The Evolution and Future of Manufacturing Competitiveness

2014 Manufacturing Summit: The Road Ahead
Franklin Furniture Institute
Mississippi State University

Jack McDougle
President & Founder
Blutre Strategies, Inc.
change is constant and faster than ever
time to reach 50 million users

75 years

38 years

13 years

4 years

3 years

50 days
only 35 days for the Angry Birds app when President Lincoln was assassinated, it took 21 days for the news to reach England
if you graduated college in 2004

these companies didn’t exist
facebook boasts the 3rd largest population

China
India
Facebook
United States
Indonesia
Brazil

facebook boasts the 3rd largest population
facebook’s market cap - surrounded by some impressive companies

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Market Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Coca-Cola</td>
<td>$177 B</td>
</tr>
<tr>
<td>23</td>
<td>Anheuser-Busch InBev SA/NV</td>
<td>$174 B</td>
</tr>
<tr>
<td>24</td>
<td>Bank of America</td>
<td>$173 B</td>
</tr>
<tr>
<td>25</td>
<td>Merck</td>
<td>$165 B</td>
</tr>
<tr>
<td>26</td>
<td>Total</td>
<td>$154 B</td>
</tr>
<tr>
<td>27</td>
<td>Facebook</td>
<td>$151 B</td>
</tr>
<tr>
<td>28</td>
<td>BP</td>
<td>$148 B</td>
</tr>
<tr>
<td>29</td>
<td>Citigroup</td>
<td>$147 B</td>
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<tr>
<td>30</td>
<td>Amazon.com</td>
<td>$145 B</td>
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<tr>
<td>31</td>
<td>Sanofi</td>
<td>$136 B</td>
</tr>
<tr>
<td>32</td>
<td>Disney</td>
<td>$136 B</td>
</tr>
</tbody>
</table>
information flows more freely than ever

- 4 billion email accounts in 2014
- more than 300 billion emails per day
- more than 50 billion instant messages per day
- U.S. Post Office handles ~600 million pieces of mail per day

Source: The Radicati Group, Inc.
data is exploding

• 90% of the world’s data created in the last 2 years

• if you stacked a pile of CD-ROMs on top of one another until you’d reached the current global storage capacity, it would stretch 50,000 miles beyond the moon

• every hour, enough information is consumed by internet traffic to fill 7 million DVDs. Side by side, they’d scale Mount Everest 95 times

• there are 30 billion pieces of content shared on Facebook every day
1 week of the New York Times contains as much information as a lifetime in the 18th century.
stunning and rapid transformation of global business
unprecedented appetite for resources
8.5 billion people by 2030
7 billion in 2014
95% of consumers will live outside of the U.S.
growing global middle class creates huge opportunities & challenges

Source: World Bank
we need to produce as much food in the next 40 years as we have in the last 500

Source: Commonwealth Scientific and Industrial Research Organization
Georges Seurat interpreted by Chris Jordan
106,000 aluminum cans
the number used in the U.S.
every 30 seconds
2 million plastic beverage bottles

the number used in the U.S. every 5 minutes
at current consumption rates, we will need 2 planets by 2030

Source: 2012 World Wildlife Fund's "Living Planet Report"
manufacturing is the greatest innovation in history
massive impact of the industrial revolution

Source: Angus Maddison’s "World Population, GDP and Per Capita GDP, 1-2003"
the 20th century was the American century
unmatched economic prosperity
the world’s arsenal of democracy
the great ages of economic development have resulted in higher living standards

- Hunting and fishing
- Agriculture
- Industrial
- Information

The developed world
The developing world
divergence between “thinking” and “making”

Innovation process

Basic R&D

Applied R&D

Tech Transfer and Commercialization

Production process

Start-up

Scale-up

On-going operations

Significant national focus
Innovation clusters and government support
Multiple collaborative efforts
Government and private sector investment

Limited national focus
Lack of coordinated efforts
Barriers to production at scale
Few government investments and incentives
Regulatory and tax policy hurdles
scaling production is difficult in the U.S.

Illustrative and signals bulk of investment focus. Exceptions can always be found.
manufacturing is changing rapidly
wrong public image of manufacturing
Advanced Materials/Composites
Additive Manufacturing
Bio Manufacturing & Bioinformatics
Flexible Electronics Manufacturing
Industrial Robotics
Nano Manufacturing
Advanced Forming/Joining/Welding
Advanced Sensing, Measurement, & Process Control
Visualization, Informatics and Digital Manufacturing
Advanced Manufacturing & Testing Equipment
Chemical Processing
a more comprehensive view of the manufacturing enterprise

For example:
GE’s Big Room
innovation is thinking and making

- Basic R&D
- Applied R&D
- Tech Transfer and Commercialization

Government and private sector support and collaboration

- On-going operations
- Scale-up
- Start-up
manufacturing is knowledge-intensive
new uses for emerging technologies:
additive manufacturing / 3D printing
"DNA origami" to make nanobots

robots that can respond to chemical cues and operate inside a living animal
North Atlantic cod 14 days on flake ice and 14 days on nano-ice
manufacturing is more important than ever
highest multiplier effect

Source: U.S. Bureau of Economic Analysis
manufacturing drives productivity growth

Source: U.S. Bureau of Economic Analysis
manufactured goods account for nearly 60% of exports
manufacturing drives R&D and innovation
manufacturing dominates U.S. domestic private sector R&D investment

Source: National Science Foundation
manufacturing pays higher average compensation

U.S. manufacturing is the world’s 7th largest economy

Source: International Monetary Fund and U.S. Bureau of Economic Analysis
U.S. faces many challenges & opportunities
stubborn long-term unemployment

![Graph showing unemployment and participation rate trends from 1990 to 2014.](image)

Unemployment and participation rate data from 1990 to 2014.

Source: U.S. Bureau of Labor Statistics
tension between productivity and employment

U.S. manufacturing jobs are growing

Source: U.S. Bureau of Labor Statistics
growing inability to fund strategic priorities

federal debt at $17.5 trillion or $151K per taxpayer
debt to gdp ratio ~108%
Percentage Contribution to U.S. Structural Cost Burden

Source: MAPI (Updated June 2011)
last quarter of 2012: 
68 regulation per day

$1 billion for manufacturing institutes
national network for manufacturing innovation
only France has higher structural costs

Source: MAPI (Updated June 2011)
Corporate tax rates remain high.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>40.0</td>
<td>40.0</td>
<td>34.6</td>
</tr>
<tr>
<td>Japan</td>
<td>57.1</td>
<td>38.0</td>
<td>29.5</td>
</tr>
<tr>
<td>France</td>
<td>36.6</td>
<td>33.3</td>
<td>34.1</td>
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<tr>
<td>Mexico</td>
<td>34.0</td>
<td>30.0</td>
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<tr>
<td>Germany</td>
<td>57.4</td>
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<td>23.8</td>
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<tr>
<td>Canada</td>
<td>44.6</td>
<td>28.0</td>
<td>20.5</td>
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<tr>
<td>China</td>
<td>33.0</td>
<td>25.0</td>
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<td>Korea</td>
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<td>United Kingdom</td>
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<td>27.9</td>
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<tr>
<td>Taiwan</td>
<td>25.0</td>
<td>17.0</td>
<td>10.9</td>
</tr>
</tbody>
</table>

Source: OECD
the U.S. is competitive but not dominant in total R&D investment
U.S. manufacturing lags Germany, Japan and Korea in technological intensity

manufacturing sector composition by technological intensity

Source: OECD
U.S. students are not competitive in math and science skills

Source: U.S. National Center for Education Statistics
U.S. lags significantly in graduating engineers

Source: National Science Foundation
manufacturing competitiveness tilting towards the U.S.
how do manufacturing CEOs view competitiveness?
drivers of global manufacturing competitiveness

Government Forces

- Talent Driven Innovation
- Labor and material costs and availability
- Energy costs and policies
- Supply networks
- Local market conditions
- Economic, trade, financial, tax systems
- Physical Infrastructure
- Government investment in manufacturing and innovation
- Legal and regulatory system
- Healthcare system

Source: Deloitte and Council on Competitiveness
# how do the key drivers stack up?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Drivers</th>
<th>Index Score</th>
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<tbody>
<tr>
<td>1</td>
<td>Talent Driven Innovation</td>
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<tr>
<td>2</td>
<td>Economic, trade, financial, tax systems</td>
<td>8.42</td>
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<tr>
<td>3</td>
<td>Labor and material costs and availability</td>
<td>8.07</td>
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<td>4</td>
<td>Supply networks</td>
<td>7.76</td>
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<tr>
<td>5</td>
<td>Legal and regulatory system</td>
<td>7.60</td>
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<tr>
<td>6</td>
<td>Physical Infrastructure</td>
<td>6.47</td>
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<tr>
<td>7</td>
<td>Energy costs and policies</td>
<td>6.25</td>
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<tr>
<td>8</td>
<td>Local market conditions</td>
<td>3.99</td>
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<tr>
<td>9</td>
<td>Healthcare system</td>
<td>2.48</td>
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<tr>
<td>10</td>
<td>Government investment in manufacturing and innovation</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Deloitte and Council on Competitiveness
what is talent driven innovation?

quality and availability of a country’s skilled workforce, including researchers, scientists, and engineers, and the resulting ability to drive innovation

Source: Deloitte and Council on Competitiveness
### Where do countries rank?

#### 2013

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Index Score</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>10.00</td>
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<tr>
<td>2</td>
<td>Germany</td>
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<tr>
<td>3</td>
<td>United States</td>
<td>7.84</td>
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<tr>
<td>4</td>
<td>India</td>
<td>7.65</td>
</tr>
<tr>
<td>5</td>
<td>South Korea</td>
<td>7.59</td>
</tr>
<tr>
<td>6</td>
<td>Taiwan</td>
<td>7.57</td>
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<tr>
<td>7</td>
<td>Canada</td>
<td>7.24</td>
</tr>
<tr>
<td>8</td>
<td>Brazil</td>
<td>7.13</td>
</tr>
<tr>
<td>9</td>
<td>Singapore</td>
<td>6.64</td>
</tr>
<tr>
<td>10</td>
<td>Japan</td>
<td>6.60</td>
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</table>

#### 2018

<table>
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<tr>
<th>Rank</th>
<th>Country</th>
<th>Index Score</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>10.00</td>
</tr>
<tr>
<td>2</td>
<td>India</td>
<td>8.49</td>
</tr>
<tr>
<td>3</td>
<td>Brazil</td>
<td>7.89</td>
</tr>
<tr>
<td>4</td>
<td>Germany</td>
<td>7.82</td>
</tr>
<tr>
<td>5</td>
<td>United States</td>
<td>7.69</td>
</tr>
<tr>
<td>6</td>
<td>South Korea</td>
<td>7.63</td>
</tr>
<tr>
<td>7</td>
<td>Taiwan</td>
<td>7.18</td>
</tr>
<tr>
<td>8</td>
<td>Canada</td>
<td>6.99</td>
</tr>
<tr>
<td>9</td>
<td>Singapore</td>
<td>6.64</td>
</tr>
<tr>
<td>10</td>
<td>Vietnam</td>
<td>6.50</td>
</tr>
</tbody>
</table>

Source: Deloitte and Council on Competitiveness
U.S. manufacturing slipped to #2

Source: United Nations
advantages and challenges of manufacturing in the U.S.

Advantages
• Technological prowess and size
• Research support for national laboratories and universities
• High productivity
• Certain policy actions
• Market size and sophistication

Challenges
• Historical high-cost labor (starting to change)
• High corporate tax rates and other structural costs
• Slowing growth

Areas to watch out
• Policy uncertainty
• Shale gas availability
• Reshoring
• Skills

Source: Deloitte and Council on Competitiveness
advantages and challenges of manufacturing in China

Advantages to manufacturers
- Favorable policy actions
- Growing middle class
- Increasing R&D
- Advanced electronics manufacturing
- Robust raw material supply base
- Physical infrastructure

Challenges
- Innovation & IP protection
- Tax burden
- Lower productivity
- Regulatory inefficiency
- Transport costs to U.S.

Areas to watch out
- Investment in strategic industries
- Slowing domestic growth
- Greater emphasis on energy and environment
- Improving education
- Rising labor costs

Source: Deloitte and Council on Competitiveness
the U.S. is the #1 destination for foreign direct investment

Source: UNCTAD World Investment Report
foreign investment in the U.S. grows

U.S. Direct Investment Position Abroad
Foreign Direct Investment Position in the U.S.

Source: U.S. Bureau of Economic Analysis
cost advantages (real & perceived) of offshoring production are diminishing

- rising wages in China
- decreasing availability of both low & high skill labor in China
- reduced energy costs in U.S.
- IP and piracy/copyright losses in China
- high rate of technology advancement is shortening the time-interval of new product demand
- increases total cost of transportation (longer distances, etc)
- ability to efficiently integrate suppliers
manufacturing labor costs in the U.S.

US labor market is the most attractive of all major developed world manufacturers

Labor costs higher in other major manufacturing economies
Productivity adjusted wages (indexed)

U.S. benefits from a relatively flexible labor market
Overall labor market regulation

Source: International Labor Organization, Economist Intelligence Unit, Fraser Institute for Economic Freedom, BCG
China’s wages are growing rapidly

Ratio of average Chinese wages to U.S. wages

Fully loaded factory-worker wages ($/hour)

U.S. wages

Chinese wages

abundant natural gas provides a huge cost advantage for U.S. based manufacturers

Natural gas prices in other major manufacturing economies (indexed)

Industrial electricity prices are lower in the U.S. (indexed)

Source: International Energy Agency, BCG
U.S. becoming one of the developed world’s lowest cost economies

Average projected manufacturing costs of the major exporting countries compared to the U.S. 2015

U.S. manufactures nearly 75% of what it consumes

Manufactured goods consumed in the U.S. by sector, 2010 (%)

Source: U.S. Census Bureau, U.S. Bureau of Economic Analyses, BCG
7 industry clusters are becoming more attractive in the U.S.

Source: U.S. Department of Transportation, U.S. Census Bureau, U.S. Bureau of Economic Analysis, BCG
Attractive industries account for nearly $2 trillion of U.S. consumption and nearly $200 billion in imports from China.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Value of goods consumed</th>
<th>Imports from China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation goods</td>
<td>$582 B</td>
<td>$6 B</td>
</tr>
<tr>
<td>Computers &amp; electronics</td>
<td>$467 B</td>
<td>$122 B</td>
</tr>
<tr>
<td>Fabricated metals</td>
<td>$262 B</td>
<td>$10 B</td>
</tr>
<tr>
<td>Machinery</td>
<td>$251 B</td>
<td>$16 B</td>
</tr>
<tr>
<td>Plastics and rubber</td>
<td>$170 B</td>
<td>$9 B</td>
</tr>
<tr>
<td>Appliances and electrical equip</td>
<td>$134 B</td>
<td>$25 B</td>
</tr>
<tr>
<td>Furniture</td>
<td>$75B</td>
<td>$13 B</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau, U.S. Bureau of Economic Analysis, BCG
recent news of interest

Ikea awarded Sauder Woodworking Co. of Archbold, Ohio, a 5 year contract. The partnership will create at least 150 new jobs and involve an equipment investment of over $13 million by Sauder.
key take-aways

• change is constant and faster than ever
• unprecedented appetite for resources
• manufacturing is the greatest innovation in history
• manufacturing will continue to change rapidly
• U.S. faces challenges & opportunities while manufacturing more important than ever
• manufacturing competitiveness tilting towards the U.S.
  - innovation
  - labor and productivity
  - energy

if we play it smart, we’re look at another century of American manufacturing excellence and leadership
Thank you

Jack McDougle
President & Founder
Blutre Strategies, Inc.