CSCP CERTIFIED SUPPLY CHAIN PROFESSIONAL

MODULE 2: GLOBAL SUPPLY CHAIN NETWORKS

SECTION A:
SUPPLY CHAIN DESIGN AND OPTIMIZATION

APICS

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Section A Introduction

Section A Key Processes:

- Define and manage the supply chain network.
  - Design the supply chain network.
    - Determine business requirements, IT strategy, and cyber security.

Section A Topics:

- Supply Chain Design and Management
- Business and IT Requirements
- Technology Analysis and Optimization

Supply Chain Design: Technology Decisions

- Visibility and velocity enabler
- Theory of constraints also true for IT
- How often data is transferred and analyzed
- Support needs of the infrastructure, internet, and e-commerce
- Competitive strategy with IT and decision support systems

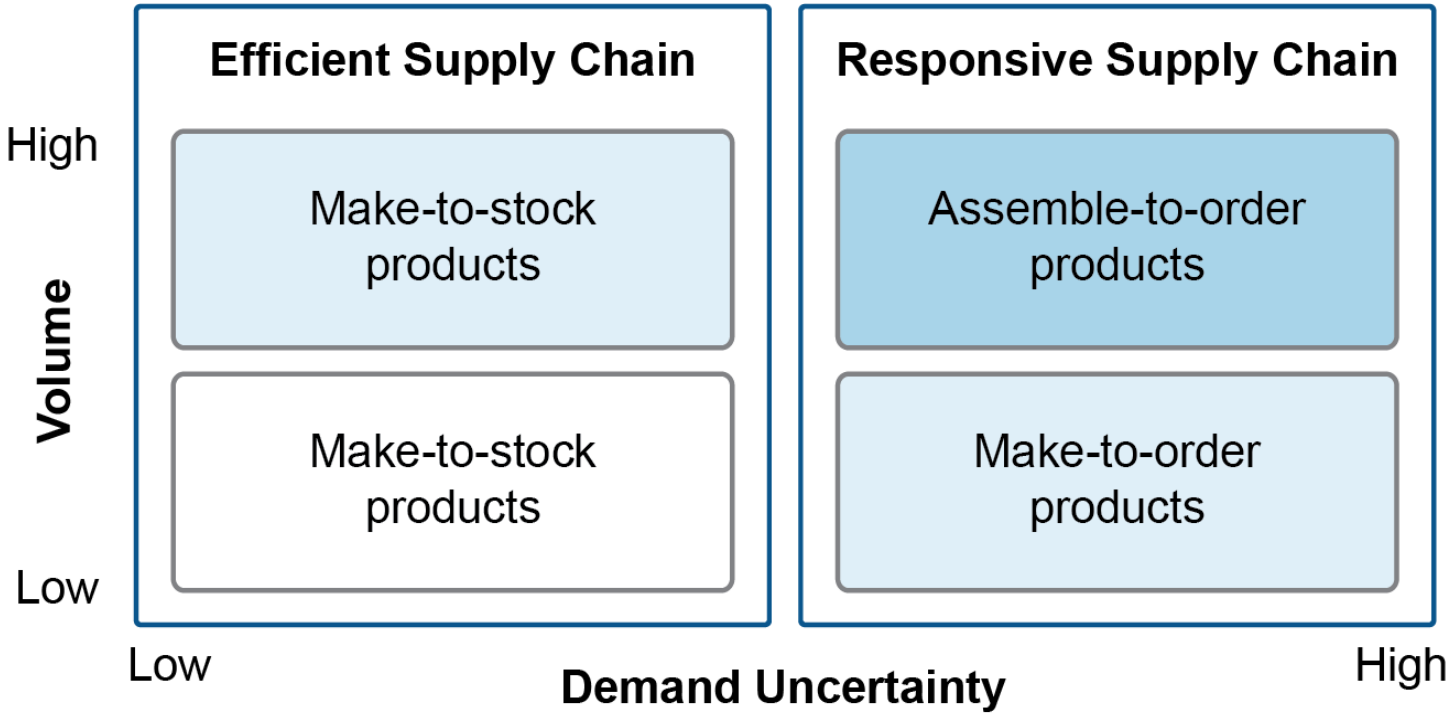
Network Configuration

- Number, location, and capacity of warehouses
- Location of plants and production levels per product
- Transportation (plant to warehouse, warehouse to retailer)
- Country-specific infrastructure assessment
- Inventory location and levels
  - Optimal levels of right kinds of inventory
  - Lowest inventory that meets customer service goals

Efficiency with Responsiveness, plus Resilience

Efficient Supply Chain	Resilient Supply Chain	Responsive Supply Chain
▪ Least-cost manufacturing/supply chain ▪ Relatively stable demand ▪ Reasonably accurate forecasts ▪ Make-to-stock strategy	▪ Enhance fit of supply chain to product ▪ Agile, adaptable, and aligned to other supply chain participants ▪ Ability “to anticipate, create plans to avoid or mitigate, and/or to recover from disruptions…”	▪ Flexible in response to changing demand ▪ More volatile demand ▪ Uncertain forecasts ▪ Make-to-order or assemble-to-order strategy

Fit Supply Chain Type to Product



Supply Chain IT Requirements and Benefits

Efficient transfer of secure information

Massive data flow over internet

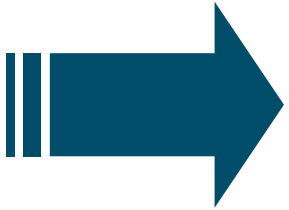
Gather, integrate, report data

Replace push with pull

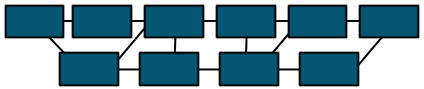
Strategic/tactical capabilities

Data entered only once

Remove “friction”



Throughout the extended supply chain



SC velocity, agility, scalability

Cost-effective global visibility

Avoid the bullwhip effect

Lean, cost-effective SCs

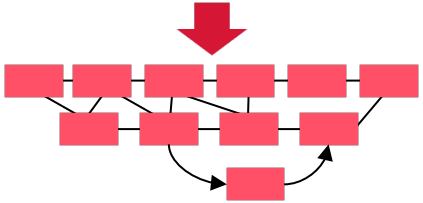
Share knowledge with SC

Data accuracy and straight-through processing

New relationships

Sharing Information Helps Build Trust

- Real-time information



- Ad hoc links in the extended supply chain increase adaptability.

Sharing information builds trust and allows coordinated planning between partners.

Supply Chain IT Cost-Benefit Analysis

- Not a computer project; a business decision.
- Recipient, not IT, develops business case.
- Strategic IT investments should
  - Pay back in cost savings
  - Increase market share
  - Innovate product/service
  - Make company more adaptive to change
  - Match company's goals.
- Technology audits for justifications and pre- and post-implementation reviews.
  - Audience is upper management.

Benefits and Costs

Benefits		Costs
Tangible	Intangible	
• Lower maintenance costs • Faster implementation • Increased sales volume • Improved scheduling • Greater financial returns • Lower overhead • Reduced cash-to-cash cycle	• Customer retention • Customer service • Order status visibility • Workforce redeployment • Employee satisfaction and efficiency	• Hardware/software • Maintenance fees • Capital expenditures • Opportunity costs • Staff/consultant time • Configuration and customization

Benefit-Cost Analysis and ROI

- $\text{Benefit–Cost Analysis} = \dfrac{\text{Total Benefits}}{\text{Total Costs}}$

$$= \frac{\text{US\$345,000}}{\text{US\$259,000}} = 1.33$$

- $\text{Return on Investment} = \dfrac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}}$

$$= \frac{\text{US\$345,000} - \text{US\$259,000}}{\text{US\$259,000}} = 0.33 = 33\%$$

Technology Analysis and Optimization

Stages of Supply Chain Network Technology Optimization

	1: Multiple Dysfunction	2: Semi-Functional Enterprise	3: Integrated Enterprise	4: Extended Enterprise	5: Orchestrated SC
Internet	Static websites	Online catalogs	Intranets across all functions	E-commerce	Responsive; cybersecurity
Integration	None; no teamwork	Batch	Internal process integration; teams	SC networks; process integration	Closed gaps; automation, visibility
SC planning	Little information exchange	Informal; no initiative coordination	Formal/global; enhanced logistics	Integrated global planning; SC vs. SC. competition	Data driven analytics; cross-functional teams
Production scheduling	Basic MRP	Closed-loop MRP	MRP—ERP	Externally integrated ERP	Automated demand data
Integration with suppliers	Fax/phone	EDI; seek low price	EDI with all large suppliers	VMI, online RFQ	Category strategies drive integration
Customer delivery	Research	Local inventory	ATP	CTP	Automated delivery quotes

Supply Chain Network Optimization Strategy

1. Determine goals and desired end state of SC.

2. Create cross-functional/cross-business teams.

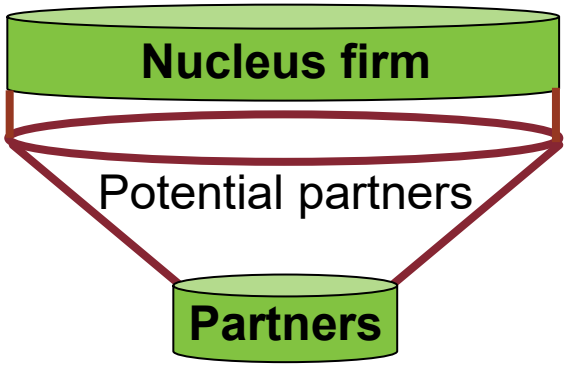
3. Organize SC's operational processes and IT's mission.

4. Design in change management and training with stringent timetables.

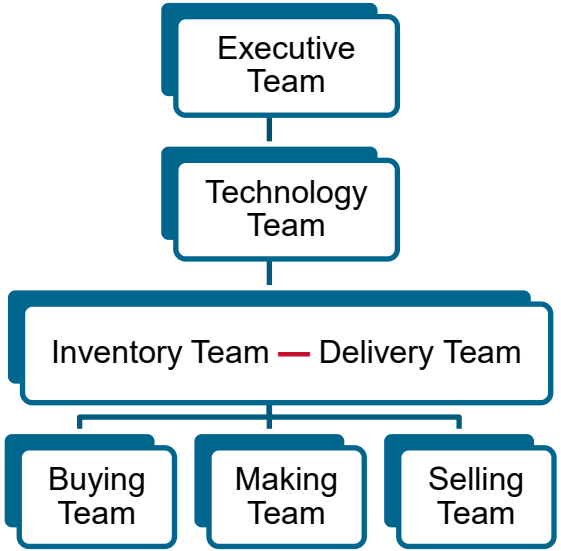
5. Create conceptual model.

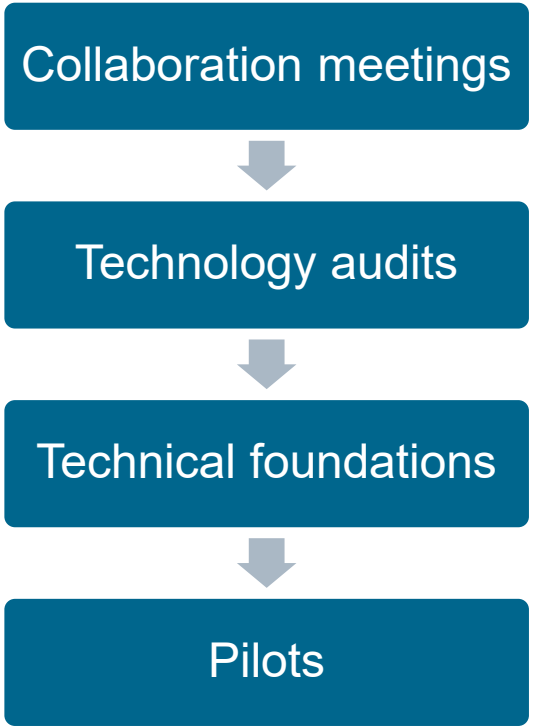
6. Establish technical infrastructure.

Role of Nucleus Firm/Cross-Functional Teams



Teams





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SECTION B: END-TO-END CONNECTIVITY AND VISIBILITY

APICS

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Section B Introduction

Section B Key Processes:

- Design/manage end-to-end SC connectivity/visibility.
  - Supply chain technology
  - Data, status, document share
  - Legal requirements
- Master data: customer, supplier, item, engineering, and logistics
  - Create, update, cleanse, retire

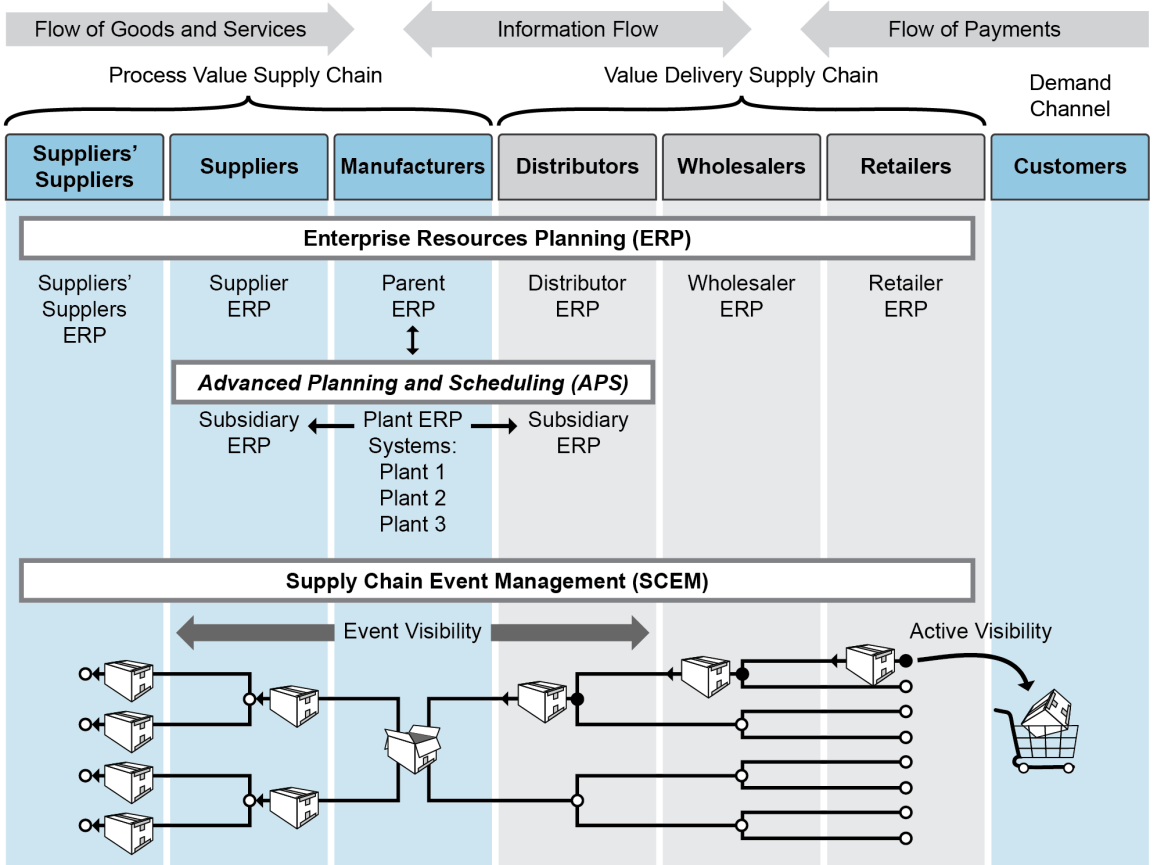
Section B Topics:

- Supply Chain Technology Applications
- Connectivity, Visibility/Sharing, and Legal
- Supply Chain Master Data

Supply Chain Technology Applications

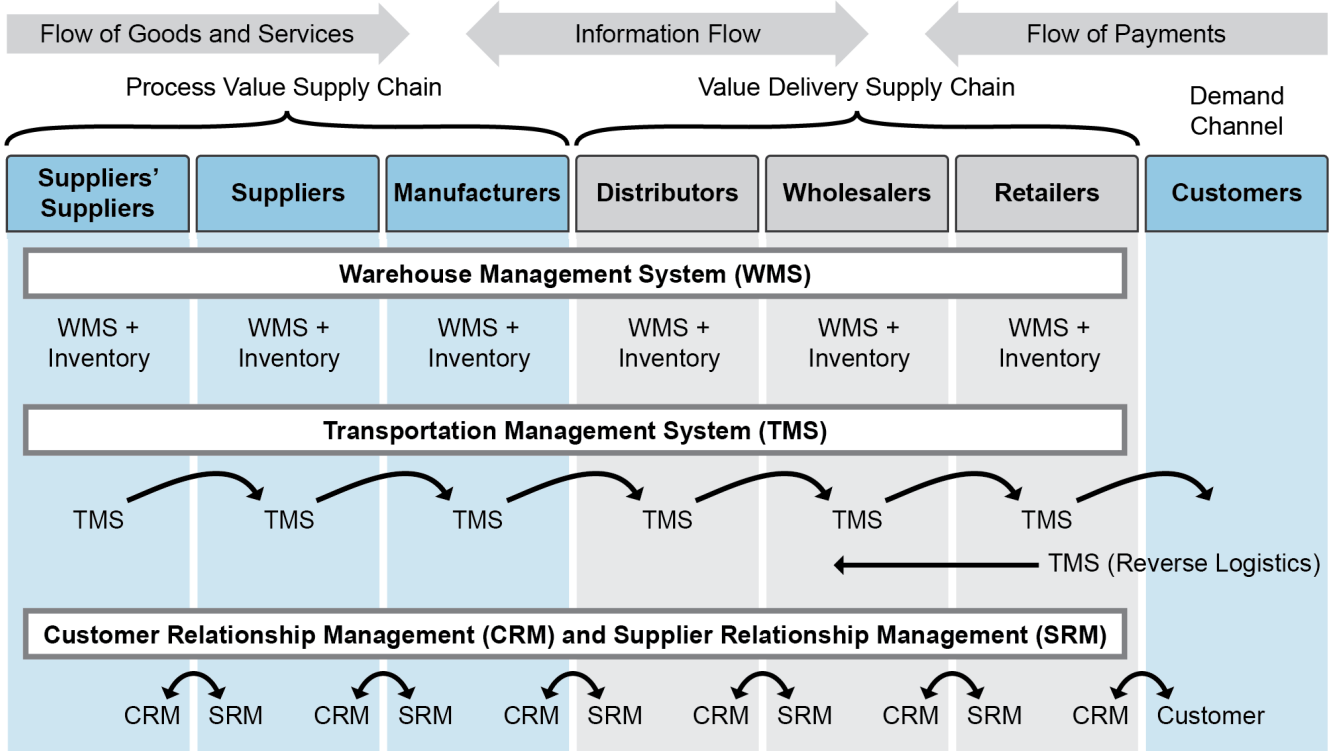
Comprehensive SC Management System

- Process value chain
- Value delivery chain
- Demand channel



Supply Chain Technology Applications

Comprehensive SC Management System (continued)



Enterprise Resource Planning (ERP)

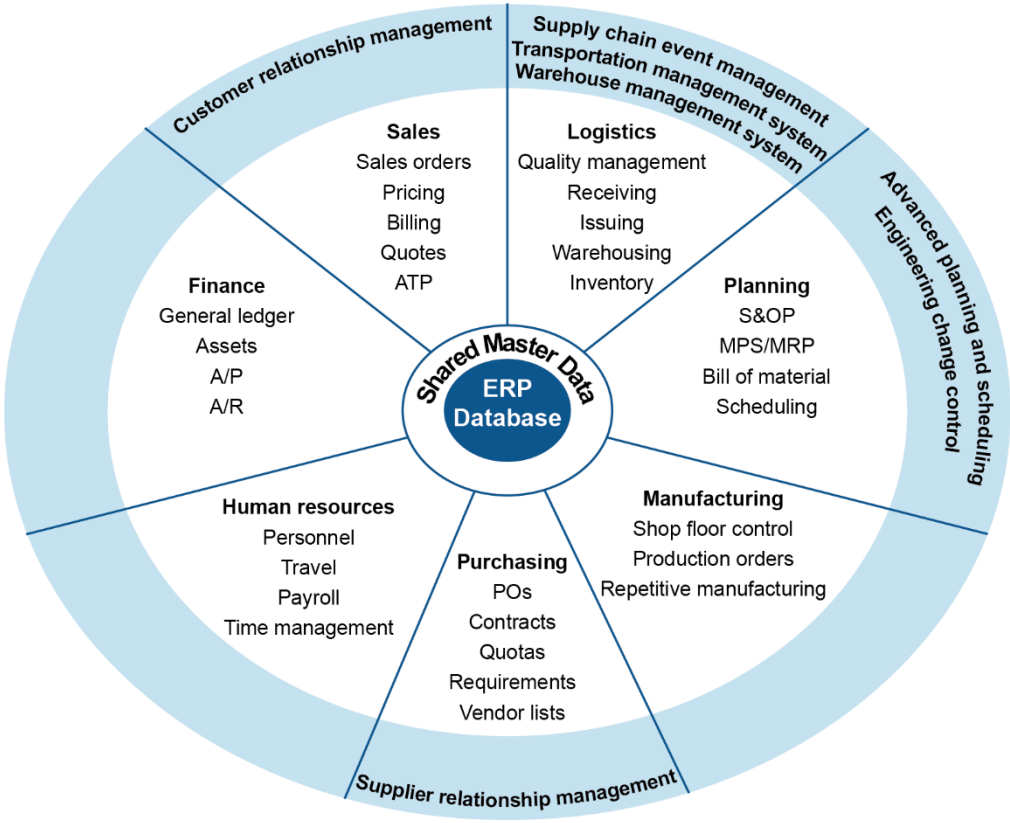
"Framework for organizing, defining, and standardizing the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage." (*ASCM Supply Chain Dictionary*)

- Modularized suite
- Automated interactions
- Common data source
- Challenge: linking supply chain partner ERP systems
- Need vision and direction for visibility and efficiency

Supply Chain Technology Applications

ERP System Functionality

- Central database creates shared master data.
- Modular suite



ERP System Evolution

Older ERP systems

Implicit business models (former best practices)

Begin with the end in mind.

Get full executive support.

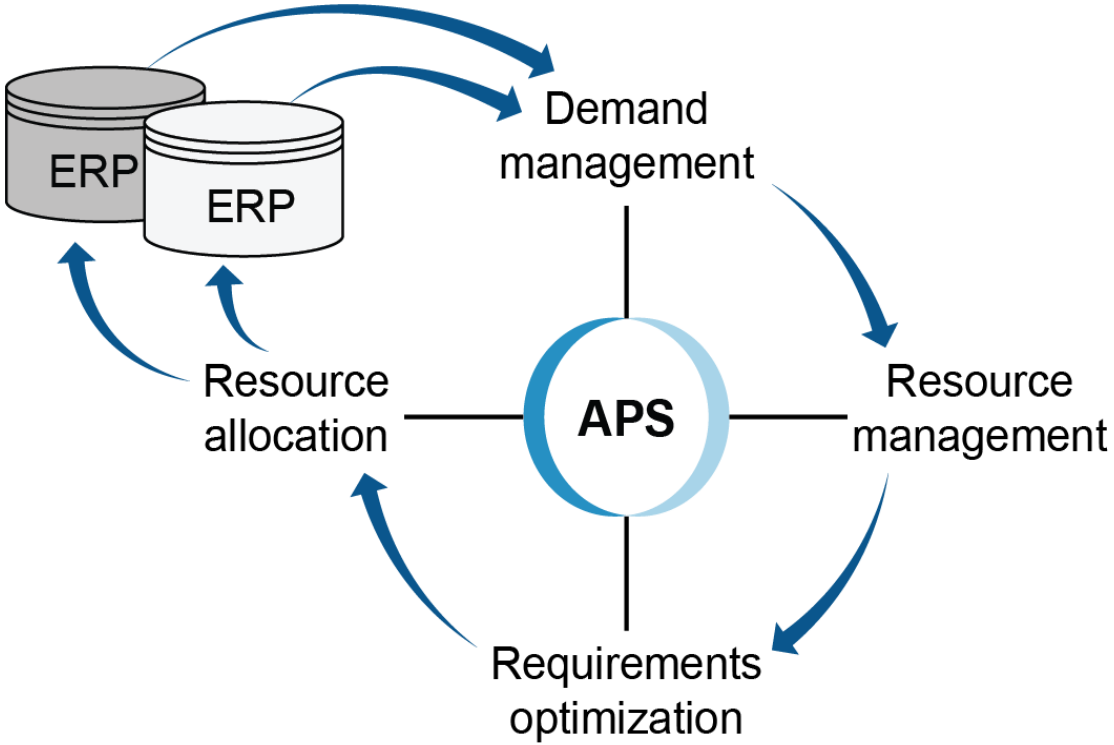
ERP versus Best-of-Breed Systems

ERP Systems	Best-of-Breed Systems
▪ Simpler, better integration ▪ Leveraged data ownership ▪ Shorter training ▪ Fewer vendors ▪ Support contracts ▪ Often lower total cost of ownership ▪ Vast resources and staff	▪ Faster innovations ▪ Industry expertise ▪ Niche applications ▪ Functional area expertise (e.g., warehousing)

Upgrades, New Releases, New Modules

- Useful new upgrades, ERP releases, and modules:
  - Support an organization's top strategic issues
  - Have better open architecture
  - Provide speed and lower cost of future upgrades
  - Ease supply chain communications
  - Have better business information/metadata
  - Provide faster learning curve
  - Fully integrate currently disjointed systems
  - Are less expensive than increasing cost of old version.
- New system should match ≥ 80% functionality goals.
  - Customize only remaining 20% (or less), configuration for rest.

Advanced Planning and Scheduling (APS)

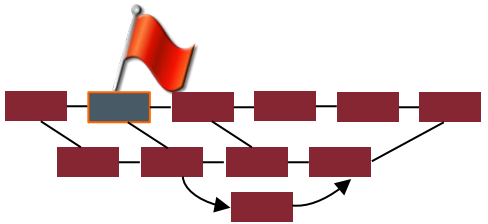


Supply Chain Event Management (SCEM)

- Flags SC events to trigger alerts or actions in other applications
- Monitors SC business processes
- Exception reporting to business intelligence software

Active visibility:

- Monitor
- Measure
- Notify
- Simulate
- Control



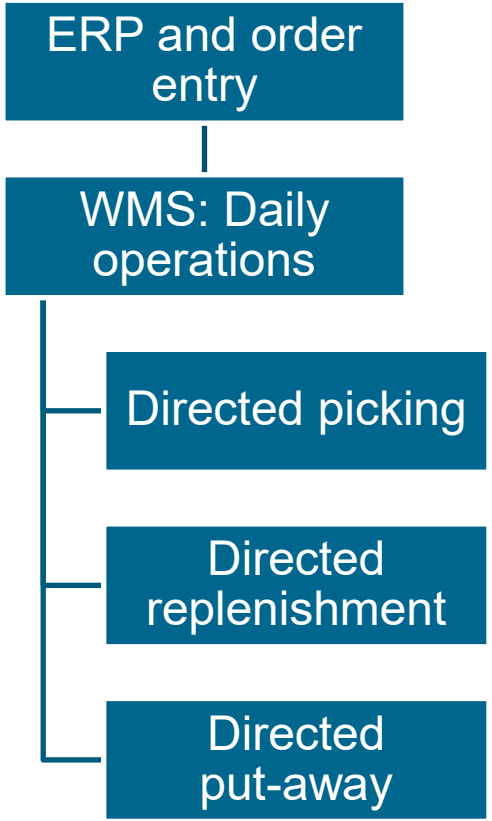
SCEM Benefits

- Faster response to supply/demand change
- Exception notices on portable devices
- Earlier marketing/sales demand reaction, better forecast
- Improved order accuracy, tracking, and cycle time
- Less management time on shipping/receiving
- Reduced inventories and total SC costs
- Greater labor efficiency and productivity
- Decentralized collaboration
- Increased customer responsiveness, fewer returns
- Real-time communications with ad hoc partners

Supply Chain Technology Applications

WMS Functions

- Receiving
- Storage location management and optimization
- Cross-docking
- Inventory control
- Quality control
- Order selection and task management
- Automated replenishment
- Shipping
- Security
- Returns



WMS Interfaces and Benefits

WMS Interfaces or Portals

- Web-based interfaces/portals.
- Visibility and control:
  - Push and/or pull data and inventory.
- Enables merge-in-transit, cross-company warehousing, etc.

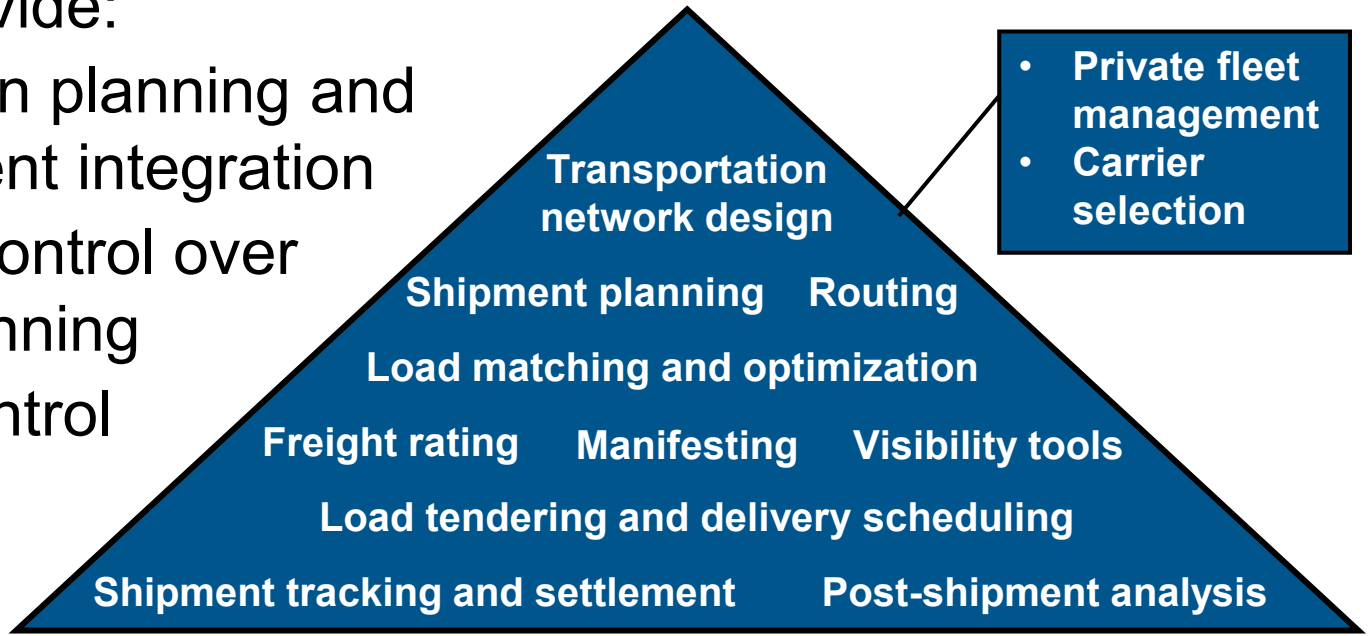
Benefits of WMS

- More productivity, fewer errors
- Competitive (e.g., cross-dock)
- Retail/international handling
- Automated put-away and pick accuracy
- Capacity and distribution efficiency (e.g., pallet discounts)
- Reduced cycle/safety stocks
- Optimized space

TMS Functions

TMS must provide:

- Transportation planning and order fulfillment integration
- Centralized control over shipment planning
- Execution control
- Visibility
- Automation.



Supply Chain Technology Applications

TMS Features

Web-Based Dynamic Updates

- Shipment costs
- Fuel costs
- Maps and routes
- Road conditions
- Traffic
- Weather
- Carrier availability

Global Track/Trace

- Cellular GPS
- AIDC (RFID)
- Bills of lading
- Shipping labels
- SKU information
- Waybills
- Driver performance

Shipper and Carrier Collaboration

- Load planning
- Cost optimization
- Shipment consolidation

Transportation Marketplaces

- E.g., Ace Hardware used its SaaS network to send an RFI to almost 500 carriers, reducing transportation costs by 4%

Benefits of TMS

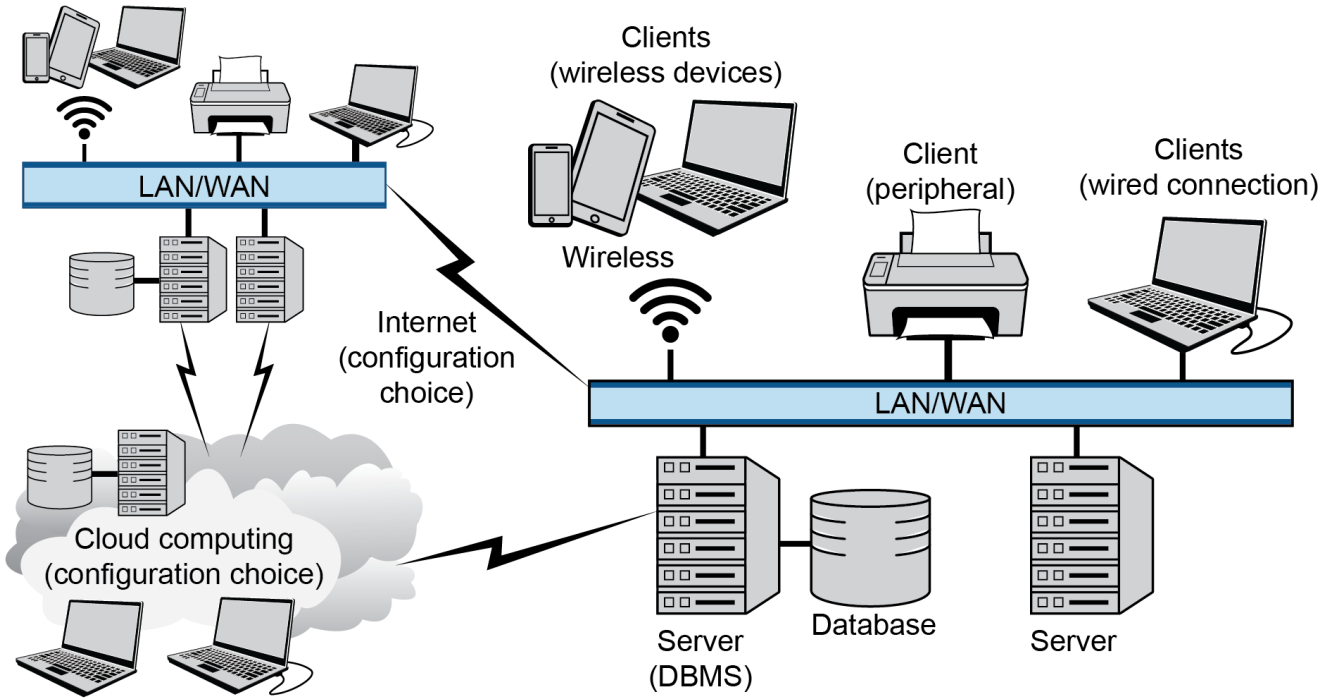
- Lower costs (less deadheading, demurrage, dwell time)
- Collaborative use of shipping
  - Linked communications
  - Aggregated volumes
  - Capacity procurement
  - Web-based visibility of information and planning
  - Distributed data access to reduce bottlenecks
- Centralized operations that lower support costs
- Real-time, accurate costs (faster, better decisions)

Information System Architecture Considerations

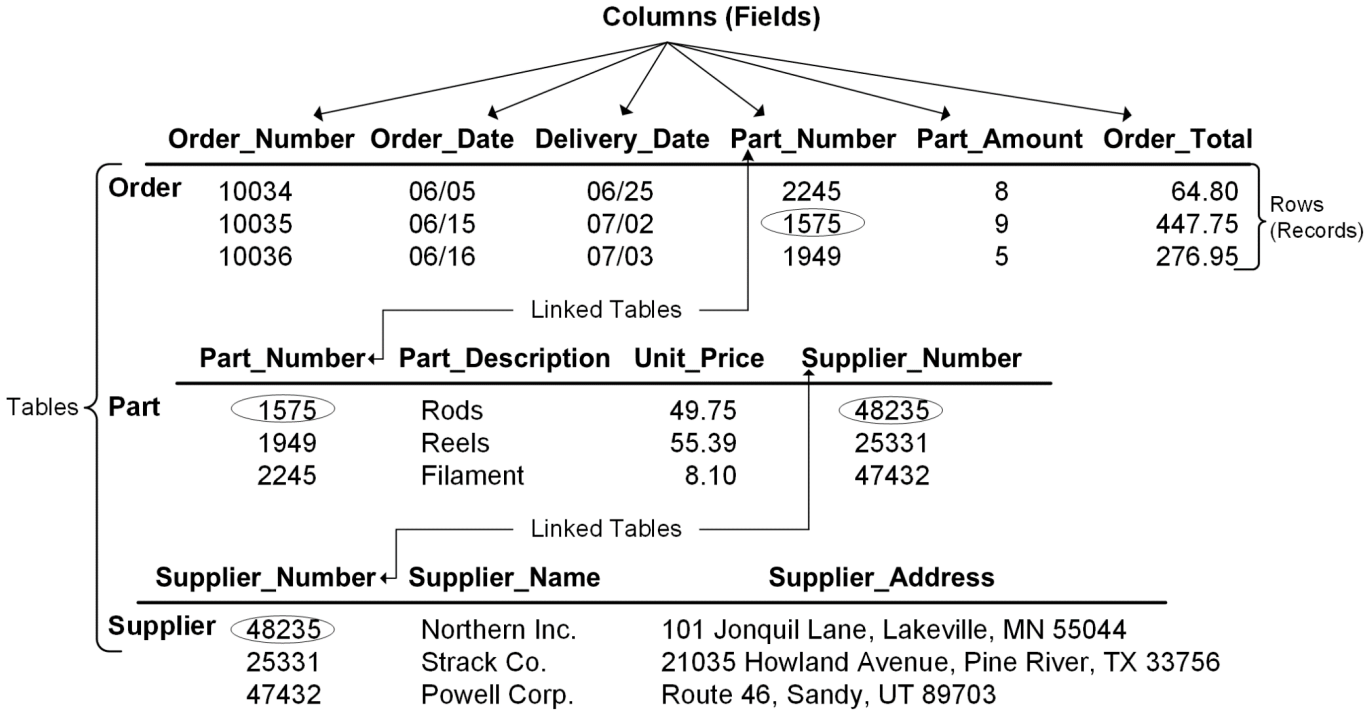
The architecture of the information system should be aligned with and match the architecture of the organization.

1. Organizational functions
2. Communication of coordination requirements
3. Data modeling needs
4. Management and control structures

Database, Networks, Software, Configuration



Databases and Database Management



Software as a Service (SaaS)

Basic Criteria	User Advantages	Vendor Advantages
▪ Vendor ▪ Logic and data stored in central location ▪ End-user access to data and software, run and used over the internet	▪ Lower initial costs ▪ Immediate use ▪ Smaller storage requirements ▪ Fewer personnel	▪ Continuous income ▪ Single version ▪ Reduced software piracy and unlicensed use

Cloud Computing

- The “cloud” is a network of data centers enabling computing resources to be accessed and shared as virtual resources.
- Secure and scalable.
- Can interface with ERP or cloud-only ERP exists.
- IaaS: Infrastructure
  - PaaS: Platform
    - SaaS: Software
- Hybrid solutions most common.
- ISO/IEC 17788:2014

Organizational and Information System Architecture

Organizational Strategy	Information Strategy
▪ Align strategies at organizational and extended supply chain levels. ▪ Translate organizational strategy into commitments to treat information as strategic investment.	▪ Set guiding principles, priorities, and common goals for network design. ▪ Envision high-level end-to-end IS structure for firm/SC. ▪ Do gap analysis.

Organizational and Information System Architecture

Information Content Definition

- What data to collect and how to gather, keep accurate, store, access, control, and analyze
- Business modeling for SC

Information Policies and Controls

- IS design, daily operations, and improvement policies
- Governance and audit
- SC communications and security

Organizational and Information System Architecture

Information Infrastructure Design

- Policies and controls translated into cohesive and cost-effective system
- Detailed decisions

Databases, Networks, Software, and Configuration

- Use of existing, adding, or upgrading
- Vendor search and selection
- Critical DBMS decisions

Organizational and Information System Architecture

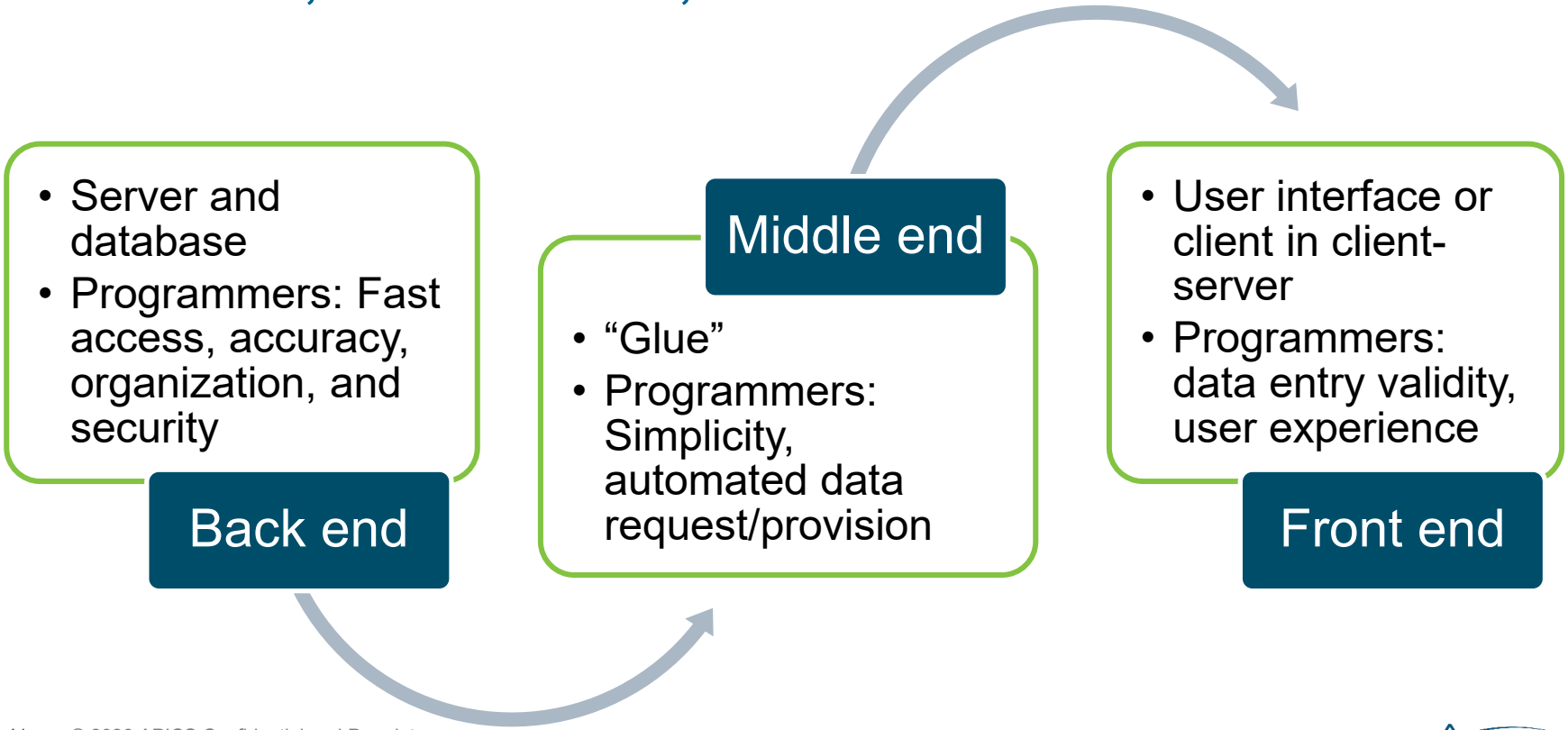
Information Infrastructure Change

- Continual system change and improvement

Action Plan, Schedule, and Prioritization

- Regular strategy, tactical update, and operational gap analyses → IT action plans

Front End, Middle End, and Back End



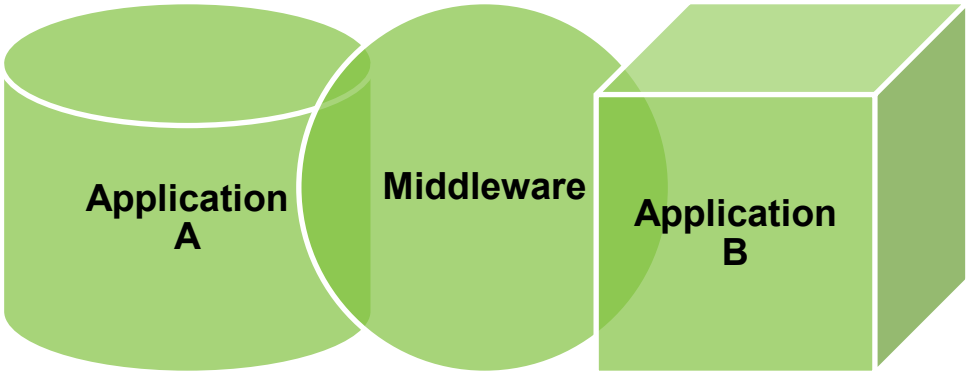
Middleware

- Sits in the “middle” between two applications (internal or external)
- Why care about middleware?
  - Helps integrate SC
  - Enables partners to share information
  - Avoids duplicate or inconsistent data
  - Breaks down organizational silos
  - Secure transactions
    - Authentication
    - Authorization

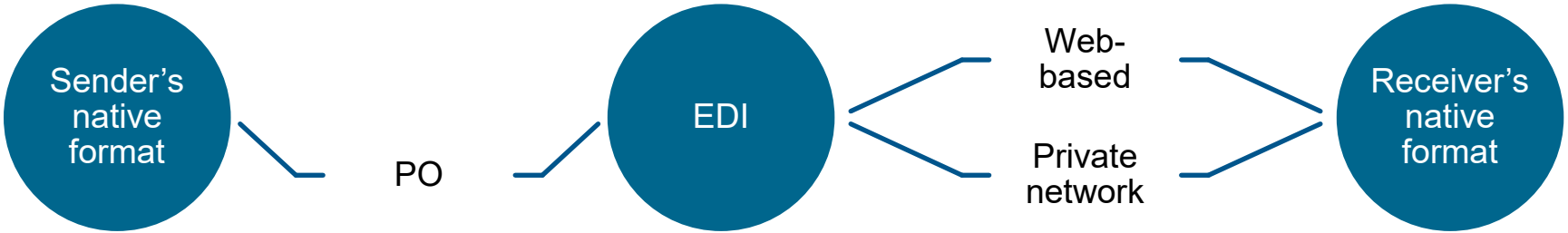
Content-level middleware: EDT and EDI

Data-oriented: custom linkages

Process-oriented (business process management [BPM])



Content-Level Middleware: EDT and EDI



- Electronic data transfer (EDT) is synonym; electronic data interchange (EDI) is standardized version.
- Electronic version of document, e.g., purchase order, ASN, or invoice.
- Batch-processed.
- Parties must agree on EDI data format.

Application Programming Interfaces (APIs)

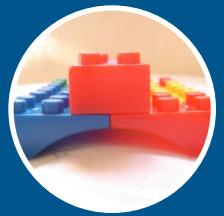
- Middle end code residing nearer to front end than middleware
- Simple one-to-one interactions (not multiple systems at once)
- Other devices can query the database automatically and frequently.
- Lightweight, developer friendly, platform independent, scalable code.
- Software architecture: Web services
  - Interchangeable “building blocks.”
  - Open standards.
  - For example, airline flight check-in:
    - Get best available database search engine and best seat assignment applications from different vendors.
    - Develop own pricing application but all works together.

Application Programming Interface Types

Service-Oriented Architecture (SOA)

Modular design

(a service)



Loose coupling of applications

(easy re-configure)

Universal functionality

(all data for processing)

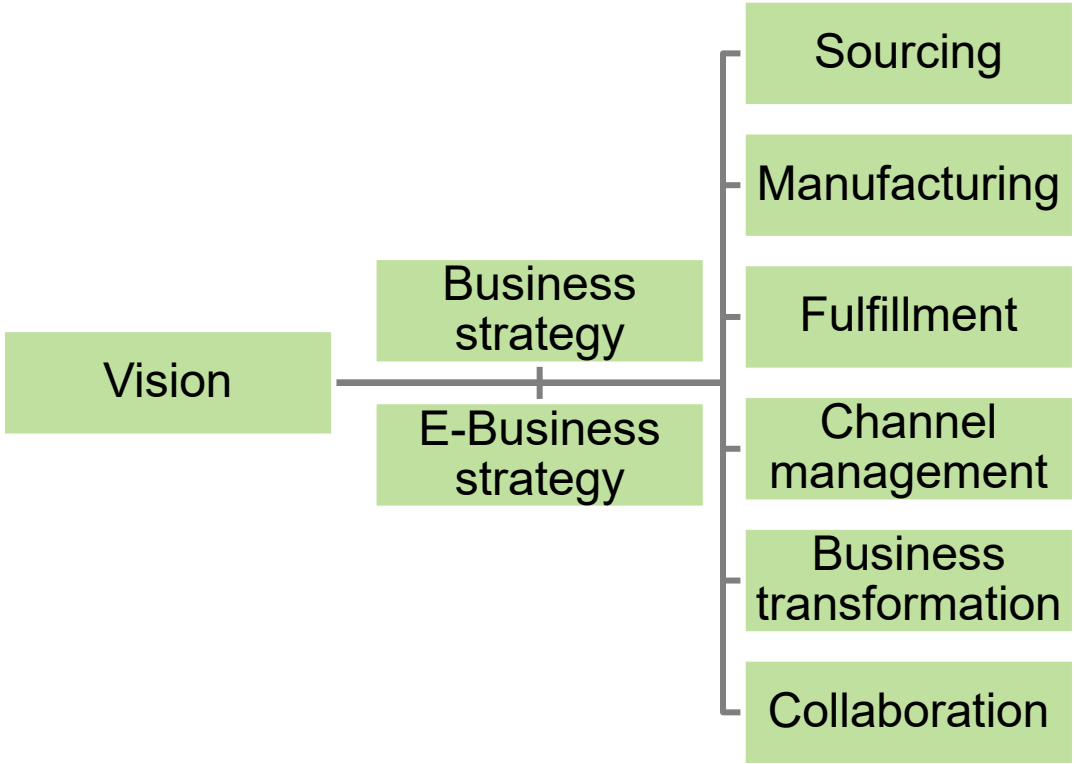
Microservices

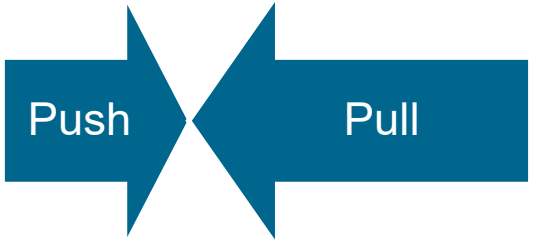
- Cloud native
- Loose coupling within an application
- Publish/subscribe messaging

Traditional vs. Electronic Business Supply Chain

Characteristic	Traditional Supply Chain	Electronic Business Supply Chain
Ownership	Own vertical SC through mergers	Own core capabilities in virtual SC
Competitive advantage	High market share/assets dominate	Agile firms with few assets dominate
Nucleus firm	Retailer/manufacturing (industrial)	Brand equity or greatest efficiency
Trading	Best deal at expense of other	Share risks and rewards
Competitors	No competitor interaction	Interact if mutual gain can be found
Production	Economies of scale and scope	Engineering competitive SC
Collaboration	Internal silos/costly networking	Partner silos/open networking
Suppliers	Limited by buyer relations (phone)	Marketplaces and partner integration
Customer service	Reactive, with little feedback used	Proactive with better use of feedback
Intermediaries	Fixed, vertically integrated	Avoid some unless they add value

E-Business Considerations

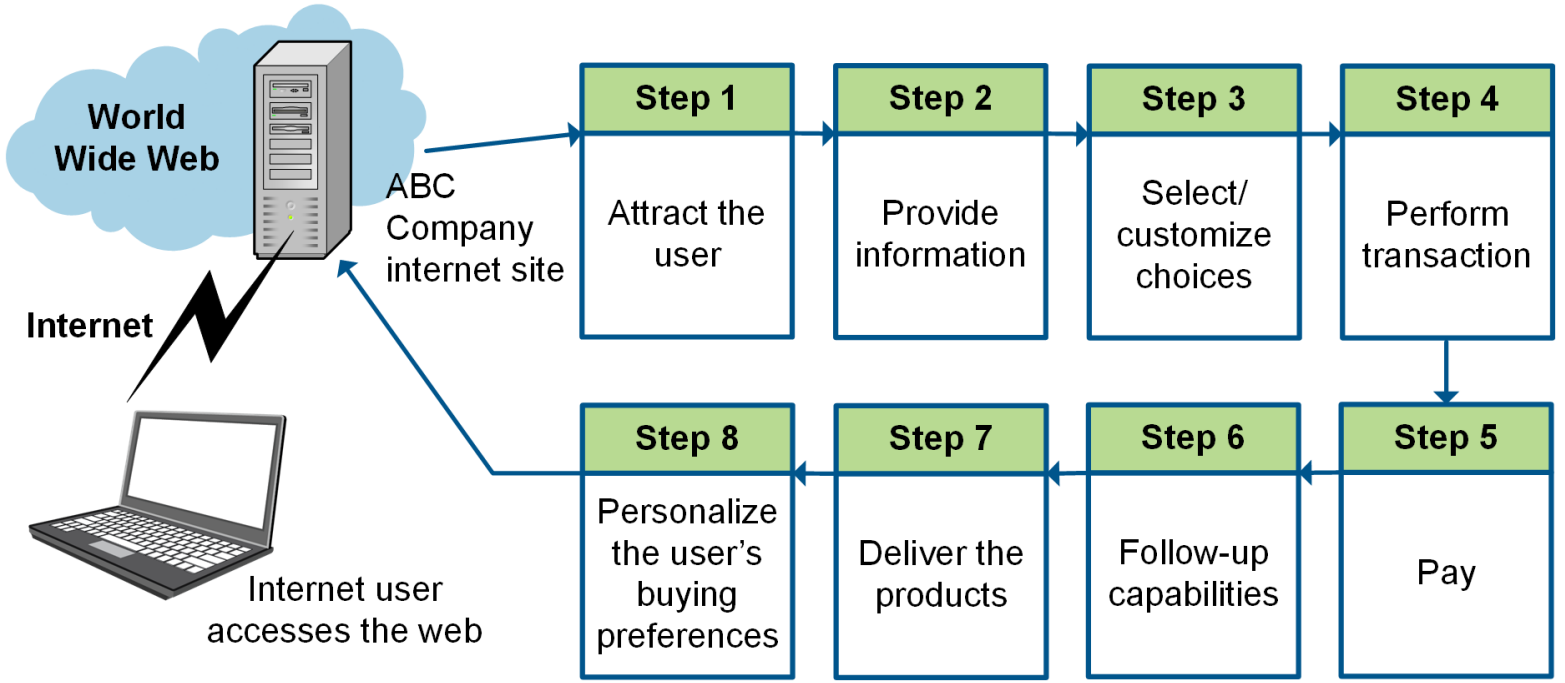




Potential Costs and Challenges with e-Business

- Regular reinvestment
- Hardware/software
- Implementation and change management
- System security
- Increased materials handling and outbound transportation costs
- Reliance on outside suppliers
- Global localization
- Accessibility, ease of use

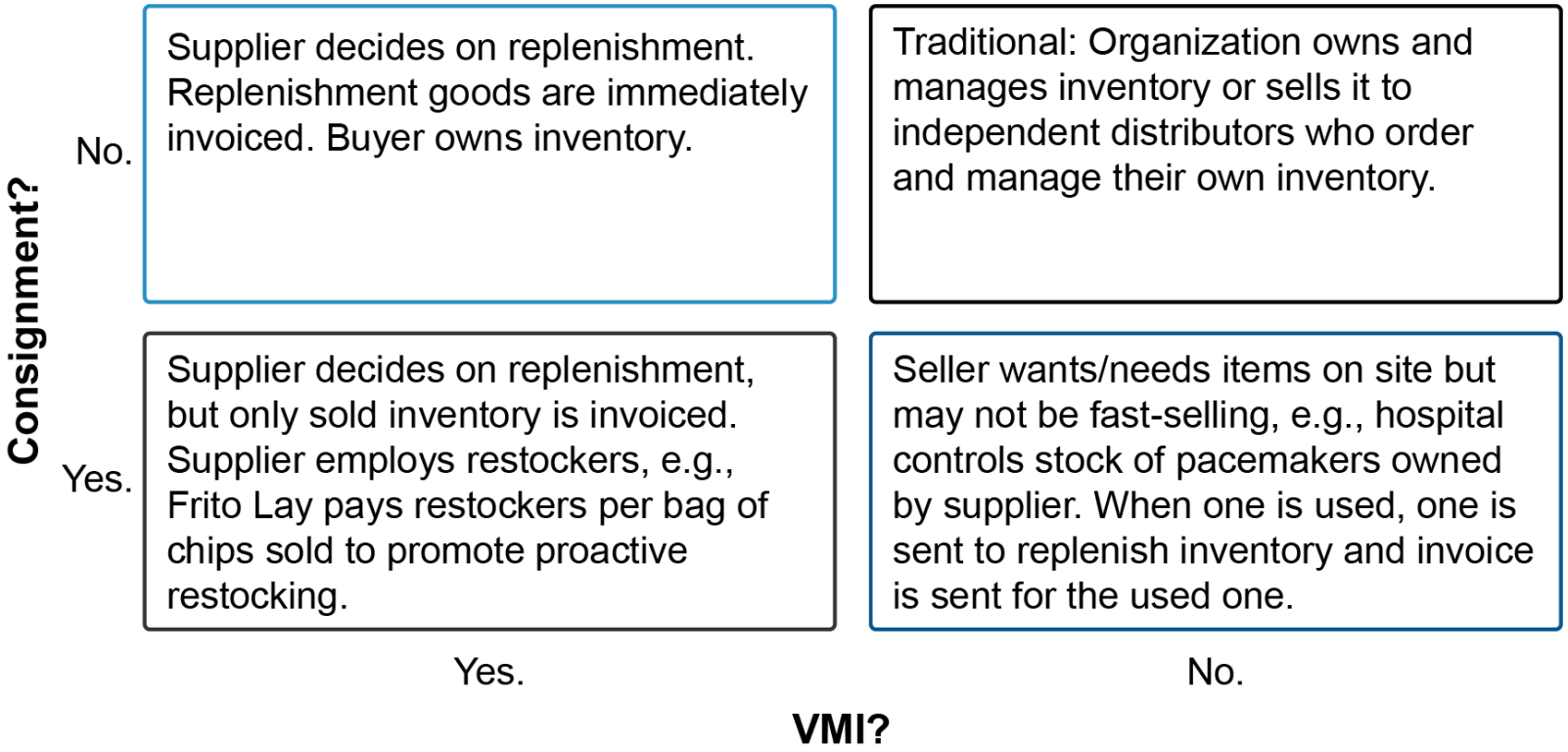
Sell-Side E-Commerce Website



Sharing Data Among Trading Partners

	Distributor Integration	Quick Response Program	Continuous Replenishment	Vendor-Managed Inventory
Customer Role	• N/A	• Provide POS data to supplier. • Submit individual orders.	• Notify suppliers of actual daily sales or ware-house shipments.	• Sell. • Do joint forecast. • Manage relationship. • Help logistics.
Supplier Role	Integrate IS to share: • Inventory data • Expertise • Inventory-related DI • Service-related DI.	• Synchronize supply with demand. • Forecast.	• Replenish without receiving orders. • Prevent stockouts. • Reduce inventory. • Improve turnover.	• Display, store, deliver, receive, stock, and count. • Schedule replenishment. • Keep inventory records. • Represent supplier at plant.

VMI and Consignment Combinations



Collaborative Planning, Forecasting, and Replenishment (CPFR®)

Manufacturer Tasks	Collaboration Tasks	Retailer Tasks
Strategy & Planning		
Account planning Market planning	Collaboration arrangement Joint business plan	Vendor management Category management
Demand & Supply Management		
Market data analysis Demand planning	Sales forecasting Order planning/forecasting	POS forecasting Replenishment planning
Execution		
Production & supply planning Logistics/distribution (outbound)	Order generation Order fulfillment	Buying/re-buying Logistics/distribution (inbound)
Analysis		
Execution monitoring Customer scorecard	Exception management Performance assessment	Store execution Supplier scorecard

Legal and Privacy Requirements

Trade disruptions	Disruption insurance
Political risk: IP expropriation	Disruption insurance
Data privacy risk	PII policies, controls
Cybersecurity	Cyber insurance

EU's GDPR Rights

- Informed how used
- Access personal data
- Correct errors
- Be forgotten
- Get copy
- Opt out

Cybersecurity Risks

NIST Cybersecurity Framework

Profile

- Cybersecurity road map per supply chain
- As is, to be

Tiers (maturity)

- Partial
- Risk informed
- Repeatable
- Adaptive

Core

- Identify
- Protect
- Detect
- Respond
- Recover

MITRE ATT&CK Framework

- Reconnaissance
- Resource development
- Initial access
- Execution
- Persistence
- Privilege escalation
- Defense evasion
- Credential access
- Discovery
- Lateral movement
- Collection
- Command and control
- Exfiltration
- Impact

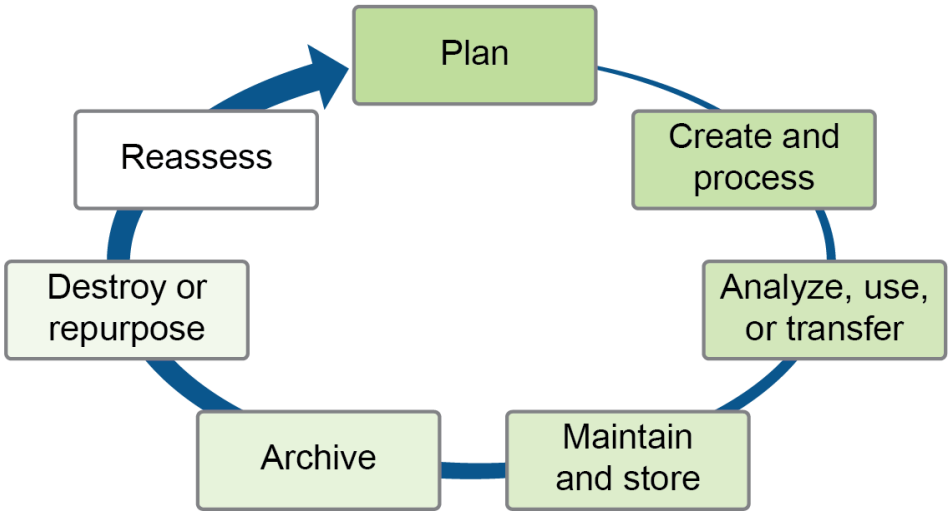
Master Data Management and Life Cycle

Master Data Management

Governance, methodologies, policies, procedures, and technologies

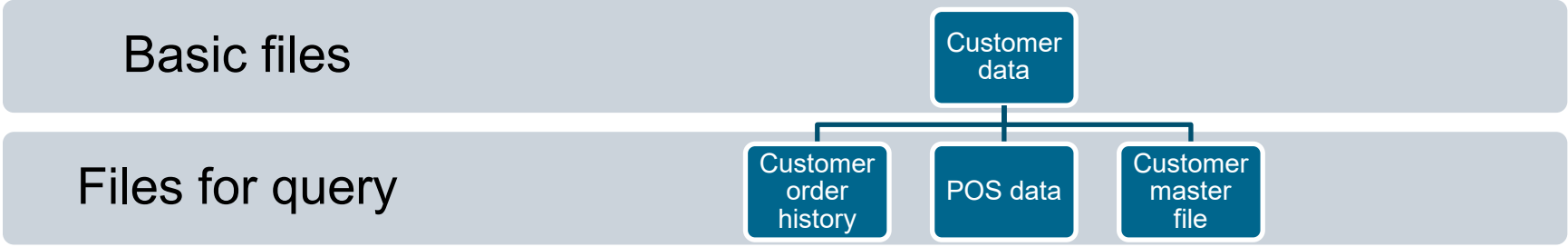
- Coordinates life cycle
- Stewardship
- Accuracy
- Consistency
- Completeness
- Timeliness

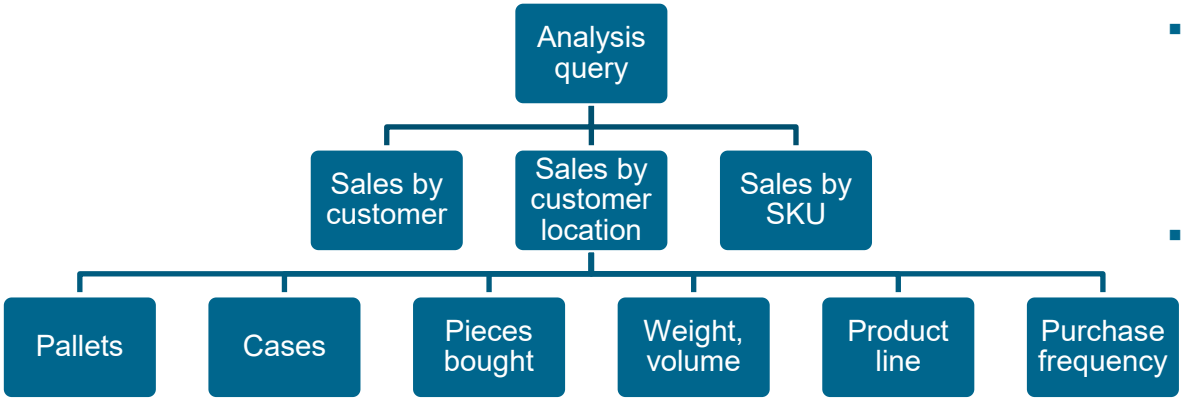
Master Data Life Cycle



Supply Chain Master Data

Types of Master Data Used





- Static data
  - Plant locations
  - Warehouses
  - SKU or part numbers
- Dynamic data
  - Forecasts
  - DM/DL standard costs
  - Current deliveries

Creating Data: Data Capture

- Incremental data volume improvement.
- Partial data better than no data.
- Capture data at the source.
- Passive better than manual capture.
- Overcome fast-paced, hostile, or language barrier areas.
- Capture ancillary data when possible.
- Real-time is best, but batch may suffice.

Automatic Identification Systems (AIS)

AIS

- Automatic classification
  - Optimize for storage/transport
- Automatic identification
  - Devices communicate presence

Types of AIS

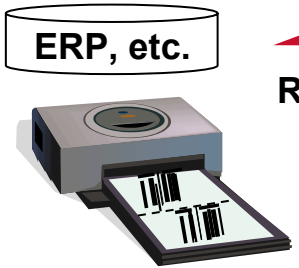
- Warehouse automation
- Barcodes
- RF devices
- RFID
- Smart cards
- Magnetic stripes
- Vision systems

Impact of AIS on SC

- Paperless, few errors
- Wireless and real-time inputs and payments
- Reduces stockouts
- Enriches customer information/service
- Automated replenishment, inventory visibility
- Track savings, ROI

Barcodes and Barcode Scanners

Direct link

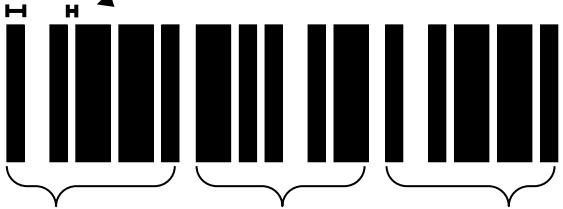


RF link

UPC

Identifies product SKU and manufacturer

Width of bars and gaps



Start character *

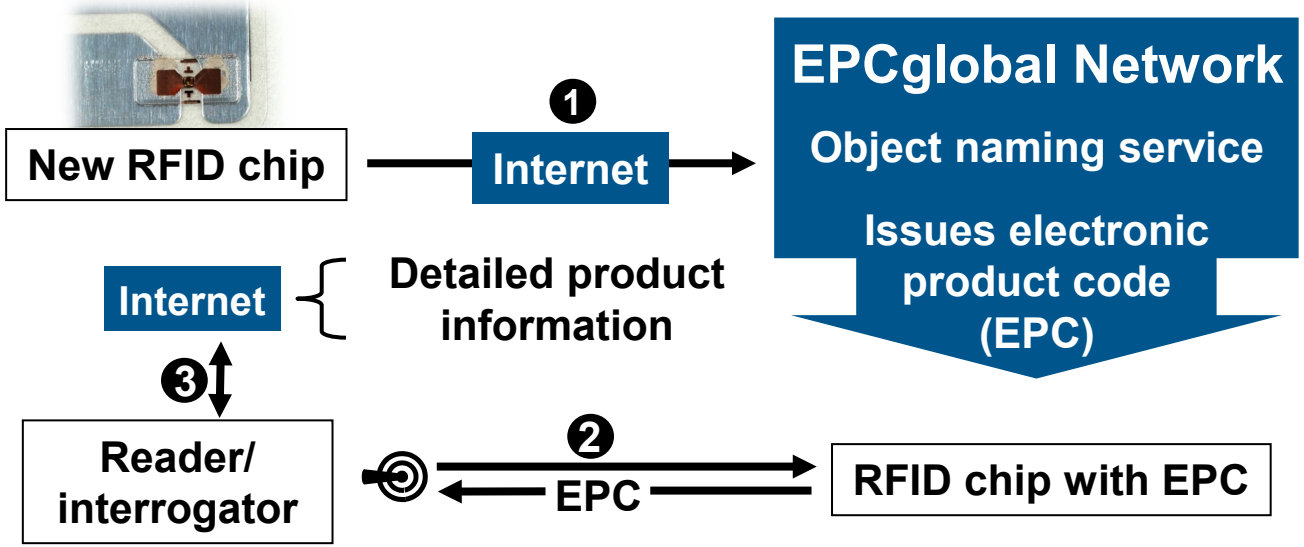
Character A

Stop character *

2D: QR code

More information, e.g., serial number

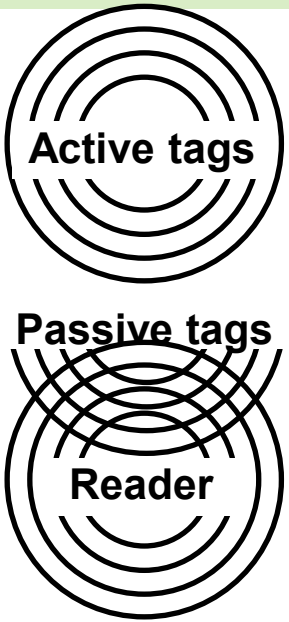
Radio Frequency Identification (RFID)



Internet verification prevents counterfeiting and stores extra product information.

RFID Tags, Errors, and Adjustments

Tag types



Causes of read errors

- Antenna size
- Reader power
- Frequency used
- Reading cases on conveyor more reliable than whole pallet

Adjustments

- Readers located for low interference
- Buffers or shields
- Adjusting angle of antennae
- Changing reader/tag to suit facility

Liquids absorb ← **Signals** → **Metals reflect**

Capturing and Communicating POS Data

Point-of-sale	Benefits
▪ Inventory and sales data adjusted at time and place of sale (barcodes, etc.). ▪ Information collected about customers at time of sale. ▪ Mobile devices can collect POS data too. ▪ Needed for VMI, etc.	▪ Capture data on SKU, promotions, inventory. ▪ Replace push with pull. ▪ Inventory deductions to finance. ▪ Collect purchasing habits. ▪ Reduce bullwhip effect. ▪ Reduce data entry errors. ▪ Low-cost updates.

Model and Data Validation

Test with historical data.

Test with current data.

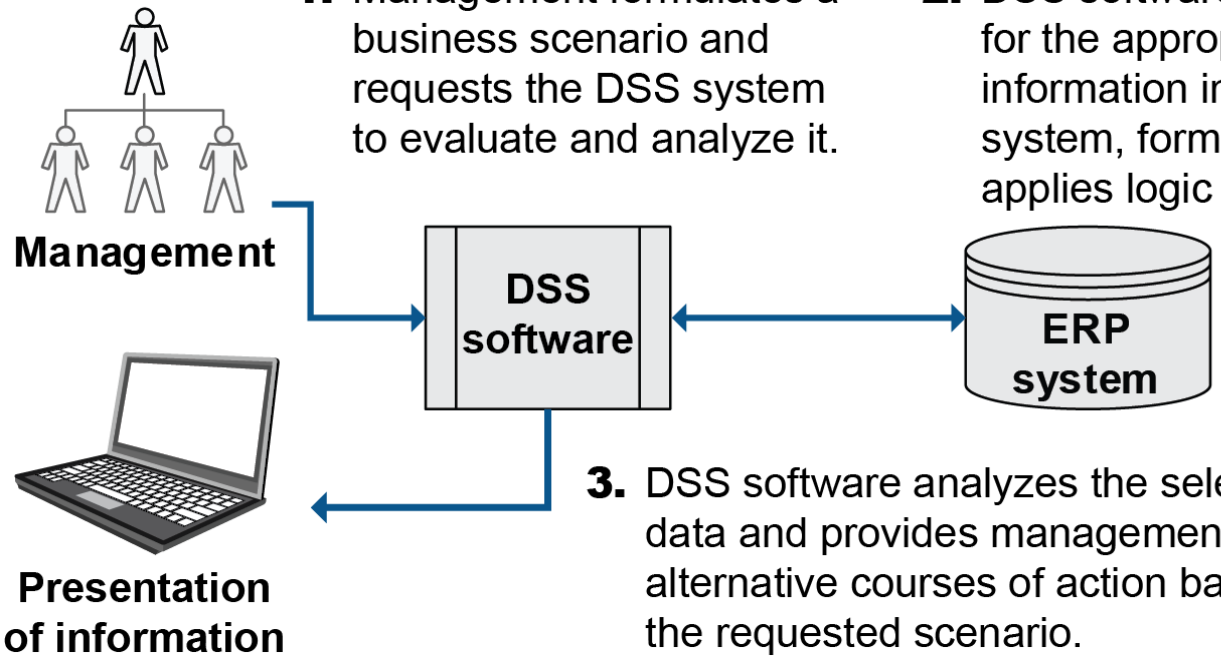
Measure error related to aggregation.

Data Aggregation

Smooths peaks and valleys: Pooling random variables reduces variance of aggregated variable.

Easier to interpret less data.

Decision Support Systems (DSS)



1. Management formulates a business scenario and requests the DSS system to evaluate and analyze it.

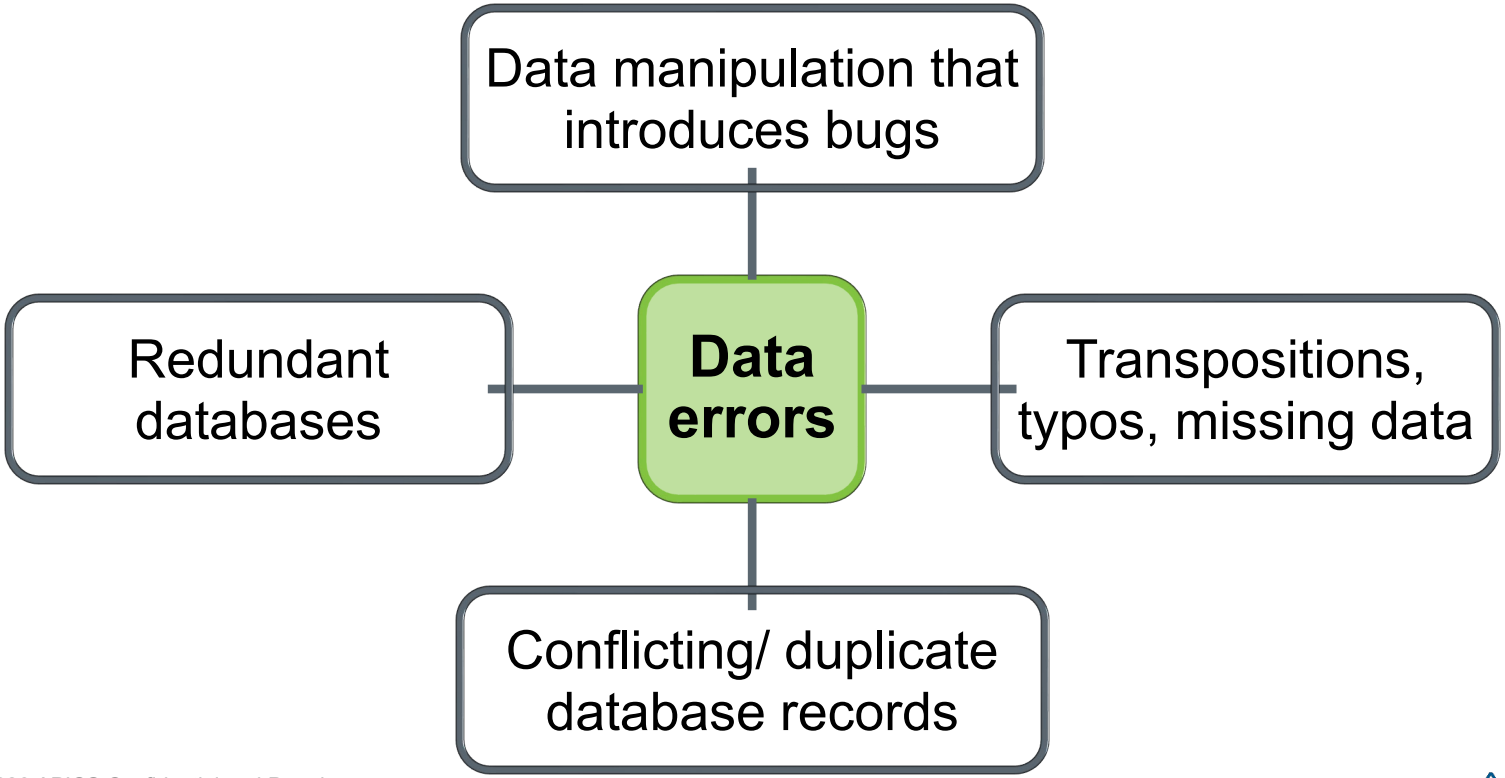
2. DSS software searches for the appropriate information in the ERP system, formats it, and applies logic to it.

3. DSS software analyzes the selected data and provides management with alternative courses of action based on the requested scenario.

Big Data and Data Analytics

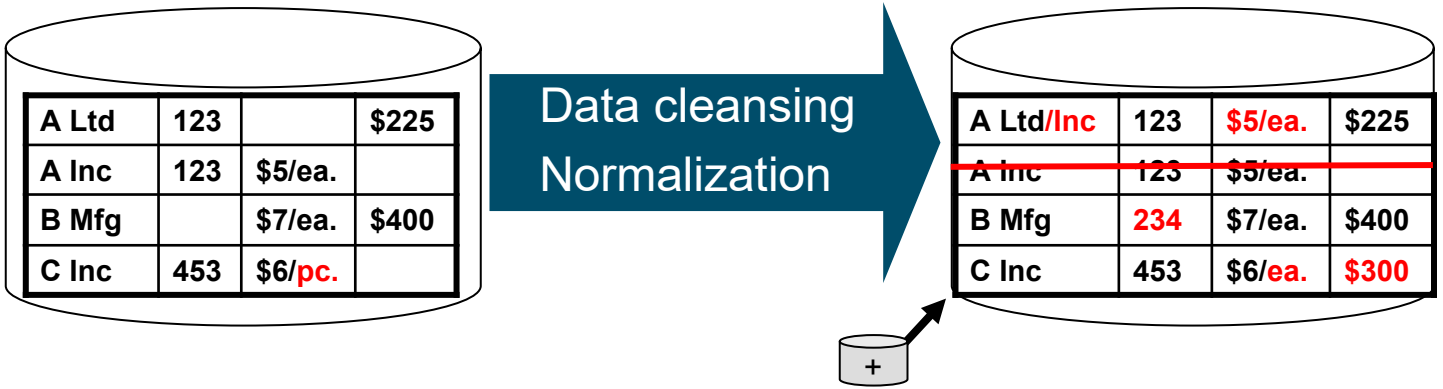
- **Big data**
  - Massive amount of structured and unstructured data
  - Identify problem areas in supply chain early
  - How best to collect, use, and leverage?
- **Data acquisition and analytics goal: Seamless links among processes and partners**
  - Collecting information
  - Timely, controlled access
  - Reducing visibility gaps
  - Improving planning effectiveness
  - Ensuring and maintaining data accuracy

Causes of Errors



Ways to Improve Data Accuracy

- Sharing POS/transaction data across SC
- Real-time transfer when feasible
- Immediate data entry/automation if feasible



Maintaining Data Accuracy

Role-based policies, procedures

Software limits for adding, deleting, modifying

Data maintenance and continuous user training

CSCP CERTIFIED SUPPLY CHAIN PROFESSIONAL

SECTION C: SUPPLY CHAIN METRICS AND REPORTS

APICS

ASCM

Section C Introduction

Section C Key Processes:

- Develop and maintain reports, analytics, and metrics.
  - Incorporate supply chain operations reference (SCOR DS) metrics.
  - Utilize dashboards and balanced scorecards.
  - Define financial metrics and reports.
  - Define operational metrics and reports.

Section C Topics:

- Supply Chain Metrics, Reports, and SCOR DS
- Financial and Operational Metrics and Reports

Measuring Performance

Performance Measures

- You get what you measure
- Objective, consistent, and quantified
- Measure at least 2 parameters (e.g., quality, time)
- Set targets to gauge relative success
- Customize

Internal Measurement Benefits

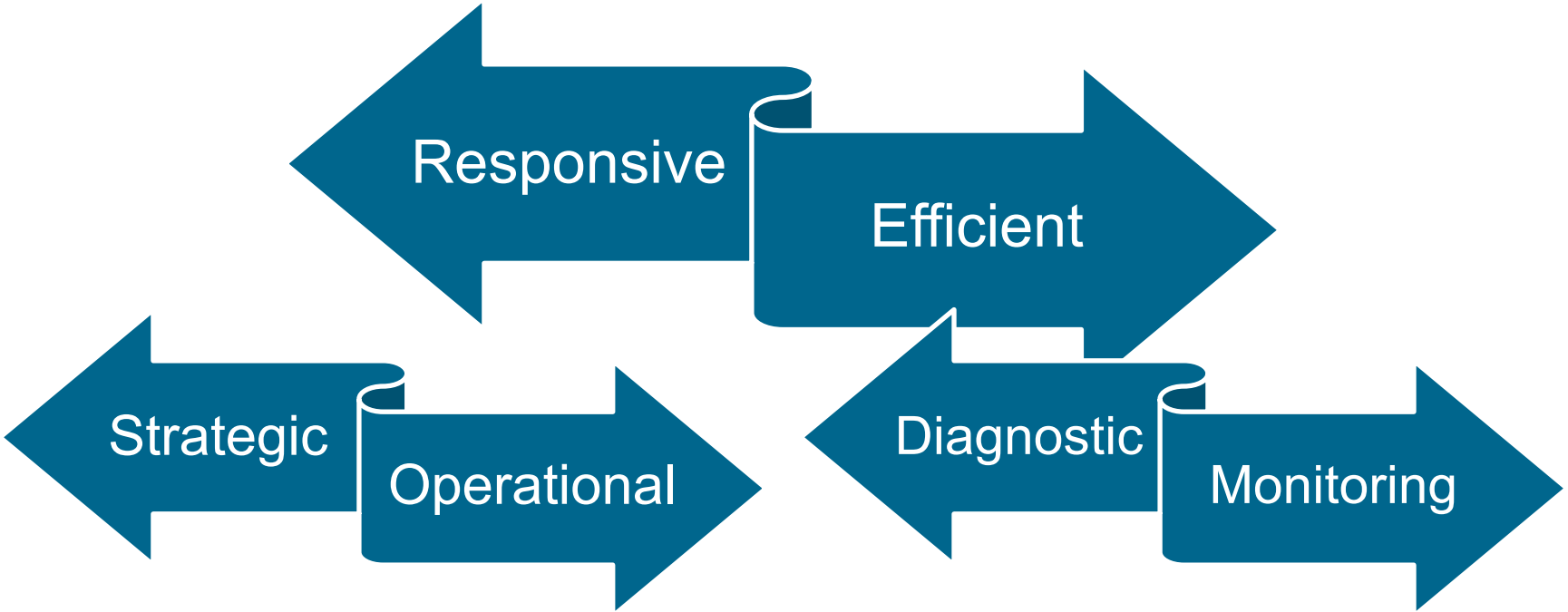
Control of processes and employees

Reporting to managers and external sources

Communication of expectations and problems

Learning and continuous improvement

Metric Selection Framework



Balanced Scorecard (BSC)

Customer Perspective

- Present performance, future prospects

Goal	Measure	Target	Actual

Innovation & Learning Perspective

- Training and product development

Goal	Measure	Target	Actual

Business Process Perspective

- Productivity, prospecting, flexibility, etc.

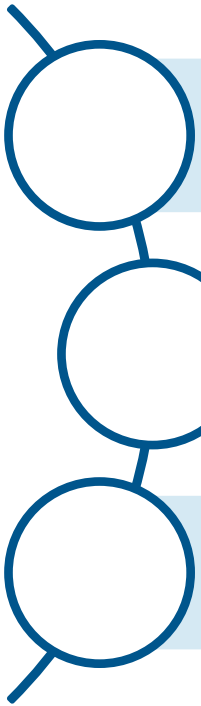
Goal	Measure	Target	Actual

Financial Perspective

- Traditional, historical only, necessary

Goal	Measure	Target	Actual

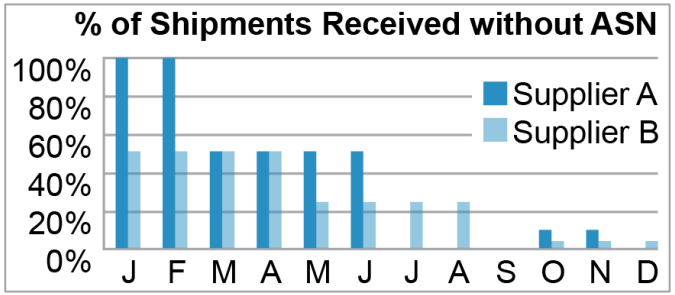
Key Elements in Balanced Scorecard (BSC) Initiative



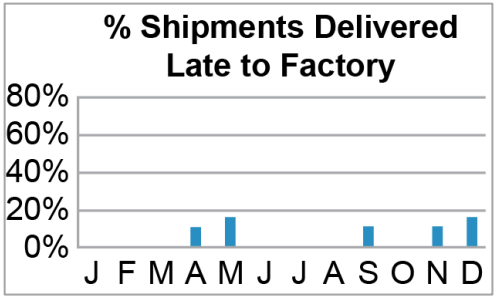
- Communicate strategic purpose of scorecard to partners.
- Develop goals and measures consistent with internal and SC strategies.
- Create schedules and assign responsibilities.

Custom Scorecard for 3PL (Service Quality)

Category	Target	Jan	Feb
ASN Compliance			
% Shipments Received Without ASN: Supplier A	0%	100%	100%
% Shipments Received Without ASN: Supplier B	0%	50%	50%
Inventory Count			
# of Parts Physically Counted	—	28	28
Inventory Accuracy Based on Physical Count	100%	80%	85%

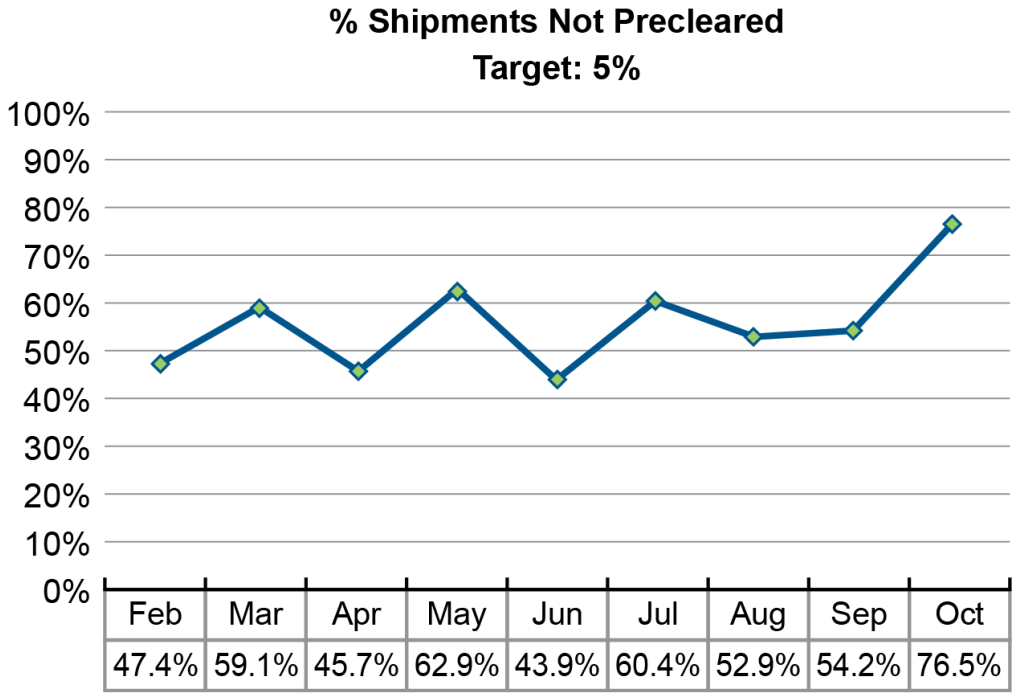


Source: Laura Gram



Source: Laura Gram

Performance Metrics



Average actual is about 50%, target is 5%, so:

- Review measurement and target to see if accurate and feasible
- Mandate supplier process correction and/or set more realistic target.

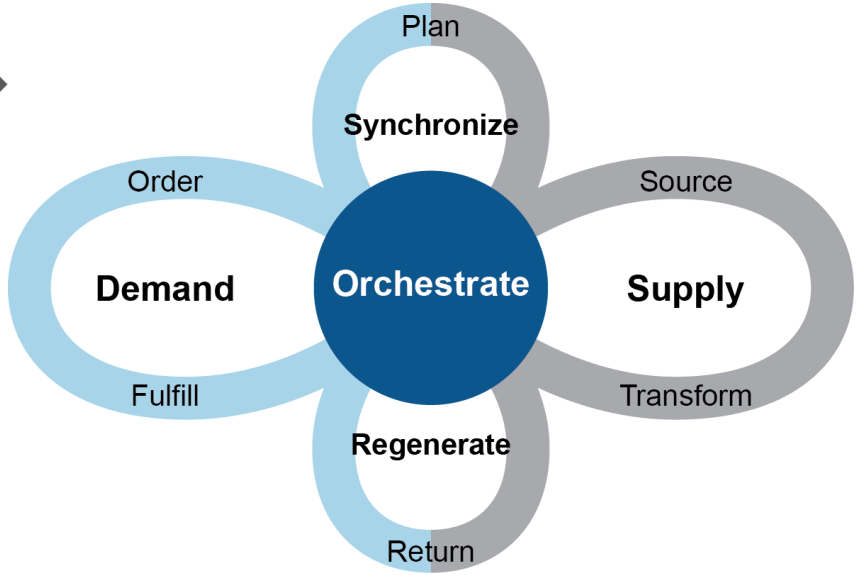
Source: Laura Gram

Supply Chain Metrics, Reports, and SCOR DS

SCOR DS

Source: ASCM, "Introduction to Supply Chain Management Using SCOR." Available from SCOR-DS website. Used with permission.

- Moving beyond linear supply chain depictions to supply networks
- Never-ending flow of processes with no artificial starts or ends



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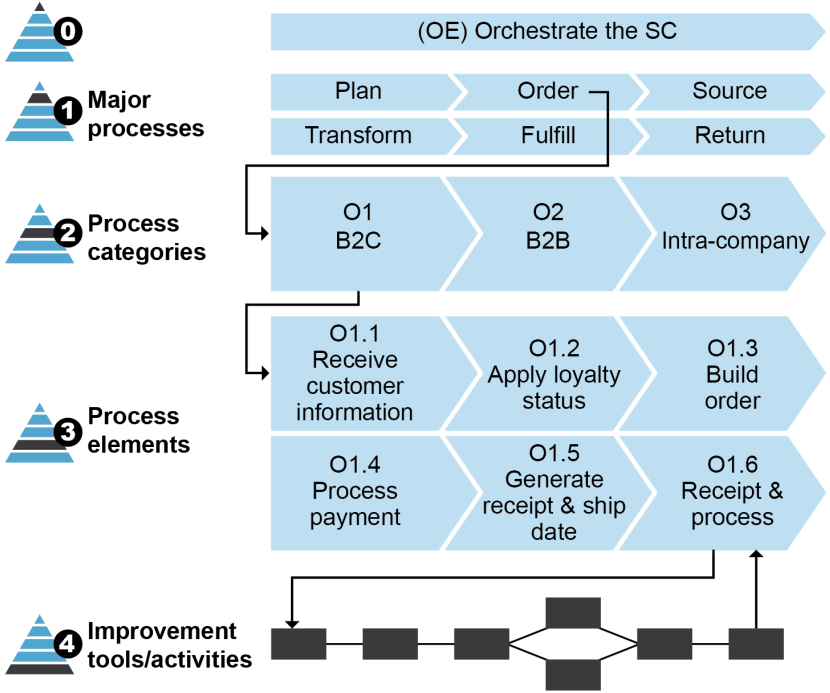
SCOR DS Hierarchical Process Model



Defines the operations strategy; process capabilities are set.

Defines the configuration of individual processes. The ability to execute is set. Focus is on process, inputs/outputs, skills, performance, best practices, and capabilities.

Use of kaizen, lean, TQM, six sigma, benchmarking.

Source: SCOR DS. Copyright ASCM. Used with permission.

- Performance: levels 1 to 3 in KPI tree
- Level 4 is specified by organization but linked to higher levels

SCOR DS Four Major Sections

Performance

- Supply chain strategy attributes (e.g., reliability, agility)
- KPI tree with related metrics

Processes

- Management process standard descriptions
- As-is, what-if, and to-be states

Practices

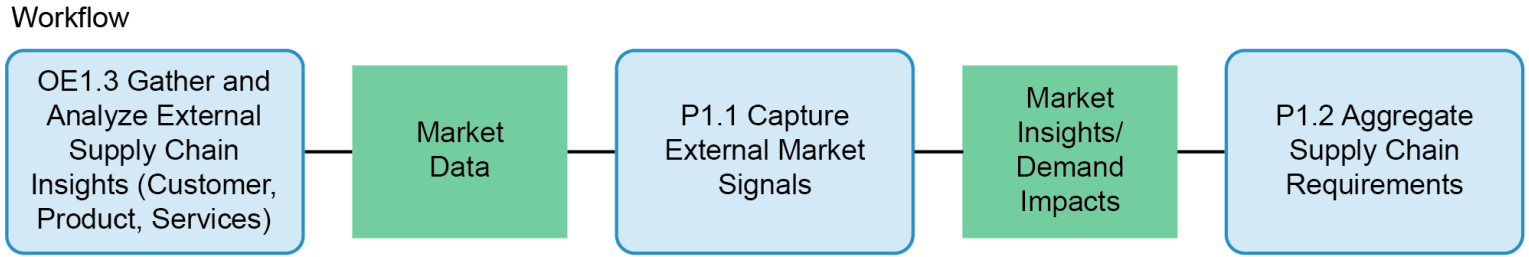
- Unique way to configure process
- Pillars
  - Analytics and technology (BP.049 Lean Planning)
  - Process (BP.009 Kanban)
  - Organization (BP.160 Lean)

People

- Standard skill definitions, experiences, and training
- Competency levels
  - Novice
  - Beginner
  - Competent
  - Proficient
  - Expert

Learning How to Use SCOR DS for Transformations

- SCOR DS scope: order entry through paid invoice
- Learn more at SCOR DS website (www.scor.ascm.org).
- Study and adapt standard process workflows to needs:



Source: ASCM, "P1.1 Capture External Market Signals." Available from SCOR DS website. Used with permission.

SCOR DS Resilience Performance Attributes

Performance Attribute	Definition
Reliability (RL)	"The ability to perform tasks as expected. Reliability focuses on the predictability of the outcome of a process. Typical metrics for the Reliability attribute include delivering a product on time, in the right quantity, and at the right quality level."
Responsiveness (RS)	"The speed at which tasks are performed and the speed at which a supply chain provides products to the customer. Examples include cycle-time metrics."
Agility (AG)	"The ability to respond to external influences and marketplace changes to gain or maintain a competitive advantage."

SCOR DS Economic Performance Attributes

Performance Attribute	Definition
Costs (CO)	"The cost of operating the supply chain processes. This includes labor costs, material costs, and management and transportation costs."
Profit (PR)	"The Profit attribute describes the financial benefit realized when the revenue generated from the business activity exceeds the expenses, costs, and taxes involved in sustaining the activity."
Assets (AM)	"The ability to efficiently utilize assets. Assets' strategies in a supply chain include inventory reduction and insourcing rather than outsourcing."

SCOR DS Sustainability Performance Attributes

Performance Attribute	Definition
Environmental (EV)	"The Environmental attribute describes the ability to operate the supply chain with minimal environmental impact, including materials, water, and energy."
Social (SC)	"The Social attribute describes the ability to operate the supply chain aligned with the organization's social values, including diversity and inclusion, and training metrics."

Benchmarking Tools: SCORmark example

- Versus competitors
  - Superior: >90%
  - Advantage: >70%
  - Parity: > 50%
- Benchmark metrics readily available, e.g.,
  - SCORmark: Compare against 1,000 organizations and 2,000 supply chains.

Attribute	Metrics	Target Performance	Your Organization	Parity (50%)	Advantage (70%)	Superior (90%)	Gap to Target
Reliability	Perfect customer order fulfillment	Advantage	70%	X 77%	85%	93%	-15%
Responsiveness	Customer order fulfillment cycle time	Parity	6	9.1	7 X	4	3.1
Agility	Supply chain agility, strategic (days)	Parity	35	X 30	25	20	-5
Cost	Total supply chain management cost (% of revenue)	Advantage	8%	8.70% X	5%	2.40%	-3%
Profitability	EBIT (as a % of revenue)	Parity	16%	14%	X 17%	20%	2%
Assets	Cash-to-cash cycle time (days)	Superior	52	55.4 X	30.5	0	-52
Environmental	Waste generated (metric tons)	Parity	14.3	X 13.4	11.2	9.2	-0.9
Social	Training (hours per year)	Advantage	80	X 82.1	91.5	100.1	-11.5

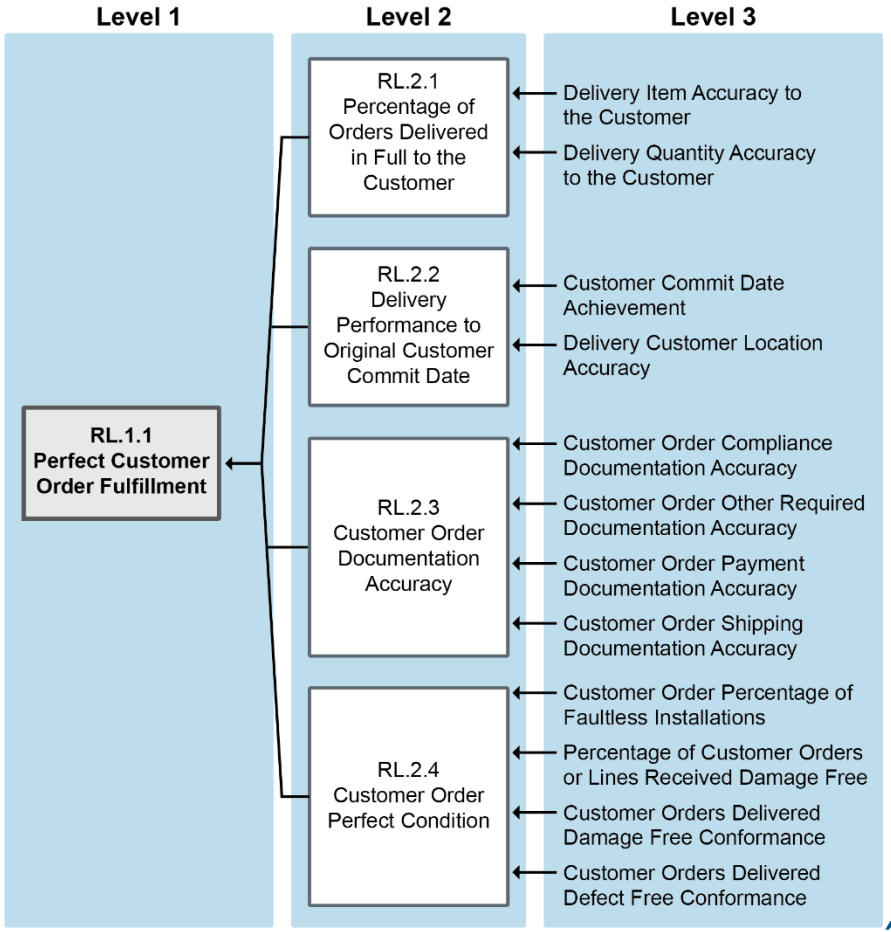
X Your organization

Source: Adapted from SCOR-Professional Training. Used with permission. Values are for example only.

SCOR DS Performance Metrics

Resilience	Economic	Sustainability
Reliability • Perfect customer order fulfillment • Perfect supplier order fulfillment • Perfect return order fulfillment	Costs • Total supply chain management cost • Cost of goods sold	Environmental • Materials used • Energy consumed • Water consumed • Waste generated
Responsiveness • Customer order fulfillment cycle time	Profit • Earnings before interest and taxes (EBIT) as a percent of revenue • Effective tax rate	
Agility • Supply chain agility (strategic or operational)	Assets • Cash-to-cash cycle time • Return on fixed assets • Return on working capital	Social • Diversity and inclusion • Wage level • Training

SCOR DS KPI Trees



Performance Targets and SCOR DS

Speed (SCOR DS responsiveness)

Customer query time, order lead time, actual vs. theoretical lead time, cycle time, minimum and average delivery time

Dependability (SCOR DS reliability)

Percent orders delivered late, average lateness, proportion in stock, mean deviation from promised arrival

Flexibility (SCOR DS agility)

Time to develop new products, range of products, machine changeover time, average batch size

Quality (SCOR DS reliability)

Number of defects per unit, level of customer complaints, scrap level, warranty claims, MTBF, customer satisfaction

Cost (SCOR DS cost and assets)

Efficiency, variance vs. budget, value added, labor productivity, cost per operation hour, resource utilization

Perfect Customer Order Fulfillment

$$\text{Perfect } \textit{Customer} \text{ Order Fulfillment} = \frac{\text{Total Perfect Orders}}{\text{Total Number of Orders}}$$

Product	**Quantity**	**Delivery**	**Customer order**
	Documentation	**Product condition**	

Responsiveness: Customer Order Fulfillment Cycle Time

- Customer Order Fulfillment Cycle Time =

$$\frac{\text{Sum of Actual Cycle Times for All Orders Delivered}}{\text{Total Number of Orders Delivered}}$$

- Customer Order Fulfillment Cycle Time = Order Fulfillment Process Time + Order Fulfillment Dwell Time

Agility

- Strategic supply chain agility (days)
  - Number of days to meet a 25% unplanned change in demand
  - Sum planned lead times for source, transform, order, fulfill, and plan
- Operational supply chain agility (% increase or decrease)
  - Sustained percentage increase or decrease in quantities that can be sustained over operational planning horizon (30 to 60 days)
  - Assume no expedite costs
  - Operational Supply Chain Agility = $\frac{\text{New Planned Volume}}{\text{Original Planned Volume}}$

Costs

- Total Supply Chain Management Cost as Percent of Revenue =

$$\frac{\text{(Order Management Costs + Material Acquisition Costs + Inventory Carrying Costs + Supply Chain Related Finance and Planning Costs +Total Supply-Chain-Related IT Costs)}}{\text{Total Product Revenue}}$$

- Cost of Goods Sold =

Direct Material Cost + Direct Labor Cost +
Indirect Costs Related to Production (Overhead)

Profit

- Earnings Before Interest and Taxes as a Percent of Revenue $= \frac{\text{Revenue} - \text{COGS} - \text{Operating Expenses}}{\text{Revenue}}$
- Effective Tax Rate
  - Average tax rate paid by organization
  - A tax-efficient supply chain can significantly impact this rate.

Assets

- Cash−to−Cash Cycle Time = Days′ Sales Outstanding + Inventory Days of Supply – Days′ Payables Outstanding
  - Days′ Sales Outstanding = $\dfrac{\text{Five−Point Annual Average of Gross A/R}}{\left(\dfrac{\text{Total Gross Annual Sales}}{365 \text{ days}}\right)}$
  - Inventory Days of Supply = $\dfrac{\text{Five−Point Rolling Average of Gross Value of Inventory at Standard Cost}}{\left(\dfrac{\text{Annual COGS}}{365 \text{ days}}\right)}$
  - Days′ Payables Outstanding = $\dfrac{\text{Five−Point Rolling Average of Gross A/P}}{\left(\dfrac{\text{Total Gross Annual Material Purchases}}{365 \text{ days}}\right)}$

Assets

- Return on Fixed Assets =

$$\frac{\text{(Supply Chain Revenue – Total Supply Chain Management Cost)}}{\text{Supply Chain Fixed Assets}}$$

- Return on Working Capital =

$$\frac{\text{(Supply Chain Revenue – Total Supply Chain Management Costs)}}{\text{(Inventory + A/R – A/P)}}$$

Sustainability Metrics

Environmental

- Materials Used = total weight or volume of materials used to produce and package main products and services
- Energy Consumed = in joules
- Water Consumed = in megaliters
- GHG Emissions = metric tons of equivalent CO_2
- Waste Generated = total weight

Social

- Diversity and Inclusion = percentage of individuals in organization's governance bodies per gender, age group, and other diversity indicators
- Wage Level = ratio of entry-level wage by gender to minimum wage
- Training = number of hours

Digital Capabilities Model for Supply Networks

Capability	Description	SCOR DS Linkages
Connected customer	Inspire at start of customer life cycle; service at the end.	Order, orchestrate
Product development	Do proactive product life-cycle management.	Orchestrate
Synchronized planning	Leverage human and process capabilities for planning efficiency.	Plan, orchestrate
Intelligent supply	Leverage technologies to reduce costs.	Source, orchestrate
Smart operations	Digital transformation for connectivity, agility, and proactivity.	Transform, orchestrate
Dynamic fulfillment	Add order fulfillment speed and agility.	Fulfill, return, orchestrate

Standard Costing

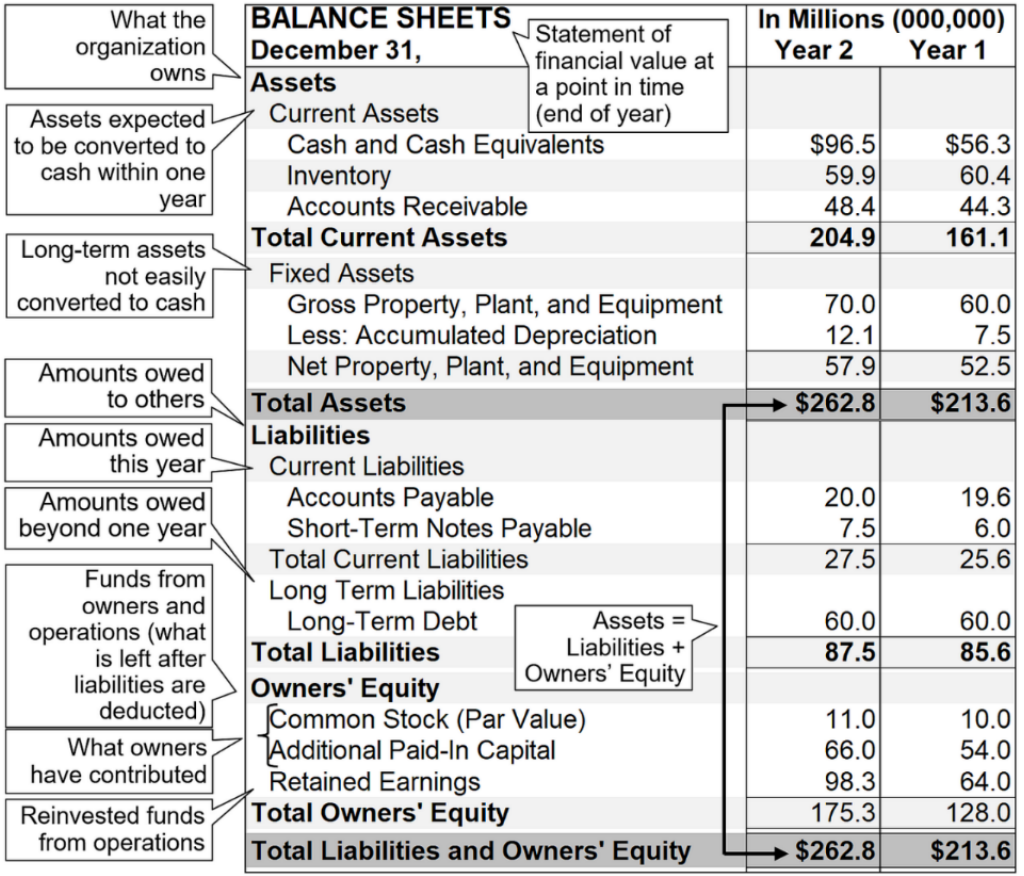
A cost accounting system that uses cost units determined before production for estimating the cost of an order or product

- COST = VOLUME × RATE

Balance Sheet for Two Years

Example: Buy house for $200,000 with $20,000 down

- $200,000 assets = $180,000 liabilities + $20,000 equity



BALANCE SHEETS December 31,	In Millions (000,000) Year 2	 Year 1
Assets		
Current Assets		
Cash and Cash Equivalents	$96.5	$56.3
Inventory	59.9	60.4
Accounts Receivable	48.4	44.3
Total Current Assets	**204.9**	**161.1**
Fixed Assets		
Gross Property, Plant, and Equipment	70.0	60.0
Less: Accumulated Depreciation	12.1	7.5
Net Property, Plant, and Equipment	57.9	52.5
Total Assets	**$262.8**	**$213.6**
Liabilities		
Current Liabilities		
Accounts Payable	20.0	19.6
Short-Term Notes Payable	7.5	6.0
Total Current Liabilities	27.5	25.6
Long Term Liabilities		
Long-Term Debt	60.0	60.0
Total Liabilities	**87.5**	**85.6**
Owners' Equity		
Common Stock (Par Value)	11.0	10.0
Additional Paid-In Capital	66.0	54.0
Retained Earnings	98.3	64.0
Total Owners' Equity	175.3	128.0
Total Liabilities and Owners' Equity	**$262.8**	**$213.6**

Financial and Operational Metrics and Reports

Income Statement for Two Years

- Depreciation shown here will be added back on cash flow statement

Expenses from providing goods/services that generate revenue

Revenue – COGS = Gross Profit

General expenses from running business that cannot be directly linked to specific units of goods/ services sold

Lowers fixed asset value for taxes

Payments on debt

Shows effect of taxes on profits

Gross Profit – Operating Expenses – Depreciation – Interest Exp. – Income Taxes = Net Income

INCOME STATEMENTS For the Years Ending (Profit or loss over a period of time)	(000,000s) except per share amts. Year 2	Year 1
Revenue (Sales)	**$302.6**	**$276.9**
Direct Labor	38.3	37.6
Direct Materials	101.5	99.7
Factory Overhead	26.6	26.1
Less: Cost of Goods Sold (COGS)	166.4	163.4
Gross Profit	**136.2**	**113.5**
Less: Operating Expenses		
Selling Expenses	30.3	24.9
General and Administrative	27.2	22.2
Lease Expense	12.1	8.3
Less: Total Operating Expenses	69.6	55.4
Less: Depreciation	4.6	4.0
Less: Interest Expense	3.9	3.9
Net Income (Profit) Before Taxes	**58.1**	**50.3**
Less: Income Taxes	16.3	14.1
Net Income (Profit) (The "bottom line")	**$41.8**	**$36.2**
Net Income (as a Pct. of Revenue)	14%	13%
Net Income Per Share-Basic	**$3.95**	**$3.78**

Statement of Cash Flows for Two Years

- Cash pays the bills, debts, salaries, and dividends.
- Inventory is less liquid.

A viable firm needs positive cash flow from operations in most years.

Depreciation is deducted on the income statement but doesn't reduce cash (added back).

Increase in inventory or accounts receivable reduces cash.

Increase in accounts payable increases cash.

Increase in business investments decreases cash.

Increase in new debt or equity provides cash.

Net Income
+/– Change in (Δ) Operating
+/– Δ Investing
+/– Δ Financing
+ Beginning Cash
= Ending Cash

CASH FLOW STATEMENTS	In Millions (000,000)	
Year (Change in cash balance over a period of time)	Year 2	Year 1
Operating Section		
After-Tax Net Income	$41.8	$36.2
Depreciation Add-Back	4.6	4.0
(Increase)/Decrease in Inventory	0.5	(8.6)
(Increase)/Decrease in Accounts Receivable	(4.1)	(4.1)
Increase/(Decrease) in Accounts Payable	0.4	1.8
Cash Flow from Operations	**43.2**	**29.3**
Investing Section		
Capex Spend (Capital Expenditures)	(10.0)	(10.0)
Cash Flow from Operations and Investment	**33.2**	**19.3**
Financing Section		
Additional Equity Capital	13.0	7.0
Less Dividends Paid	(7.5)	(5.0)
Increase/(Decrease) in Long-Term Debt	-	-
Increase/(Decrease) in Short-Term Notes	1.5	(1.5)
Cash Flow from Operations, Investments, and Financing	**40.2**	**19.8**
Beginning Cash Balance	56.3	36.5
Ending Cash Balance	**$96.5**	**$56.3**

Supply Chain Financial Metrics

Supply chain profit	Supply chain management cost reduction and efficiency efforts impact profit, e.g., Contribution Margin = Sales − Variable Costs.
Supply chain cost	Cost areas include order processing, inventory, transportation, warehousing and materials handling, and network integration.
Supply chain total cost	An aggregation of the costs of all organizations that participate in a given supply chain.
Altman Z-score	A combination of four or five weighted ratios to measure bankruptcy risk.
Customer creditworthiness	The goal of monitoring customer creditworthiness is to ensure that invoices are paid on time.

Operational Metrics: Day-to-Day Operations Check

Quality	Productivity	Asset Management
▪ Accuracy ▪ Manufacturing goods to quality standards ▪ Avoidance of damage to goods ▪ Supplier Performance Index = $\frac{\text{Material Cost + Nonconformance Cost}}{\text{Material Cost}}$	▪ Output of production ▪ Resource inputs used as efficiently and effectively as possible	▪ Ability of organization to maximize its operational assets ▪ Primary concerns are inventory and facility capacity