Industry 4.0
Opportunity & Trends : Business, Academia, & Government

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About Dow

Dow is a subsidiary of DowDuPont (NYSE: DWDP), a holding company comprised of Dow and DuPont with the intent to form three strong, independent, publicly traded companies in agriculture, materials science and specialty sectors.

Combines science and technology knowledge to develop premier materials science solutions that are essential to human progress.

Has one of the strongest and broadest toolkits in the industry, with robust technology, asset integration, scale and competitive capabilities that enable it to address complex global issues.

Broad range of differentiated technology-based products and solutions for customers in high-growth markets such as packaging, infrastructure, and consumer care.
Industry 4.0: Many Variants of Technology – **Value is Key**

- Big Data
- Augmented Reality
- Virtual Reality
- Mobility
- Additive Manufacturing
- Cloud Computing
- Cyber Security
- Industrial Internet of Things
- Digital Thread
- Modeling, Simulation & Digital Twin
- Robotics

Source Adapted from: [http://www.aethon.com/industry-4-0-means-manufacturers/](http://www.aethon.com/industry-4-0-means-manufacturers/) and Boston Consulting Group
Value Opportunities Drive Interest and Investment

2025 Sustainability Goals

- Leading the Blueprint
- Delivering Breakthrough Innovations
- Advancing a Circular Economy
- Valuing Nature
- Increasing Confidence in Chemical Technology
- Engaging Employees for Impact
- World-Leading Operations Performance

Productivity

Growth

Safety

Drive To Zero


SAP: "IOT in Chemicals" 2014
Mckinsey & Company: "Digital Manufacturing Advanced Analytics and IOT in Manufacturing" Sept 21, 2015
Frost & Sullivan: Digital Transformation
Accelerating Research and Interest in Industry 4.0


Chemical Engineering Progress March 2016
Analytics and Knowledge Management – Data Domination

Discussion triggered by Data between Technical and On-site Persons
Consult Existing Knowledge
Agree on Actions
Plant makes Changes
Integrate learning into enterprise
Real-time Tracking and Notification Dashboard

Data, Calculations, Predictive models “Big Data”


http://mlawards.gilcommunity.com/winners/2016-winners/
Overall Visibility and Knowledge Management

Source: Northwest Analytics/Dow Program
Robotics and Drones: New Tools for a New Era

Eliminate all confined space entries by 2025
Limit use of scaffolding

→ Productivity and worker safety increased

Relative Ratio of CS E Jobs

<table>
<thead>
<tr>
<th>Job Type</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>High</td>
</tr>
<tr>
<td>Cleaning</td>
<td>Medium</td>
</tr>
<tr>
<td>Welding</td>
<td>Low</td>
</tr>
<tr>
<td>Assembly</td>
<td>Low</td>
</tr>
<tr>
<td>Object Movement</td>
<td>Very Low</td>
</tr>
<tr>
<td>Coating</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

Productivity and worker safety increased
Mobile: Connectivity Goes with the Worker

**Wireless Sensors** - machine to machine connections without wires, including RFID and bar coding

**Mobile Apps** are critical in business digitalization

Corporate wide **Mobility** platforms satisfying ever increasing cybersecurity requirements
From Basic Process Control to Connected Production

Real-Time Optimization of Factory Operations

- Part traceability through surface scanning
- Automatic OEE tracking utilizing sensors
- Automated Guided Vehicles moving parts
Full Factory and Logistics Optimization

Plants $i$

Potential Warehouses $j$

Customers $k$

$t$: time periods (months)

$p$: products

$m$: transportation modes
Leveraging National Infrastructure – USA Example

A role to play for public-private partnerships to drive innovation

https://manufacturingusa.com/
Digital Enterprise Knowledge Domains - Workforce Required

Final Thoughts…

- New methodologies are occurring at a faster rate than in the past and they will change the way we work
- Human safety and cyber security remain paramount in the next generation production unit
- Risk averseness may stifle accelerating innovations
- The process industries have a strong base from which to draw
- Careful consideration of how value is generated with respect to market offerings is required
- Workforce skill augmentation and curriculum changes required
- Government can support infrastructure and workforce developments
Thank You

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