

Logistics for Public Freight Planners: Theory and Practice

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Outline

- Background
- Introduction to Supply Chain and Logistics
- Topic Areas
 - Supply Chain Strategies
 - Network Design and Facility Location
 - Procurement and Outsourcing
 - IT and Logistics
- Summary
- Online GIS Tool for Truck Parking Study

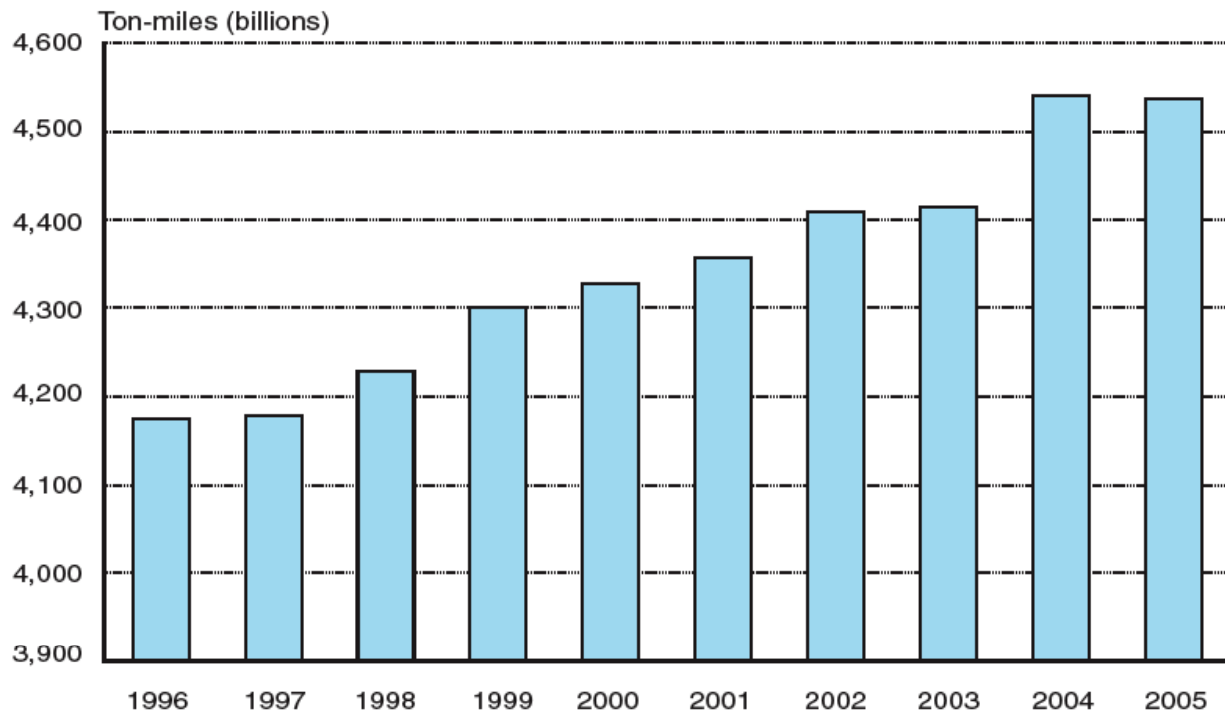
Background

- Continued growth in freight traffic
- Logistics and freight planning
- Freight planners lack of logistics background
- Mississippi Valley Freight Coalition Project
 - Online course
 - Team: Teresa Adams, Bruce Wang and Ernie Wittwer

Course Outline


- Part One
 - Introduction and total cost competition
 - Managing inventories
 - Managing transportation
 - The European experience and conclusions
- Part Two
 - Logistics strategies
 - Network design
 - Outsourcing and third party logistics
 - Information technology
- Summary

Growth in Ton-Miles



2020 Congestion: A Challenge to Public Freight Planners

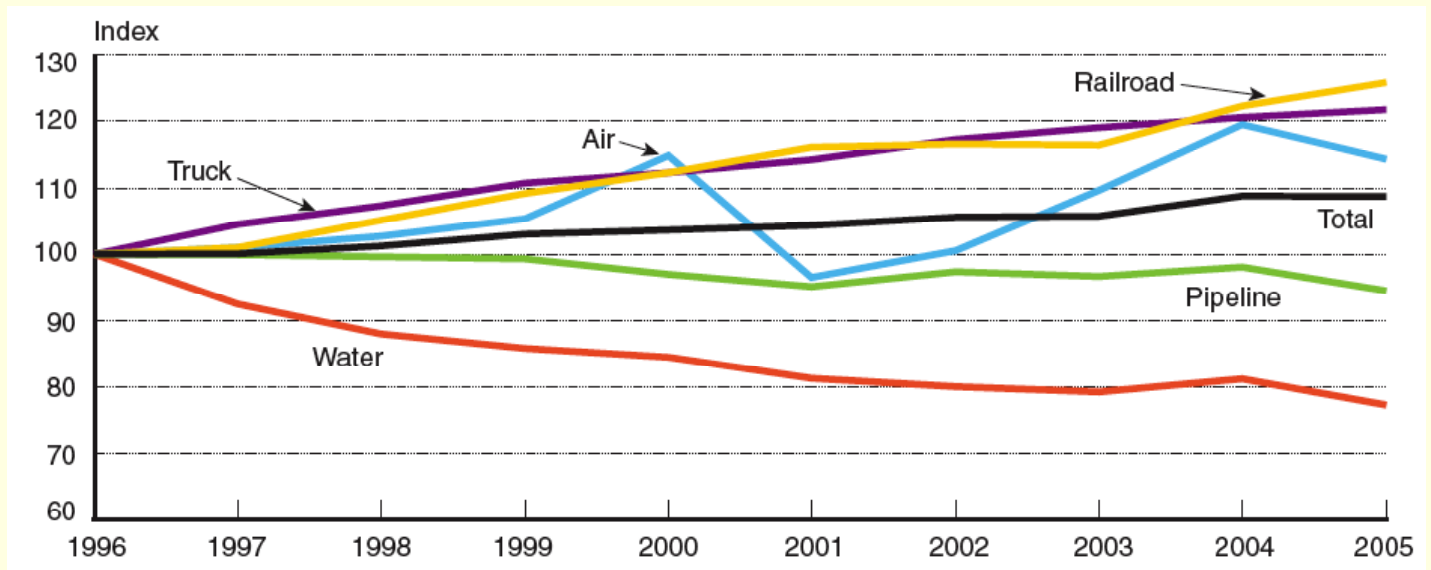



National Highway System Estimated Peak Period Congestion
 (2020)

US Department of Transportation
 Federal Highway Administration
 Office of Freight Management and Operations
 Freight Analysis Framework

NHS Highways
 — Below Capacity
 — Approaching Capacity
 — Exceeding Capacity

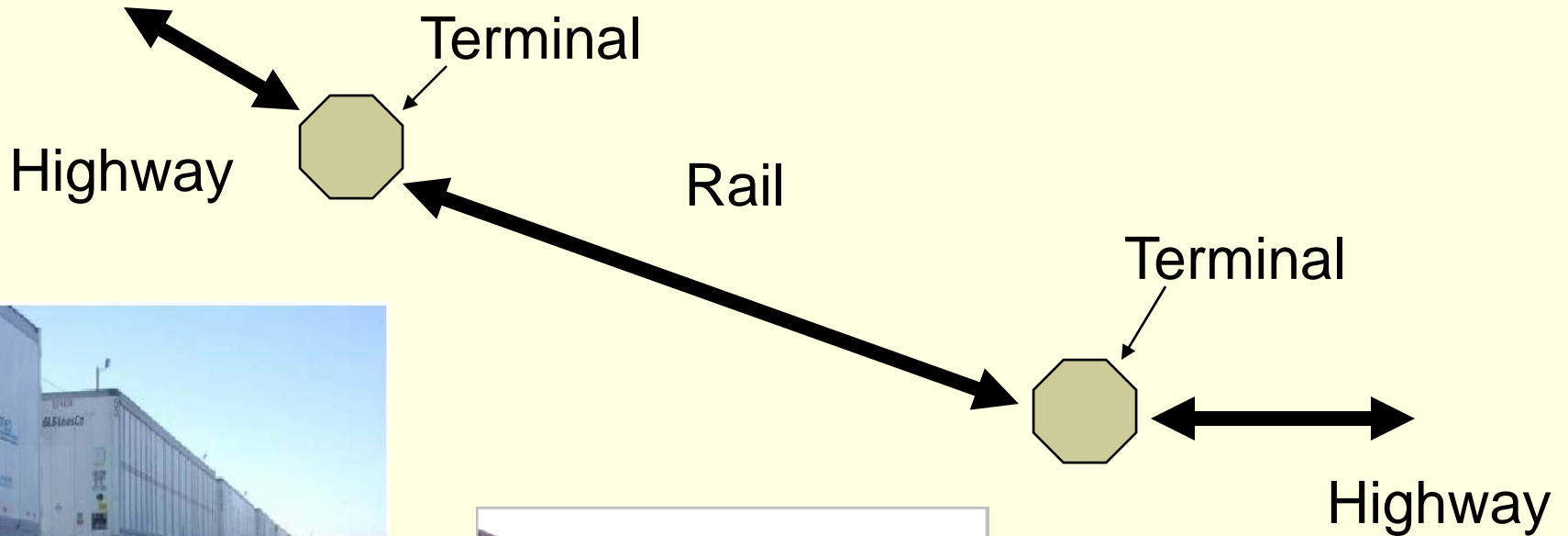
Modal Share Trends



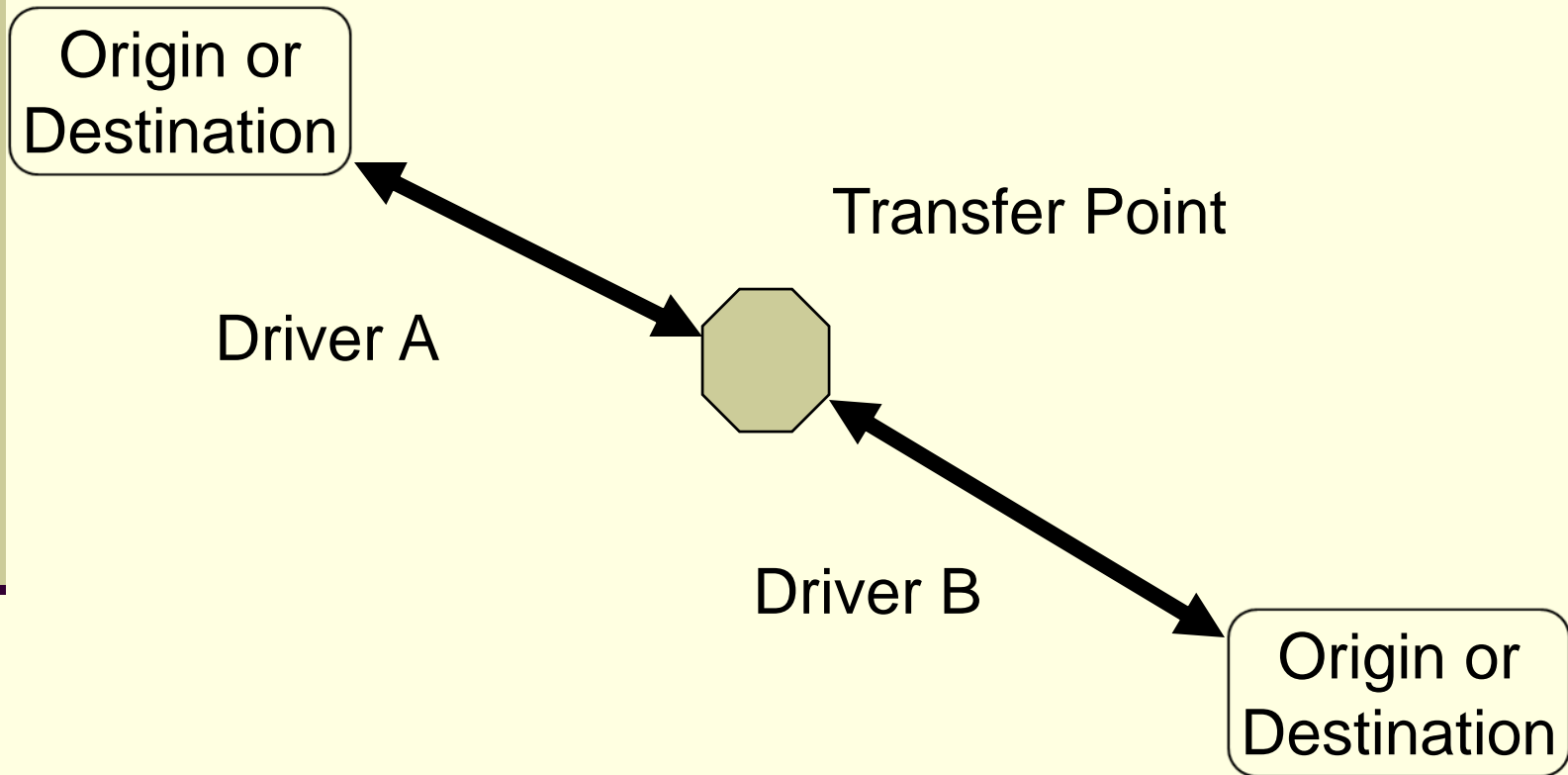
Obstacles to Modal Diversion

Market Viability	Institutional Readiness	Public Barriers
<ol style="list-style-type: none"> 1. Equivalent Services 2. Access limitations 3. Interoperability 4. Density 	<ol style="list-style-type: none"> 1. Capacity 2. Capital 3. Institutional Commitment 4. Institutional structure 	<ol style="list-style-type: none"> 1. Public acceptance 2. Competitive reckoning

Truck Rail Intermodal



Trucking Strategy



Supply Chain Management

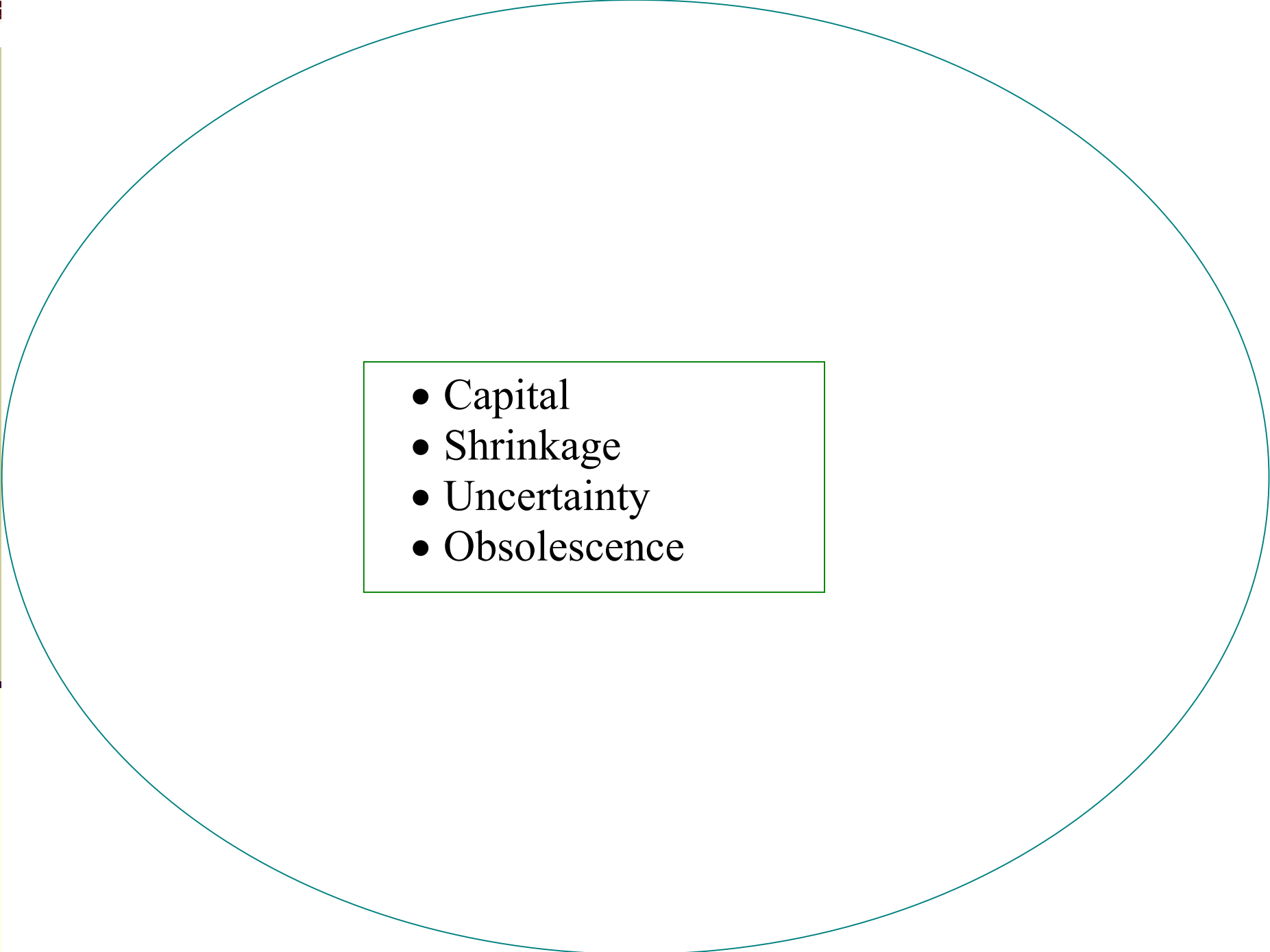
- Encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities
- It also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers

Logistics Management

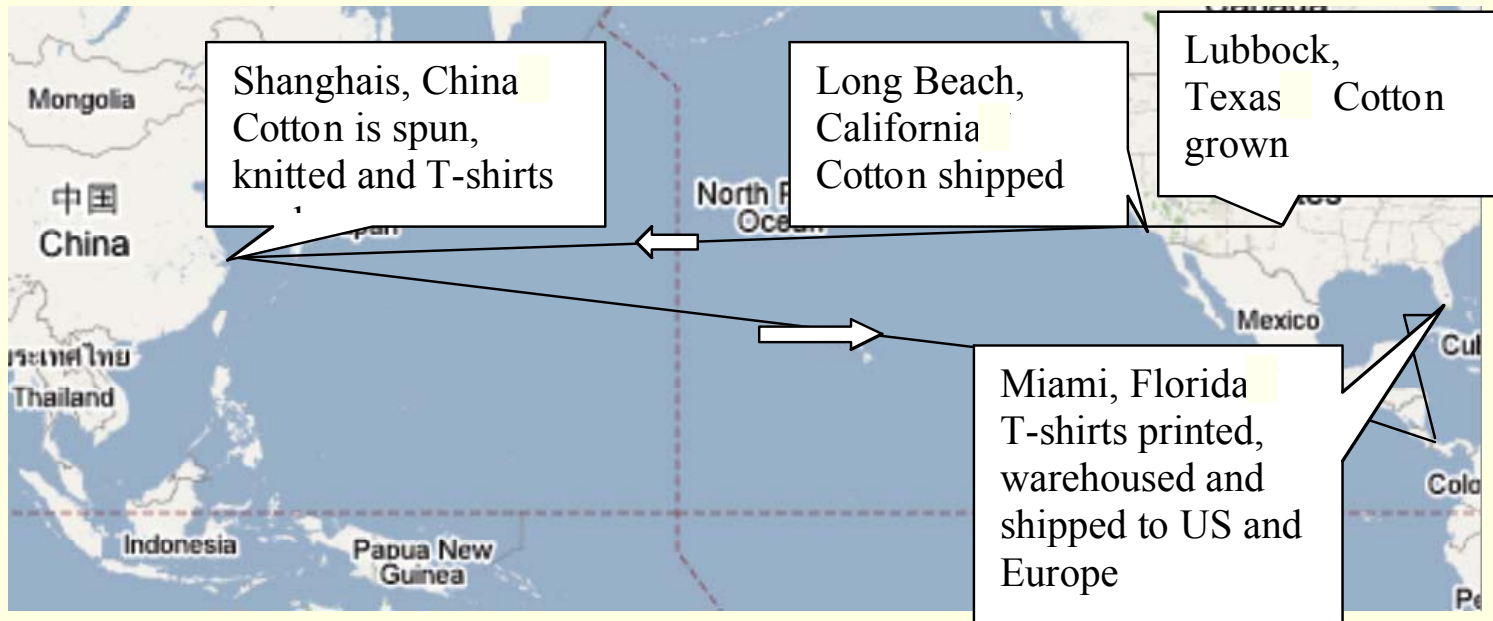
- The part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements
- Logistics is part of the supply chain management concerning materials movement and storage

Factors in Logistics

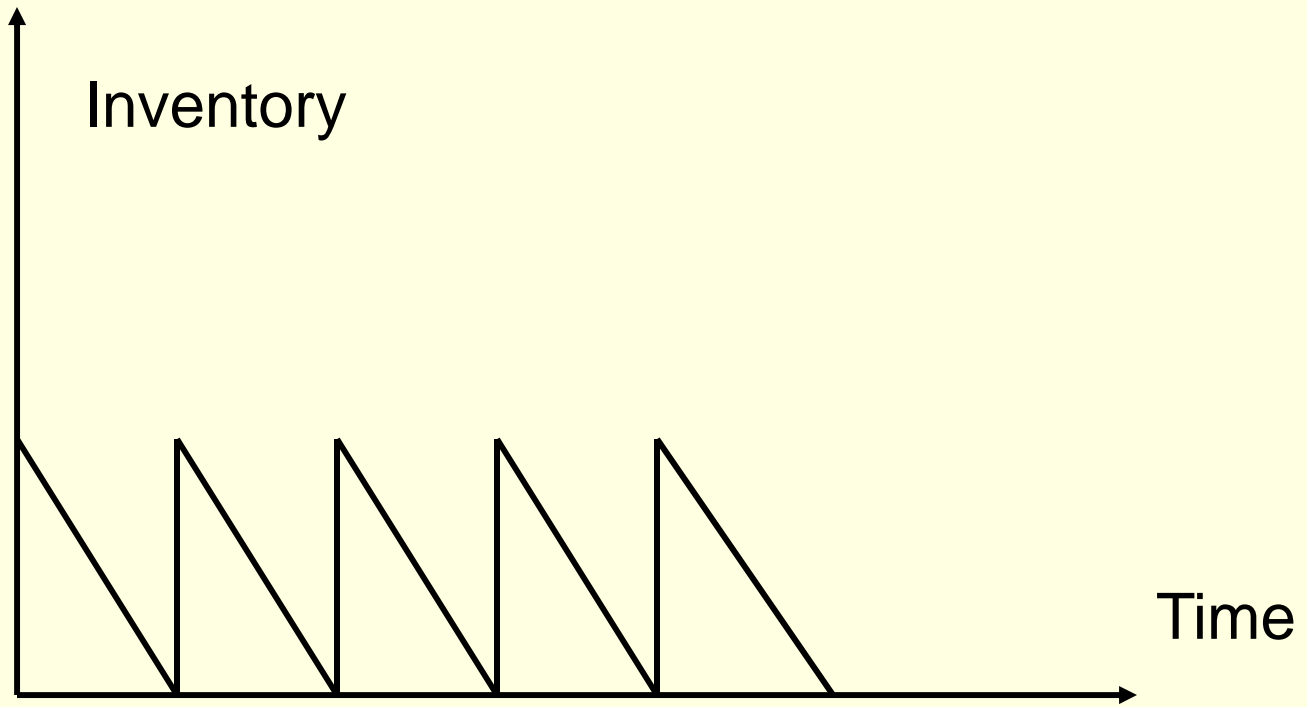
- Cost reduction
- Inventory and service
 - Commodity characteristics, markets and service needs
- Service and mode choice
- Corridor density and transportation availability
 - Truck-rail intermodal constraints

- 
- Capital
 - Shrinkage
 - Uncertainty
 - Obsolescence

The T-Shirt



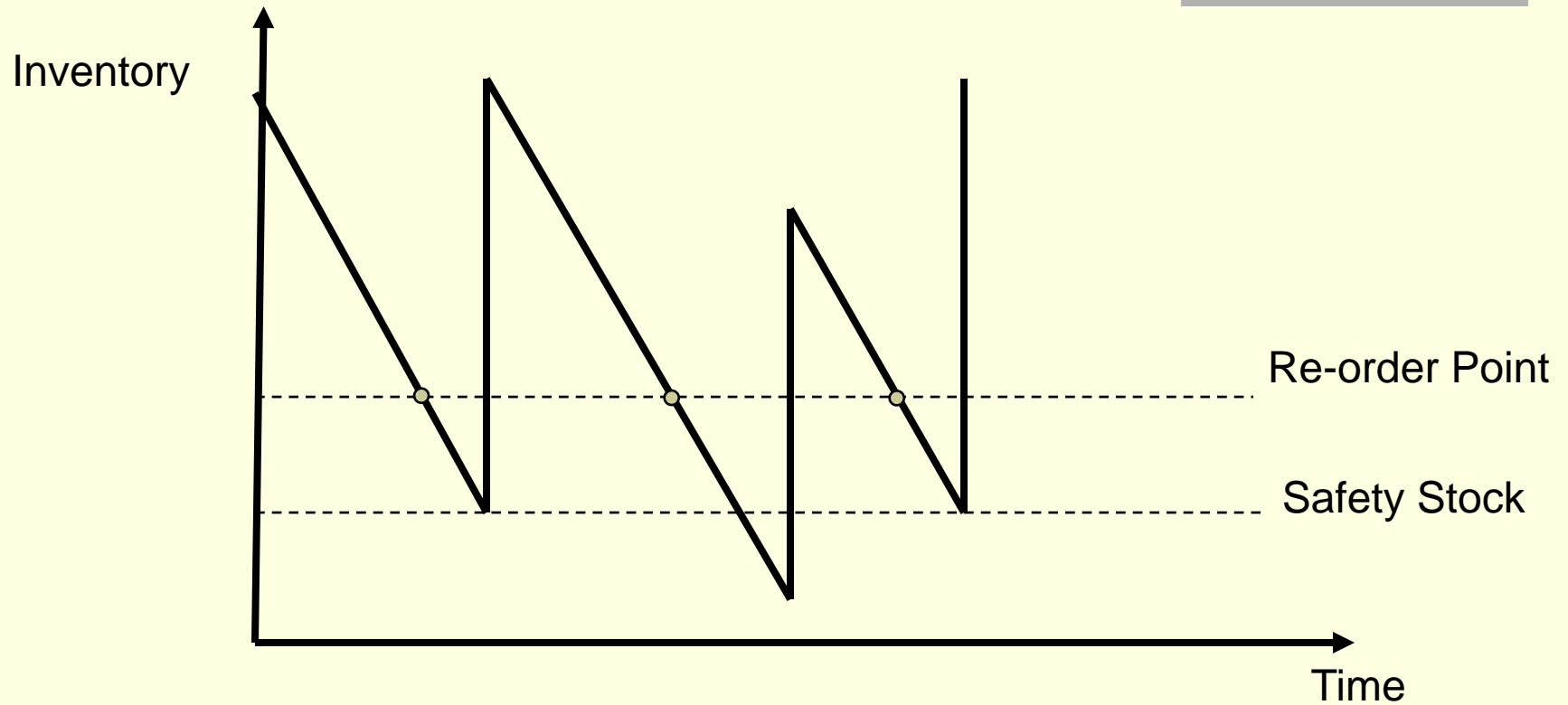
Cyclical Inventory



Trade-off Considerations

- Unit purchase price
- Fixed ordering costs
- Holding costs
 - Capital
 - Storage
 - Shrinkage, loss, damage, obsolescence

Safety Stock



Issues in Safety Stock

- Uncertainty in demand
- Uncertainty in delivery



- Cost of holding
- Cost of administration

Implications for Freight

- Reliability
- Timed arrivals
- More frequent delivery
- More truck-reliant
- More complex congestion solutions

Several Topic Areas

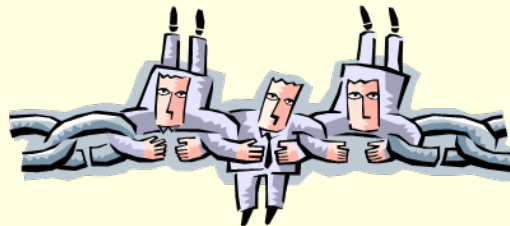
Supply Chain Strategies

Objectives of Supply Chain Strategies



To reduce total cost through

- Reducing the time from manufacturing to consumption, reduce redundant inventory in the supply chain;
- Facilitating smooth flow of products, raw materials, finance, information, technology between parties through partnership and cooperation;
- Improving system integration and system resiliency.



Logistics Cost as a Percentage of GDP

Country	GDP %
USA	10.5
Canada	12
UK	10.63
Denmark	12.88
Ireland	14.26
Spain	11.52
Hong Kong	13.71
Japan	11.37

Source: Financial Times, December 1998

Logistics Cost Breakdown in USA

Cost	Percentage
Transport	46
Storage/Warehousing	22
Inventory Carrying	22
administration	10

Cited in the Handbook of Logistics and Distribution Management.
 Source: Financial Times, December 1998.

Cost Itemization as a Percentage of Final Sales Turnover

Main Business	Transport Cost	Warehousing/ Depot	Inventory Holding	Administration	Overall
Office Equipment	3.2	10.7	0.87		14.77
Health Supply	1.36	9.77	0.66	0.19	11.98
Beer	8.16	2.82	0.56	2.19	13.74
fashion	0.38	1.31	0.33		2.02
Cement	25.2	9.1	7.1	4.6	46
Auto Parts	2.07	6.35	1.53		9.96
Computer Supply	0.65	0.78	0.09		1.52

*Source: Benchmark Survey of UK Companies by Dialog Consultants Ltd.
 Cited in Handbook of Logistics and Distribution Management
 by Rushton, Oxley and Croucher, 2000.*

Inventory Policies

- Continuous Review
- Periodic Review
- (s, S) Ordering Policy
- Economic Order Quantity (EOQ) Model – Most Basic Model

$$Q^* = \sqrt{\frac{2KD}{h}}$$

D = Demand; K = fixed ordering cost; h = inventory carrying cost

Time Reliability (Lead Time Variance) to Optimal Inventory Cost (B)

Standard Deviation (in days)	Re-order Point (units)	Inventory increase
2	179	0.78%
3	183	1.72%
4	188	2.97%
5	194	4.49%
6	202	6.23%
7	210	8.14%
8	219	10.20%
9	228	12.38%

Note: order quantity remains the same. Assume a lead time of 2 weeks.

Source: Formula from *Designing and Managing the Supply Chain* by Simchi-Levi, etc.

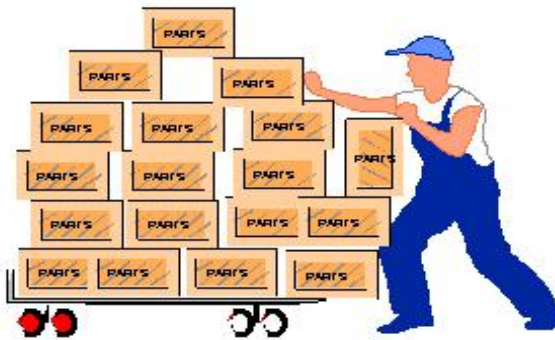
Lead Time Duration to Inventory Cost

New Lead Time (day)	Demand During Lead Time	Safety Stock	Re-order Point	Average Inventory Change
24	153	113	266	6.26%
23	146	110	257	5.70%
22	140	108	248	5.13%
21	134	106	239	4.55%
20	127	103	230	3.95%
19	121	100	221	3.34%
18	115	98	212	2.71%
17	108	95	203	2.06%
16	102	92	194	1.40%
15	96	89	185	0.71%
14	89	86	175	0.00%
13	83	83	166	-0.74%
12	76	80	156	-1.50%
11	70	76	146	-2.30%
10	64	73	137	-3.14%

Pull vs Push Systems

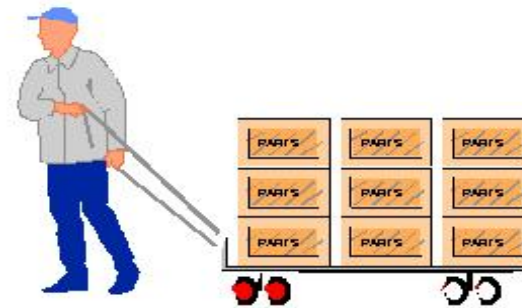
Push vs. Pull

**Make all we can
just in case.**



- Production Approximation
- Anticipated Usage'
- Large Lots
- High Inventories
- Waste
- Management by Firefighting
- Poor Communication

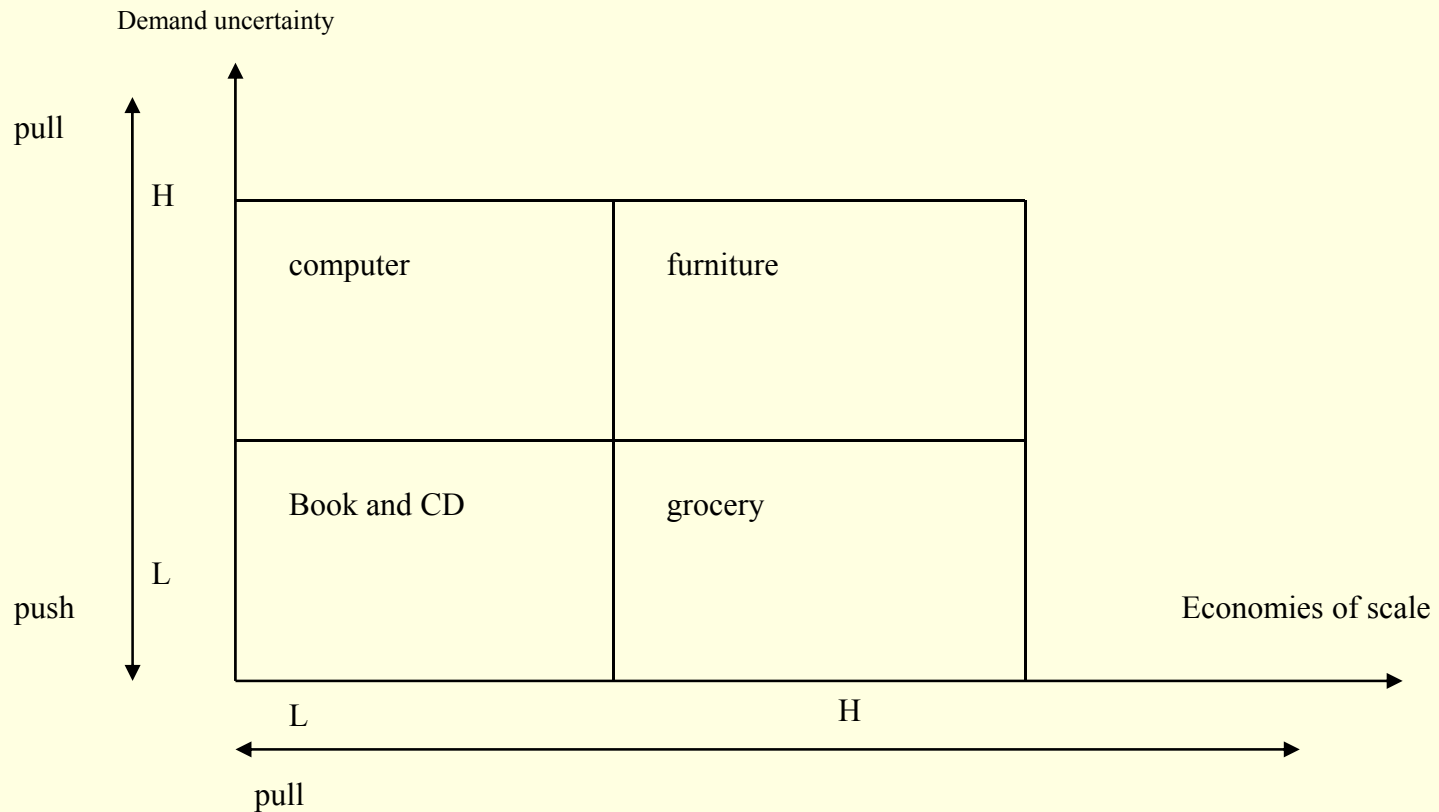
**Make what's needed
when we need it**



- Production Precision
- Actual Consumption
- Small Lots
- Low Inventories
- Waste Reduction
- Management by Sight
- Better Communication

Source: http://elsmar.com/Pull_Systems/. Accessed on September 10, 2007

Push vs. Pull systems



Source: *Designing and Managing the Supply Chain* by Simchi Levi et al. 2000

Vendor Managed Inventory (VMI) System

- Under VMI, instead of the customer monitoring its sales and inventory for the purpose of triggering replenishment orders, the vendor assumes responsibility for these activities

Assemble-to-order system

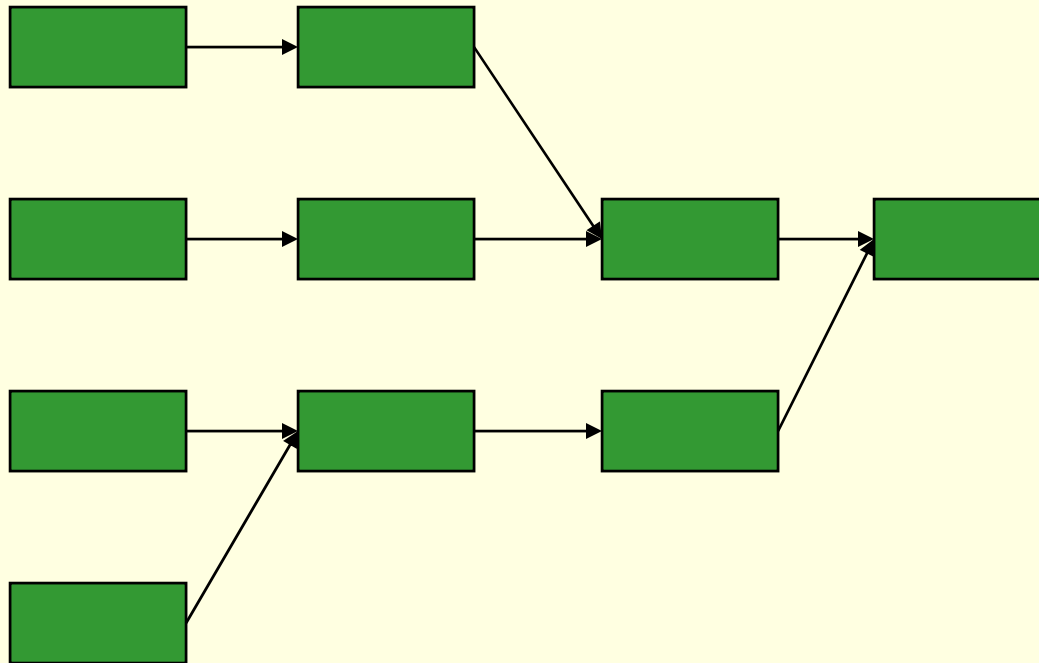
- Components ordered
- Product not assembled until order arrives
- Application condition
 - Plethora of products sharing the same set of components with different configurations.
 - Demand for each product is uncertain
 - Examples
 - PC Industry
 - Stain mixture

Just-In-Time System

- JIT demands timely, but not too early, supply of needed materials for production in just the right quantity.
- It views inventory as a cost and redundant
- Inventory needed is reduced to the minimum
- It imposes high standard onto products quality (no backup in the inventory!)

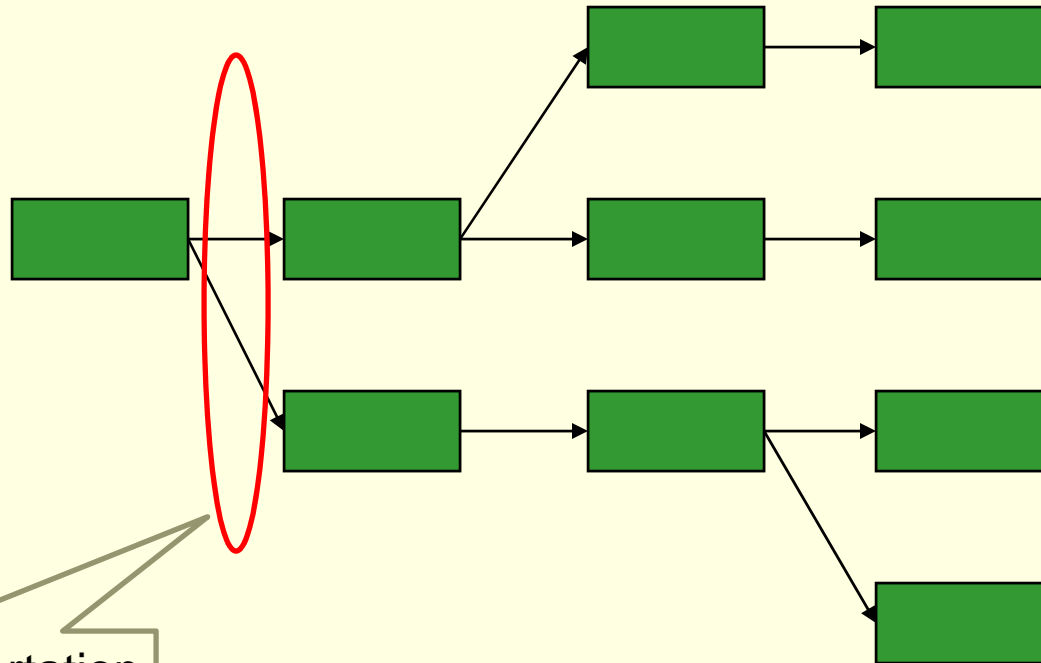
Logistics Network Design and Facility Location

Multi-echelon System



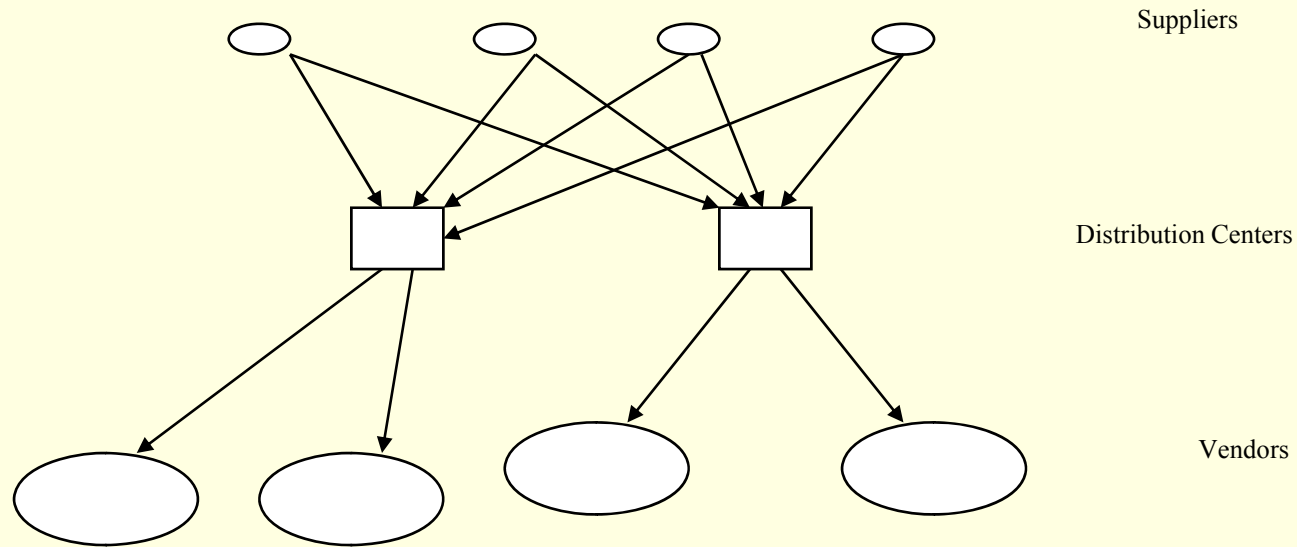
An assemble system

Multi-echelon System: An Example of Distribution

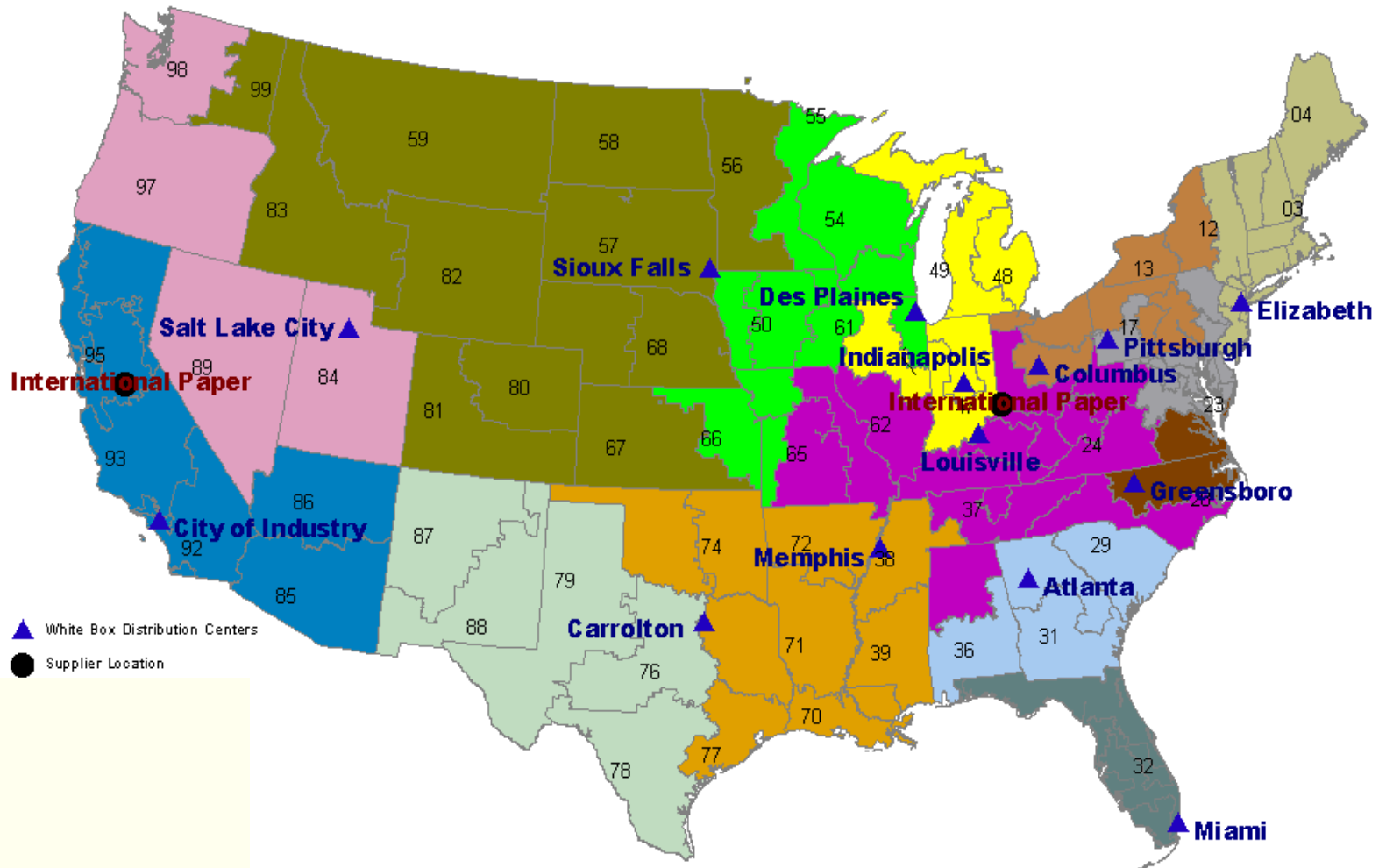


Key link in transportation

Illustrative Distribution Network



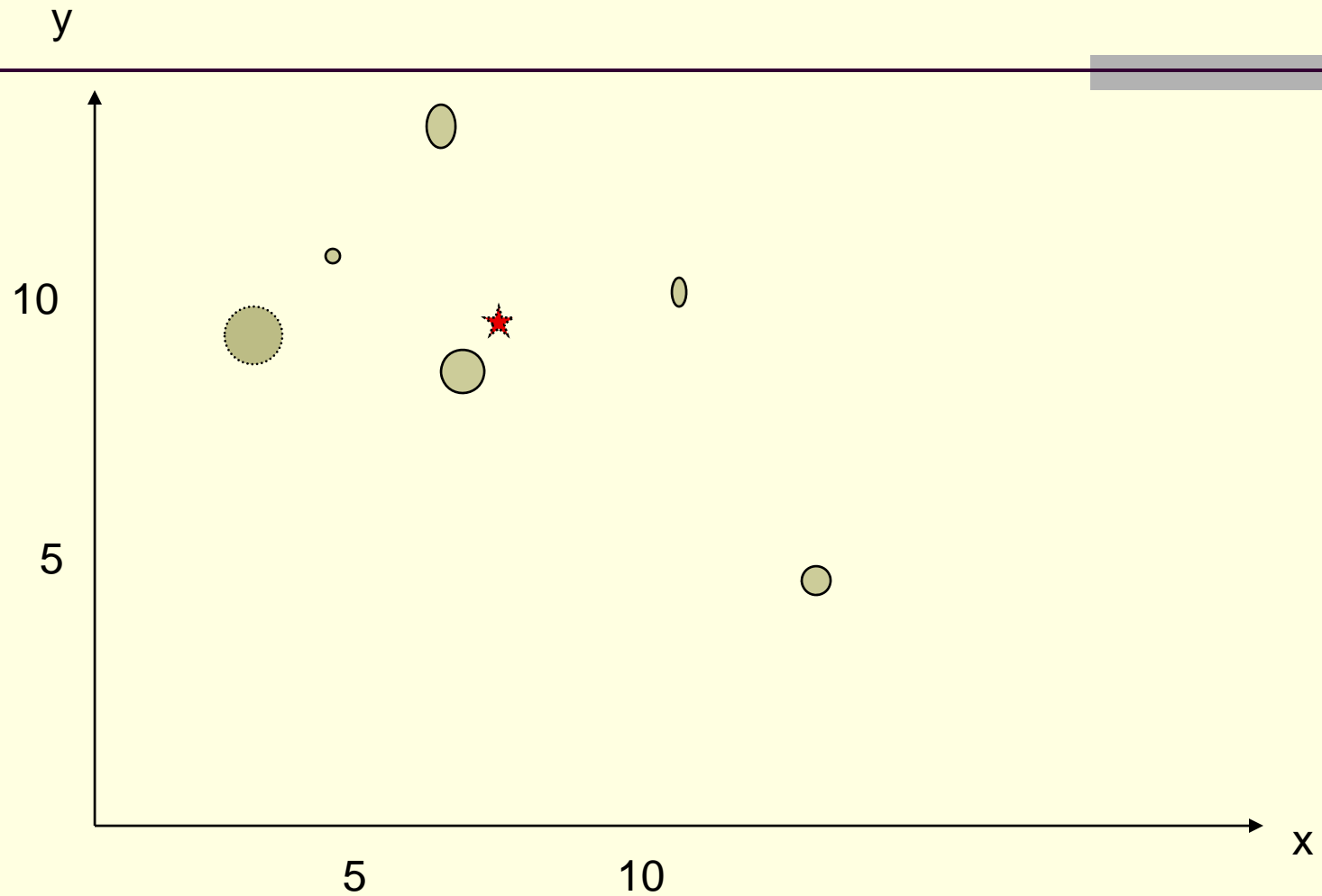
Example Logistics Network



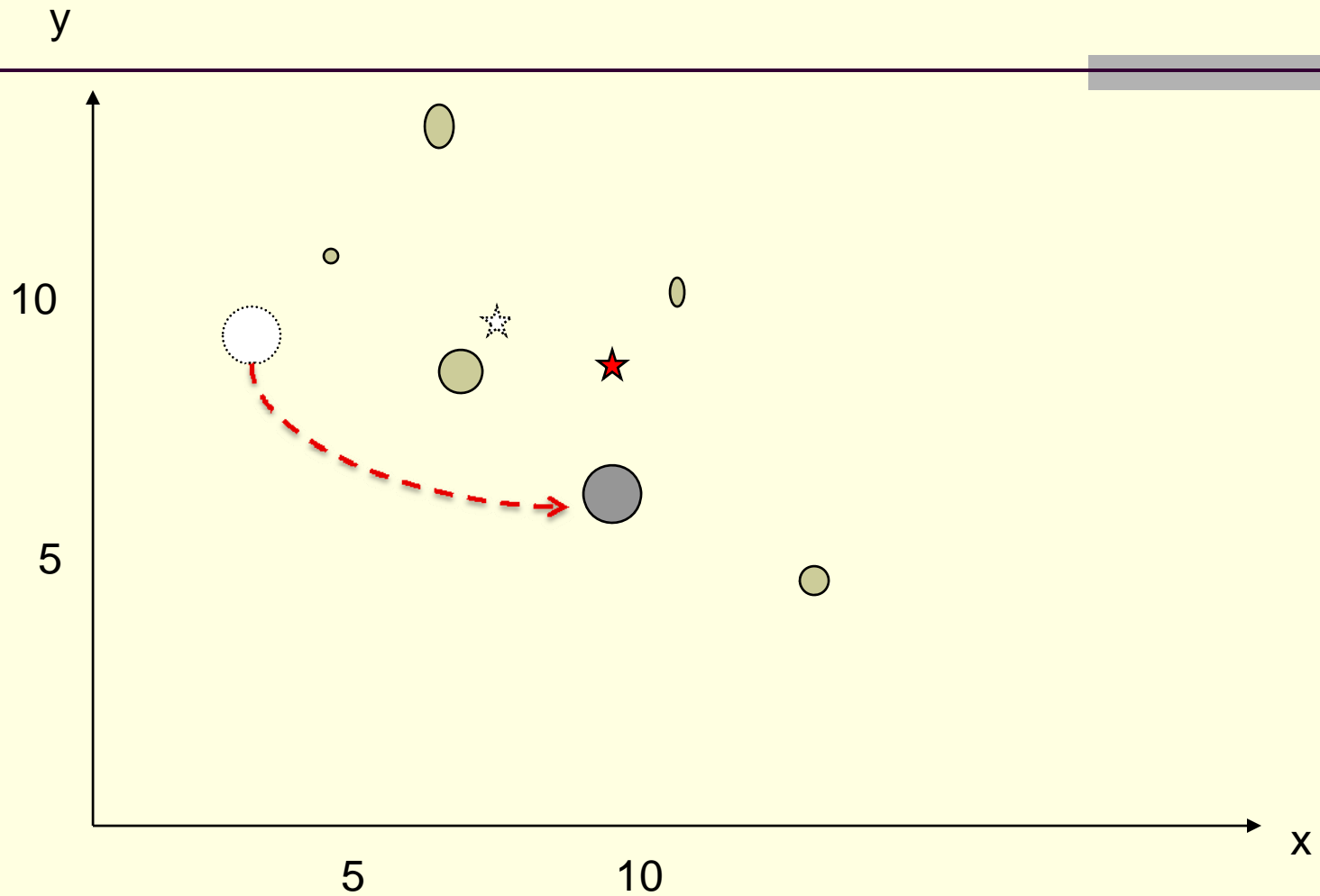
Factors Affecting Logistics Network Design

- Strategic factors
- Technological factors
- Macroeconomic factors
- Exchange rate and demand risk
- Political factors
- Infrastructure factors
- Competitive factors
- Customer response time and local presence
- Logistics and facility cost

Example: Demographic Shift

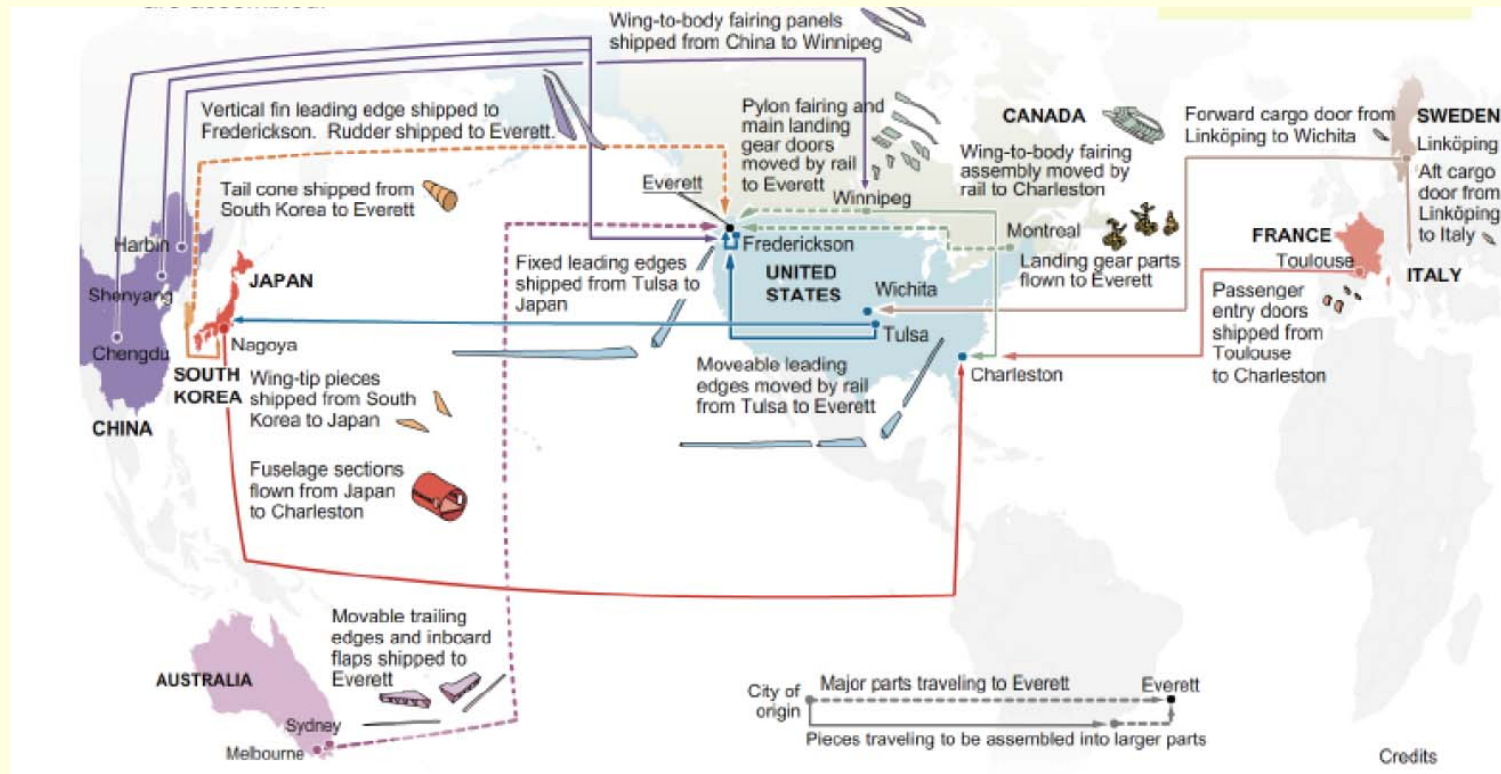


Example: Demographic Shift



Procurement and Outsourcing

Dreamliner Assembly



Results of Sourcing/Outsourcing

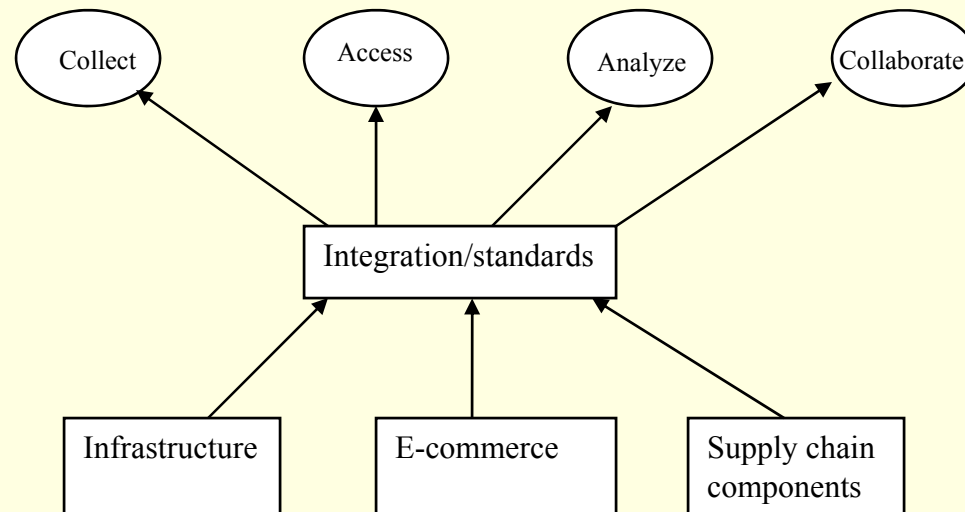
- More business exchanges
- Closer relationship between businesses
- Expedited globalization

- Question: Does this mean more reliance on transportation?

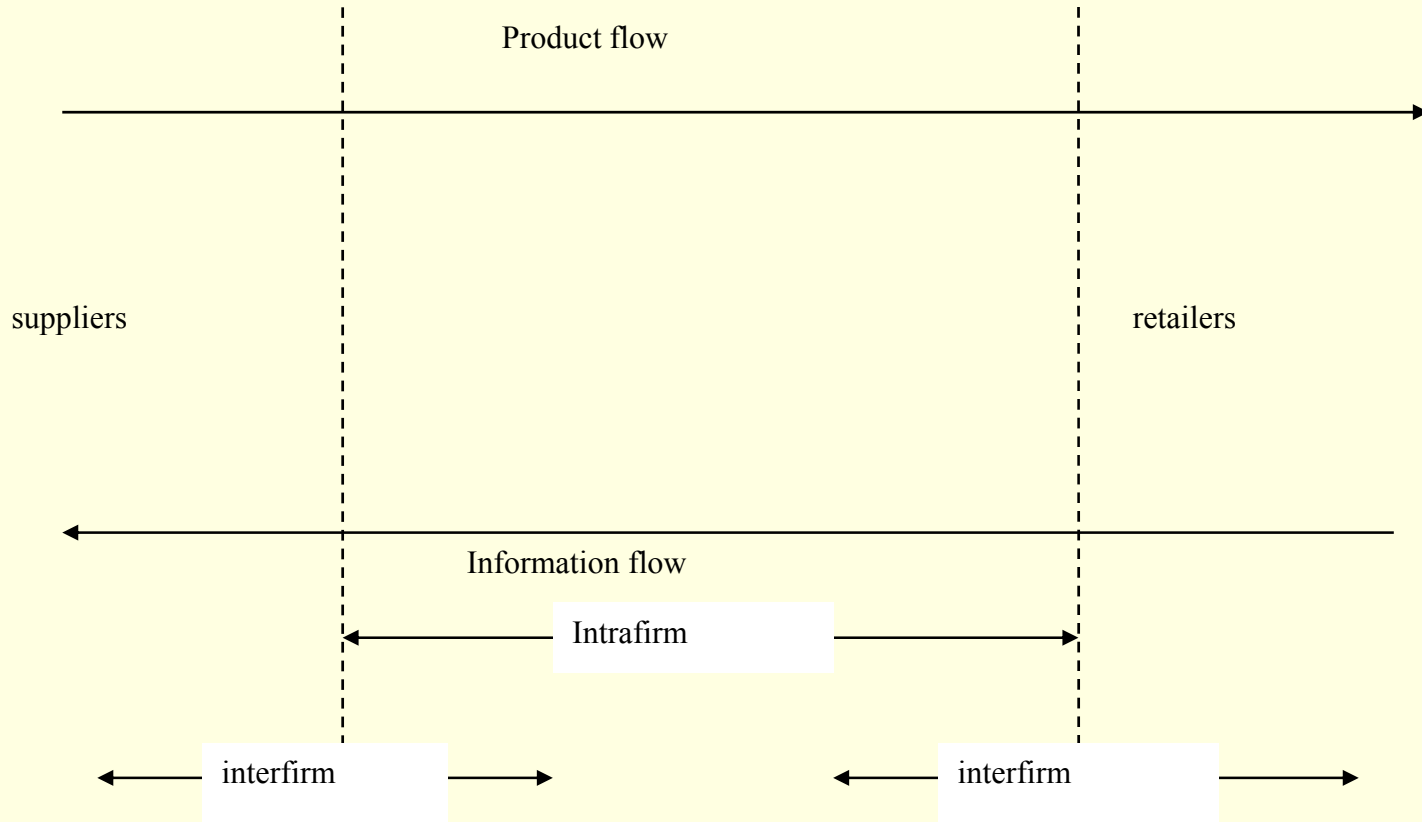
Information Technology and Logistics

Information Technology

- Information must be *accurate, accessible in a timely manner and of the right kind* in order to be useful.



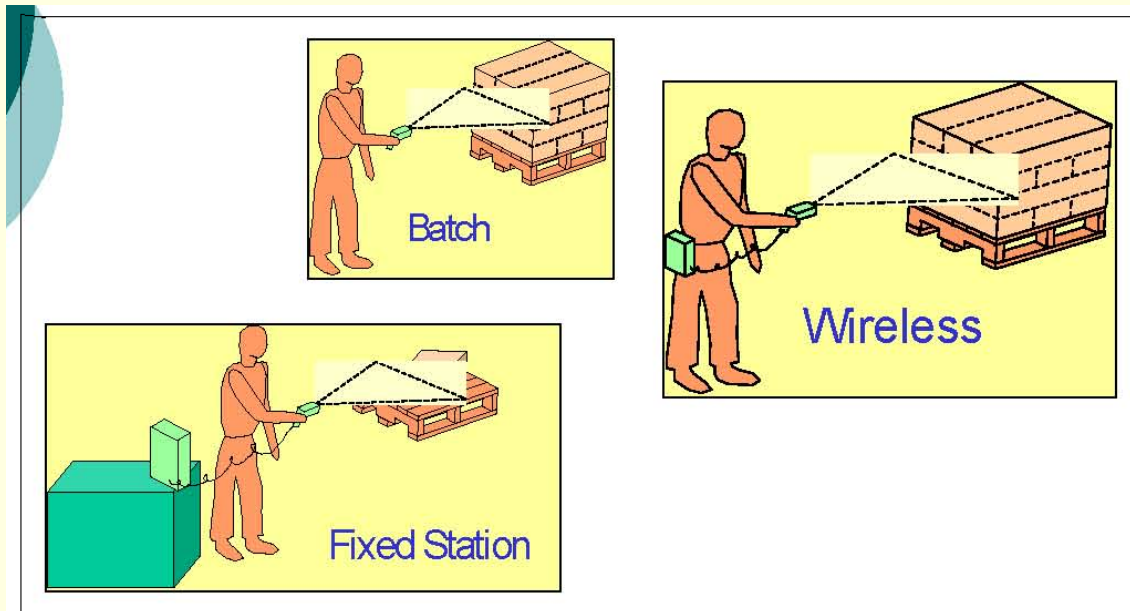
Information Flow on a Supply Chain



Major Applications of IT

- **Strategic network design**
This layer decides the optimal number of facilities (manufacturing plants, warehouses, distribution centers), their locations, outsourcing strategies and best distribution channel, etc. These decisions lay the ground for the general cost picture of operations.
- **Supply chain master planning**
This layer of decision is made on a weekly to monthly schedule in order to coordinate production, distribution strategies, and storage requirements by efficiently allocating supply chain resources to maximize profit or minimize system wide cost.
- **Operational planning**
These systems enable efficiencies in production, distribution, inventory and transportation for short term planning. The planning horizon is typically from daily to weekly. This layer includes typically four factors: demand planning, production scheduling, inventory management, and transportation planning.
- **Operational execution**
This system generally provides the data, transaction processing, user access, and infrastructure for running a company. It includes five factors: enterprise resource planning, customer relationship management, supplier relationship management, supply chain management and transportation management.

IT Examples: RFID



GPS



Source: www.howstuffworks.com

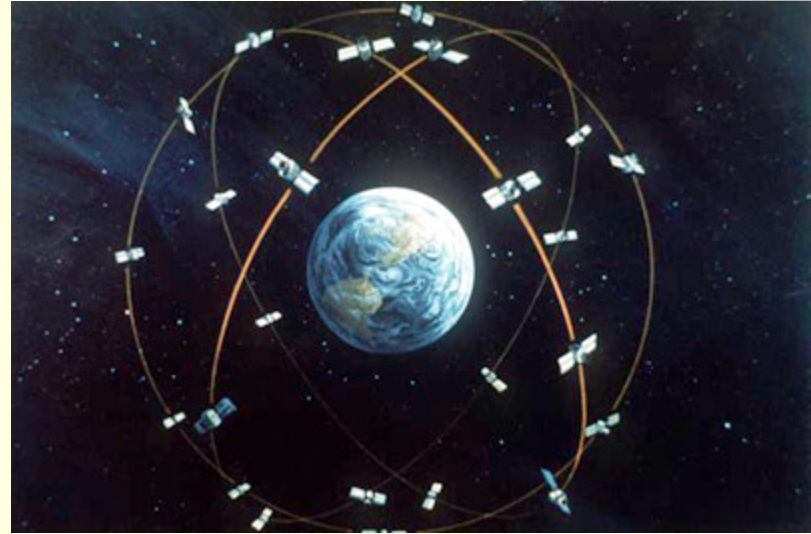


Photo courtesy [U.S. Department of Defense](#)

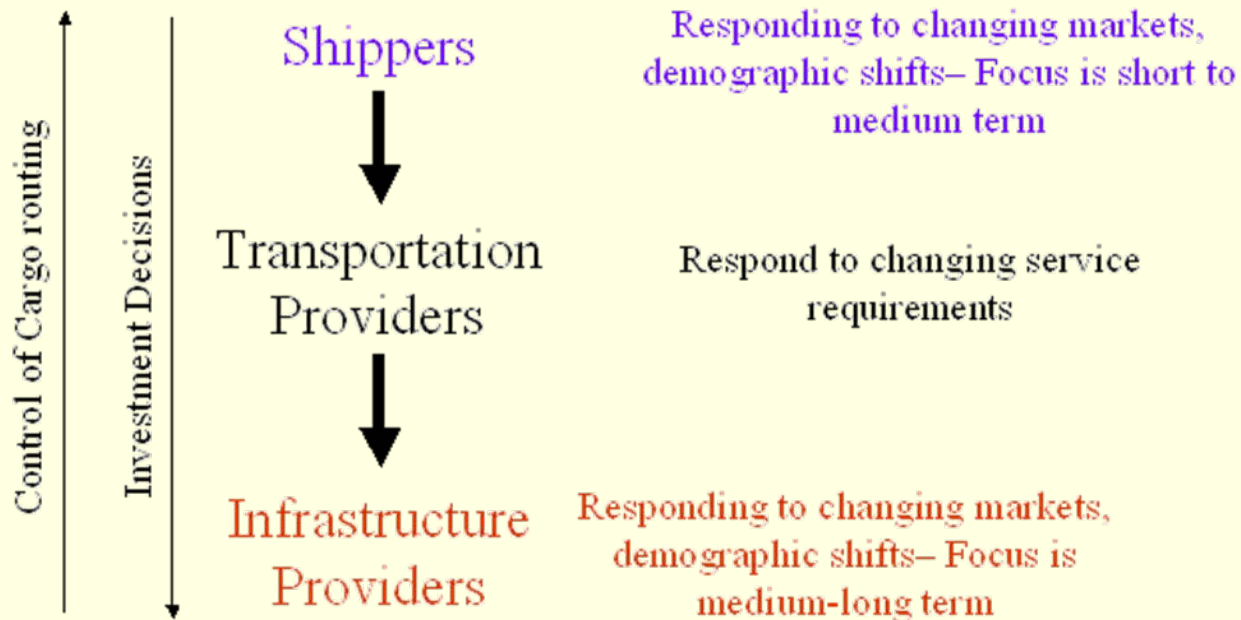
Routing/Scheduling Software: an Example

- Automated Decision Support System
- Input
 - Available resources (vehicles, drivers, connectivity between locations, etc.)
 - Demand
 - Constraints: drivers working hours, weight limit, road restrictions, etc.
- Output
 - Work schedules (where to go, at what time and on which route)

Concluding Remarks

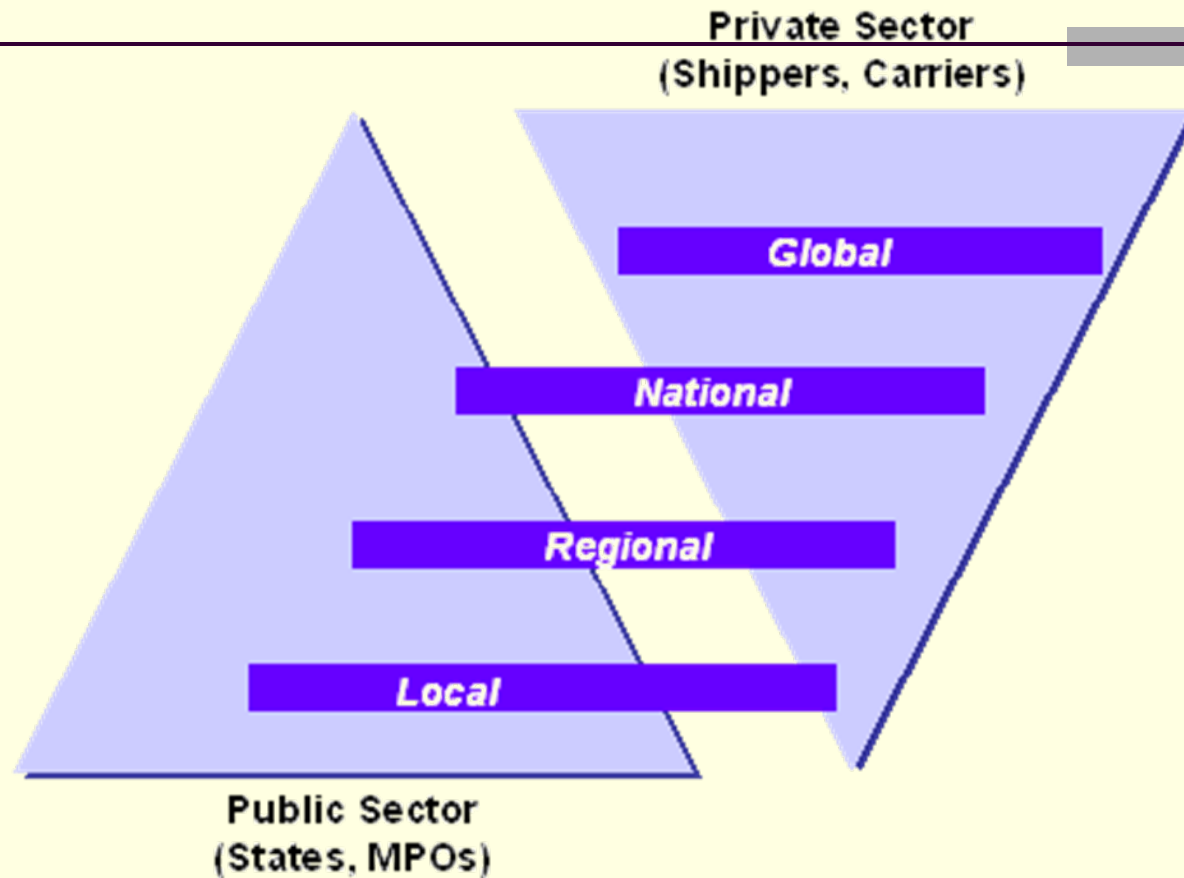
Public vs Private Sectors Planning and Implementation

Public and Private Sector Planning



Source: <http://www.fhwa.dot.gov/freightplanning/caldwell.htm>

Differences in Planning Perspectives



Source: <http://www.fhwa.dot.gov/freightplanning/caldwell.htm>

Truck Parking Study In the Upper Midwest Region

- Survey for Truck Parking Problems
 - Truckers and other stakeholders can mark locations and answer location specific questions
- Result Display