

# Essentials of Supply Chain Management

## Teaching Guide & Syllabus

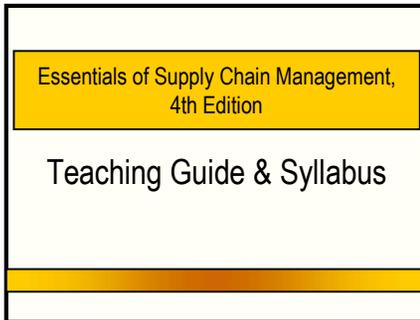
Companion to *Essentials of Supply Chain Management, 4<sup>th</sup> Edition*

- Learning Objectives and Lesson Plans
- Presentation Slides
- Chapter Quizzes
- Suggested Supply Chain Simulations

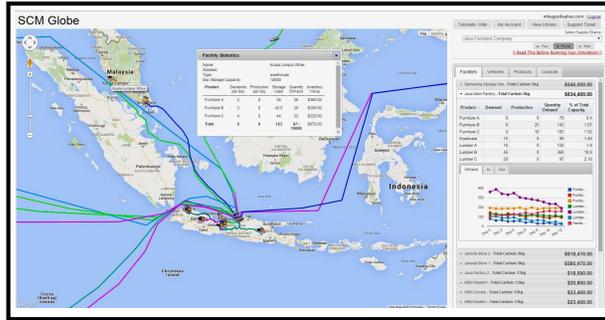
Part of a complete package for instructors in supply chain management

# Complete Package for Supply Chain Learning

Increase student engagement and knowledge retention with combination of readings, lectures and interactive simulations

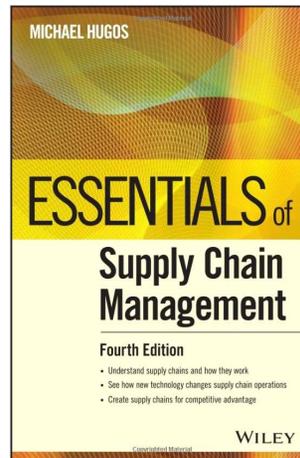


- Learning objectives and lesson plans
- Presentation slides and quizzes
- Suggested supply chain simulations and case study guides
- Companion to **Essentials of Supply Chain Management, 4<sup>th</sup> Edition**
- Book available on Amazon.com - <https://www.amazon.com/Essentials-Supply-Chain-Management/dp/1119461103/>

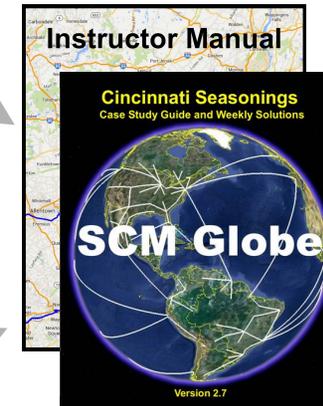


- Web app to model and simulate operations of real or fictional supply chains anywhere in the world
- Apply learning from readings and lectures to solve real problems
- Increase engagement and learning

[www.SCMGlobe.com](http://www.SCMGlobe.com)



- Best selling supply chain book worldwide since 2004 as reported by Amazon.com
- Translated into six languages



- Instructor Manual and Case Study Guides – available on request as Adobe PDF
- Course syllabus examples and interactive case studies to explore supply chain dynamics

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# Preface

Use this teaching guide in conjunction with my book *Essentials of Supply Chain Management, 4<sup>th</sup> Edition*. This guide is organized into 10 class lectures to match the 10 chapters in my supply chain book.

This teaching guide is laid out as a series of presentation slides. If you have the PDF version you can download the free Adobe Reader software (<http://get.adobe.com/reader/>) and display these pages as presentation slides. If you purchased the PowerPoint version of this guide you can add your logo and customize the slides as you wish so long as you give me appropriate attribution.

At the end of each section is a supply chain simulation exercise available through the SCM Globe website (<http://www.scmglobe.com/>). These simulations provide a laboratory where students apply what they learn in lectures and readings to solve highly realistic supply chain problems.

SCM Globe enables students to model and simulate the operations of real supply chains anywhere in the world. The simulations show how supply chains work and where problems occur. Students try different designs until they find what works best. You can request a free evaluation account here - <http://scmglobe.wpengine.com/get-your-free-30-day-trial-demo/>

I welcome hearing from you with comments, questions and ideas for improving this teaching guide. Please email me at: [mhugos@scmglobe.com](mailto:mhugos@scmglobe.com)

Best regards,  
Michael Hugos  
Chicago, Illinois USA

**Note:** Please do not resell or share the PowerPoint version of this teaching guide outside your organization. Contact me if you have special needs or volume purchase requests. You can share the PDF version freely.

# Chapter 1

## Key Concepts of Supply Chain Management

# Chapter 1 Learning Objectives

- Appreciate what a supply chain is and what it does
- Understand where your company fits in the supply chains it participates in and the role it plays in those supply chains
- Be able to discuss ways to align your supply chain with your business strategy
- Start an intelligent conversation about the supply chain management issues in your company
- Use interactive supply chain simulations to explore how supply chains operate

# What is Supply Chain Management?

“**A supply chain is** a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and distribution of these finished products to customers.”

Ganeshan and Harrison, “An Introduction to Supply Chain Management”, 1995

“**Supply chain management is** coordination of production, inventory, location, transportation, and information among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served.”

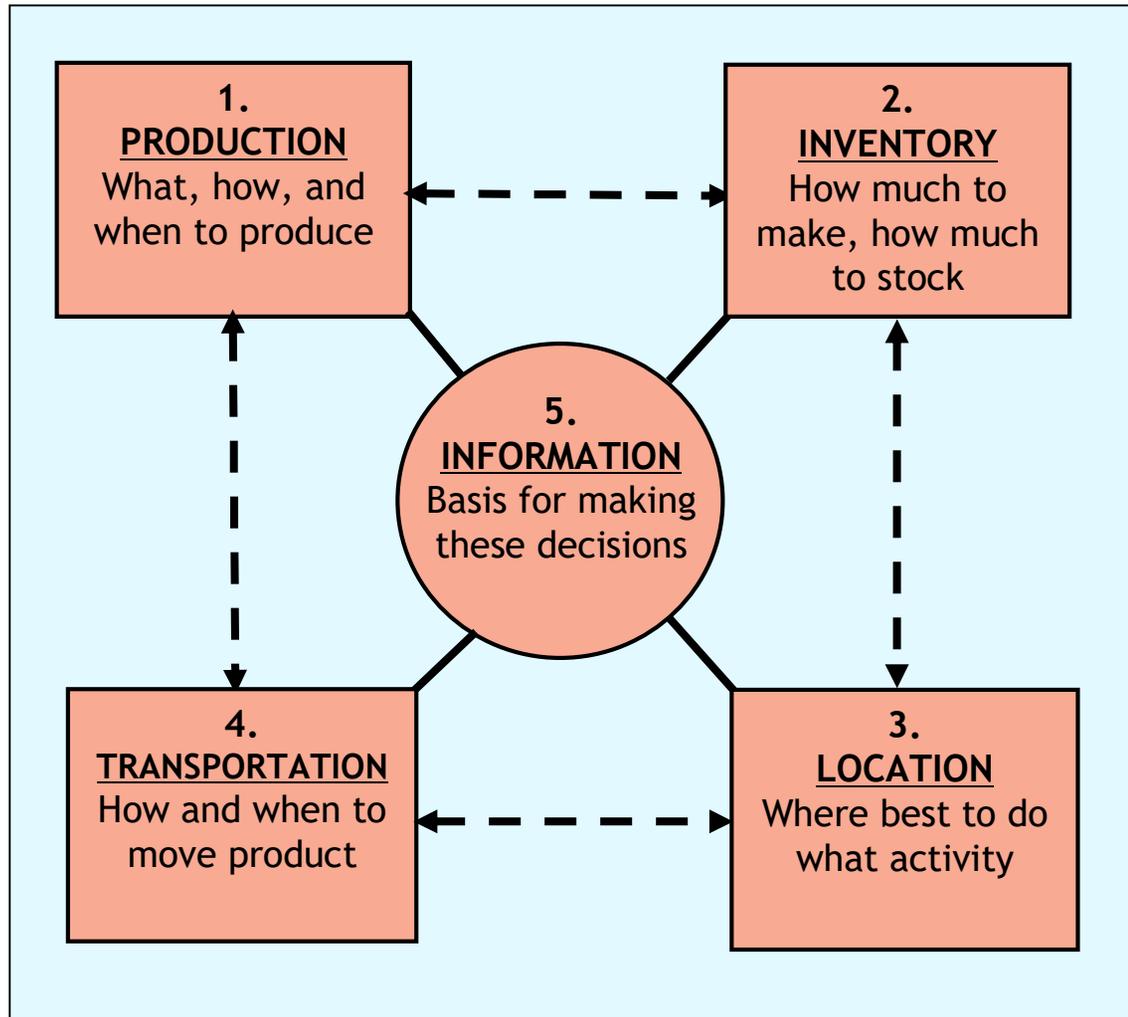
Hugos, *Essentials Of Supply Chain Management, 4th Edition*, 2018

# Supply Chain Drivers

“Increase throughput while simultaneously reducing inventory and operating expense.”

Goldratt, *The Goal*,

Responsiveness  
VS.  
Efficiency



# Five Supply Chain Drivers

## 1. Production

- Factories for making products
  - Product Focus
  - Functional Focus
- Warehouses for storing and distributing products
  - Stock Keeping Unit Storage
  - Job Lot Storage
  - Crossdocking

## 2. Inventory

- Cycle inventory to meet on-going customer demand
- Safety inventory to protect against stockouts
- Seasonal inventory to meet seasonal demands

## Five Supply Chain Drivers (cont.)

**3. Location** – place facilities so as to maximize performance

**4. Transportation**

- Ship or barge is slowest and least expensive way to move products
- Rail can be both fast and efficient
- Pipeline is efficient way to move liquid and gas products
- Truck is fast but also more expensive
- Airplane is fastest and most expensive
- Electronic transport is fast and inexpensive way to move data products

**5. Information**

- To coordinate daily supply chain activities
- For forecasting and planning of supply chain activities

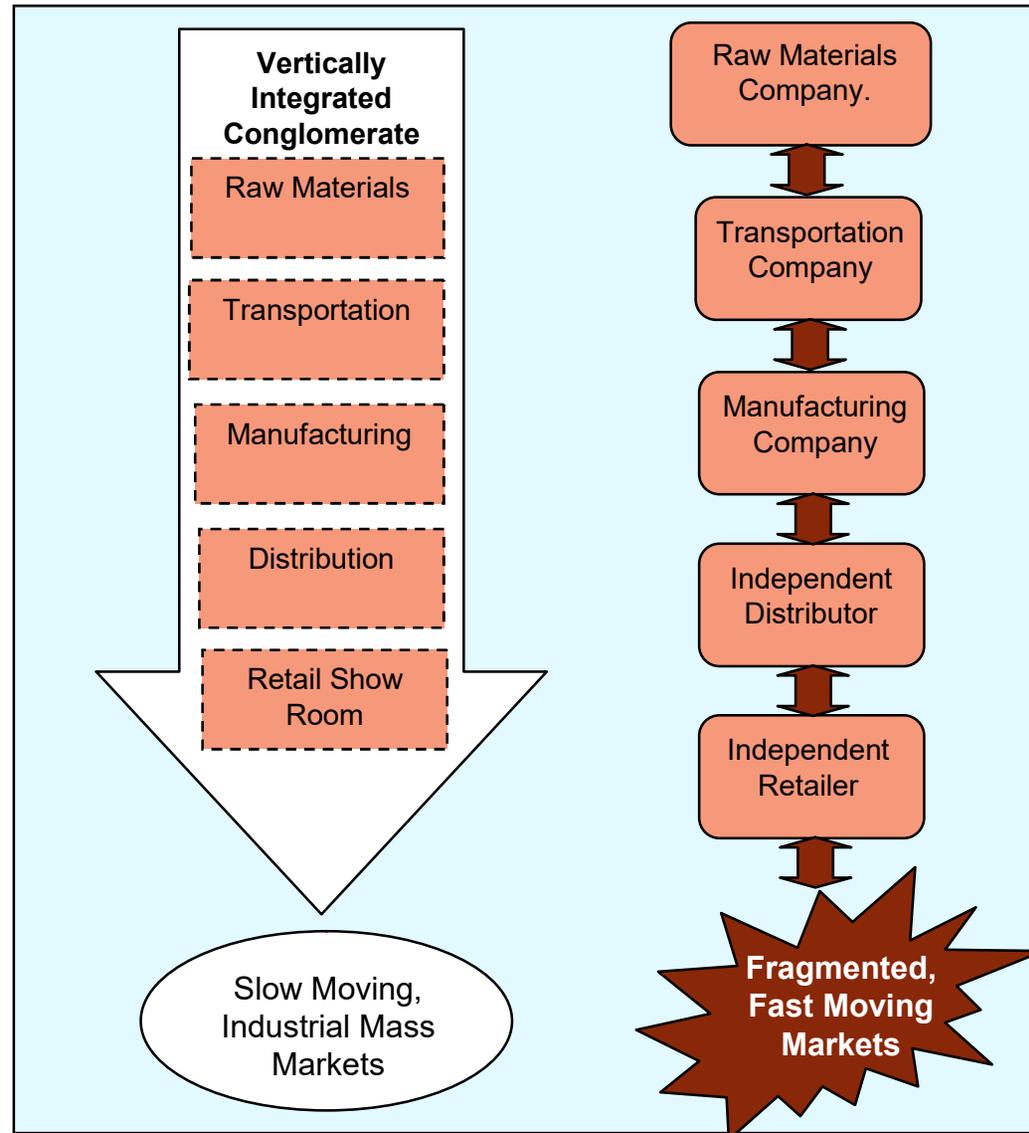
# Responsiveness versus Efficiency

Supply Chain Drivers	Responsiveness	Efficiency
1. Production	<ul style="list-style-type: none"> <li>- Excess capacity</li> <li>- Flexible manufacturing</li> <li>- Many smaller plants</li> </ul>	<ul style="list-style-type: none"> <li>- No excess capacity</li> <li>- Narrow product focus</li> <li>- Few large plants</li> </ul>
2. Inventory	<ul style="list-style-type: none"> <li>- High inventory levels</li> <li>- Wide range of items</li> </ul>	<ul style="list-style-type: none"> <li>- Low inventory levels</li> <li>- Narrow range of items</li> </ul>
3. Location	<ul style="list-style-type: none"> <li>- Many locations close to customers</li> </ul>	<ul style="list-style-type: none"> <li>- Few central locations serve wide areas</li> </ul>
4. Transportation	<ul style="list-style-type: none"> <li>- Frequent small shipments</li> <li>- Fast &amp; Flexible modes</li> </ul>	<ul style="list-style-type: none"> <li>- Few large shipments</li> <li>- Slower and cheaper modes</li> </ul>
5. Information	<ul style="list-style-type: none"> <li>- Collect &amp; share timely and accurate data</li> </ul>	<ul style="list-style-type: none"> <li>- Cost of information drops while other costs rise</li> </ul>

# Old Supply Chains vs. New

## VERTICAL INTEGRATION has given way to “VIRTUAL INTEGRATION”

Companies now focus on their core competencies, and partner with other companies to create supply chains for fast moving markets.



# Supply Chain Structure

**Producers**

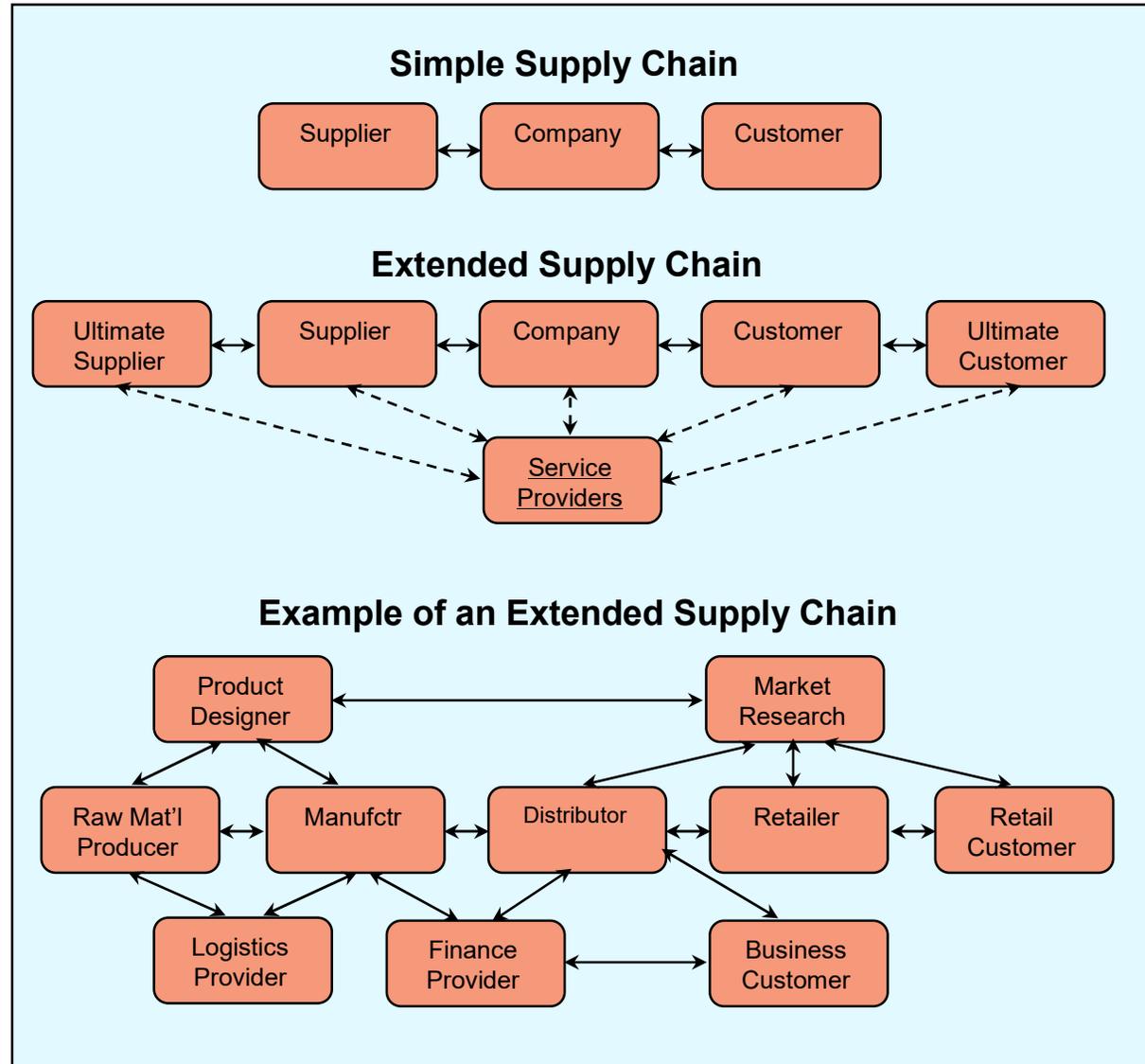
**Distributors**

**Retailers**

**Customers**

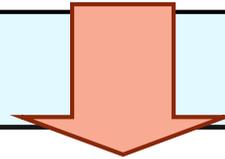
**Service Providers**

- Logistics
- Finance
- Market Research
- Product Design
- Information Technology



# Align Supply Chain with Business

1. Understand the requirements of your customers.
2. Define core competencies and the roles your company will play to serve customers.
3. Develop supply chain capabilities to support the roles your company has chosen.



## *Supply Chain Drivers*

### 1. Production

	<b>Responsiveness</b>	<b>Efficiency</b>
1. Production	<ul style="list-style-type: none"> <li>• Excess capacity</li> <li>• Flexible manufacturing</li> <li>• Many smaller factories</li> </ul>	<ul style="list-style-type: none"> <li>• Little excess capacity</li> <li>• Narrow focus</li> <li>• Few central plants</li> </ul>
2. Inventory	<ul style="list-style-type: none"> <li>• High inventory levels</li> <li>• Wide range of items</li> </ul>	<ul style="list-style-type: none"> <li>• Low inventory levels</li> <li>• Fewer items</li> </ul>
3. Location	<ul style="list-style-type: none"> <li>• Many locations close to customers</li> </ul>	<ul style="list-style-type: none"> <li>• Few central locations serve wide areas</li> </ul>
4. Transportation	<ul style="list-style-type: none"> <li>• Frequent shipments</li> <li>• Fast and flexible mode</li> </ul>	<ul style="list-style-type: none"> <li>• Shipments few, large</li> <li>• Slow, cheaper modes</li> </ul>
5. Information	<ul style="list-style-type: none"> <li>• Collect &amp; share timely, accurate data</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of information drops while other costs rise</li> </ul>

### 2. Inventory

### 3. Location

### 4. Transportation

### 5. Information

Capabilities of responsiveness and efficiency come from decisions made about the five supply chain drivers.

# Chapter 1 Quiz Questions

1. Write a short description of what a supply chain is and what it does. (see p. 3 - 4)\*\*
2. What is the goal of supply chain management?  
("Increase throughput of goods and services while simultaneously reducing inventory and operating expense." Goldratt, *The Goal*)
3. What are the five major supply chain drivers? (see p. 5 - 6)
4. Explain the meaning of the saying "Amateurs talk strategy and professionals talk logistics."  
(see p. 8 - 10)
5. What are two approaches to production used by factories and how are they different?  
(see p. 11)
6. What are three approaches to warehouse operations and how are they different?  
(see p. 11 -12)
7. What are three kinds of inventory and what is the purpose of each? (see p. 12 -13)
8. Describe four supply chain innovations introduced by Wal-Mart and explain why they are so powerful when used together. (see p. 18 - 19)
9. Discuss when a supply chain should emphasize responsiveness and when it should emphasize efficiency. (see p. 27 - 29)
10. What are the three main steps to align supply chain and business strategy and do they affect the way a company implements the five supply chain drivers? (see p.29 – 33)

\*\* Page numbers refer to answers in *Essentials of Supply Chain Management, 4th Edition*

# Supply Chain Simulation Exercise

The screenshot displays the SCM Globe website interface. At the top, there are navigation links for 'Espanol', 'Services', 'Blog', 'Pricing', and 'Contact Us'. The main header includes the 'SCM Globe' logo and the 'COGNITIVA' logo with the text 'Latin America Sales and Service'. The central content area features a 'Login' form with fields for 'Email' (containing 'mhugos@scmglobe.com') and 'Password', a 'Login' button, a 'Remember me' checkbox, and a 'Forgot password?' link. Below the login form are 'Register' and 'Purchase - Compra' buttons. A red arrow labeled '1' points from the 'Register' button to a video player showing a map of the supply chain simulation. Below the video player is an 'Additional Information' section with a 'Start Here' button, a 'Tutorials Videos FAQs' section, and a 'YouTube' logo. A red arrow labeled '2' points from the 'Start Here' button to the 'Additional Information' section. To the right of the 'Additional Information' section is an 'Instructor Manual' section with a 'For Instructors Only' label. At the bottom right, there is a contact section with the text 'SCM Globe complements any supply chain or logistics course from beginner to advanced levels.' and 'Contact us at info@scmglobe.com', along with social media icons for YouTube, LinkedIn, Twitter, and Facebook.

## See *SCM Globe Cincinnati Seasonings Study Guide, Week 1 – Supply Chains and Simulations*

1. Register and purchase access to SCM Globe
2. Go to [www.scmglobe.com](http://www.scmglobe.com) and click on the “Start Here” button. All training and user support is online. Click on “Getting Started” and watch the handful of short videos there. Click on “FAQs” and read the answers to the most common questions.

# Chapter 2

## Supply Chain Operations: Planning and Sourcing

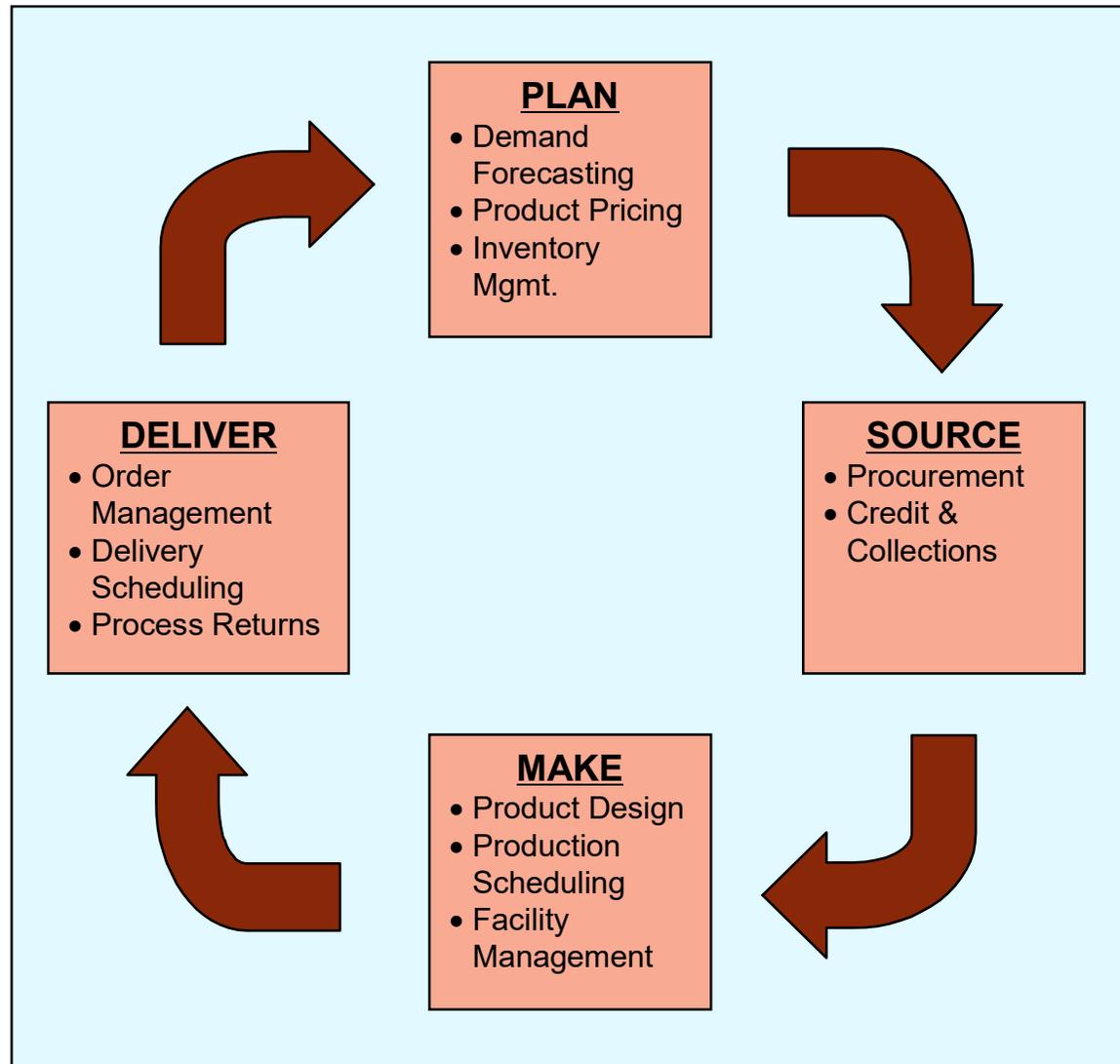
## Chapter 2 Learning Objectives

- Gain a conceptual appreciation of the business activities that drive supply chain operations
- Exercise a high-level understanding of activities involved in supply chain planning and sourcing
- Understand basic concepts of demand forecasting and inventory management
- Begin to assess how well these activities operate within your own organization

# Supply Chain Operations

- Companies perform operations in one or more of these four activity categories
- Sales and Operations Planning (S&OP) coordinates these operations
- This chapter looks at Plan and Source activities

NOTE: this simplified SCOR model treats returns as a sub-category of the Deliver category



# Four Forecasting Variables

VARIABLES		
1.	<b>Demand</b>	overall market demand for product
2.	<b>Supply</b>	amount of product available
3.	<b>Product Characteristics</b>	product features that influence demand
4.	<b>Competitive Environment</b>	actions of product suppliers in the market

# Four Forecasting Methods

METHODS		
1.	<b>Qualitative</b>	Relies on a person's intuition or opinions
2.	<b>Causal</b>	Assumes demand is strongly related to certain factors
3.	<b>Time Series</b>	Based on historical demand patterns
4.	<b>Simulation</b>	Combines causal and time series methods

# Aggregate Planning

- Once demand forecasts are created, the next step is to create an aggregate supply plan for the company to meet product demand
- There are three basic approaches to use in creating the aggregate supply plan:
  1. **Use production capacity to meet demand** – align production capacity to meet demand, add/remove production capacity so that 100% of capacity is utilized
  2. **Use varying levels of total production capacity** as needed to meet forecast demand, plan to keep extra production capacity in reserve to use as needed
  3. **Use inventory and work-in-progress inventory** to meet demand, build up extra inventory as needed to meet forecasted future demand

# Product Promotions

Is it best to do product promotions in PEAK periods to increase revenue, or in SLOW periods to cover cost?

PEAK periods if company can quickly vary size of workforce and production capacity

SLOW periods if company cannot quickly vary workforce and production

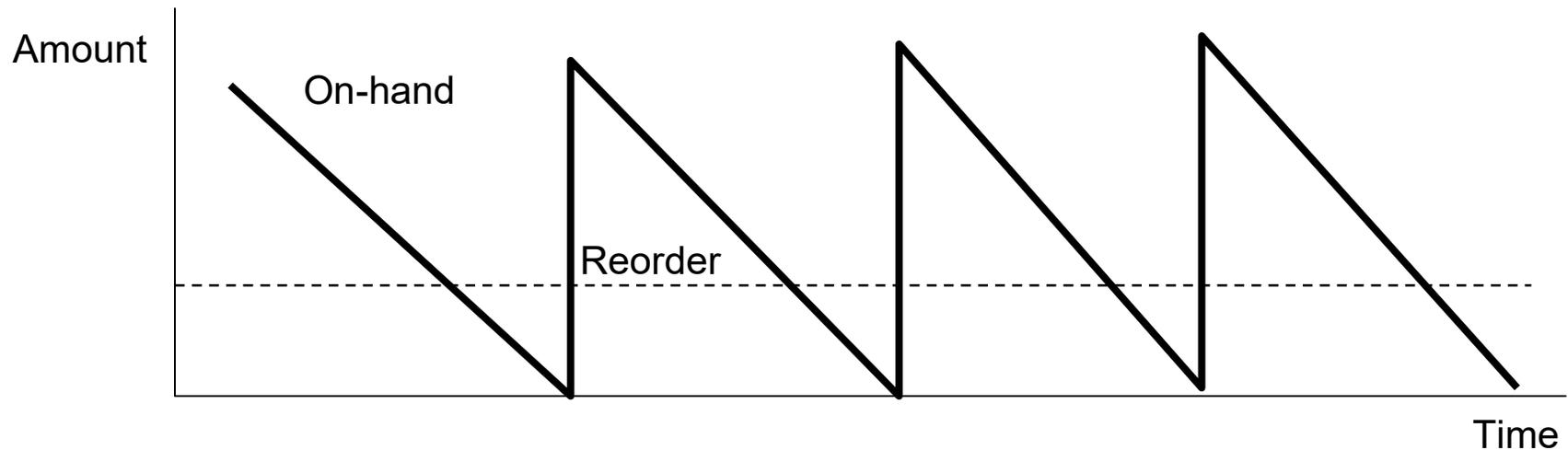
## 3 EFFECTS OF PRODUCT PROMOTIONS:

- Growth in market size
- Growth in market share
- Forward buying

# Three Kinds of Inventory

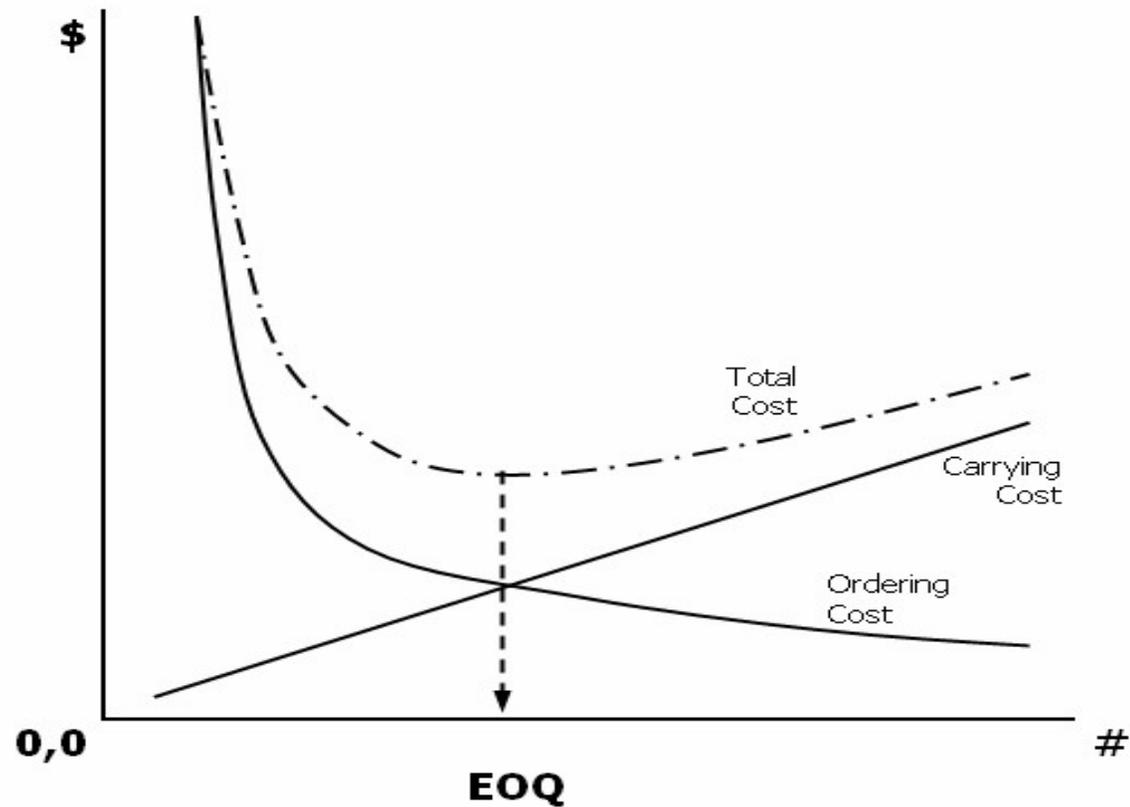
1. **CYCLE INVENTORY** — amount of inventory needed to satisfy demand in periods between replenishment
2. **SAFETY INVENTORY** — buffer against uncertainty in demand and order lead times
3. **SEASONAL INVENTORY** — built up in anticipation of expected increases of demand at certain times of year

# Cycle Inventory



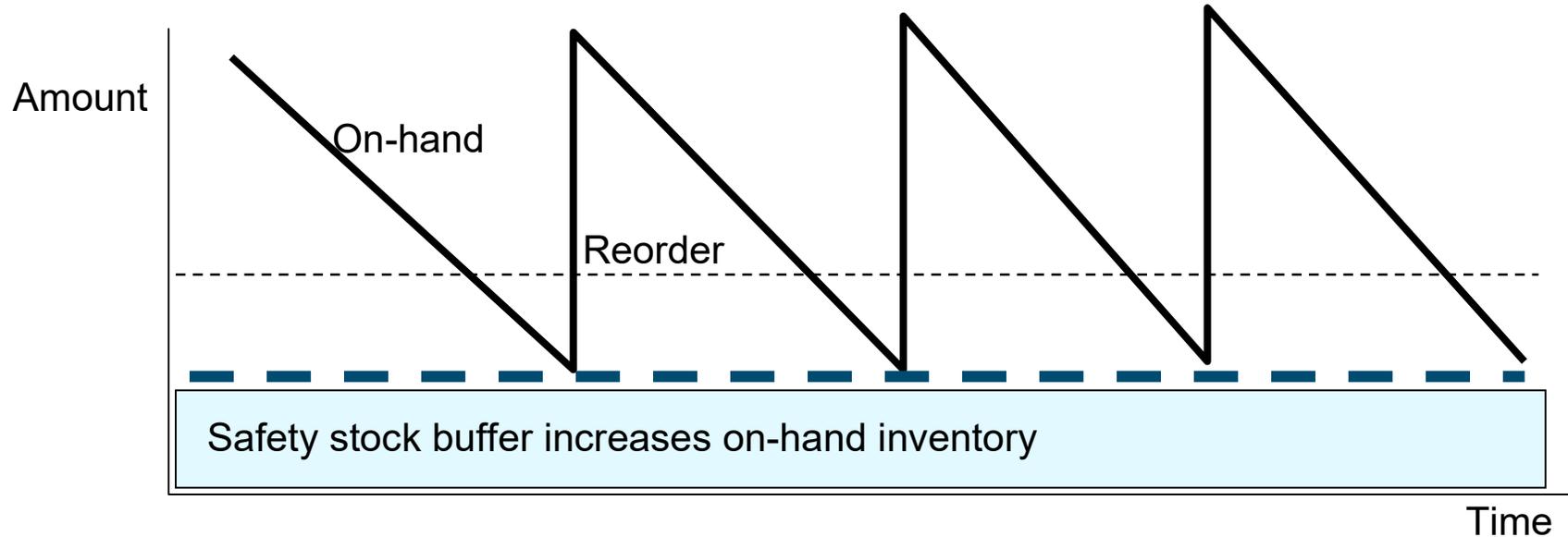
- On-hand inventory to meet forecasted customer demand
- More efficient to make few large orders instead of many small orders
- Actual customer demand usually continuous small purchases
- Companies attempt to balance usage with ordering cost and carrying cost

# Economic Order Quantity (EOQ)



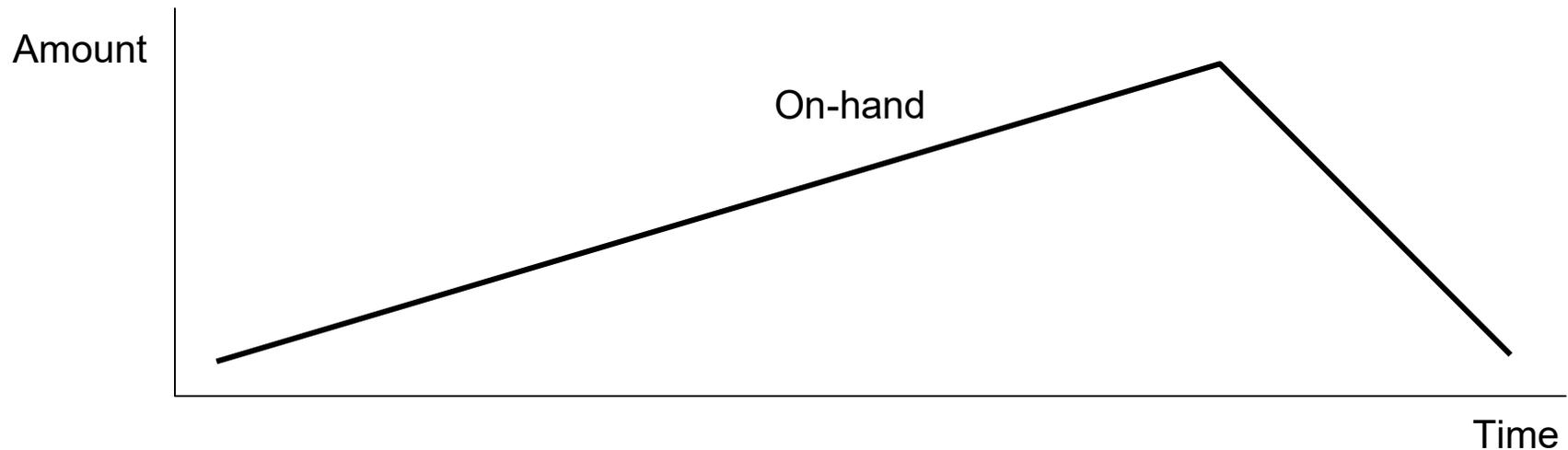
$$EOQ = \sqrt{\frac{2 \times \text{Annual Usage} \times \text{Ordering Cost}}{\text{Annual Holding Cost as \% of Unit Cost} \times \text{Unit Cost}}}$$

# Safety Stock Inventory



- Safety stock is buffer to account for uncertainty – fixed cost
- Four ways to reduce safety stock:
  1. Reduce demand uncertainty (better forecasts)
  2. Reduce order lead times
  3. Reduce order lead variability
  4. Reduce product availability uncertainty

# Seasonal Inventory



- When there is fixed production capacity companies may stockpile inventory in anticipation of large future demand
- Driven by desire to best utilize available productive capacity to meet forecasted demand
- Calls for manufacturers to offer price incentives to distributors to purchase product before actual demand occurs

# Five Procurement Activities

- 1. Purchasing** – routine issuing of purchase orders for needed products
  - Direct or strategic materials for making company product
  - Indirect or maintenance, repair and operations (MRO)
- 2. Consumption Management** – monitor product usage
- 3. Vendor Selection** – identify appropriate suppliers
- 4. Contract Negotiation** – define products, prices and service level agreements (SLAs)
- 5. Contract Management** – track supplier performance and adherence to contract terms and SLAs

# Credit and Collections

- **Set Credit Policy**
  - Management sets credit policies to attract customers
  - And also manage receivables risk
- **Implement Credit and Collections Practices**
  - Analyze potential customers to screen out those who won't pay
  - Work with sales people and customers to collect payment for products delivered by company
- **Manage Credit Risk**
  - Find ways to lower risk of selling to new customers
  - Create credit and financing programs to fit customer needs
  - Review and revise customer credit status over time

## Chapter 2 Quiz Questions

1. What are four main categories of supply chain operations and what are some of the activities in each category? (see p. 42 - 43)\*\*
2. Describe the four variables that are addressed in demand forecasting. (see p. 44 – 46)
3. What are four forecasting methods and what is the main focus of each method? (see p. 46 – 48)
4. How does product promotion relate to company cost structure and what are the effects of running product promotions? (see p. 53)
5. Name the three types of inventory and the purpose of each type. (see p. 54 – 58)
6. Explain cycle inventory and what causes cycle inventory levels to rise and fall. (see p. 54)
7. What is the Economic Order Quantity (EOQ) and how does it work? (see p. 55 – 57)
8. What is safety inventory and how can companies reduce safety inventory? (see p. 58 – 59)
9. Describe the five main functions that make up the procurement activity? (see p. 59, 66 – 69)
10. What are the three main functions that occur within the credit and collections activity? (see p. 69 – 72)

\*\* Page numbers refer to answers in *Essentials of Supply Chain Management, 4th Edition*

# Supply Chain Simulation Exercise

SCM Globe

Search Location

My Account View Library Logout

Simulation Cincinnati Seasonings V1

Edit

Name: Seasonings DC

Type: warehouse

Max Storage Capacity: 15000

Daily Rent Cost per m<sup>2</sup>: 2

Daily Operating Cost: 10000

Daily Carbon Output: 0 kg

Product	Demand per day	Production per day	Quantity Onhand	Storage Used
Spicy Cube	0	0	4000	4000
<b>Total</b>	<b>0</b>	<b>0</b>	<b>4000</b>	<b>4000</b>

Update

Products

Facilities - Seasonings DC

- Ft Wayne Store
- Indianapolis Store
- Louisville Store
- Seasonings DC
- Seasonings Factory

Vehicles

Routes

## See *SCM Globe Cincinnati Seasonings Study Guide, Week 2 – Improve Existing Supply Chain*

1. Load Cincinnati Seasonings case study from the library into your account and read the introduction to this case study - <http://scmglobe.wpengine.com/user-manual-2/supply-chain-case-studies/cincinnati-seasonings/>
2. Click on various facilities, vehicles and routes to see how they are defined
3. Click on “Simulation” button to see how this supply chain operates – make improvements as needed

# Supply Chain Simulation Exercise (cont.)

The screenshot shows the SCM Globe simulation interface. A map of the Cincinnati area is displayed with supply chain routes. A red arrow labeled '1' points to the Louisville Store location on the map. Another red arrow labeled '2' points to a line graph in the data panel on the right. The data panel shows the following information:

**Facilities**

- Seasonings Factory - Total Carbon: 0kg **\$528,000.00**
- Seasonings DC - Total Carbon: 0kg **\$480,000.00**
- Louisville Store - Total Carbon: 0kg **\$90,000.00**
- Indianapolis Store - Total Carbon: 0kg **\$66,000.00**
- Fl Wayne Store - Total Carbon: 0kg **\$86,400.00**

**Product Summary:**

Product	Demand	Production	Quantity Onhand	% of Total Capacity
Spicy Cube	0	350	1090	36.33

**Onhand Inventory Graph:**

Day	Onhand
Day 0	1000
Day 2	1100
Day 4	1200
Day 6	1300
Day 8	1400
Day 10	1500

**Facility Statistics (Louisville Store):**

Product	Demands per day	Production per day	Storage Used	Quantity Onhand	Inventory Value
Spicy Cube	100	0	-40	-40	(\$400.00)
<b>Total</b>	<b>100</b>	<b>0</b>	<b>-40</b>	<b>-40</b>	<b>(\$400.00)</b>

An error message at the bottom of the panel reads: "Error: Not enough goods for Spicy Cube in Louisville Store."

## See *SCM Globe Cincinnati Seasonings Study Guide, Week 2 – Improve Existing Supply Chain*

1. Simulation highlights points of failure in supply chain design
2. Graphic and numeric displays provide operations and cost data for analysis
3. Keep improving design until it runs for 30 days at lowest cost

# Visualize Case Study Data with this Worksheet

Students can visualize supply chain data for this and other case studies with a worksheet such as the one shown here

**Supply Chain Management Worksheet**

**Factory**

C = \_\_\_\_\_  
DP = \_\_\_\_\_  
OH = \_\_\_\_\_

T = \_\_\_\_\_  
C = \_\_\_\_\_  
Days = \_\_\_\_\_

**Warehouse**

C = \_\_\_\_\_  
OH = \_\_\_\_\_

T = \_\_\_\_\_  
C = \_\_\_\_\_  
Days = \_\_\_\_\_

**Warehouse**

C = \_\_\_\_\_  
OH = \_\_\_\_\_

T = \_\_\_\_\_  
C = \_\_\_\_\_  
Days = \_\_\_\_\_

**Warehouse**

C = \_\_\_\_\_  
OH = \_\_\_\_\_

T = \_\_\_\_\_  
C = \_\_\_\_\_  
Days = \_\_\_\_\_

**Store1:** \_\_\_\_\_

C = \_\_\_\_\_  
DD = \_\_\_\_\_  
OH = \_\_\_\_\_

**Store2:** \_\_\_\_\_

C = \_\_\_\_\_  
DD = \_\_\_\_\_  
OH = \_\_\_\_\_

**Store3:** \_\_\_\_\_

C = \_\_\_\_\_  
DD = \_\_\_\_\_  
OH = \_\_\_\_\_

**Store4:** \_\_\_\_\_

C = \_\_\_\_\_  
DD = \_\_\_\_\_  
OH = \_\_\_\_\_

T = \_\_\_\_\_  
C = \_\_\_\_\_  
Days = \_\_\_\_\_

**Store1:** \_\_\_\_\_

DD	DD	DD	DD	DD	DD
0	1	2	3	4	5
DD	DD	DD	DD	DD	
6	7	8	9	10	
OH	OH	OH	OH	OH	OH
0	1	2	3	4	5
OH	OH	OH	OH	OH	
6	7	8	9	10	

**Store2:** \_\_\_\_\_

DD	DD	DD	DD	DD	DD
0	1	2	3	4	5
DD	DD	DD	DD	DD	
6	7	8	9	10	
OH	OH	OH	OH	OH	OH
0	1	2	3	4	5
OH	OH	OH	OH	OH	
6	7	8	9	10	

**Store3:** \_\_\_\_\_

DD	DD	DD	DD	DD	DD
0	1	2	3	4	5
DD	DD	DD	DD	DD	
6	7	8	9	10	
OH	OH	OH	OH	OH	OH
0	1	2	3	4	5
OH	OH	OH	OH	OH	
6	7	8	9	10	

**Store4:** \_\_\_\_\_

DD	DD	DD	DD	DD	DD
0	1	2	3	4	5
DD	DD	DD	DD	DD	
6	7	8	9	10	
OH	OH	OH	OH	OH	OH
0	1	2	3	4	5
OH	OH	OH	OH	OH	
6	7	8	9	10	

**Legend:**

C = capacity      DP = daily production  
OH = on hand      DD = daily demand  
T = mode of transportation

Worksheet designed by Eric Minch, Wilfredo Febus, Anya Smith, Leland Shuck and Christopher Robinson, 2012, Florida Institute of Technology

# Chapter 3

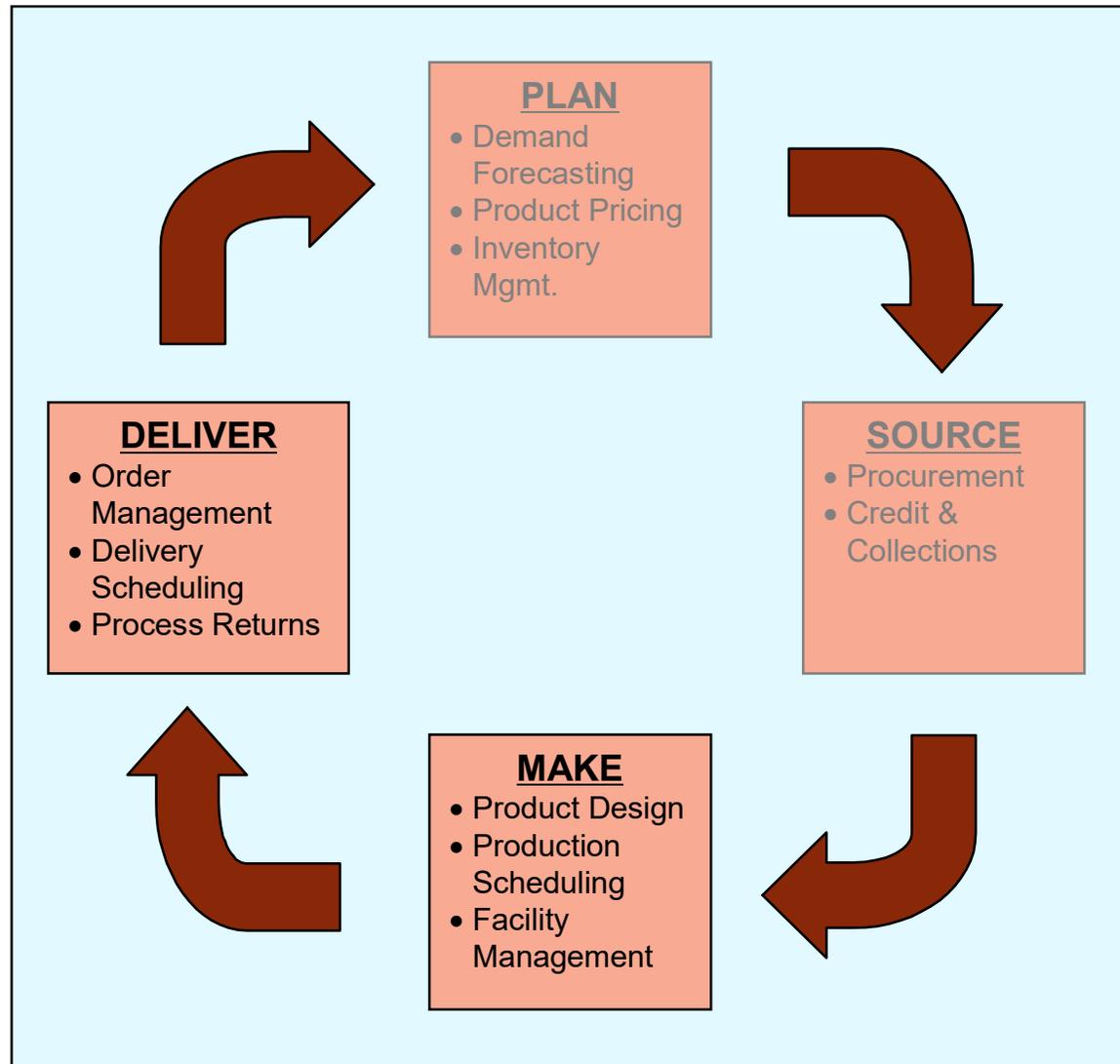
## Supply Chain Operations: Making and Delivering

## Chapter 3 Learning Objectives

- Gain a basic understanding of supply chain operations involved in making and delivering products
- Understand how product design affects the supply chain that supports that product
- Appreciate the balancing act between utilization rates, inventory levels and customer service that is inherent in production scheduling
- Be able to apply the four rules of efficient order management in your company
- Assess different delivery scheduling options and know which ones are relevant to your own organizations

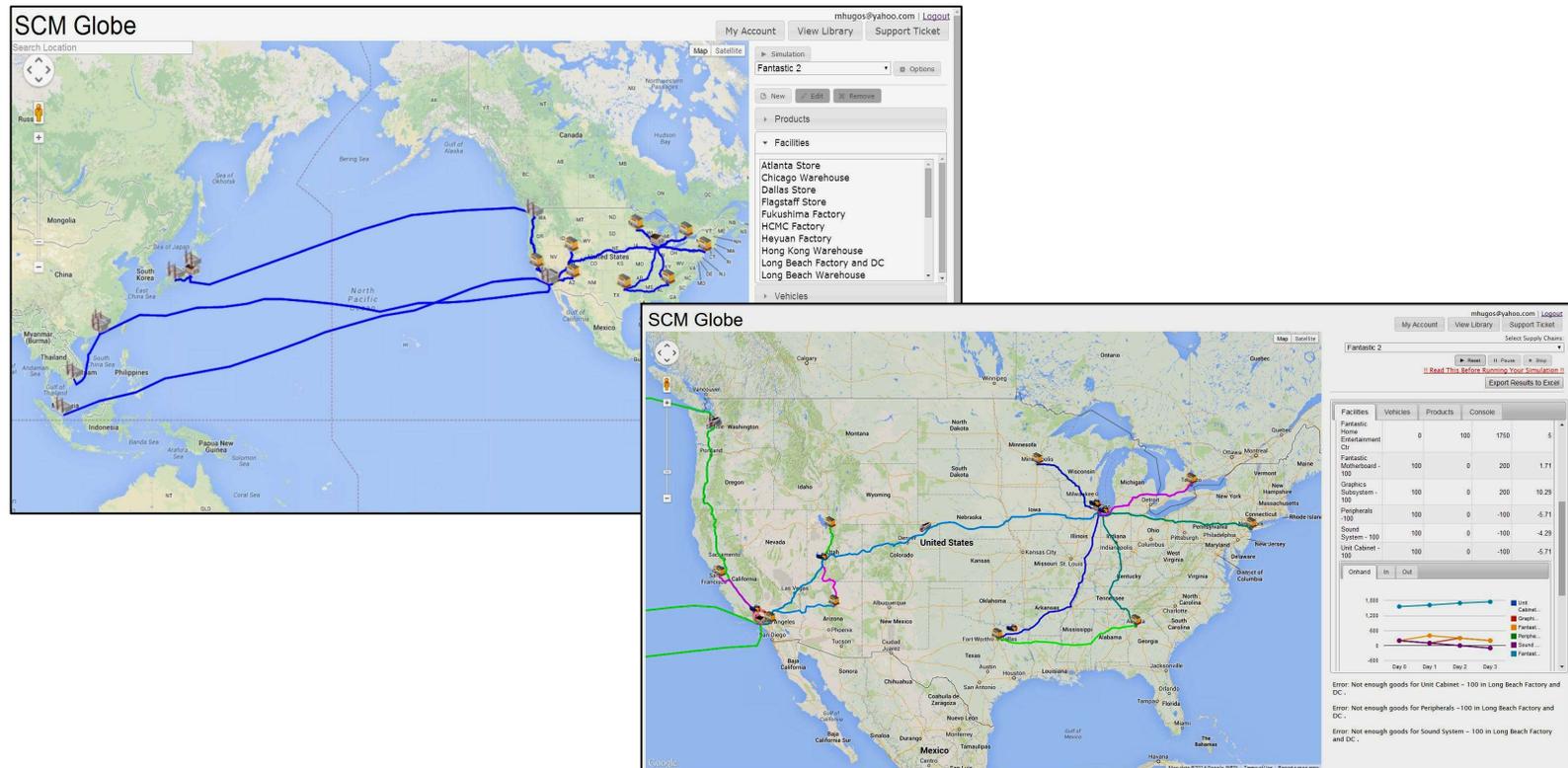
# Supply Chain Operations

- Companies perform operations in one or more of these four categories of chain activity
- This chapter looks at Make and Deliver activities



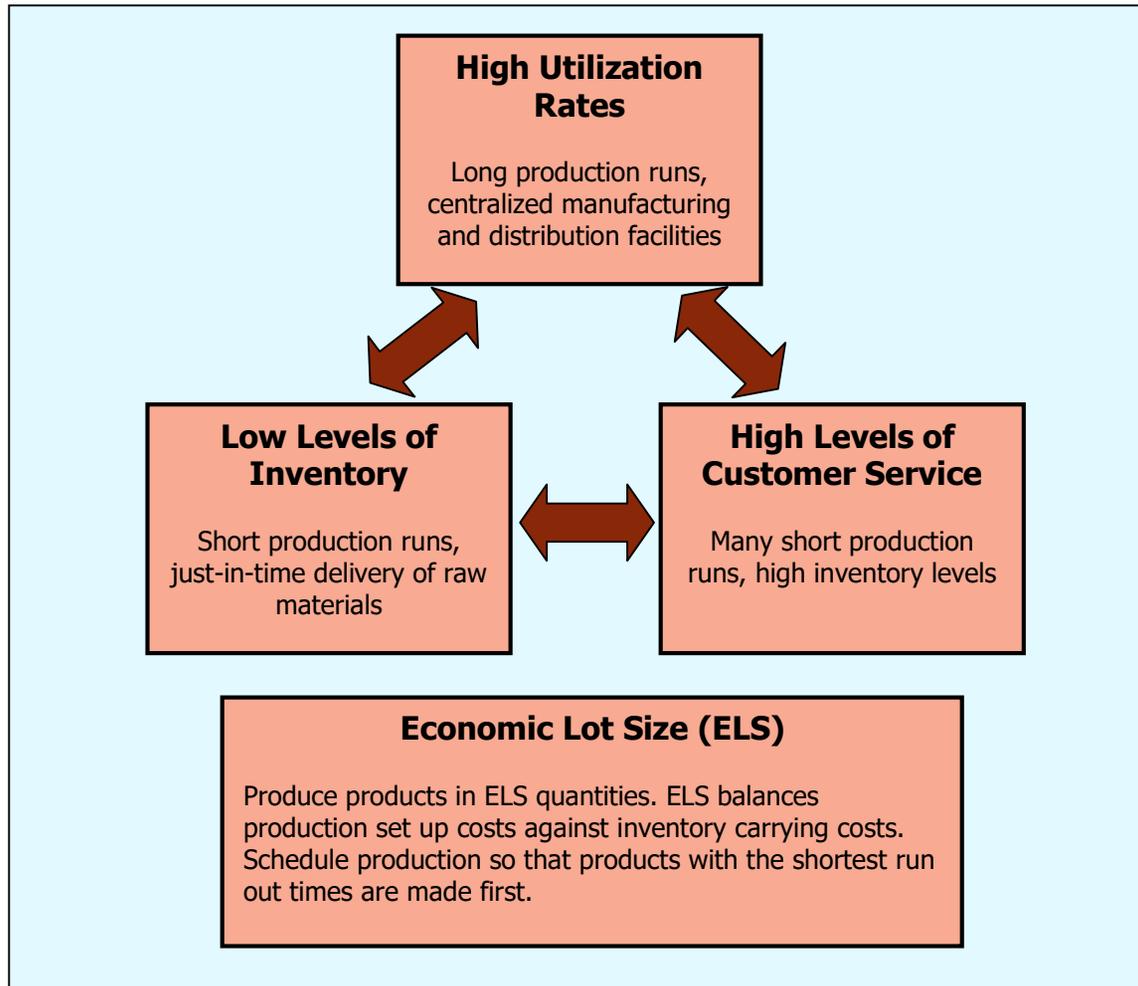
NOTE: this simplified SCOR model treats returns as a sub-category of the Deliver category

# Product Design and Supply Chain



- Product design determines component parts needed and that influences supply chain complexity
- Complex designs and complex supply chains result in higher costs and lower productivity

# Production Scheduling



Production scheduling is a continuous balancing act as business conditions change

Production managers must balance often conflicting needs of delivering high levels of customer service while maintaining low levels of inventory and high rates of factory utilization

# Facility Management

- Facility management takes location as a given
- Focus is on how best to use available capacity
- This involves decisions in three main areas:
  1. Role each facility will play in supply chain
  2. How to allocate capacity in each facility
  3. Allocation of suppliers and markets to each facility

## Economic Lot Size and Run-Out Time

- Economic lot size (ELS) balances production setup costs against inventory carrying costs
- If setups are done frequently and small production runs are used there will be low inventory carrying costs but high setup costs
- If setups are done infrequently and long production runs are used there will be higher inventory carrying costs but lower setup costs – ELS is always changing as business conditions change
- When ELS is determined schedule production based on product run-out time
- Run-Out Time = Product On Hand / Demand for Product  
( $R = P / D$ )

# Rules for Order Management

## 1. Enter the Order Once and Only Once

Capture the order electronically as close to the original source as possible. Do not manually re-enter the order again.

## 2. Automate Order Routing

Automatically send orders to appropriate fulfillment locations. People do only exception handling.

## 3. Make Order Status Visible

Let customers and service agents see order status information automatically when ever they want.

## 4. Use Integrated Order Mgmt. Systems

Electronically connect order management systems with other related systems to maintain data integrity.

Think about how your company receives and processes orders for its products and services

Does your company follow all of these four rules or are some rules missed?

# Delivery Scheduling

- Make **direct deliveries** from one location to another when delivery quantities equal EOQ amounts
- Use **milk-run deliveries** from one facility to many facilities when smaller amounts are required – do routing by:
  - Savings matrix technique
  - Generalized assignment technique
- There are two kinds of delivery sources:
  - Single product locations such as factories
  - Distribution centers stocking multiple products
- Return Processing – can be seen as delivery in reverse
  - Known as “Reverse Logistics”
  - Increasingly important as products are returned for recycling and products are returned after ecommerce online purchases
  - Return processing is important and should be handled efficiently, but it is often better to focus on ways to reduce the causes of product returns

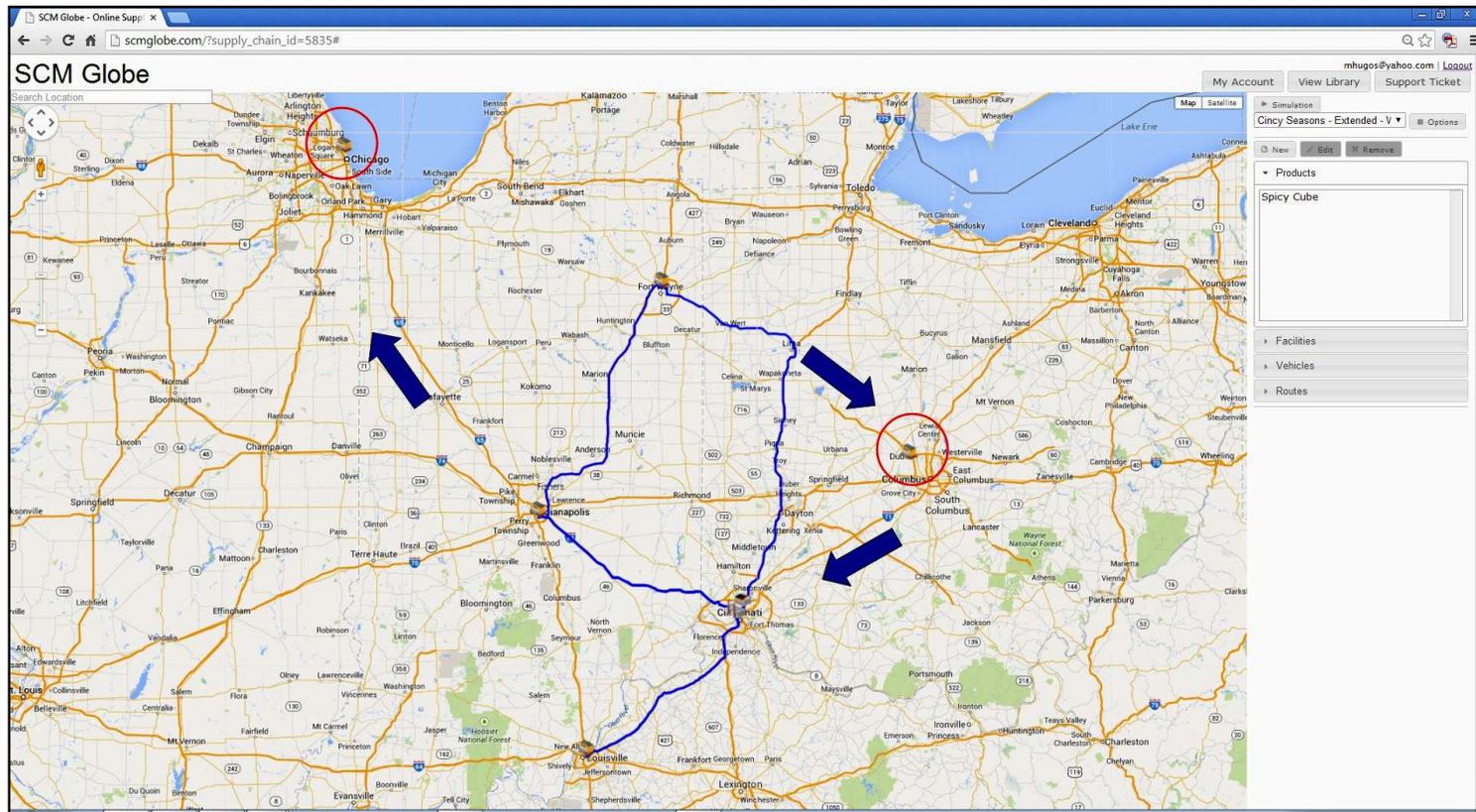
# Outsourcing Supply Chain Operations

- Relentless pressure on profit margins drives companies to focus on their core competencies and outsource supporting operations to business partners
- Supply chain operations are core competencies for some companies and not for others
- 20<sup>th</sup> century industrial model of massive vertical integration depended on stable and predictable mass markets in order to deliver economies of scale
- In volatile and unpredictable markets of this century it is less risky for companies to outsource non-core activities

## Chapter 3 Quiz Questions

1. Name some of the supply chain activities that occur in the making and delivering of products  
(see p. 43 – 44)
2. Write a short explanation of how the design of a product affects the shape of the supply chain that will support that product. (see p. 77 – 80)
3. What are the three performance objectives that a factory manager must balance against each other as business conditions change and why are they often conflicting?  
(see p. 80 – 83)
4. Define the factors that go into calculating economic lot size (ELS) and explain how this calculation is used in production scheduling. (see p. 81)
5. What is the equation for product run-out time? (see p. 81 – 82)
6. What are the three main decisions that need to be made in facility management?  
(see p. 83 – 84)
7. What are the four rules of efficient order management and why are they important?  
(see p. 90 – 91)
8. When do you use direct deliveries and when do you use milk-run deliveries and why?  
(see p. 92 – 93)
9. What are the strengths and weaknesses of delivery scheduling using the savings matrix technique versus the generalized assignment technique? (see p. 93 – 94)
10. What forces are driving outsourcing of supply chain activities? (see p. 105 - 106)

# Supply Chain Simulation Exercise



See *SCM Globe Cincinnati Seasonings Study Guide, Week 3 – Expand Supply Chain Operations*

1. Add new facilities, vehicles and routes to support business expansion
2. Simulate expanded supply chain operations and find points of failure in supply chain
3. Make needed improvements

# Chapter 4

## New Technology Changes How Work is Done

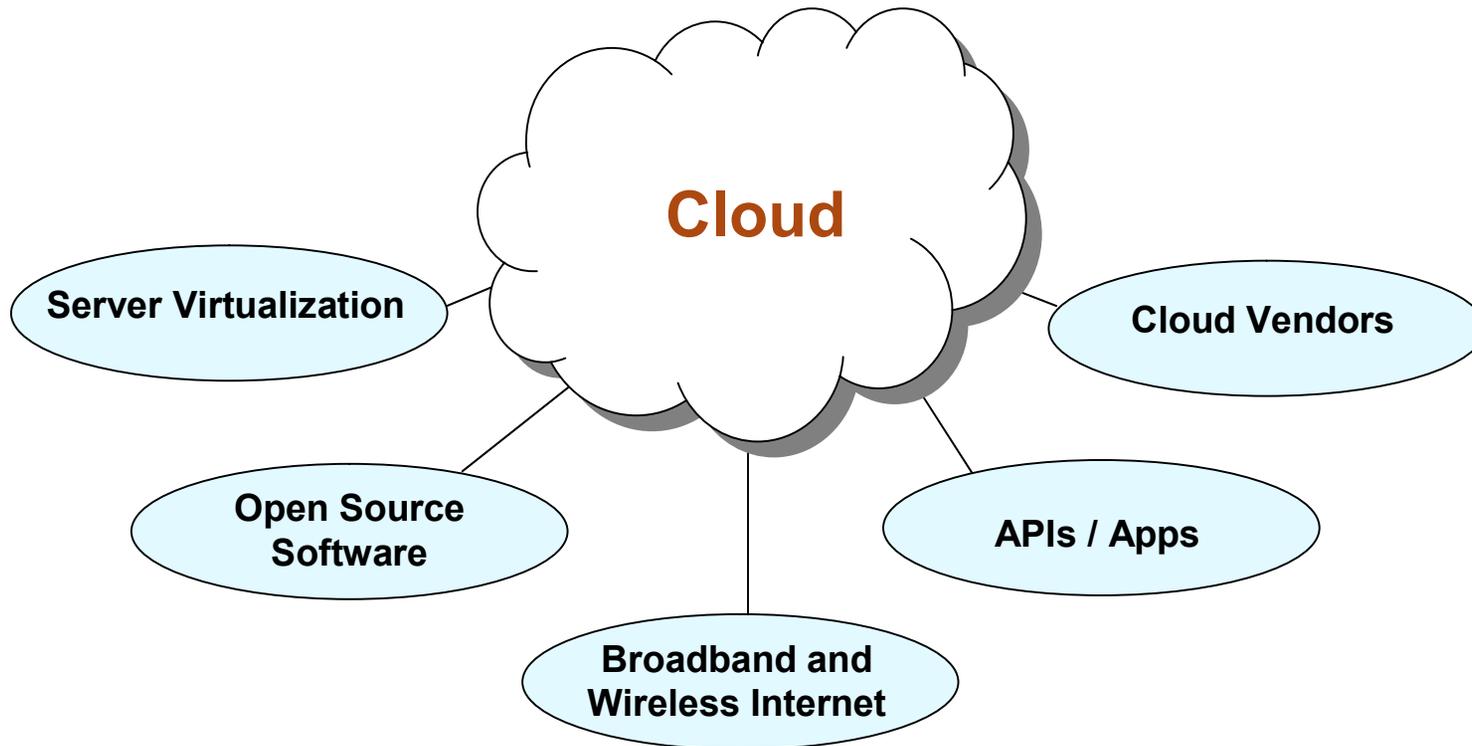
## Chapter 4 Learning Objectives

- Assess the merits of technology available to support supply chain operations
- Understand basic uses of supply chain technology such as: Cloud Computing; Robots; Drones; Big Data; AI; 3D Printing
- Appreciate new technology trends and the business capabilities they enable
- See opportunities to apply technology to your organization's supply chain operations

# Key Components of Information Technology

1. **CLOUD COMPUTING** – a broad array of Internet-based services providing a range of systems capabilities on a pay-as-you-go basis that previously required large investments in hardware and software
2. **DATA TRANSMISSION** – EDI and XML technology offering high-speed and flexible data communications
  - **EDI**: common technology for batch transmission of predefined standard transactions (PO, ASN, Invoice, etc.) between supply chain partners
  - **XML**: eXtensible Markup Language for changing and non-predefined data transmissions between companies
3. **DATABASES AND BUSINESS ANALYTICS** – databases are organized groupings of data stored in electronic format, and business analytics read the data in databases to produce reports and alerts
4. **SUPPLY CHAIN APPLICATION SYSTEMS** – there is a standard set of application systems used by companies to operate their supply chains, these applications are available as software packages delivered via cloud computing or from in-house computers

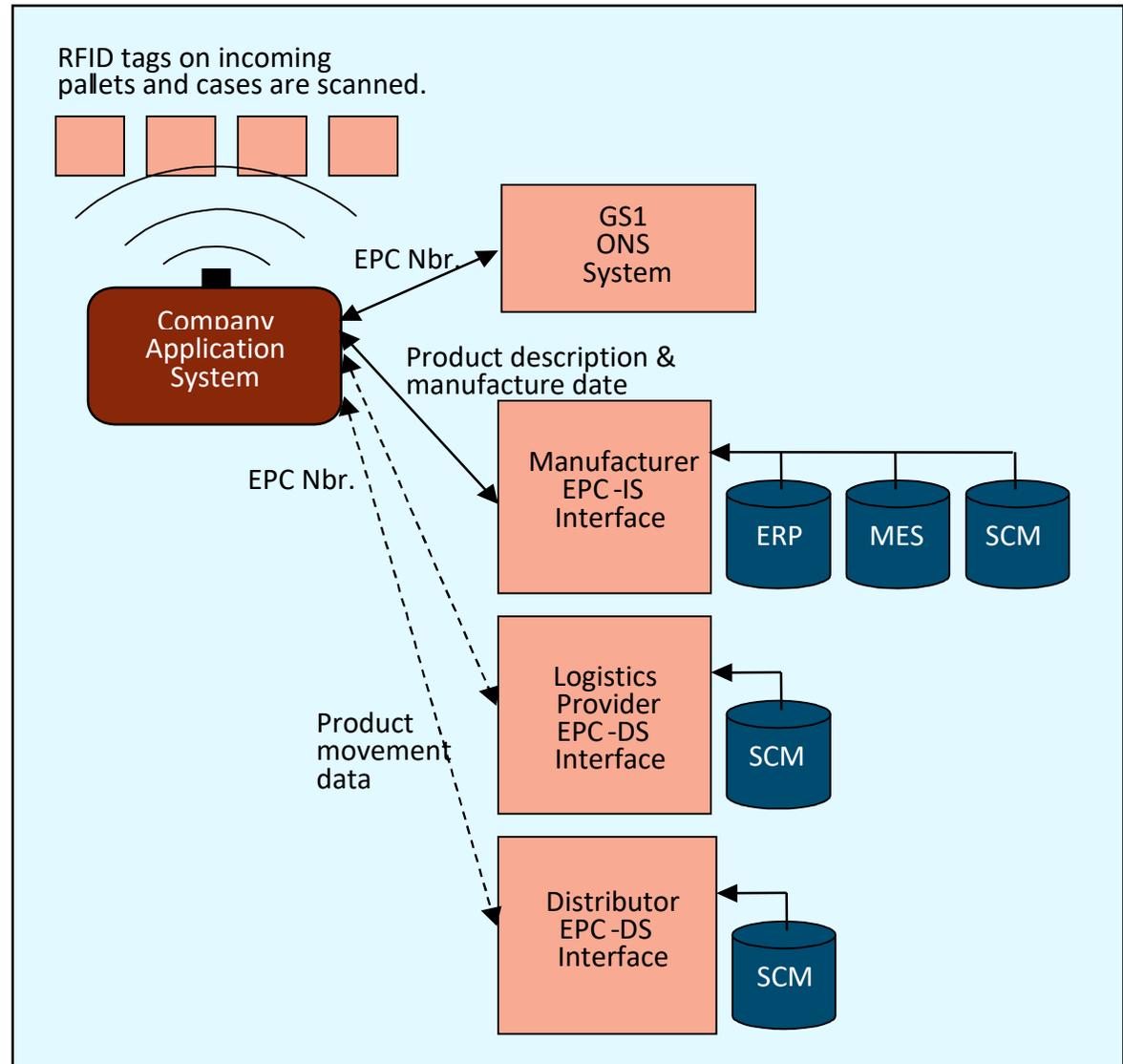
# Cloud Computing Combines Technologies



- Cloud computing provides delivery platform for supply chain systems – enables inter-company connections and collaboration
- Cloud enables financial and operational flexibility – pay-as-you-go operating model to manage uncertainty

# EPCglobal Network for Product Data

- Company receiving system sends scanned EPC numbers to GS1 and gets web address of manufacturers
- Manufacturer systems send back product description and manufacture date
- Company may contact other companies who handled the product as it moved through supply chain



# Common Supply Chain Application Systems

- Enterprise Resource Planning (ERP)
- Procurement Systems
- Advanced Planning and Scheduling (APS)
- Transportation Planning and Scheduling Systems
- Demand Planning Systems
- Customer Relationship Management (CRM)
- Sales Force Automation (SFA)
- Supply Chain Management (SCM)
- Inventory Management Systems
- Manufacturing Execution Systems (MES)
- Warehouse Management Systems (WMS)

# New Technologies Change How Work is Done



**Industrial Robots** – move materials, parts, and tools to perform a variety of programmed tasks that are dangerous or unsuitable for humans and can be done more efficiently

**Warehouse Automation** – application of robots to automate such warehouse activities as storing, picking, packing and shipping products

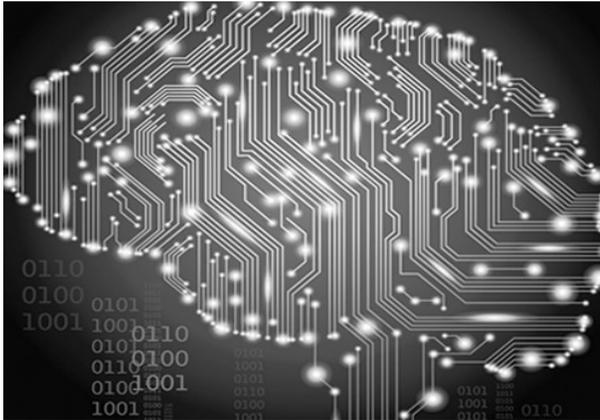


**Delivery Drones** – robots that fly, drive, walk or swim in order to deliver products to locations that ordered those products

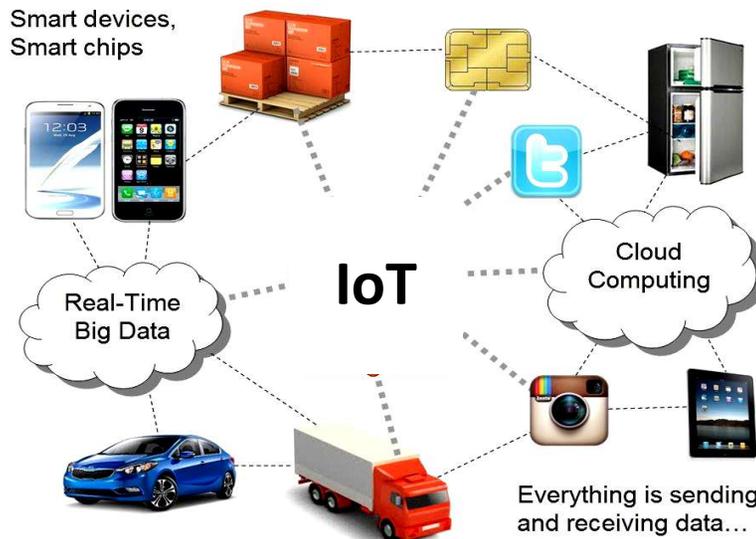


**Robots** – can be controlled by central application systems or can operate autonomously based on internal intelligence

## New Technologies (cont.)

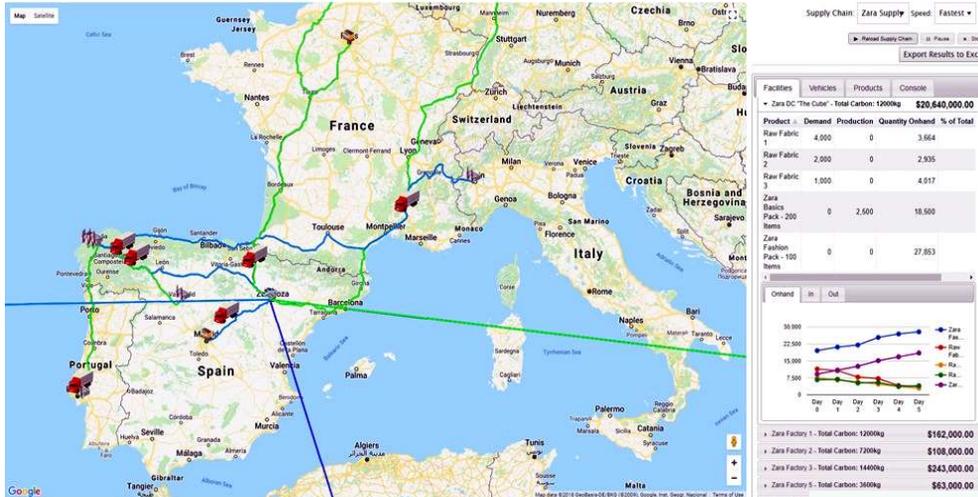


**Artificial Intelligence (AI)** – intelligence exhibited by machines; devices that perceive their environment and take action to maximize their chances for successfully achieving some goal



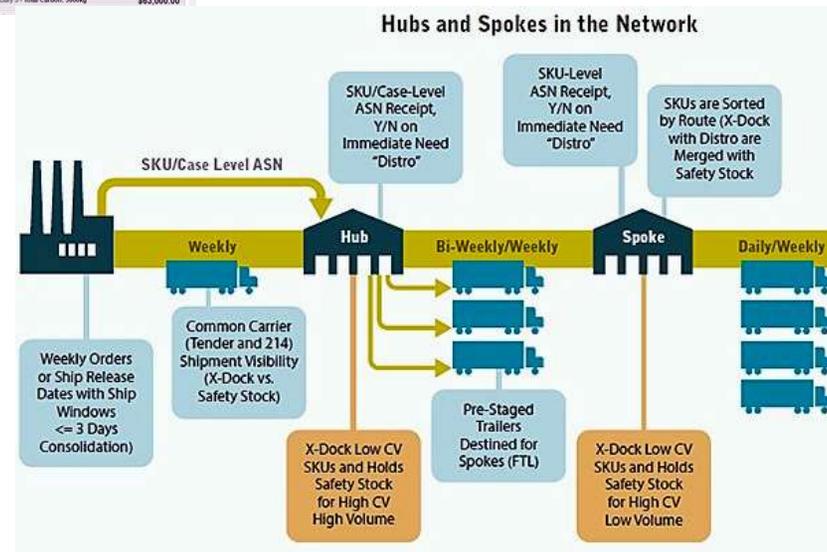
**Internet of Things (IoT)** – interconnection via Internet of computing devices embedded in everyday objects, enabling them to send and receive data

# New Technologies (cont.)



**Simulation Modeling** – process of creating and analyzing a digital prototype of a physical object or system to predict its performance in the real world under different conditions

**Optimization** – application of linear programming, statistical analysis and other mathematical techniques to a digital model or real world performance data to optimize its performance



## New Technologies (cont.)



**3D Printing** – also known as additive manufacturing, a process of creating 3D objects with layers of material formed under computer control

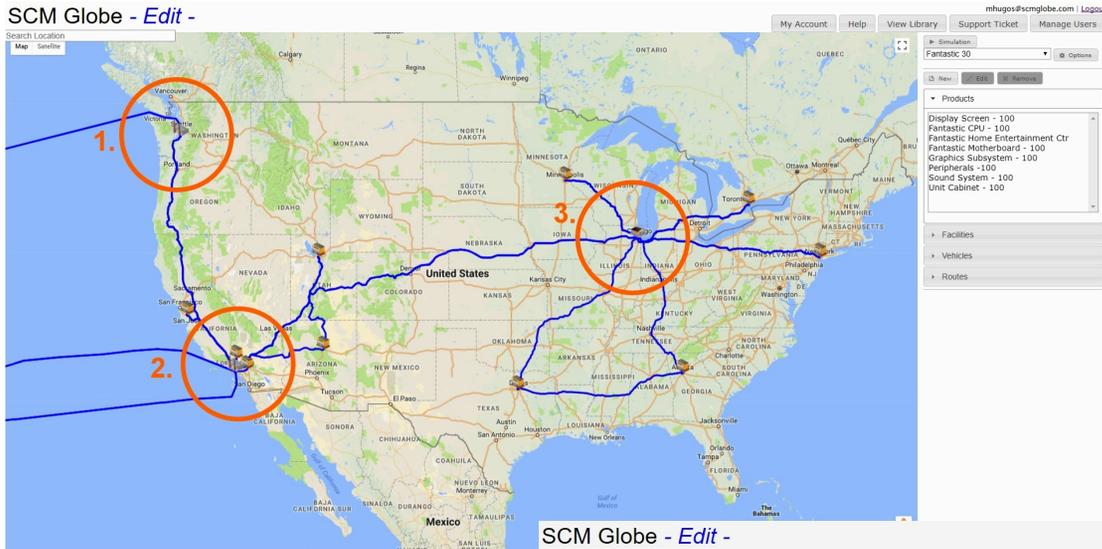
**Food Replicator** – we don't have this technology yet... but it has some similarities to 3D Printing at a molecular level, could happen sooner than we think



**Transporter** – don't have this yet... not even close, more than just rearranging matter, it's about converting matter to energy and back to matter again

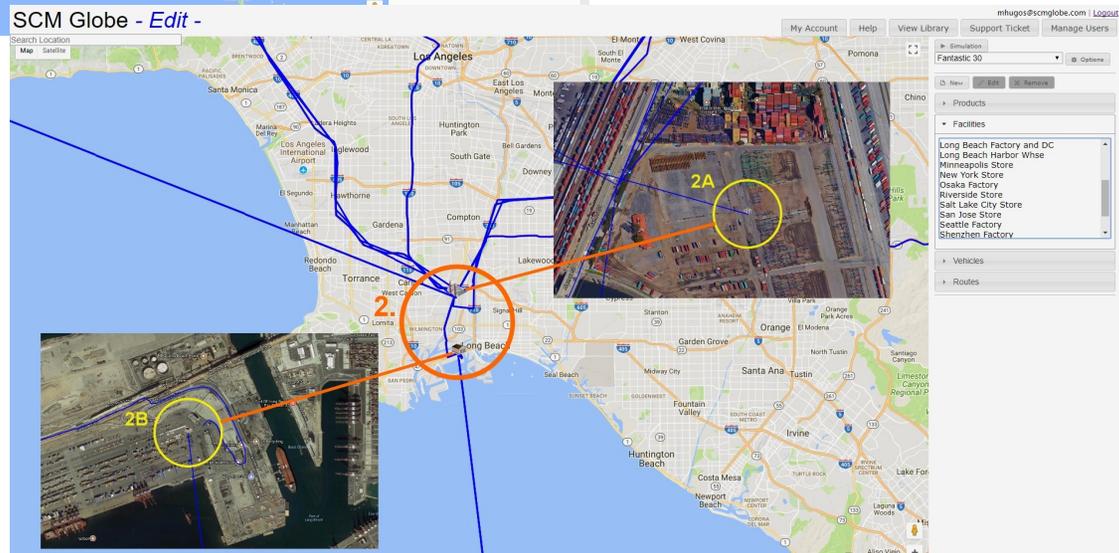
BUT if we do figure it out it will completely change most of what we know about supply chain management

# Applying New Supply Chain Technology



- Look for logistics hubs where improvements can make a big impact
- Use new technology to manage flow of products to meet demand and respond to changing market conditions.
- New technology can improve timeliness and accuracy of product deliveries to customers

- Driverless trucks move cargo unloaded from arriving ships (2B) to factory (2A). Robots do loading of delivery vehicles
- Robotic manufacturing systems adjust production to meet fluctuating demand as determined by big data analytics and AI.
- 3D printing makes several components on demand from common feedstock



# E-Business and Supply Chain Integration

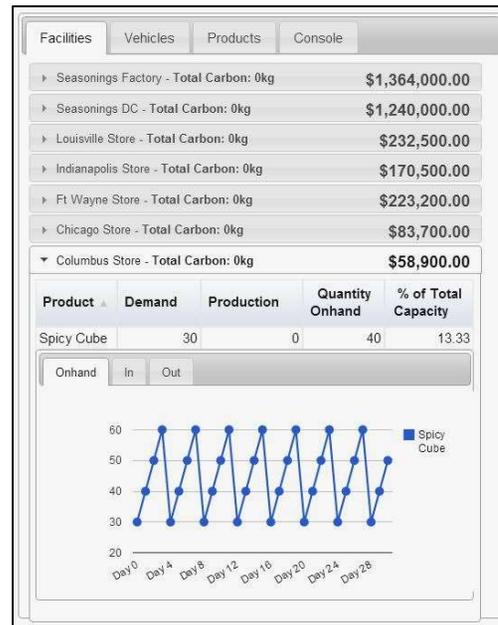
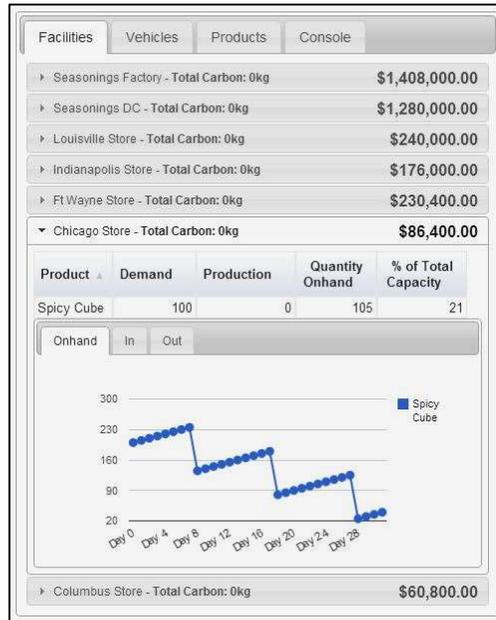
- **Information Integration** – ability for different companies in a supply chain to electronically share relevant information
- **Planning Synchronization** – ability for different companies to participate in joint demand forecasting and inventory replenishment scheduling
- **Workflow Coordination** – ability to automate, monitor and adjust on-going business operations occurring between companies in a supply chain
- **New Business Models** – when above three capabilities are in place, roles and responsibilities of different companies in a supply chain can be redesigned so as to increase value delivered by each company

Each level of integration builds upon the previous one... we see this in what Amazon is doing and retailers like Zara Clothing

## Chapter 4 Quiz Questions

1. What are four key components of supply chain information technology? (p. 116 - 117)
2. Why is cloud computing spreading so fast? What new capabilities does cloud computing provide that earlier computing technologies could not provide? (p. 117 - 119)
3. How does the pay-as-you-go operating model of cloud computing applications help manage supply chain operating costs? (p. 118)
4. What is EDI and where is it used? What is XML and where is it used? (p. 119 – 120)
5. What do these system acronyms stand for: ERP; MES; WMS? And how do these systems work together in a supply chain? (p. 122 - 126)
6. Name at least five new supply chain technologies and briefly explain what each one is (p. 127 – 134)
7. What is the EPCglobal Network and why is it needed to help companies collect and analyze product information from their supply chain operations? (p. 130 - 132)
8. How and where can new technologies be used in supply chains and what is their potential impact? (p. 142 – 143)
9. How can simulation modeling help a company make decisions about its supply chain? (p. 134 - 141)
10. Describe the four levels of supply chain integration defined by Lee and Whang and explain how each level builds on the one before it. (p. 144)

# Supply Chain Simulation Exercise



## See *SCM Globe Cincinnati Seasonings Study Guide, Week 4 – Supply Chain Simulation Results*

1. Students create and present short management briefings using screenshots and data from simulations
2. What were their biggest challenges to get the Cincinnati Seasonings supply chain to run for 30 days and how did they address them?
3. How could they use the technology described in the reading assignment to improve Cincinnati Seasonings supply chain?

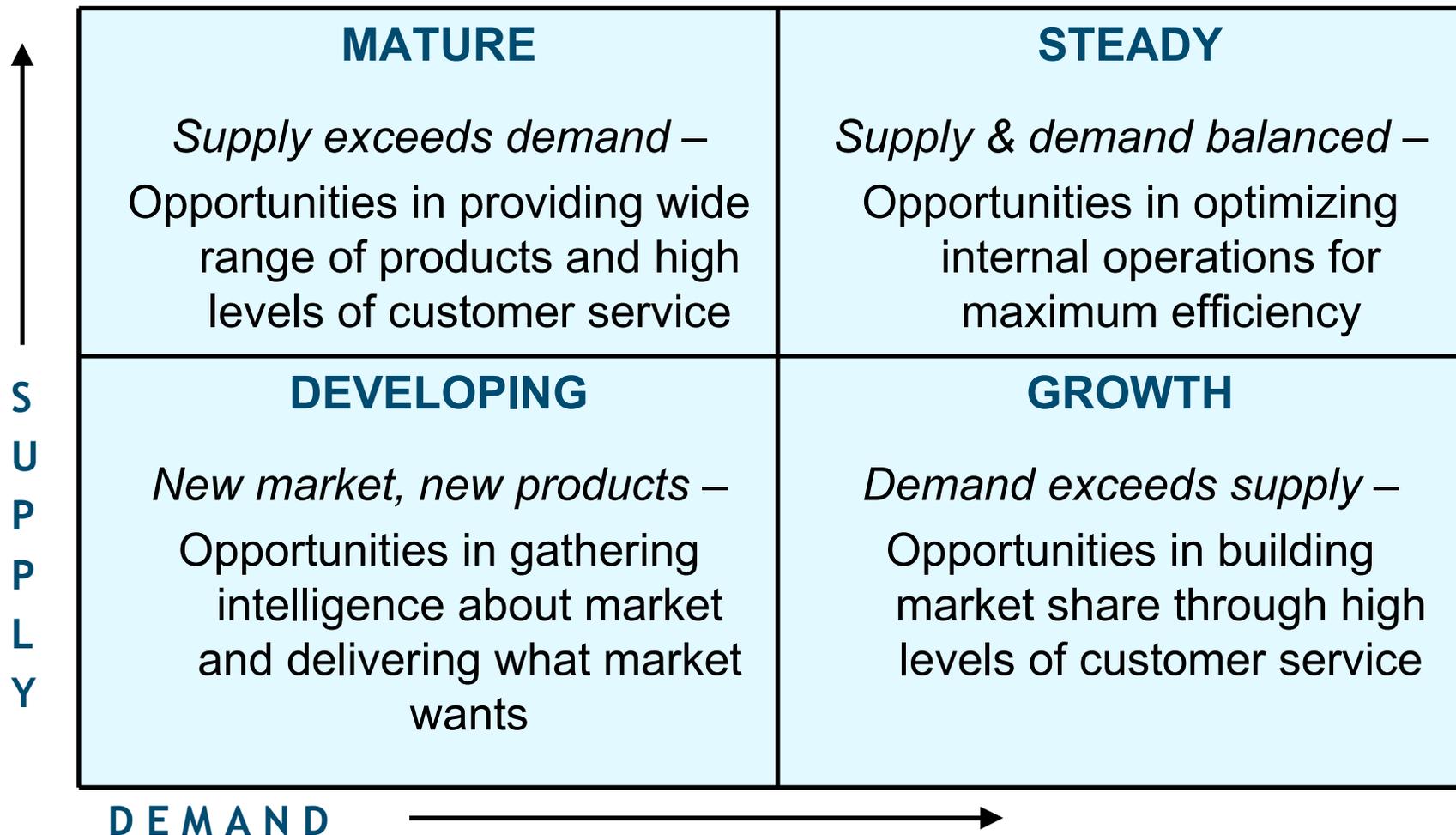
# Chapter 5

## Metrics for Measuring Supply Chain Performance

## Chapter 5 Learning Objectives

- Employ a useful model for assessing markets and the supply chains that support them
- Define a concise set of metrics for measuring the performance of supply chain operations
- Discuss ways to collect, display and make use of supply chain performance data
- Use performance data to spotlight problems and opportunities

# Markets & Required Performance



# Four Measurement Categories

## 1. Customer Service

- Ability of supply chain to meet customer expectations
- Order fill rate and on time delivery

## 2. Internal Efficiency

- Ability to operate profitably in markets being served
- Profits commiserate with market risks

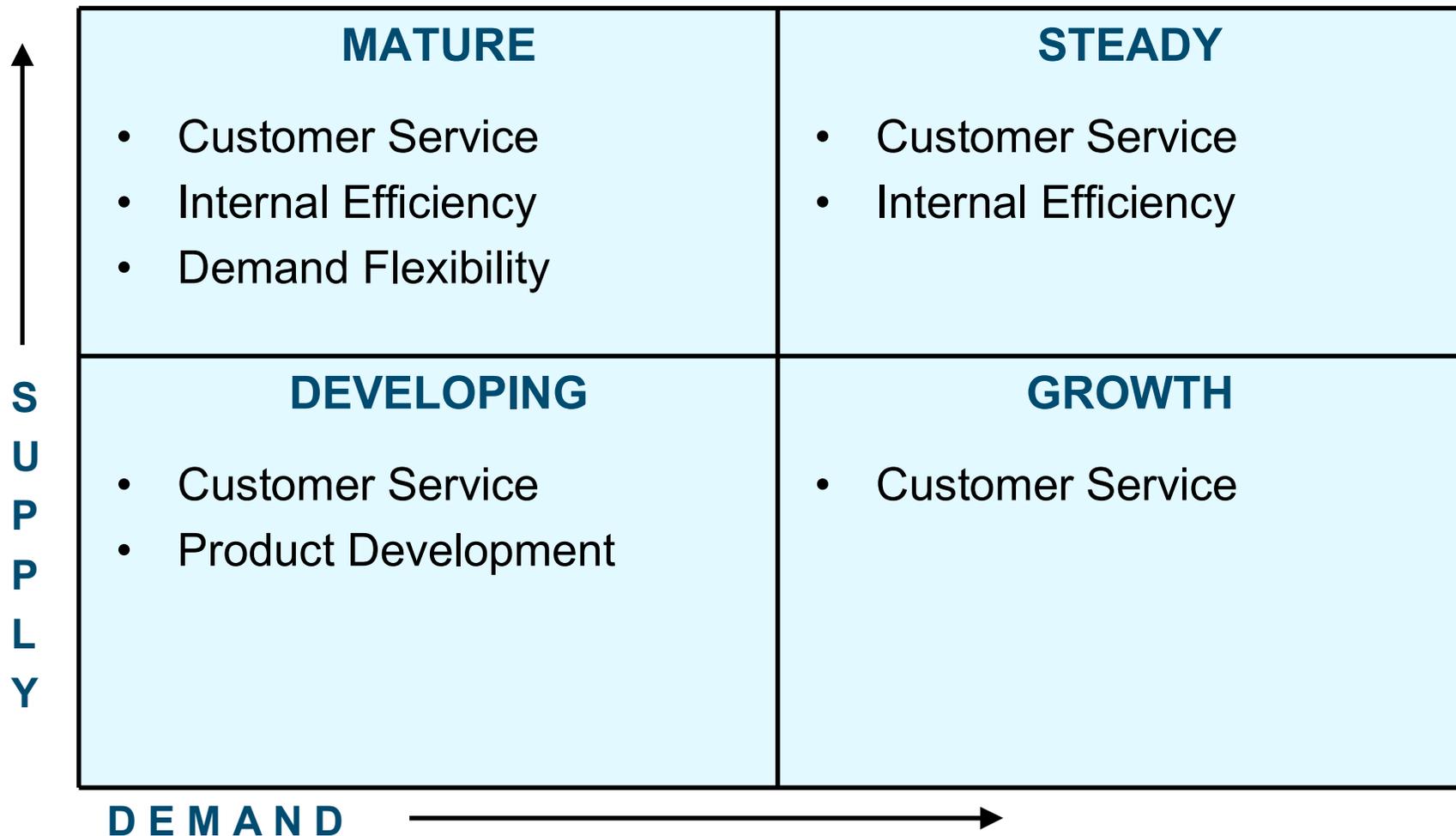
## 3. Demand Flexibility

- Ability to respond to uncertainty in levels of product demand
- Ability to respond to uncertainty in range of products

## 4. Product Development

- Ability to evolve with changing market desires
- Develop and deliver new products in timely manner

# Markets & Required Performance



# Performance Measures

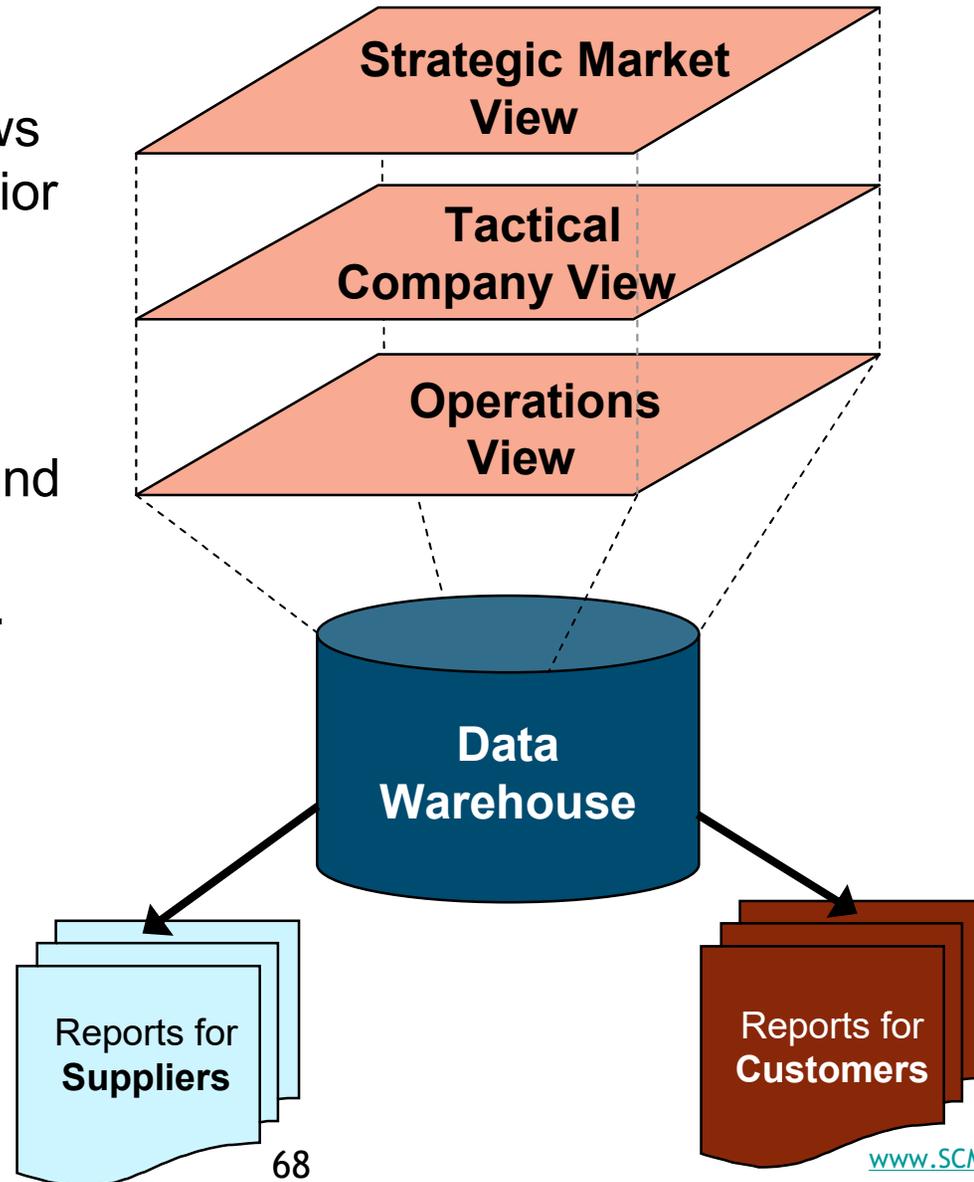
<u>Build to Stock</u>	CUSTOMER SERVICE	<u>Build to Order</u>
<ul style="list-style-type: none"> <li>• Order &amp; line item fill rate</li> <li>• On time delivery rate</li> <li>• Return rate</li> </ul>		<ul style="list-style-type: none"> <li>• Quoted lead time &amp; completion rate</li> <li>• On time delivery rate</li> <li>• Warranty returns &amp; repairs</li> </ul>
<b>INTERNAL EFFICIENCY</b>		
<ul style="list-style-type: none"> <li>• Inventory value</li> <li>• Inventory turns</li> </ul>		<ul style="list-style-type: none"> <li>• Return on sales</li> <li>• Cash-to-cash cycle time</li> </ul>
<b>DEMAND FLEXIBILITY</b>		
<ul style="list-style-type: none"> <li>• Activity cycle times</li> <li>• Upside flexibility</li> </ul>		<ul style="list-style-type: none"> <li>• Outside flexibility</li> </ul>
<b>PRODUCT DEVELOPMENT</b>		
<ul style="list-style-type: none"> <li>• % of sales from new products</li> <li>• % of SKUs as new products</li> </ul>		<ul style="list-style-type: none"> <li>• Cycle time for new product development/introduction</li> </ul>

# Business Operations & Company Performance

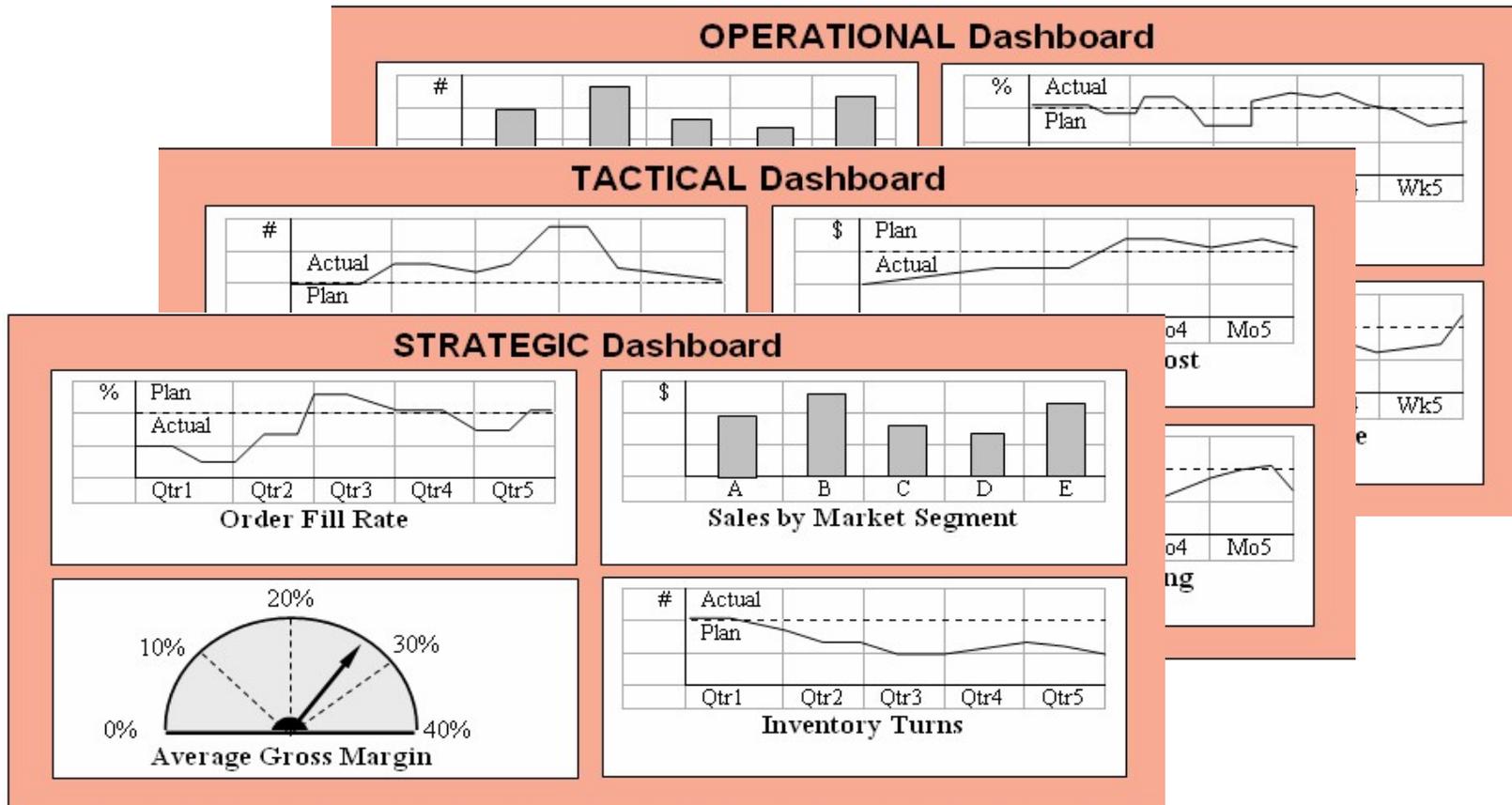
<b>BUSINESS OPERATIONS</b>		<b>PERFORMANCE CATEGORIES</b>	<b>CUSTOMER SERVICE</b> As measured by: Fill Rate; On-Time Delivery; Product Returns	<b>INTERNAL EFFICIENCY</b> As measured by: Inventory Turns; Return on Sales; Cash-to-Cash	<b>DEMAND FLEXIBILITY</b> As measured by: Cycle Times; Upside Flex; Outside Flex	<b>PRODUCT DEVELOPMENT</b> As measured by: New Prod Sales; % Revenue; Cycle Time
<b>P L A N</b>	Demand Frcst.		X	X	X	
	Product Pricing		X	X		
	Inventory Mgmt.		X	X	X	
<b>S O U R C E</b>	Procurement			X	X	
	Credit & Collections		X	X		
<b>M A K E</b>	Product Design		X			X
	Production Sched.			X	X	
	Facility Mgmt.		X	X		
<b>D E L I V E R</b>	Order Management		X	X		X
	Delivery Scheduling		X	X		

# Timely Data Enables Collaboration

- Data warehouse provides different views of data to support senior executives, line managers, and staff.
- Facilitates sharing of data with customers and suppliers and other supply chain partners.



# Dashboard Designs are Different at Each Level



People at different levels design their dashboard displays for quick access to data they need to do their jobs and monitor their own progress

# Performance Metrics & Diagnostics - PLAN

	<b>LEVEL 2 (Tactical)</b>	<b>LEVEL 3 (Operational)</b>		
	Performance Metrics	Complexity Measures	Configuration Measures	Practice Measures
<b>P L A N</b>	<ul style="list-style-type: none"> <li>• Planning costs</li> <li>• Financing costs</li> <li>• Inventory days of supply</li> </ul>	<ul style="list-style-type: none"> <li>• % of order changes</li> <li>• # of SKUs carried</li> <li>• Production volume</li> <li>• Inventory carrying costs</li> </ul>	<ul style="list-style-type: none"> <li>• Product volume by channel</li> <li>• # of channels</li> <li>• # of supply chain locations</li> </ul>	<ul style="list-style-type: none"> <li>• Planning cycle time</li> <li>• Forecast accuracy</li> <li>• Obsolete inventory on hand</li> </ul>

\* Metrics and diagnostics suggested by APICS Supply Chain Council SCOR Model

# Performance Metrics & Diagnostics - SOURCE

	<b>LEVEL 2 (Tactical)</b>	<b>LEVEL 3 (Operational)</b>		
	Performance Metrics	Complexity Measures	Configuration Measures	Practice Measures
<b>S O U R C E</b>	<ul style="list-style-type: none"> <li>• Material acquisition costs</li> <li>• Source cycle time</li> <li>• Raw material days of supply</li> </ul>	<ul style="list-style-type: none"> <li>• # of suppliers</li> <li>• % of purchasing spending by distance</li> </ul>	<ul style="list-style-type: none"> <li>• Purchased material by geography</li> <li>• % of purchasing spend by distance</li> </ul>	<ul style="list-style-type: none"> <li>• Supplier delivery performance</li> <li>• Payment period</li> <li>• % of items purchased by their associated lead times</li> </ul>

\* Metrics and diagnostics suggested by APICS Supply Chain Council SCOR Model

# Performance Metrics & Diagnostics - MAKE

	<b>LEVEL 2 (Tactical)</b>	<b>LEVEL 3 (Operational)</b>		
	Performance Metrics	Complexity Measures	Configuration Measures	Practice Measures
<b>M A K E</b>	<ul style="list-style-type: none"> <li>• # of defects or complaints</li> <li>• Make cycle time</li> <li>• Build order attainment</li> <li>• Product quality</li> </ul>	<ul style="list-style-type: none"> <li>• # of SKUs</li> <li>• Upside production flexibility</li> </ul>	<ul style="list-style-type: none"> <li>• Manufacturing process steps by geography</li> <li>• Capacity utilization</li> </ul>	<ul style="list-style-type: none"> <li>• Value add %</li> <li>• Build to order %</li> <li>• Build to stock %</li> <li>• % mfg. order changes due to internal issues</li> <li>• WIP inventory</li> </ul>

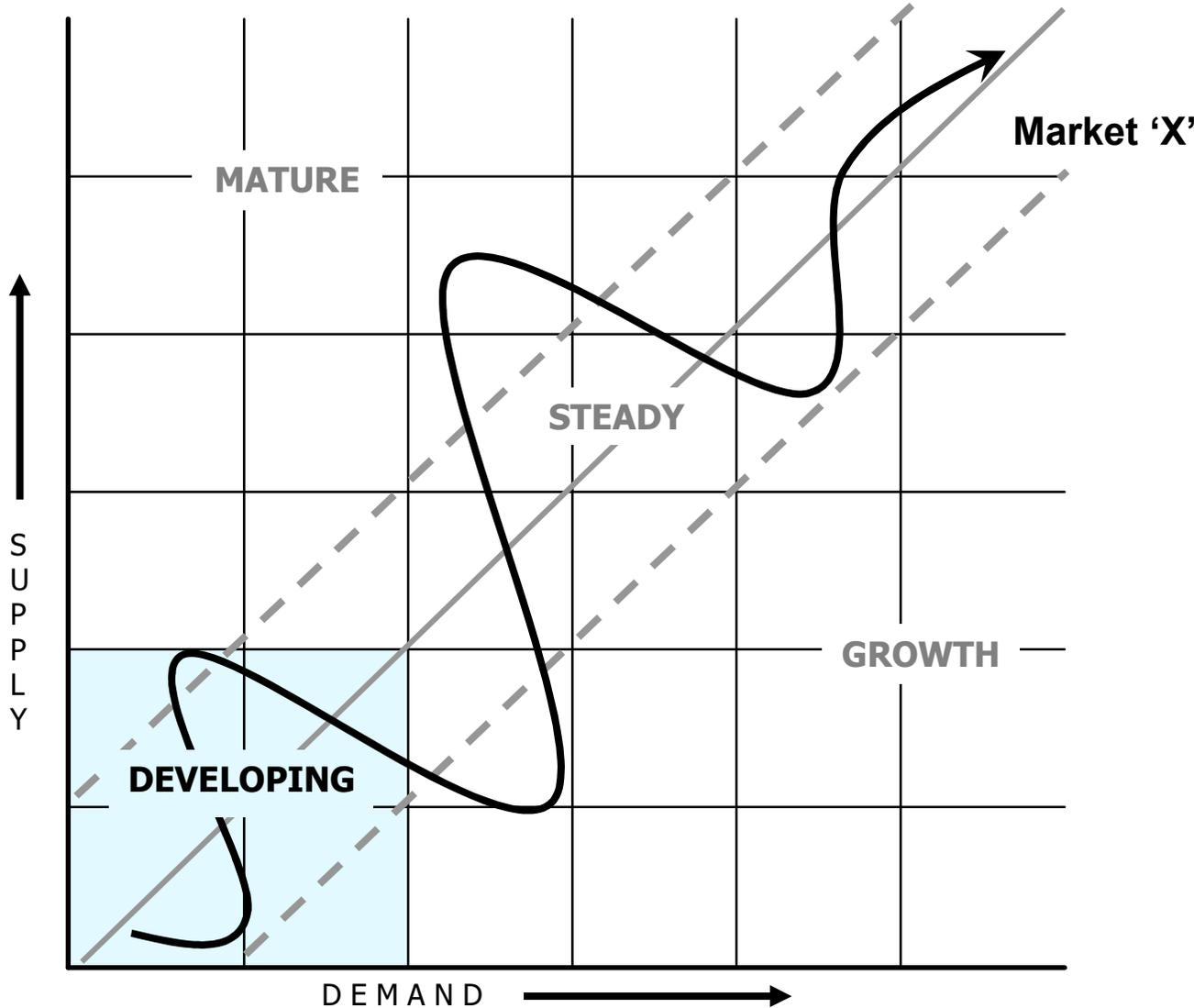
\* Metrics and diagnostics suggested by APICS Supply Chain Council SCOR Model

# Performance Metrics & Diagnostics - DELIVER

	<b>LEVEL 2 (Tactical)</b>	<b>LEVEL 3 (Operational)</b>		
	Performance Metrics	Complexity Measures	Configuration Measures	Practice Measures
<b>D E L I V E R</b>	<ul style="list-style-type: none"> <li>• Fill rates</li> <li>• Order mgmt. costs</li> <li>• Order fulfillment lead times</li> <li>• Line item return rates</li> </ul>	<ul style="list-style-type: none"> <li>• # of orders by channel</li> <li>• # of line items and shipments by channel</li> <li>• % of line items returned</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery locations by geography</li> <li>• # of channels</li> </ul>	<ul style="list-style-type: none"> <li>• Published delivery lead times</li> <li>• # of invoices w/billing errors</li> <li>• Order entry methods</li> </ul>

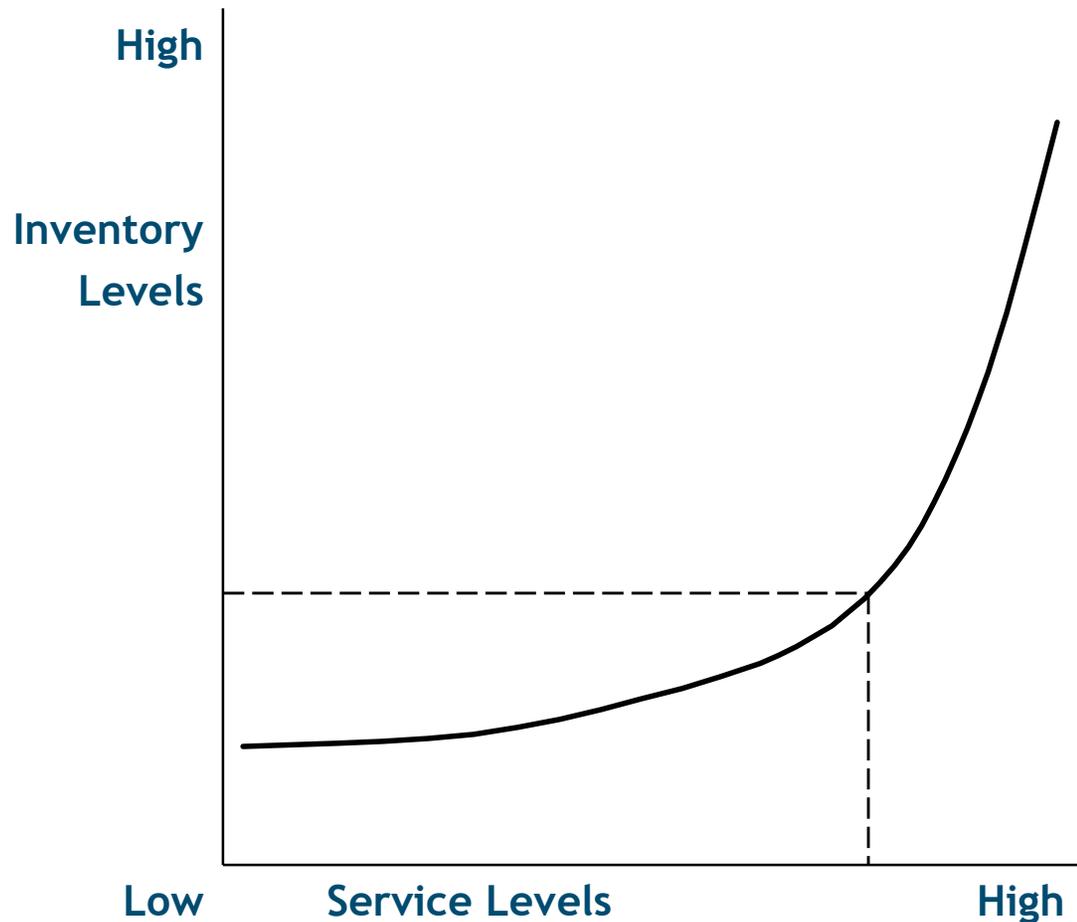
\* Metrics and diagnostics suggested by APICS Supply Chain Council SCOR Model

# Market Conditions Shift Over Time



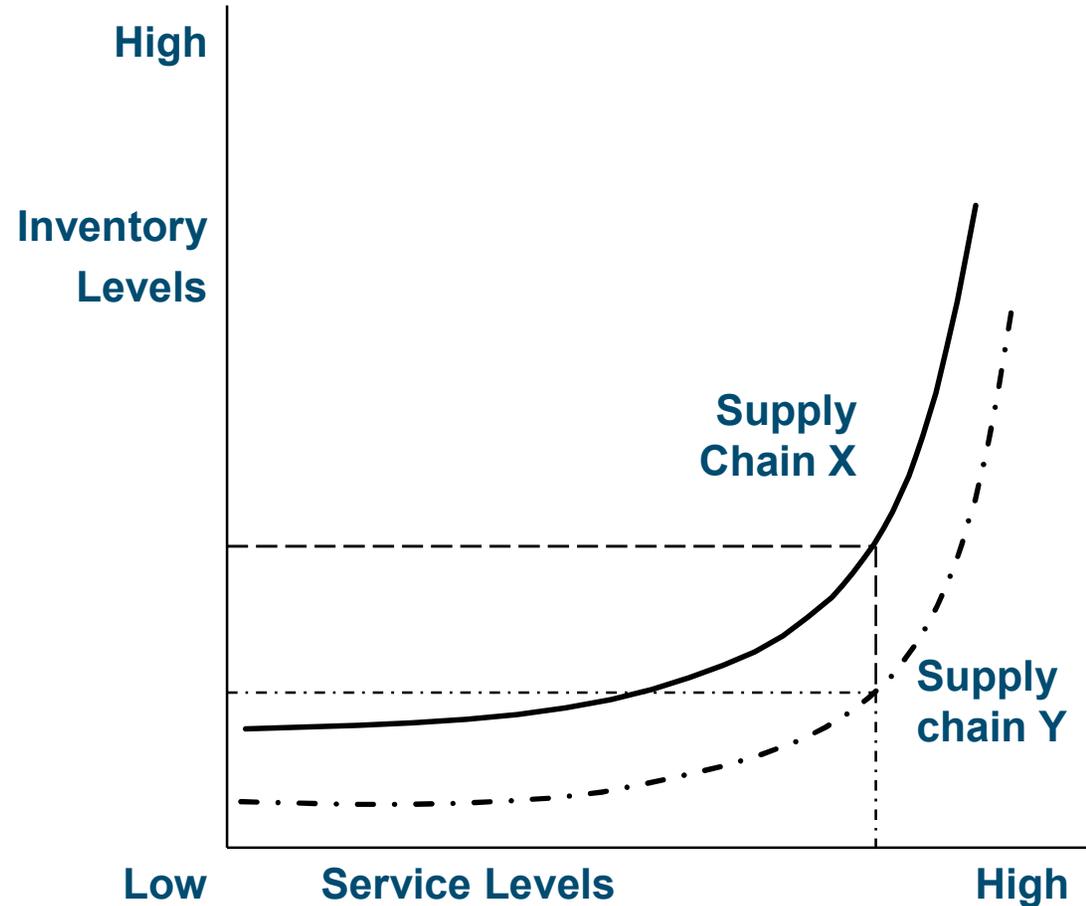
# Benefits of Data Sharing

- Company A may have high levels of customer service with low levels of inventory...
- *But success may be short-lived if its customer is not the end use customer of the supply chain*



## Benefits of Data Sharing (cont.)

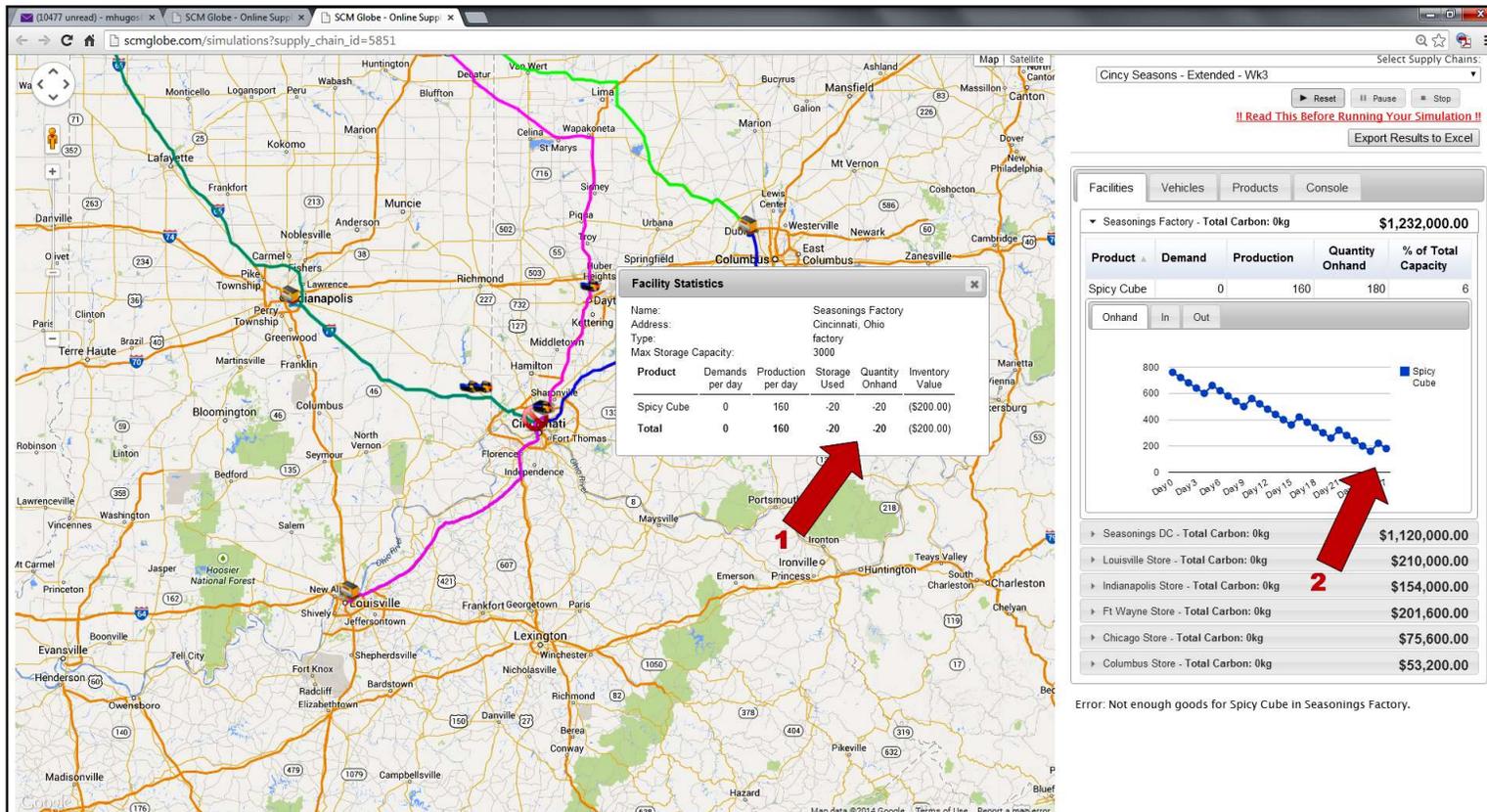
- Company A may be part of Supply Chain X which has to hold more inventory than Supply Chain Y to deliver similar levels of customer service.
- *Supply chain distortions drive up inventory carrying costs*



## Chapter 5 Quiz Questions

1. Name the four market quadrants (p. 160)
2. Describe the situation and opportunities in each of these four markets (p. 162)
3. What are the four measurement categories for supply chain operations? (p. 163)
4. Draw a diagram showing the four market quadrants. Label each quadrant with its name and write in the measurement categories that are relevant to success in each quadrant. (p. 165)
5. For each measurement category, name at least two metrics in that category and describe what they measure (p. 167 – 172)
6. Name the three levels of data detail and describe who are the people who use data at each of these levels of detail (p. 181)
7. What kind of data do people need at each level of detail in order to support the work they do? (p. 180 - 184)
8. Describe how market conditions shift over time and how companies in those markets must adjust their supply chains to meet these changing conditions. (p. 187 - 189)
9. Draw a diagram of how a market starts and grows through the four market quadrants. Explain how conditions of supply and demand change from market to market. (p. 188)
10. Draw a diagram that illustrates the relationship between levels of inventory and customer service that supply chains can attain with good information sharing. Why is it beneficial to have lower inventory levels but still maintain high levels of customer service? (p. 191)

# Supply Chain Simulation Exercise



## See *SCM Globe Cincinnati Seasonings Study Guide, Week 5 – Designs for Lower Inventory Cost*

1. Simulations show where inventory builds up and where it runs out
2. How can you adjust delivery schedules and amounts so as to meet product demand without accumulating excess inventory?
3. How far can you lower inventor expenses and on-hand amounts and still keep supply chain running?
4. What kind of data and metrics are needed in order to lower inventory expenses

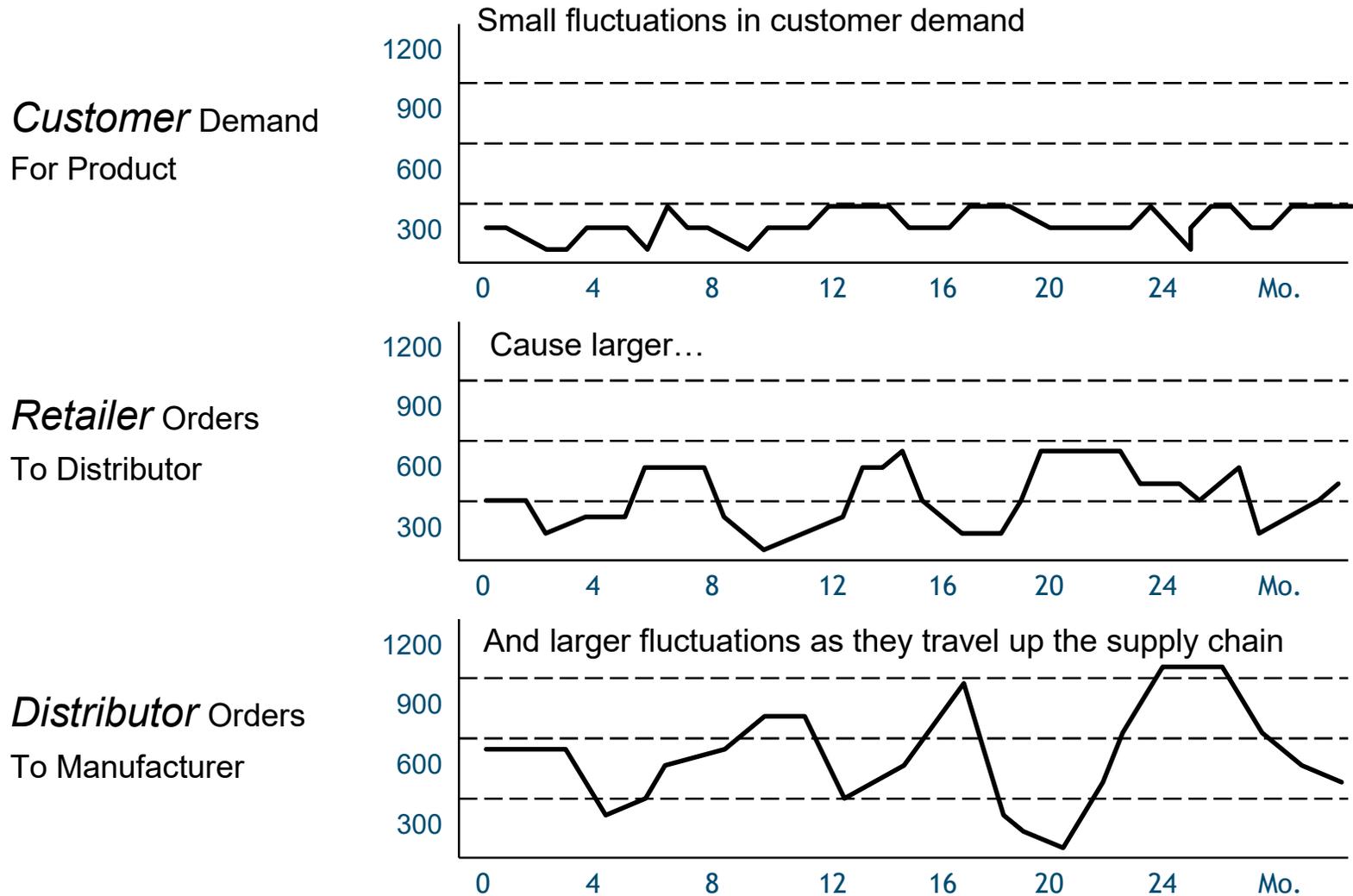
# Chapter 6

## Supply Chain Coordination

## Chapter 6 Learning Objectives

- Understand a common supply chain dynamic – the “Bullwhip Effect”
- Appreciate the factors that contribute to this dynamic
- Gain an overview of the Global Data Synchronization Network (GDSN) and see how it can help improve supply chain coordination
- Evaluate methods such as Collaborative Planning, Forecasting and Replenishment (CPFR) and Sales & Operations Planning (S&OP) to improve supply chain coordination and combat the Bullwhip Effect

# The “Bullwhip Effect”



# Five Factors Cause the Bullwhip

## 1. Demand Forecasting

Based on orders received instead of end user demand

## 2. Order Batching

Companies place periodic orders based on EOQ, etc

## 3. Product Rationing

Allocation of available supply as % of amount ordered

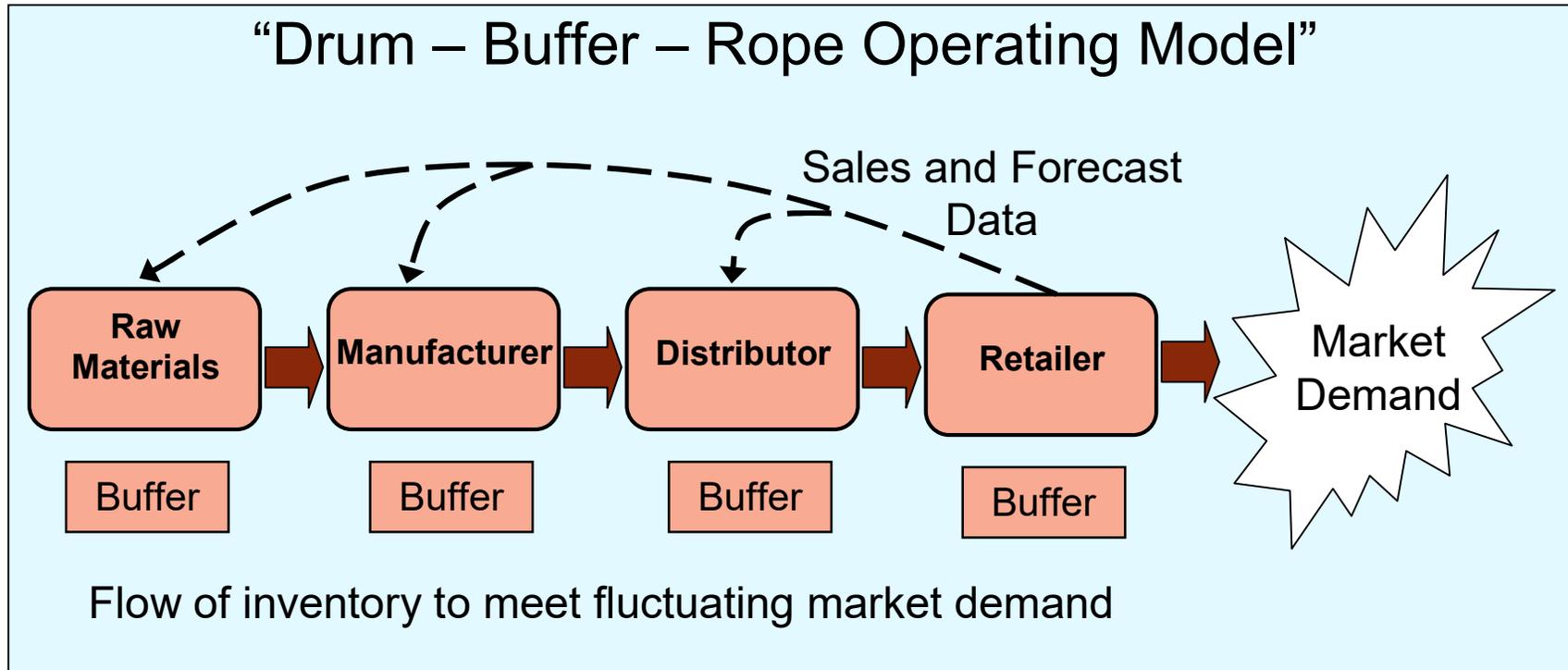
## 4. Product Pricing

Promotional pricing causes distortions in demand

## 5. Performance Incentives

Quarterly and yearly quotas and sales bonuses

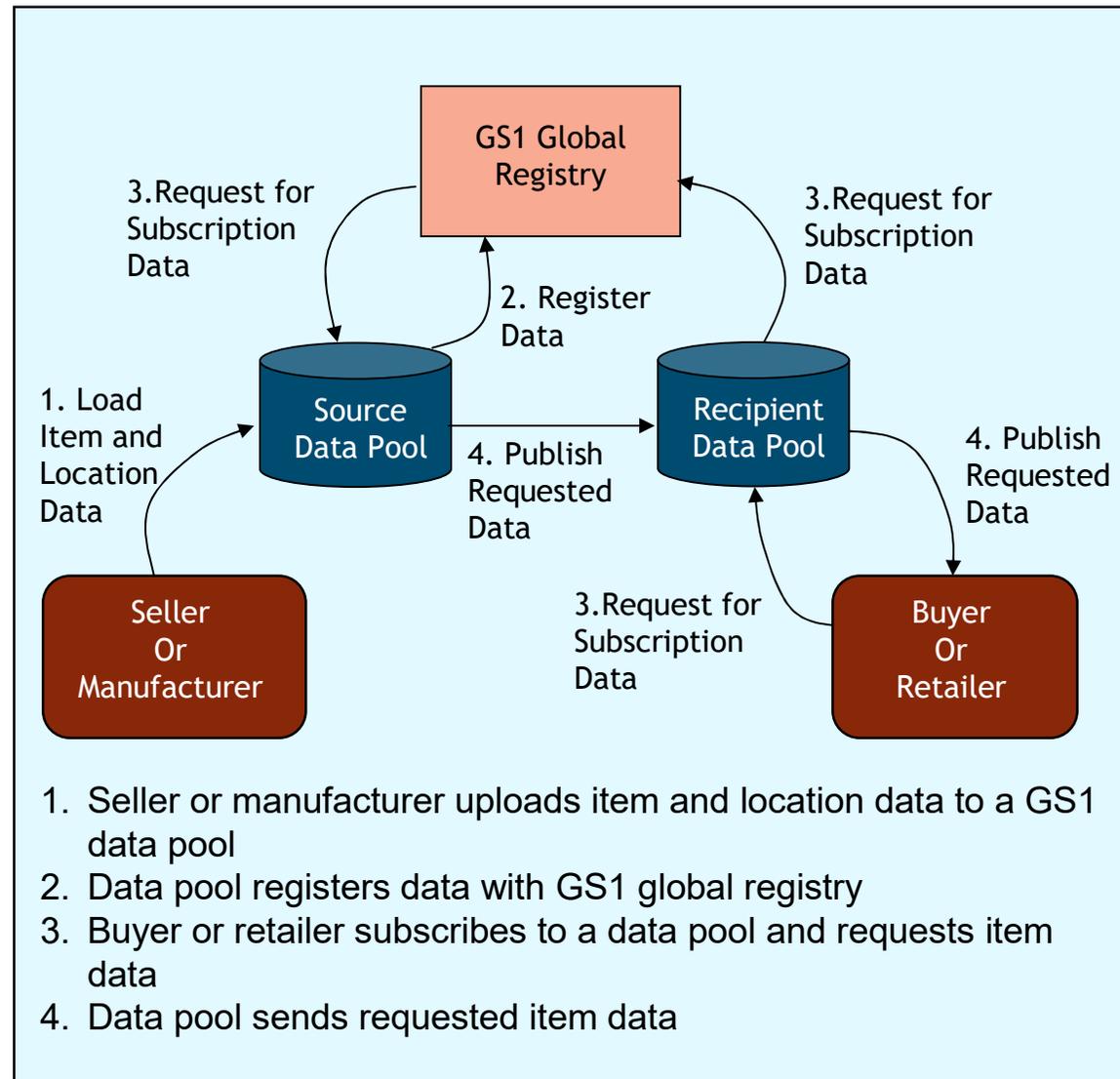
# Synchronized Supply Chain



- Market demand sets **drum** beat or tempo of supply chain
- Manage uncertainty with **buffer** of either inventory or production capacity
- Reduce uncertainty and keep buffers low by sharing sales and forecast data
- Data is **rope** that ties supply chain together

# GDSN - Global Data Synchron Network

Synchronized supply chains that overcome demand distortions caused by the bullwhip effect require timely and accurate data available to all parties



# CPFR - Collaboration Framework

## 1. Collaborative Planning

- Negotiate front-end agreement defining company responsibilities
- Build joint business plan to guide inter-company operations

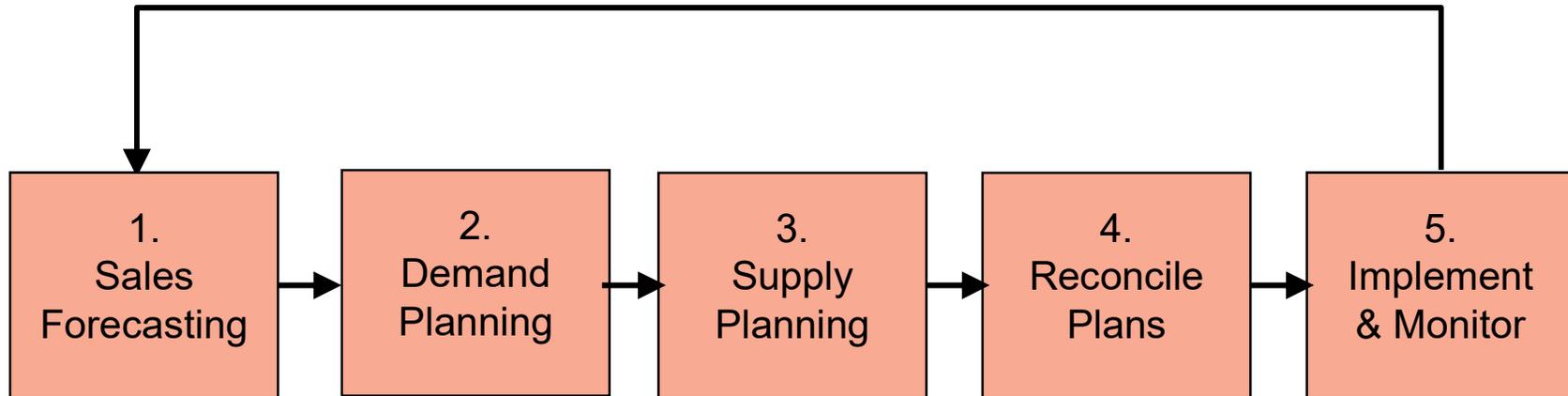
## 2. Collaborative Forecasting

- Create sales forecasts for all companies in supply chain
- Identify and resolve exceptions and differences in forecasts

## 3. Collaborative Replenishment

- Create order forecasts for all companies in supply chain
- Identify and resolve exceptions and differences in forecasts

# Collaborative S&OP Process (Sales & Ops Planning)



- Shorter cycle times provide competitive advantage
- Easier to forecast for shorter periods (15 or 30 days instead of 90 or 180)
- Enable continuous improvement in changing environment
- Simple system with good data is better than complex system with bad data (“Garbage In/Garbage Out”)

## Chapter 6 Quiz Questions

1. Why is the Bullwhip Effect named after a bullwhip? (p. 196)
2. List the five major factors that cause the Bullwhip Effect (p. 199)
3. Give a reason for why each of these five major factors contributes to the Bullwhip (p. 199 – 202)
4. What is an effective way to allocate product in a time when there are more orders than product available to fill orders (p. 200)
5. What is the purpose of the Global Data Synchronization Network and why is this valuable for supply chain coordination? (p. 208)
6. What is the GS1 organization and what does it do? (p. 208)
7. What does CPFR stand for and why would it be useful to companies working together in supply chains? (p. 200)
8. What are the three steps in CPFR and what are some of the activities that happen in each of these steps? (p. 212 - 213)
9. What does S&OP stand for and why is it useful? (p. 219)
10. What can companies do to overcome the effects of the Bullwhip Effect? (p. 221 - 222)

# Supply Chain Simulation Exercise

The screenshot shows the SCM Globe simulation interface. The main map displays a network of routes connecting various facilities across the Midwest, including Chicago, Detroit, Columbus, and Cincinnati. A red arrow points to the 'Vehicles' tab in the table below.

Facilities	Vehicles	Products	Console
Vehicle	Running Cost	Total Carbon (kg)	Destination Route
Factory Truck 1	\$6,858.00	0.00	Seasonings DC Factory to DC
Truck1	\$7,560.00	0.00	Louisville Store Cincy - Louisville
Truck3	\$10,395.00	0.00	Indianapolis Store Cincy - Indy
Truck4	\$9,540.00	0.00	Ft Wayne Store Cincy - FtWyn - Columbo
Truck5	\$17,712.00	38316960.00	Chicago Store Cincy - Chicago

Simulation Stopped

See *SCM Globe Cincinnati Seasonings Study Guide, Week 6 – Designs for Lower Transportation Cost*

1. Simulations show the vehicle costs to transport products on each of the routes in the supply chain
2. Students experiment with different kinds of vehicles and delivery route designs to lower transport costs
3. What changes can be made and how much were you able to lower transportation cost?
4. What kind of coordination is needed between supply chain partners to lower transportation costs?

# Chapter 7

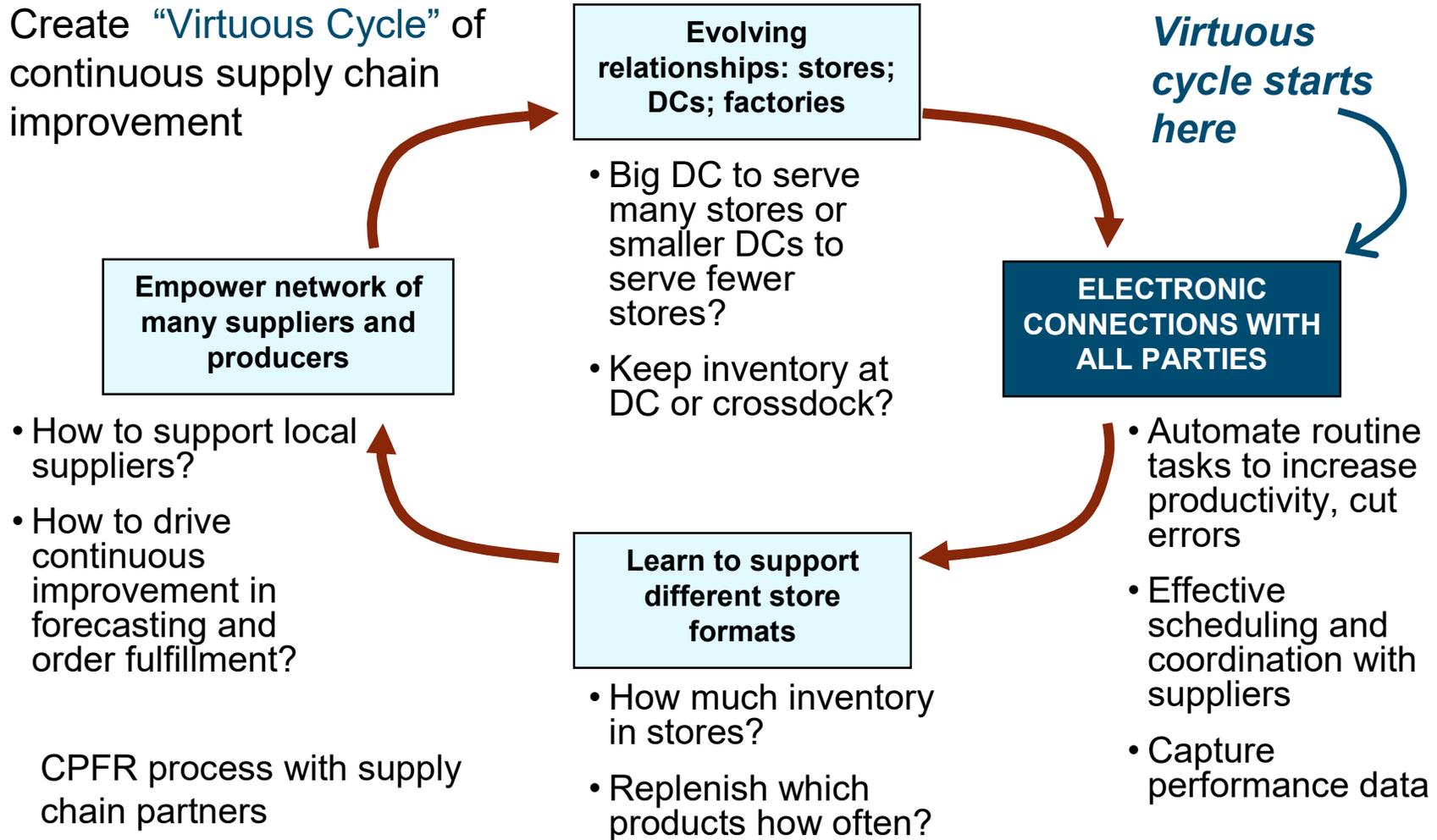
## Supply Chain Innovation for the Real-Time Economy

## Chapter 7 Learning Objectives

- Understand the need for timely and accurate data sharing among all parties in a supply chain
- Appreciate need for universal, easy and inexpensive data connections between all parties in a supply chain
- See why coordination and collaboration are key requirements for success in 21<sup>st</sup> century supply chains
- Discuss the potential of simulation to explore new supply chain operating models and promote effective collaboration
- Assess the potential for combining existing technology and software applications to create online collaboration platforms for use by millions of people every day

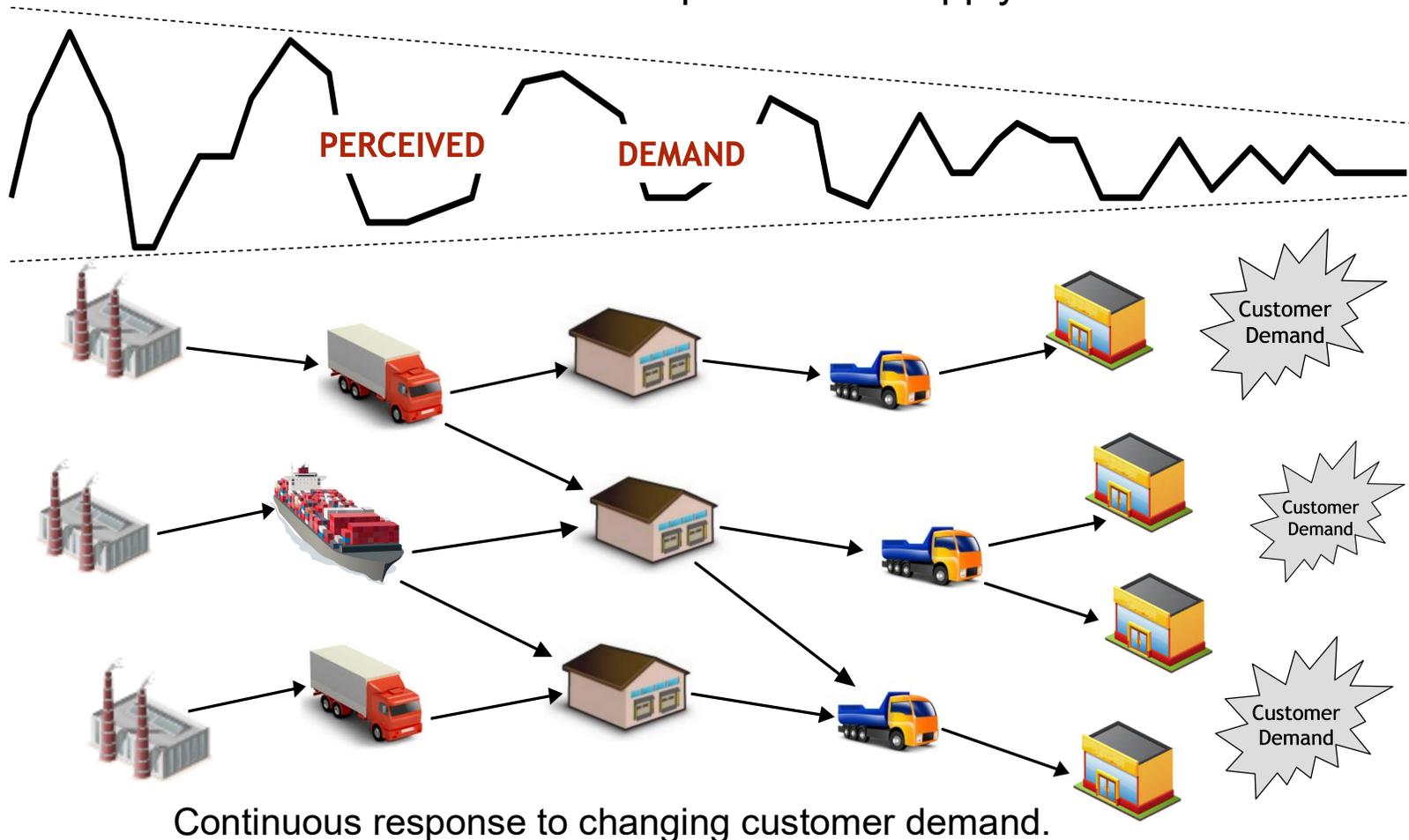
# Supply Chain Performance Depends on Timely Data

Create “Virtuous Cycle” of continuous supply chain improvement

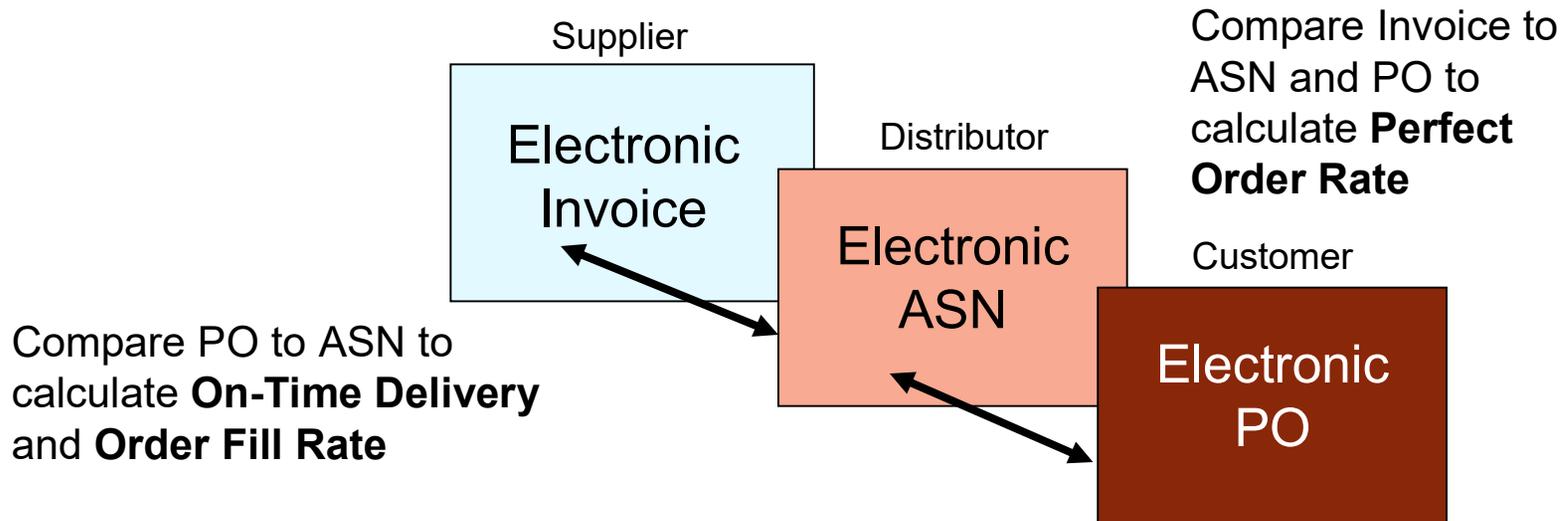


# Responsive Supply Chain Tames the Bullwhip

Respond to bullwhip effect with continuous data sharing and S&OP between and within companies in a supply chain

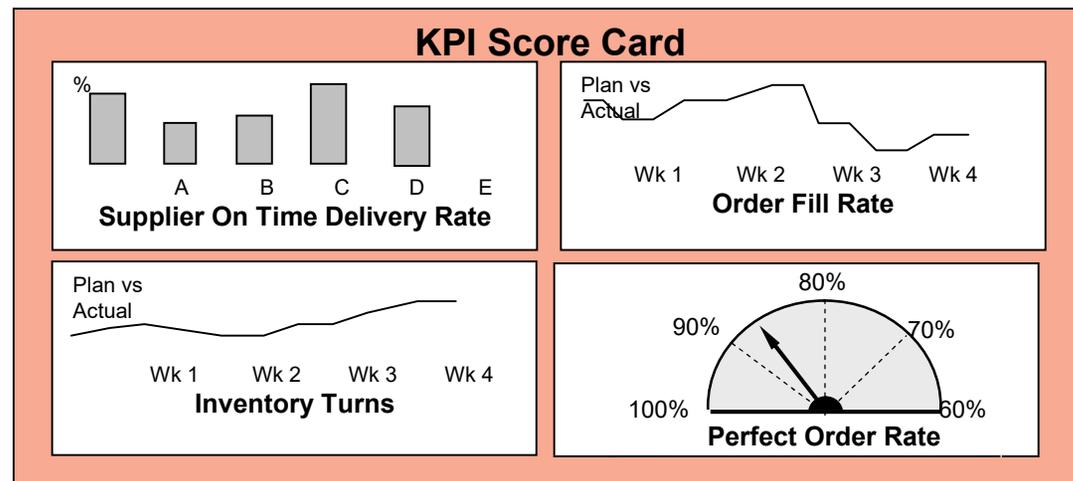


# Dashboards & Data Drive Responsiveness



Display KPI score cards through dashboards on company web site.

Set customer service alerts for quick response.



# Excessive Focus on Efficiency will Cause Problems

Efficiency



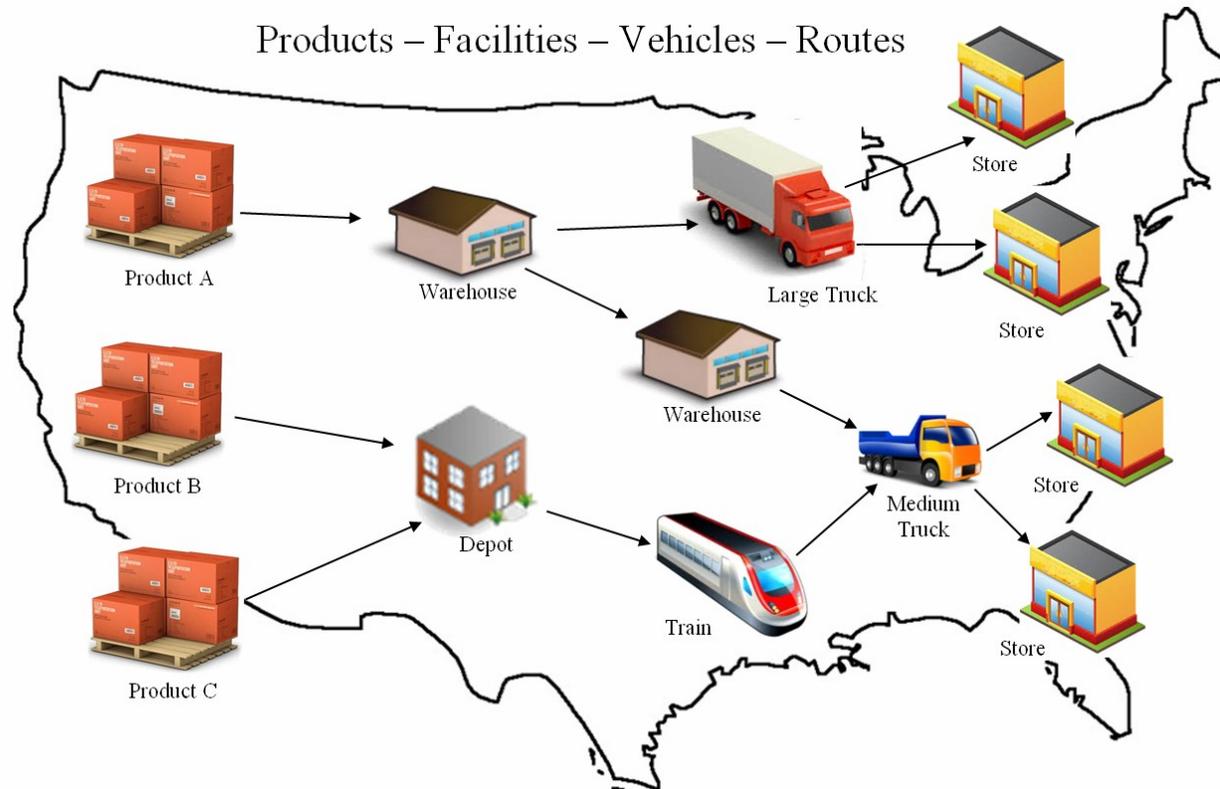
Responsiveness

- Efficiency requires **predictability** and **stability**
- Both now *conspicuously absent*
- Responsive supply chain is to real-time economy as assembly line was to industrial economy – **source of wealth creation**
- Respond to changing customer needs by continuously evolving products and services
- Use responsiveness to differentiate yourself or else participate in “**race to the bottom**”
- Example of the mobile phone... **Efficient vs. Responsive**



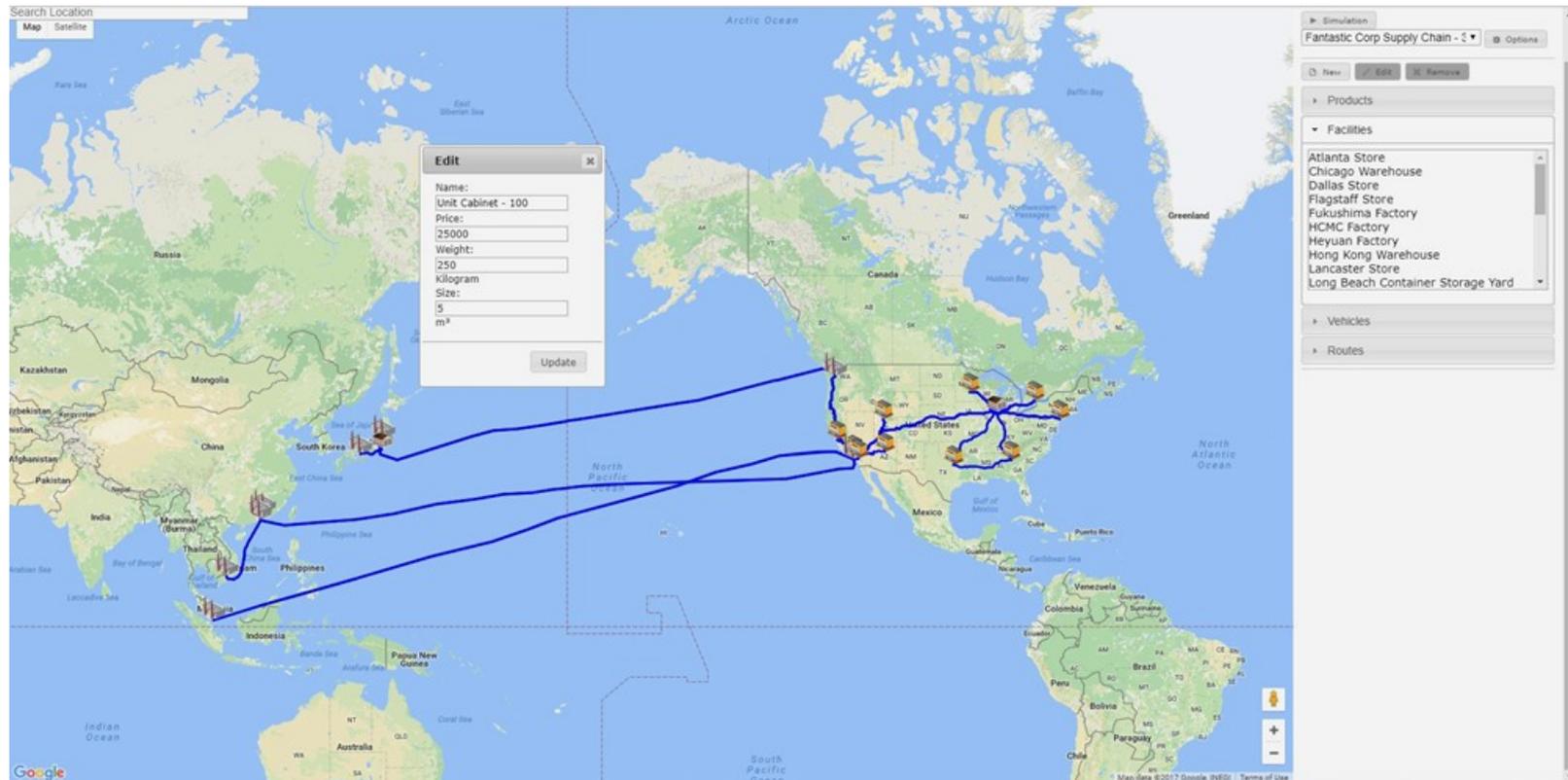
# Responsiveness Calls for Collaboration

Collaboration requires common understanding and common goals



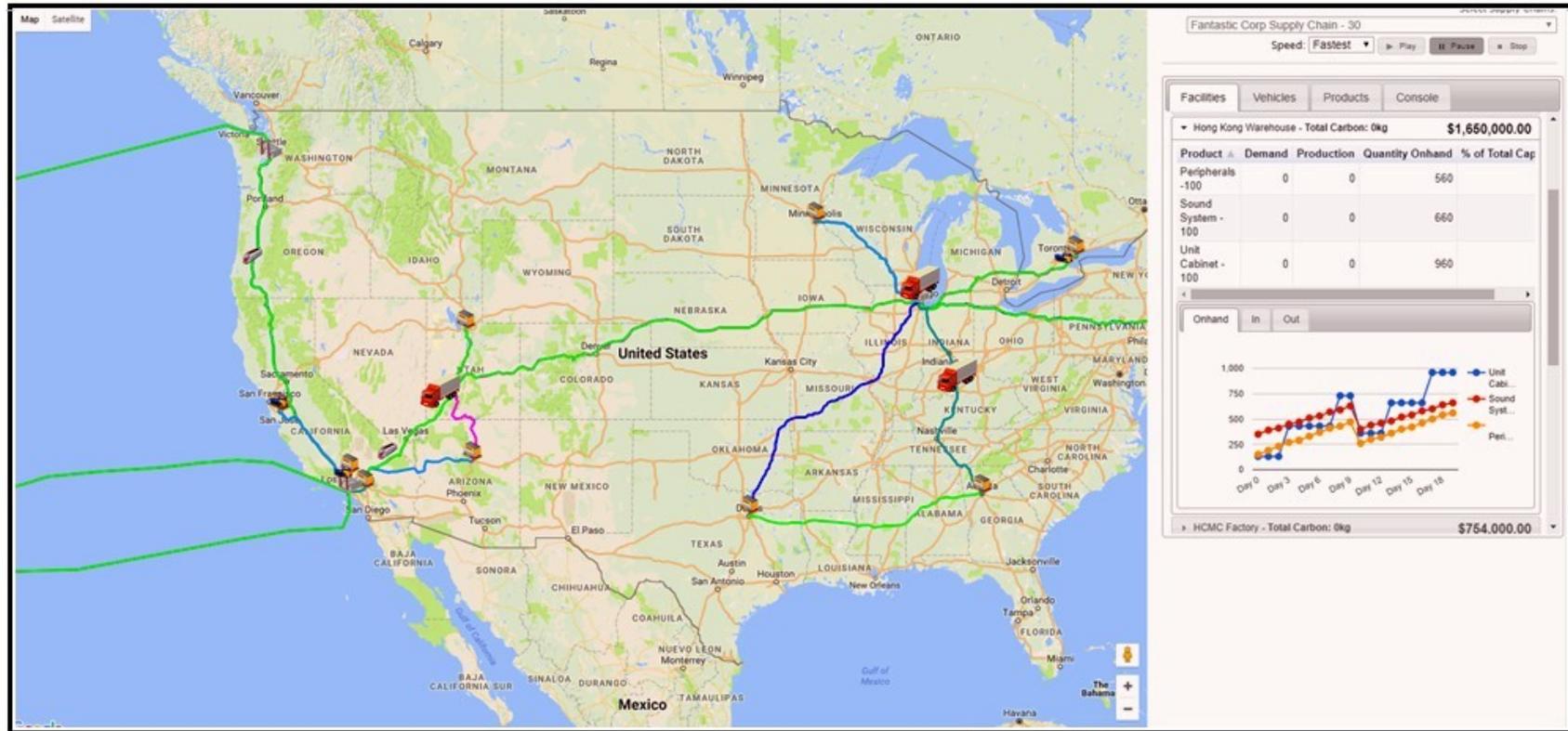
- Companies share data about: Products; Facilities; Vehicles; and Routes
- Display data on a map to create accurate supply chain models and quick understanding for large audience of people (operations, sales, finance, etc)

# Design Supply Chains and Simulate Performance



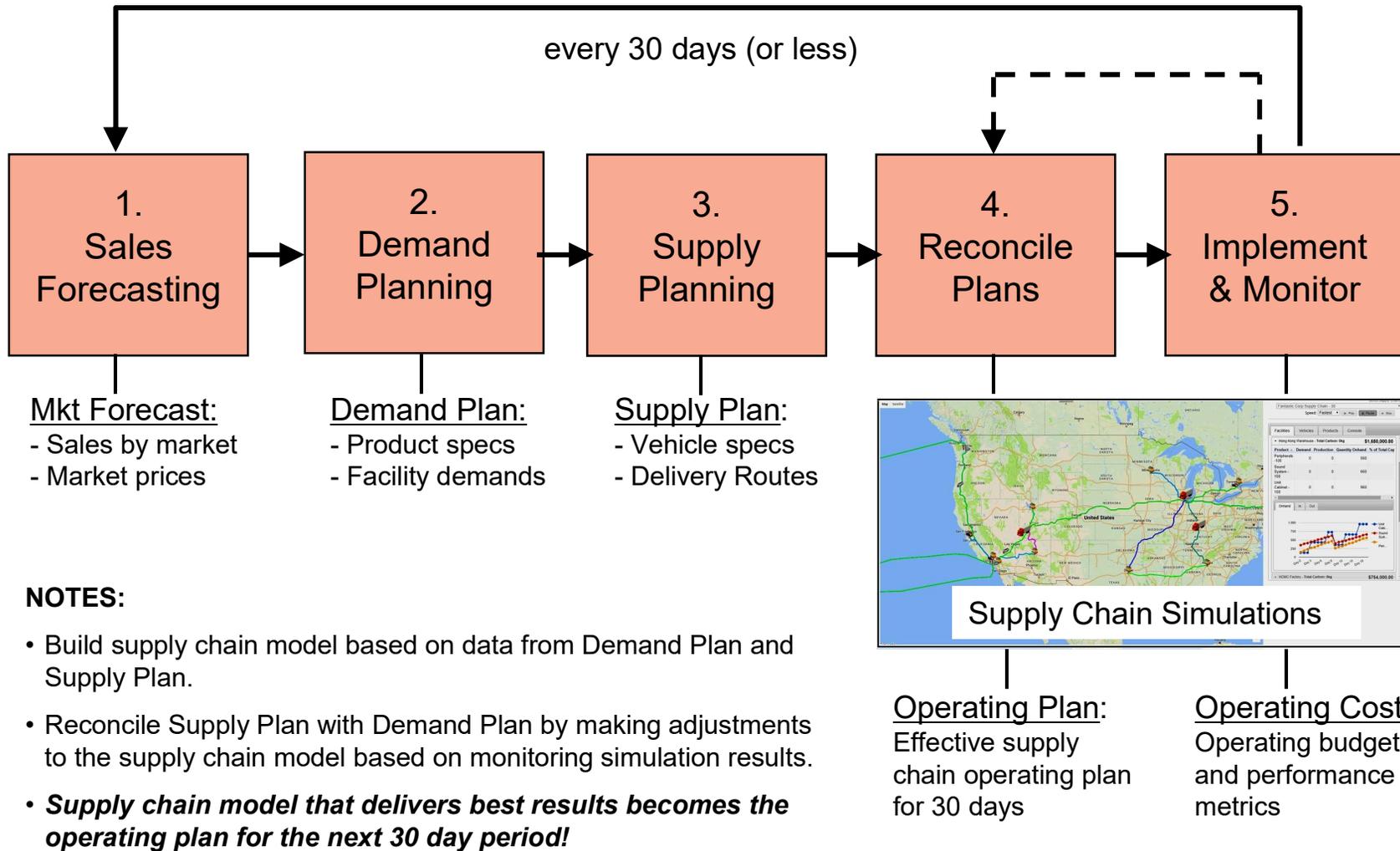
- Combine the four supply chain objects (Products, Facilities, Vehicles, Routes) to create accurate models of real or fictional supply chains anywhere in the world
- Simulate the performance of these supply chains and continuously modify their design until they deliver desired levels of performance

# Display Real-Time Data from Actual Operations



- Collect and display streaming real-time data from facilities and vehicles showing status of inventory, deliveries and other operating metrics
- Send alerts to appropriate parties if operating metrics move outside predefined parameters – simulate possible solutions and pick most effective one

# Collaborative S&OP to Operate Supply Chains

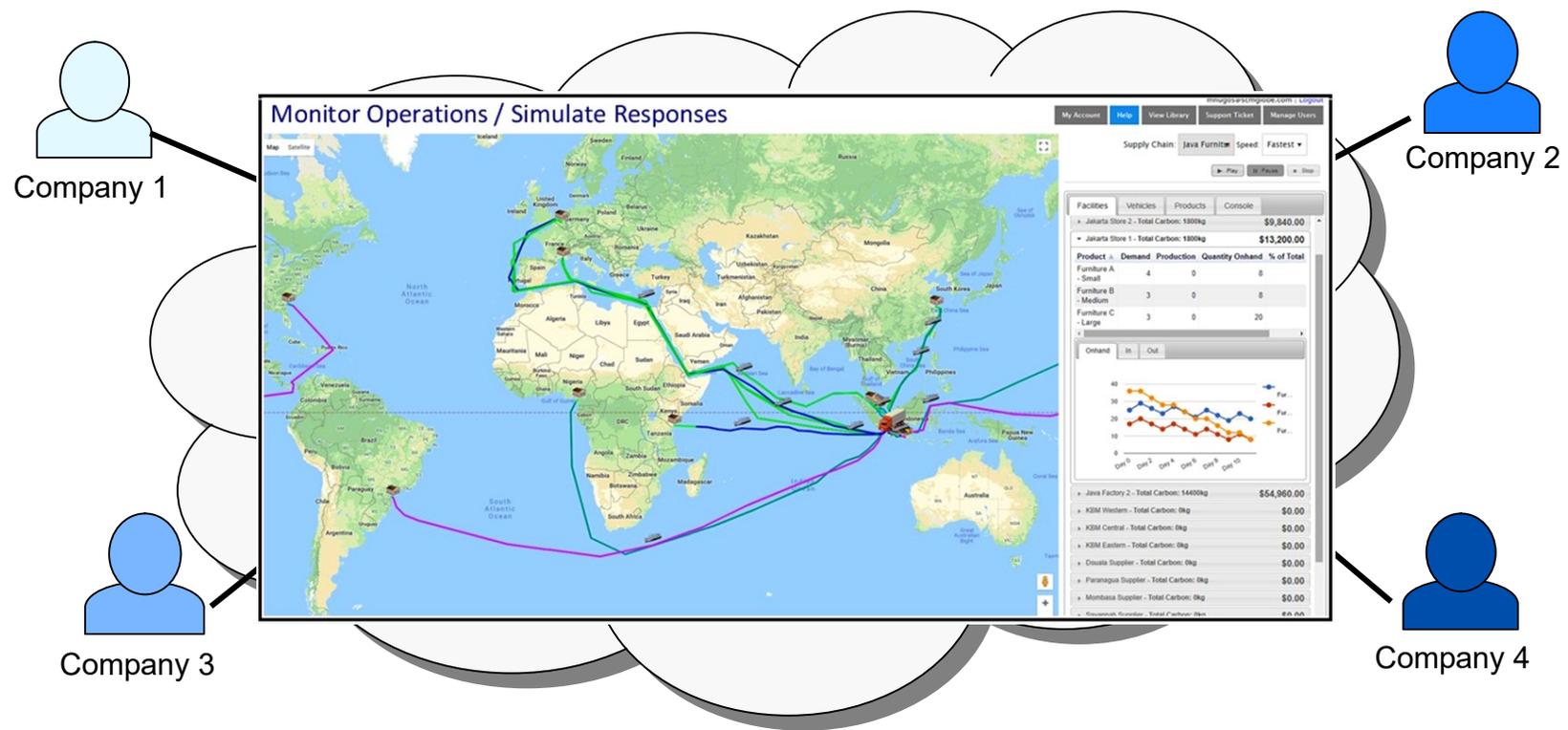


## NOTES:

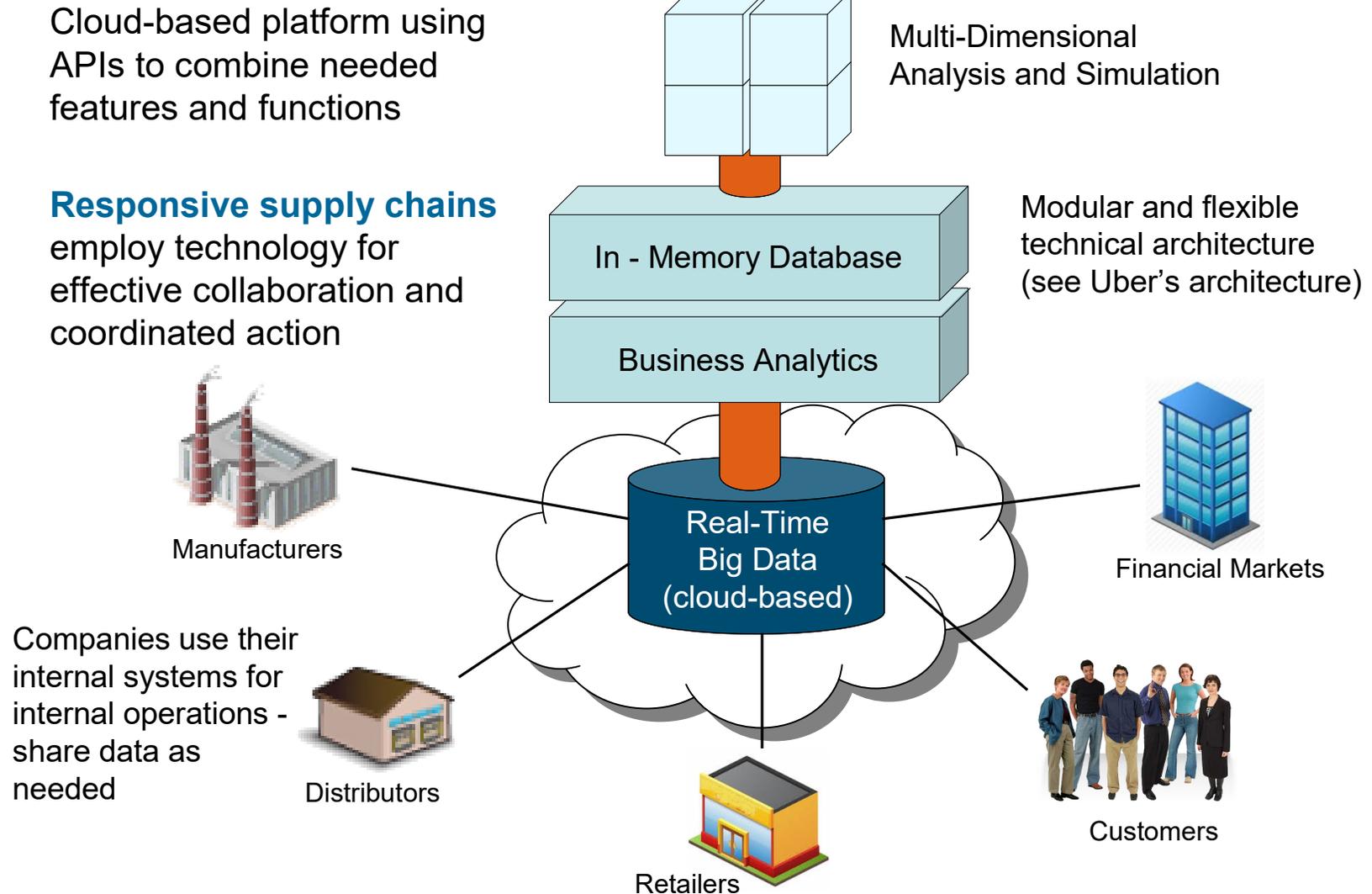
- Build supply chain model based on data from Demand Plan and Supply Plan.
- Reconcile Supply Plan with Demand Plan by making adjustments to the supply chain model based on monitoring simulation results.
- ***Supply chain model that delivers best results becomes the operating plan for the next 30 day period!***

# Cloud-Based Supply Chain Collaboration

1. **Cloud-based software-as-a-service**, APIs for data exchange with other applications
2. **Intuitive user interface provides context** for streams of data – promotes “Situational awareness” for wide groups of people involved in supply chain operations
3. **People do the thinking, computers do the calculating** – simulations show where different ideas can lead – all can see so consensus emerges quickly



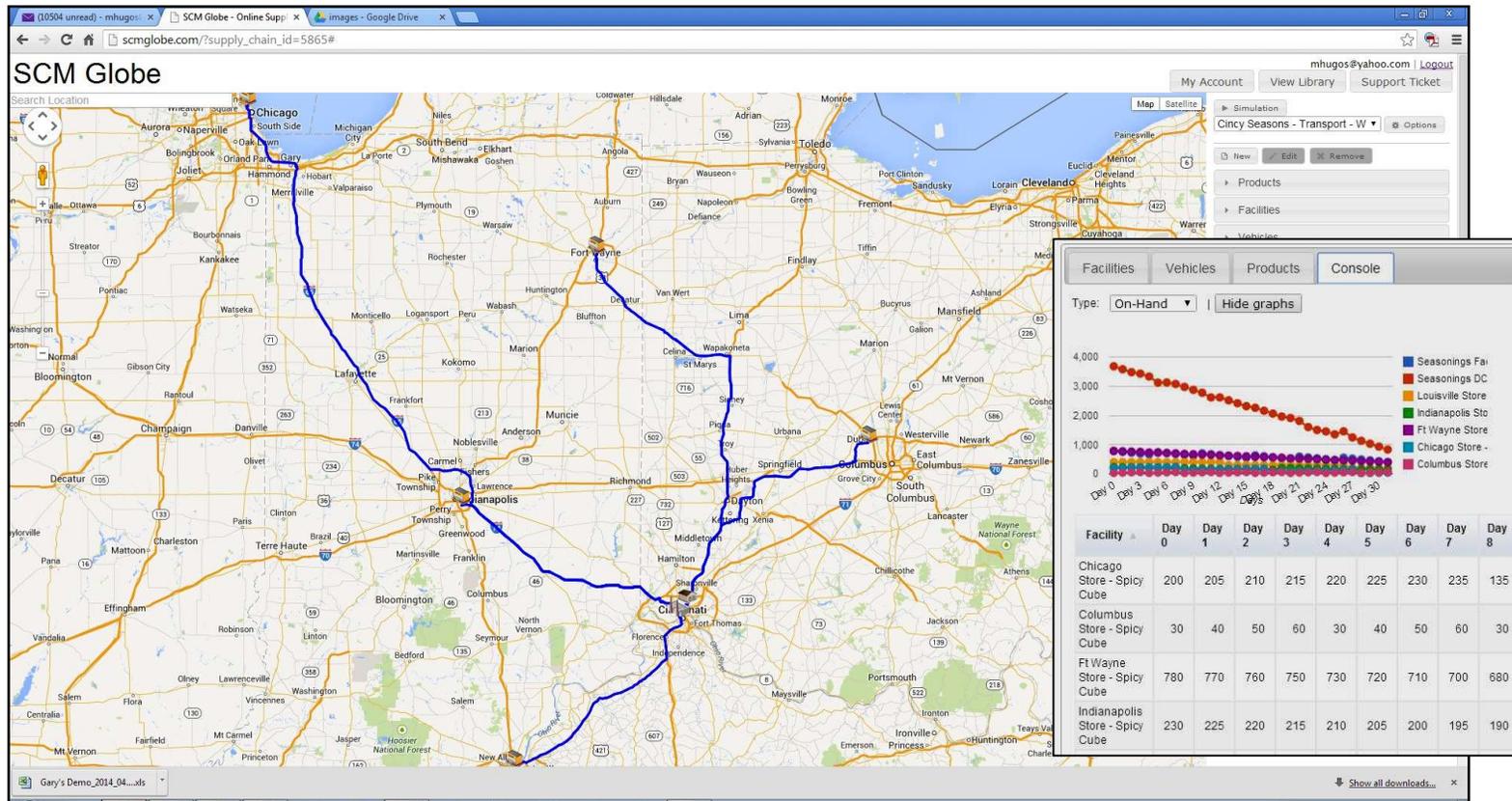
# Real-Time Supply Chain Collaboration Platform



## Chapter 7 Quiz Questions

1. Why is it so important for all companies participating in a supply chain to have good, timely data? (p. 223 - 226)
2. How can companies and supply chains reduce the Bullwhip effect? (p. 226 - 228)
3. How do performance scorecards improve performance and support collaboration? (p. 227)
4. Draw a diagram of a simple supply chain score KPI scorecard and explain how the some of the scores are calculated – such as perfect order rate (p. 228)
5. What is the effect of excessive focus on efficiency at the expense of responsiveness? Provide an example of this. (p. 229 – 231)
6. How can collaboration be used to increase supply chain responsiveness? (p. 231 – 233)
7. What is a good way to create common understanding and consensus for continuous supply chain improvement? (p. 234 – 237)
8. Describe a simple process that can be used as a framework to guide decision making in collaborative supply chains (p. 239 - 241)
9. Explain a good way to combine people and technology to support collaborative supply chain operations? (p. 241 - 244)
10. How can existing hardware and software technologies be combined to create a supply chain collaboration platform? (p. 251 – 252)

# Supply Chain Simulation Exercise



## See *SCM Globe Cincinnati Seasonings Study Guide, Week 7 – Midterm Report of Findings*

1. Present management briefing using screenshots and simulation data
2. Students describe their big wins for reducing inventory and transportation costs
3. Describe the present state of the Cincinnati Seasonings supply chain and present research into different supply chain options such as shipping by rail
4. What were the two or three biggest challenges encountered so far?

# Chapter 8

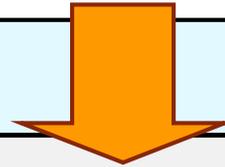
## Defining Supply Chain Opportunities

## Chapter 8 Learning Objectives

- Apply the market analysis framework to define the type of markets your company services and identify the performance capabilities most valuable to those markets
- Define performance targets your company must meet to succeed in the markets you serve – the goal
- Create a strategy and define the objectives needed to reach the goal
- Estimate the budget needed for this effort and calculate the return on investment (ROI)
- Create a high-level project plan that will guide the system development project needed to reach your goal

# Identify Opportunity and Define Goal

1. Understand the requirements of your customers.
2. Define core competencies and the roles your company will play to serve customers.
3. Develop supply chain capabilities to support the roles your company has chosen.



<i>Supply Chain Drivers</i>	<b>Responsiveness</b>	<b>Efficiency</b>
<b>1. Production</b>	<ul style="list-style-type: none"> <li>• Excess capacity</li> <li>• Flexible manufacturing</li> <li>• Many smaller factories</li> </ul>	<ul style="list-style-type: none"> <li>• Little excess capacity</li> <li>• Narrow focus</li> <li>• Few central plants</li> </ul>
<b>2. Inventory</b>	<ul style="list-style-type: none"> <li>• High inventory levels</li> <li>• Wide range of items</li> </ul>	<ul style="list-style-type: none"> <li>• Low inventory levels</li> <li>• Fewer items</li> </ul>
<b>3. Location</b>	<ul style="list-style-type: none"> <li>• Many locations close to customers</li> </ul>	<ul style="list-style-type: none"> <li>• Few central locations serve wide areas</li> </ul>
<b>4. Transportation</b>	<ul style="list-style-type: none"> <li>• Frequent shipments</li> <li>• Fast and flexible mode</li> </ul>	<ul style="list-style-type: none"> <li>• Shipments few, large</li> <li>• Slow, cheaper modes</li> </ul>
<b>5. Information</b>	<ul style="list-style-type: none"> <li>• Collect &amp; share timely, accurate data</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of information drops while other costs rise</li> </ul>

Capabilities of responsiveness and efficiency come from decisions made about the five supply chain drivers.

# Create Strategy to Accomplish Goal

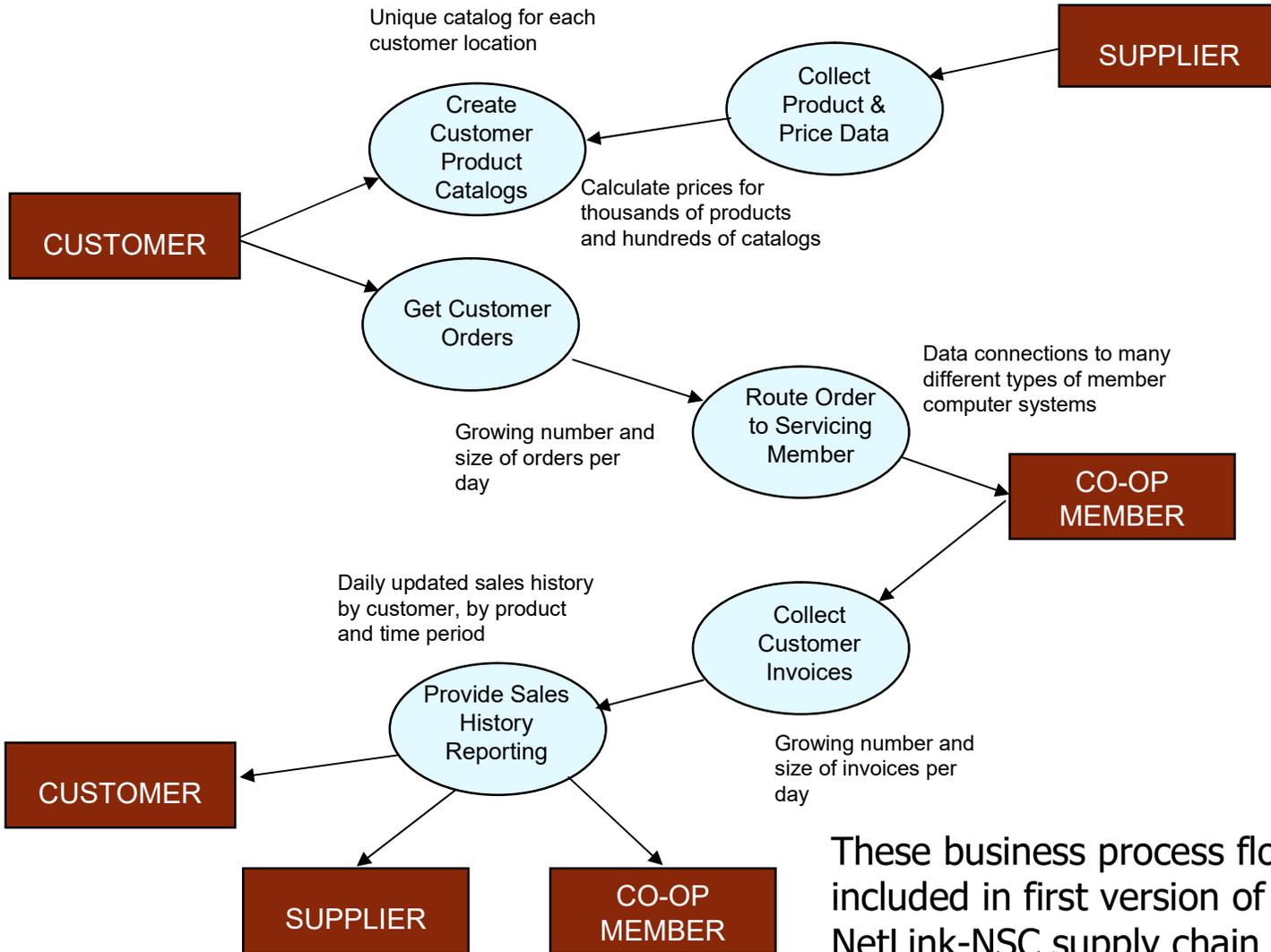
- What market quadrants does company serve? (Developing / Growth / Steady / Mature)
- Do you lead, equal or lag competitors in areas of: Customer Service; Internal Efficiency; Demand Flexibility; Product Development?
- Sample Goal and Objectives:
  - Create the low cost and highly responsive supply chain needed to be the distributor of choice in the markets we serve
    - Automate routine processing of common transactions (purchase orders, invoices, etc.) so as to increase productivity and decrease errors
    - Focus people on exception handling and value added activities such as customer service, inventory management, and sales

# Improve Operations to Achieve Objectives

- Brainstorm improvement ideas for business operations
- Company business objectives call for improvements in Customer Service and Demand Flexibility.
- To achieve objectives investments are made in Demand Forecasting, Product Pricing and Order Management

PERFORMANCE CATEGORIES		CUSTOMER SERVICE As measured by: Fill Rate; On-Time Delivery; Product Returns	INTERNAL EFFICIENCY As measured by: Inventory Turns; Return on Sales; Cash-to-Cash	DEMAND FLEXIBILITY As measured by: Cycle Times; Upside Flex; Outside Flex	PRODUCT DEVELOPMENT As measured by: New Prod Sales; % Revenue; Cycle Time
P L A N	Demand Forecasts	⊗	×	⊗	
	Product Pricing	⊗	×		
	Inventory Management	×	×	×	
S O U R C E	Procurement		×	×	
	Credit & Collections	×	⊗		
M A K E	Product Design	×			×
	Production Scheduling		×	×	
	Facility Mgmt.	×	×		
D E L I V E R	Order Management	⊗	×		×
	Delivery Scheduling	×	×		
	Return Processing	×			×

# Design New Business Process Flows

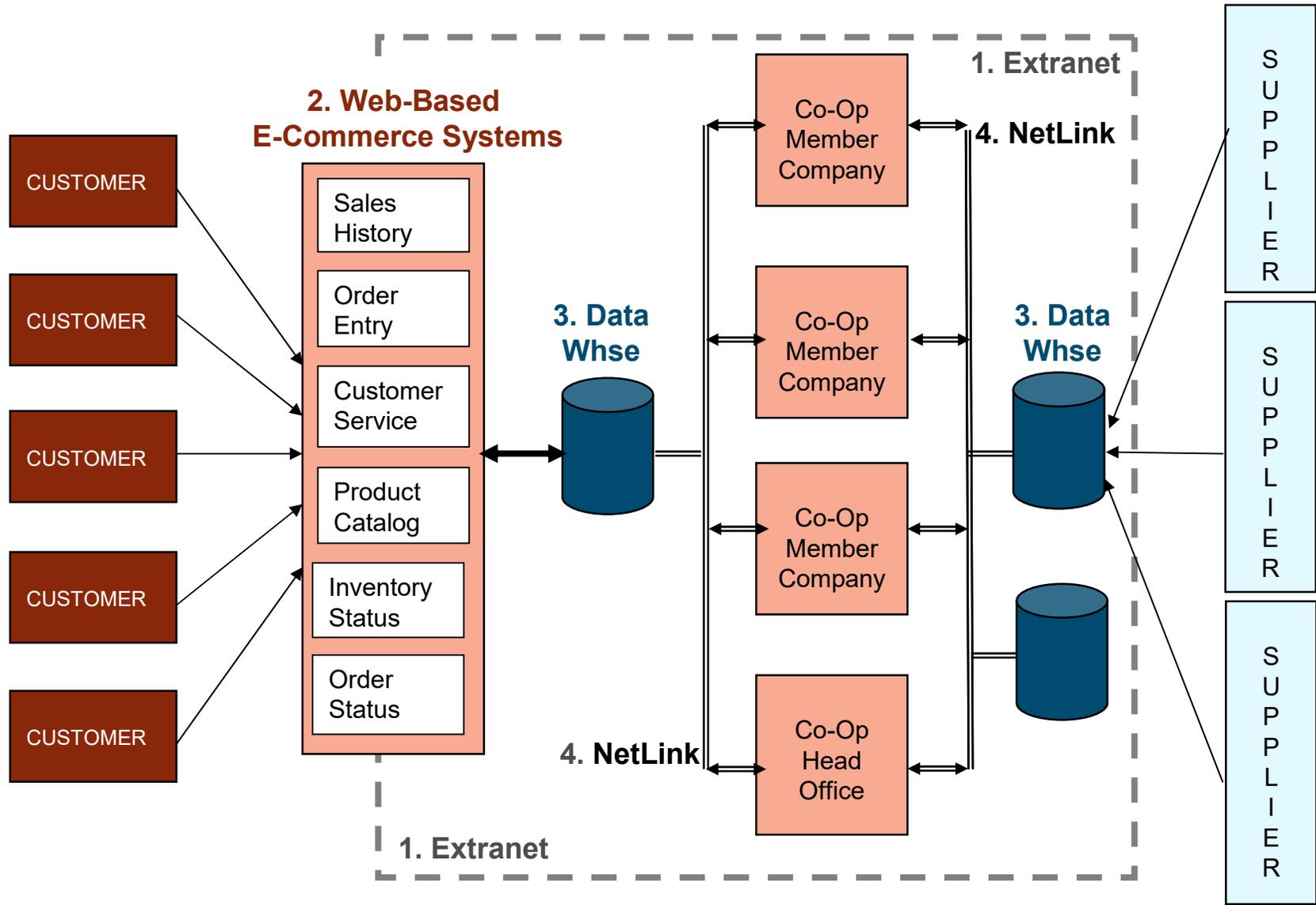


These business process flows were included in first version of the NetLink-NSC supply chain system

# Strategic System Design Guidelines

1. Closely align system designs with the business goals and performance targets they are intended to accomplish.
2. Use systems to change the competitive landscape.
3. Leverage the strengths of existing systems infrastructure.
4. Use the simplest possible combination of technology and business procedures to achieve the maximum number of performance targets.
5. Structure the design so as to provide flexibility in the development sequence used to create the system.
6. Do not try to build a system whose complexity exceeds the organization's capabilities.
7. Do not renew a project using the same people or the same system design after it has once failed.

# A Conceptual System Design



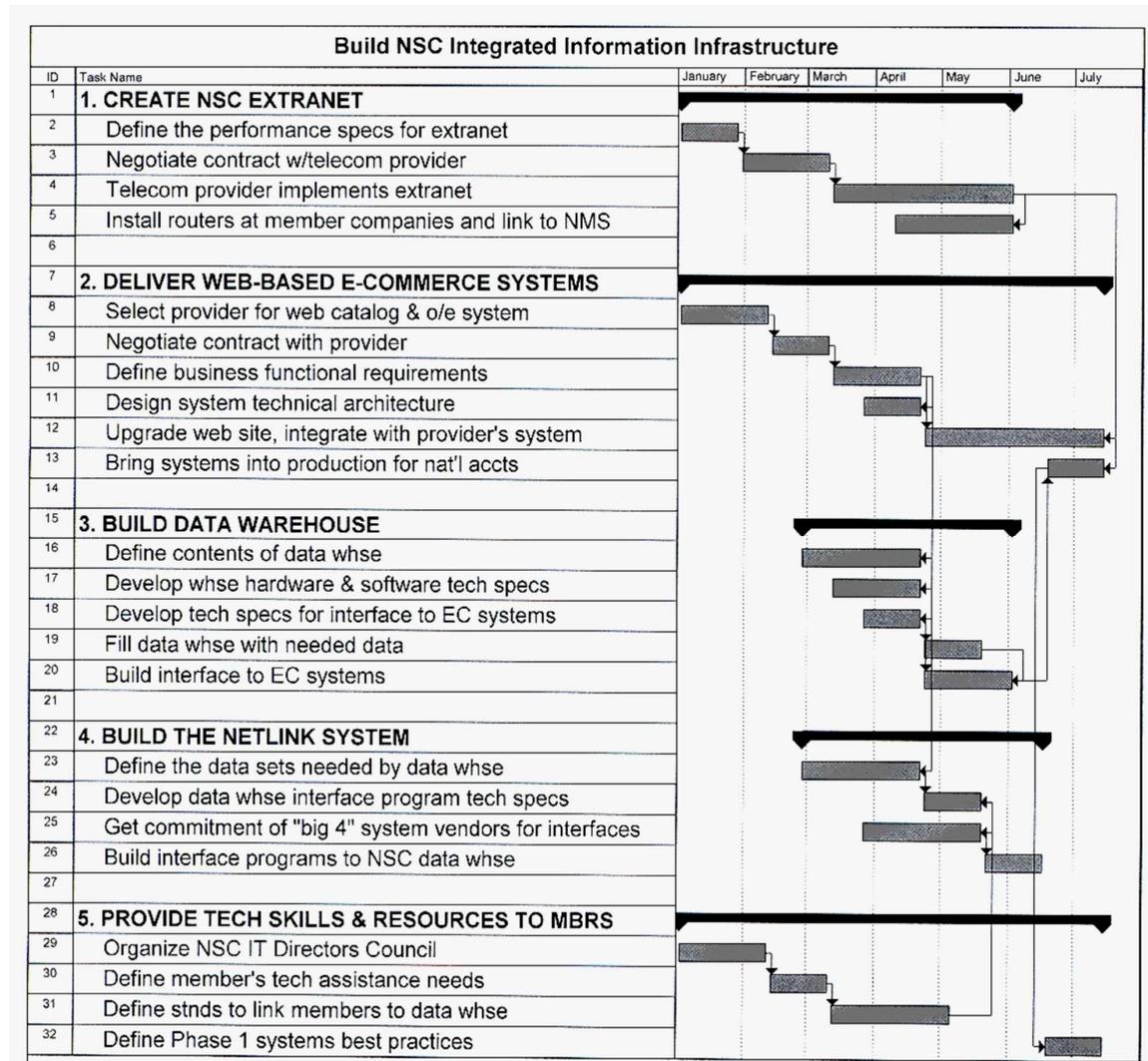
# Initial Project Plan to Develop System

Section of plan for each component of supply chain system:

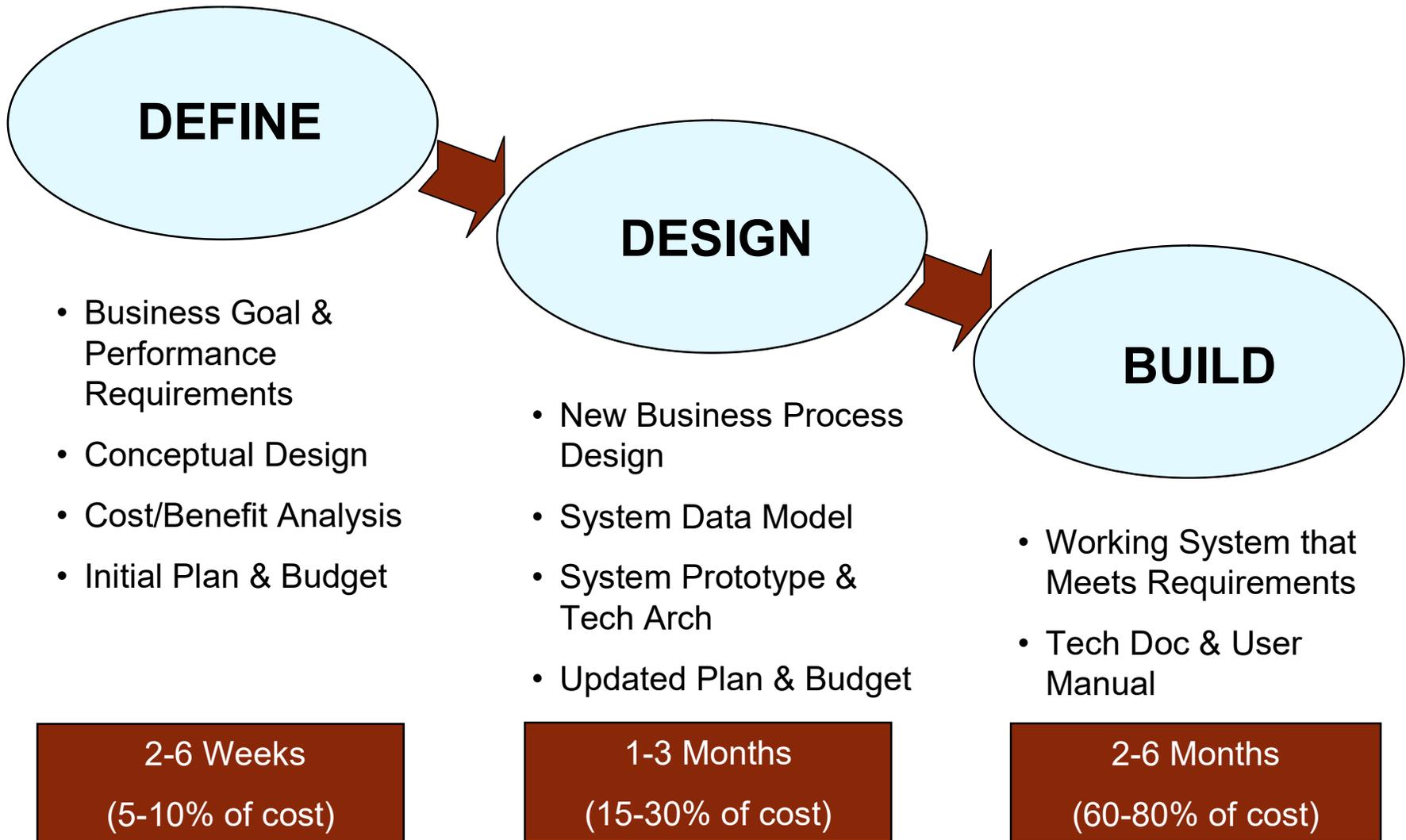
1. Extranet
2. e-Commerce System
3. Data Warehouse
4. NetLink System

Tasks to Define, Design and Build each system component

First version of system put it into operation in six months – additional system features added as needed over time



# System Development Process



# Systems Costs and Benefits

- **SYSTEM COSTS**

- Hardware and software – costs for hardware, software and communications network needed for new system
- Development time – cost estimates for designing, building and rolling out new system
- Operating expense – ongoing cost of operating new system

- **SYSTEM BENEFITS**

- Direct Benefits – productivity increases and cost savings due to capacity increases of new system
- Incremental Benefits – monetary benefits due in significant degree to the capabilities of new system
- Cost Avoidance Benefits – savings related to capacity increases of new system
- Intangible Benefits – hard to quantify but important benefits

## Chapter 8 Quiz Questions

1. Name the market quadrant(s) that your company serves and describe how this affects the design and operation of your company's five supply chain drivers (p. 257)
2. Describe a high-level strategy your company could use to respond to a new opportunity in one of these market quadrants (p. 258 - 260)
3. Draw out the supply chain workflows that would be needed to address this opportunity and define which workflows will be automated and which manual (p. 262 – 265)
4. Draw a high-level conceptual design for a system that would support the automated workflows and provide information for people performing work in the manual workflows (p. 269 - 271)
5. Explain how your design respects the seven strategic guidelines for designing systems (p. 265 – 268)
6. Create an initial project plan, time frames and budget for building this system you have designed (p. 273 – 275)
7. How does your project plan make use of the Define – Design – Build system development sequence? (p. 276 - 278)
8. What are the tasks and deliverables that will be produced in the three steps of Define, Design and Build? (p. 277)
9. Estimate costs for system hardware, software and development work. (see p. 279)
10. Estimate value of direct benefits, incremental benefits and cost avoidance benefits and list the intangible benefits (p. 280)

# Supply Chain Simulation Exercise

The screenshot shows the SCM Globe interface with a map of Cincinnati. A facility location is highlighted in blue. An 'Edit' dialog box is open, showing the following details:

- Name: Seasonings Factory
- Type: Factory
- Max Storage Capacity: 3000 m<sup>3</sup>
- Daily Rent Cost per m<sup>3</sup>: 3
- Daily Operating Cost: 35000
- Daily Carbon Output: 0 kg

Product	Demand per day	Production per day	Quantity Onhand	Storage Used
Spicy Cube	0	190	700	700
<b>Total</b>	<b>0</b>	<b>190</b>	<b>700</b>	<b>700</b>

The dialog box also includes an 'Update' button and a 'Product' dropdown menu.

See *SCM Globe Cincinnati Seasonings Study Guide, Week 8 – Supply Chain for Lowest Total Cost*

1. Adjust delivery schedules so as to reduce number of missed deliveries
2. Download simulation data into spreadsheets for further analysis
3. Experiment with different sizes of facilities and
4. What reduction in rent expenses can be had by reducing amounts of on-hand inventory?

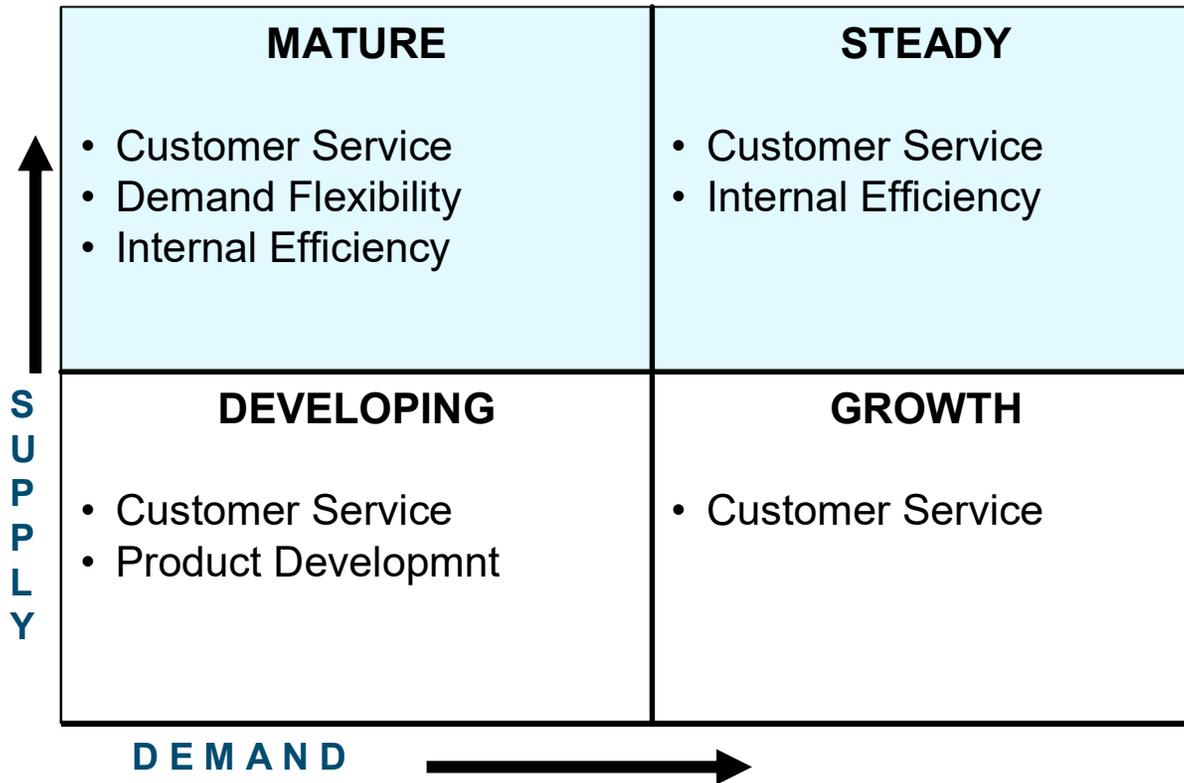
# Chapter 9

## Creating Supply Chains for Competitive Advantage

## Chapter 9 Learning Objectives

- Understand how one company created customized supply chains for its customers and in doing so created a strong competitive advantage for itself
- See how to apply concepts and techniques presented in Essentials of Supply Chain Management to respond to real-world supply chain challenges and opportunities
- Gain insight into how to leverage supply chain capabilities into longer-term alliances with the customers and suppliers that your company does business with

# Performance Capabilities by Market



Performance capabilities needed for success in each market quadrant are shown - Charlie Supply currently participates in supply chains of **MATURE** and **STEADY** markets.

## Charlie Supply - Competitive Response

Competitive Analysis:	LAG	EQUAL	LEAD	EXCEL
Customer Service			X.....→ X	
Internal Efficiency	X			
Demand Flexibility		X.....→ X		
Product Developmnt		X		

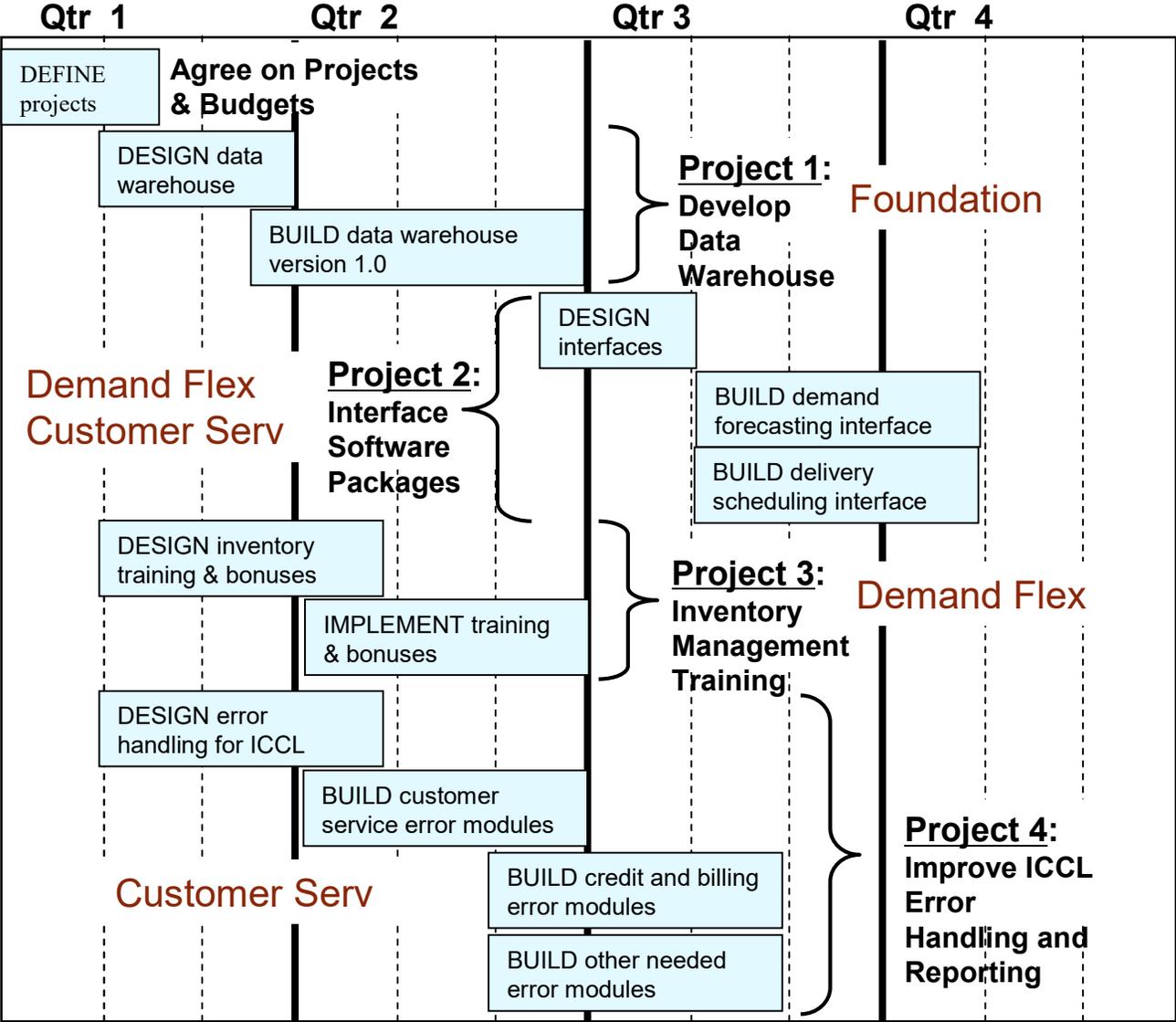
- Charlie Supply builds on its strengths to differentiate itself in eyes of its customers
- Improvements in Customer Service and Demand Flexibility best leverage existing company strengths – can change competitive landscape to company’s advantage

# Improvements to Achieve Objectives

- Company business objectives call for improvements in Customer Service and Demand Flexibility.
- To achieve objectives investments are made in Demand Forecasting, Inventory Management, Order Management and Deliver Scheduling

PERFORMANCE CATEGORIES		CUSTOMER SERVICE As measured by: Fill Rate; On-Time Delivery; Product Returns	INTERNAL EFFICIENCY As measured by: Inventory Turns; Return on Sales; Cash-to-Cash	DEMAND FLEXIBILITY As measured by: Cycle Times; Upside Flex; Outside Flex	PRODUCT DEVELOPMENT As measured by: New Prod Sales; % Revenue; Cycle Time
P L A N	Demand Forecasts	⊗	⊗	⊗	
	Product Pricing	×	×		
	Inventory Management	⊗	⊗	⊗	
S O U R C E	Procurement		×	×	
	Credit & Collections	×	×		
M A K E	Product Design	×			×
	Production Scheduling		×	×	
	Facility Mgmt.	×	×		
D E L I V E R	Order Management	⊗	⊗		×
	Delivery Scheduling	⊗	⊗		
	Return Processing	×			×

# Ex # 1 - Project Completion Schedule

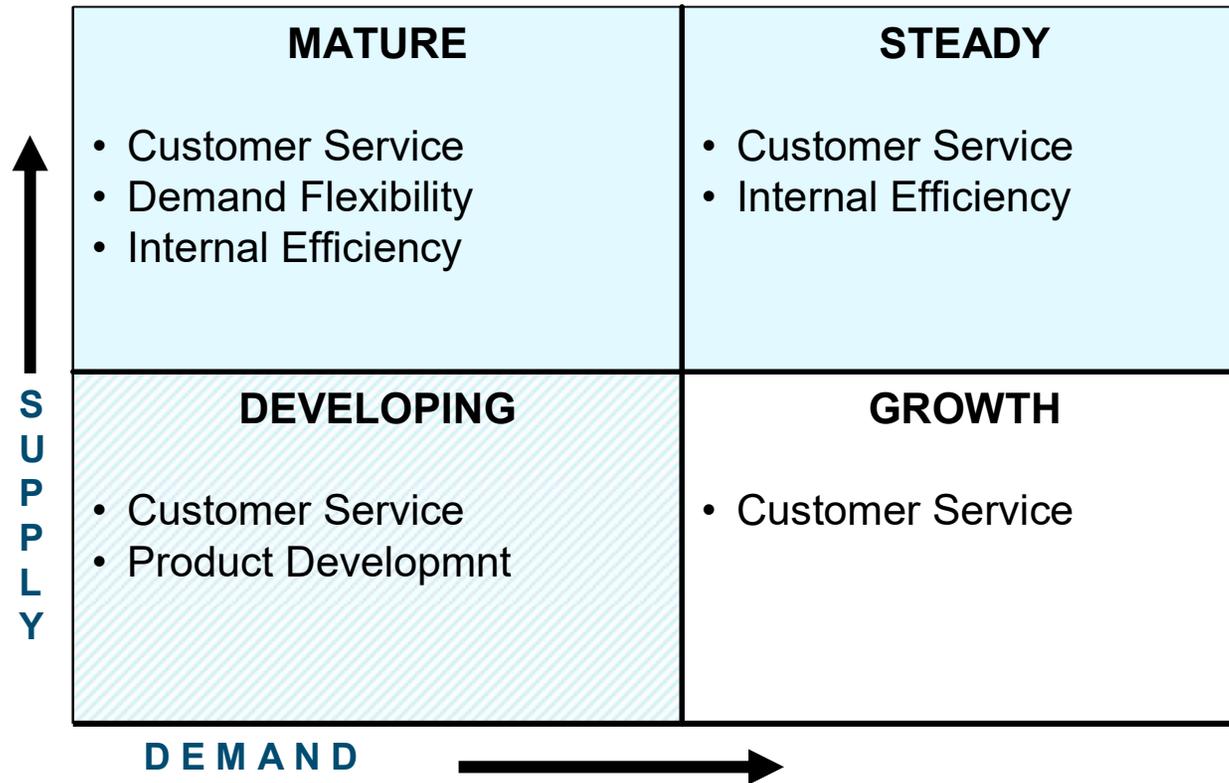


**SET AGGRESSIVE** but achievable time boxes to accomplish the work involved in each project.

**TAILOR THE WORK** to fit the time available. Remember that each project will produce the first version of a system or process.

**FIRST VERSIONS** need to have only the most immediately useful features.

# Signs of New Developing Market



Charlie Supply market research sees opportunity to participate in a new developing market – introduction of “green” cleaning and foodservice supplies are in demand by certain kinds of customers

## Charlie Supply - Competitive Response

Competitive Analysis:	LAG	EQUAL	LEAD	EXCEL
Customer Service				X .....▶
Internal Efficiency	X			
Demand Flexibility			X	
Product Development		X .....▶		

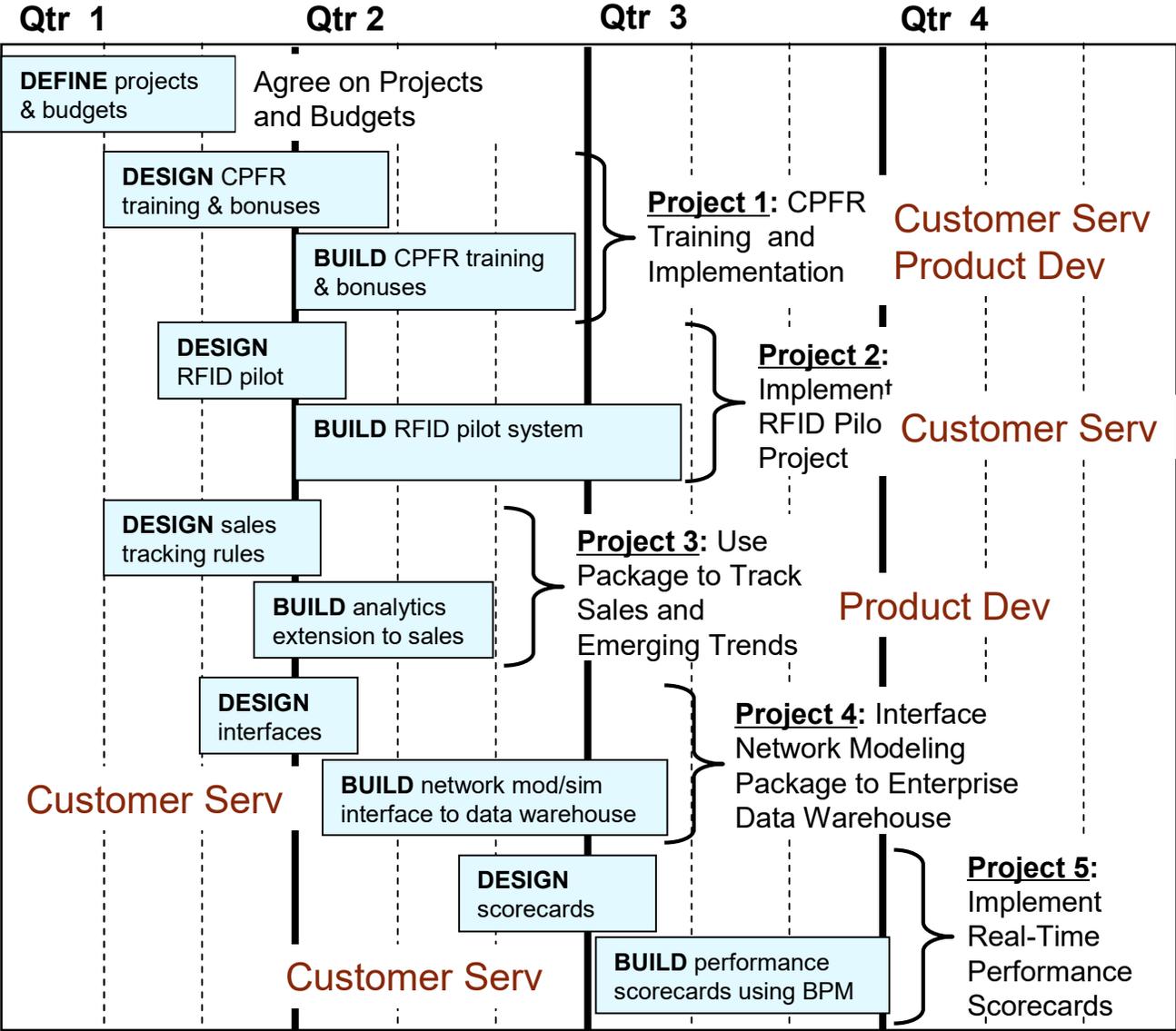
- Charlie Supply continues to build on its strengths in Customer Service
- Improvements in Product Development increase company value as strategic partner with manufacturers – can change competitive landscape to company's advantage

# Improvements to Achieve Objectives

- Company business objectives call for improvements in Customer Service and Product Development.
- To achieve objectives investments are made in Demand Forecasting, Inventory Management, Order Management, Deliver Scheduling and Return Processing.

PERFORMANCE CATEGORIES		CUSTOMER SERVICE As measured by: Fill Rate; On-Time Delivery; Product Returns	INTERNAL EFFICIENCY As measured by: Inventory Turns; Return on Sales; Cash-to-Cash	DEMAND FLEXIBILITY As measured by: Cycle Times; Upside Flex; Outside Flex	PRODUCT DEVELOPMENT As measured by: New Prod Sales; % Revenue; Cycle Time
P L A N	Demand Forecasts	⊗	x	x	
	Product Pricing	x	x		
	Inventory Management	⊗	x	x	
S O U R C E	Procurement		x	x	
	Credit & Collections	x	x		
M A K E	Product Design	x			x
	Production Scheduling		x	x	
	Facility Mgmt.	x	x		
D E L I V E R	Order Management	⊗	x		⊗
	Delivery Scheduling	⊗	x		
	Return Processing	x			⊗

# Ex # 2 - Project Completion Schedule



**AGGRESSIVE AND ACHIEVABLE** time boxes

**TAILOR THE WORK** to fit time available;

**SYSTEMS WITH** most immediately useful features.

**SCHEDULE ACTIVITY** in first three quarters; use fourth quarter for wrap up and review



# Characteristics of Strategic Alliances

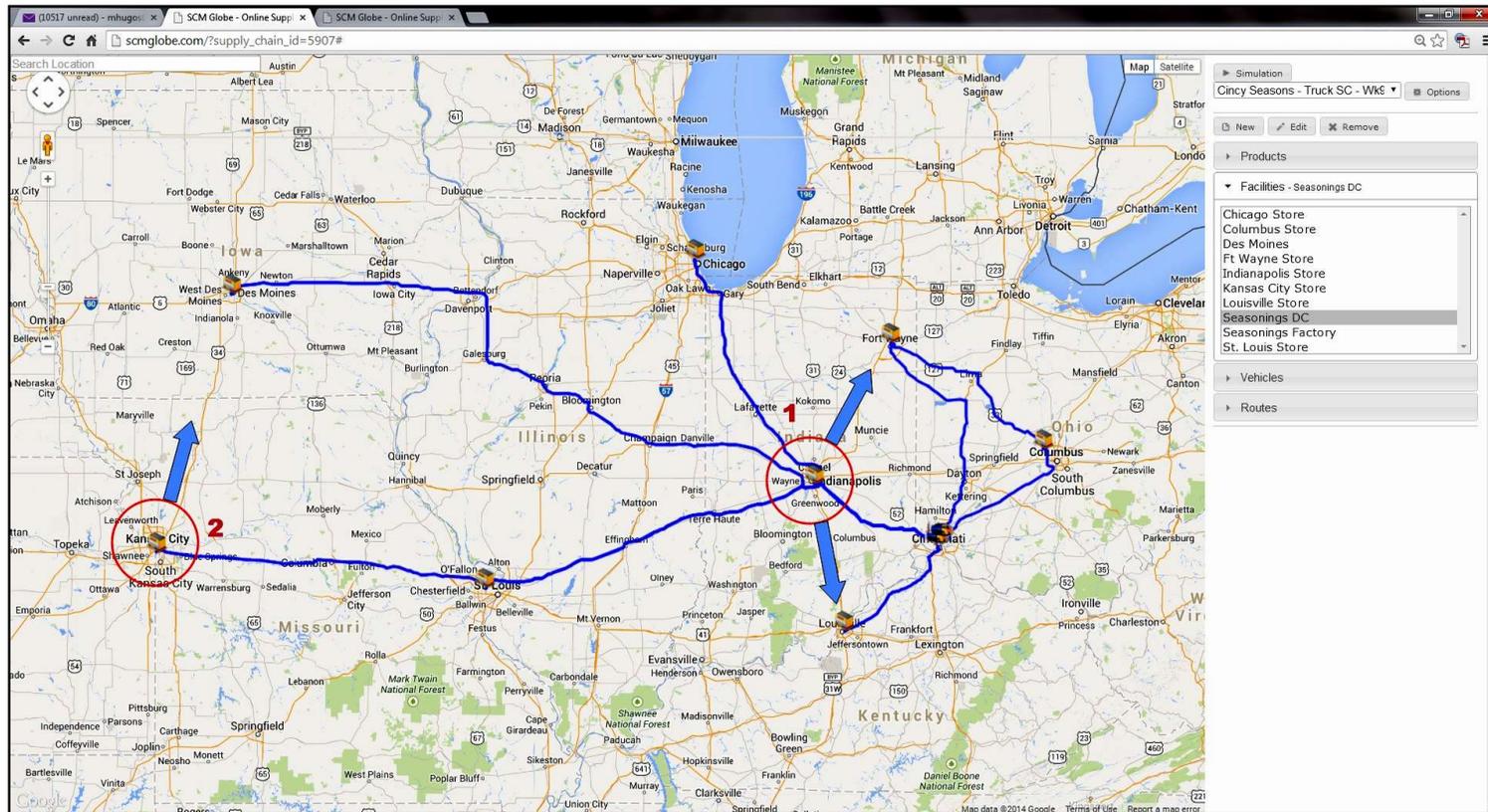
1. Delivery of a customized blend of products and services to meet a specific set of business needs
2. Coordination of inter-company operations so as to achieve predefined performance targets
3. Longer term, 3 to 5 year, contract time frames for the alliance partners to work together
4. Prospects for mutually profitable business growth over the life of the contract

*Strategic supply chain alliances have these four characteristics, without them, relationship is not strategic*

## Chapter 9 Quiz Questions

1. Why did Charlie Supply choose not to improve its internal efficiency when competitive analysis showed that it lagged its competitors in this area? (p. 294 - 296)
2. What projects did Charlie Supply identify that would enable performance improvement in areas of customer service and demand flexibility and why? (p. 296 – 299)
3. Why did Charlie Supply structure the Define – Design – Build activities on each project as shown in their project plan for Exercise Number 1? (p. 299 – 300)
4. In Exercise Number 2 why did Charlie Supply choose to continue to improve a capability where it already excelled? (p. 304 - 305)
5. Why did it not focus instead on improving a capability where it still lagged its competitors? (p. 305)
6. Explain the benefits of the project completion schedules laid out by Charlie Supply in Exercise Number 2. Why did they not schedule work in the last quarter of the year? (p. 309)
7. What operations does it make sense for a company to outsource to alliance partners? (p. 312)
8. List the four characteristics of a strategic alliance. (p. 313)
9. Why are all four of these characteristics required for a truly strategic alliance? (p. 313 - 314)
10. Why does a strategic alliance require sustainable growth and profitability for all partners? (p. 314 - 316)

# Supply Chain Simulation Exercise



See *SCM Globe Cincinnati Seasonings Study Guide, Week 9 – Expanding to Support Business Growth*

1. Students add additional facilities, vehicles and routes to model the business expansion
2. Experiment with different rail and truck combinations to reduce inventory and operating expenses
3. What happens with transportation and inventory costs with different mixes of rail and truck transport?

# Chapter 10

## Promise of the Real-Time Supply Chain

## Chapter 10 Learning Objectives

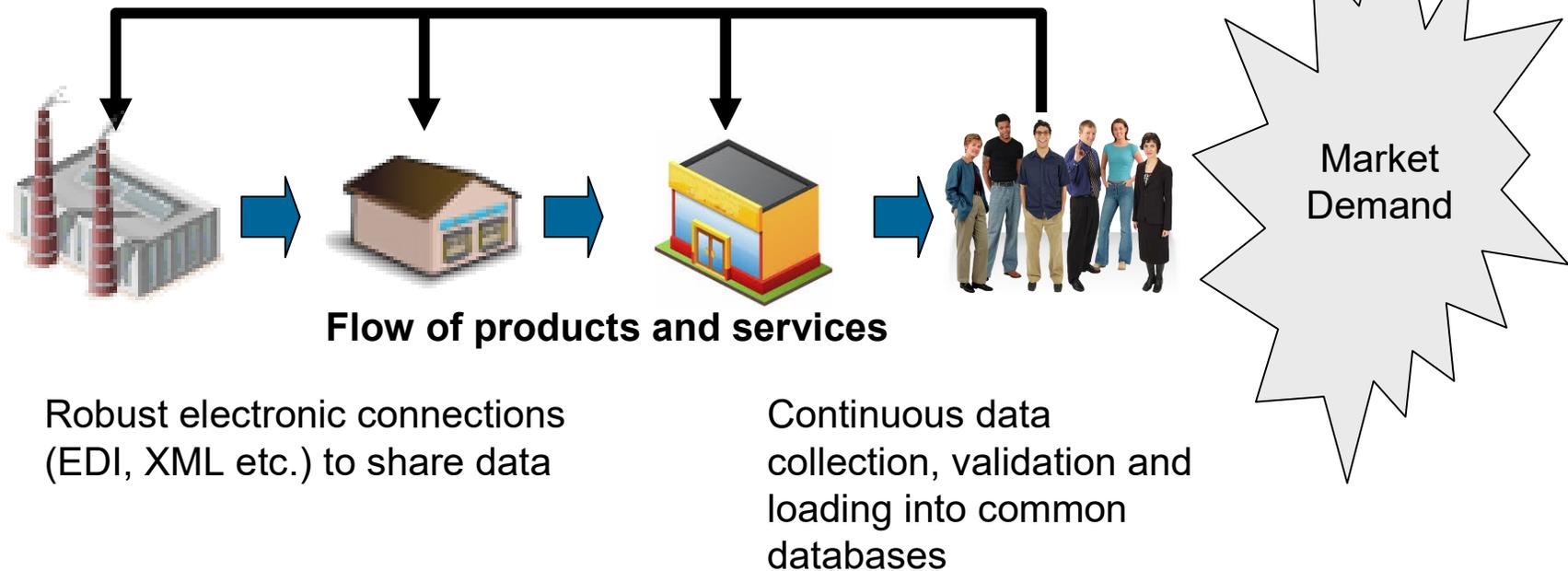
- Appreciate the power of “always on” Internet connections that link companies together in the real-time economy
- Assess the profit potential inherent in the self-adjusting feedback loop
- Explore ways to harness game mechanics and the power of feedback loops to drive supply chain operations
- Discuss the concept of “emergent systems” and understand why supply chains can be seen as emergent systems
- Introduce ideas of adaptive systems and economic cycles

# Start of Something Big

- Until turn of this century only big companies could handle the complexity and cost of electronic connections
- Now Internet creates global, **multi-directional, always-on communication network** that is easy to connect to and easy to afford
- More and more companies of all sizes connect via Internet and cloud platforms and are able to **exchange data and react in real-time**
- Real-time data flows and reactions create self-adjusting feedback loops
- **Self-adjusting feedback loops** guide operations:
  - Cruise control guides operation of car to maintain steady speed
  - Thermostat controls operation of HVAC to maintain steady temp
  - Supply chains that monitor KPIs and maintain steady throughput rates
- Bullwhip Effect is example of positive or reinforcing feedback – supply chains can control the bullwhip with application of negative or balancing feedback

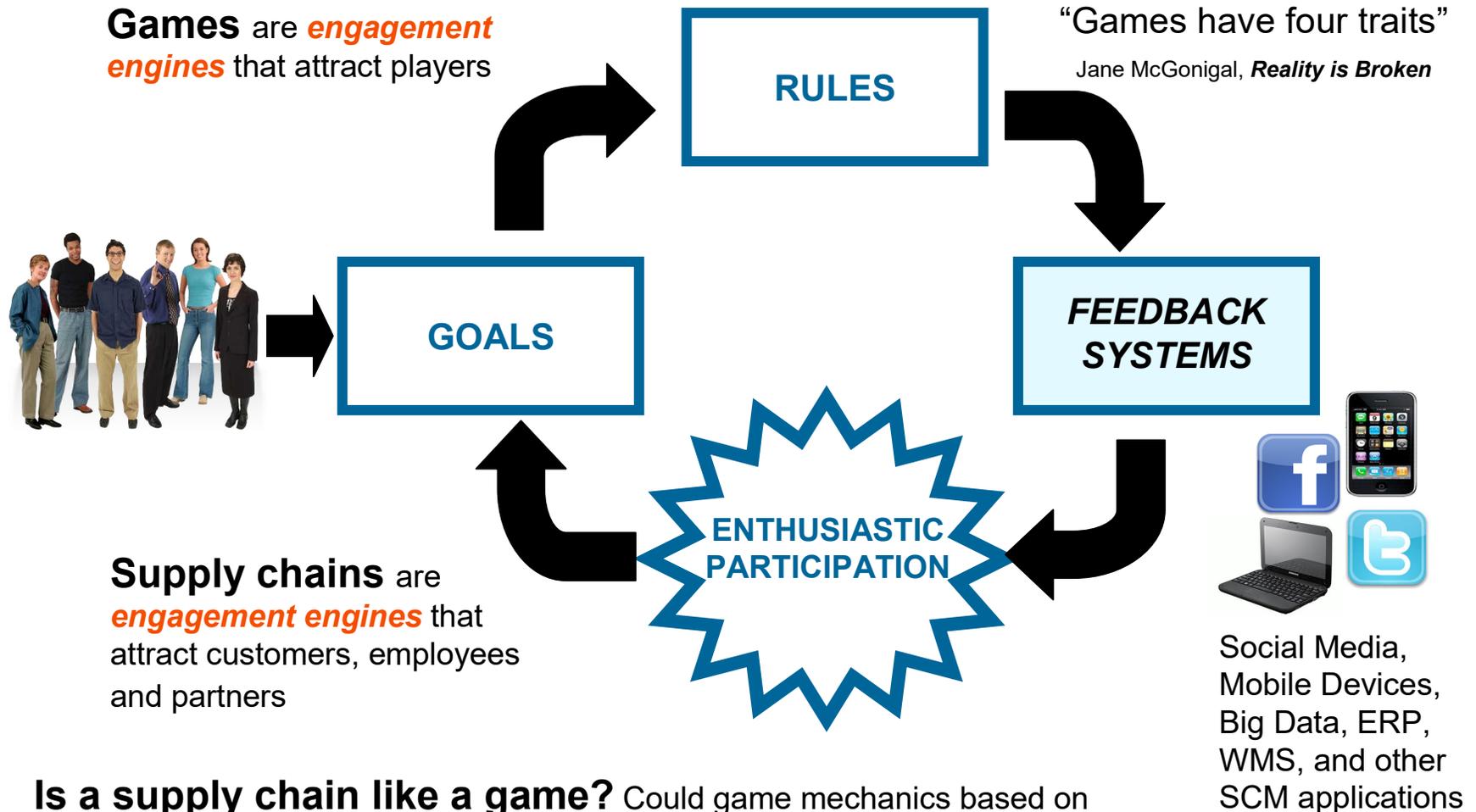
# Harnessing Feedback Loops to Supply Chains

**Business Intelligence:** Forecasts, Sales, Inventory, Customer Data etc.



**Connect, communicate, collaborate – *corrective feedback for bullwhip***

# The Game of Supply Chain Management



**Is a supply chain like a game?** Could game mechanics based on feedback loops drive supply chain performance?

# Three Requirements for Self-Adjusting Feedback Loops



Use game mechanics to empower players on a supply chain team.  
**Observe – Act – Win** in unpredictable and high change environments (agility).

# Emergent Behavior in Supply Chains

- Adam Smith's "invisible hand" of the market sets prices so as to best balance supply and demand for products
- Many local transactions between large numbers of players governed by game mechanics and feedback systems produce larger effect – **emergent behavior** – "whole is greater than sum of the parts"
- If supply chain management comes to be practiced as a game, then good players in supply chains serving different markets will seek each other out to play together – **supply chains become a team sport**
- Economy would be driven by competing supply chains (teams) rather than by individual competing companies (players)
- Use computers to automate rote and repetitious activities (**efficiency**)
- Use people to do creative, problem-solving work (**agility**)
- This combination of computers and people create supply chains that **learn and grow smarter with experience** – Emergent Behavior

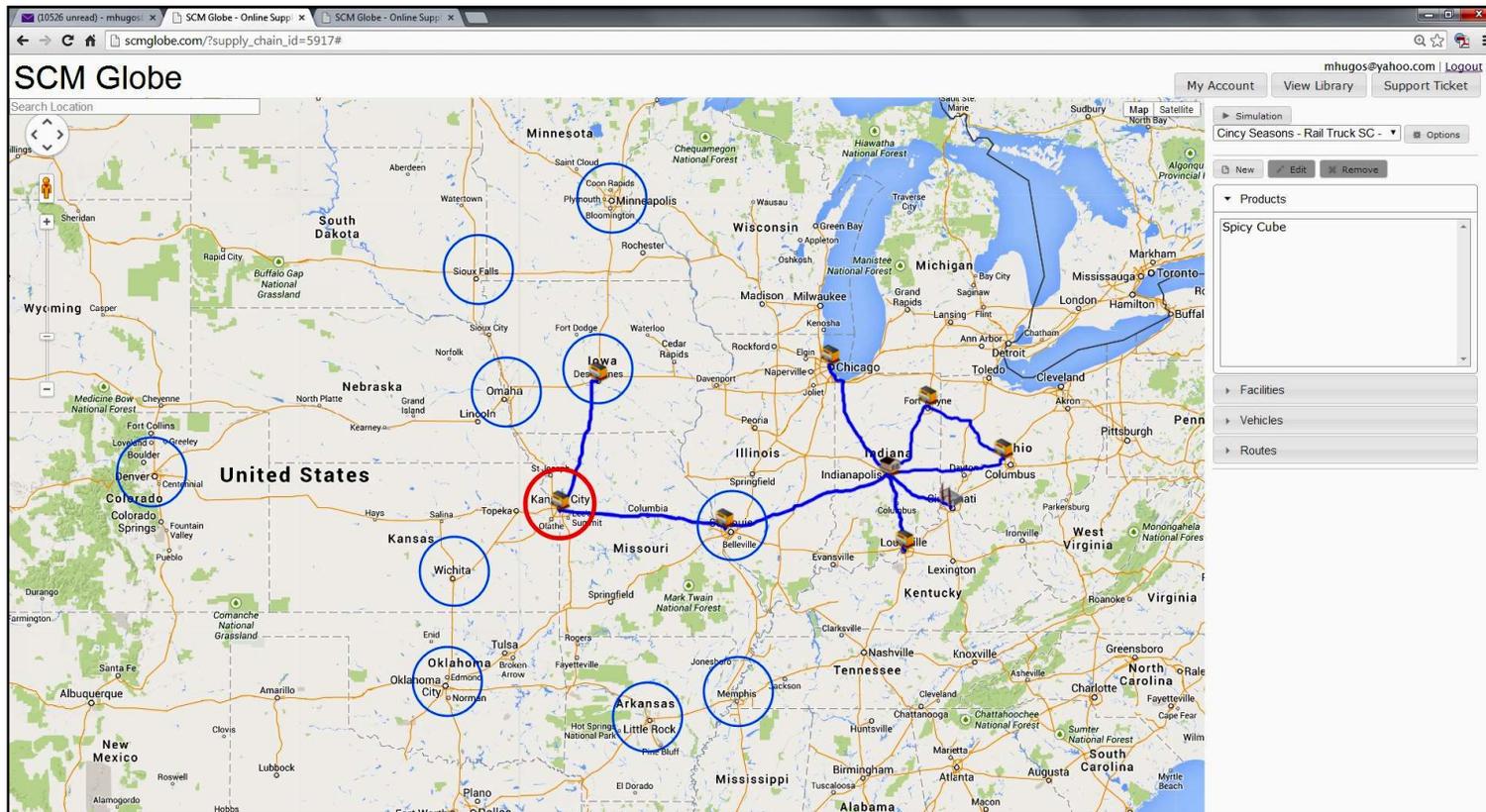
# Adaptive Networks and Economic Cycles

- Any industry or market where there is a “boom-to-bust” cycle is experiencing a form of the **Bullwhip Effect**
- As supply chains become more like games or “**goal-seeking emergent systems driven by feedback loops**” they will get better at recognizing and counteracting the boom-to-bust cycle
  - Dot-com bubble of 1997 – 2001
  - Real estate bubble of 2003 – 2008
  - Other examples of boom-to-bust cycles illustrating Bullwhip Effect
- Ability to recognize and smooth out excessive swings in demand, prices, productive capacity and inventory will lead to **more economic stability and longer periods of prosperity**

## Chapter 10 Quiz Questions

1. Why are electronic connections that are always on different from connections that are only sometimes on? (p. 320)
2. What is created by real-time data flows and continuous reactions to them? (p. 321)
3. Describe how supply chains could become more profitable by harnessing self-adjusting feedback loops. (p. 322)
4. How can supply chains counter the Bullwhip Effect? (p. 322)
5. A game can arise when what four conditions are present? (p. 323)
6. What three conditions act to strengthen strategic alliances and why? (p. 325)
7. How can supply chains exhibit characteristics of emergent behavior? (p. 327 – 331)
8. Explain why markets could be driven more by competing supply chains than by competing companies. (p. 332)
9. How is a boom-to-bust cycle similar to the Bullwhip Effect? (p. 333)
10. What would happen if emergent behavior in supply chains allowed them to recognize and counteract the effect of boom-to-bust cycles? (p. 333)

# Supply Chain Simulation Exercise



See *SCM Globe Cincinnati Seasonings Study Guide, Week 10 – Exploring Other Options and Plans*

1. Students create and present short management briefings using screenshots and data from simulations
2. What were their biggest challenges to get the Cincinnati Seasonings supply chain to run for 30 days?
3. How did they address each of these challenges?

# Your Feedback

What are your thoughts and suggestions for how to improve this teaching guide?

Did your students use my book *Essentials of Supply Chain Management, 3<sup>rd</sup> Edition* in the course you taught? Does this guide go well with the book?

Did you use the SCM Globe interactive simulations suggested in this guide? How well did the simulations work for your classes? How could they be made better?

Do you have an interactive case study you would like to contribute to the library of case studies on SCM Globe? If so please contact me. If we publish your case study, it will be copied into the SCM Globe Library and you will receive full credit and attribution for your work.

Any feedback you provide is much appreciated,

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Items in this complete package for supply chain learning  
can be accessed online – see links below:

*Essentials of Supply Chain Management, 4th Edition*

<https://www.amazon.com/Essentials-Supply-Chain-Management/dp/1119461103/>

90 Days Access to SCM Globe Simulations

<http://www.scmglobe.com/>

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