Logistics and Distribution Part III

Course: Production Management and Logistic Systems [10592713]

Economia e management (Latina Campus)

AA 2024-2025 | Prof. Alessandro Pietrogiacomi

SAPIENZA
UNIVERSITÀ DI ROMA

Latina 9 April, 2025

Lesson Plan for Wednesday, April 9

Overview of the lesson, and educational objectives,

Topic: **Logistics and Distribution.**

Part III– Logistic Fundamentals, Total Cost Concept and Tradeoffs, Value of Logistics Management, Logistics Costing and Optimization

Time: **14:00–17:00**

Duration**: 3 hours**

Learning Objectives

By the end of this lesson, students will be able to:

- Understand Logistics Fundamentals
- Define logistics and its role in supply chain management
- Evaluate how logistics affects GDP, industry costs, and competitive advantage (efficiency, agility, resilience)..
- Explore Optimization and Risk Management
- Identify ways to optimize logistics and assess risks in supply chain decisions.

Logistics History, Definitions, and Scope

What Is Logistics?

- Designs, plans, executes, and controls forward and reverse movement, storage, and handling of goods
- Optimizes goals:
  - Effectively meet customer requirements
  - Efficiently minimize total system cost
- Logistics = physical supply + distribution
- Coordinates
  - Supply and demand
  - Subsystems and people

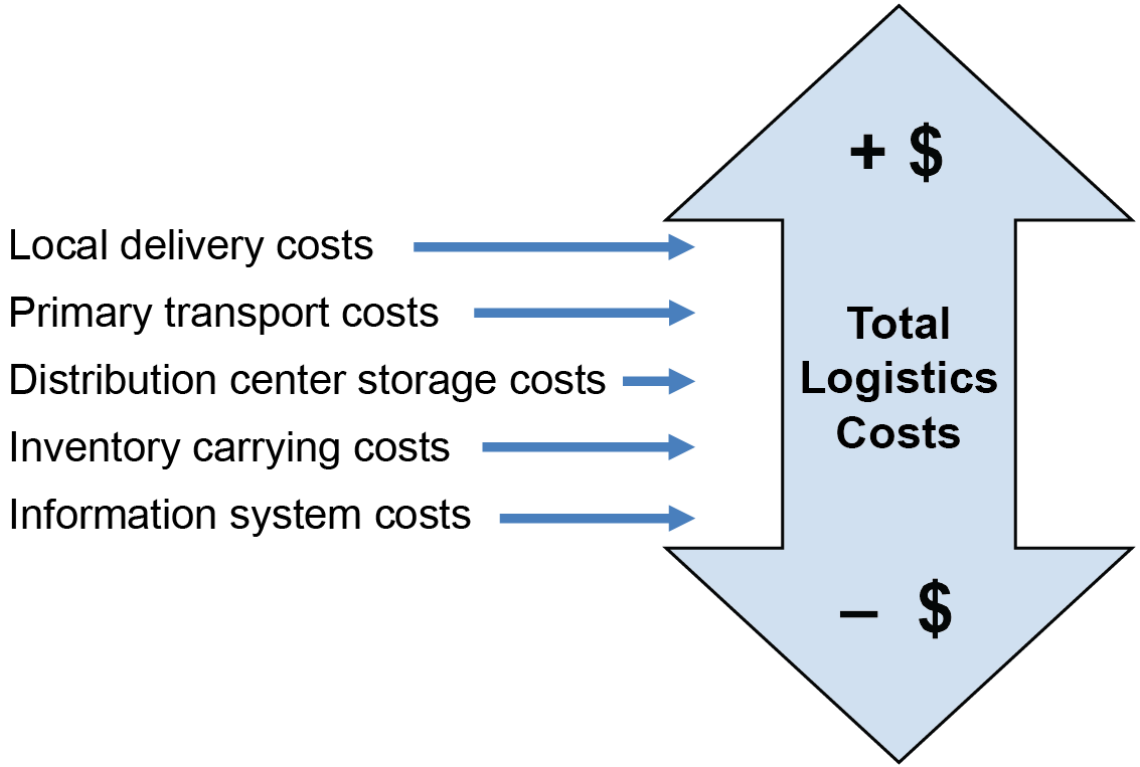
Logistics History, Definitions, and Scope

Definitions of Logistics

Warehousing	Transportation	Imports/exports
Packaging	Materials handling	Inventory management
Order management	Warehouse management/ transportation execution systems	

Total Cost Concept and Tradeoffs

Total Cost Concept



Total Cost Concept and Tradeoffs

Tradeoffs

Logistics Area	Common Tradeoffs
Warehousing	All three are interrelated: ▪ Slower transport requires more inventory and warehousing, long lead times. ▪ Faster transport reduces inventory and warehousing but increases transport costs. ▪ More warehouses, less transport cost, more inventory carrying cost. ▪ Close to suppliers, cheaper inbound and vice versa. ▪ DC layout and capabilities impact transport frequency and inventory.
Transportation	
Inventory management	

Total Cost Concept and Tradeoffs

Tradeoffs

Logistics Area	Common Tradeoffs
Import/export	Lean or just in time (JIT): ↓ inventory ↑ transportation (fewer truckloads)
Packaging	Ocean and rail versus air
Demand management and forecasting	Early forecast timely, less accurate
Purchasing	Must consider transportation cost and lead time

Total Cost Concept and Tradeoffs

Tradeoffs

Logistics Area	Common Tradeoffs
Production planning	Operating environment strongly affects finished goods inventory.
Materials handling	Equipment, automation impact DC capacity, labor, and cost.
Order management	Speeding this can reduce strain elsewhere.
Logistics information systems	Information replaces inventory (e.g., reroute).
Customer service management	Short lead time quotes require more DCs.

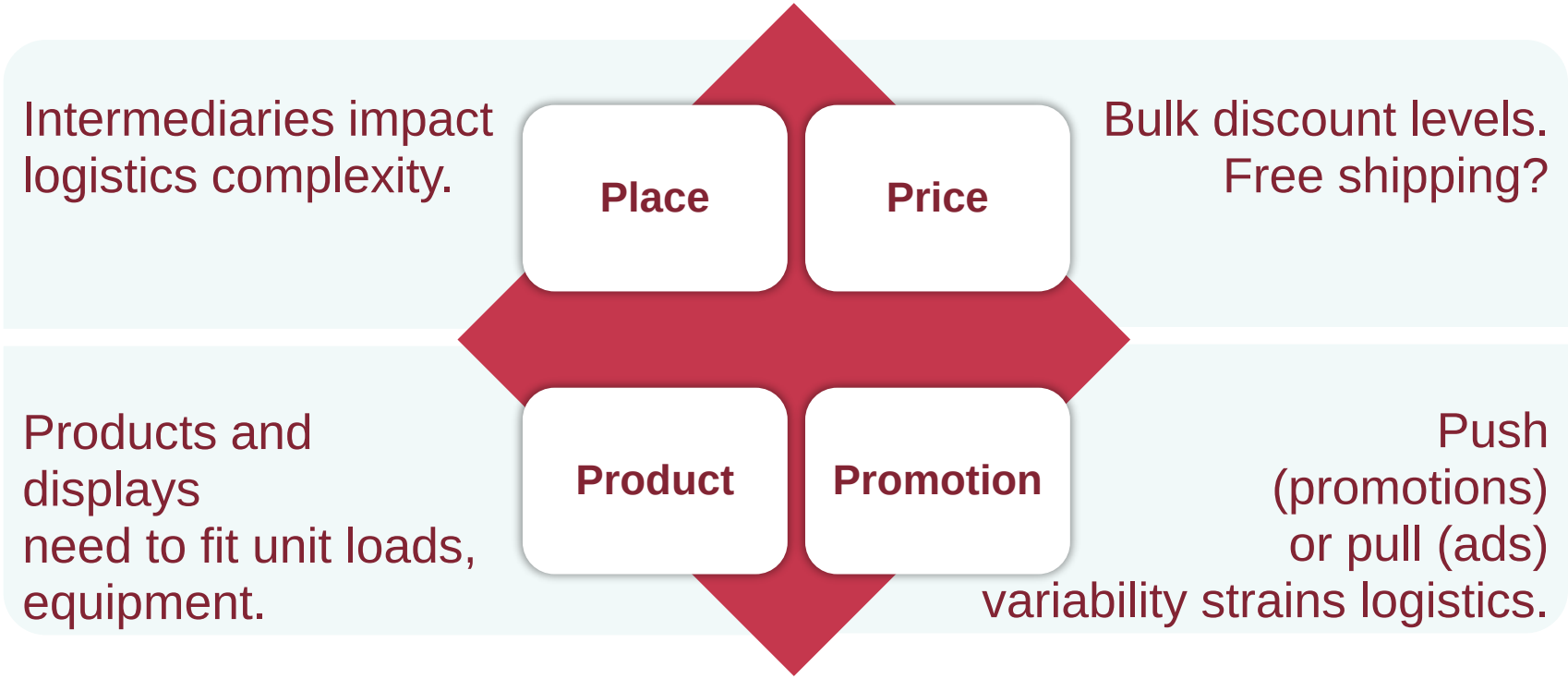
Total Cost Concept and Tradeoffs

Tradeoffs With Other Stakeholders

Finance	Production	Sales/Marketing
▪ Desire to control logistics budget ▪ Productivity suffers due to low-value units ▪ Unit-driven budget: more units moved than planned (high productivity)	▪ Desire for long production runs and few changeovers ▪ Account for inventory buildup	▪ Desire for short lead times, no stockouts, no damaged goods ▪ Add DCs, inventory, and packaging ▪ Postponement

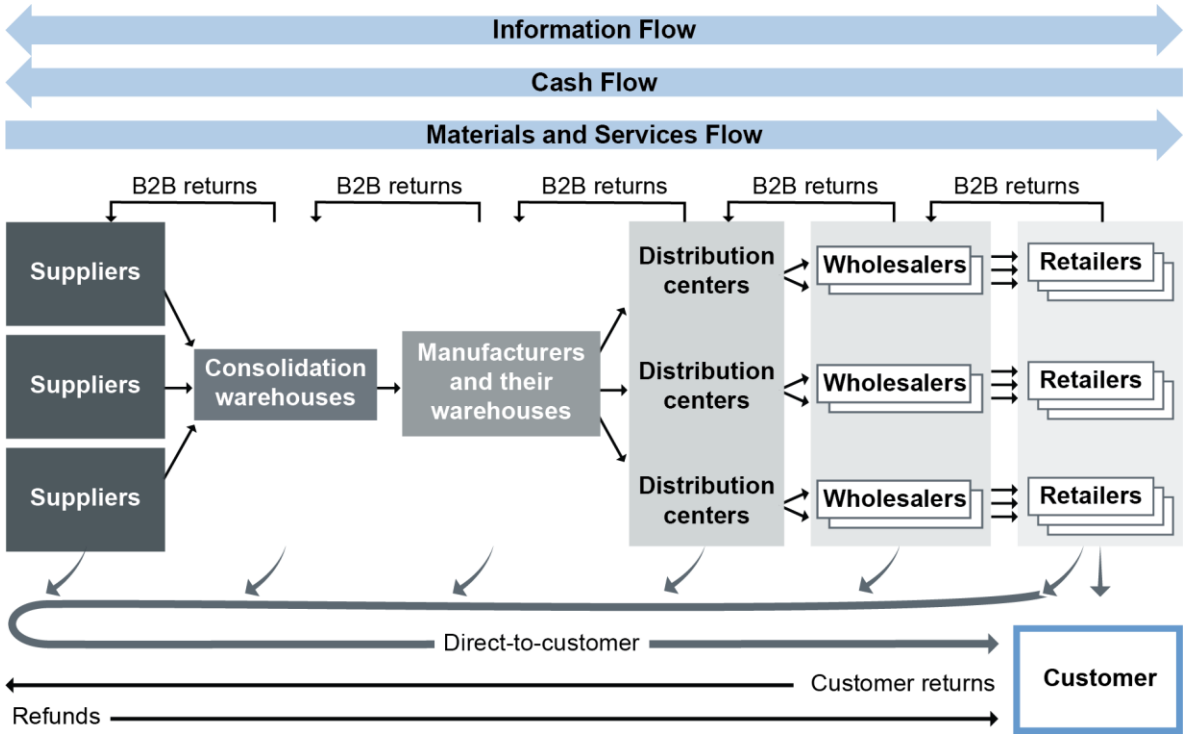
Total Cost Concept and Tradeoffs

Tradeoffs Related to the 4Ps of Marketing



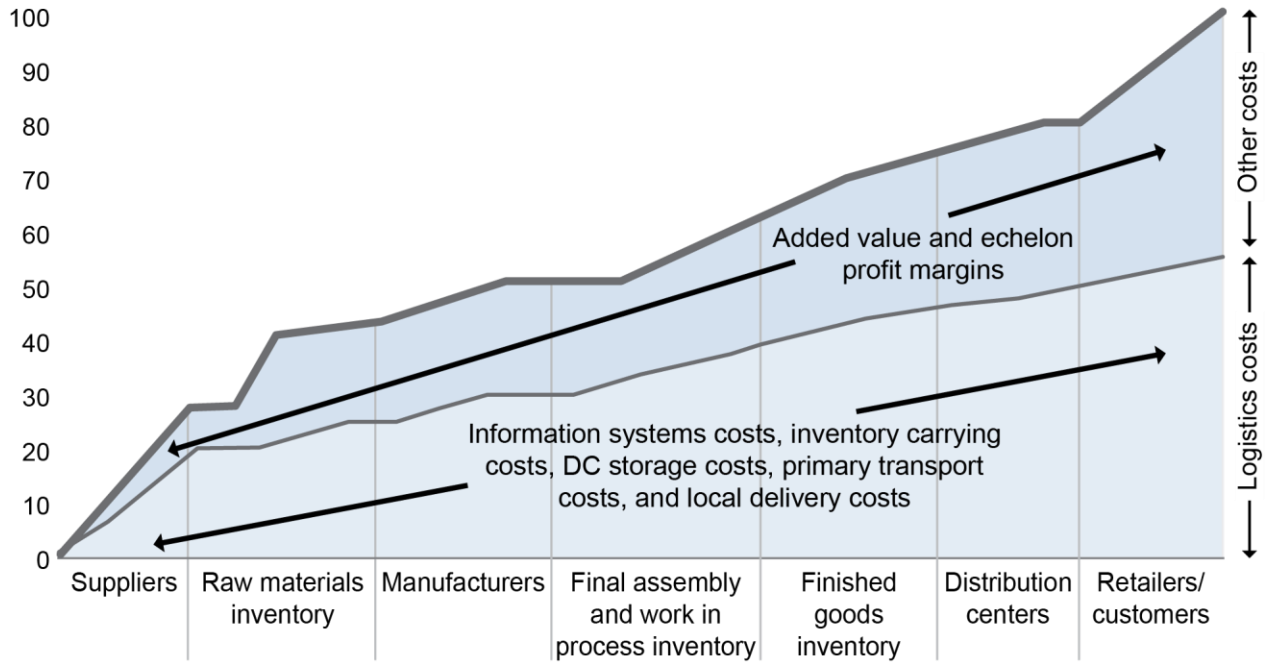
Principles, Components, and Drivers of Logistics

Flows of Goods/Services, Information, and Cash



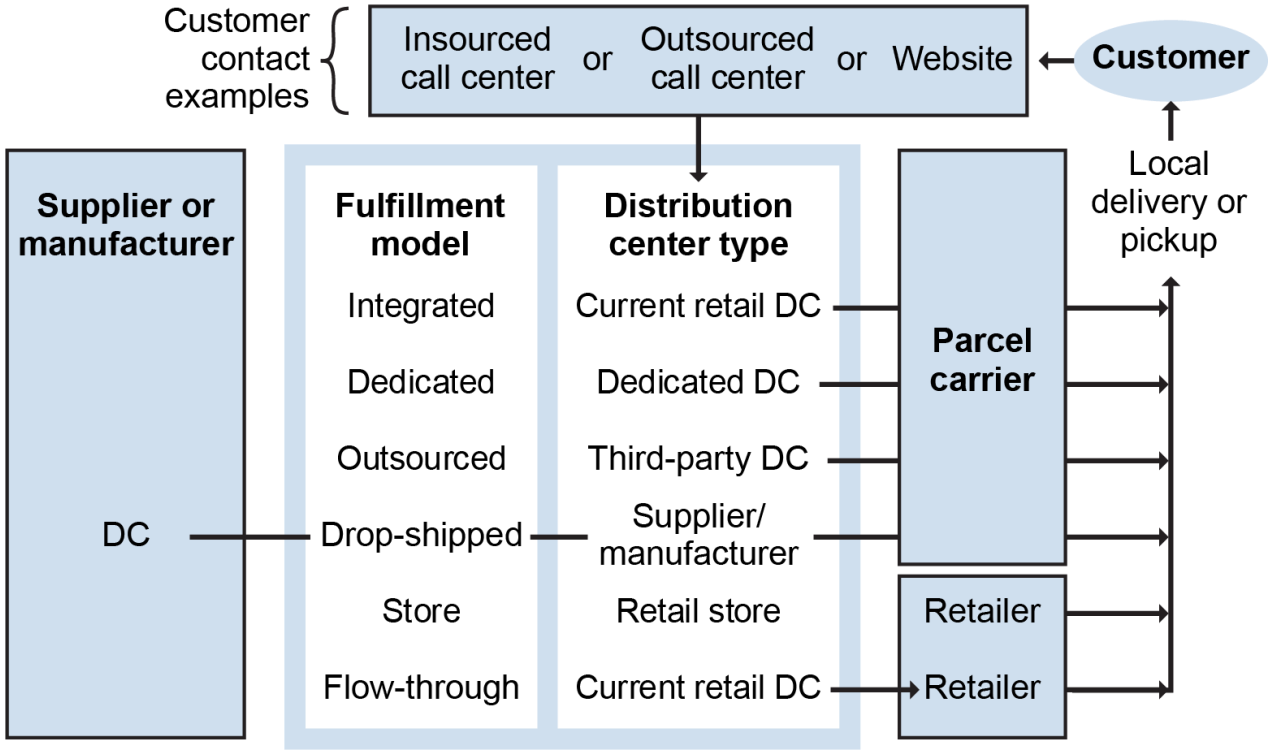
Principles, Components, and Drivers of Logistics

Cumulative Logistics Cost Reveals Waste



Principles, Components, and Drivers of Logistics

Direct-to-Consumer



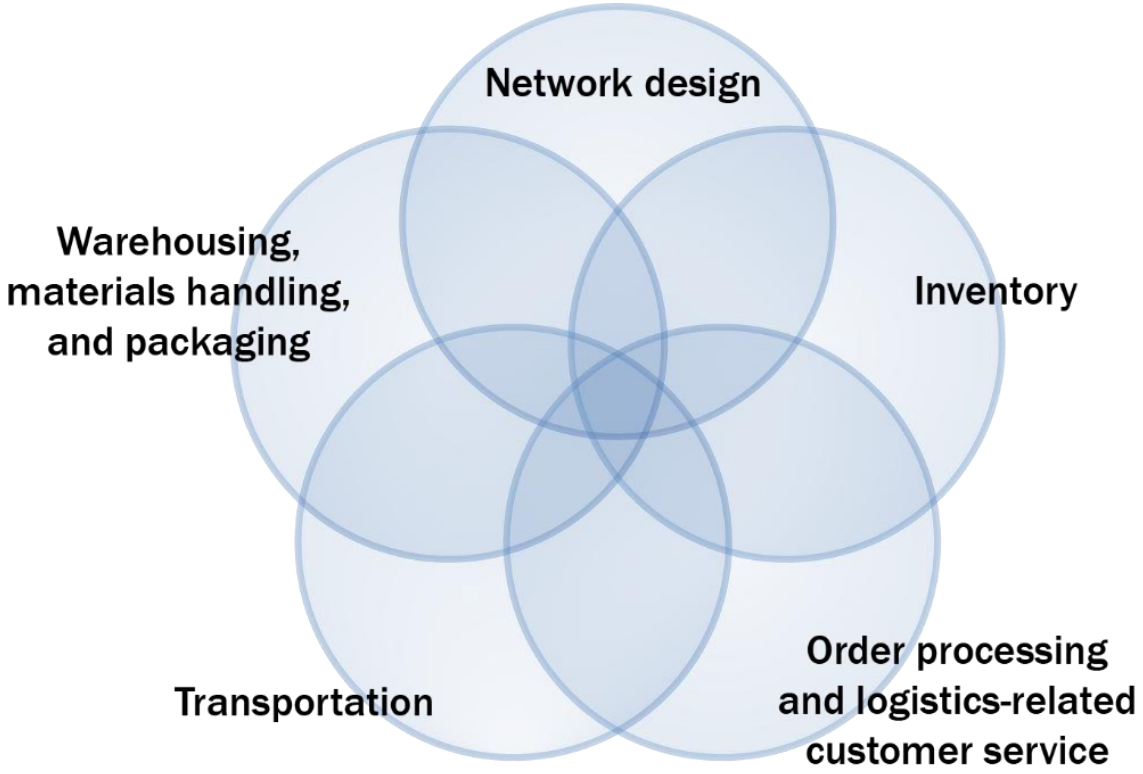
Principles, Components, and Drivers of Logistics

Various Forms of Logistics Utility

Time	Place	Possession	Form
Quantity	Information	Service	

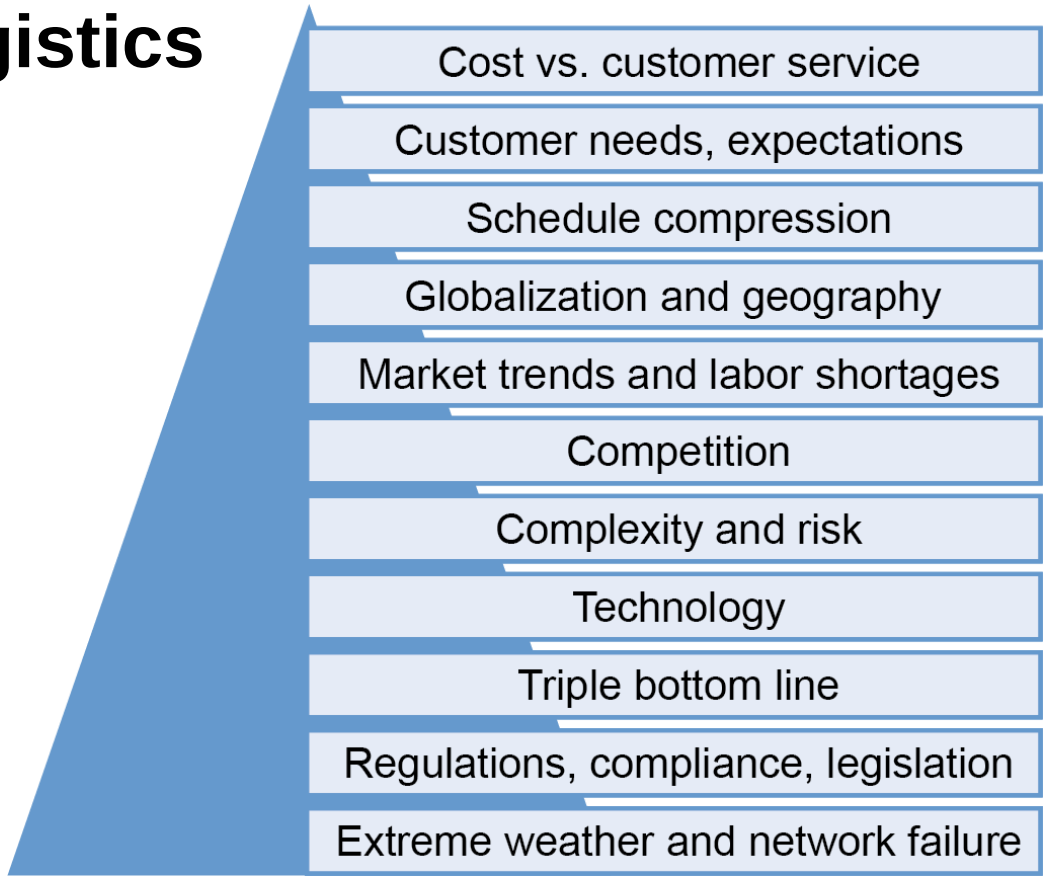
Principles, Components, and Drivers of Logistics

Grouping Components for Integration



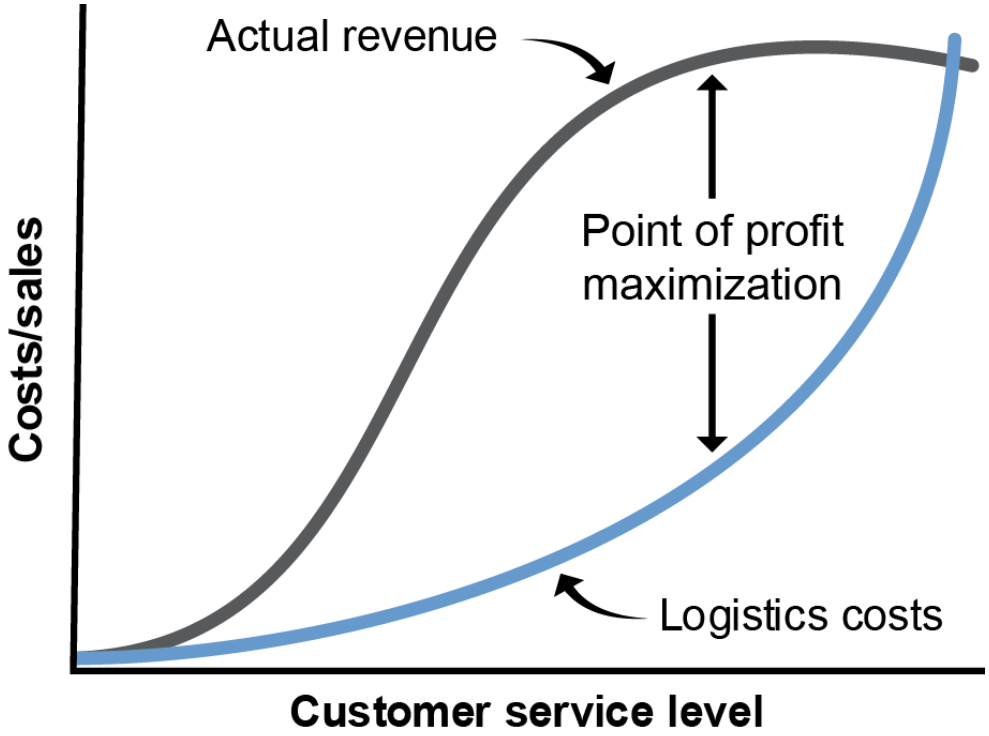
Principles, Components, and Drivers of Logistics

Drivers of Logistics



Principles, Components, and Drivers of Logistics

Cost-Revenue Tradeoffs

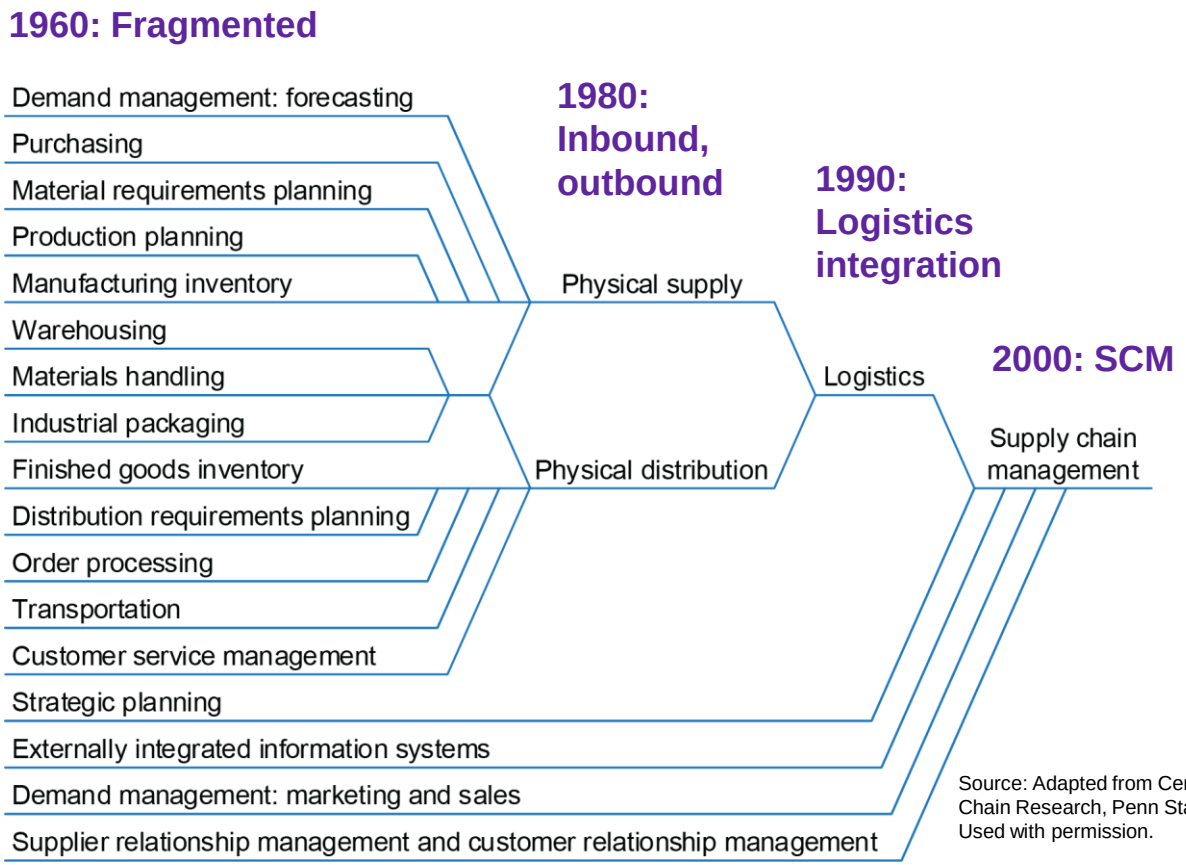


Supply Chain Management and the Role of Logistics

SCM and Logistics

SCM = Suppliers + Logistics + Customers

Supply Chain Management and the Role of Logistics



Source: Adapted from Center for Supply Chain Research, Penn State University. Used with permission.

Economic Impact of Logistics

Logistics as percentage of GDP

- Highlights comparative advantage between countries
  - China: 17.8% in 2012 to 14 to 15% range in 2017

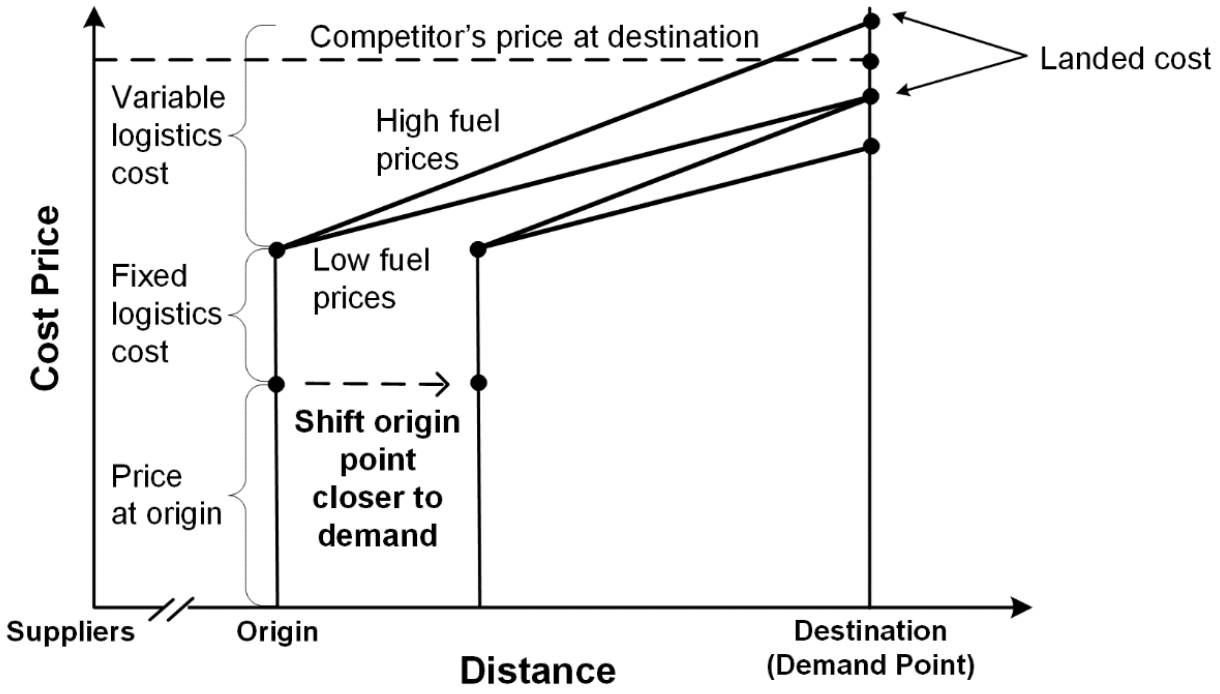
Making an impact/Challenges

- How
  - Country's investment in infrastructure
  - Changes in regulations
  - Reduced aggregate inventory levels
- Leaders: Hard to improve what is already efficient

Supply Chain Management and the Role of Logistics

Economic Impact of Logistics

Fixed and variable costs impact place utility.

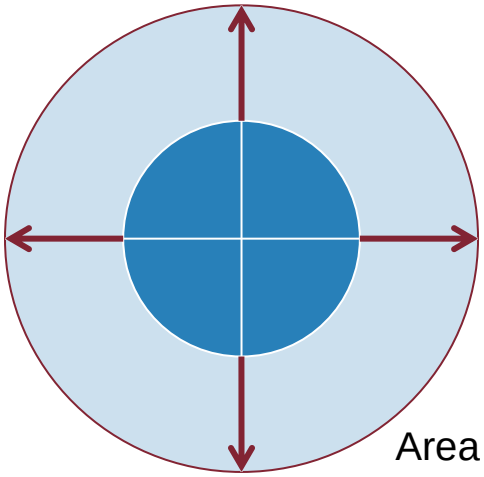


Supply Chain Management and the Role of Logistics

Economic Impact of Logistics

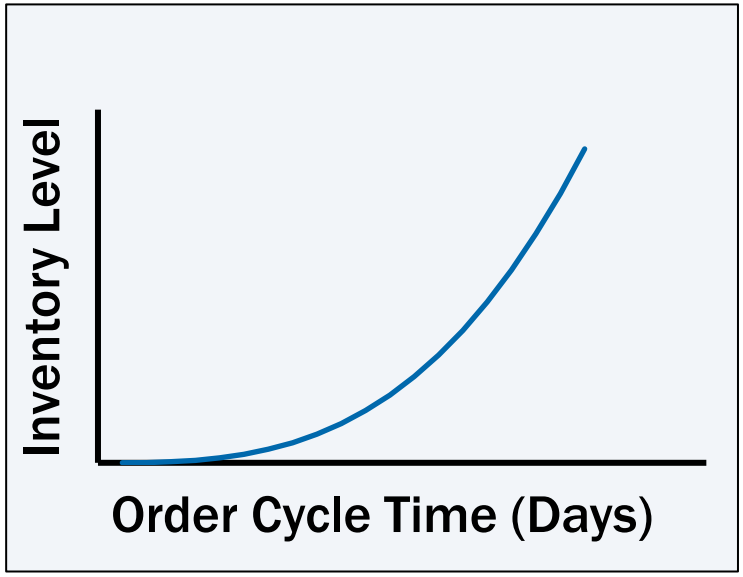
Law of squares (Lardner's law)

½ Transport Costs = Radius × 2



Area × ~4

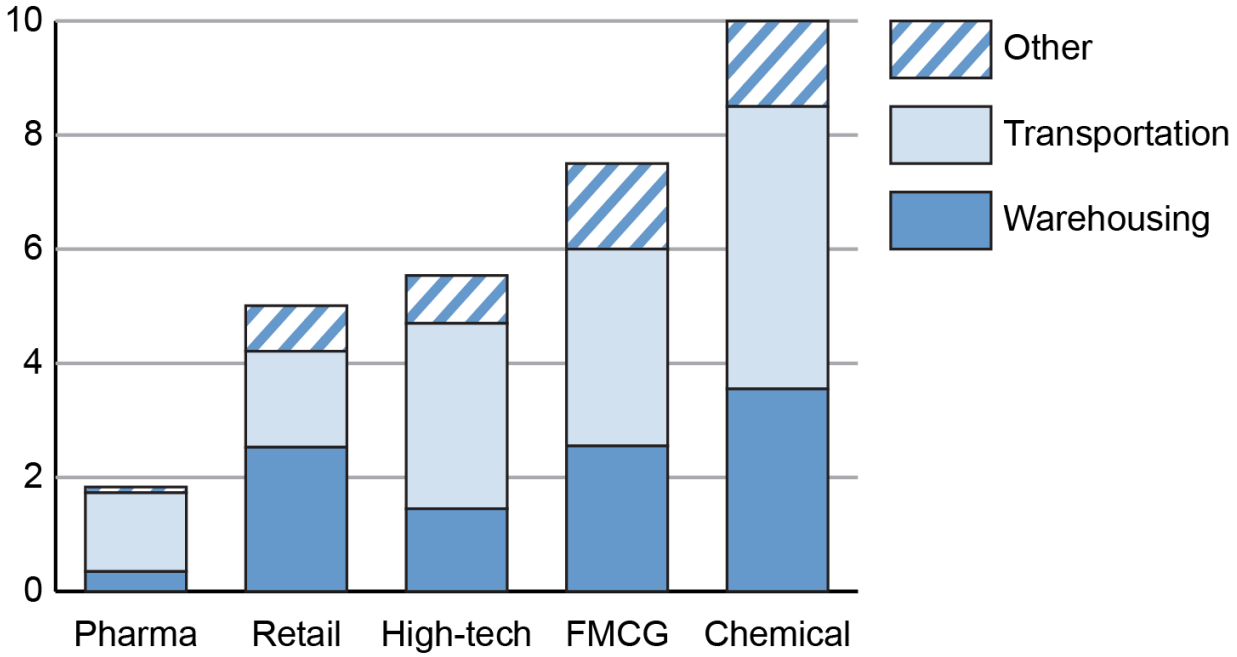
Inventory level vs. cycle time



Supply Chain Management and the Role of Logistics

Economic Impact of Logistics

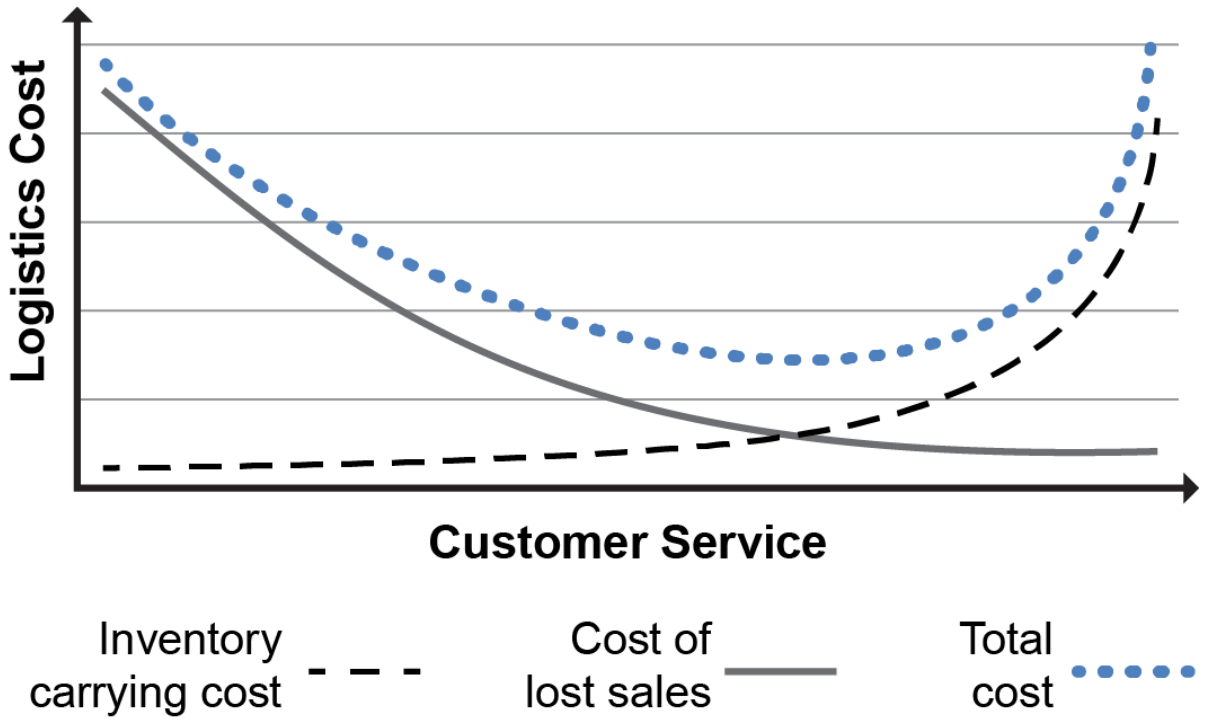
Logistics as percentage of sales by industry



Source: "Lean and Mean: How Does Your Supply Chain Shape Up?" McKinsey & Company, www.mckinsey.com.

Economic Impact of Logistics

Inventory carrying cost vs. cost of lost sales



Economic Impact of Logistics

- Transportation is largest cost area.
- Macroeconomic data obscures differentiating information:
  - Logistics as percentage of sales varies by industry.
  - Average doesn’t show high vs. low performers.
  - Small vs. large firms (economies of scale).
  - Substitution effect.
- Valuable inventory.
  - Costs more.
  - Lower logistics cost as percentage of sales.
- Dense, fragile.

Economics of Supply and Demand

Comparative advantage

Analyze spatial relationships between suppliers, producers, and key markets.

- Compare costs
  - Transportation
  - Labor
  - Warehousing
- Sourcing for strategic reasons
  - Availability of raw materials
  - Establishing sales market (i.e., “locally sourced”)

Spatial Relationship Competitive Analysis Example

	Local Producer	Low-Labor-Cost Producer	Cost Advantage (Local Perspective)
Production	€10/unit	€5/unit	– €5/unit
Inbound physical supply	€2/unit	€3/unit	€1/unit
Outbound physical distribution	€1/unit	€6/unit	€5/unit
Total logistics	€3/unit	€9/unit	€6/unit
Total landed	**€13/unit**	**€14/unit**	**€1/unit**

Supply Chain Management and the Role of Logistics

Globalization

- Global volatility
  - Supply
  - Demand
  - Commodity prices
  - Direct sales
- Service expectations and buying power
- Local final assembly
- Larger containerships
- Skilled labor in low-labor-cost countries
- EU passport-free zone
- Intermodal tools
- Barriers
  - Broker research
  - Culture
  - Terrorism responses
  - Infrastructure

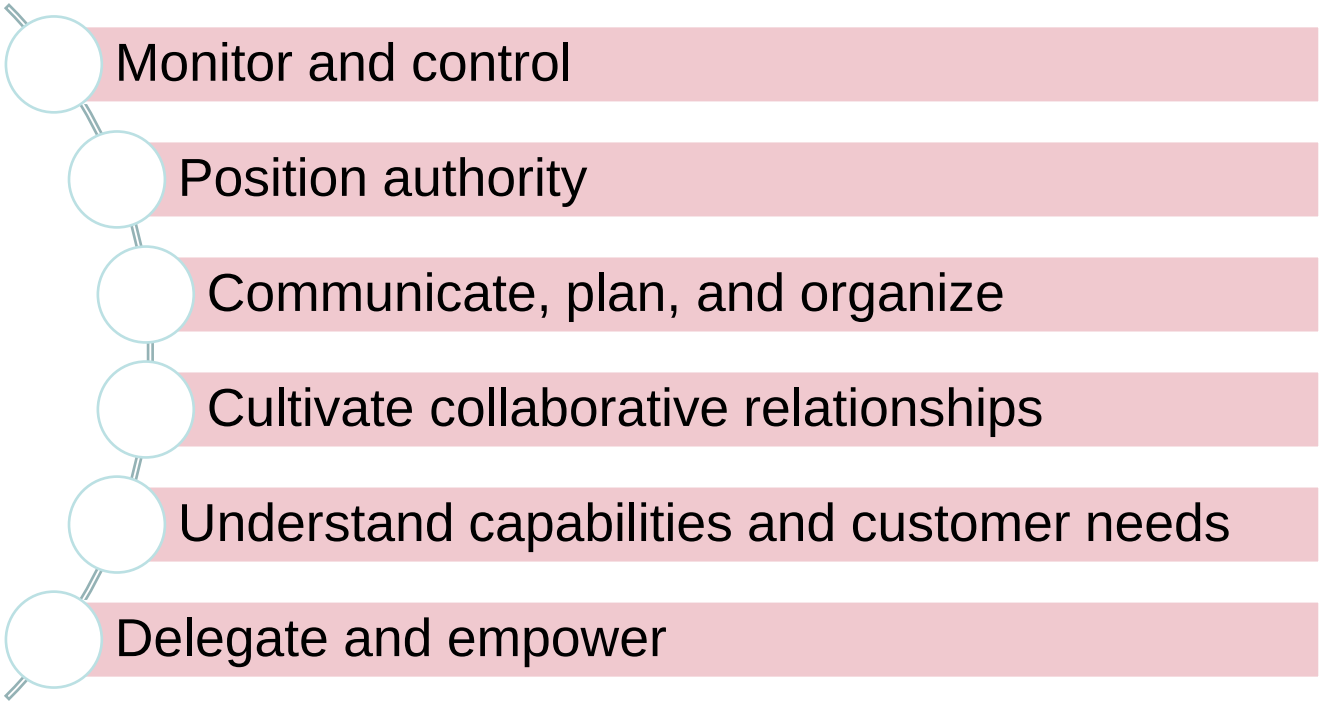
Supply Chain Management and the Role of Logistics

e-Commerce

- Growth rate faster than for retail
- Truckload (TL) and less-than-truckload (LTL) logistics under pressure as parcel delivery grows in demand
- Use retail centers for online fulfillment
- Narrow evening delivery window
- Kiosks

The Value of Logistics Management

Creating Value Through Management



The Value of Logistics Management

Value Through Leadership: Influence, Envision, Inspire

Trait Model	Process-Based Model
• Charisma, passion, decisiveness • Do candidates have technical experience?	• Process improvement • Delegate to right team • Admit mistakes • Can candidates challenge status quo?

The Value of Logistics Management

Creating Competitive Advantage

Efficiency

- Compete on price
- Asset utilization, turnover, low inventory/ spoilage

Resilience

- Recover from hazards without interruptions
- Geographic diversification, redundant networks

Agility

- Ramp up or down quickly
- Flexible volume, variety, value-added/ customized services

Customer focus

- Customer satisfaction
- Responsiveness, quality, customer experience, complexity, competence

The Value of Logistics Management

How Can a Supply Chain Increase Profits?

Two basic ways:

- Increase end-to-end sales revenue (throughput).
- Reduce costs.

However, increasing sales will also increase an organization's variable costs such as production, material, and selling costs.

The Value of Logistics Management

Reduce Logistics Costs, Increase Satisfaction

- Find cuts that affect service priorities least.
- Labor and monitoring/controlling savings.
- Increase inventory turnover.
- Innovate to find lowest total cost.
- Discover customers’ true pain points.

Logistics Costing

Traditional Cost Accounting

Logistics need: How much does it cost to pick and pack each unit?

Traditional: Costs obscured

- Aggregated by account
- Accounts include non-logistics costs

Logistics Costing

Cost Terminology

Fixed cost

Variable cost

Direct costs

(direct material, direct labor)

Indirect costs

Logistics Costing

Contribution Margin Analysis

Amounts shown in thousands USD

Warehouse Product Line Analysis				
	Product Line A	**Product Line B**	**Total**	**Eliminate Line B**
Revenue	1,000	500	1,500	1,000
- Variable Cost of Goods Sold	- 400	- 250	- 650	- 400
Variable Gross Profit	600	250	850	600
- Variable Direct Costs	- 50	- 50	- 100	- 50
Contribution Margin	550	200	750	550
- Fixed Direct Costs	- 160	- 70	- 230	- 160
Net Segment Contribution	390	130	520	390
- Indirect Fixed Costs			- 300	- 300
Net Profit			220	90
Contribution Margin Ratio	55%	40%	50%	55%
Net Segment Contribution Ratio	39%	26%	35%	39%

Logistics Costing

Cost Allocation

Cost allocation assigns all costs.

- Net profit: Segment sales volume ÷ total volume.
- May not be fair and equitable?
  - For example, if one-third of sales, does it consume one-third of warehouse space? One-third of transportation volume?

Logistics Costing

Activity-Based Costing (ABC)

- Direct costs
  - Can be specifically traced
  - If economically feasible
- Cost object
- Activity drivers
  - Unloading: Quantity or unit type (e.g., pallet)
  - Palletizing: Quantity of cartons
  - Put-away: Quantity or cubic volume
  - Order picking: Quantity, visits to pick location, lines on order
  - Transportation: Number of deliveries or distance

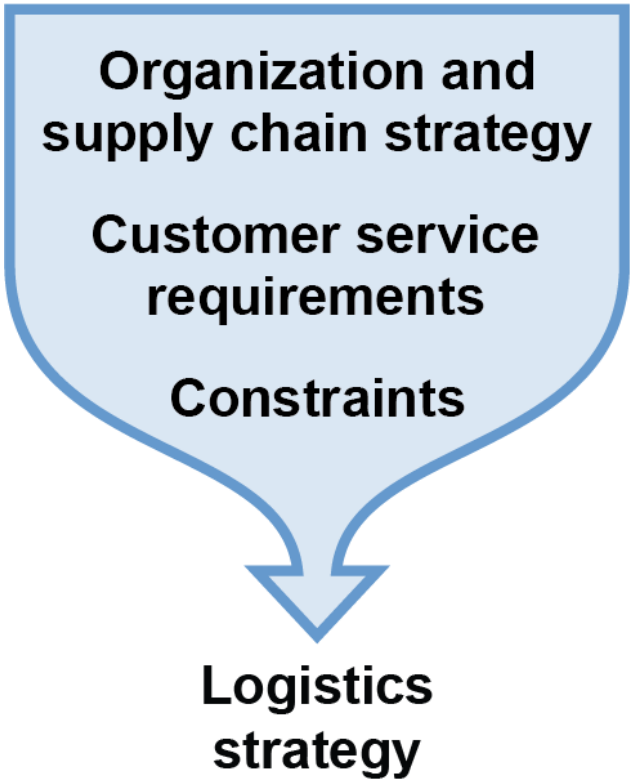
Goals and Objectives

Planning and Control Horizons

Level	Elements Planned or Controlled	
Strategic *Planning horizon:* 3–5 years+ *Purpose:* Planning	• Capital expenditures, operating costs • Customer service levels • Distribution channels • Supply locations • Manufacturing locations	• Warehouse types, sizes, numbers, locations • Modes and delivery • Make-or-buy • Inventory
Tactical *Planning horizon:* 6–12 months *Purpose:* Planning and control	• Warehouse layout, hardware, control • Materials-handling process, equipment • Order processing	• Mode, carriers, routes, schedules • Vehicle type, quantity • Metrics and process • Service process
Operational *Planning horizon:* Daily *Purpose:* Control	• Receiving • Storage • Order picking, packing • Replenishment • Load planning	• Routing, scheduling • Personnel • Order documentation • Inventory level • Maintenance, repair

Goals and Objectives

Inputs to Logistics Strategy



Goals and Objectives

Generic Logistics Strategies

Process strategy

Market strategy

Information strategy

Goals and Objectives

Logistics Goals and Objectives

Goals	Objectives (More Comprehensive)	SMART
Broad plan to realize strategy (e.g., parties, channels add value or are eliminated)	• Network integration • Variance reduction • Agility • Product life cycle support and reverse logistics • Quality • Customer service and responsiveness	Specific Measurable Attainable Relevant Time-bound

Value Propositions and Cost and Service Optimization

Value Proposition for Generic Strategies

Process strategy	▪ High quality at low price ▪ Economies of scale
Market strategy	▪ Convenient variety when and where needed ▪ Economies of scope
Information strategy	▪ Relevancy to customer segment ▪ Integrates and sequences custom networks

Value Propositions and Cost and Service Optimization

Value Propositions for Logistics

Logistics Goals and Objectives	Value Proposition
Network integration	Achieve lowest total cost at acceptable service level.
Variance reduction	Shorten order cycles.
Agility	Postpone operations.
Product life cycle support	Be agile to help meet variations in demand.
Reverse logistics	Proactively manage returns to manage profitability.
Quality	Invest in quality.
Customer service and responsiveness	Establish a base logistics service to set expectations.

Optimizing Logistics: Basic Optimization Categories

Availability	Operational performance	Service reliability
▪ Faster shipping ▪ Frequent deliveries ▪ Safety stock	▪ Delivery consistency ▪ Flexibility for requests ▪ Responsiveness to changes in demand	▪ Training ▪ Performance measurement ▪ Continuous improvement ▪ Recovery, repair, and replacing lost customers

Value Propositions and Cost and Service Optimization

Innovate for Low-Cost Transport, Warehouse

- Longer line hauls, more full loads
- Shipment consolidators
- Delaying shipments to consolidate loads
- Partnering with others with same origin-destination pairings
- Long-term package service contracts
- Spot stocking
- Dwell reduction
- Demurrage charges elimination

Value Propositions and Cost and Service Optimization

Labor and Technology Optimization

Labor	Technology
• Preventive investments • Empowered workforce • Cross-training • Worker safety measures • Rules • Tracking technology	• On-demand role-based access • Accurate and timely • Know desired results • Understand actual product capabilities and drawbacks • Training and change management

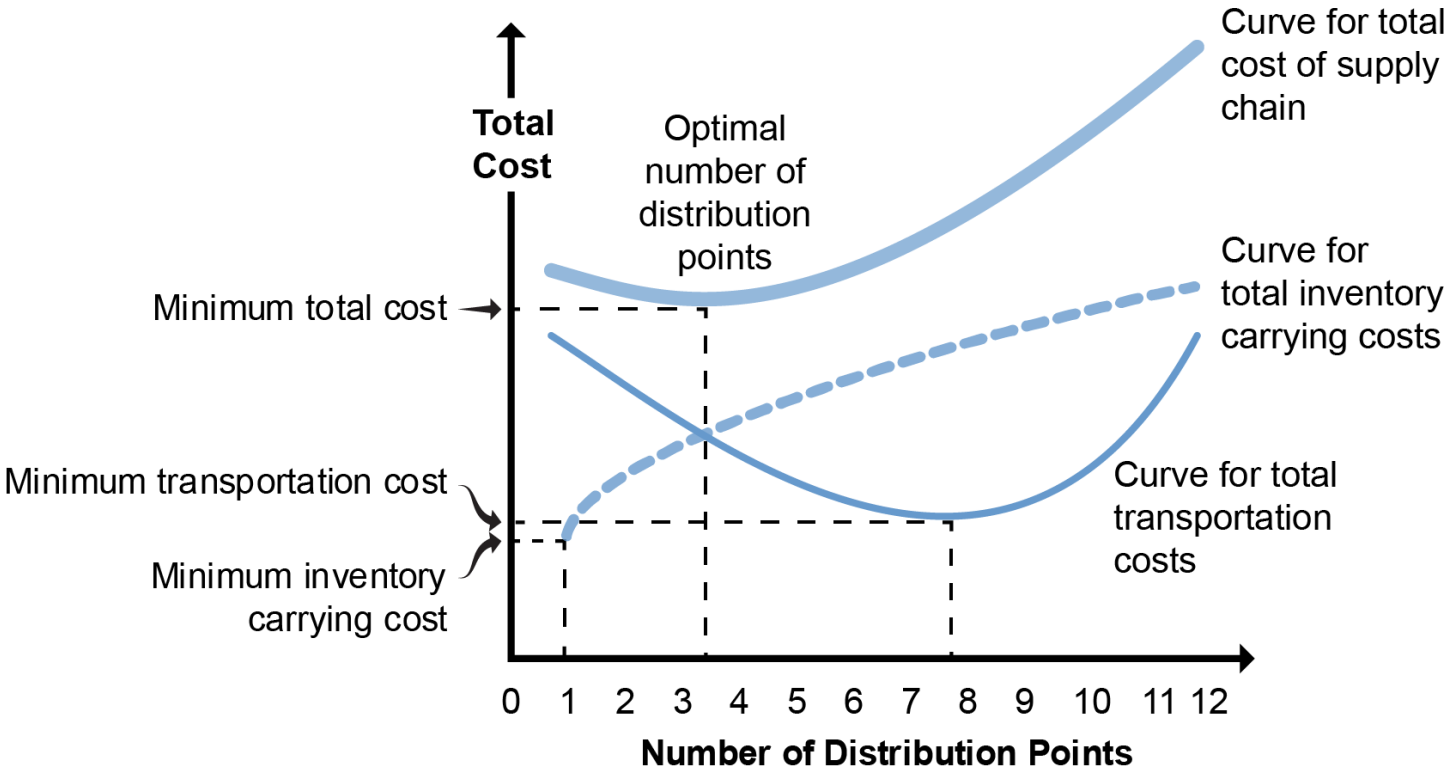
Value Propositions and Cost and Service Optimization

Total Cost of Ownership (TCO)

Pre-transaction components	Identifying need and sources, suppliers; educating on operations
Transaction components	Purchase price, landed costs (transportation, tariffs, duties, taxes, inventory carrying costs, 3PL fees)
Post-transaction components	Life cycle, MRO, cost of quality, sustainability, customer service and reputation

Value Propositions and Cost and Service Optimization

Cost of Distribution Centers



Value Propositions and Cost and Service Optimization

TCO Supplier Comparison

Copper tubing comparison example

- What are your priorities?

CPC # PO33293	Description: 3/8" Copper Tubing Type M, 10 feet long			
Suppliers	**A (Brazil)**	**B (Korea)**	**C (China)**	**D (U.S.A)**
Landed costs				
Price per unit	USD 9.800	USD 9.600	USD 8.200	USD 11.200
Inbound transportation	1.200	1.600	1.650	0.211
Total landed costs	11.000	11.200	9.85	11.411
Life-cycle costs				
Contracting	0.200	0.200	0.200	0.200
Business unit purchasing	1.488	0.880	0.990	0.790
Logistics administration	2.120	2.570	2.100	1.110
Receiving	0.027	0.032	0.054	0.012
Inspection	0.050	0.070	0.110	0.080
Cost of internal quality	0.430	0.540	0.520	0.780
Inventory carrying	1.200	1.600	1.650	0.08
Accounts payable	0.050	0.050	0.050	0.050
Exchange rate factor	0.057	2.000	0.003	0.000
Outbound transportation	0.100	0.100	0.100	0.100
Waste disposal	0.054	0.054	0.054	0.054
Cost of external quality	0.068	0.064	0.062	0.080
Total LCC	5.844	8.160	5.893	3.336
TCO (Landed + LCC)	USD 16.844	USD 19.360	USD 15.743	USD 14.747

Value Propositions and Cost and Service Optimization

Make-or-Buy Considerations

- Is the activity a core competency?
- What are the consequences of losing related skills or knowledge, and how will this impact the customer experience?
- What is the landed cost (or TCO)?
- What is the break-even point?

Core Competency Analysis

Is the competency a core competency?

- Not if others do it better or the same for less (Seek external opinions to counter internal bias.)

Should it be a core competency?

- Need must exist

- Skills of workers and organization
- Collective learning and collaboration
- Not directly related to product or market
- Rarely good reason to contract out core competency

TCO Factors Favoring Make or Buy

Favoring “make”	Favoring “buy”
• Control • Customer focus and responsiveness • Risk management	• Better agility • Better resilience • Reduced capital expenditures • Better focus on core competencies • New ways of thinking • Access to new markets • Expertise/management of complexity

Value Propositions and Cost and Service Optimization

Break-Even Analysis

"A study of the number of units or amount of time required to recoup an investment."

– ASCM Supply Chain Dictionary

Make Fixed Cost + (Make Variable Cost per Unit × Q) =

Buy Fixed Cost + (Buy Variable Cost per Unit × Q)

Q = Quantity in units

Segmentation

Customer and Delivery Channel Segmentation

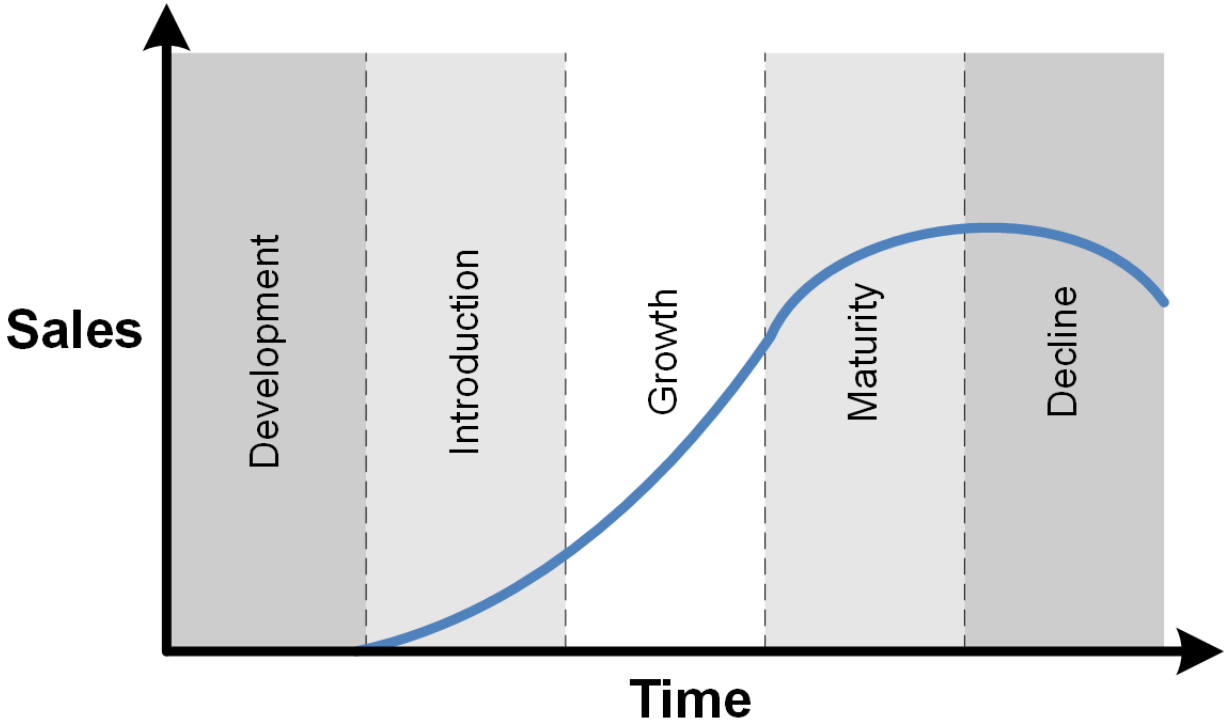
- Customer segmentation
  - What services does each segment want?
- Delivery channel segmentation
  - Omni-channel
  - Simple

Segmentation

Product Segmentation

Product Life Cycles

Product Life Cycle



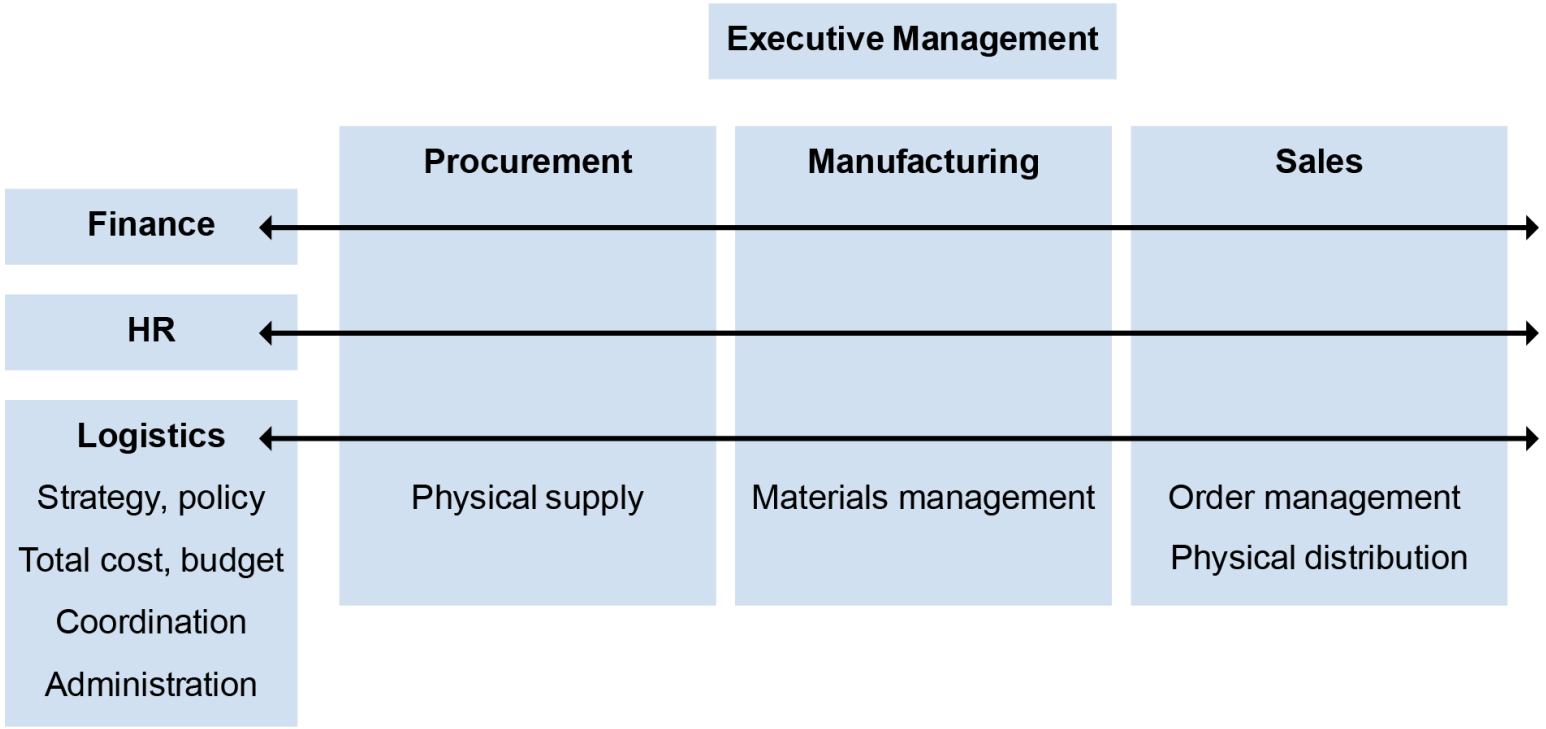
Organizational Design and SC Synchronization

Logistics Organizational Structure

- Functional (hierarchical)
  - Silos with logistics split up or a logistics functional area.
  - If cross-functional logistics manager, authority level?
- Matrix
  - Logistics has planning and process authority.
- Network
  - Empowered, decentralized decision making.

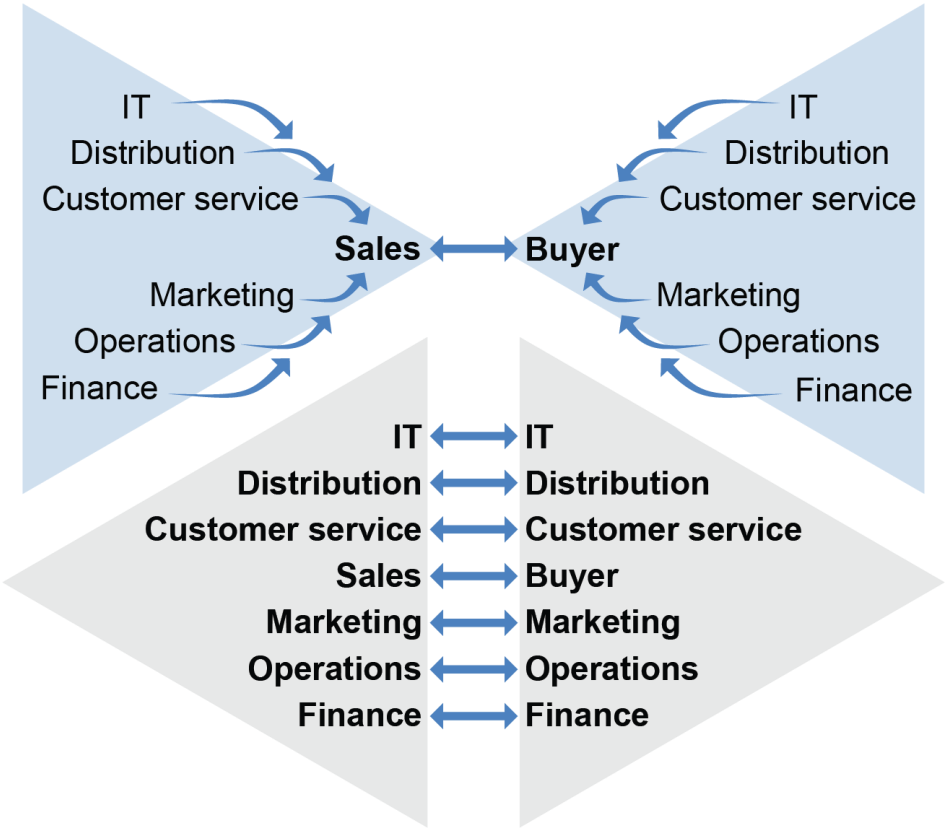
Organizational Design and SC Synchronization

Matrix Structure with Logistics as Cross-Functional Area



Organizational Design and SC Synchronization

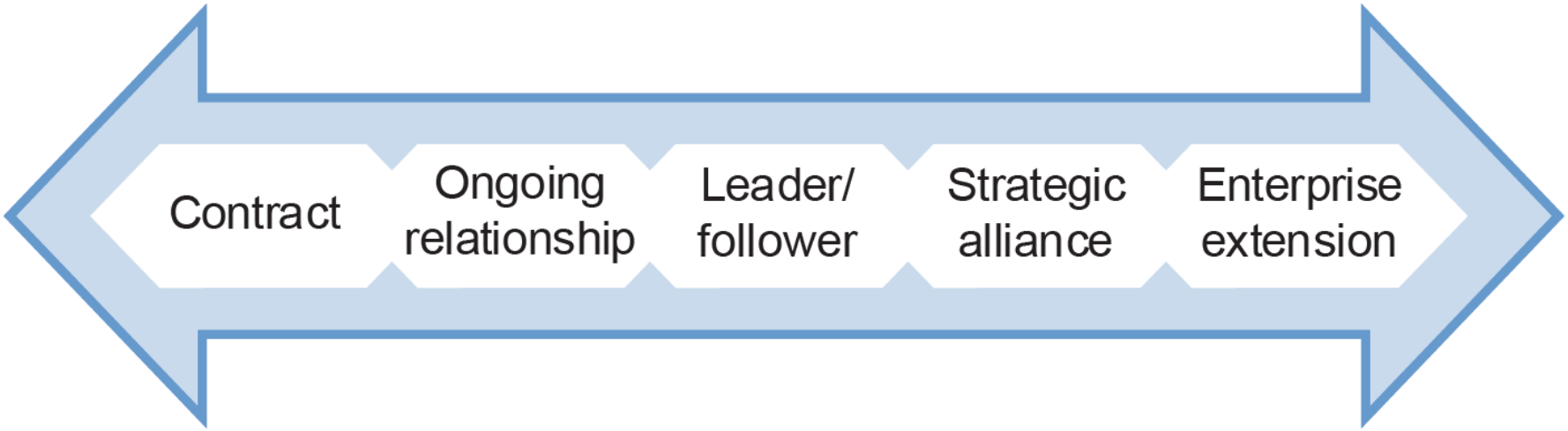
From Transactional to Linked Relationships



Source: *The Practice of Supply Chain Management,* Terry P. Harrision, Hau L. Lee, and John J. Neale, editors.

Logistics Relationships

Relationships Types Fall on a Spectrum



Logistics Relationships

Developing Relationships

3PL perspective	Factors to address
• Value added: better efficiency and effectiveness • Web-based integration • Visibility • Understand customer goals • Customer sets strategy initially • Strategy participation	• Trust • Leadership • Power • Risk • Information sharing and visibility

Logistics Relationships

Initiating, Maintaining, and Terminating Relationships

- Invest time in analysis and project planning.
  - Reduces risk of failure
  - Increases benefits
- Develop exit plan.
- Reasons for termination:
  - Unprofitable cost pressure
  - Failure to remedy service issues
  - Difference of opinions
  - Competition

Logistics Relationships

Types of Collaboration

Horizontal collaboration

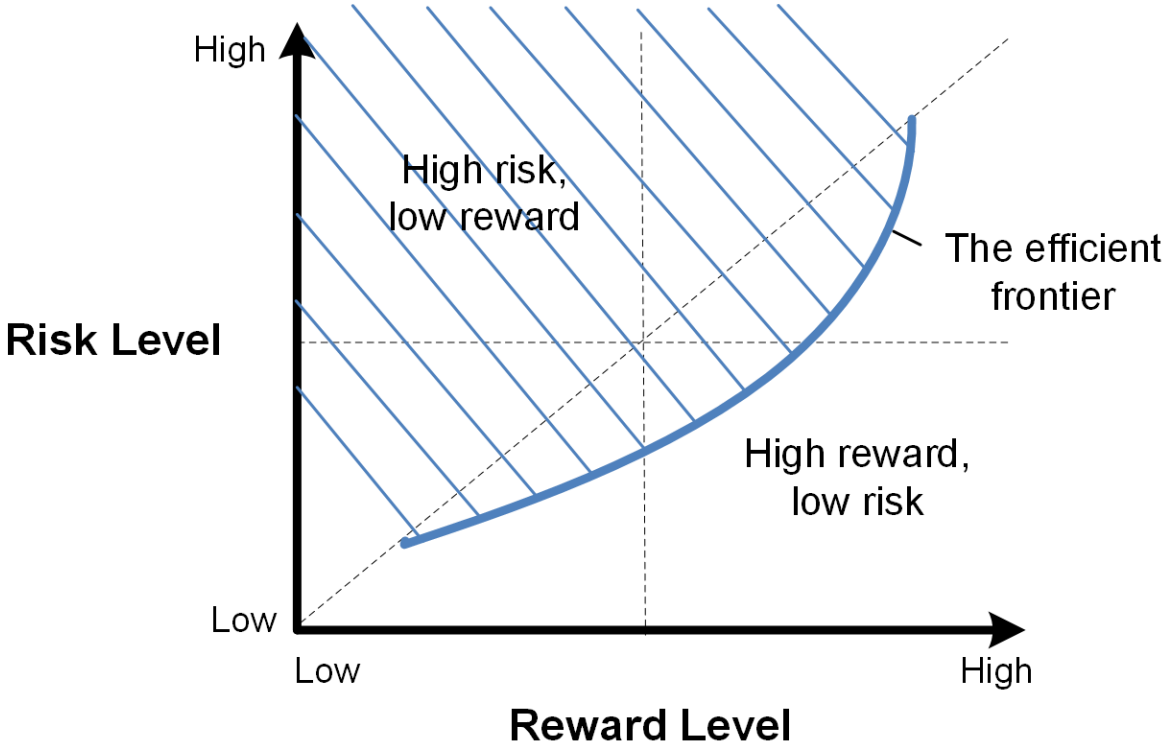
- Relationships between competitors or organizations doing parts of a process in parallel or sequence
- Shared logistics services through 3PLs

Vertical collaboration

- Quick response (QR)
- Efficient consumer response (ECR)
- Collaborative planning, forecasting, and replenishment (CPFR)
- Vendor-managed inventory (VMI)

Strategic Risk Management

Strategic Risk versus Reward



Strategic Risk Management

Types of Risk

Demand

Supply

Process

Financial

Environmental

Strategic Risk Management

Tradeoffs Involve Risk

Strategy	Opportunities	Risks
Lean	Less waste and less buffer for better turnover.	No buffers increases risk of stockouts or line stoppage after disruption.
Fewer suppliers	Lean works with long-term suppliers to gain economies of scale.	Fewer suppliers increases supply risk due to disaster or financial failure.
Low-cost country sourcing	Low-labor-cost sourcing creates cost advantage.	Longer lead times and risk of intellectual property theft or government appropriation.
Contracting	Opportunity to focus on core competencies and cut costs.	Operations are less visible and harder to coordinate.

Strategic Risk Management

Additional Areas of Risk

Supply chain security

- Be proactive
- Safer modes
- Insurance
- Pilferage
- Safety policies
- Damage prevention

Compliance

- Customs
- Prohibited goods
- Country of origin
- All modes
- Safety
- Anti-terrorism

Social mandates

- Voluntary initiatives
- Consumer pressure

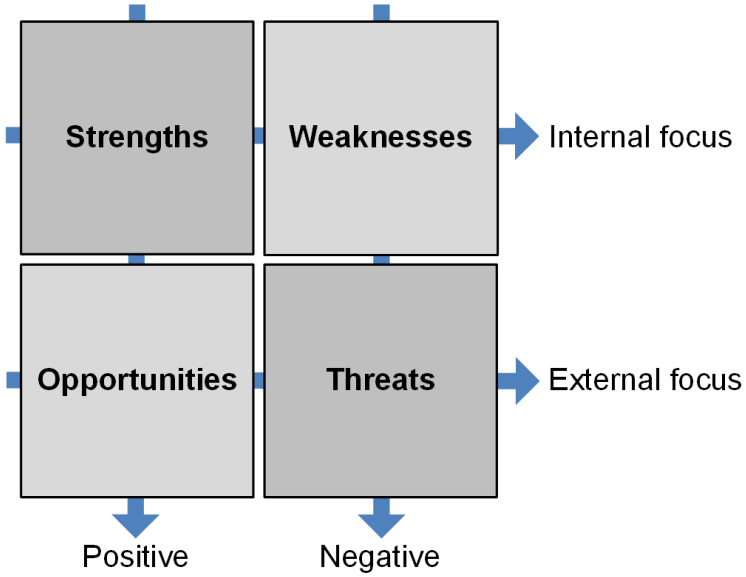
Strategic Risk Management

Strategic Risk Tools

Exceptions

- Detecting gaps in strategy
- Anonymous surveys
- Ways strategy might fail
- Common-sense exceptions
- Reduce complexity and variety

SWOT analysis



Strategic Risk Management

LTD Continuity Plan: Quick, Effective Action

Standards and policies

- Planning and control methodologies
- IT and tools
- Administer and audit
- Insured vs. not insured

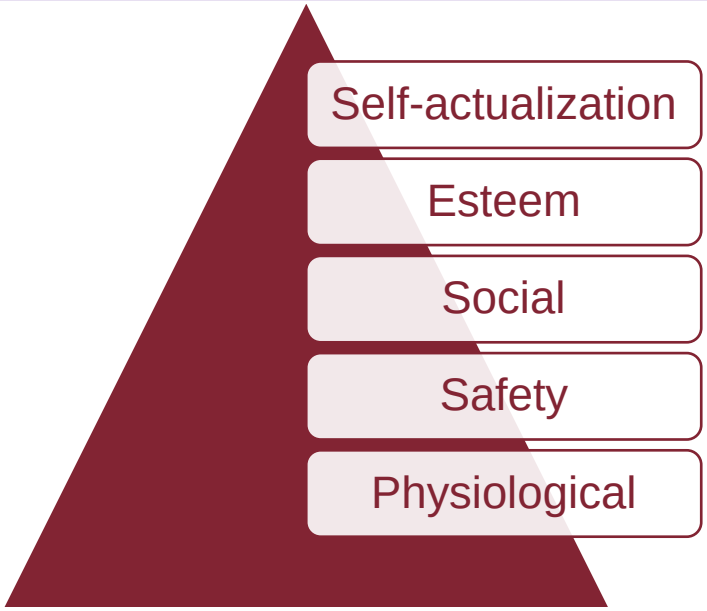
Plan governance

- Historical use and effectiveness
- Gap analysis
- Up to date
- Appropriately sized based on likelihood and impact

Talent Acquisition and Management

Talent Retention: Understand Wants/Needs

Maslow's hierarchy



Common survey priorities

- Competitive salary
- Challenging work
- Work-life balance
- Talented team
- Appreciation for your work
- Training/career path
- Admired leaders/company

Talent Acquisition and Management

Talent Requirements and Recruitment

Talent requirements	Recruitment

• Talent capacity constraint
• Digitization of logistics
• Degree earners lacking
• Line-haul drivers lacking
  – High turnover, costs
  – “Arms race” among carriers
	• Raise awareness of logistics as career path.
	• Clearly lay out promotions, career path.
	• Drivers:
	  – Redesign networks for work-life balance.
	  – Regional operations.

Talent Acquisition and Management

Development, Retention, and Management

Development and retention

- Invest in training and development
- Certifications
- Career path
- Management quality
  - Care about work/worker
  - Know what jobs entail

Personnel management

- ERP tracks pay and capability
- Just enough supervisors
- Drug and alcohol testing

Recap of Key Points

- Logistics involves designing, planning, executing, and controlling the movement, storage, and handling of goods to meet customer requirements efficiently.
- It includes physical supply and distribution, coordinating supply and demand, and optimizing total system costs.
- Total Cost Concept and Tradeoffs focuses on minimizing overall logistics costs while balancing tradeoffs (e.g., transportation vs. inventory costs).
- Logistics Management creates competitive advantage through efficiency, agility, resilience, and customer focus.
- Strategies include reducing costs (e.g., inventory turnover, labor savings) and innovating to address customer pain points.
- Optimization involves service reliability, labor/technology investments, and Total Cost of Ownership (TCO) analysis for supplier comparisons.

Homework Assignment

- Select a Company: Choose a company known for innovative logistics/distribution practices (e.g., Amazon, Walmart, DHL, Zara, or a local business).
- Research & Analyze:
  - Logistics Strategy: How does the company align inventory with demand? Mention tools like ABC analysis or JIT.
  - Cost Tradeoffs: Identify one key tradeoff (e.g., faster shipping vs. higher costs) and how the company manages it.
  - Innovation: Describe one technology or process (e.g., automation, IoT, 3PL partnerships) that improved efficiency.
  - Challenges: Briefly note a logistics challenge the company faced (e.g., supply chain disruptions, high transportation costs).
- Recommendation: Propose one improvement to their logistics strategy (e.g., adopting drone delivery, better inventory tracking).
- Deliverable (2-5pages max):
- Format: Short report (bullet points or paragraphs).
- Submission: Due on April 16
- Grading Criteria: Relevance to lesson concepts, Clarity and critical thinking. Practical recommendation