Industry in Evolution

An Examination of Industry Trends & Opportunities across the United States

March 2017
Private Industry in the United States
In the past 50 years, private industry has grown steadily.
The Engine of Growth is Changing

The 1960s reflected a diverse economy, heavily fuelled by manufacturing.

### 1963

- **30%** Manufacturing
- **16%** Finance, Insurance & Real Estate
- **5%** Professional & Business Services
- **4%** Agriculture
The Engine of Growth is Changing
By 1980 finance, insurance, and professional services take-off

<table>
<thead>
<tr>
<th>Industry</th>
<th>1980</th>
<th>Change</th>
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<tbody>
<tr>
<td>Machinery</td>
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<td>Food and beverage and tobacco</td>
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<td>Chemical products</td>
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<td>Fabricated metal products</td>
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<tr>
<td>Finance, insurance, real estate</td>
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<tr>
<td>Manufacturing</td>
<td>24%</td>
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<tr>
<td>Finance, Insurance &amp; Real Estate</td>
<td>18%</td>
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<tr>
<td>Professional &amp; Business Services</td>
<td>7%</td>
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<tr>
<td>Agriculture</td>
<td>3%</td>
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The Engine of Growth is Changing

Finance and insurance nearly double, computers are on fire, and life science domination begins

![Graph showing the engine of growth in 1990]

- **Manufacturing**: 20%
- **Finance, Insurance & Real Estate**: 20%
- **Professional & Business Services**: 10%
- **Agriculture**: 2%
The Engine of Growth is Changing
Finance, insurance and real estate more than double – all other industries hold strong

2005

- **Manufacturing**: 15%
- **Finance, Insurance & Real Estate**: 23%
- **Professional & Business Services**: 13%
- **Agriculture**: 1%
The Engine of Growth is Changing

Industry composition begins to level out, growth is generally even among industries

TODAY

- **Manufacturing**: 14%
- **Finance, Insurance & Real Estate**: 23%
- **Professional & Business Services**: 14%
- **Agriculture**: 1%

### TODAY

- **Finance, insurance, real estate, rental, and leasing**
- **Miscellaneous professional, scientific, and technical services**
- **Management of companies and enterprises**
- **Retail trade**
- **Broadcasting and**
- **Motion picture and Data**
- **Construction**
- **Accommodation and food services**
- **Arts, entertainment, etc.**
- **Mining**
- **Utilities**
- **Other services, except government**
- **Other**
- **Chemical products**
- **Computer and electronic products**
- **Food and beverage and tobacco products**
- **Educational services, health care, and social assistance**
- **Wholesale trade**
- **Administrative and waste management services**
The Changing Economic Development Landscape

How are 3D Printing, Battery Manufacturing and Autonomous Vehicles impacting the U.S. landscape?
3D Printing – Additive Manufacturing (AM)
Industry Applications

Technologies that build 3D objects by adding layer upon layer of material, whether the material is plastic, metal, concrete, etc.

3D printing technology applications are nearly limitless; however, current, common industry applications are as follows:

- Jet engines
- Medical devices and implants (e.g. custom hearing aids)
- Automotive components
- Unique opportunities such as the US Navy’s ‘Print the Fleet’ initiative, which is a Navy wide, consolidated effort to bring 3D printing to the service – technology to be used to print spare parts on the fly or even manufacture advanced weaponry such as unmanned aerial vehicles
- Other uses – printing organs from a patient’s own cells, prototyping parts at a rapid pace for all industries, NASA engines, prosthetics, and more…
3D Printing – Additive Manufacturing (AM)

The Changing Workforce

The AM industry requires highly trained engineering and technical talent; engineers and technicians are critical to maximizing this technology

- According to a 2015 article by the Institute of Electronics and Electrical Engineers, 35% of engineering job postings now require 3D printing skills
- Talent must have high skills in equipment design, material technology and data management
- BUT, must also be creative, resourceful and ready to “figure things out” in an industry that continues to develop and evolve at a rapid pace.

A recent study indicated that job postings calling for 3D printing skills increased 1,834% between 2010 and 2014, with industrial engineers among the most sought after professionals. As such, the high demand for a finite talent pool has created ongoing recruitment and hiring challenges, including the following considerations:

- Accelerating retirement of skilled workers
- Working against negative perception of the manufacturing industry
- Lack of STEM skills the overall manufacturing talent market
- However, only 16% of US based firms have extensive AM experience so these deficits may continue to grow
- In addition, the trend towards automation and AM favors the US v. low wage countries
3D Printing – Additive Manufacturing (AM)

STEM

Fostering a deep talent pool requires a vibrant STEM-related ecosystem that builds basic skills in science and technology, on which 3D printing operations can draw. Some examples of areas with extensive STEM programs include:

- RTP (Raleigh)
- Boston
- Ann Arbor

Another important component to a vibrant STEM-related ecosystem are institutional partnerships between universities and AM manufacturers. Some examples of institutions which have partnered with manufacturing companies are:

- University of Illinois and the Design Innovation Institute (in conjunction with Boeing and GE, with Pentagon funding)
- Rochester Institute of Technology
- University of Maryland

Another notable partnership is the Commonwealth Center for Advanced Manufacturing (“CCAM”) in Virginia

- Public-private partnership dedicated to research and innovation
- Collaboration with the Tobacco Region Revitalization Commission and nine community colleges
- Plans to develop an Advanced Manufacturing Apprentice Academy to provide hands-on industry-relevant training on modern AM equipment, professional certifications and pathways to employment
3D Printing – Additive Manufacturing (AM)

The Changing Facility Standard

As the AM industry evolves, the once standard manufacturing facility requirement is changing as well

Some unique features and benefits of an AM facility include:

• Connectivity to the Internet
• Greater power requirements
• Automated guided vehicles
• Autonomous Lift trucks
• Multi-modal manufacturing; the ability to service multiple business lines and industries under one roof
• Reduced inventory
  • Just in time manufacturing
  • In Auburn, AL, GE used AM techniques to reconfigure the aircraft engine fuel nozzle; past models using traditional production methodologies used 20+ parts
• Predictable supply
• Reliable data security providers (Blackberry)
Battery Manufacturing

Notable Case Studies

**Tesla Gigafactory**
One of the most notable announcements related to battery manufacturing was Tesla’s announcement of their planned facility in Reno, NV with 6,500 employees and $5B in capital investment.

- Factory will resemble an advanced computer chip v. traditional battery plant
- Ore from Nevada’s lithium mines – only “operating” lithium mine in U.S. Will recently discovered lithium mines in Wyoming generate additional opportunity for similar projects?
- Factory’s exterior walls are removable to provide ease of expansion (facility is currently only about 15% constructed)

**Oakridge Global Lithium-Ion Battery Facility**
Oakridge Global recently announced a new lithium-ion battery manufacturing facility in Brevard County, FL. The project also considered Utah and Nevada.

- Only 6 locations in the US have a higher concentration of workers in advanced industries
- 13.5% of jobs in Palm Bay are in science, engineering and technology industries
- Only Washington, San Francisco, Detroit, Wichita, Seattle and San Jose rank higher in comparison
- The project estimates average wages of $50,075 for the manufacturing positions
- Desired skill set for the project’s new jobs include chemical & mechanical engineers, product designers, tool-and-die, production, etc.
Autonomous Vehicles
Vehicle Automation Technology and the Connected Vehicle

*Federal funding included in the most recent Budget proposal. Michigan continues to lead in the rush to develop an autonomous vehicle.*

- The US Government has begun work on a national policy for autonomous cars, and proposes to invest $4B over the next 10 years to accelerate the development and adoption of safe vehicle automation.

Recent joint venture announcements by auto giants indicate a technology race to vehicle automation:

- Ford recently announced a $75M investment in a California based autonomous tech firm, expanding R&D and related technology capabilities related to the production of laser sensors. Ford has also announced a $182M investment in Pivotal, a San Francisco based tech firm specializing in cloud based, advanced software development technology.
- GM announced the development of self-driving Chevy Bolt EV in San Francisco and Scottsdale, AZ, as part of a collaboration with Cruise Automation, a Silicon Valley tech firm it recently acquired.
- Google’s Alphabet and Fiat announced a partnership that will test Google’s self-driving car program in the 2017 Chrysler Pacifica hybrid minivan.
Opportunities for Smaller Markets
Small Markets lead for Advanced Manufacturing

Top rated markets had the following in common:

- Location in right to work state
- Abundance of renewable energy
- Easy access to transport and shipping
- Strong job training programs
- Lifestyle amenities (e.g. amenities that create a high quality of life)
- Willingness to partner with the private sector to drive incredible value for the state and community (e.g. Nevada’s partnership to bring the Tesla gigafactory to the state)

We may begin to see a shift from the Southeast to the West/Midwest for advanced manufacturing

- We may see a trend in shifting towards smaller, less costly and more manageable cities – with just in time manufacturing and AM technologies, facilities may be able to be more remote
- A smaller, but more highly skilled/educated (or trainable) workforce
What Can State and Local Governments do to attract these industries?
Flexibility and Creativity Are the Key

• Incenting the use of emergent technologies by consumers – companies want to be closer to their consumers (tax credits for autonomous technology, similar to consumer incentives for solar and electric or hybrid vehicles)
• Incenting heavy capital investment may have an advantage vs. heavy job creation
• Retraining incentives
• Full service training programs – many states do not have quality job training programs (good examples include Georgia, Louisiana and South Carolina)
• Early adoption of testing regulations for autonomous vehicles
Thank you