Enterprise-Wide Optimization

Session 20

IT Applications in the CPI
AIChE Spring 2004 Conference
New Orleans, LA

Agenda

1:30 PM	**Session Introduction**
1:35 PM	**An Overview of Enterprise-Wide Optimization**
2:05 PM	**Managing Supply Chain and Operational Crisis Using Scheduling Algorithm for Overall Refinery Operations**
2:35 PM	**Optimization Based Approach for Managing Enterprise-Wide Business Planning in a Petrochemical Industry**
3:05 PM	**Enterprise Operations Management**
3:35 PM	**Achieving Lowest-cost Emission Level Compliance under Cap & Trade Using a Math Programming-based Emissions Optimizer that Links Regional Customers through a Web-based Environmental Management Information System**
4:05 PM	**Enterprise-Wide Optimization Roundtable Discussion**


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An Overview of Enterprise-Wide Optimization

Vince Grassi, Andy Bringhurst, Ken Anselmo, Tom Brinker, Jim Hutton

Air Products and Chemicals, Inc.
AIChE Spring 2004 Conference
New Orleans, LA

Enterprise Wide Optimization

Leverage

information, modeling and solution technologies

Integrate

strategic, tactical and operational decision-making

Optimize

across customer engagement, manufacturing, supply chain, financial processes

25 Years of Progress in Process Systems Engineering

"The nineties too saw a further widening of the scope of process systems engineering from the concerns of integrated design and plant-wide control to the consideration of management issues for the whole enterprise, and even the whole supply chain."

R.W.H. Sargent, "Introduction: 25 years of progress in process systems engineering," Computers and Chemical Engineering 28 (2004) 437–439.

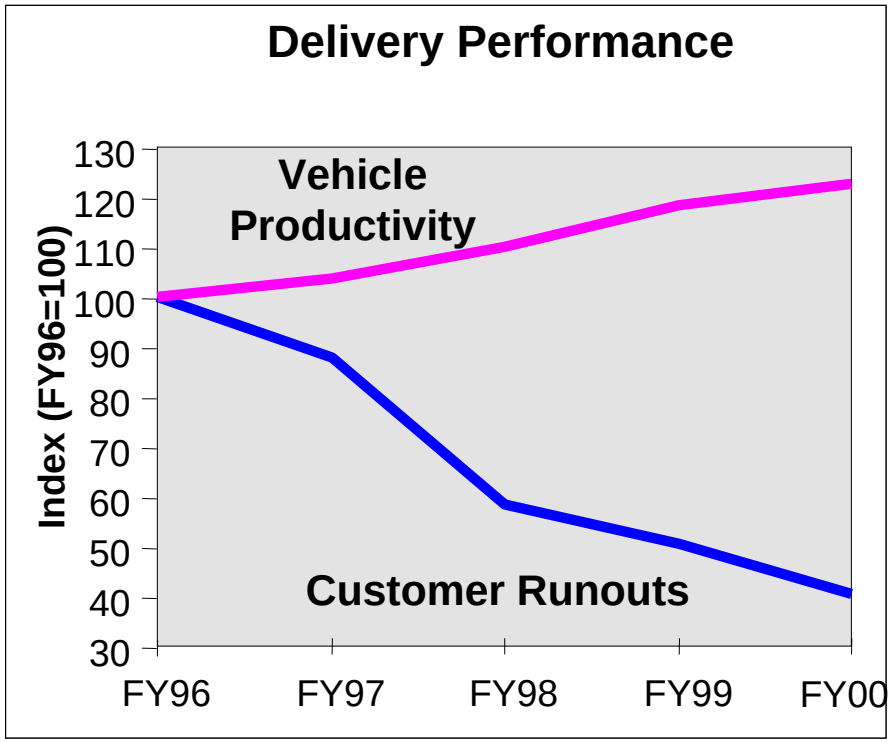
Why Enterprise-Wide Optimization?

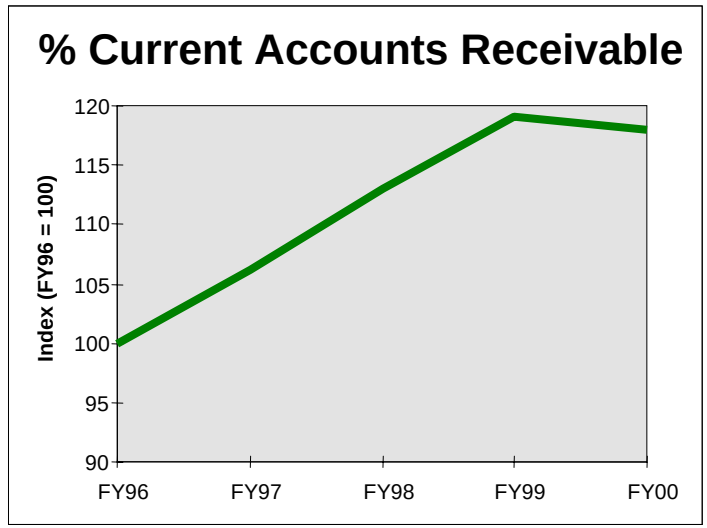
- **Significant Manufacturing Improvements Made**
  - **Total Quality Management**
  - **Lean Manufacturing / Six Sigma**
  - **Plant-wide optimization and control**
  - **e-business**
  - **Enterprise Resource Planning Systems Installed**
- **We have only begun to exploit these as an integrated approach.**
  - **The underlining technologies continue to improve at an accelerated rate**
  - **Our suppliers and customers expect more collaboration and partnerships**
  - **We live in a global village**
  - **Others have demonstrated impressive results**

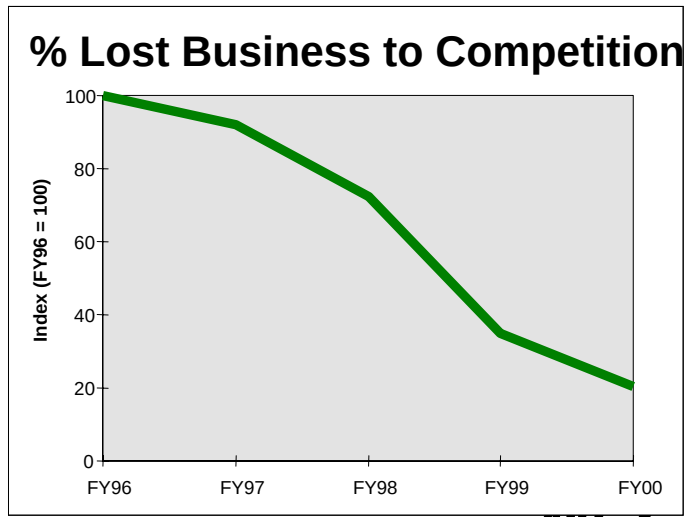
Examples

- **Dell – Build after order & just in time supply**
- **WalMart – Inventory Management**
- **W. W. Grainger – Internet ordering**
- **BP/Chevron – Formed Atlas Supply**
- **UPS – Logistics Tracking and Services**
- **ExxonMobil – Worldwide Crude Distribution Logistics**
- **Air Products – Delivery network optimization**

THE GENIUS OF THE "AND"







Enterprise Wide Optimization

- **To identify, assess, and prioritize opportunities to implement integrated decision modeling across the enterprise**

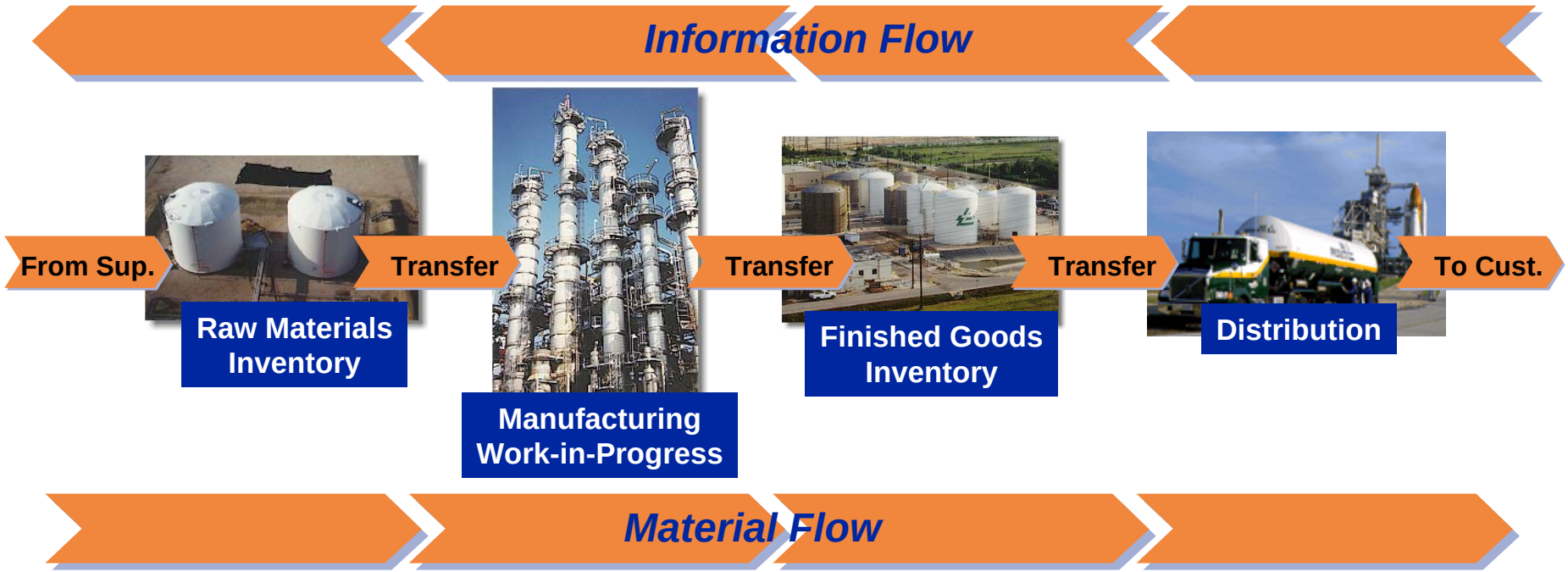
- **Defines both the types of decision models that should be used and the interface points between the models**

Enterprise Wide Optimization

- **Integration across:**
  - **Temporal decompositions (frequency of decision-making)**
  - **Spatial decompositions (hierarchy)**
  - **Process based decompositions (business, product)**
- **All three forms of decomposition need to be considered**
- **Decompositions impact how to**
  - **Identify decision models that can be standardized**
  - **Define linkages between decision models**

General Supply Chain Considerations

- **Strategic vs. Tactical vs. Operational**
- **Global vs. Regional vs. Local**



The Bullwhip Effect

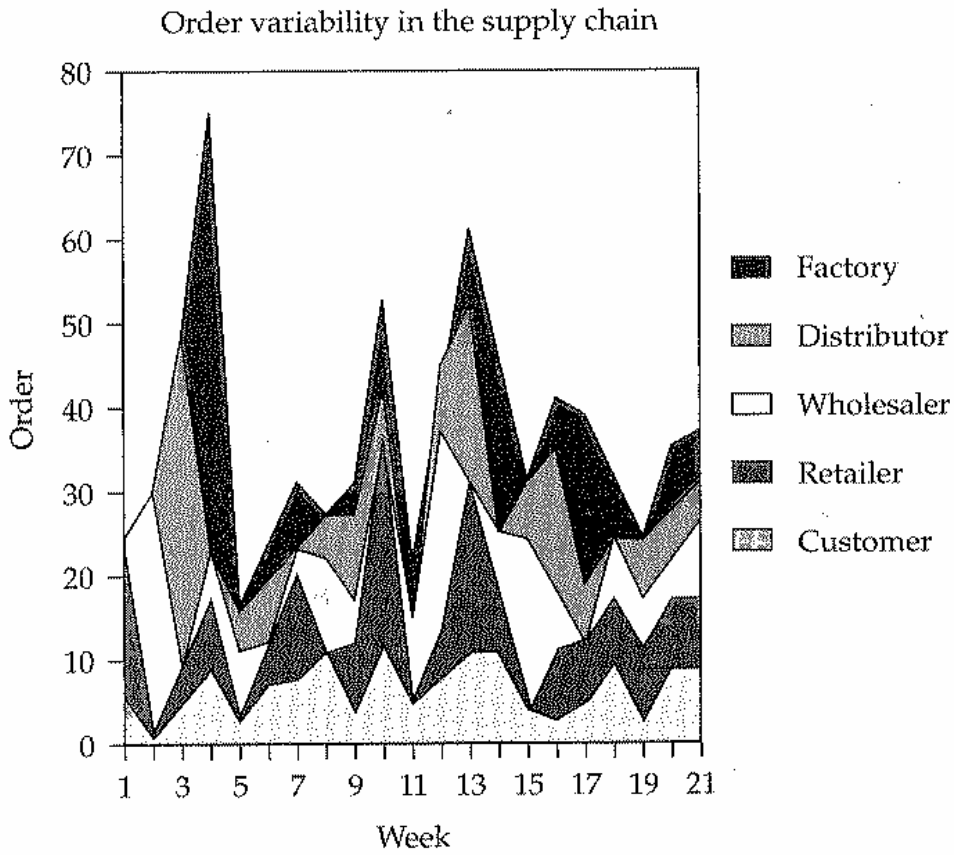


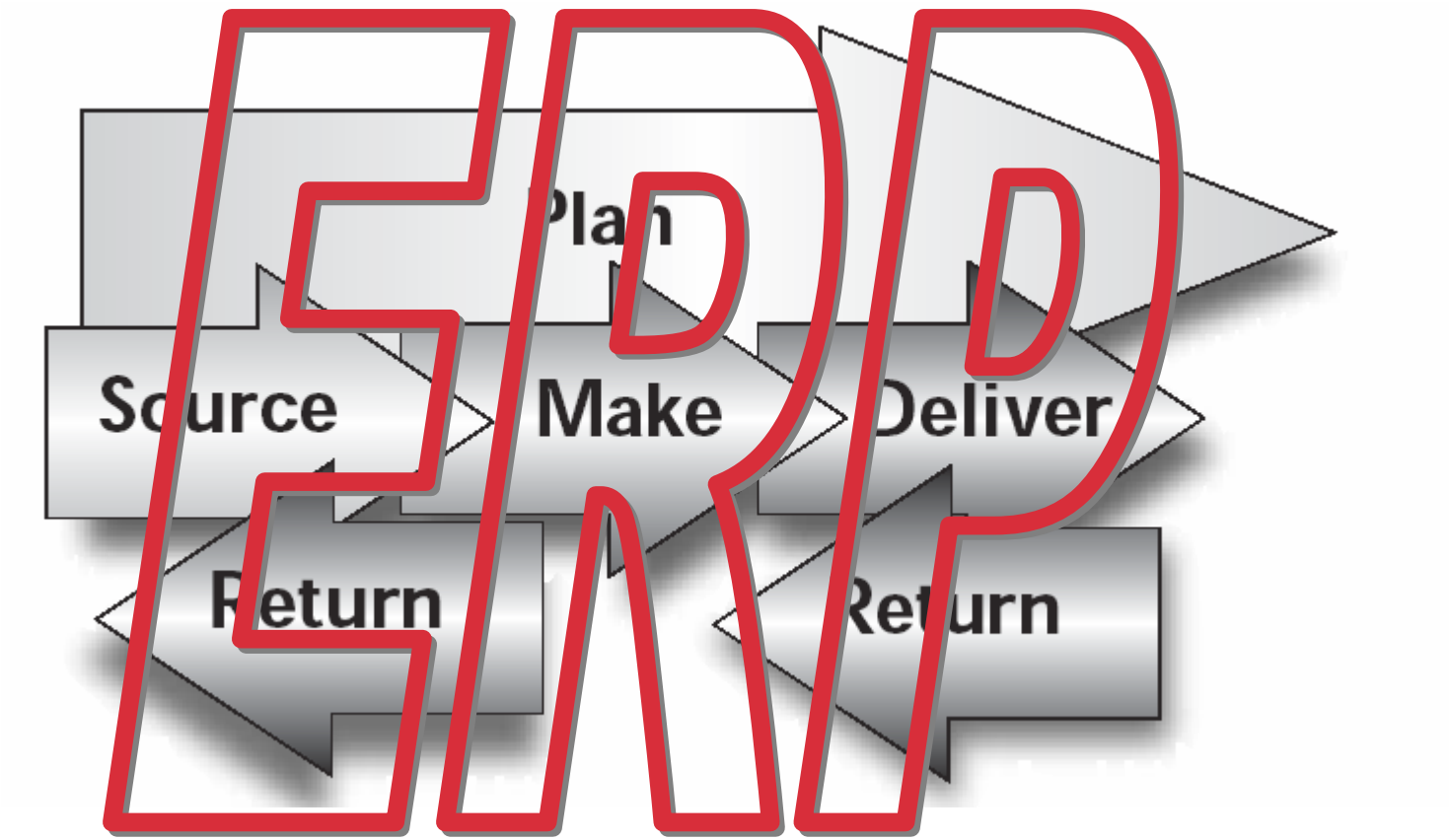
Figure 2-2 The increase in variability in the supply chain.

Taken from: Simchi-Levi, et al, Managing the Supply Chain

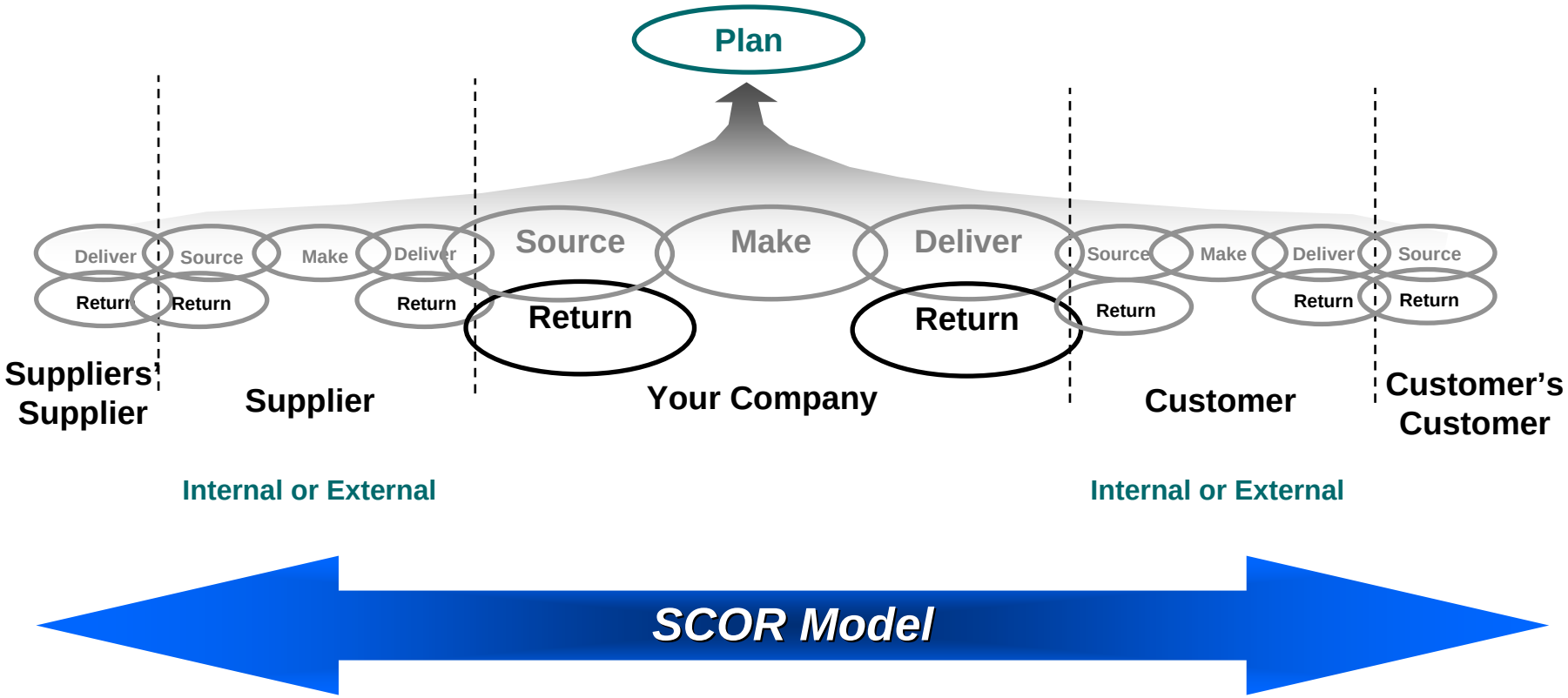
Some Questions to Ponder

- **What information do you wish you had?**
- **How does what I do link up and down stream and in what enterprise processes?**
- **How do we decompose the problem?**
  - **Time scale**
  - **Geography**
  - **Process**
- **How do we link the outputs of one model to the inputs of others, when we haven't done this before?**
- **How do I align my skills with the future direction of my company's core competencies?**

Components of a Supply Chain

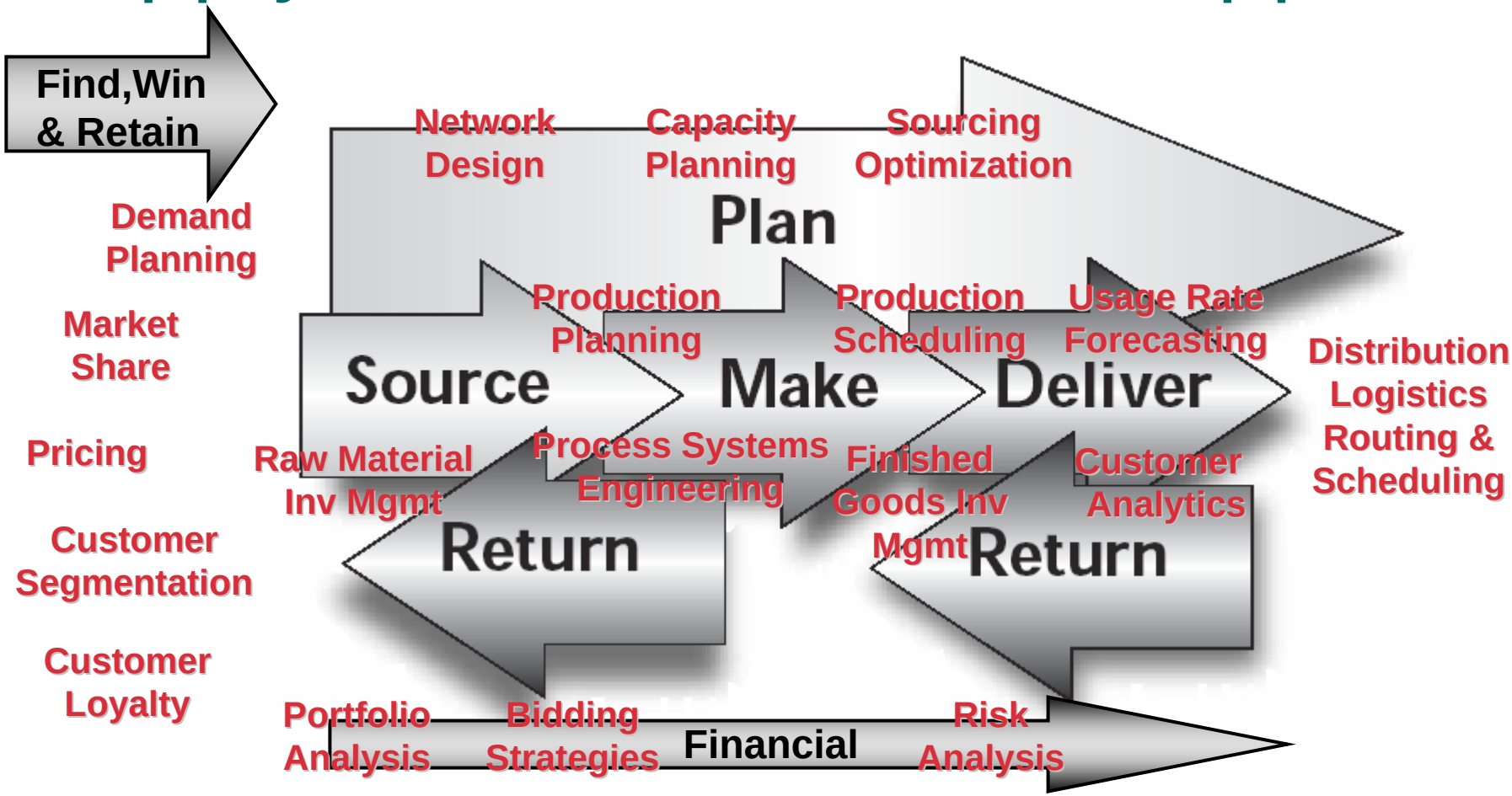


Supply Chain SCOR Processes



Source: The Supply Chain Council SCOR Model

Supply Chain – Decision Support



Business Intelligence / Knowledge Management

SCOR Performance Metrics

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Areas of Opportunity

- **Find, Win, and Retain**
  - **Marketing**
  - **Market Share**
- **Supply Chain – Customer Engagement**
  - **Logistics / Distribution Scheduling**
  - **Customer Analytics**
  - **Order Acceptance**
  - **Pricing**
  - **Customer Segmentation**
  - **Customer Loyalty**

Areas of Opportunity

- **Supply Chain – Manufacturing/Production**
  - **Scheduling**
  - **Re-scheduling/Rework**
  - **Real Time Optimization**
  - **Asset Management/Capacity Planning**
  - **Forecasting**
  - **Logistics**
  - **Sourcing**
  - **Coordination/Collaboration**
  - **Production Planning**

Areas of Opportunity

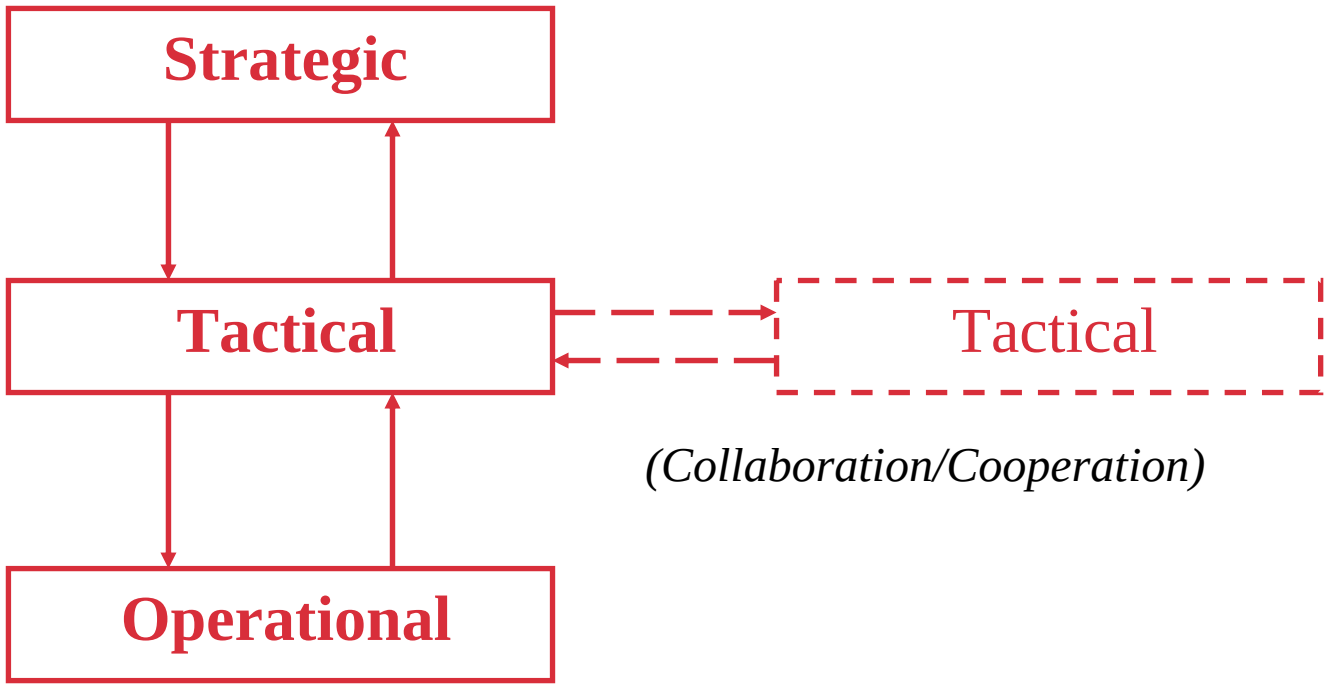
- **Supply Chain – Purchase to Pay**
  - **Material Management**
  - **Inventory Management**
- **Financial**
  - **Portfolio Analysis**
  - **Mergers and Acquisitions**
  - **Divestitures**
  - **Bidding**
  - **Capital Expenditures**
  - **Risk Analysis**

Areas of Opportunity

- **Other Areas**
  - **Research and Development**
  - **Strategic Planning**
  - **Legal / Taxes**
  - **Human Resources**
  - **Engineering**
  - **Continuous Improvement**

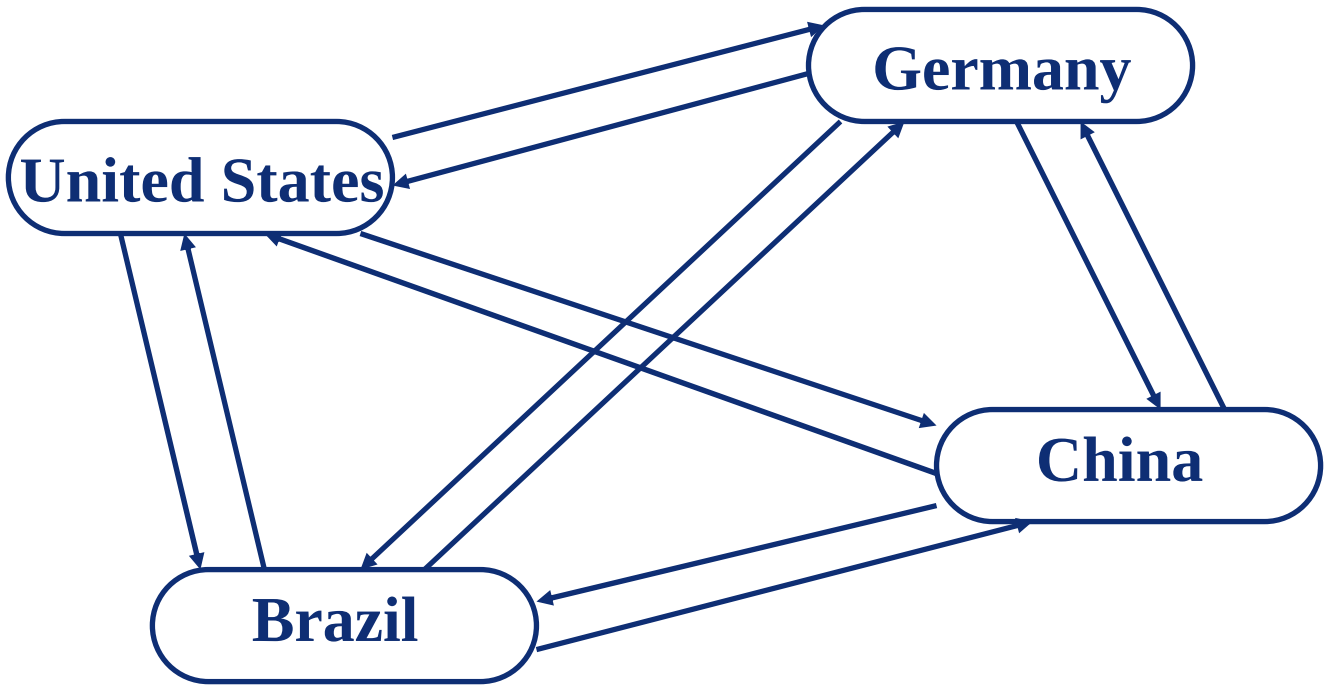
Integrated Decision Models

- **Across Planning Levels (Temporal)**



Integrated Decision Models

- **Across Geographies (Spatial)**

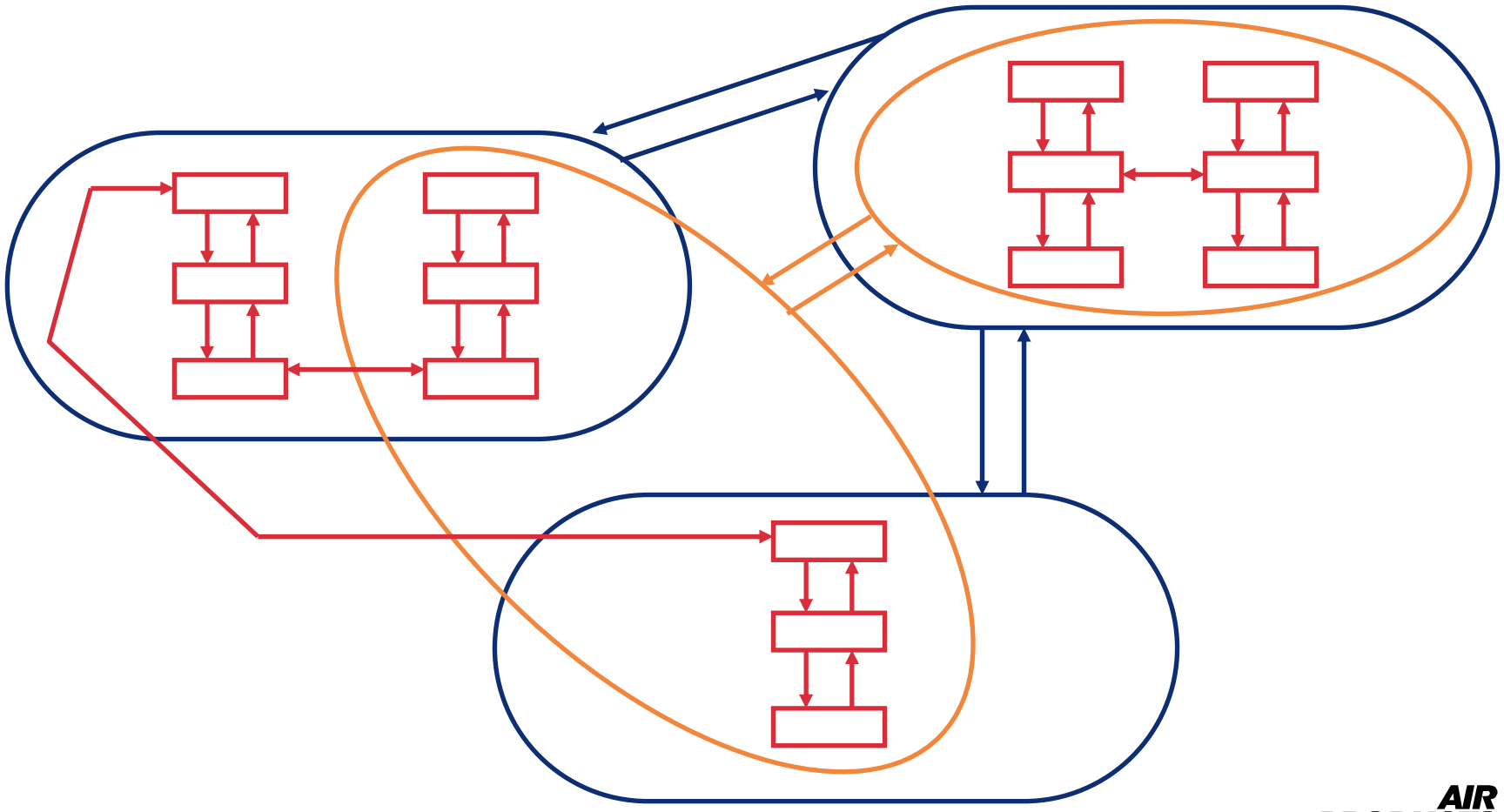


Integrated Decision Models

- **Across Processes**

Integrated Decision Models

- **Enterprise-wide Optimization**



Concluding Remarks

- **Enterprise Wide Optimization is now possible**
  - **ERP systems provide the underlying data**
  - **Increased computing power**
  - **Governing principles continue to evolve**
  - **Advanced modeling techniques**
- **Enterprise Wide Optimization allows us to understand the impact of local decisions on system wide performance measures**
- **The companies that adopt this mindset will improve the efficiency of their supply chains leading to reduced costs and improved customer service**

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Session Questions to Consider

- **How do you see EWO creating new problems that Chemical Engineers are well positioned to address?**
- **The National Academy of Engineers says that all of the new innovations will occur at the boundaries between disciplines. What are the disciplines, the boundaries, and problems EWO solves?**
- **What different ways can academia, industry, and government collaborate to develop successful EWO implementations?**

Some Useful References

Foundations of Computer Aided Process Operations, "A View to the Future Integration of R&D, Manufacturing, and the Global Supply Chain," Sponsored by CAChE, AIChE CAST, INFORMS, Coral Springs, FL, Jan 2003.

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Jeremy F. Shapiro, Modeling the Supply Chain, Duxbury, 2001.

Simchi-Levi, et. al., Managing the Supply Chain, McGraw-Hill, New York, 2004.

Supply Chain Council, http://www.supply-chain.org/

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