2012

Technology Generators in the Dayton Region: Leveraging Regional Assets for Economic Recovery

Kim Frazier
Dayton Development Coalition

Jane Dockery
Wright State University - Main Campus, jane.dockery@wright.edu

Follow this and additional works at: http://corescholar.libraries.wright.edu/cupa_econdev

Part of the Public Economics Commons

Repository Citation

This Article is brought to you for free and open access by the Center for Urban and Public Affairs at CORE Scholar. It has been accepted for inclusion in Economic Development by an authorized administrator of CORE Scholar. For more information, please contact corescholar@www.libraries.wright.edu.
Kim Frazier
Executive Director, Strategic Analytics and Evaluation
Dayton Development Coalition

Jane Dockery
Associate Director
Wright State University
Center for Urban and Public Affairs
**table of contents**

4 executive summary

6 primary technology generators

8 challenges of translating technology

11 transforming the dayton region

26 endnotes
executive summary

The Dayton Region shows tremendous promise in becoming an area known for its technology and innovation with a strong concentration of research and development and a capacity for innovative manufacturing. Yet to become an innovative leader, the Dayton Region must transform its culture and realign investments that will promote its technology capability and strengthen the economy. The old ways of doing business and training the workforce are no longer sufficient to become a player in the global economy. This report compares the Dayton Region to other regions across the country, points out gaps in various innovation and economic indicators, and makes recommendations for transforming the Dayton Region into an innovative, knowledge-based economy.

**recommendation one**
Develop an Innovation Ecosystem. Performing research isn’t enough. In order to be a player in the innovation economy, the Dayton Region must find applications for technology – potential commercial markets where technology is adapted and advanced.

**recommendation two**
Increase the Region’s Global Fluency. In addition to seeking out global markets for exports, the Dayton Region must also welcome immigrants, a demographic that is known for its entrepreneurship.

**recommendation three**
Transform the Region’s Workforce. The Dayton Region’s workforce can no longer earn a high wage without postsecondary education and training.
Transform the culture into one that values higher education, with a special emphasis on high school students and the adult workforce. In addition, the higher education system must be responsive to business demand for skilled workers.

**recommendation four**
Track Regional Performance. For the Dayton Region to be a global player in the innovation economy, it must be measured against other globally fluent regions. This will provide state and local leaders a view to any gaps that exist and a strategy to address them with public and private investment.

Building an innovation economy is within the Dayton Region’s reach. Yet these culture transformations must begin now in order to be competitive.
The 21st century brought with it an era of turmoil for the Dayton Region. Thousands of job losses occurred simultaneously with growth in technological innovations and industries.

This duality has made it imperative to leverage the assets that the Dayton Region offers to create new jobs and opportunities for the Region’s residents and the industries that drive the regional economy. At the same time, the Region’s culture, workforce, and investment priorities must be realigned to ensure future growth and prosperity.

This report will provide a comparison between Dayton and other regions expected to grow in “technology generator industries.” Technology generator industries are industries that innovate and develop new technologies, offering economic growth potential to regions. Technology generator industries, including knowledge-intensive service and high-technology manufacturing industries, have become a major part of the global economy (NSF, 2010).

The U.S. economy has the highest concentration of technology generator industries among major economies (NSF). These industries account for 38 percent of U.S. gross national product (GNP).

Studying trends in technology generator industries and analyzing economic measures will help to identify the Dayton Region’s challenges and form a strategy to accelerate economic development.
One of the Dayton Region’s greatest assets is the existence of industries that generate technology – from advanced manufacturing that generates technology and improves productivity to the research and development (R&D) industry that continuously seeks solutions to scientific and engineering challenges.

The combination of advanced manufacturing and research and development promises to grow over the next five years. A study by the State Science and Technology Institute (SSTI) identifies the industries that generate technology based on two criteria: the percentage of the workforce within the industry that is made up of scientists and engineers, and the percentage of corporate investment that is spent on research and development based on a survey of industries from the National Science Foundation (NSF).1

Applying SSTI’s criteria for primary technology generators and adding the R&D industry, 24 regions were found to have strong technology generator industries, having location quotients (LQ) of 1.25 or higher. The LQ measures industry concentration, with 1.0 being the national average. An LQ of 1.25 means that a region has a 25 percent higher industry concentration than the national average of 1.0.

Of the 24 regions with a strong concentration of technology generator and R&D industries (LQ>1.25), 17 regions are expected to grow within the next five years, including the Dayton Region. Dayton’s expected growth rate is 9 percent, which is higher than the national average of 7 percent. In addition, Dayton’s jobs multiplier for this group of industries is 5.2. Therefore, with the current projected increase...
of nearly 1,700 jobs, the impact will total nearly 9,000 jobs. And the jobs created will be high-skill, high-wage positions.

Technology generator industries are more concentrated in the Dayton Region than in Ohio. Although the Dayton MSA represents only 7 percent of the State of Ohio’s total workforce, the Dayton MSA represents almost 12 percent of Ohio’s workforce within the technology industries.

Of the regions that are expected to grow in the technology generator industries, only three are located in Midwestern rust-belt states, and only two of those, Madison and Dayton, are expected to grow faster than the national average in technology generator industries.

Source: EMSI Covered Employment - 2011.4
Of the nine regions that are expected to grow faster than the national average in technology generator industries, Dayton’s economy is the smallest as measured by Gross Domestic Product (GDP). Although most of these regions have a significantly larger population, which drives GDP, Dayton also has the lowest GDP per capita in technology generator industries. This paper investigates the factors affecting Dayton’s ability to translate technology into economic output.

<table>
<thead>
<tr>
<th>Metro Area</th>
<th>2010 GDP (millions)</th>
<th>2010 GDP per capita</th>
<th>Ranking of GDP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington, DC</td>
<td>$452,167</td>
<td>$68,283</td>
<td>4</td>
</tr>
<tr>
<td>San Francisco</td>
<td>$235,927</td>
<td>$68,008</td>
<td>16</td>
</tr>
<tr>
<td>Boston</td>
<td>$313,690</td>
<td>$62,395</td>
<td>9</td>
</tr>
<tr>
<td>Seattle</td>
<td>$231,221</td>
<td>$60,859</td>
<td>12</td>
</tr>
<tr>
<td>San Diego</td>
<td>$171,568</td>
<td>$40,002</td>
<td>16</td>
</tr>
<tr>
<td>Baltimore</td>
<td>$144,789</td>
<td>$47,720</td>
<td>19</td>
</tr>
<tr>
<td>Raleigh</td>
<td>$57,278</td>
<td>$45,386</td>
<td>49</td>
</tr>
<tr>
<td>Madison</td>
<td>$35,615</td>
<td>$35,392</td>
<td>63</td>
</tr>
<tr>
<td>Dayton</td>
<td>$33,371</td>
<td>$35,669</td>
<td>65</td>
</tr>
</tbody>
</table>

Source: US Bureau of Economic Analysis
*Among the Top 100 Metropolitan Statistical Areas in the U.S.

A factor affecting Dayton’s low GDP is the continuous economic downturn suffered in the last decade. Although the U.S. has been in a recession since December 2007, the Dayton Region’s economic stress began much earlier. In the decade between 2001 and 2011, the Dayton Region lost jobs every year, with an overall reduction of more than 60,000 of the more than 430,000 jobs in the Dayton MSA.

The industry most damaged was the manufacturing industry, which lost nearly 35,000 jobs in the period from 2001-2011, representing a 46 percent reduction in the Region’s manufacturing workforce.

As the Dayton Region’s driver industry, the manufacturing losses devastated the rest of the economy. During the ten-year period, the Dayton MSA was third among U.S. regions for the number of non-manufacturing jobs lost.

<table>
<thead>
<tr>
<th>Metropolitan Statistical Area (MSA)</th>
<th>Jobs Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detroit-Warren-Livonia, MI</td>
<td>-105,761</td>
</tr>
<tr>
<td>New Orleans-Metairie-Kenner, LA</td>
<td>-38,317</td>
</tr>
<tr>
<td>Dayton, OH</td>
<td>-13,242</td>
</tr>
<tr>
<td>San Francisco-Oakland-Fremont, CA</td>
<td>-11,525</td>
</tr>
<tr>
<td>Toledo, OH</td>
<td>-9,476</td>
</tr>
<tr>
<td>Topeka, KS</td>
<td>-7,718</td>
</tr>
<tr>
<td>Flint, MI</td>
<td>-5,724</td>
</tr>
<tr>
<td>Muncie, IN</td>
<td>-5,348</td>
</tr>
<tr>
<td>Battle Creek, MI</td>
<td>-4,409</td>
</tr>
<tr>
<td>Saginaw-Saginaw Township North, MI</td>
<td>-3,574</td>
</tr>
</tbody>
</table>

Source: EMSI Covered Employment - 2011.4

Since 2004 through most of 2011, the Dayton Region had a higher unemployment rate than the US average, and at times this difference exceeded 2 percentage points. In addition to the job losses and related high unemployment rates, the Dayton MSA experienced a population loss of almost 6,000 people, landing Dayton on the Forbes 2008 list of America’s Fastest-Dying Cities. The loss of population also resulted in the Dayton Region’s loss of a congressional seat in 2012.

However, even with all the economic challenges, the Dayton Region has opportunity. Most importantly, the Dayton Region is home to the Wright-Patterson Air Force Base (WPAFB), which includes the Air Force Research Laboratory (AFRL). The Base Realignment and Closure (BRAC) 2005 resulted in several wins for WPAFB, which is projected to create approximately 1,200 direct jobs for the Dayton Region, of which nearly half were civilian positions.

More than 27,000 people work at Wright-Patterson Air Force Base. Not only is that the largest single-site employer in the state and the largest employer in the Dayton area, it creates as many jobs as the 2nd, 3rd, and 4th largest Dayton-based employers combined. More than 10.6 percent of the entire Dayton GDP...
results from federal government employment in the Dayton MSA.

AFRL’s research and development budget alone is nearly twice the R&D investment made by all Ohio Academic and public institutions. In fact, if AFRL’s R&D expenditures were compared in public and private universities across all state R&D expenditures, AFRL ranks #3. Only California and New York universities are spending more on R&D.

The research and development industry cluster that supports WPAFB also grew during the ten-year period, adding approximately 1,400 jobs since 2005, or an increase of almost 17 percent. Aerospace manufacturing also managed to grow by 32 percent during the decade, even while the automotive manufacturing industry fell by 78 percent.

The Dayton Region is still competitive in manufacturing, having a concentration 20 percent higher than the national average in manufacturing employment and even higher concentrations in targeted industries, such as aerospace parts manufacturing.

<table>
<thead>
<tr>
<th>Industry</th>
<th>2001 Jobs</th>
<th>2011 Jobs</th>
<th>% Change</th>
<th>2011 LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive mfg</td>
<td>16,905</td>
<td>3,747</td>
<td>-78%</td>
<td>1.91</td>
</tr>
<tr>
<td>Aerospace mfg</td>
<td>2,120</td>
<td>2,798</td>
<td>32%</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Source: EMSI Covered Employment - 2011.4
Technology Generators and the Dayton Region

Innovative manufacturers will require access to an extensive R&D capacity to remain competitive and efficient, while creating new products that anticipate and respond to market demand. This necessary interplay between technology generator industries and R&D industries is essential to adding value and is another challenge for the Dayton Region.

For the Dayton Region to transform its economy and compete in a global marketplace, it requires a cluster transformation. Having an R&D and manufacturing capacity in the Region will not be enough to drive the innovation economy. Manufacturers will need to have access to the R&D and to the innovations that will make production more efficient and competitive in the global marketplace. Dayton must create new models for industry to connect with R&D. By connecting these two capacities, the Dayton Region could be a leader in innovative manufacturing and technology generation.

The company will need to respond quickly to customer needs by rapidly producing customized, inexpensive, and high-quality products. This will require factories that can be quickly reconfigured to adapt to changing production and that can be operated by highly motivated and skilled knowledge workers. Workers organized into teams—both within and outside a company—will become a vital aspect of manufacturing. As participants in extended enterprises, next-generation companies will only undertake that part of the manufacturing process that they can do better than others, something industry calls “adding value.”

Job multipliers for innovative industries are usually much higher than those for industries that have low-skilled workers. For instance, the industry for research and development in physical, engineering, and life sciences (NAICS 541712) has a jobs multiplier of 2.32, meaning that every job created, an additional 1.32 jobs is generated as well. Contrast this to the industry for home health care services (NAICS 621610), an industry that has grown rapidly due to Ohio’s aging population. However, this industry’s job multiplier is just 1.36. In addition, approximately 75 percent of the occupations in the R&D industry are high-skilled and the average wages in 2010 were $82,500. The home health care industry mostly employs low-skilled workers, and the average 2010 wages were $32,500.

Although the Dayton Region lost jobs during the 2001-2011 decade, it gained high-skilled jobs, while losing low-skilled ones. This same trend is expected to continue, as occupational projections for the Region indicate that an increasing percentage of the future workforce will require some kind of postsecondary education.

<table>
<thead>
<tr>
<th>Education level required</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term on-the-job training</td>
<td>-14,683</td>
</tr>
<tr>
<td>Moderate-term on-the-job training</td>
<td>-25,801</td>
</tr>
<tr>
<td>Long-term on-the-job training</td>
<td>-7,847</td>
</tr>
<tr>
<td>Work experience in a related field</td>
<td>1,968</td>
</tr>
<tr>
<td>Postsecondary vocation award</td>
<td>6,873</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>3,762</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>14,365</td>
</tr>
<tr>
<td>Degree plus work experience</td>
<td>1,893</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>1,903</td>
</tr>
<tr>
<td>First professional degree</td>
<td>1,173</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>1,256</td>
</tr>
</tbody>
</table>

Source: EMSI Covered Employment - 2011.4
The expected growth in technology generator industries suggests that the Dayton Region – and its strong capacity in manufacturing and R&D – could be a player in the high-tech, high-skilled industries that will drive the U.S. and global economies.

The Dayton Region’s strength as a technology generating region is evident from the industries that are growing, its prominence in research and development, and its technical workforce of computer scientists and engineers.

But serving a Department of Defense industry creates unique and hard-to-scale challenges. For example, for national security reasons, not even job numbers associated with the intelligence center on WPAFB are released to the public, much less the innovations there that may be transferable to the commercial sector.

To achieve economic growth that will accelerate the recovery and build a strong economy, the Dayton Region must overcome significant barriers. According to the Council on Competitiveness, communities that have excelled in technology and innovation are those that have successfully linked innovation to local assets.

Comparing the Dayton Region to other regional leaders in the technology generator industries will dissect the challenges just described. The following analysis digs deeper into these challenges and offers recommendations that direct the Region toward success.

Many indicators are used to compare the Dayton MSA to other targeted regions, including research and development inputs and outputs, venture capital, exports, immigration, educational attainment, higher education, and workforce measures. When MSA data is not available, state comparisons are used. The measures are often from different years, as not all data was available annually.
Technology Generators and the Dayton Region

RECOMMENDATION ONE: LEVERAGE R&D ASSETS FOR ECONOMIC DEVELOPMENT

The Dayton Region has a strong research and development industry, and it is expected to continue to grow over the next decade. In addition to the presence of the Air Force Research Laboratory, the region hosts many R&D contractors from the private sector, including such renowned companies as Ball Aerospace, Northrop Grumman, and Lockheed Martin, as well as research universities.

As the foundation for technology innovation, R&D can generate improved productivity for companies and industries, spin-off technologies, commercialization opportunities for existing or new companies, and potential increases in jobs as new technologies are produced and brought to market.

Yet when comparing the Dayton Region to the other top MSAs that are also generating technologies, the Dayton Region falls short on numerous indicators. This assessment of Dayton’s and, for that matter, Ohio’s current inability to convert its strong R&D presence into high-tech commercial growth aligns with a study conducted by the National Association of Manufacturers entitled, “The Innovation Imperative in Manufacturing: How the United States Can Restore its Edge.” The study measures innovation inputs and performance and ranks Ohio as a state “struggling to translate positive inputs into performance.”

DEVELOP AN INNOVATION ECOSYSTEM

In addition to the R&D capacity, an innovation ecosystem requires smart customers that drive technology advancements as well as entrepreneurs that can identify winning technologies and find applications or commercial markets to advance the technology. Several measures of innovation uncover Dayton’s challenges to finding applications or commercial markets for the defense intellectual property (IP) developed in the region.

One measure of innovation is Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards. Dayton is the fourth largest recipient of SBIR and STTR awards among the top technology generator regions. Using a formula to measure R&D concentration compared to SBIR funding, the Dayton Region’s R&D concentration was 1.37, placing it above the national average of 1.0. Using a similar concentration formula to measure SBIR, the Dayton Region had the second highest concentration among the targeted regions. The high SBIR concentration versus the fair R&D concentration indicates that SBIR awards are not being leveraged into additional R&D investments.

<table>
<thead>
<tr>
<th>MSA</th>
<th>R&amp;D Concentration</th>
<th>SBIR concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>1.69</td>
<td>5.24</td>
</tr>
<tr>
<td>Dayton</td>
<td>1.37</td>
<td>5.13</td>
</tr>
<tr>
<td>Madison</td>
<td>6.28</td>
<td>4.52</td>
</tr>
<tr>
<td>San Diego</td>
<td>1.94</td>
<td>2.63</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>0.62</td>
<td>1.89</td>
</tr>
<tr>
<td>Baltimore</td>
<td>3.82</td>
<td>1.41</td>
</tr>
<tr>
<td>San Francisco</td>
<td>1.24</td>
<td>1.31</td>
</tr>
<tr>
<td>Seattle</td>
<td>0.81</td>
<td>1.02</td>
</tr>
<tr>
<td>Raleigh</td>
<td>1.59</td>
<td>0.59</td>
</tr>
<tr>
<td>US</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Dayton Development Coalition
Dayton ranks 21st among all MSAs in the dollar amount of Federal SBIR funding. Yet almost all of Dayton’s SBIR funding comes from the Department of Defense. As the table shows below, regions that are technology generators are receiving most of their SBIR funding from the U.S. Department of Health and Human Services. This analysis indicates that biotechnologies have more immediate commercialization capacity than defense technologies. Pharmaceuticals and medical devices have identifiable commercial markets, whereas the defense-related technology needs, particularly combat-related technologies, face barriers of secrecy and marketability.

Source: Dayton Development Coalition
Both the Dayton Region and the State of Ohio make substantial investments in the research and development that is required for innovation. The rate of academic R&D expenditures made in the Dayton Region and in Ohio is higher than the national average. The Ohio Third Frontier has also contributed greatly to state investment in R&D, making the state R&D expenditure per employee the highest among the targeted states.

Although Ohio’s universities are ahead of the national average in academic R&D, R&D outputs fall below the national average. Both journal article output and academic patents are below the national average and among the lowest of the targeted states.

Furthermore, business investments in R&D are lower in Ohio than in the other states that host the tech-gen regions. According to a private survey from the National Science Foundation, Ohio businesses invested a lower percentage of their overall industry expenditures in R&D than did businesses in California, Washington, and Massachusetts. In fact, Ohio performs below the U.S. average for corporate R&D.

Studying patents as another measure of innovation, private industry patent output in the Dayton Region is above the national average but far below the top-performing MSAs. Considering the number of patents awarded on a per employee basis, the Dayton Region ranks slightly above the national average and Washington, DC.

PATENTS PER 1,000 WORKERS, 1997-2008

Source: Innovation in American Regions

STATE AGENCY R&D EXPENDITURES PER CIVIL WORKER, 2007

ACADEMIC R&D PER $1,000 OF GDP, 2008

ACADEMIC SCIENCE AND ENGINEERING ARTICLE OUTPUT PER 1,000 S&E DOCTORATE HOLDERS IN ACADEMIA, 2008

ACADEMIC PATENTS AWARDED PER 1,000 SCIENCE & ENGINEERING DOCTORATE HOLDERS IN ACADEMIA, 2006

BUSINESS PERFORMED AS PERCENT OF PRIVATE INDUSTRY OUTPUT, 2007

Source: NSF Science and Engineering Indicators 2010
A highly developed innovation ecosystem would help the Dayton Region convert patents, business and university IP and R&D investments, and SBIR funding into technologies developed for commercial use. By connecting customers to the R&D capacity and connecting skilled entrepreneurs to winning technologies, the Dayton Region could leverage its R&D capacity into commercial opportunities.

DEVELOP AN INNOVATION ECOSYSTEM

In order for the innovation ecosystem to be effective, the Dayton Region needs people and organizations that can make connections between customer demands, technology catalogs, research capacity, and commercial opportunities. The Dayton Region’s R&D culture has historically focused on solving a specific problem, often associated with the Air Force. Yet for commercialization to happen, this research capacity must be connected to solving problems beyond the Air Force while scanning the landscape to see other applications for specific technologies.

To transform the R&D culture into an innovation culture, the Dayton Region needs innovation intermediaries. The innovation intermediaries would serve as neutral integrators that would connect customers, inventors, and entrepreneurs and advance technology into the marketplace.6

As the commercialization ecosystem is constructed, there are numerous roles for various innovation intermediaries at different stages in the process. Whether connecting smart customers with a technology demand to a researcher who can solve the problem or connecting an existing technology platform to a commercial market, the innovation intermediaries will expand the Region’s R&D capacity into an innovation culture.

Some of these intermediaries already exist, such as the Wright Brothers Institute that works as an intermediary between the Air Force Research Laboratory and local businesses in order to solve complex problems for the Air Force. However, that is just one example with a sophisticated customer.

R&D generated by businesses and universities could be connected to customer demand using innovation intermediaries. SBIR-funded and other R&D companies/organizations could work with innovation intermediaries acting as agents, brokers or market-makers. With such support, businesses can explore market opportunities for their technologies without diverting their internal resources.

Working with innovation intermediaries that can help “translate” technology opportunities into commercial markets may attract venture capital. In addition, each success that the Dayton Region has with innovative technology will attract more attention for the Region’s assets from potential investors, entrepreneurs, or corporate executives.
Venture capital and equity investment are necessary in an innovation economy to bring innovative technology to market. Pre-seed and seed capital are some of the most challenging funds to develop in an innovation ecosystem. The State of Ohio, through the Third Frontier program, is investing seed capital into its regions. The Dayton Region has the best outcomes in Ohio for its seed capital fund and is just embarking on the development of a pre-seed fund.

In terms of venture capital, Ohio not only ranks below the national average for venture capital as a percent of high-tech business establishments, but it ranks the lowest among the targeted regions. Ohio also ranks near the bottom for venture capital expenditures per $1,000 of GDP, far below the national average and greatly trailing the top performing states of Massachusetts and California.

The Dayton Region has much to offer investors in technology. With the help of innovation intermediaries that connect the R&D that exists to internal and external markets, the Region can grow its innovation capital.
RECOMMENDATION TWO: INCREASE THE REGION’S GLOBAL FLUENCY

The Brookings Institution and JPMorgan Chase have launched a Global Cities Initiative designed to help American cities become more “globally fluent.” The premise is that globally fluent cities will serve as the economic drivers for the global economy. Brookings reported that between 2009 and 2010, the fastest-growing global economies were outside the US and Europe.

For U.S. metropolitan areas to become globally fluent, the Global Cities Initiative argues that they must leverage the assets their regions offer and become more engaged in the global economy. In addition to other innovation indicators, two additional indicators of global fluency are exports and immigration.

INCREASE THE REGION’S IMPORTS

Although exports from the Dayton Region have fallen since 2008 due to the loss of automotive manufacturing exports, the Dayton Region still performs higher than the national average for exports. In addition, Dayton’s exports account for 11 percent of its total GDP, while Ohio’s exports are only 7 percent of Ohio’s GDP, making the Region’s exports an important contributor to Ohio’s global economy.

A recent report from the Council on Foreign Relations shows that for the nation to recover from recession, jobs must be created in the tradeable sectors, which are industries that produce goods or services that can be traded domestically or internationally. Similarly, efforts to develop job growth in the Dayton Region must be smart growth with a focus on tradeable sectors. This will not only offer the greatest return on investment, but growth in the tradeable sector will be less vulnerable to domestic economic downturns.

Using analyses of supply chain and industry input and output (I/O), the Dayton Region can assist local businesses in their efforts to strengthen their competitiveness and find additional markets for their products. A supply chain and I/O analysis may help businesses to identify potential regional suppliers that may offer a lower cost to provide a needed product or service. By using a national industry comparison, a local business may identify additional industries that may have a market for their product or service. By leveraging existing industries, investment would be minimal but could return additional jobs and sales for the Region.

Economic development organizations and business associations in the Dayton Region can work with local businesses to help them find additional markets for exports. Using federal sources such as the National Export Initiative (http://export.gov/nei/), local businesses can find technical assistance that will help them navigate foreign markets and find trade mission opportunities to potentially advance their products.

Businesses can consult with global trade experts to find additional export markets. Industry trade shows or trade association meetings are a helpful way for businesses to find export markets. Building relationships with international trade or company representatives may help to identify markets. Local Small Business Development Centers (SBDCs) can help local companies identify export markets and trade opportunities.
A closer analysis of the technology generator industries in the Dayton Region points to a large gap in exports from the non-manufacturing industries. For example, Boston exports a much higher percentage of information and professional services, particularly in the R&D industries. While Boston exports 91 percent of R&D in Biotechnology, the Dayton Region exports only 9 percent. This gap suggests that outside markets could be targeted to identify customers for the region’s information and professional services.

Even though a comparison between Dayton and the other targeted technology generator regions showed that Dayton had the second highest exports as a percentage of GDP (see previous page), it ranks the lowest for export revenue from technology generator industries. Exports of technology generators include both international exports and domestic exports that leave the region. As shown in the table above, goods and services exported from the region account for only 30 percent of the revenue from the technology generator industries. This is approximately 45 percent less than San Francisco, the lead exporter of technology generator industries. This gap in revenue and exports for Dayton has tremendous growth potential. Since the job multiplier for this industry is 5.2, even a slight increase in exports of 5 percent could result in as many as 500 jobs.

A closer analysis of the technology generator industries in the Dayton Region points to a large gap in exports from the non-manufacturing industries. For example, Boston exports a much higher percentage of information and professional services, particularly in the R&D industries. While Boston exports 91 percent of R&D in Biotechnology, the Dayton Region exports only 9 percent. This gap suggests that outside markets could be targeted to identify customers for the region’s information and professional services.

A closer analysis of the technology generator industries in the Dayton Region points to a large gap in exports from the non-manufacturing industries. For example, Boston exports a much higher percentage of information and professional services, particularly in the R&D industries. While Boston exports 91 percent of R&D in Biotechnology, the Dayton Region exports only 9 percent. This gap suggests that outside markets could be targeted to identify customers for the region’s information and professional services.

A closer analysis of the technology generator industries in the Dayton Region points to a large gap in exports from the non-manufacturing industries. For example, Boston exports a much higher percentage of information and professional services, particularly in the R&D industries. While Boston exports 91 percent of R&D in Biotechnology, the Dayton Region exports only 9 percent. This gap suggests that outside markets could be targeted to identify customers for the region’s information and professional services.
Immigrants can be an important economic driver, particularly as the Dayton Region has lost population and a Congressional seat. Not only do they bring additional demand for goods and services, immigrants are also a source of entrepreneurship. According to the Kauffman Foundation, immigrants were twice as likely to start their own business each month in 2010 than were native-born citizens. An infusion of entrepreneurial-minded immigrants can spur job growth in the Region.

The City of Dayton has already begun an initiative to attract more immigrants to the Region with *Welcome Dayton*, a project designed to make the city friendly and welcoming for immigrants. City leaders are hopeful that immigration will turn around the population decline that the City has experienced, while strengthening the Region’s economy.

Other communities in the Dayton Region may also consider strategies to attract immigrants to the Region. Regional leaders might also consider advocating for federal initiatives such as the DREAM (Development, Relief, and Education for Alien Minors) Act, which was proposed to provide a path to residency for alien students who graduate from U.S. high schools.
RECOMMENDATION THREE: TRANSFORM THE REGION’S WORKFORCE

Ohio’s prominence in the manufacturing industry during the 20th century allowed the State to invest heavily in higher education and other infrastructure important for economic development and innovation. In addition to an extensive community college system, higher education institutions invested in branch campuses, research and development, and improved access to higher education. As a result, Ohio has a higher education institution within 30 miles of every citizen.

At the same time, the traditional manufacturing culture allowed multiple generations to gain high-wage employment without requiring higher education. This reality formed a culture in Ohio that did not value higher education and has resulted in educational attainment rates lower than the national average.

INCREASE EDUCATIONAL ATTAINMENT LEVELS

Transforming the workforce to participate in the knowledge economy underscores the importance of higher education. Community colleges have been singled-out as the lynchpin to this transformation. To do that, community colleges must “create a more learner centered environment by offering modular, easily accessed curriculum using eLearning and other delivery methods and featuring shorter, occupationally focused courses leading to an occupational credential. These offerings must be integrated into the college curriculum so that the courses may also earn college credit.”9 They must “break down the walls between the credit and the noncredit sides of the institution and be much more closely aligned to businesses – seeking their active involvement in defining curriculum.”

Workers need education and training that is directly responsive to employer demand, which would gain them immediate employment opportunities. Yet most community colleges do not have the direct relationships with businesses. Even when those relationships do exist, the community colleges often offer customized training to businesses that results in non-credit training for the workers.

Yet Ohio is well positioned to respond to this crisis. In fact, successful examples of collaboration between businesses and higher education exist across the state. In these cases, businesses are working directly with their community colleges and career technical centers to provide short-term training that will lead directly to employment. In many cases these short-term training programs offer credit for experiential learning and can articulate into a degree program, which allows workers to continue their education at their own pace and potentially go to school while earning an income.

In short, higher education institutions, and especially community colleges, have to meet students where they are and bring them forward. Ohio’s four-year universities have specified Centers of Excellence that connect the university to regional industry drivers. While those centers have industry connections, policy should require them to also have workforce development strategies and hold them accountable to meet outcome measures (beyond counting the number of peer reviewed articles).

Bureau of Labor Statistics data from 2010 shows that the level of degree attainment impacts both unemployment and wages. High school graduates had an unemployment rate of 10.3 percent, while only 5.4 percent of those with a bachelor’s degree were unemployed.10 Weekly wages for high school graduates average $626, while average weekly wages for college graduates are $1,038.
Ohio’s educational attainment level falls below the national average for both bachelor’s degrees (15 percent compared to 17 percent in the US) and advanced degrees (almost 9 percent compared to 10 percent). Although the Dayton Region’s educational attainment level is slightly higher than the level for the State of Ohio, it still falls short of the other targeted regions.

Ohio also falls short in an indicator from NSF regarding the percentage of students that are taking advanced placement exams. This indicator suggests that Ohio is not preparing a sufficient number of high school students for advanced education. The long-standing culture of not valuing higher education appears to be a direct threat to the economic growth of the Dayton Region. Demand for workers with postsecondary credentials is growing, while the demand for low-skilled workers continues to fall (see page 10).

One issue impacting the educational attainment level of Ohioans may also be the cost of education. In 2008, Ohioans were paying more than any of the other targeted states for state tuition, with undergraduate charges equalling 52 percent of their disposable income, which is much higher than the US average of 38 percent. Ohio also spent less on student aid than the U.S. average.

---

### EDUCATIONAL ATTAINMENT LEVEL, 2010

![Bar chart showing educational attainment levels for various cities and states.](chart1)

Source: U.S. Census

---

### AVERAGE UNDERGRADUATE CHARGE AT PUBLIC 4-YEAR INSTITUTIONS AS PERCENTAGE OF DISPOSABLE INCOME, 2008

![Bar chart showing average undergraduate charges as percentage of disposable income.](chart2)

Source: NSF Science and Engineering Indicators 2010

---

### STATE EXPENDITURES ON STUDENT AID PER FULL-TIME UNDERGRADUATE STUDENT, 2007

![Bar chart showing state expenditures on student aid.](chart3)

Source: NSF Science and Engineering Indicators 2010
INCREASE STEM DEGREES

Although advanced degrees are important for a strong innovation climate, degrees in science, technology, engineering, and math (STEM) fields are critical. At the graduate degree level, Ohio produces more than the national average of STEM degrees, yet Ohio lags in undergraduate STEM education.

SCIENCE AND ENGINEERING GRADUATE STUDENTS PER 1,000 INDIVIDUALS, AGED 25-34, 2007

![Graph showing science and engineering graduate students per 1,000 individuals, aged 25-34, 2007.]

Source: NSF Science and Engineering Indicators 2010

Another challenge that exists in Ohio for the production of STEM degrees is the percentage of advanced STEM degrees that are awarded to foreign-born students. Although some foreign-born students may stay in the US beyond graduation, many will return to their native country. In addition, the demand for STEM occupations in Dayton Region in particular usually requires US citizens to perform the work, since the jobs are with the WPAFB, AFRL, or defense contractors. This low supply of US citizens holding advanced STEM degrees signals a workforce challenge.

BUILD A STEM WORKFORCE

STEM occupations are those that include scientists, engineers, computer specialists, and any other STEM-related field. All of the MSAs that are expected to grow in technology generator industries have a STEM workforce that is higher than the national average, including Dayton. Yet of the targeted cities, Dayton currently had the lowest percentage of STEM workers at nearly 6 percent. Even so, this level is substantially higher than the Ohio average, which is only 4 percent.

PERCENTAGE OF WORKFORCE IN STEM OCCUPATIONS, 2011

![Graph showing percentage of workforce in STEM occupations, 2011.]

Source: EMSI Covered Employment - 2011.4
Leveraging Regional Assets for Economic Recovery

The type of scientific research being conducted in a targeted region will result in higher concentrations of certain occupations, such as life sciences, computer technology, or other STEM disciplines. The Dayton Region exceeds both the state and national average in both the percentage of engineers and computer specialists but has a smaller percentage of life scientists than the national average. Ohio’s workforce is less than 1 percent engineers and 2 percent computer specialists, while Dayton’s has 1.6 percent engineers and 3 percent computer specialists.

Responding to the workforce challenges is necessary for the Dayton Region and Ohio to recover. Skilled workers are needed now, and the workforce and higher education systems must respond.
RECOMMENDATION FOUR: TRACK REGIONAL PERFORMANCE

This report measures and compares many innovation indicators in Dayton, in Ohio, and across other MSAs and states to understand where the Dayton Region’s strengths and weaknesses are. But this data provides just one snapshot of those indicators. In order to make improvements or to understand what investments are required to help build an innovative economy, these metrics – and others – must be tracked annually.

TRACK INNOVATION INDICATORS

Many regions have already begun tracking innovation indicators, including Silicon Valley and the State of Massachusetts. To stay competitive, both the Dayton Region and the State of Ohio need to establish indicators and metrics that will help drive innovation and economic development.

The National Science Foundation produces the Science and Engineering Indicators,11 a selection of comparison data between the US and other countries in indicators that impact the growth of science and technology. These indicators measure resources or assets that are generally viewed as necessary for a strong innovation environment through which technology, industry, and the high-skilled, high-wage workforce would grow.

Similar to the NSF Science and Engineering Indicators, Silicon Valley publishes an annual Index, which monitors four areas of the region: People, Economy, Society and Place. Among other metrics, it monitors its innovation climate based on the region’s assets and challenges.

Metrics to be measured should include the gaps that have been identified – culture, commercialization, and workforce – as well as economic and social indicators that will measure economic progress. By tracking these indicators, the Dayton Region can prioritize private and public investments and make realignments as needed, based on results.
The Dayton Region has the opportunity to transform itself. Unlike many of its Midwestern neighbors and the other Rust Belt communities, the Dayton Region already has a knowledge-based economic engine in WPAFB and the headquarters of five out of ten Air Force research directorates, which has cultivated a strong R&D culture. Like its Midwestern neighbors, Dayton has a rich manufacturing heritage. In addition, the Region boasts two strong research institutions and community colleges that can respond to workforce challenges.

However, in order to position the Dayton Region as a globally fluent and economically growing community, the challenges that have been identified must be overcome. The cultural transformation from a manufacturing economy to a knowledge economy has no easy solution, yet it can be accomplished.

Each of the recommendations outlined here will require action steps from a variety of players – policy makers, businesses, educational institutions, non-profit and other advocacy organizations, economic development, and the R&D community.

The best part of all is that the Dayton Region and its committed leadership and community can lead this transformation and serve as an example for other Midwestern communities. By doing so, the Dayton Region will be renown for its strong economy and innovation.
endnotes

1  http://www.ssti.org/Publications/Onlinepubs/NAICS_Tech1.pdf


5  [(Regional SBIR + University research)/Regional GDP]/[(US SBIR + University research)/US GDP]


9  The Future Role of Community Colleges in Workforce Development, Maher and Maher, 2009

10 http://www.bls.gov/emp/ep_chart_001.htm
