The Changing Nature of Collaborative Supply Chains

Irene J. Petrick
Irene J. Petrick, Ph.D.
ipetrick@ist.psu.edu

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The complexities of collaborative development in traditional supply chains

Products reach the market through the collective efforts of an extended network.

Technology evolves at multiple points and has multiple possible uses.

System architectures evolve primarily at the OEM.
• **Assertions**
  – 3D printing/additive manufacturing is ON THE HORIZON and there will be competition from directions we don’t expect
  – The roles and rules of traditional supply chains are becoming obsolete
  – Economies of scale will go from a barrier to entry to a barrier to change

• **Implications: traditional handoffs in the supply chain are insufficient for innovation**
IT driven trends in the production & operational environment

FUTURE SCENARIO
IT driven design and production enables Economies of One

Trend 1: Technical (high performance) computing capabilities enable complex design and simulation

Trend 2: Additive manufacturing attains commercial viability for multiple materials

Trend 3: Cloud-based IT solutions reduce administrative overhead for smaller enterprises and enable new business models

Trend 4: Social media-based funding models democratize production investments

Trend 5: Internet savvy do-it-yourself hobbyists embrace open source innovation tools

Design & production as experimentation

The rise of the “Any Man”
“Any sufficiently advanced technology is indistinguishable from magic.”

-- Arthur C. Clark

- Where is the magic?
  - Design
  - Production
  - Post Production
  - Delivery/distribution
Simplified supply chain

TRADITIONAL DYNAMICS

- Well understood roles & responsibilities
- Reducing complexity is the key to competitive advantage
- Design as a “finished” input to production
Changing nature of design & designers

**Physical → Digital**

Modeling External and Internal Features

- Scanners
- Reverse Engineering & Modeling

**Digital → Actionable**

Standards, File Formats, Instruction Sets, Design Rules

- Design Software
  - ISVs, Computing Hardware

- 3D Printer Unique Firmware
  - Printer Manufacturers

**Imagination → Digital**

Customization, Solid Models, Surface Models

- Hobbyists & Prosumers
- Animators
- Engineers
- Architects
- Manufacturers
- Design Firms

- Internet Design Files & Kits
- App Designers
Changing nature of production & post production

Polymers, Powders, Binders, Gas Materials Producers, Auxiliary Suppliers

Inventory Sites
Materials Producers, Printer Makers, Distributors

3D Printer
Unique Hardware
Printer Manufacturers

Net/Near Net Shape Parts

Post Production

Experimentation & Redesign
Collaborative Innovation

Process Parameter Framework
Toolpaths, Process Plan, Machine Parameters, Support, Orientation, Material Parameters
Changing nature of distribution

**Printer Hubs**

*Printer as the Ultimate FAX Machine*

**Local Manufacturing or Traditional Shipping**

1. **Design**
2. **3D Printer**
3. **Post Production**
4. **Direct Distribution**
   - UPS, USPS, FedEx
5. **Local Manufacturers**
6. **Internet File**

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Experimentation as strategy... collaborative innovation

- Fewer clear boundaries in the design-build-deliver paradigm
- Design and production interactions produce innovations
- Design thinking across multiple actors in the ecosystem
- Proximity matters
- From long-term planning to real-time planning
For existing manufacturers ...

Great gifts

- Customization is feasible (Economies of One)
- Production of replacement parts is simplified
- Manufacturing is sexy again
- Entrepreneurs drive change in unanticipated ways

Serious challenges

- We don’t know how to design for this technology
- Cloud-based business models enable artisan entrepreneurs to compete
- Extensive installed base is a barrier to change
- Entrepreneurs drive change in unanticipated ways
Dr. Irene J. Petrick, managing director of TrendScape Innovation Group and Penn State University professor, is an internationally recognized expert in strategic roadmapping. She is actively engaged with companies in their innovation and technology strategy activities, including work with twelve Fortune 100 companies, the U.S. military, and a wide variety of small to medium sized enterprises. Her research interests include innovation and supply chain collaboration. She has over 25 years of experience in technology forecasting, management and product development in both the academic and industrial settings. Irene is author or co-author on over 140 publications and presentations.