

# Industry 4.0

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# Semiconductor Manufacturing



<https://www.youtube.com/watch?v=-KTKg0Y1snQ>

<https://www.youtube.com/watch?v=WVLGKq9An28>

[https://www.youtube.com/watch?v=DIL\\_OOF5FFw](https://www.youtube.com/watch?v=DIL_OOF5FFw)

# Industry 4.0 Drivers: Performance and Cost



- **Advancing Use of Big Data and Analytics in an Information-Driven Factory**
  - Equipment increasingly equipped with vast array of intelligent integrated sensors
  - Driven by the push for ever-advancing capability, and the availability of such advanced sensors to both enable and monitor (iterative)
  - Sensor capability matched by tremendous increase in computing and communication technology
  - Real time monitoring, pause and correction
  - IoT/loE providing the connectivity

# Industry 4.0 Customer Drivers



- **Zero defects/single digit PPMs**
  - Loss of traditional cause-and-effect defect reduction methods
  - Replaced by much more sophisticated analytics
  - Project work to correlate the most subtlest of defects with the most subtlest of variations
- **100% on-time delivery**
  - Information requirements massive to schedule a wafer fab and meet this objective
- **Ever-present ongoing cost reduction pressures**

*Requirement to sustain 100% on time delivery, near-100% yields, and 0 defects drives sophisticated collection, and analysis, of 'Big Data'*

# Industry 4.0: Changing Workforce Skills Affecting all Labor Functions



- Process Development Engineers (M.S./Ph.D.)
- Process Sustaining Engineers and Managers (B.S./M.S./M.B.A.)
- Operations Research Professionals (B.S./M.S./M.B.A./Ph.D.)
- Supervisors, Production Managers (ideally B.S./M.S./M.B.A.)
- Equipment Engineers (B.S.)
- Facilities Engineers and Managers, CAD Engineers (B.S.)
- Skilled/Licensed Technicians - Process, Equipment, Facilities (HVAC, Water, Electrical, etc.)
- Environmental, Health and Safety Engineers (B.S./M.S.)
- Quality and Reliability Engineers (B.S./M.S./Ph.D.)
- Supply Chain/MRP Managers (B.S./M.S.)
- IT/Shop Floor Control/Data Analytics Engineers and Managers (B.S.)
- Procurement and Purchasing Experts (B.S.)
- Manufacturing Finance Professionals (B.S./M.S./M.B.A.)
- Manufacturing Human Resources Professionals (B.S./M.S.)
- Highly Skilled Factory Operators (H.S./B.A./B.S.)
- Numerous Contractors for Services

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# Industry 4.0: Implications



- 1. Non-traditional skills and structures in the workforce**
- 2. More collaboration required across all functions within the company, with its customers, and with its suppliers (especially tool vendors and IT)**
- 3. Need for advanced cyber security increasing exponentially**
- 4. Investment requirements increasing**