The exciting future of manufacturing
<table>
<thead>
<tr>
<th></th>
<th>The exciting future of manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manufacturing competitiveness – why we manufacture</td>
</tr>
<tr>
<td>2</td>
<td>Profiling Advanced Materials Systems (AMS) – what we use to manufacture</td>
</tr>
<tr>
<td>3</td>
<td>Profiling the future of automotive and mobility</td>
</tr>
<tr>
<td>4</td>
<td>Profiling the future of forestry, pulp, paper and packaging</td>
</tr>
</tbody>
</table>
Speakers

Karthi Pillay
Africa Manufacturing Industry Leader
Deloitte South Africa

Bronwyn Kilpatrick
Automotive Leader
Deloitte South Africa

Roy Campbell
Forestry, Pulp, Paper and Packaging Leader
Deloitte South Africa

Jason McPherson
Advanced Materials Systems Specialist
Deloitte South Africa
Setting the scene: Present and Future focus
We have the ability to choose our destiny & become leaders: So, how do we get together as a manufacturing community (public + private)

Current focus is on the here and now

Challenge is to spend more time focusing on the future

Deloitte globally is spending time focusing on the here and now, plus working with leading universities, public sectors, private sectors, to understand and shape the future of manufacturing
Examples of innovation

Google becomes car manufacturer

Intelligent roads

Uber

GE fuel nozzle

Discovery Drive
Discovery Insure wants you to drive like a boss with this new app

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Global Megatrends

- 3D printing/4D printing
- Crowd sourcing, gamification – Large US retailer example
- Analytics and Big Data
- Manufacturers want to get closer to customer
Global Megatrends

3D printing/4D printing

Crowd sourcing, gamification – Large US retailer example

Analytics and Big Data

Manufacturers want to get closer to customer
To remain competitive you need to understand the future

So: what role will South Africa play in the future of manufacturing?
Manufacturing competitiveness - why we manufacture
Drivers of global manufacturing competitiveness

Government forces
- Talent-driven innovation
- Cost and availability of labour and materials
- Energy cost and policies
- Supplier network
- Local market attractiveness

Manufacturing competitiveness

Market forces
- Economic, trade, financial and tax systems
- Physical infrastructure
- Government investments in Manufacturing and innovation
- Legal and regulatory system
- Healthcare system
## Top 10 Drivers of SA Manufacturing Competitiveness

**South Africa ranking compared to the rest of the world**

<table>
<thead>
<tr>
<th>SA rank</th>
<th>Competitiveness driver</th>
<th>Global rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost and availability of labour and materials</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Local market attractiveness</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Energy cost and policies</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Economic, trade, financial and tax system</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Physical infrastructure</td>
<td>6</td>
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<tr>
<td>6</td>
<td>Supplier network</td>
<td>4</td>
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<tr>
<td>7</td>
<td>Talent - driven innovation</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Government investments in manufacturing</td>
<td>10</td>
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<tr>
<td>9</td>
<td>Legal and regulatory system</td>
<td>5</td>
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<tr>
<td>10</td>
<td>Healthcare system</td>
<td>9</td>
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</tbody>
</table>
# 2013 Global Manufacturing Competitiveness Index

## Global CEO Survey: 2013 Country Manufacturing Competitiveness Index rankings

<table>
<thead>
<tr>
<th>Current competitiveness</th>
<th>Index score</th>
<th>10 = High 1 = Low</th>
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<tbody>
<tr>
<td>Rank</td>
<td>Country</td>
<td>Score</td>
</tr>
<tr>
<td>19</td>
<td>Czech Republic</td>
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<td>Turkey</td>
<td>5.61</td>
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<tr>
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<td>Sweden</td>
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<tr>
<td>22</td>
<td>Switzerland</td>
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<tr>
<td>23</td>
<td>Netherlands</td>
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<tr>
<td>24</td>
<td>South Africa</td>
<td>4.92</td>
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<td>France</td>
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<td>Belgium</td>
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<td>3.23</td>
</tr>
<tr>
<td>38</td>
<td>Greece</td>
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</tr>
</tbody>
</table>

## Competitiveness in five years

<table>
<thead>
<tr>
<th>Competitiveness in five years</th>
<th>Index score</th>
<th>10 = High 1 = Low</th>
</tr>
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<tbody>
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<td>Rank</td>
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Source: Deloitte and U.S. Council on Competitiveness, 2013 Global Manufacturing Competitiveness Index
Profiling Advanced Materials Systems (AMS) — what we use to manufacture
Igniting growth: Advanced Materials Systems is about maximizing growth based on materials-enabled solutions

**Advanced Material Systems (AMS) are a pathway for re-igniting growth** through the combination of:
- Materials, process technologies, partnerships, and business models that together, through systems level engineering, help create and capture value by addressing large, global unmet wants and needs.

### Key concepts

#### Market opportunity
- **Ability to substitute an existing solution or address unmet needs**

#### Systems level design
- **Design of the final product and ecosystem that determines requirements of supporting components / functional solutions**

#### Functional solutions
- **Physical systems enabled by the performance properties of materials**

#### Advanced Material Systems Integrator
- **Approach to deliver functional solutions to the market to maximize value creation and capture**

#### Business models
- **How a company creates and captures value in the marketplace**
The AMS framework provides companies with a structured approach to innovation and growth.

<table>
<thead>
<tr>
<th>Drivers of Performance</th>
<th>Challenges to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand</strong></td>
<td>How do you determine which megatrends and market opportunities apply to you?</td>
</tr>
<tr>
<td></td>
<td>Is there a specific place where you should start?</td>
</tr>
<tr>
<td></td>
<td>How do you translate market requirements to functional solutions?</td>
</tr>
<tr>
<td><strong>Functional Solutions</strong></td>
<td>How do you define performance requirements and orient your system-level design, optimization, and testing approach?</td>
</tr>
<tr>
<td></td>
<td>How do you approach material and process engineering (i.e. technology selection, development, and integration)?</td>
</tr>
<tr>
<td></td>
<td>How do you establish a foothold? How do you sustain a viable technology roadmap?</td>
</tr>
<tr>
<td><strong>Value Capture</strong></td>
<td>How do technical and commercial development activities reinforce one another?</td>
</tr>
<tr>
<td></td>
<td>How should you assess and pursue business model alternatives?</td>
</tr>
<tr>
<td></td>
<td>How do you develop and access a network of required capabilities?</td>
</tr>
<tr>
<td></td>
<td>How do you protect your value potential across the system (AMS)?</td>
</tr>
</tbody>
</table>
A case study
Medtronic and 480 Biomedical used a market driven approach to develop bio-active composite implants

1. **Unmet need**
   - Dissolvable scaffolds for treating arterial diseases throughout the body

2. **Material innovation**
   - The design required the combination of two different bio-resorbable polymers to be integrated into a composite structure. The company used libraries of existing materials

3. **IP & process technology**
   - Their strong IP position came from the design and the innovative process technology they used to integrate the different materials.

4. **Systems Level Design**
   - The design was inspired by other structures outside of medicine like braided pipes used in residential plumbing that are strong radially but can twist and bend easily

5. **Business models and ecosystem**
   - A strategic investment from Medtronic helped fund development, while guidance on product performance requirements based on detailed market knowledge shapes the functional solution
Why Advanced Materials Systems?
Change in the inertia of new materials innovation is reinforcing the need for change

Many manufacturing companies are struggling to grow

Fundamental limitations in what can be done at the molecular level

Research without market direction is unsustainable

Cost of and duration of “science projects” is prohibitive

Resulting in:

Increasingly impatient capital and intense goal focus by investors

Consolidation of value to those closest to solutions

Structural re-sorting of basic and applied research capabilities

Syndication of technical, market, and financial risk

Power shift to systems integrators

Beginning of a new age of materials engineering
And there is growing evidence that companies that deliver systems versus materials, lead in value creation.
Meanwhile, there is an explosion of global market opportunities to meet seemingly limitless demands

Example unmet needs and wants

- New sources of fuel and feedstock to replace petroleum
- New technologies to scale up and scale out renewable energy solutions
- Weight reduction and downsizing of vehicles for emissions and efficiency
- Alternative vehicle propulsion systems
- New energy storage and transport technologies
- Decentralized solutions for diagnostics, therapeutics, disease prevention, and care
- New technologies/solutions for recovery and recycling
- New technologies to promote efficient commercial and residential use of water
- Solutions to improve farming productivity, food preservation, and transport
- Info/media solutions to enable more targeted and localized connectivity
- Cost effective solutions for building small buildings or larger “mega” cities
- End markets where Advanced Material Systems can create value are large, estimated to be greater than US$7 trillion globally with a US$400 billion opportunity for material providers by 2030

Source: DTTL Global Manufacturing Industry group, October 2012
Advanced Materials Systems: Business models and go-to-market strategies
Success requires that target markets define system performance and cost, not the material.

A company wishing to sell composites should understand each end market’s needs and performance criteria.

Achievement of required system performance allows for market entry.

Materials are selected based on ability to influence system performance.

Market needs set threshold for system performance.

Source: DTTL Global Manufacturing Industry group, October 2012.
Recognizing ecosystem complexity and how value is created is basic to approaching the opportunity
The innovation pathway evolves as questions around system creation, value capture and business models are answered.

**System creation**

Translation of market needs into performance requirements enables a system to be designed and managed for the opportunity.

**Value capture**

Overall business objectives and core capabilities inform decisions around how to take a new functional solution to market.

**Business model selection**

Business models are an integral part of the system and are as fundamental as the solution itself.

Source: DTTL Global Manufacturing Industry group, October 2012
In essence, AMS is about **growth**

- Translation of needs to functional solution
- Systems level design
- New ways of leveraging existing materials
- Open innovation
- Decentralized and scalable solutions
- Emerging industries and competitive space
Profiling the future of automotive
The rise of an Automotive Ecosystem
A few examples of global trends

The impact and integration of smartphone with vehicle

New technologies challenging the paradigm of car ownership, lowering the transaction costs of sharing vehicles and coordinating rides.

Consumers can now research, negotiate, and purchase vehicles using the Internet. eBay Motors alone has sold over 4.3 million used cars.

An explosion of innovative new services are being tested today, including City CarShare, Zipcar, SideCar, Uber and Lyft.

Source: http://www.forbes.com/sites/bigbangdisruption/2013/06/03/big-bang-disruptions-are-transforming-the-automotive-industry/
The rise of an Automotive Ecosystem
A few examples of global trends

Driverless, electric, alternate fuels, new competitors

Source: http://www.forbes.com/sites/bigbangdisruption/2013/06/03/big-bang-disruptions-are-transforming-the-automotive-industry/
The rise of an Automotive Ecosystem
A few examples of global trends

Computerized design & testing – fewer defects, longer life spans, reduced maintenance

Source: http://www.forbes.com/sites/bigbangdisruption/2013/06/03/big-bang-disruptions-are-transforming-the-automotive-industry/
The rise of an Automotive Ecosystem
A few examples of global trends

Source: http://www.forbes.com/sites/bigbangdisruption/2013/06/03/big-bang-disruptions-are-transforming-the-automotive-industry/
Profiling the future of forestry, pulp, paper and packaging
I don’t see the wood....

Newspapers, magazines and books

Paperless office

Digital

Wood products are appearing in unusual applications – food, clothing

Sustainable forests in South Africa (FSC) – forestry offers good economic opportunities for rural communities – e.g owner growers (KZN & Eastern Cape)

South Africa provides one of the best hardwood growing areas in the world
Forest, Pulp, Paper and Packaging

- Is there a future?
  - It's not just about tissue

- Emotional connection

- It's all about going green

- Changing consumption patterns and manufacturing origin

- Niche products

- Link into by-products
Future of packaging

1. **“Talking” packaging**
The key to the technology is a layer of digital paper that is embedded with electronics, squeezed in between a thick cardboard sheet and another sheet printed with product information. The paper is printed with conductive inks, which transmits information to a micro-computer that contains recorded audio files when applied with pressure. Printed speakers, which are formed from more layers of conductive inks and sit over an empty cavity to form a diaphragm, then play back the sounds. Examples include SelfTalk by German manufacturer Wipak, which, instead of touch sensors, the pack uses a pen-shaped reader to retrieve and replay audio information that is stored in a printed 2D code on top of images and texts. Only by using a special varnish and without the use of RFID or microchips, the sound reacts to the pen and plays the sounds.

2. **4D packaging**
The material connects with customers on a sensory and emotional level by using 3D printing, tactile inks, sensory elements, as well as metallic and holographic effects. The technology is about creating a material that provides texture mapped to colour.

3. **Smart packaging**
Research is currently being done on an innovative technology which can “taste” food through sensors embedded in the packaging. When food is spoilt or contaminated, the packaging will change colour to alert the consumer. Other developments include creating smart packaging with a "release on command" insta-preservative that salvage food right before it goes bad.

4. **Edible packaging**
Creating technology that one will be consume along with its contents. Harvard University ha already started producing edible food containers called WikiCells.

Source: [www.packaging-gateway.com](http://www.packaging-gateway.com); [www.fooddive.com](http://www.fooddive.com)
Future of packaging

5. Micro packaging
Texas A&M University has developed packaging using nanotechnology to produce material which is thousands of times thinner than human hair, consist solely of water, a soluble polymer and 70% clay particles. Global pharmaceutical company Bayer, has developed a plastic film using clay nanoparticles that prevent oxygen, moisture and carbon dioxide from decomposing food products.

6. Anti-microbial packaging
This includes the development of packaging which not only shields food against bacteria, but also actively fights against them. Other anti-microbial technology includes packaging that can absorb oxygen and keep food fresh.

7. Water soluble packaging
This is the development of packaging which is essentially food pouches that dissolve in water. It dissolves faster in hot water. The technology does currently needs secondary packaging to protect against contamination.

8. Self cooling – self heating packaging
A company has created technology that absorbs carbon dioxide from the atmosphere which is released when the activation button is pressed, causing the liquid inside the can to drop to 30 degrees Fahrenheit within a matter of minutes. The self heating technology can heat a product to 145 degrees Fahrenheit in two minutes, and will be embedded at the bottom of the product’s packaging.

Source: www.packaging-gateway.com; www.fooddive.com