Understanding Biomass Supply Chains: The Uncertainty Framework

NEWBio Short Course Series
Bioenergy Supply Chain Business Opportunities

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SCM is the art and science of integrating the flows of products, information and financials through the entire supply pipeline from the supplier’s supplier to the customer’s customer.

Suppliers  
Contracted Manufacturers  
Manufacturers  
Wholesalers/Distributors  
Retailers/Customer

Product/Services Flow  
Information Flow  
Cash Flow  
Demand Flow

Source: John J. Coyle, Center for Supply Chain Research Presentation
Supply Chain Network

Source: John J. Coyle, Center for Supply Chain Research Presentation
Supply-Chain Operations Reference (SCOR) Model

Source: Council of Supply Chain Management Professionals
Demand and supply uncertainties affect how the supply chain should be devised.

Source: Lee (2002), Aligning Supply Chain Strategies with Product Uncertainties, California Management Review
### Demand Uncertainty

**FUNCTIONAL**
- Low demand uncertainties (stable, or more predictable)
- Long product life
- Low inventory cost
- Low profit margins
- Low product variety
- Low stockout cost
- Low obsolescence

**INNOVATIVE**
- High demand uncertainties (variable, or difficult to forecast)
- Short selling season
- High inventory cost
- High profit margins
- High product variety
- High stockout cost
- High obsolescence

### Supply Uncertainty

**STABLE**
- Less breakdowns
- Stable & higher yields
- Less quality problems
- More supply sources
- Reliable suppliers
- Less process changes
- Less capacity constraint
- Dependable lead time

**EVOLVING**
- Vulnerable to breakdowns
- Variable & lower yields
- Potential quality problems
- Limited supply sources
- Less reliable suppliers
- More process changes
- Potential capacity constrained
- Variable lead time
Aligning Supply Chains with Product and Supply Uncertainties

**DEMAND UNCERTAINTY**

- **Low (Functional Products)**
  - **EFFICIENT**
  - Examples: Grocery, basic apparel, food, oil and gas

- **High (Innovative Products)**
  - **RESPONSIVE**
  - Examples: Fashion apparel, computers

**SUPPLY UNCERTAINTY**

- **Low (Stable)**
  - **RISK-HEDGING**
  - Examples: Hydro-electric power, some food produce

- **High (Evolving)**
  - **AGILE**
  - Examples: Telecom, high-end computers

Source: Lee (2002), Aligning Supply Chain Strategies with Product Uncertainties, California Management Review
### Supply Chain Uncertainty Analysis

<table>
<thead>
<tr>
<th>Demand Uncertainty (Bioenergy)</th>
<th>Supply Uncertainty (Switchgrass, Miscanthus, Willow)</th>
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</thead>
<tbody>
<tr>
<td><strong>FUNCTIONAL</strong></td>
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<td>- High demand uncertainties (e.g. prices of fuel and substitute products)</td>
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Uncertainty Framework Analysis: What Are Other Markets for Biomass?

**Demand Uncertainty**
- Low (Functional Products)
  - Efficient
    - Livestock bedding, straw bale housing, low-grade feed, substrate for growing mushroom, soil conservation
- High (Innovative Products)
  - Responsive

**Supply Uncertainty**
- Low (Stable)
  - Risk-Hedging
    - Bio-degradable plastics
    - Pellets
- High (Evolving)
  - Agile
    - Bio-energy
Uncertainty Framework: Supply Chain Strategies

DEMAND UNCERTAINTY

Low (Functional Products)  High (Innovative Products)

EFFICIENT

RISK-HEDGING
• Inventory pooling
• Multiple supply bases
• Alternative supply
• Lead-time reduction
• Process flexibility

RESPONSIVE

AGILE
• Risk-hedging, plus:
  – Postponement
  – Mass customization
  – Supplier hub close to production site

SUPPLY UNCERTAINTY

Low (Stable)  High (Evolving)
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