Disruption in the world
Economy, innovation
and positioning in the
new international dynamics

Tim Hanley
Global Lead-partner of Manufacturing, Deloitte

December 2014
Global economy in 2014 shows few signs of strength

IMF cuts global growth forecast down to 3.3 percent in 2014 and 3.8 percent in 2015

United States to grow by 2.2 percent in 2014 then pick up to 3.1 percent in 2015. Recent lowered growth projections for Japan to 0.9 percent, and 0.3 percent for Brazil in 2014.

Eurozone treading water with growth around 0.8 percent in 2014. Geopolitical tensions with Ukraine crisis impacting Europe’s biggest economy, Germany

Growth in emerging markets (BRIC and other developing markets) slower than expected 2014. China growth modified down to 7.4 percent
Today’s presentation will highlight…

Technologies

Ecosystems

Enablers
Since the advent of the microchip, the topple rate - the rate at which companies switch leadership positions in a sector - has increased 39 percent.
Reinventing the way they innovate

Expanding their supply chain to collaborate with others

Achieving speed to market with new ideas

Advanced manufacturing is replacing smoke stacks and shuttered factories with high-tech laboratories and state-of-the-art plants. These new, 21st-century models for prototyping and innovating enable the manufacturing industry to generate up to 90 percent of business R&D spending.

…. Today, the breakthroughs we seek – game-changing ideas like self-healing materials and self-driving cars – are so complex that they will never materialize if we all stay within the boundaries of our sectors or our companies.

Andrew Liveris, Chairman and CEO of Dow Chemicals

Source: CNBC. Perspective article by Andrew Liveris, Chairman and CEO of Dow Chemicals. Why it’s time to unleash manufacturing innovation, 20 January 2014
Companies are beginning to leverage next generation opportunities

- **Operational efficiency**
  - Remote monitoring / manipulation
  - Operator efficiency
  - Delivery optimization
  - Inventory management

- **Workforce optimization**
  - Remote centralized expert assistance
  - Cloud-connected workforce
  - On-demand field training
  - Personnel tracking

- **Contextual management**
  - Condition-based management
  - Strategic prototyping
  - Predictive analytics
  - Real-time insight

- **Social responsibility**
  - Safety
  - Energy profile
  - Regulatory compliance
  - Sustainability

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Advanced Manufacturing technologies expected to double in value to $85+ billion globally by 2019

- **Advanced Sensors**: Create an internet of things using embedding sensors
- **Advanced Robotics**: Use of sophisticated robots for complex tasks
- **Additive Manufacturing**: Use of 3D printing for manufacturing
- **Pervasive Automation**
  - Adding artificial intelligence to automation

**Global nanomaterial market**
- **2012**: USD 2.0 billion
- **2019e**: USD 5.5 billion
- **CAGR**: 15.5%

**Global smart sensors’ market**
- **2013**: USD 10.8 billion
- **2019e**: USD 21.6 billion
- **CAGR**: 12.2%

**Global industrial robotics market**
- **2012**: USD 26.8 billion
- **2020e**: USD 41.2 billion
- **CAGR**: 5.5%

**Global additive manufacturing market**
- **2012**: USD 2.5 billion
- **2019e**: USD 16.2 billion
- **CAGR**: 45.7%

Note: ¹Growth estimate data is not available


© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Systems design will become increasingly important

A large portfolio of existing materials...

- Semiconductors
- Metals
- Ceramics
- Polymers

... and emerging combinations of materials

- Conformal GaAs PV
- Biodegradable Composites
- Self-assembled materials

Process technology advancements

- Nanotechnology
  - Specific enabling process technology
  - Extract greater performance or different properties from existing materials

- Industrial biotechnology
  - A new way of making existing materials
  - Sustainable alternatives for fuels and feedstock's

- Additive manufacturing
  - Distributed customized manufacturing (scale-out)
  - Produce unique 3D objects that can not be made any other way

Companies that deliver systems versus materials achieve greater value creation

Performance divergence between materials and systems...

...while market consistently rewards systems players


© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Advanced sensors:
Wearable technology to reduce human error and ultimately reduce cost

Source: Google.com/glass
Advanced robotics: Testing processes improved using robots

Source: “New robot can test 10,000 chemicals weekly”, Voice of America, May 2011; “Modular vision system eases printed circuit board traceability”, Vision Systems, April 2014

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Pervasive automation: IBM’s Watson at work

Source: IBM. Press release: IBM Research and Thiess Use Data ‘Vital Signs’ to Predict Mining Equipment Health and Drive Business Performance. 20 February 2013

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Additive Manufacturing: Patient applications

Source: 3D Systems. Manufacturing the Future presentation at Deloitte event on 13 October 2014
© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Additive Manufacturing: Parts for Space

Source: 3D Systems. Manufacturing the Future presentation at Deloitte event on 13 October 2014
© 2014 For information, contact Deloitte Touche Tohmatsu Limited.
Additive Manufacturing can significantly impact the way products are created and distributed

3 Product evolution
- Customization to customer requirements
- Increased product functionality
- Market responsiveness
- Zero cost of increased complexity

4 Business model evolution
- Mass customization
- Manufacturing at point of use
- Supply chain disintermediation
- Customer empowerment

1 Stasis
- Design and rapid prototyping
- Production and custom tooling
- Supplementary or “insurance” capability
- Low rate production/no changeover

2 Supply chain evolution
- Manufacturing closer to point of use
- Responsiveness and flexibility
- Management of demand uncertainty
- Reduction in required inventory

Source: Deloitte. 3D Opportunity: Additive manufacturing paths to performance, innovation, and growth
© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Additive Manufacturing is changing how we make and distribute products

Considerations and impact on companies’ business functions

R&D/ Production
- Choice of components that favor Additive Manufacturing over traditional
- Crowd-source ideas to break existing design and manufacturing limitations

Supply chain management
- Decisions related to in-house over outsource
- Choice of suppliers driven by their Additive Manufacturing capabilities
- Co-production with suppliers and customers

Legal
- Intellectual property issues
- Regional and country regulations

Human Resources
- Need for lower headcount
- Talent with requisite skills in areas such as design and material sciences

Finance
- Fixed and variable cost comparisons between Additive Manufacturing and traditional manufacturing

Information Technology
- CAD/CAM systems
- Integration of IT systems with R&D and manufacturing platforms

Source: Deloitte. 3D Opportunity: Additive manufacturing paths to performance, innovation, and growth

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Digital disruption challenges you to find adjacencies and collaborate with others.
Collaboration in developing bio-based plastics

1. **Unmet need**
   - Development of non-petroleum based supply chains for large volume plastics used in packaging, apparel, food, and other consumer packaging

2. **Material innovation**
   - Polyethylene terephthalate (PET) is a versatile, inexpensive plastic used in synthetic fabrics, packaging for food and beverages, and for other liquids.

3. **Process technology**
   - New biorefining technologies enable the production of the constituent monomers of PET, ethylene glycol and terephthalic acid, from biomass

4. **Business models and ecosystem**
   - These companies have formed the Plant PET Technology Collaborative (PTC) to support the development and use of plant-based PET.

5. **Open innovation**
   - PTC members are pooling their resources, knowledge and experience in an effort to find a sustainable alternative to using fossil fuels for PET manufacturing

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
Public and private partnerships to pursue material and process innovation

**Unmet need**
- Ongoing trends related to sustainability and energy efficiency driving OEMs like Ford to explore new ways to reduce energy use in their high-volume vehicles with low weight materials

**Material innovation**
- Identify new, low-cost, and light weight materials and design manufacturing processes that enable OEMs to reduce vehicle weight and cost while maintaining safety

**Open innovation and ecosystem**
- Ford, Dow, and Oak Ridge Laboratory have created a partnership to bring each of their expertise in materials, process technologies, and federal research and grants to develop lower-cost, more energy efficient vehicles. In June 2012 the US DOE committed $9 million to funding this partnership.

**Process technology**
- New process and design technologies and manufacturing methods will be required to enable these materials to be applied to composite automobile frames for high volume production

Emerging ecosystems such as the Maker Movement - while disruptive – also offers opportunities to bring ideas to life
Maker ecosystem

Source: Deloitte Center for the Edge. A movement in the making.

© 2014. For information, contact Deloitte Touche Tohmatsu Limited.
TechShop teams with Ford on Employee Patent Incentive Program which has in part led to 50 percent more patentable ideas by Ford employees.
Blue Sprout tech factory offers innovators flexible office, co-working space, work/live units, light manufacturing and rapid prototyping facilities
Public policy and investments are vital to building world-class capabilities in Advanced Manufacturing
Building Advanced Manufacturing capabilities

**Industry initiatives**
- Visualization and simulations to help adoption
- Incremental adoption across multiple manufacturing functions to help stagger the deployment of capital
- Incorporate social and environmentally sustainable solutions to ensure long-term returns

**Joint initiatives**
- Invest in skills training
- Invest in Advanced Manufacturing related R&D
- Open facilities that simulate Advance Manufacturing at manufacturing sites
- Develop sustainable energy sources to ensure continuous power supply

**Government initiatives**
- Bring in regulations that aid the use of advanced and sustainable manufacturing practices
- Develop infrastructure that enables Advance Manufacturing’s deployment
- Offer funding and/or financial incentives and implement policies to encourage Advance Manufacturing

Source: DTTL Global Manufacturing Industry group. October 2014
Governments and companies are investing in Advanced Manufacturing

**United States**
- Advanced Manufacturing Partnership
- High-Tech Manufacturing Innovation Hub
- GE developing Power & Water Advanced Manufacturing Facility

**China**
- 12th Five Year plan to invest in Advanced Materials

**Japan**
- Private and public partnerships with global partners towards sustainability through a low carbon economy

**European Union**
- Horizon 2020 innovation program
- Siemens training workers at Massachusetts schools

**United Kingdom**
- Institute for Advanced Manufacturing and Engineering

**Canada**
- Advanced Manufacturing Fund

**Brazil**
- National Strategy for Science, Technology and Innovation targeting ~USD$30b investment over five years
- Tax programs such as Lei do Bem and Inovar Auto aimed at spurring in-country R&D and innovation

**India**
- Research collaboration with UK in areas such as Additive Manufacturing, Smart Energy Grids and Energy Storage
Brazil’s opportunity with innovation

Strong desire and need for innovation
Lack of infrastructure and capabilities to support it
What will the future of Advanced Manufacturing mean for Brazil?

- Opportunity or threat?
- Collaborate for solutions
- The CFO role will be vital

- Look to evolving business models
- Stay current with evolving technology
- Act quickly to evolving competition and ecosystems
- Cater to evolving customer expectations