Building Meaningful Use Priorities, Consensus and an Actionable Program Agenda for Smart Process Manufacturing

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SPM Steering Committee

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Definition of SPM

Smart Process Manufacturing (SPM) is a dramatically intensified knowledge-enabled industrial enterprise in which ALL business and operating actions are executed to achieve substantially enhanced energy, sustainability, environmental, safety and economic performance

Implies Infrastructure and Application
Simulation Based Engineering & Science (SBE&S)
Networked Information & Control Technologies (NICT)

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Smart Manufacturing Transformation

- Ultimate vision is to create significant and measurable improvements in U.S. manufacturing competitiveness through innovative, highly-optimized, demand-dynamic and sustainable industrial plants and supply chains enabled by information and knowledge technologies

- Key goals:
  - Move to proactive operations and life-cycle management to optimize production economics, quality, safety and efficiency
  - Drive energy, sustainability, EH&S and economic agility into meaningful integrated performance criteria
  - Transform manufacturing from fixed, supplier-driven production to flexible, demand-dynamic production
  - Enable sustainable production of nationally strategic goods (e.g., Bio/Nano, Clean Energy, Green/Tech, and DOD needs.)
  - Build manufacturing intelligence

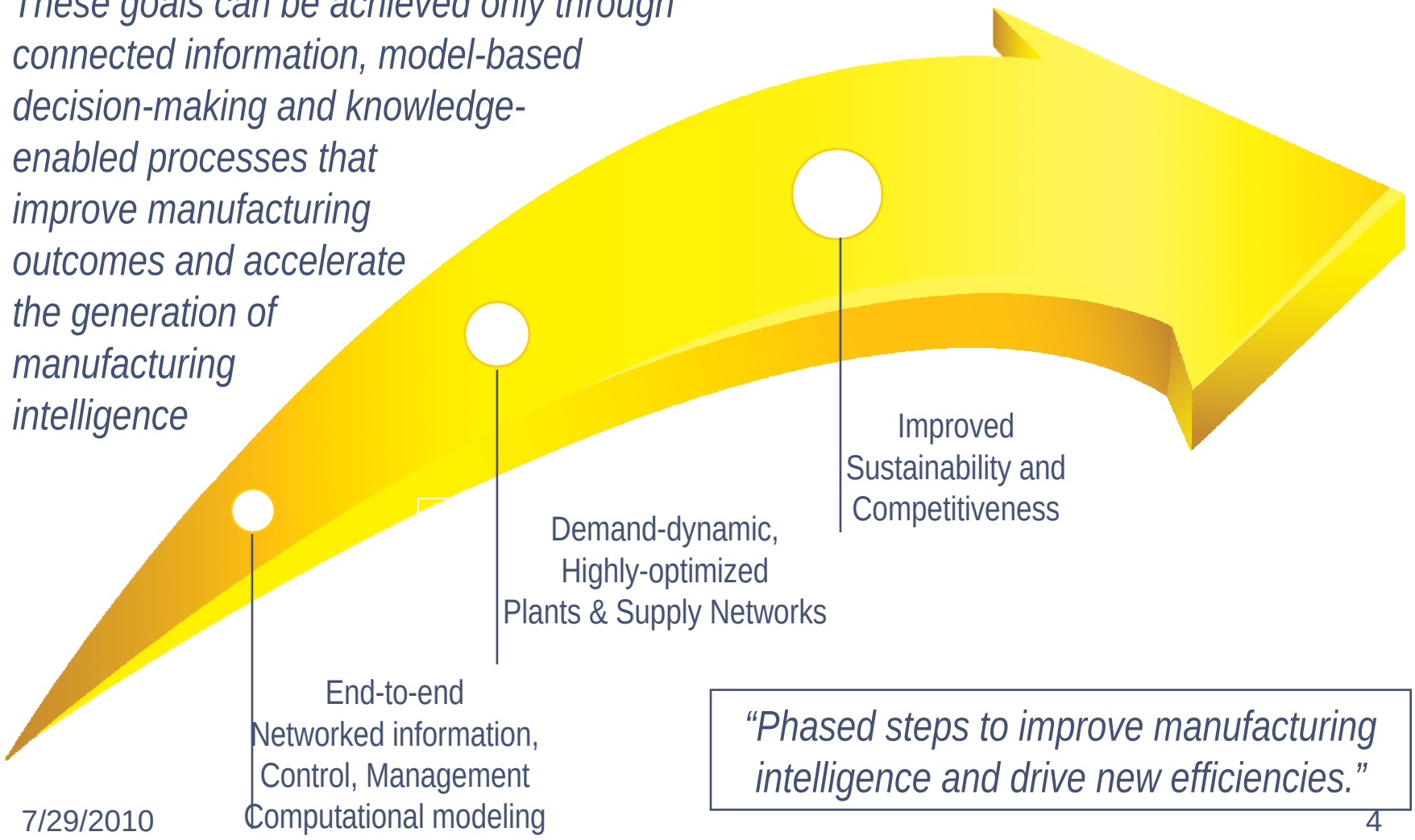
Increase U.S. manufacturing competitiveness and exports

Revitalize the 21st Century industrial community model

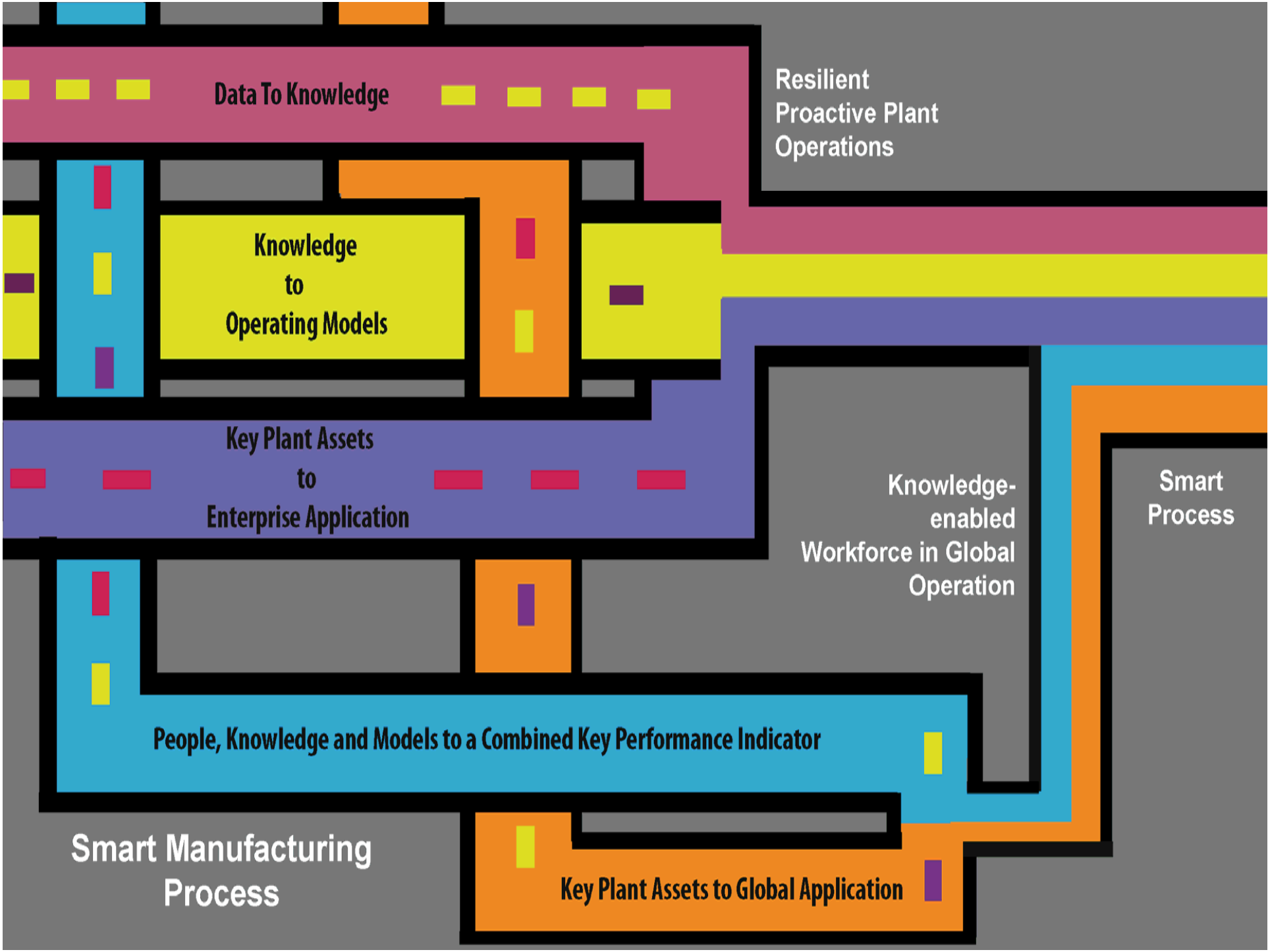
Bending the Curve Toward Smart Manufacturing

Achieving Meaningful Use of Production Data

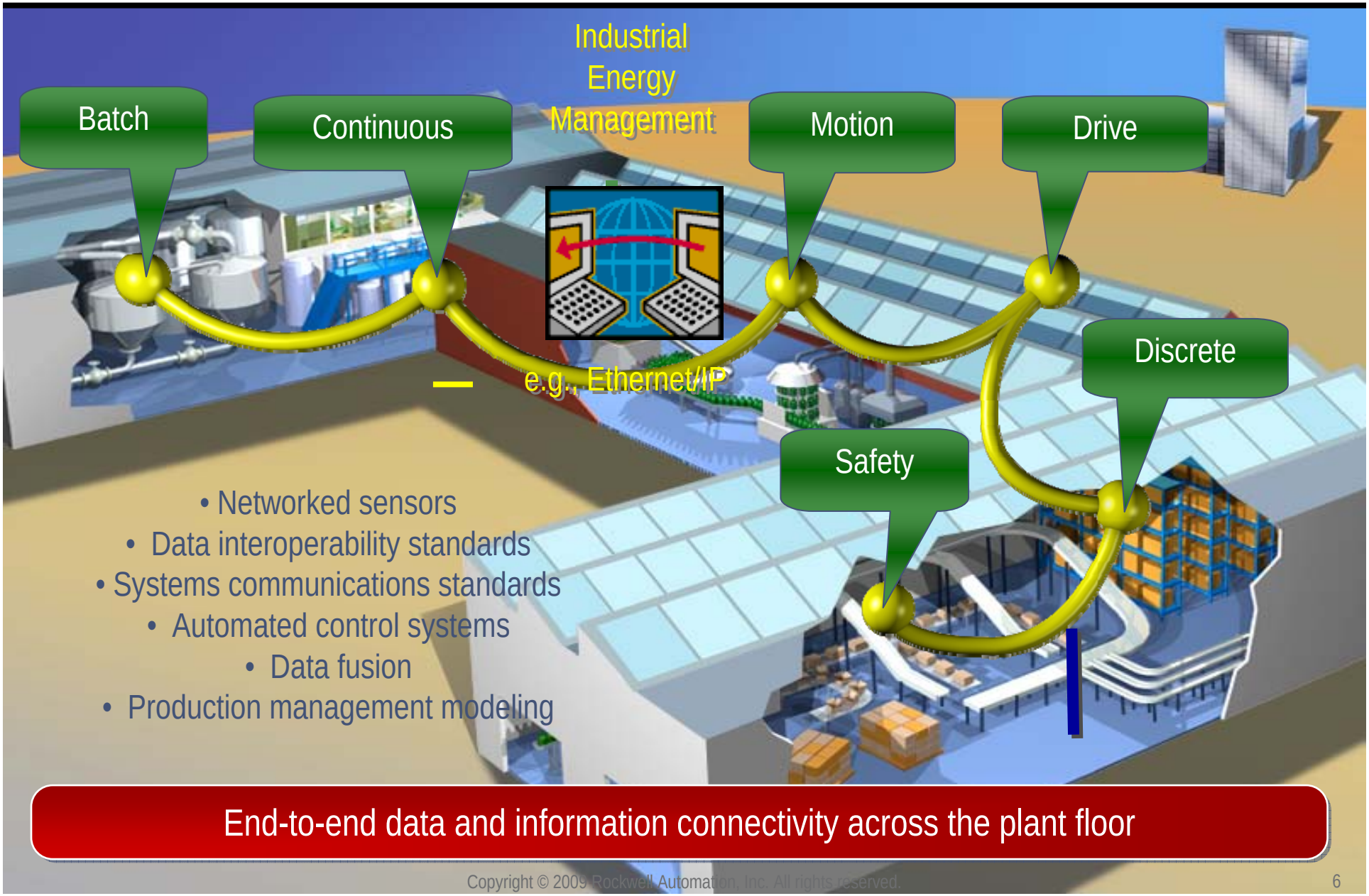
These goals can be achieved only through connected information, model-based decision-making and knowledge-enabled processes that improve manufacturing outcomes and accelerate the generation of manufacturing intelligence



"Phased steps to improve manufacturing intelligence and drive new efficiencies."


Data To Knowledge
Resilient
Proactive Plant
Operations
Knowledge
to
Operating Models
Key Plant Assets
to
Enterprise Application
Knowledge-
enabled
Workforce in Global
Operation
Smart
Process
People, Knowledge and Models to a Combined Key Performance Indicator
Smart Manufacturing
Process
Key Plant Assets to Global Application

Smart Manufacturing 1.0: Integrated Decision-Making



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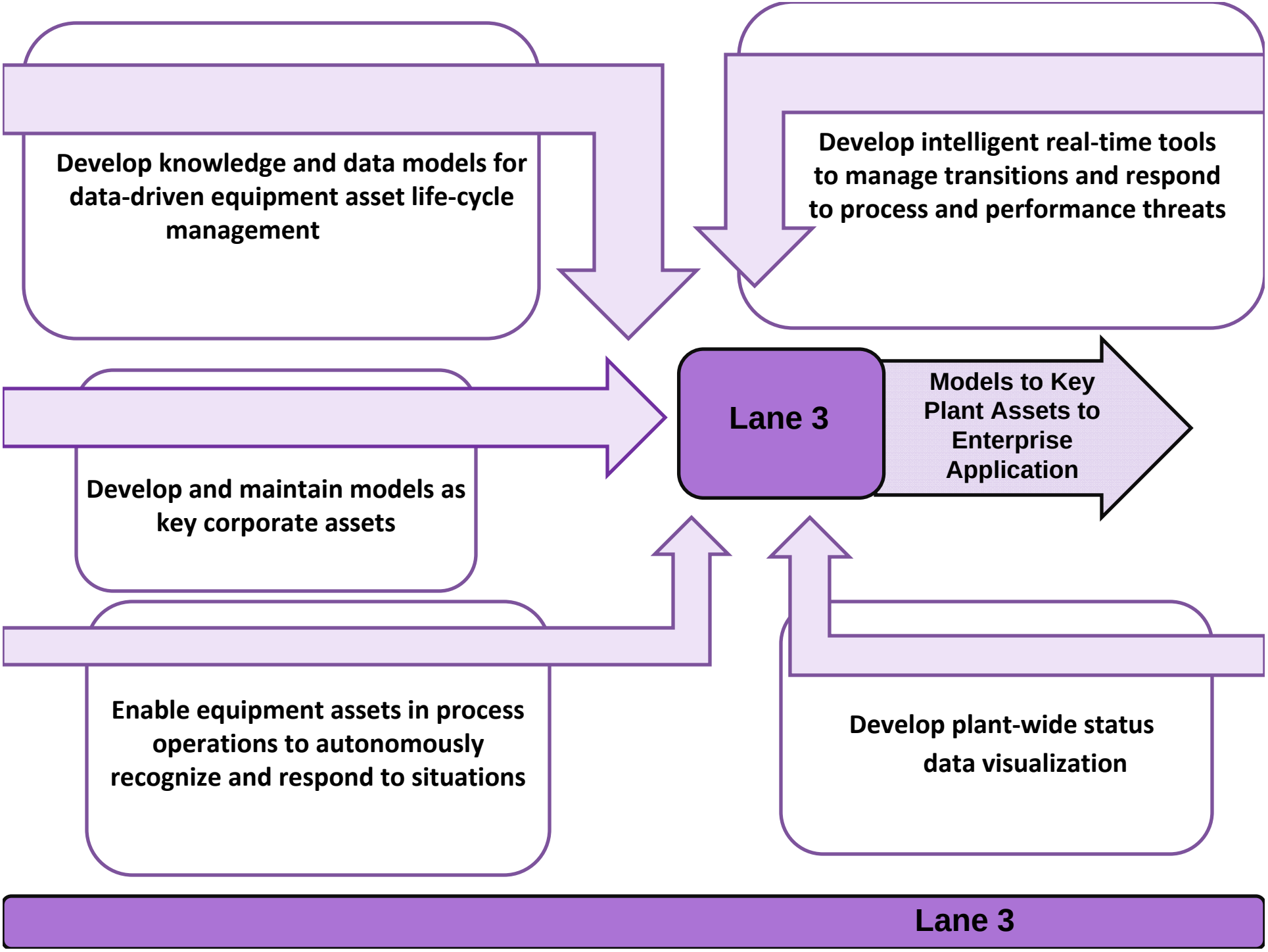
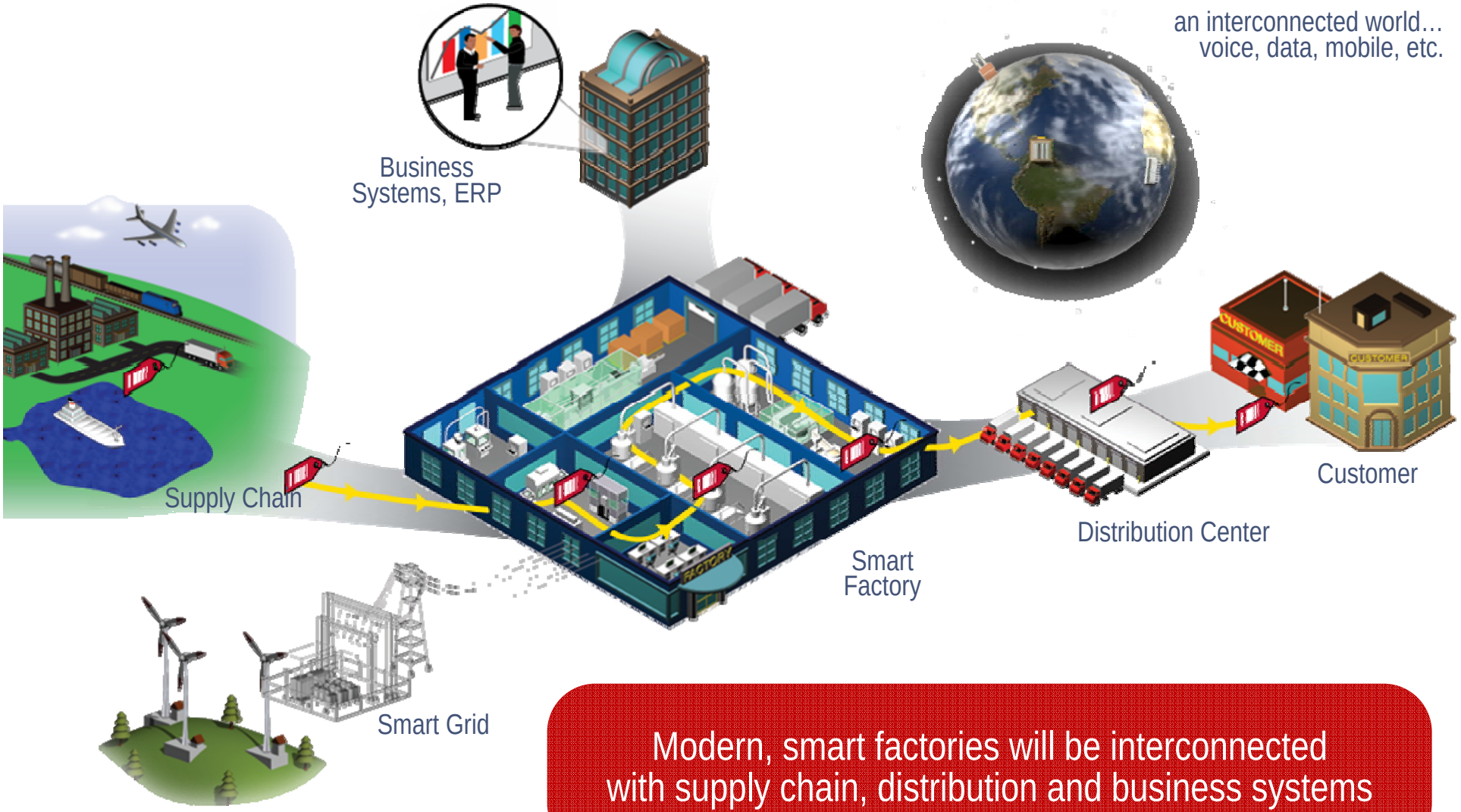

Develop knowledge and data models for data-driven equipment asset life-cycle management
Develop intelligent real-time tools to manage transitions and respond to process and performance threats
Develop and maintain models as key corporate assets
Lane 3
Models to Key Plant Assets to Enterprise Application
Enable equipment assets in process operations to autonomously recognize and respond to situations
Develop plant-wide status data visualization
Lane 3

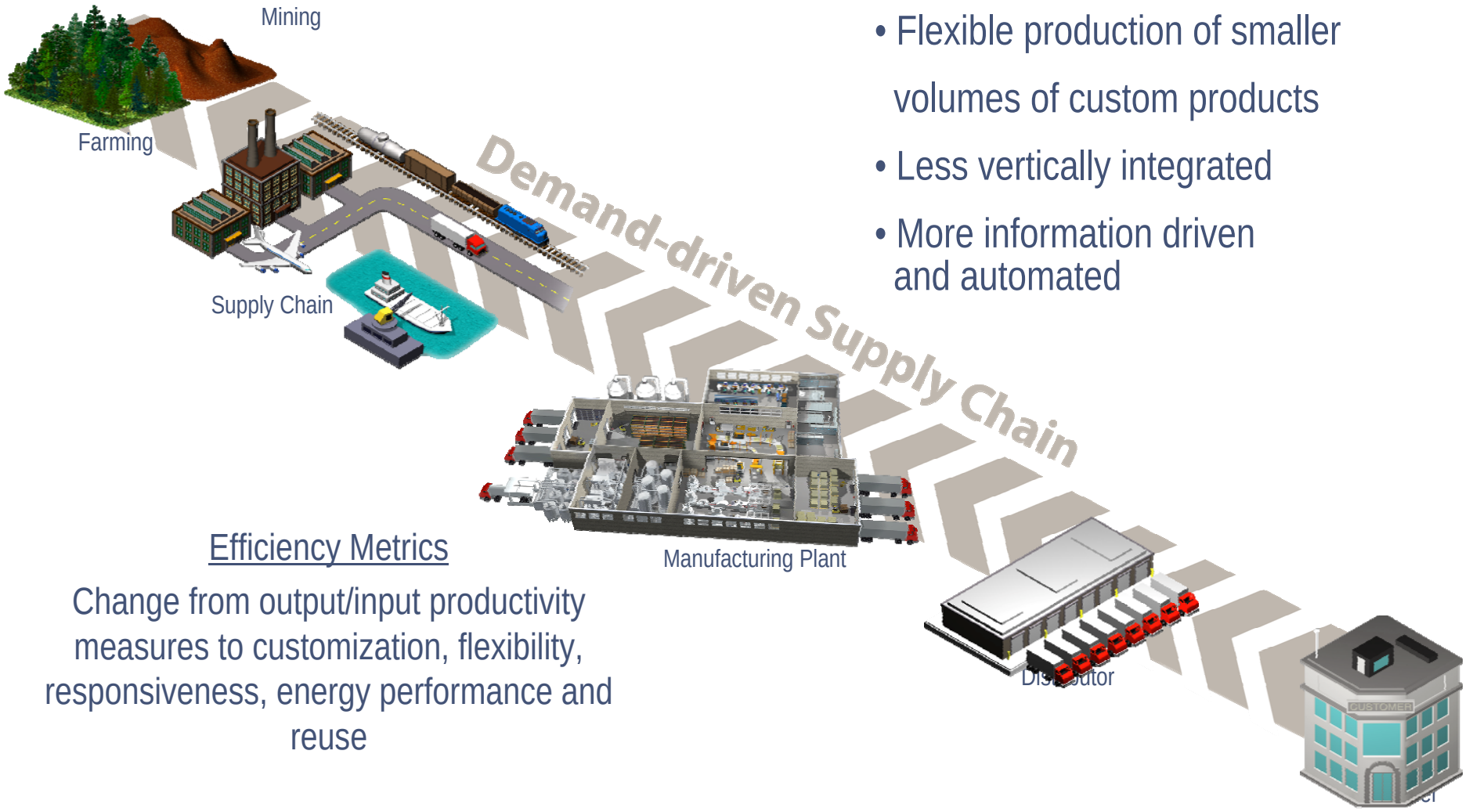
Smart Manufacturing 2.0:
Enterprise-wide End-to end Connectivity



Modern, smart factories will be interconnected with supply chain, distribution and business systems

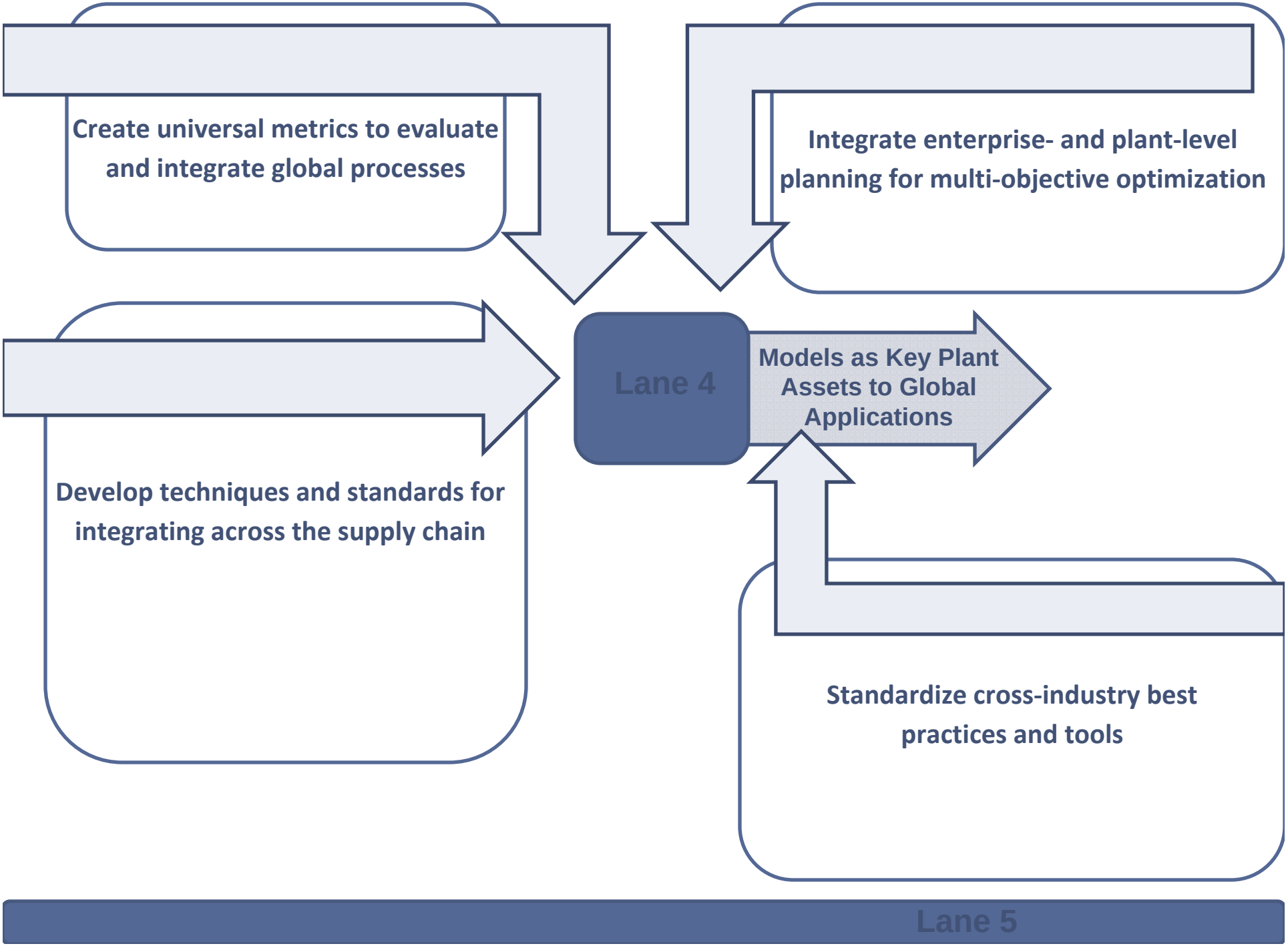
Highly-optimized Production and Demand-Dynamic Supply Chain Efficiency

- Customers “pushing” demands
- Flexible production of smaller volumes of custom products
- Less vertically integrated
- More information driven and automated

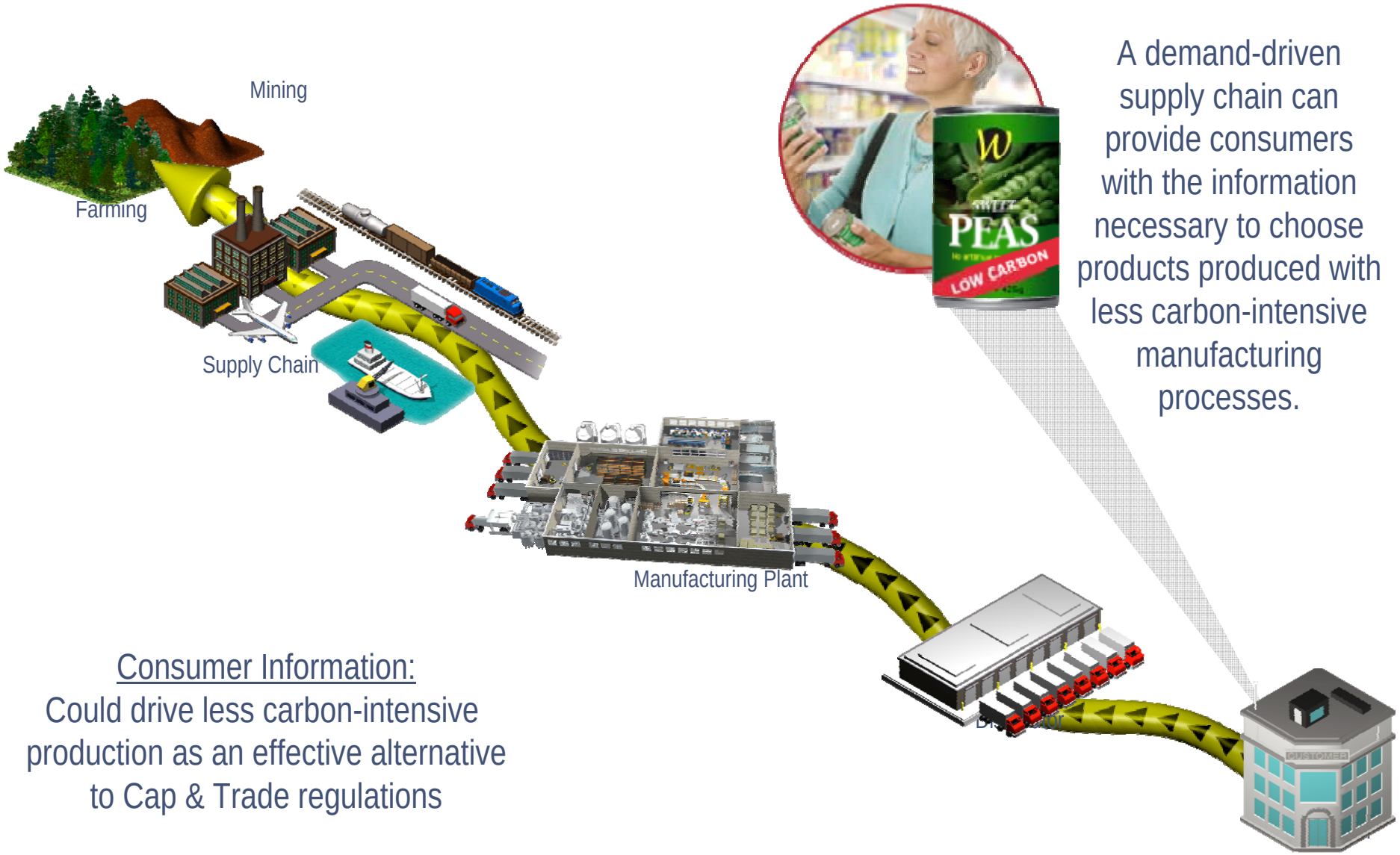


Efficiency Metrics

Change from output/input productivity measures to customization, flexibility, responsiveness, energy performance and reuse


Create universal metrics to evaluate and integrate global processes
Integrate enterprise- and plant-level planning for multi-objective optimization
Develop techniques and standards for integrating across the supply chain
Lane 4
Models as Key Plant Assets to Global Applications
Standardize cross-industry best practices and tools
Lane 5

The Consumer in the Optimized, Demand-Dynamic Plants and Supply Networks?



A demand-driven supply chain can provide consumers with the information necessary to choose products produced with less carbon-intensive manufacturing processes.

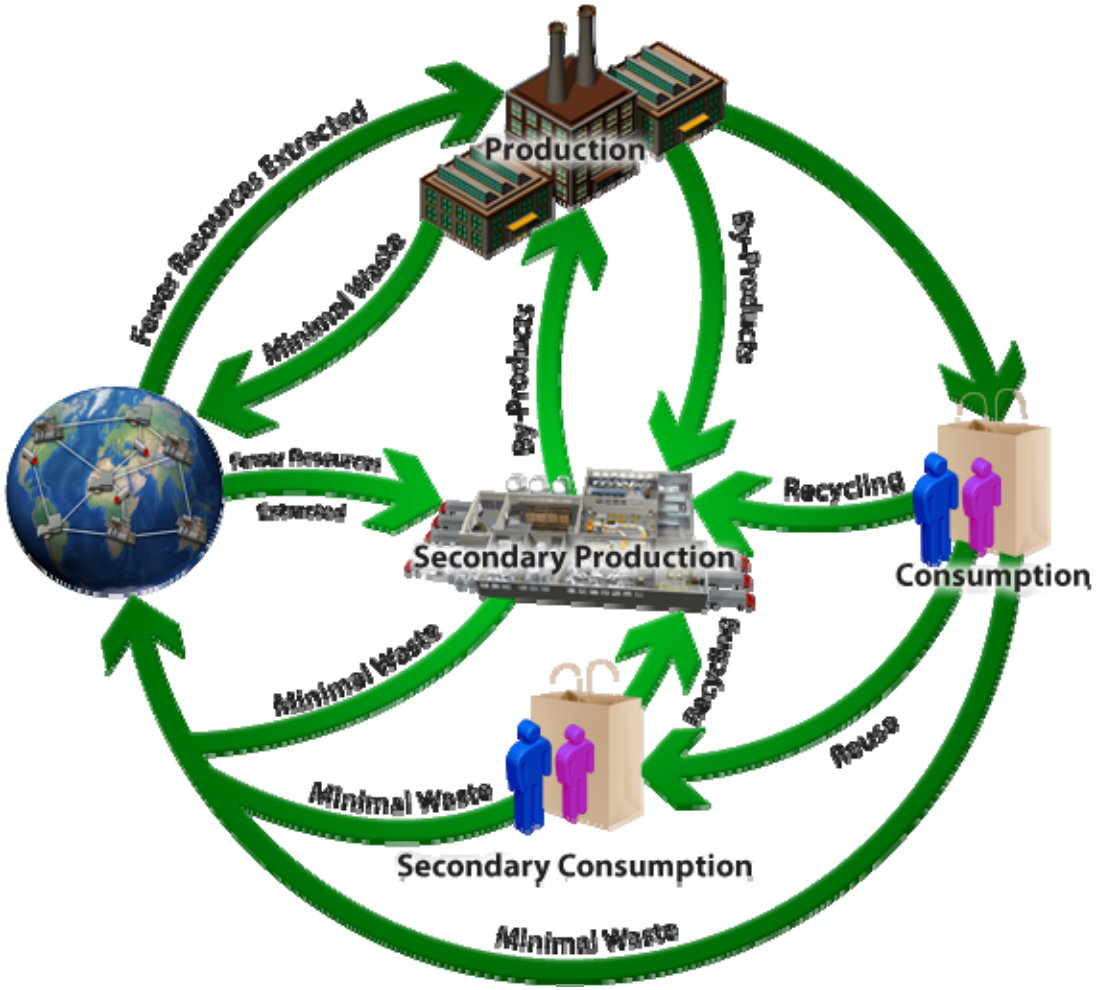
<u>Consumer Information:</u>
Could drive less carbon-intensive production as an effective alternative to Cap & Trade regulations

Closing the loop in Pulp & Paper Supply Chains

Recycling closed the loop in Supply Chains as consumers demanded Recycled Paper

International Center for Industrial Ecology

- Whereas productivity measures are used to improve a "linear" process
- Efficiency measures are used to improve a "closed loop" process
- Advanced modeling and software simulation are critical to improve the efficiency of very complex closed loop processes



Source: Yale University's School of Forestry & Environmental Studies' Center for Industrial Ecology

The transformation of IT-connected manufacturing to optimized plants & supply networks may be essential to efficiently manage this vision

Jobs Surround The Smart Factories In The Optimized Plant & Supply Chain Network

21st Century Industrial Community

Greater Economic Multiplier

Smart Factory

Electric car "lights out"
100% automated smart factory

Tier 2 Suppliers

Batteries, motors, seats, tires
75% automated, 25% labor

Tier 3 Suppliers

Raw materials
50% automated, 50% labor

Services & Support

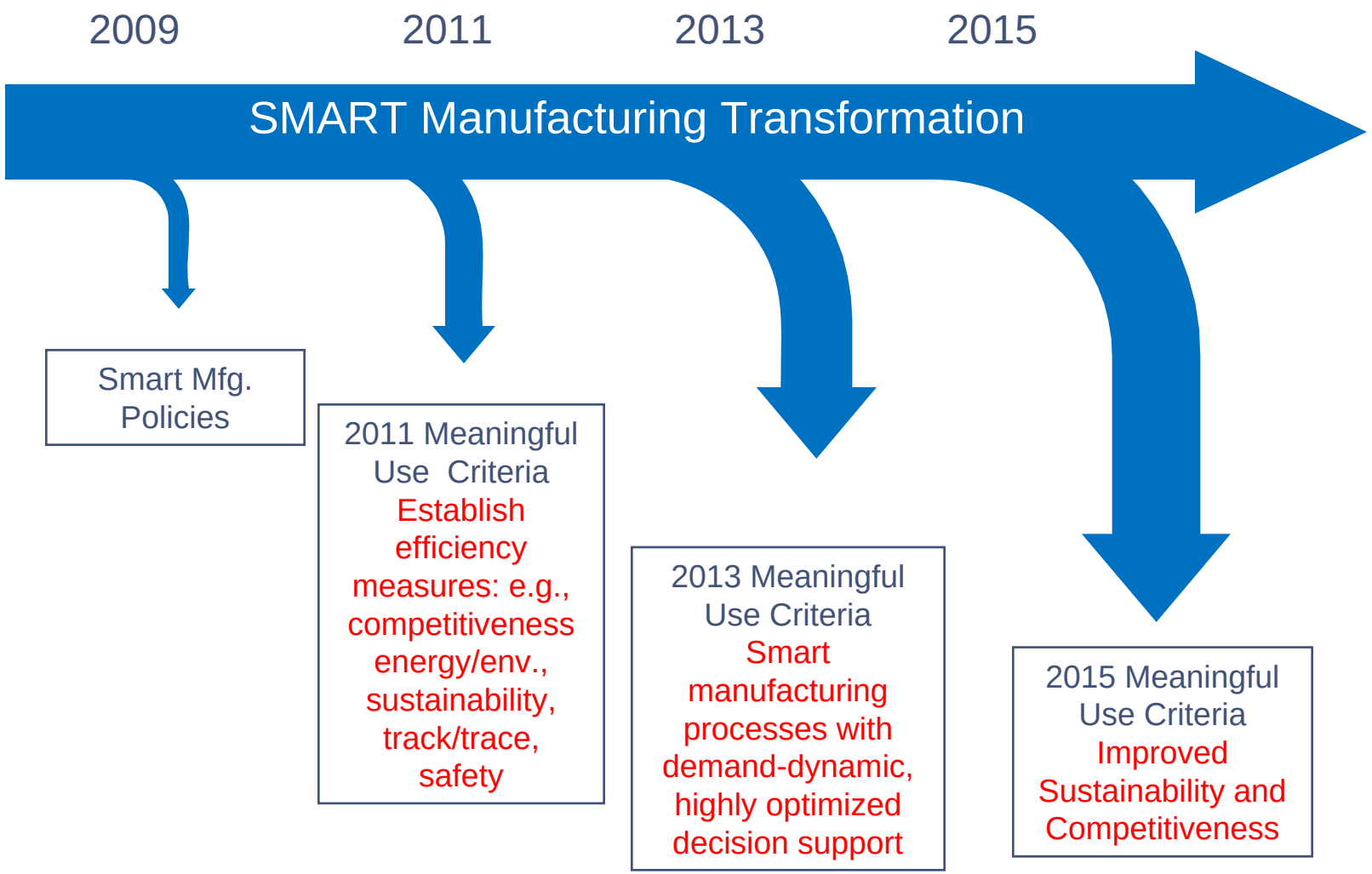
Financial, IT/Telecom, transportation, etc.
25% automated, 75% labor

Education, Health Care & Government

Financial, IT/Telecom, transportatio
100% labor

Manufacturing Transformation to SMART

Achieving Meaningful Use



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Actionable Program Agenda

- CTO/CXO Roundtable and Leadership Workshop
  - Meaningful Use criteria
  - Roadmap actions
  - Technology development
  - Collaboration model
- Industries
  - Continuous, batch and discrete
  - Large and small companies
  - Practitioner and supplier
  - Information technology. NICT and SBE&S
- Academia, Government and Manufacturing Consortia

http://www.oit.ucla.edu/smart_process_manufacturing