360.0	689,751.6
352	Data processing, hosting, ISP, web search portals and related services	0.0	27,567.3	32,801.5	60,368.8
353	Other information services	0.0	391,055.8	40,408.0	431,463.8
354	Monetary authorities and depository credit intermediation activities	0.0	929,367.4	602,531.3	1,531,898.8
355	Nondepository credit intermediation and related activities	0.0	44,877.8	80,302.1	125,179.9
356	Securities, commodity contracts, investments, and related activities	0.0	-2,847.3	-4,590.7	-7,438.0
357	Insurance carriers	0.0	202,515.3	386,166.2	588,681.4
358	Insurance agencies, brokerages, and related activities	0.0	35,843.3	62,142.9	97,986.2
359	Funds, trusts, and other financial vehicles	0.0	-4,428.6	-89,257.2	-93,685.9
360	Real estate establishments	0.0	2,338,179.8	1,709,530.0	4,047,709.5
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	3,452,692.5	3,452,692.5
362	Automotive equipment rental and leasing	0.0	15,279.7	14,917.3	30,197.1
363	General and consumer goods rental except video tapes and discs	626.4	257.2	317.8	1,201.5
364	Video tape and disc rental	0.0	0.0	1,671.5	1,671.5
365	Commercial and industrial machinery and equipment rental and leasing	0.0	20,147.1	7,171.1	27,318.2
366	Lessors of nonfinancial intangible assets	17,445,574.0	144,739.8	33,277.3	17,623,590.0
367	Legal services	0.0	212,730.8	96,641.7	309,372.5
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	118,470.6	31,452.4	149,923.0
369	Architectural, engineering, and related services	5,385.1	3,659.6	639.6	9,684.3

370	Specialized design services	0.0	23,964.6	5,747.4	29,712.0
371	Custom computer programming services	0.0	933.2	227.4	1,160.6
372	Computer systems design services	0.0	-72,190.5	-14,794.0	-86,984.5
373	Other computer related services, including facilities management	0.0	38,229.5	8,437.3	46,666.8
374	Management, scientific, and technical consulting services	0.0	193,724.5	26,018.6	219,743.0
375	Environmental and other technical consulting services	24,060.2	52,511.4	6,033.3	82,604.9
376	Scientific research and development services	-2,980,542.5	-129,751.7	-7,125.9	-3,117,420.3
377	Advertising and related services	0.0	96,494.3	22,207.1	118,701.5
378	Photographic services	0.0	3,575.4	3,033.1	6,608.5
379	Veterinary services	0.0	169.1	2,520.7	2,689.8
380	All other miscellaneous professional, scientific, and technical services	0.0	687,777.4	91,250.8	779,028.1
381	Management of companies and enterprises	0.0	576,202.1	74,258.8	650,460.9
382	Employment services	0.0	57,027.1	16,652.7	73,679.8
383	Travel arrangement and reservation services	0.0	60,844.7	24,319.7	85,164.4
384	Office administrative services	0.0	76,375.3	16,844.3	93,219.6
385	Facilities support services	0.0	1,212.4	165.2	1,377.6
386	Business support services	0.0	76,720.4	14,018.9	90,739.3
387	Investigation and security services	0.0	12,031.7	6,820.5	18,852.2
388	Services to buildings and dwellings	0.0	100,341.5	25,651.0	125,992.6
389	Other support services	73,754.8	71,047.0	21,243.6	166,045.5
390	Waste management and remediation services	0.0	37,962.9	27,330.7	65,293.6
391	Private elementary and secondary schools	0.0	0.0	1,856.6	1,856.6
392	Private junior colleges, colleges, universities, and professional schools	0.0	232.1	21,889.0	22,121.1
393	Other private educational services	0.0	736.8	25,648.8	26,385.7
394	Offices of physicians, dentists, and other health practitioners	0.0	1.2	206,666.4	206,667.6
395	Home health care services	0.0	0.0	52,107.7	52,107.7
396	Medical and diagnostic labs and outpatient and other ambulatory care services	0.0	212.3	234,652.2	234,864.5
397	Private hospitals	0.0	0.6	59,020.5	59,021.1
398	Nursing and residential care facilities	0.0	0.0	544.7	544.7
399	Child day care services	0.0	0.0	68,132.1	68,132.1
400	Individual and family services	0.0	0.0	20,185.9	20,185.9
401	Community food, housing, and other relief services, including rehabilitation services	0.0	0.0	-18,226.1	-18,226.1
402	Performing arts companies	0.0	395.7	1,065.4	1,461.1
403	Spectator sports companies	0.0	600.1	974.0	1,574.1
404	Promoters of performing arts and sports and agents for public figures	0.0	1,872.6	4,682.5	6,555.0
405	Independent artists, writers, and performers	0.0	5,366.6	3,135.3	8,501.9
406	Museums, historical sites, zoos, and parks	0.0	0.0	3,531.6	3,531.6



407	Fitness and recreational sports centers	0.0	203.1	879.0	1,082.1
408	Bowling centers	0.0	2.1	582.2	584.3
409	Amusement parks, arcades, and gambling industries	0.0	11.0	10,588.3	10,599.4
410	Other amusement and recreation industries	0.0	3,118.6	32,724.3	35,842.9
411	Hotels and motels, including casino hotels	0.0	6,963.8	6,313.2	13,276.9
412	Other accommodations	0.0	95.5	646.5	742.1
413	Food services and drinking places	0.0	81,783.3	257,034.8	338,818.0
414	Automotive repair and maintenance, except car washes	0.0	21,886.4	43,118.4	65,004.8
415	Car washes	0.0	1,999.4	5,835.1	7,834.5
416	Electronic and precision equipment repair and maintenance	0.0	51,178.8	18,609.4	69,788.2
417	Commercial and industrial machinery and equipment repair and maintenance	0.0	92,571.0	17,704.6	110,275.7
418	Personal and household goods repair and maintenance	0.0	27,692.6	19,045.8	46,738.4
419	Personal care services	0.0	0.0	48,187.2	48,187.2
420	Death care services	0.0	0.0	274.8	274.8
421	Dry-cleaning and laundry services	0.0	6,440.6	19,777.4	26,218.0
422	Other personal services	0.0	19,288.7	99,119.3	118,408.0
423	Religious organizations	0.0	0.0	12,562.1	12,562.1
431	State and local government electric utilities	0.0	3,452.1	2,083.2	5,535.3
432	Other state and local government enterprises	0.0	41,987.3	61,347.7	103,335.0

## Appendix S: Implan Results – Indirect Business Taxes

### Indirect Business Taxes

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Sector	Description	Direct	Indirect	Induced	Total
		1,200,132.	1,978,941.	2,960,822.	6,139,896.
0	Total	5	8	4	7
20	Extraction of oil and natural gas	0.0	9,229.3	5,501.7	14,731.0
25	Mining and quarrying stone	0.0	303.9	111.7	415.6
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	0.0	190.4	58.6	249.0
29	Support activities for oil and gas operations	0.0	2.4	1.4	3.8
30	Support activities for other mining	0.0	26.2	0.7	26.8
31	Electric power generation, transmission, and distribution	0.0	146,833.5	89,251.0	236,084.5
32	Natural gas distribution	0.0	19,084.6	11,751.1	30,835.8
33	Water, sewage and other treatment and delivery systems	0.0	484.4	953.2	1,437.6
38	Construction of other new residential structures	0.0	12.5	18.3	30.9
39	Maintenance and repair construction of nonresidential structures	0.0	6,159.0	972.0	7,131.0
40	Maintenance and repair construction of residential structures	0.0	42.8	492.2	535.0
70	Soft drink and ice manufacturing	0.0	21.7	605.9	627.6
71	Breweries	0.0	129.4	11,715.5	11,844.9
74	Tobacco product manufacturing	0.0	0.0	833.0	833.0
105	Paper mills	0.0	313.7	286.4	600.1
106	Paperboard Mills	0.0	219.2	39.3	258.5
107	Paperboard container manufacturing	0.0	1,984.9	440.4	2,425.4
	Coated and laminated paper, packaging paper and plastics film				
108	manufacturing	0.0	331.4	109.9	441.2
113	Printing	0.0	2,319.7	639.0	2,958.7
114	Support activities for printing	0.0	141.0	38.8	179.8
115	Petroleum refineries	0.0	152.7	127.8	280.5
126	Other basic organic chemical manufacturing	0.0	783.7	59.5	843.2
127	Plastics material and resin manufacturing	0.0	2,030.5	230.4	2,260.9
128	Synthetic rubber manufacturing	0.0	115.5	6.2	121.8
132	Medicinal and botanical manufacturing	0.0	409.5	7.2	416.7
133	Pharmaceutical preparation manufacturing	69,402.6	3,236.2	1,100.3	73,739.2
134	In-vitro diagnostic substance manufacturing	0.0	79.4	65.7	145.1
135	Biological product (except diagnostic) manufacturing	32,434.5	1,617.5	24.1	34,076.1
141	All other chemical product and preparation manufacturing	0.0	104.9	25.5	130.4
142	Plastics packaging materials and unlaminated film and sheet manufacturing	0.0	465.4	106.6	572.0

146	Polystyrene foam product manufacturing	0.0	705.9	334.0	1,039.9
149	Other plastics product manufacturing	0.0	836.1	228.3	1,064.4
150	Tire manufacturing	0.0	11.0	37.0	48.0
151	Rubber and plastics hoses and belting manufacturing	0.0	0.3	0.2	0.5
152	Other rubber product manufacturing	0.0	342.4	66.4	408.8
171	Steel product manufacturing from purchased steel	0.0	236.1	28.7	264.9
243	Semiconductor and related device manufacturing	0.0	748.7	194.7	943.4
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	4,081.9	24.0	6.8	4,112.7
283	Motor vehicle parts manufacturing	0.0	146.9	99.9	246.8
299	Institutional furniture manufacturing	6,150.8	9.7	1.2	6,161.7
305	Surgical and medical instrument, laboratory and medical instrument manufacturing	36,296.6	608.4	56.1	36,961.0
311	Sporting and athletic goods manufacturing	0.0	4.2	316.2	320.4
312	Doll, toy, and game manufacturing	0.0	1.9	83.8	85.8
313	Office supplies (except paper) manufacturing	0.0	1.6	2.0	3.6
314	Sign manufacturing	0.0	348.9	81.1	429.9
					1,392,513.
319	Wholesale trade businesses	540,653.8	513,158.2	338,701.1	1
320	Retail Stores - Motor vehicle and parts	0.0	5,490.9	82,810.6	88,301.5
321	Retail Stores - Furniture and home furnishings	0.0	1,430.1	33,184.7	34,614.8
322	Retail Stores - Electronics and appliances	0.0	1,185.0	18,017.6	19,202.5
323	Retail Stores - Building material and garden supply	0.0	3,295.7	73,305.3	76,600.9
324	Retail Stores - Food and beverage	0.0	5,393.1	134,111.3	139,504.4
325	Retail Stores - Health and personal care	0.0	2,041.6	53,699.2	55,740.9
326	Retail Stores - Gasoline stations	0.0	1,550.5	36,700.0	38,250.6
327	Retail Stores - Clothing and clothing accessories	0.0	2,946.9	79,050.6	81,997.6
328	Retail Stores - Sporting goods, hobby, book and music	0.0	1,227.9	27,182.3	28,410.2
329	Retail Stores - General merchandise	0.0	2,751.5	65,798.2	68,549.7
330	Retail Stores - Miscellaneous	0.0	1,677.4	34,859.4	36,536.8
331	Retail Nonstores - Direct and electronic sales	0.0	5,497.7	84,471.1	89,968.9
332	Transport by air	0.0	3,614.1	6,829.9	10,444.1
333	Transport by rail	0.0	1,321.9	817.8	2,139.8
334	Transport by water	0.0	10,828.6	435.6	11,264.2
335	Transport by truck	0.0	2,877.4	2,739.5	5,617.0
336	Transit and ground passenger transportation	0.0	1,611.2	1,660.4	3,271.7
337	Transport by pipeline	0.0	617.9	581.0	1,198.9
338	Scenic and sightseeing transportation and support activities for transportation	0.0	15,794.2	5,132.0	20,926.2

339	Couriers and messengers	0.0	17,947.9	4,995.2	22,943.1
340	Warehousing and storage	0.0	821.6	332.9	1,154.5
341	Newspaper publishers	0.0	3,349.9	1,072.6	4,422.5
342	Periodical publishers	0.0	2,233.7	600.8	2,834.6
343	Book publishers	0.0	326.2	494.2	820.3
344	Directory, mailing list, and other publishers	0.0	1,458.0	356.9	1,814.9
345	Software publishers	0.0	1,956.9	706.1	2,663.1
346	Motion picture and video industries	0.0	1,177.6	1,513.8	2,691.5
347	Sound recording industries	0.0	14.5	105.0	119.6
348	Radio and television broadcasting	0.0	2,785.2	717.8	3,503.0
349	Cable and other subscription programming	0.0	1,842.4	698.7	2,541.1
350	Internet publishing and broadcasting	0.0	9,115.8	2,109.4	11,225.2
351	Telecommunications	0.0	113,822.7	77,480.9	191,303.5
352	Data processing, hosting, ISP, web search portals and related services	0.0	1,932.6	2,299.6	4,232.2
353	Other information services	0.0	8,809.4	910.3	9,719.7
354	Monetary authorities and depository credit intermediation activities	0.0	45,307.8	29,374.1	74,681.9
355	Nondepository credit intermediation and related activities	0.0	7,549.9	13,509.3	21,059.2
356	Securities, commodity contracts, investments, and related activities	0.0	13,404.1	21,611.4	35,015.4
357	Insurance carriers	0.0	48,206.1	91,921.7	140,127.8
358	Insurance agencies, brokerages, and related activities	0.0	1,245.7	2,159.7	3,405.4
359	Funds, trusts, and other financial vehicles	0.0	297.3	5,991.0	6,288.2
360	Real estate establishments	0.0	538,692.1	393,857.8	932,549.9
361	Imputed rental activity for owner-occupied dwellings	0.0	0.0	688,556.9	688,556.9
362	Automotive equipment rental and leasing	0.0	6,809.7	6,648.1	13,457.8
363	General and consumer goods rental except video tapes and discs	5,073.9	2,083.4	2,574.3	9,731.6
364	Video tape and disc rental	0.0	0.0	1,518.1	1,518.1
365	Commercial and industrial machinery and equipment rental and leasing	0.0	6,514.1	2,318.6	8,832.7
366	Lessors of nonfinancial intangible assets	341,440.3	2,832.8	651.3	344,924.4
367	Legal services	0.0	39,024.4	17,728.4	56,752.9
368	Accounting, tax preparation, bookkeeping, and payroll services	0.0	4,875.0	1,294.3	6,169.3
369	Architectural, engineering, and related services	7,751.2	5,267.6	920.6	13,939.4
370	Specialized design services	0.0	3,161.0	758.1	3,919.1
371	Custom computer programming services	0.0	2,310.6	563.0	2,873.6
372	Computer systems design services	0.0	8,146.2	1,669.4	9,815.5
373	Other computer related services, including facilities management	0.0	2,311.1	510.1	2,821.2
374	Management, scientific, and technical consulting services	0.0	17,199.7	2,310.0	19,509.8
375	Environmental and other technical consulting services	1,059.9	2,313.3	265.8	3,639.0
376	Scientific research and development services	153,038.7	6,662.2	365.9	160,066.8
377	Advertising and related services	0.0	12,440.6	2,863.1	15,303.7

378	Photographic services	0.0	944.6	801.3	1,745.9
379	Veterinary services	0.0	142.2	2,120.0	2,262.1
380	All other miscellaneous professional, scientific, and technical services	0.0	15,523.3	2,059.5	17,582.8
381	Management of companies and enterprises	0.0	39,261.6	5,059.9	44,321.5
382	Employment services	0.0	3,743.9	1,093.3	4,837.1
383	Travel arrangement and reservation services	0.0	1,195.1	477.7	1,672.8
384	Office administrative services	0.0	7,715.3	1,701.6	9,416.8
385	Facilities support services	0.0	321.3	43.8	365.0
386	Business support services	0.0	8,230.3	1,503.9	9,734.2
387	Investigation and security services	0.0	3,133.5	1,776.3	4,909.9
388	Services to buildings and dwellings	0.0	28,322.7	7,240.3	35,563.0
389	Other support services	2,748.3	2,647.4	791.6	6,187.2
390	Waste management and remediation services	0.0	10,440.6	7,516.5	17,957.2
391	Private elementary and secondary schools	0.0	0.0	3,174.5	3,174.5