2016 Global Manufacturing Competitiveness Index Report highlights
Years of successful collaboration exploring manufacturing competitiveness
In collaboration with leading organizations, Deloitte has explored the trends and key drivers of manufacturing competitiveness worldwide.

- Interviews with CEOs, CTOs, university presidents, national lab leaders, and labor leaders
- Insights from 1,000s of senior executives worldwide
- Surveys of average Americans on perception of industry and technology
Today’s discussion leverages findings from two simultaneous research initiatives: the Advanced Technologies Initiative and the 2016 Global Manufacturing Competitiveness Index.

- Based on nearly three dozen interviews with senior technology leaders to identify the most promising forward technologies and key challenges facing the US technology ecosystem.

- 2016 analysis based on survey findings from 550+ global executives.

- Ranks 40 nations on key aspects of global manufacturing competitiveness.

www.deloitte.com/globalcompetitiveness
2016 Global Manufacturing Competitiveness Index
Global CEOs Rank Manufacturing Competitiveness

China hangs on – barely - to the most competitive manufacturing nation ranking for 2016, but the US is very close and expected to take over the top spot in five years.

![Global CEOs Rank Manufacturing Competitiveness Table]

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
Traditional manufacturing powerhouse nations of the 1980s are back atop the global rankings
Innovation, Talent, and Ecosystems are key to their renewed strength

- Shift to higher value, advanced manufacturing forms a new battleground for global competitiveness going forward
- US is leading the way having surpassed Germany and closed the gap to China over the last five years
- A resurgence from the UK results in a top ten position now and into the next five years
- Executives ranked US, Germany, and Japan highly competitive in Talent, Innovation, Legal & Regulatory Environment, and Physical Infrastructure – key drivers of global manufacturing competitiveness

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
The link between the 2016 GMCI rankings and high tech manufacturing exports is clear

Manufacturing battleground shifts to higher value, advanced technology products & processes

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
CEOs say advanced technologies are vital to manufacturing competitiveness

The digital and physical worlds are converging. Executives indicate the path to manufacturing competitiveness is through advanced technologies

Ranking of future importance of advanced manufacturing technologies by CEOs

<table>
<thead>
<tr>
<th>Advanced Manufacturing Technologies</th>
<th>US</th>
<th>China</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictive analytics</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Smart, connected products (IoT)</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Advanced materials</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Smart factories (IoT)</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Digital design, simulation, and integration</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>High performance computing</td>
<td>6</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Advanced robotics</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Additive manufacturing (3D printing)</td>
<td>8</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Open-source design/Direct customer input</td>
<td>9</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Augmented reality (to improve quality, training, expert knowledge)</td>
<td>10</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Augmented reality (to increase customer service &amp; experience)</td>
<td>11</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

**US:** Predictive Analytics, Smart Products (IoT), and Advanced Materials are considered most promising

**China:** Prioritizing Predictive Analytics to close the gap with the US and creating competitive advantage through HPC

**Europe:** Integrated priorities very much aligned with “Industry 4.0” paradigm, creating closed loop design/build process
Regional clusters of strength emerge

A closer look at the top 15 nations projected to be the most competitive in the future clearly shows the formation of three distinct regional clusters of manufacturing strength.

High skilled and technology intensive Manufacturing Exports, 2014 ($Billion)

- $900 billion
- $600 billion
- $320 billion
- $30 billion

Note: Figure in parenthesis represent the projected 2020 GMCI rank by CEOs

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
All North American nations are among the top 10 current & future rankings on competitiveness

The North American region enjoys high levels of investments, a rich set of natural resources, and support from large industries.

**North American cluster**

- The US emerges as a formidable anchor in this cluster with...
  - Highest levels of manufacturing investments along with a strong energy profile.
  - High quality talent and infrastructure.
  - Dedicated industrial clusters providing strong support for innovation.
- Canada, considered the freest economy in the region, is G7’s first tariff-free zone.
- Mexico enjoys advantages such as relatively lower labor costs, more than 40 free trade agreements and close proximity to the US.

Note: Figure in parenthesis represent the projected 2020 GMCI rank by CEOs. (Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
Asia-pacific is home to 10 of the top 15 ranked countries for future manufacturing competitiveness

Besides China, Japan, and South Korea, the Asia-Pacific cluster also houses other attractive manufacturing destinations like Malaysia, India, Thailand, Indonesia and Vietnam (MITI-V)

**Asia-Pacific cluster**

- Driven by talent and innovation, this cluster is anchored by China, Japan and South Korea.
- Region further strengthened by hi-tech export focus, including from countries like Singapore and Taiwan.
- Also home to rising stars like Malaysia, India, Thailand, Indonesia, and Vietnam (MITI-V)
- China continues to hold top rankings as one of the most competitive manufacturing nations.

Note: Figure in parenthesis represent the projected 2020 GMCI rank by CEOs.
(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
...Putting a squeeze on European countries

While clusters of manufacturing strength form in both North America and Asia-pacific, most European nations are expected to slip in the overall competitiveness rankings in the next five years.

European cluster

- Germany and the UK are the only European nations forecast to remain in the top ten global manufacturing markets going forward.
- Only two European countries (Czech Republic and Romania) are expected to show any improvement in their relative rank position over the next five years.

<table>
<thead>
<tr>
<th>European country</th>
<th>2016 rank (Current)</th>
<th>2020 rank (Projected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>↔</td>
<td>3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>(↘ -2)</td>
<td>6</td>
</tr>
<tr>
<td>Switzerland</td>
<td>(↘ -7)</td>
<td>12</td>
</tr>
<tr>
<td>Sweden</td>
<td>(↘ -5)</td>
<td>13</td>
</tr>
<tr>
<td>Poland</td>
<td>(↘ -1)</td>
<td>15</td>
</tr>
<tr>
<td>Turkey</td>
<td>(↘ -1)</td>
<td>16</td>
</tr>
<tr>
<td>Netherlands</td>
<td>(↘ -1)</td>
<td>20</td>
</tr>
<tr>
<td>France</td>
<td>(↘ -4)</td>
<td>22</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>(↗ +3)</td>
<td>23</td>
</tr>
<tr>
<td>Finland</td>
<td>↔</td>
<td>24</td>
</tr>
<tr>
<td>Spain</td>
<td>(↘ -2)</td>
<td>25</td>
</tr>
<tr>
<td>Belgium</td>
<td>(↘ -3)</td>
<td>26</td>
</tr>
<tr>
<td>Italy</td>
<td>(↘ -2)</td>
<td>28</td>
</tr>
<tr>
<td>Ireland</td>
<td>↔</td>
<td>31</td>
</tr>
<tr>
<td>Romania</td>
<td>(↗ +5)</td>
<td>33</td>
</tr>
<tr>
<td>Portugal</td>
<td>↔</td>
<td>35</td>
</tr>
<tr>
<td>Greece</td>
<td>↔</td>
<td>40</td>
</tr>
</tbody>
</table>

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
The long-awaited promise of the BRIC countries as emerging manufacturing goliaths continues to unravel in the face of sharp declines in competitiveness...

- Brazil joins Russia in a steep decline in the global competitiveness rankings as economic and socio-political instability takes its toll.

- Some hope remains for India to rejoin China in the top five manufacturing nations in the next five years.

“Goldman Sachs, which coined the term BRIC, took the inevitable and highly symbolic step of closing its BRIC fund in 2015 following a steep and prolonged decline from its peak value in 2010.”

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
The search begins for a “New China”... as Executives look to the “Mighty Five” (MITI-V) nations

As China begins to pivot towards a higher value manufacturing paradigm to align with other innovation-oriented markets, where’s the “New China”?

The MITI-V, an alternative to China

<table>
<thead>
<tr>
<th>Country</th>
<th>Malaysia</th>
<th>India</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Rank</td>
<td>13</td>
<td>5</td>
<td>14</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Difference</td>
<td>(↗ +4)</td>
<td>(↗ +6)</td>
<td>↔</td>
<td>(↗ +4)</td>
<td>(↗ +6)</td>
</tr>
<tr>
<td>Current Rank</td>
<td>17</td>
<td>11</td>
<td>14</td>
<td>19</td>
<td>18</td>
</tr>
</tbody>
</table>

- Rapidly rising wages in China present opportunities for other emerging nations to be competitive on the cost of labor and materials.

- MITI-V (The Mighty 5: Malaysia, India, Thailand, Indonesia, and Vietnam) are emerging as alternative low-cost destinations.

- This presents significant opportunities and challenges for companies currently operating in China that depend on a lower cost base.

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
So what drives manufacturing competitiveness?

For the 2016 index, global CEOs point to talent (again), cost competitiveness, and workforce productivity as the top three drivers of manufacturing competitiveness.

**Rankings of drivers of global manufacturing competitiveness**

1. TALENT
2. COST COMPETITIVENESS
3. WORKFORCE PRODUCTIVITY
4. SUPPLIER NETWORK
5. LEGAL AND REGULATORY SYSTEM
6. EDUCATION INFRASTRUCTURE
7. PHYSICAL INFRASTRUCTURE
8. ECONOMIC, TRADE, FINANCIAL AND TAX SYSTEM
9. INNOVATION POLICY AND INFRASTRUCTURE
10. ENERGY POLICY
11. LOCAL MARKET ATTRACTIVENESS
12. HEALTHCARE SYSTEM

(Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index)
Deeper dive on drivers and leading nations
Both advanced and emerging economies demonstrate varied strengths and weaknesses when compared on key drivers of competitiveness

<table>
<thead>
<tr>
<th>Selected County Manufacturing Competitiveness Drivers</th>
<th>US</th>
<th>Germany</th>
<th>Japan</th>
<th>South Korea</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talent</td>
<td>89.5</td>
<td>97.4</td>
<td>88.7</td>
<td>64.9</td>
<td>55.5</td>
<td>51.5</td>
</tr>
<tr>
<td>Innovation policy and infrastructure</td>
<td>98.7</td>
<td>93.9</td>
<td>87.8</td>
<td>65.4</td>
<td>47.1</td>
<td>32.8</td>
</tr>
<tr>
<td>Cost competitiveness</td>
<td>39.3</td>
<td>37.2</td>
<td>38.1</td>
<td>59.5</td>
<td>96.3</td>
<td>83.5</td>
</tr>
<tr>
<td>Energy policy</td>
<td>68.9</td>
<td>66.0</td>
<td>62.3</td>
<td>50.1</td>
<td>40.3</td>
<td>25.7</td>
</tr>
<tr>
<td>Physical infrastructure</td>
<td>90.8</td>
<td>100.0</td>
<td>89.9</td>
<td>69.2</td>
<td>55.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Legal and regulatory environment</td>
<td>88.3</td>
<td>89.3</td>
<td>78.9</td>
<td>57.2</td>
<td>24.7</td>
<td>18.8</td>
</tr>
</tbody>
</table>

• The mosaic above clearly demonstrates the competitive advantage Germany, the US and Japan have on most of the top drivers including talent, innovation policy and infrastructure (with the obvious exception being cost competitiveness).

• China and India still hold a significant competitive advantage when it comes to the cost of labor and materials.
What talent issues are manufacturers facing?
Skills gap 2015 and beyond
Talent remains a top CEO concern and filling jobs is no easy task. The 2015 Manufacturing Institute and Deloitte Skills Gap study confirmed there is still a significant shortage of talent in U.S. Manufacturing and is only projected to grow over the next decade.

84% of executives agree there is a talent shortage in U.S. manufacturing and...

SIX out of TEN open skilled production positions are unfilled due to talent shortage.

It takes 90+ days to recruit highly skilled workers.

80% of manufacturing companies are willing to pay more than the market rates in workforce areas reeling under talent crisis.
The skills gap is widening

Over the next decade nearly **3 ½ Million** manufacturing jobs need to be filled...

The skills gap will likely result in **2 Million** of those jobs going unfilled.

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**The implications are significant**

Every job in manufacturing creates another **2.5 new jobs** in local goods and services.\(^1\)

For every $1 invested in manufacturing, another **$1.37 in additional value is created** in other sectors.\(^2\)

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By 2025 the skills gap will grow to **2 million**

In 2011, **600K** jobs were unfilled due to the skills gap.

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The retirement of baby boomers, strength of the economy and attractiveness of the industry are ranked among leading factors impacting the talent shortage.

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Sources include: Bureau of Labor Statistics (BLS) and Deloitte analysis
1 Milken Institute and Economic Planning Institute.
2 The U.S. Department of Commerce, Bureau of Economic Analysis.
Talent shortage significantly impacts manufacturers
The skills gap negatively influences operations, company growth and the bottom line in a variety of ways.

82% of executives believe the skills gap will impact their ability to meet customer demand

Executives also agree it will impact their ability to:

- 78% implement new technologies and increase productivity
- 69% provide effective customer service
- 62% innovate and develop new products
- 48% expand internationally

The implications are significant
Between 2004 and 2012, U.S. manufacturing industry lost $9 billion to $25 billion per year of output because of open positions that went unfilled.¹
Closing the gap: attracting and developing talent is essential. Adding to the complexity is finding workers with the skills required to meet today’s advanced manufacturing requirements. A holistic approach is needed in order close the gap and remain competitive.

Start by developing and retaining current workforce:

The most effective skilled production workforce development strategies cited by executives:

- 94% Internal employee training and development
- 72% Involvement with local schools and community colleges
- 64% External training and certification programs
- 49% Creation of new veteran hiring programs

Percentage of executives that indicate current employees are not sufficient in key skills:

- 70% technology/computer skills
- 67% basic technical training
- 69% problem solving skills
- 60% math skills

Then employ methods to attract and develop the right people:

Find: Employ advanced analytics to enhance candidate screening practices.

Develop: Invest in internal training programs and external partnerships that build critical skills.

- Dream It. Do It.™ | Skills Certification System | STEP

Target: Develop integrated recruiting and communications approach with the target in mind.

Grow: Change the public’s perception in order to grow the overall pool of interest.

- Manufacturing Day | Manufacturing Institute and Deloitte Public Perception Study
Availability of a qualified workforce remains a challenge for many nations

Skilled workers and engineers are the top categories that employers find difficultly in recruiting around the world

• Many nations are facing a critical skills shortage, most notably nations like Japan and India where over half of employers are having difficulty filling jobs.

• For example, United States is facing a manufacturing workforce talent challenge due to an aging population, changing dynamics of the skillset needed for advanced manufacturing, and attractiveness of the industry.

• Two million positions in US manufacturing industry will likely go unfilled due to a lack of skilled workers over the next decade (2015 Deloitte Skills Gap Study).
Talent (and collaboration) is the fuel for a vibrant ecosystem. Many nations have invested heavily in ecosystems to connect people, policies, and organizations to translate ideas into commercial products and services.

An Illustration of the current US Innovation Ecosystem

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