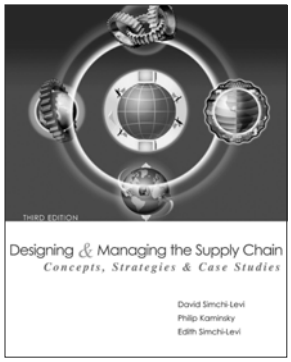

Chapter 14

IT and Business Processes

14.1 Introduction

- Information technology (IT) an important enabler of effective supply chain management
- Typically spans the entire enterprise and beyond, encompassing suppliers on one end and customers on the other.
- Includes systems that are:
  - internal to an individual company
  - external which facilitate information transfer *between* various companies and individuals

Questions

- What is the impact of business process change on IT implementation?
- What are the goals of IT from the perspective of supply chain management?
- What IT components are needed to achieve the goals of supply chain management?
- What are the supply chain component systems and how should they be approached?
- What are decision support systems and how do they support supply chain management?
- What criteria should be used to select decision support systems?
- What drives the selection of best of breed systems?

14.2 The Importance of Business Processes

- Recent study by MIT, PRTM and SAP
- Companies that invest mostly in business processes do better than those who invest in IT only and lack the appropriate business processes.
- Investments only in technology without the appropriate business processes lead to negative returns.

Challenges

- Identify measures to characterize supply chain effectiveness
  - KPIs and SCOR Model are objective ways
- Develop measures to characterize the level of maturity of the business process and the information technology employed by the company
  - Much more difficult because of variations across companies

Characteristics of the Level of Business Maturity

- Based on the SCOR model
- Consists of four stages

Level I: Disconnected Processes

- Many independent processes.
- Organized functionally with no or low degree of integration.
- Supply chain planning typically done for each site independently of other sites.
- Characteristics:
  - Functional (silo) strategies.
  - Lack of clear, consistent supply chain management processes.
  - No measurements, or measurements not aligned with company objectives.

14-7

Level II: Internal Integration

- Organized functionally, with a high degree of integration.
- Decisions made through the integration of key functional areas.
- Common forecasts applied throughout the organization.
- Characteristics:
  - Integration of some functional information.
  - Documented processes followed across the entire organization.
  - Key measurements that are used departmentally.

14-8

Level III: Intra-Company Integration and Limited External Integration

- Cross-functionally organized.
- Involves key suppliers and customers in decision making processes.
- Characteristics:
  - Decisions optimized across the internal supply chain.
  - Sophisticated processes that involve all affected internal organizations.
  - Key suppliers and customers are included in supply chain planning.

14-9

Level IV: Multi-Enterprise Integration

- Multi-enterprise processes
- Common business objectives/extensive knowledge of the suppliers and customers business environments.
- Collaboration links trading partners and enables them to operate as one virtual corporation.
- Characteristics:
  - Collaboration across the entire supply chain.
  - Internal and external collaborative supply chain management focus on key service and financial goals.
  - Measures directly link supply chain results to company goals.

14-10

Four Categories of IT Systems

- **Level I**
  - Batch processes, independent systems and redundant data across the organization.
  - Focus on spreadsheet and manual manipulation of data for decision making.
- **Level II**
  - Shared data across the supply chain.
  - Decisions made using planning tools
- **Level III:**
  - Complete visibility of internal data
  - Key suppliers and customers have access to some of this data
  - Processes are also shared across the supply chain
- **Level IV**
  - Data and processes are shared internally and externally.

14-11

Areas of PRTM Data Collection

- **Strategic Planning**: Network design, Inventory positioning and Manufacturing strategy
- **Demand Planning**: Demand forecasts and Promotional planning
- **Supply Planning**: Coordination of manufacturing, inventory and transportation activities across the supply chain
- **Supply-Demand Balancing**: Trade off between suppliers capability and customer demand are considered; Pricing and promotional activities are applied systematically to better match supply and demand
- **Procurement Planning**: Materials and commodities sourcing strategy
- **Manufacturing Planning**: Single site vs. Enterprise wide strategy;
- **Delivery Planning**: Commitments to customers are based on forecast, available capacity, or real-time inventory and manufacturing information.

14-12

Main Results

- **Companies with mature business processes have lower inventory levels**
- **Improvements in certain areas demand IT investments**
- **BICS companies with mature processes achieve superior financial performance**
- **Investing only in IT infrastructure leads to significant inefficiencies**
- **Priority in IT investments depends on your objectives**

14-13

Companies with Mature Business Processes Have Lower Inventory Levels

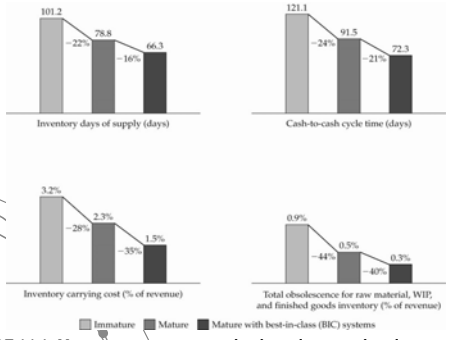

FIGURE 14-1: **Mature process companies have improved on inventory performance; BICS companies that are process mature perform even better.**

14-14

Improvements in Certain Areas Demand IT Investments

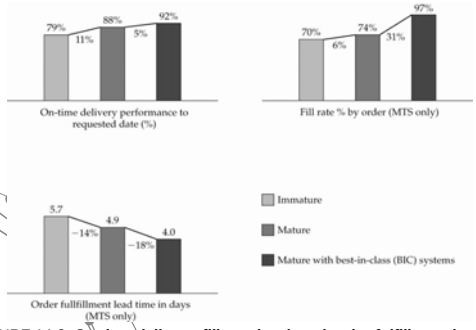

FIGURE 14-2: **On-time delivery, fill rate level, and order-fulfillment lead time**

14-15

BICS Companies with Mature Processes Achieve Superior Financial Performance

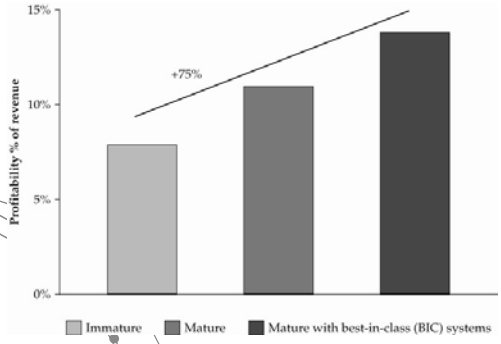

FIGURE 14-3: **Process and systems maturity and financial performance**

14-16

Investing Only in IT Infrastructure Leads to Significant Inefficiencies

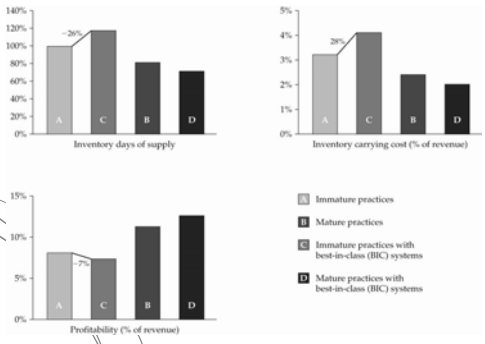

FIGURE 14-4: **Impact of investment in IT infrastructure**

14-17

Priority in IT Investments Depends on Your Objectives

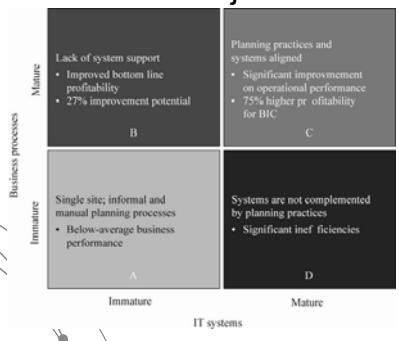

FIGURE 14-5: **Linking processes and systems with operations and financial performance**

14-18

Linking Processes and Systems

- Box A
  - Immature business processes and IT systems.
  - Below average business performance.
- Box B
  - mature business processes and immature systems.
  - Perform significantly better than those who did not invest in either processes or systems, but they leave a lot on the table.
- Box C
  - mature systems and processes.
  - Enjoy significant improvements in operational performance.
- Box D
  - mature IT systems but not processes.
  - Performance even worse than those with immature systems and processes.
  - IT infrastructure typically requires significant investment accompanied by expensive support staff.
  - IT provides only information

14.3 Goals of Supply Chain IT

- Desired goals of IT as they relate to the supply chain management and its unique requirements.
- Some companies and industries are currently far from achieving these goals
- Others are well on their way to accomplishing many of them.

SCM System Goals

- Collect information on each product from production to delivery or purchase point
  - provide complete visibility for all parties involved.
- Access any data in the system from a *single point of contact*.
- Analyze, plan activities, and make trade-offs based on information from the entire supply chain.
- Collaborate with supply chain partners.
  - Allows companies to manage uncertainty

Primary Goal

- Link the point of production seamlessly with the point of delivery or purchase.
- Have an information trail that follows the product's physical trail.
- Allows planning, tracking, and estimating lead times based on real data.
- Any party that has an interest in the whereabouts of the product should be able to have access to this information.

Flow of Information and Goods in the Supply Chain

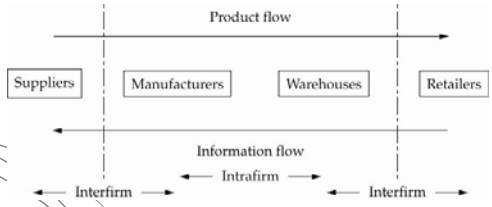

FIGURE 14-6: **Flow of information and goods in the supply chain**

Collect Information

- Information Requirements:
  - Status of retailer's orders
  - Suppliers' need to be able to anticipate an incoming order from the manufacturer.
- Data access requirements:
  - From other companies' information systems
  - Across functions and geographic locations inside a company
  - Data in their own terms
- Alert diverse systems to the implications of this movement
- Requires standardization of product identification (e.g., bar coding) across companies and industries
  - Radio Frequency Identification (RFID) technology an attempt to address this issue

Access Data

- Single-point-of-contact
- All available information accessed in one stop and consistent regardless of:
  - the mode of inquiry used (e.g., phone, fax, Internet, kiosk)
  - who is making the inquiry.
- Information may reside in various locations within one company and across several companies.
- Problem of synchronizing data across multiple systems and making sure data is available real-time

14-25

Current Information Systems

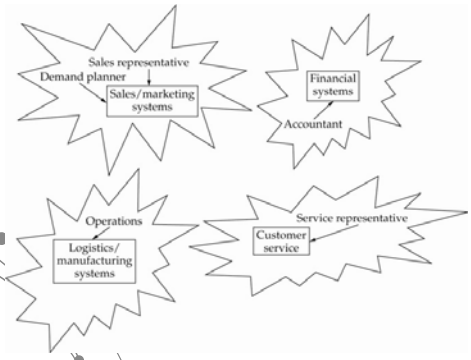

FIGURE 14-7: **Current information systems**

14-26

New Generation of Information Systems

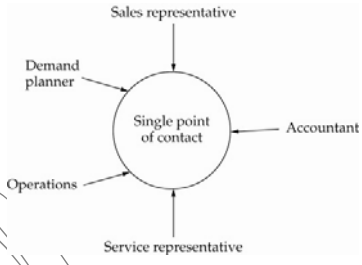

FIGURE 14-8: **New generation of information systems**

14-27

Analysis Based on Supply Chain Data

- Data analysis should take into account the global supply chain picture.
- Information system must be utilized to find the most efficient ways to produce, assemble, warehouse, and distribute products
- Different levels of analysis required (Strategic/Tactical/Operational)
- Systems need to be flexible enough to accommodate changes in supply chain strategies.
- Systems need to be highly configurable and new standards need to be developed.

14-28

Collaborate with Supply Chain Partners

- Ability to collaborate key for most companies
- Sophisticated alignment of IT systems
- Integration of business processes.
- Collaboration among supply chain partners
  - Ability to link and work effectively with suppliers through supplier relationship management (SRM) systems.
  - Collaboration platforms, whether private or public.
  - Customer relationship management (CRM) systems to provide better contact and understanding of customer needs.

14-29

Other Issues

- Four goals of supply chain management
  - Do not all have to be achieved at the same time
  - Not necessarily dependent on each other.
  - Can be targeted in parallel
- Enterprise Resource Planning (ERP) systems
  - Installed in most companies today
  - Cover the first two requirements to a large extent.
  - Common infrastructure throughout the company with role based access to data.
  - Web based portals provide the entry point into the systems

14-30

7-Eleven and the Four SCM Goals

- Collected data item by item, store by store, day by day, for the last decade while other retailers are only collecting point of sale data at best.
- Mobile Operations Terminal, a lightweight wireless tablet with a colorful screen allows access to the item information in the store and allows recording of inventory changes.
- Retail Information System installed in the stores supports the provides timely sales data that enables each store to tailor its product assortment to its customers.
- Supplier collaboration enabled through sharing of 7-Eleven,'s data analysis through a program called 7-Exchange.

14.4 SCM System Components

- ERP systems
  - attempt to resolve, bring all business functions together to make an enterprise more efficient.
  - do not help answer the fundamental questions of what should be made, where, when, and for whom.
- Such decisions made by human planners using various analytical tools such as decision-support systems (DSS).

DSS

- Range from spreadsheets to expert systems
- Appropriate DSS depends on:
  - nature of the problem, the planning horizon, and the type of decisions that need to be made.
- DSS helps in analysis:
  - At various planning levels
  - Exact nature depends on manufacturing characteristics, demand fluctuation, transportation costs, and inventory costs.

Data Analysis Techniques in DSS

- **Queries**
  - Vast quantities of data make manual analysis difficult.
  - Decisions often facilitated by simply asking specific questions about the data
- **Statistical analysis**
  - Used to determine trends and patterns in the data

Data Analysis Techniques in DSS

- **Data mining**
  - With larger corporate databases
  - New tools to look for "hidden" patterns, trends, and relationships in the data.
- **On-line analytical processing (OLAP) tools**
  - An intuitive way to view corporate data, typically stored in data warehouses.
  - Aggregates data along common business dimensions
  - Let users navigate through the hierarchies and dimensions by drilling down, up, or across levels.
  - Also provide sophisticated statistical tools to analyze these data and tools to present them.

DSS Interfaces

- Display and report based on the specific problem being solved.
- Uses analytical tools that have some specific embedded knowledge of the problem being solved.

DSS Interfaces Example

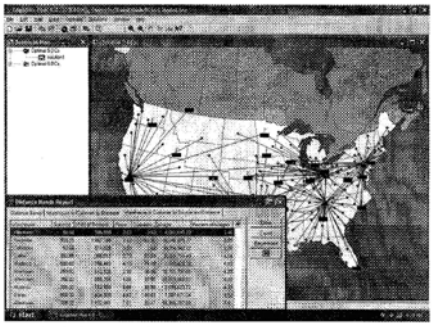

FIGURE 14-9: **A typical GIS interface for supply chain management**

Analytics Used in DSS

- **Calculators**
  - Simple decision-support tools that facilitate specialized calculations such as accounting costs.
- **Simulation**
  - Incorporates random components.
  - Create a model of the process on a computer.
  - Specify each of the random elements of the model with a probability distribution.
  - Run the model to study effects

Analytics Used in DSS Artificial Intelligence (AI)

- Systems that exhibit intelligence by incorporating some form of learning.
- Concept of **agents**
  - A software process
  - Communicate and interact with other agents,
- *Expert systems* are a type of AI system
  - Capture an expert's knowledge in a database and use it to solve problems.
  - Relies on an extensive database of knowledge, usually expressed as a set of rules.
  - Not extensively used in logistics practice

Analytics Used in DSS Mathematical Algorithms

- Can be applied to the data to determine potential solutions to problems
- **Exact algorithms**
  - **Fi**nds a solution that is mathematically the "best possible solution" or optimal solution.
  - May take a long time to run, especially if a problem is complex.
  - Input data to these algorithms are often approximated or aggregated
  - **Exact solutions to approximate problems may be worth no more than approximate solutions to approximate problems**
- **Heuristics**
  - Provide good, but not necessarily optimal, solutions to problems.
  - Typically run much faster
  - Most DSSs employ heuristics when using mathematical algorithms.
  - Quality of a good heuristic defined by how rapidly it can give a solution that is very close to the optimal solution

Appropriateness of Different Tools

- Typically a hybrid of different tools used
- Factors to consider:
  - The type of problem being considered.
  - The required accuracy of the solution
  - Problem complexity
  - The number and type of quantifiable output measures.
  - The required speed of the DSS
  - The number of objectives or goals of the decision maker

Applications and Analytical Tools

Problem	Tools used
Marketing	Query, statistics, data mining
Routing	Heuristics, exact algorithms
Production scheduling	Simulation, heuristics, dispatch rules
Logistics network configuration	Simulation, heuristics, exact algorithms
Mode selection	Heuristics, exact algorithms

Capabilities for Supply Chain Excellence

FIGURE 14-10: **Capabilities required to achieve supply chain excellence**

IT Capabilities Strategic Network Design

- Pick the optimal number, location, and size of warehouses and/or plants
- Determine optimal sourcing strategy
- Determine the best distribution channels
- Objective: minimize total costs, including sourcing, production, transportation, warehousing, and inventory, by identifying the optimal trade-offs between the number of facilities and service levels.
- Planning horizon typically a few months to a few years
- Uses aggregated data and long-term forecasts.

IT Capabilities Tactical Planning

- Determines resource allocation over shorter planning periods such as weeks or months
- **Supply chain master planning**
  - Coordinates production, distribution strategies, and storage requirements
  - Efficiently allocates supply chain resources to maximize profit or minimize system-wide cost.
- **Inventory planning**
  - Determines the optimal amount of safety stock
  - How to best position inventory in the supply chain.

IT Capabilities Operational Planning

- Enables efficiencies in procurement, production, distribution, inventory, and transportation for short-term planning.
- Planning horizon typically daily to weekly
- Systems focused on generating feasible strategies, not optimized solutions

Four Components of Operational Planning

- *Demand planning*
  - Generates demand forecasts based on various historical and other pertinent information.
  - Statistical analysis and forecasting methods
- *Production scheduling*
  - Generates detailed production schedules based on the supply chain master plan or demand forecasts.
  - Constraint-based feasibility analysis that satisfies all production constraints.
- *Inventory management*
  - Generates inventory plans for the various facilities in the supply chain
  - Statistical and computational methods.
- *Transportation planning*
  - Produces transportation routes and schedules
  - Fleet planning, transportation mode selection, routing, distribution planning.

IT Capabilities Operational Execution

- Provide the data, transaction processing, user access, and infrastructure for running a company.
- Tend to be real-time in the sense that the data are current and are constantly being updated by users and events.

Five Components of Operational Execution

- Enterprise resource planning
- Customer relationship management
- Supplier relationship management
- Supply chain management systems
- Transportation systems

14-49

Other Factors

- **Planning horizons different for various capabilities**
- **Return on investment different for various system**
  - High for strategic systems
  - Much smaller gain for operational planning and execution
- **Implementation complexity different**
  - Low for strategic network design is not high
    - Tools and processes not integrates with other systems or processes.
    - Does not require real-time updates
  - High for operational systems
    - Integrate and require real-time data
    - Extensive training.

14-50

14.5 Sales and Operations Planning (S&OP)

- Business process that continuously balances supply and demand.
- Cross-functional integrating sales, marketing, new product launch, manufacturing and distribution into a single plan
- Typically involves analysis of aggregated volume such as product families.
- Most companies use some demand planning software and spreadsheet analysis of data collected from various ERP, CRM and manufacturing systems.

14-51

S&OP Implementations

- Achieving S&OP process success is quite challenging.
- Process does not include optimization, inventory considerations, what-if capabilities
- Data complexity and too many options to analyze in a spreadsheet results in a need to create a repeatable and visible process that is integrated with ERP systems.

14-52

Advanced S&OP Process

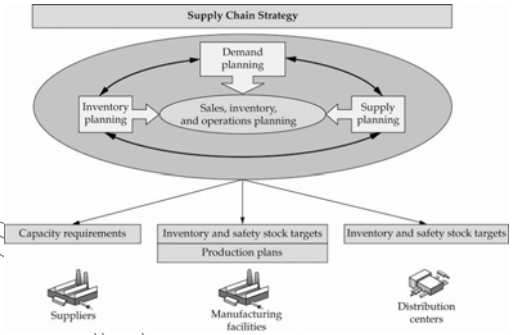

FIGURE 14-11: **Advanced S&OP process**

14-53

Features in the New Process

- Aided by new technology platforms
  - Allows easier integration of data
- Ability to optimize and not focus solely on the forecast.
- Integration of different activities into the S&OP process

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14.6 Integrating Supply Chain IT

- Systems are complex
- Companies may think it is not cost effective to implement some of the systems
- Implementing ERP systems
  - Internal processes have to be converted
  - Follow some industry conventions
- No single standard has emerged as yet
- Therefore, companies need to decide:
  - What are the priorities in implementation?
  - What should a company invest in first?

14-55

Implementation of ERP and DSS

Implementation issue	ERP	DSS
Length	18-48 months	6-12 months
Value	Operational	Strategic, tactical, operational operational
ROI	2-5 year payback	1-year payback
Users	All end users	Small group
Training	Simple	Complex

14-56

Implementation Issues

- Companies must first install ERP so that data is available
- However companies can start installing DSS before/in-parallel with ERP as data is already available in legacy systems
  - DSS projects take much lesser time
  - DSS projects have a higher ROI
- Type of DSS implemented and benefits achieved depends on the industry

14-57

Priorities when Implementing DSS

Industry	DSS
Soft drink distributor	Network and transportation
Computer manufacturer	Demand and manufacturing
Consumer products	Demand and distribution
Apparel	Demand, capacity, and distribution

14-58

"Best of Breed" vs Single Vendor Solution

- Single Vendor
  - Purchase ERP and supply chain DSS as a total solution from one vendor
- Best of Breed
  - Purchase the best-fit solution in each category from a different vendor,
  - System better fits each function in the company.
  - More complex and takes longer to implement
  - Provides greater long-term flexibility
  - Better overall solutions to the company's problems.

14-59

Proprietary Systems Development

- Makes sense for extremely large companies
- Already existing expert IT departments and systems that already serve the company well.
- Latest technologies provide easier business oriented development and integration
  - May be a push back towards more internal or software integrator development

14-60

Issues with the Various Options

Implementation issue	Best of breed	Single vendor	Proprietary
Length	2–4 years	12–24 months	Not known
Cost	Higher	Lower	Depends on expertise
Flexibility	Higher	Lower	Highest
Complexity	Higher	Lower	Highest
Quality of solution	Higher	Lower	Not sure
Fit to enterprise	Higher	Lower	Highest
Staff training	Longer	Shorter	Shortest

14-61

SUMMARY

- **Four major goals for IT**
  - Information availability on each product from production to delivery point.
  - Single point of contact.
  - Decision making based on total supply chain information.
  - Collaboration with supply chain partners.

14-62

What Is the Impact of Achieving These Goals on the Logistics Manager?

- Standardization brings about cheaper and easier methods to implement the basic infrastructure.
- Data display and access more integrated in systems that do not require any specialized knowledge.
- Various systems interact in a way that will blur the current boundaries
  - SOA will allow easier integration
  - Disparate systems will become better integrated
  - Likely proliferation of applications that can plug into a company's enterprise system
- E-commerce is changing the way we work, interact, and do business.
  - Provides an interface to businesses and government that allows meaningful data comparison
  - Data access possible
  - Extends access throughout the supply chain

14-63

Quote from Lou Gerstner, Former CEO of IBM

"The payoff from information technology is going to be in making transactions and processes more effective and efficient, so it's not about creating a new economy, it's not about creating new models of behavior or new models of industry. It's about taking a tool, a powerful tool, and saying, "How can I make my supply chain more effective and efficient, how can I make my purchasing process more efficient, how can I make my internal employee communications more effective and efficient, how can I as a government deliver services to constituents more efficiently and more effectively?"

14-64