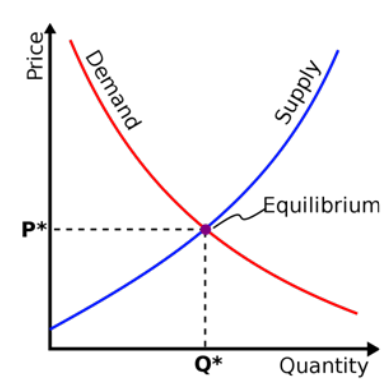


Topic 2:  
Extremely Efficient & Effective Manufacturing  
Affordability and Sustainability

*Paul Collopy, Chair*

January 11, 2011



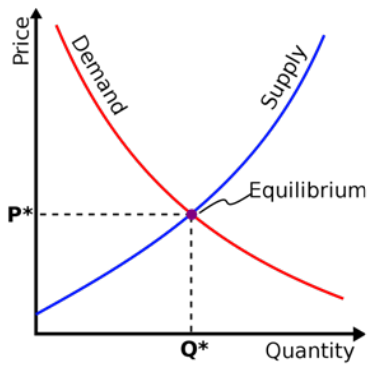
# Overview



- Definition/scope of topic area
- Importance and key issues
- Highlights from the issue papers



# Definitions and Scope



- **Affordability** - Ability to survive in the current economy
- **Sustainability** - Capacity to endure (survival in a different future)

## Mass Customization

Complexity at low cost

- casting and lithography
- additive manufacturing
- configurable materials

Organization

- Electro-mechanical fabs
- Bit-programmable floor
- Command & Control
  - sensors
  - intelligent control

## Innovation Networks

Robust Design Infrastructure

- Rules and Tools
- accepted limitations

Organization

- Separation: Design // Mfg
- Small / Medium Design organizations are Gorillas
- Ultra small design teams breaking oligopolies
- Desktop manufacturing

## Sustainability

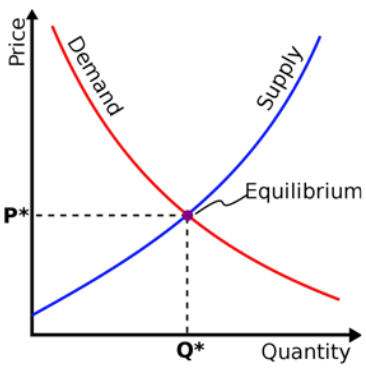
Highly Adaptable Products

Highly Adaptable, Reconfigurable Firms

- optimization
- zero excess input / output
- rapid, test-free prod devel
- designed materials

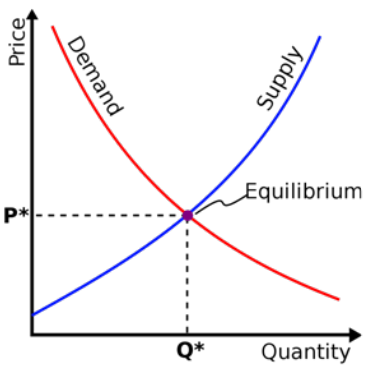
Organization

- Product networks for recycling



# Why is this important?

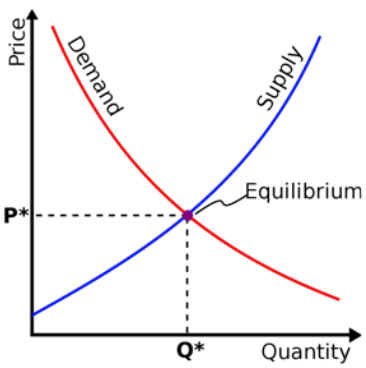
- “A manufacturing plant that develops and applies manufacturing intelligence will be able to dramatically **reduce costs** and drive higher U.S. exports. The widespread application of virtual plant enterprise tools will produce at least a 10x improvement in **time to commercialization**.”
- “Sophisticated **tools** that have traditionally been available only to engineers in industrial settings are now becoming **accessible** to individuals without formal training in engineering.”
- “If (high performance computing is) shared throughout the entire manufacturing base, America’s **global competitiveness** will be greatly enhanced, particularly in desirable areas such as high-tech R&D manufacturing and modeling/simulation tools development.”



# Issues and Concerns



- “**Data** needs to be more easily **obtained** via low cost sensors, more easily **collected**, consistently defined, **managed** as an operating asset, shared within companies, and selectively shared among companies.”
- “**Producibility** issues can have significant long term impacts on manufacturing enterprise operating costs due to the ‘hidden factory’ **rework**, process **inefficiencies**, and overhead they introduce into the day to day production operations.”
- “Some of the most pressing challenges in manufacturing arise from the need to cost-effectively produce low-cost, high-performance, reliable, and long-life **energy technologies** at **high throughput rates**.”

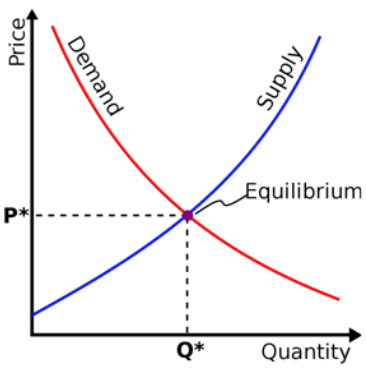


# Highlights of the Issue Papers



- “Recently, a new **materials platform** has been discovered that could take **mass customization to the extreme**. This new approach enables fabrication of unique open-cellular materials with micro-scale truss, or lattice features ranging from tens to hundreds of microns. ”
- **Knowledge Infrastructure** for Innovation and Efficiency
  - “...creating an infrastructure that can give...**teams of citizen-designers** full access to the means...for designing, prototyping, testing, financing, manufacturing, promoting and marketing their inventions is extreme.”
  - “...establishment of a new community source data analytics, modeling and simulation platform that will function as a clearinghouse and gateway for **core, pre-competitive tools and practices** which small, medium and large enterprises can readily **access and contribute**.”
  - “...define a roadmap for the development of advanced **simulation-based producibility and supply chain analysis** capabilities and frameworks that will enable true concurrent engineering and virtual prototyping of both product, manufacturing, and industrial base design concepts...”





# Breakout 2

## Efficient & Effective Affordable & Sustainable



- What does this topic area mean to you and how would you define it?
- What aspects of this topic area might be especially important, and why?
- What is the current state of the art and what extreme realms do you foresee in the future, and when?
- What are some of the compelling technology questions and concerns about these particular extreme realms in manufacturing?