



The Future of Industrial Automation Technology and global trends

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Jim Pinto Purpose

- I'm here today as a catalyst
 - To trigger fresh thinking, to open your mind, to help by generating thoughts and ideas that can make a difference
 - To provide an automation futurist's perspective regarding the growth and success of automation in the global arena



The New Century

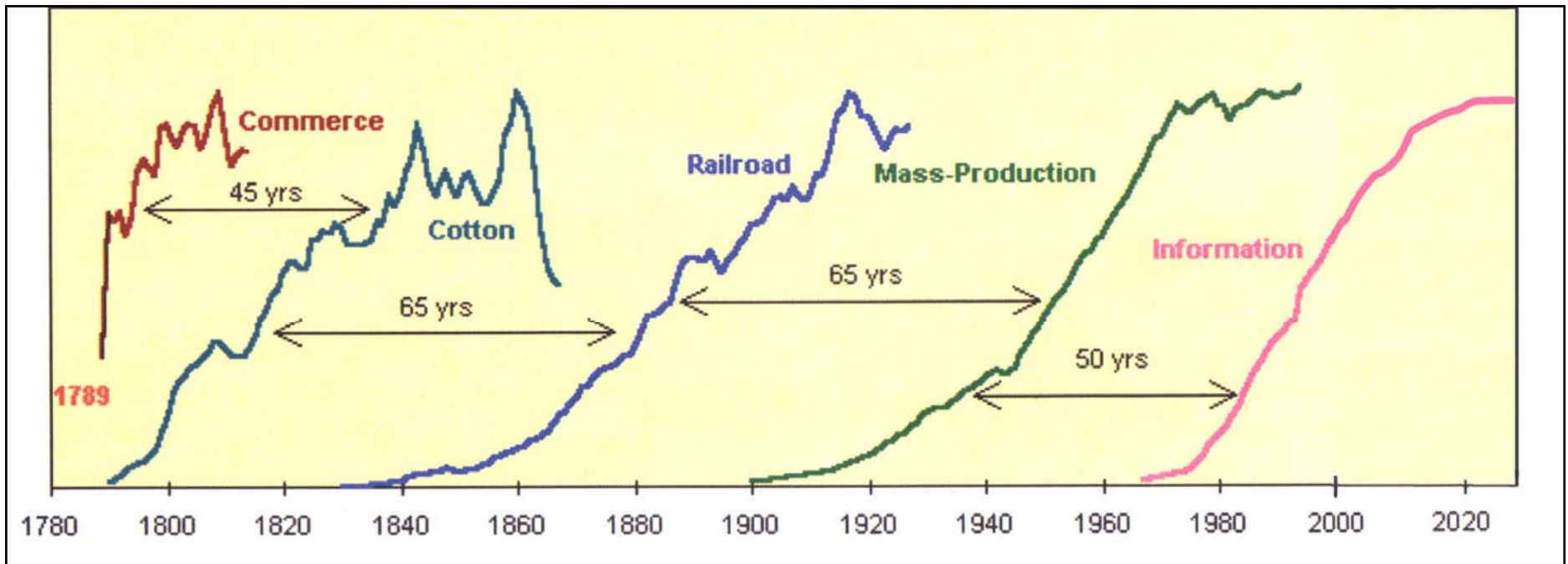
- The turbulence of a new age is re-writing all the rules of business
- Nothing 'traditional' any more
- Old dinosaurs are dying, as new leaders emerge
- Change is occurring faster than ever before, caused by globalization and technology advances.



World structural changes

- Old globalization was “cheap labor”
 - New globalization is “knowledge”
- Globalization and free trade
 - Massive disruptions in where and how world’s goods are produced
- The Achilles heel of Capitalism
 - Selling/losing knowledge advantage with short-term profit motive

Cycles of Growth





3 sources of wealth

- Natural resources
 - Location based
- Labor
 - Reduced by automation
- Knowledge
 - Key source of advantage
 - Innovation enhances knowledge



Knowledge work - anywhere

- Internet makes physical location irrelevant
 - Availability of trained people
 - Know-how is spreading
- Knowledge is power
 - The “first world” is losing the advantage
 - Outsourcing moving up the food-chain
- New competition brewing
 - China, India, others



China & India - *Chindia*

- World – 6.5 billion population
- China 1.4 billion, India 1.16 billion (40%)
 - Smartest 25% of China, 28% of India - more than the population US or Europe
 - World's largest "middle class"
 - Consumers, Competing for energy
 - China 700,000 – India 500,000 engineers per year
 - More than US, Europe (Germany, UK, France, Italy) combined
 - University system growing in size & quality
 - New "high-tech competitors"



Global HiTech

- Other regions/countries are competing strongly
 - Central & Eastern Europe
 - Russia, Brazil, Mexico
- Traditional leaders steadily losing advantage in many key technologies
- Read Tom Friedman's book "The World is Flat"
 - Review: <http://www.jimpinto.com/writings/flatworld.html>



Faster, Cheaper, Better

- Productivity has become a global race
- Fierce, head-to-head competition between regions and nations
- Reason: It is the source of the wealth
 - Key to improvements in living standards
- Those who can produce materials and products cheaper, faster, better – win!



Automation Purpose

- The fundamental purpose of automation is to improve productivity
- Generate increased output with reduced costs
- The intrinsic value of each and every piece of automation equipment is its ability to provide increased productivity for the user
- Continuous improvement of Productivity



Automation Systems

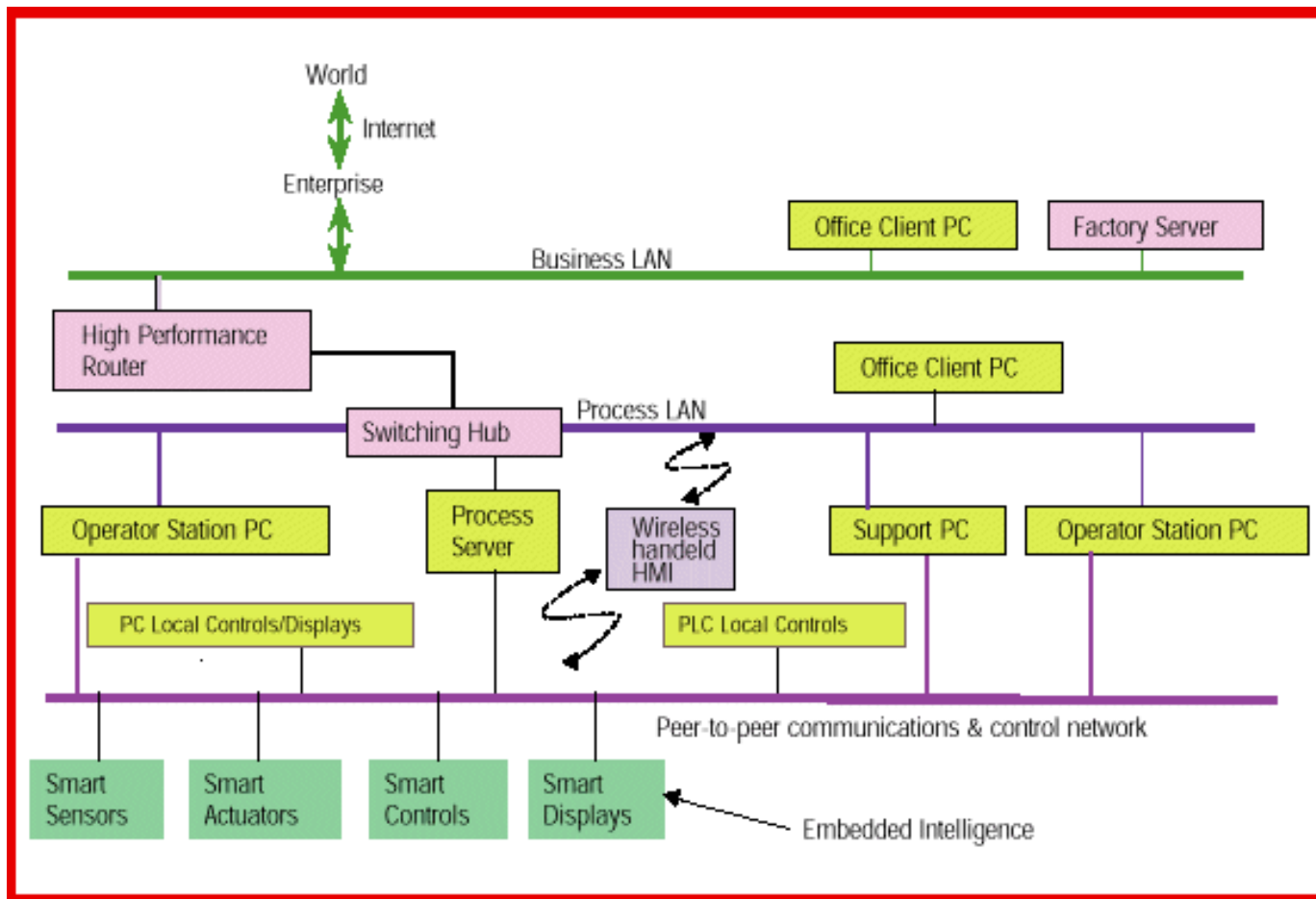
- Distributed control systems (DCS)
 - Large systems with multiple controllers and workstations.
- Programmable logic controllers (PLC)
 - Controls machines or processes - specific functions such as logic, sequencing, timing, counting, with digital/analog inputs/outputs.
- Supervisory control and data acquisition (SCADA)
 - Monitor and control dispersed assets. Hardware-embedded software is interfaced through PLC or equivalent RTU (remote-terminal-units).



I/O processing

- Industrial equipment processes Inputs (Sensors) and Outputs (Actuators).
 - Measurement (sensors)
 - Controls (actuators)
 - Alarms, Displays, Sequencers
 - Communications (networking)
 - Recording (trends, historians, records)
- All processing functions can become “intelligent”

Industrial Networks





Fieldbus & Sensor Networks

- Profibus (FMS, DP, PA)
- Foundation Fieldbus
- ControlNet
- Modbus
- DeviceNet (Canbus)
- ASibus
- HART (Wireless HART)

- Overlap between factory automation fieldbuses and sensor networks.
- Ethernet – Ethernet/IP
- BACnet & LON (Echelon) – building controls

Fieldbus: Where do we stand?

<http://tinyurl.com/2kr2oy>



Technology Shift

- Old technology - commodities
 - PLC, DCS, SCADA, Drives
 - Software – HMI, MES
 - Sensors, valves, equipment
- New technology – inflection points
 - Nanotech, MEMS
 - Sensors – tiny, low-cost, pervasive
 - Wireless everywhere
 - Pervasive Internet – M2M
 - Complex adaptive systems – Mesh networks



Industrial Automation Top-10

	N. America	Global
■ Emerson Process	1	3
■ Rockwell Automation	2	4
■ ABB	3	2
■ Siemens	4	1
■ Danaher	5	10
■ Honeywell Process	6	6
■ Schneider	7	5
■ GE	8	12
■ Cameron Valves	9	16
■ Ametek	10	17
■ Invensys	11	14

Source: Control/ARC Top-50 Automation Companies, Dec. 2009



10 things end-users need to know about automation vendors

1. Early signs and proposal depth
2. Watch for licensing fees and add-ons
3. Old versus new
4. Standards
5. Quality and customer support
6. Training and services
7. Long term support
8. Business and regional focus
9. Financial stability
10. Partnership development



Smart Equipment Trends

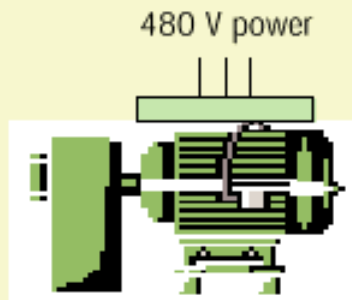
- Operating Information
 - “Smart” manuals - context sensitive on-line help
 - Progressive teaching/learning
- Real-time Condition Monitoring
 - Especially rotating machinery
- Maintenance
 - Scheduled
 - Event-driven
 - Adaptive (driven by history)
 - Predictive (projected via diagnostics)
- Operation
 - Adaptive (optimize based on history)
 - Predictive (optimize via calculation)

Intelligent Motors (example)

Dumb Motor

Information Provided

Powered or Not
Overload Trip
Single-direction
Hard-start



Smart Motor

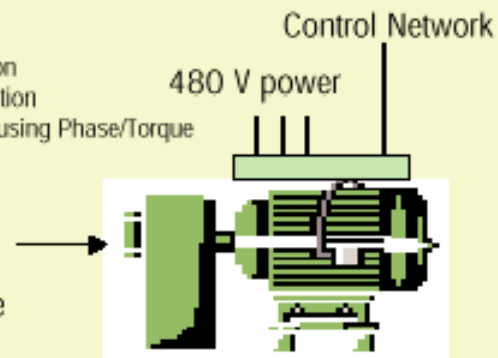
Information Provided

Specifications (applicable Rev.)
Maintenance
Replacement
Where Else Used
Run Status
RPM
Direction
Torque
Power
Current
Voltage
Temperature
Bearing condition
Bent shaft detection
Process health using Phase/Torque

Features

Speed Control
Soft Start / Stop
Braking
Phase correction
Accel / Decel control
Torque Control
Programmable Logic
Alarm Messaging
Pre-failure Warnings

Embedded
Objects &
Intelligence





Predictive Diagnostics

- Self-diagnostics — not only showing causes of failure after failure has occurred, but also predictive (before failure), preventive (precautionary and deterrent) and advisory (maintenance instructions).
- Key advances are closely linked with M2M



Self-monitoring Equipment

- Imagine every product, system and equipment monitoring its own operation
 - uptime
 - downtime
 - dwell-time
 - energy usage
 - malfunction
 - repair-time
- Usage reported with an Internet connection M2M



Machine-to-Machine - M2M

- Operating return on investment (ROI) on all plant equipment assets available all the time, any time
- End-users will manage their own assets
- Complete revolution of conventional services
- Equipment Suppliers
 - Help end-users add M2M capabilities as retrofits
 - Build self-monitoring and networking capabilities into new equipment
 - Provide diagnostics, pre-failure warnings, download upgrades
 - Embedded diagnostics locks-in the supplier and locks-out competition



Industrial Wireless

- A variety of technology choices are available for factory and process installations
 - Wireless HART and ISA 100
 - Standards are important, but don't wait
- Revolutionary implications
- Security is a key issue
- Fast investment break-even
- Significant growth expected



Wireless networks

- Vast arrays of real-time, remote interaction with the physical world
- Industrial automation moving to take advantage of overwhelming benefits
- The future of industrial wireless
 - Not just wire-replacement
- Smart, wireless networked sensors everywhere
 - Intelligence and connectivity for everything
 - Monitoring individual measurements as well as overall *patterns* of change
 - Intelligent diagnostics



Future Software

- Self-organizing
- Embedded knowledge – the Plant Genome
- Monitoring and management of literally hundreds of thousands of measurement and control points
 - Not just scaled-up SCADA
- Pattern-recognition
- Predictive diagnostics
- Non-hierarchical
- Complex-adaptive systems



Security Systems

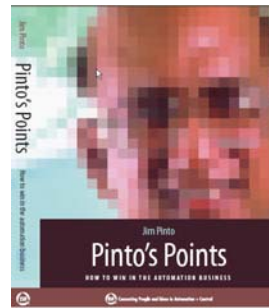
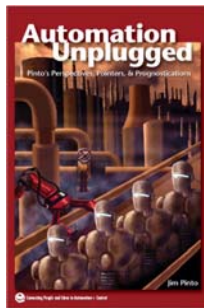
- Most automation systems are PC-based
 - Windows
 - Intel
- Most automation networks are connected to the Internet
- Security issues
 - Sneaker-nets
 - Spam
 - Virus Attacks
 - Deliberate hacking



Pinto's Pointers (summary)

- Globalization
- Knowledge rules
- Faster, Cheaper, Better
- Smart, Predictive Diagnostics
- Internet connections – M2M
- Wireless
- Security issues

Books by Jim Pinto



- Table of Contents:
 - Automation Unplugged: jimpinto.com/writings/unplugged.html
 - Pinto's Points : jimpinto.com/writings/points.html

- Available:
 - ISA : <http://isa.org>
 - Amazon.com & Other Online Bookstores
 - Autographed Copies: <http://JimPinto.com>



Related Links – Contact

- 10 things end-users need to know about automation vendors:
<http://www.controlglobal.com/articles/2005/545.html>
- Cheaper, Faster, Better - The Productivity Race:
<http://jimpinto.com/writings/productivityrace.html>
- Trends in the 3 different worlds
<http://jimpinto.com/enews/aug26-2008.html#4>
- Video – Shift Happens – Globalization
<http://www.youtube.com/watch?v=ljbl-363A2Q>
- China targets the Achilles-heel of Capitalism
<http://jimpinto.com/writings/chinapricing.html>
- JimPinto.com: <http://JimPinto.com>
e-mail: jim@jimpinto.com