

Roles of logistics in supply chains

EE382



Supply Chain Management

- The art and science of integrating the flows of products, information, and financials through the entire supply pipeline from the supplier's supplier to the customer's customer
- The supply chain can be viewed as a series of integrated enterprises that must share information and coordinate physical execution to ensure a smooth, integrated flow of goods, services, information, and cash through the pipeline



What is Logistics?

- Logistics is the process of anticipating customer needs and wants; acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants; optimizing the goods or service-producing network to fulfill customer requests; and utilizing the network to fulfill customer requests in a timely manner



Value-Added Roles of Logistics

Five principal types of economic utility add value to a product or service (Form, Time, Place, Quantity, and Possession)

Production

- Form utility
 - The value added to goods through a manufacturing or assembly process



Logistics

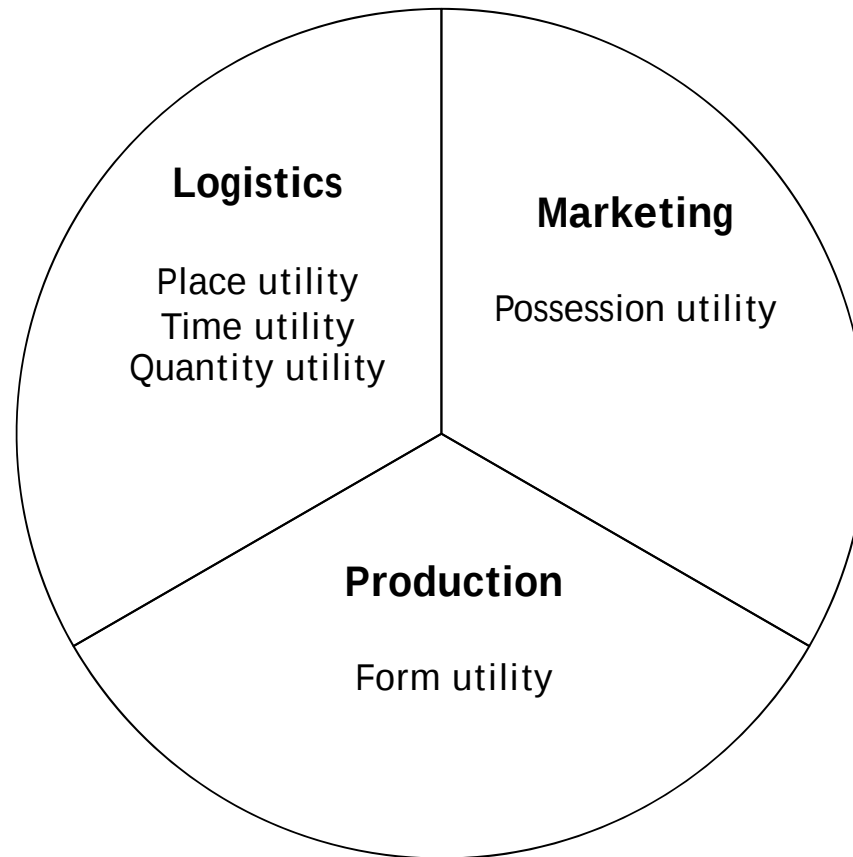
- Place utility
 - Logistics provides place utility by moving goods from production surplus points to points where demand exists
- Time utility
 - The economic value added to a good or service by having it at a demand point at a specific time
 - Logistics creates time utility through proper inventory maintenance, the strategic location of goods and services, and transportation
- Quantity utility
 - Production forecasting, production scheduling, and inventory control



Marketing

- Possession utility
 - Promotion of products and services
 - The effort through direct and indirect contact with the customer, to increase the desire to process a good or to benefit from a service

Fundamental utility creation in the economy





Logistics Activities

- Transportation
- Warehousing and storage
- Industrial packaging
- Materials handling
- Inventory control
- Order fulfillment
- Demand forecasting
- Production planning/scheduling
- Procurement
- Customer service
- Facility location
- Return goods handling
- Parts and service support
- Salvage and scrap disposal



Transportation

- Largest variable logistics cost
- Physical movement or flow of goods and on the network that moves the product
- The logistic manager is responsible for selecting the mode or modes and carriers used in moving raw materials, components, and finished goods or for developing private transportation



Storage

- A tradeoff relationship with transportation
- Inventory management
- Warehousing
- Example
 - If organizations use a relatively slow mode of transportation, they usually have to hold higher inventory levels and thus have more warehousing space for inventory
 - An organization might consider using a faster mode of transportation to eliminate some of these warehouses and the inventory stored in them



Packaging

- Industrial packaging protects the product during transportation and storage
- Rail or Ocean transportation typically requires additional packing expenditures because of the greater possibility of damage in transit



Material handling

- Mechanical equipment used for short-distance movement and includes equipment such as forklift trucks, overhead cranes, automated storage, and retrieval systems
- Important in warehouse design and efficient warehouse operations
- Logistics manager are concerned with the movement of goods into a warehouse, the placement of goods in a warehouse, and the movement of goods from storage to order-picking areas and to dock areas for transportation out of the warehouse



Inventory control

- Assuring adequate inventory levels
 - Requires logistics to monitor current inventory levels and either place replenishment orders or schedule production to bring inventory levels up to a predetermined level
 - Example – a distribution center fills customer orders for shipment, current inventory levels are depleted
- Certifying inventory accuracy
 - Assure that the actual physical inventory levels match that shown in the information system, cycle counts are taken of selected items every period throughout the year



Order fulfillment

- Filling and shipping customer orders
- An important physical distribution factor is the time that elapses from when a customer places an order until the customer receives a satisfactory fulfillment of the order – **lead time**
- Example
 - Assume that the present order fulfillment process takes a total lead time of 8 days for order transmittal, order processing, order preparation, and order shipment
 - Order processing -4 days, Order preparation 2 days, Order shipment 2 days
 - The short delivery time require a premium mode of transportation



Forecasting

- Accurate forecasting of inventory requirements and materials and components is essential to inventory control, manufacturing efficiency, and customer satisfaction



Production Planning

- Once a forecast is developed and the current inventory on hand and usage rate are determined, production managers can calculate the number of units to manufacture to ensure adequate market coverage



Procurement

- Transport costs relate directly to the geographic location of raw materials and component parts purchased for an organization's manufacturing needs
- Transportation and inventory costs- the quantities purchased would also affect total logistics costs



Customer service

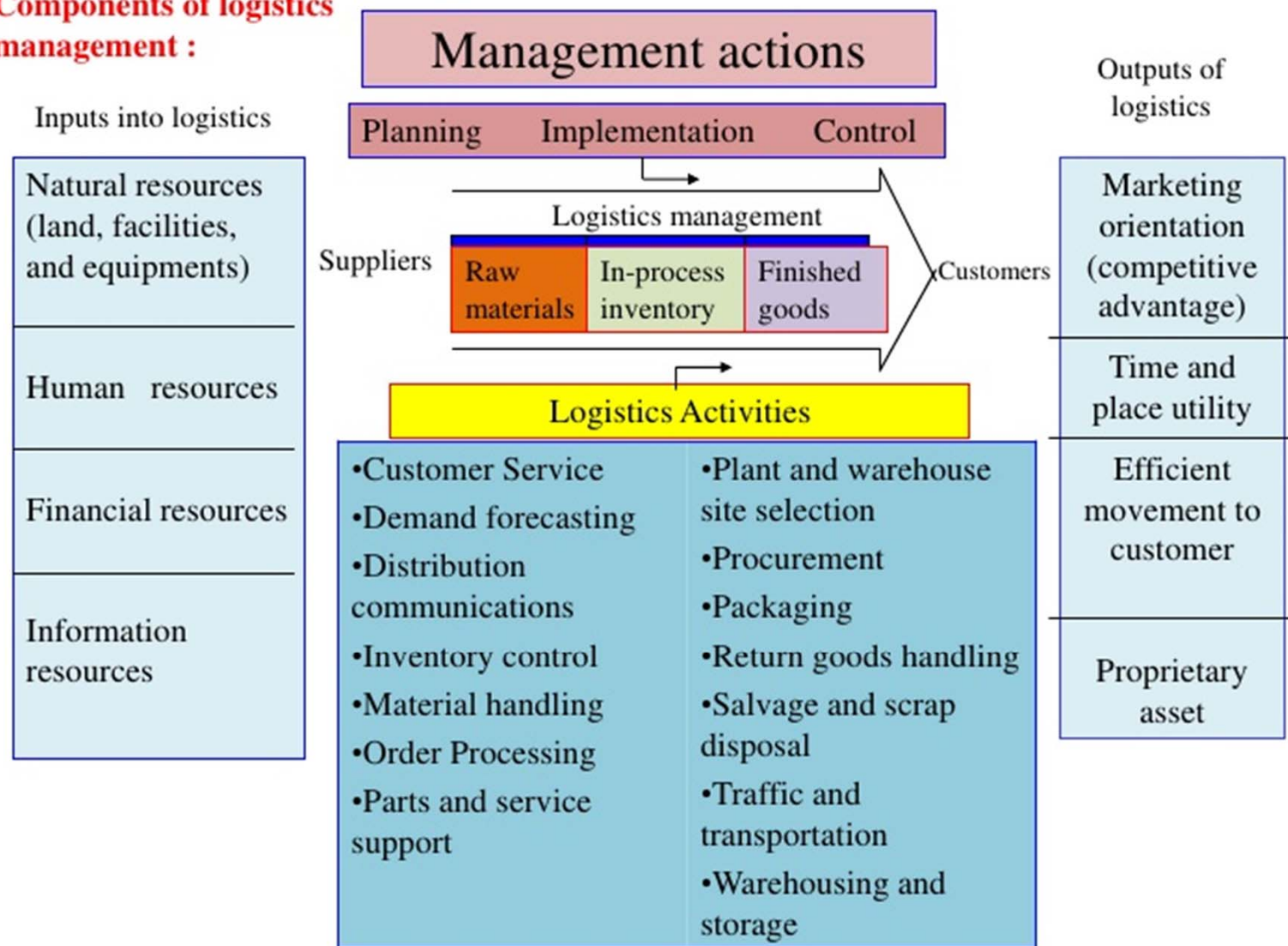
- The process of interacting directly with the customer to influence or take the order
 - Logistics is concerned with being able to promise the customer, at the time the order is placed, when the order will be delivered
- The levels of service an organization offers to its customer
 - Order fill rates and on-time delivery rates
 - Decisions about inventories, transportation, and warehousing relate to customer service levels



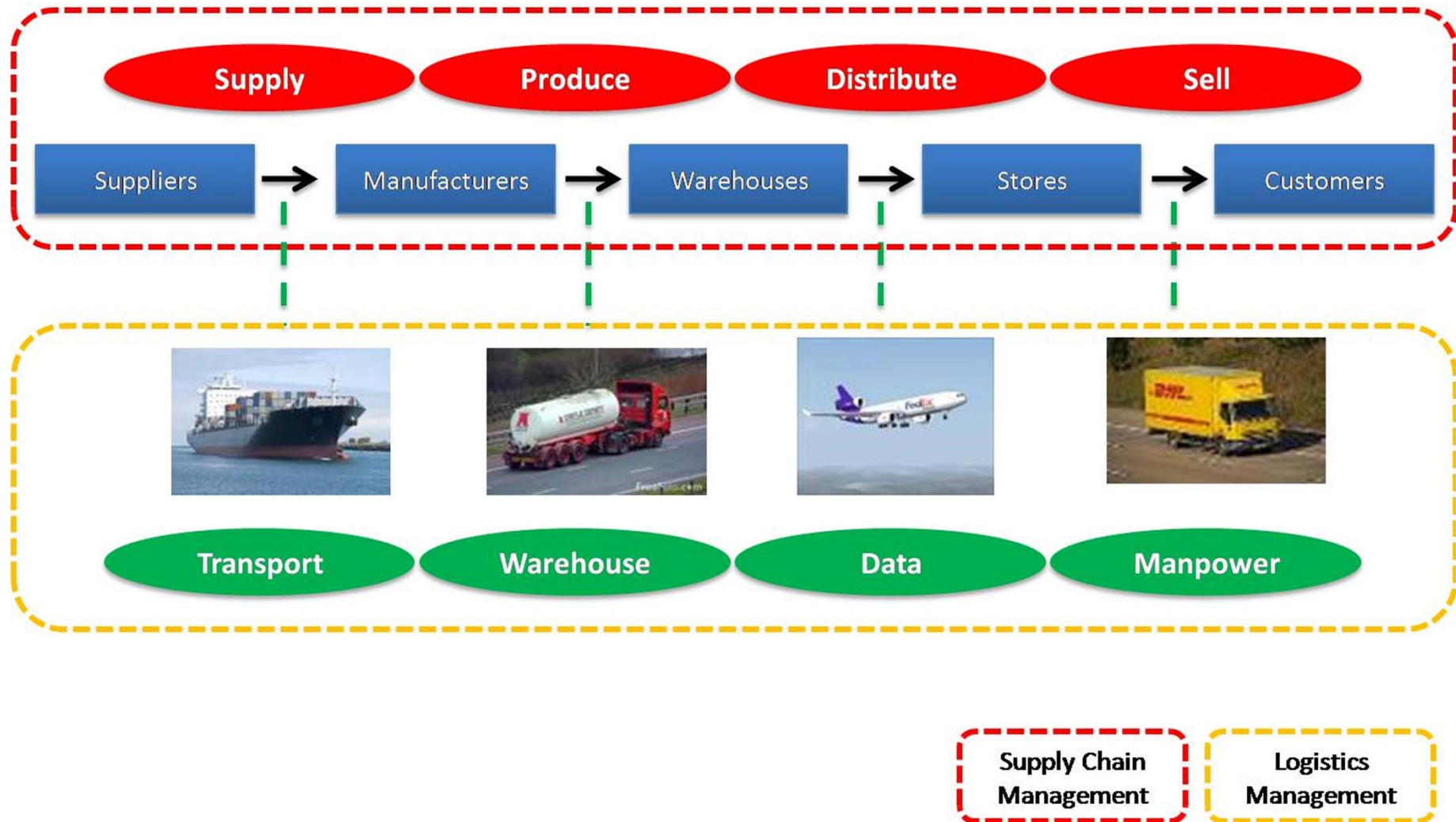
Facility location

- Plant and warehouse site location

Components of logistics management :



Example of Supply Chain Management vs Logistics Management



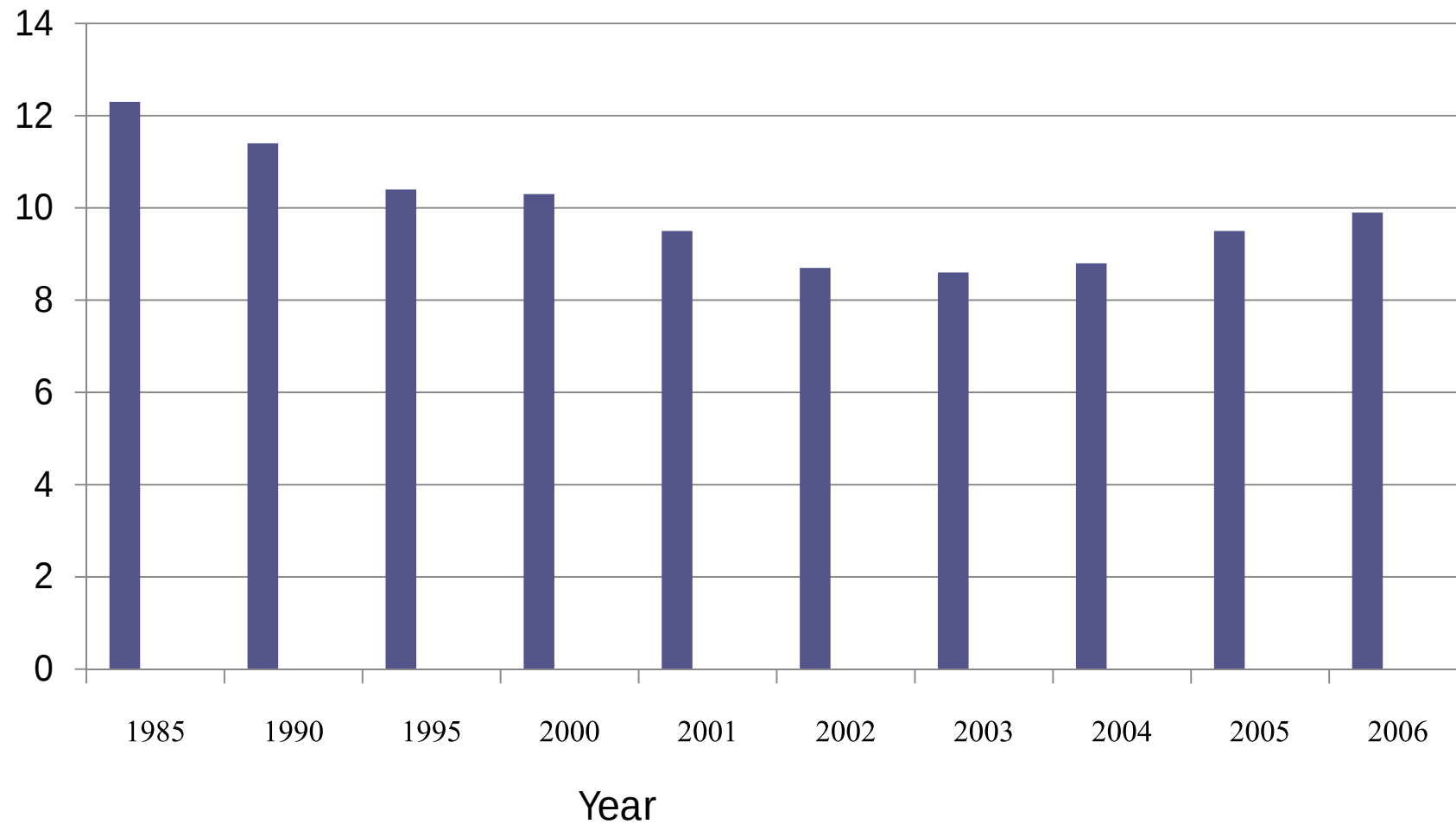


Logistics in the Economy: A macro perspective

- Absolute cost of logistics on a macro basis will increase with growth in the economy
- If more goods and services are produced, logistics costs will increase
- To determine the efficiency of the logistic system, total logistics costs need to be measured in relationship to GDP

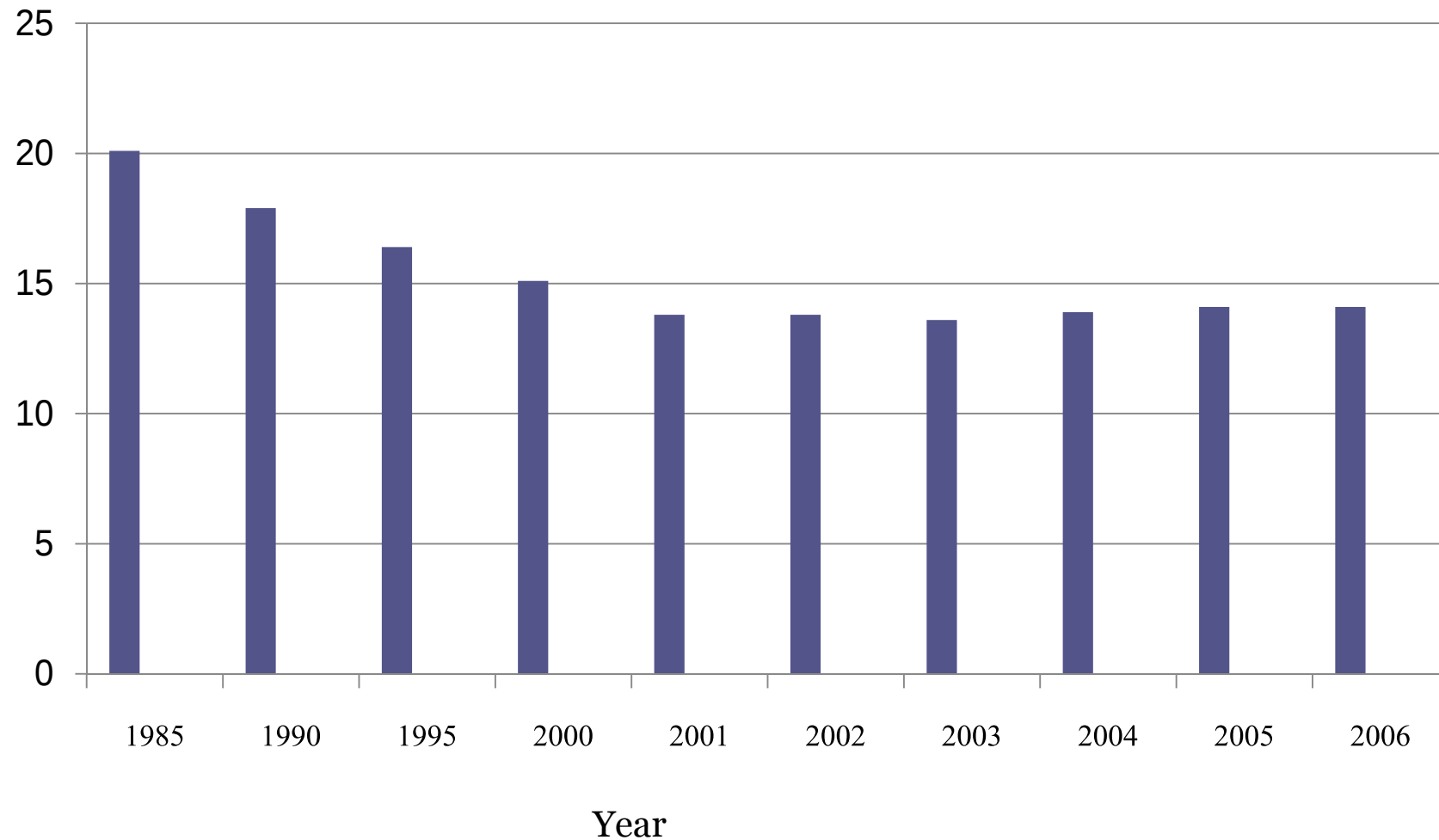
Logistics costs as a percentage of GDP

percent



Macro Inventory as a Percentage of GDP

Percent





Logistics in the Firm: The Micro Dimension

- Logistics interfaces with manufacturing/operations
- Logistics interfaces with marketing



Logistics interfaces with manufacturing/operations

- Length of production run
- Long run versus Short run production
- JIT approaches to inventory and scheduling
- Pull system – the product is pulled in response to demand
 - Lowers inventory levels- can lower total logistics costs
- Push system – the product is pushed in advance of demand
- A logistics manager is responsible for the inbound movement and storage of raw materials and components that will support production, logistics and manufacturing



Logistics interfaces with marketing

- Price
 - Adjust quantity prices to conform to shipment sizes appropriate for transportation
- Product
 - Size, shape, weight, packaging affect ability of the logistics system to move and store them
- Promotion
 - An organization making a promotional effort to stimulate sales should inform its logistics manager so that sufficient quantities of inventory will be available for distribution to the customer
- Place
 - Distribution channels decision



Logistics in the firm: factors affecting the cost and importance of logistics

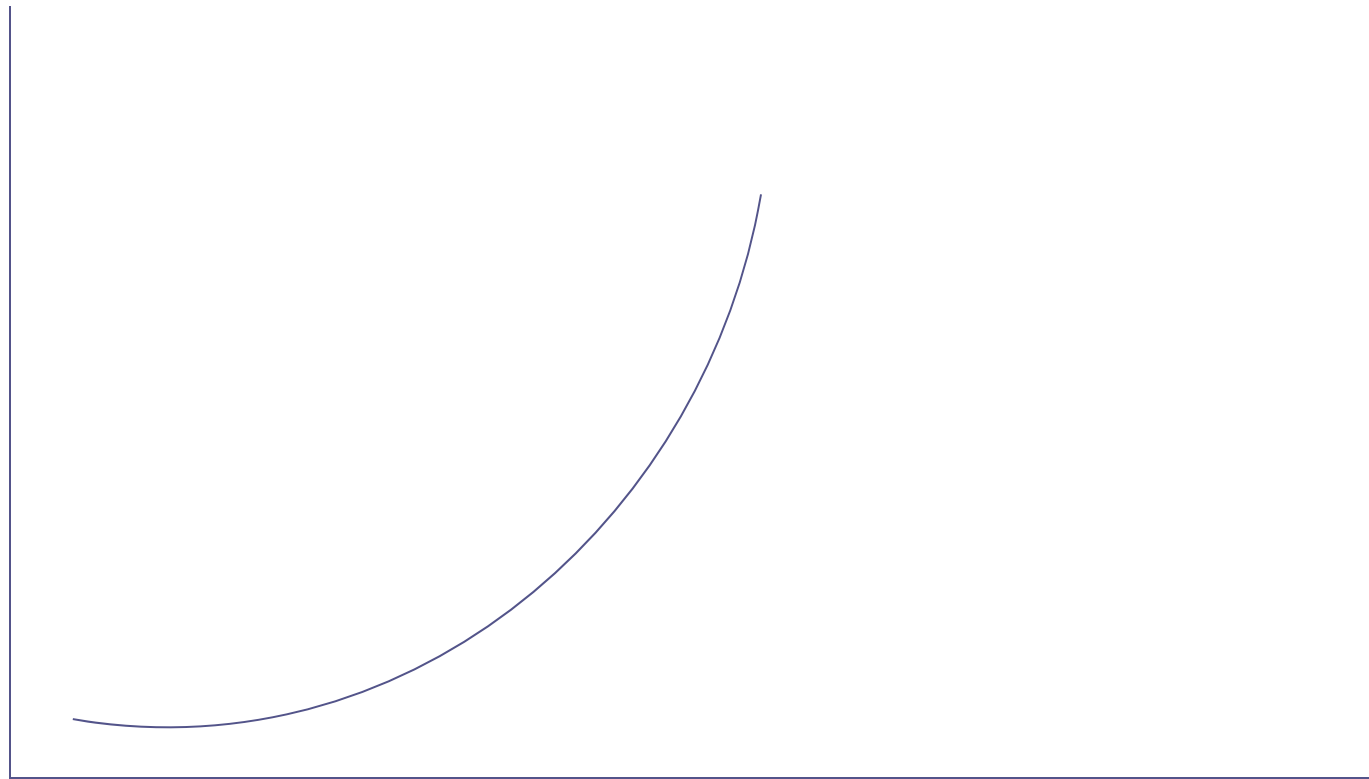
- Competitive relationships
- Product relationships
- Spatial relationships

Competitive relationships

- Order cycle
 - The time elapses from when a customer places an order until the order is received
- Substitutability
 - Affects the importance of customer services
 - If a product is similar to other products, consumer might be willing to substitute a competitive product if a stockout occurs
- Inventory effect
- Transport effect

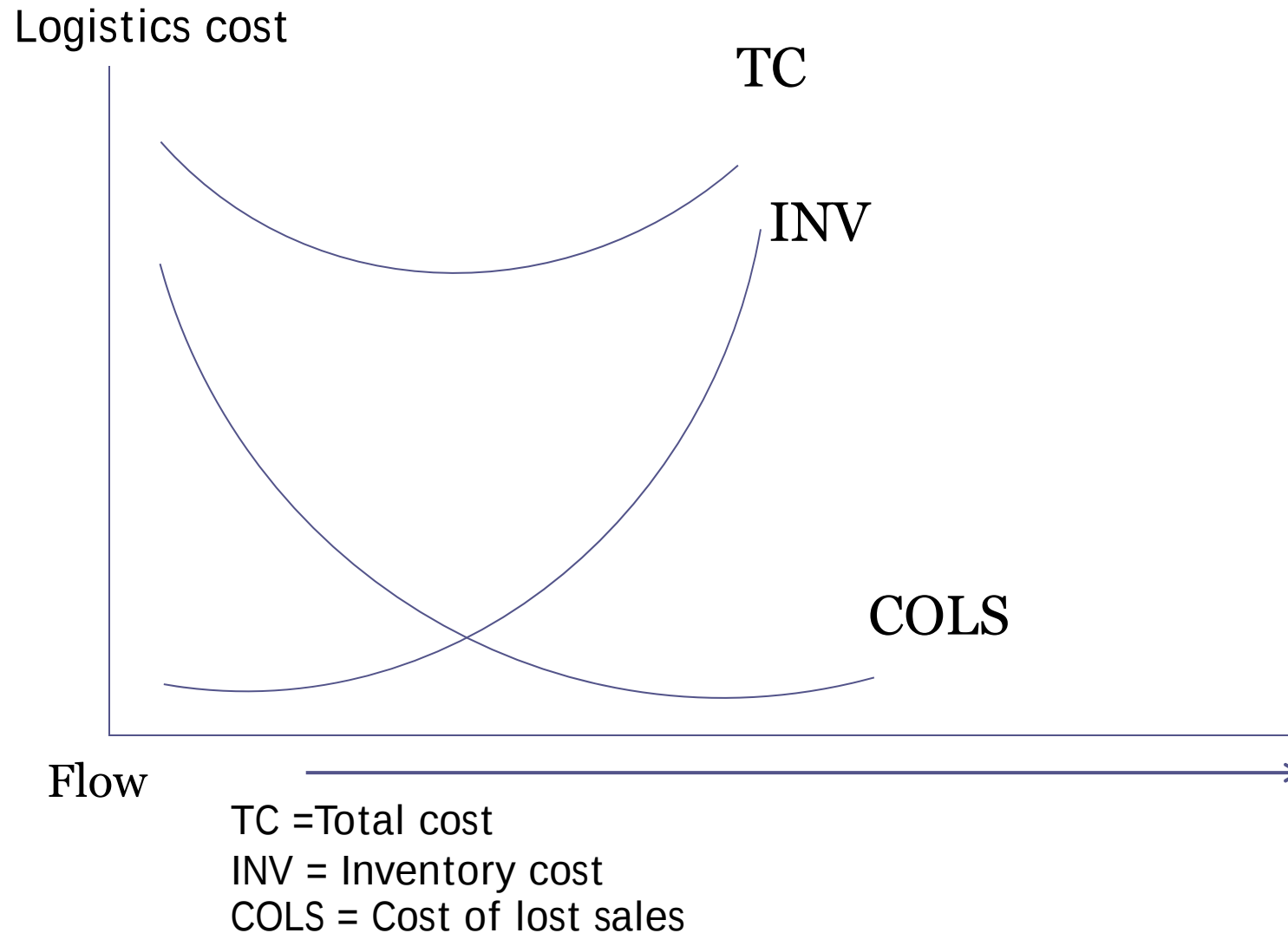
The relationship between required inventory and order cycle length from a customer perspective

Units of inventory

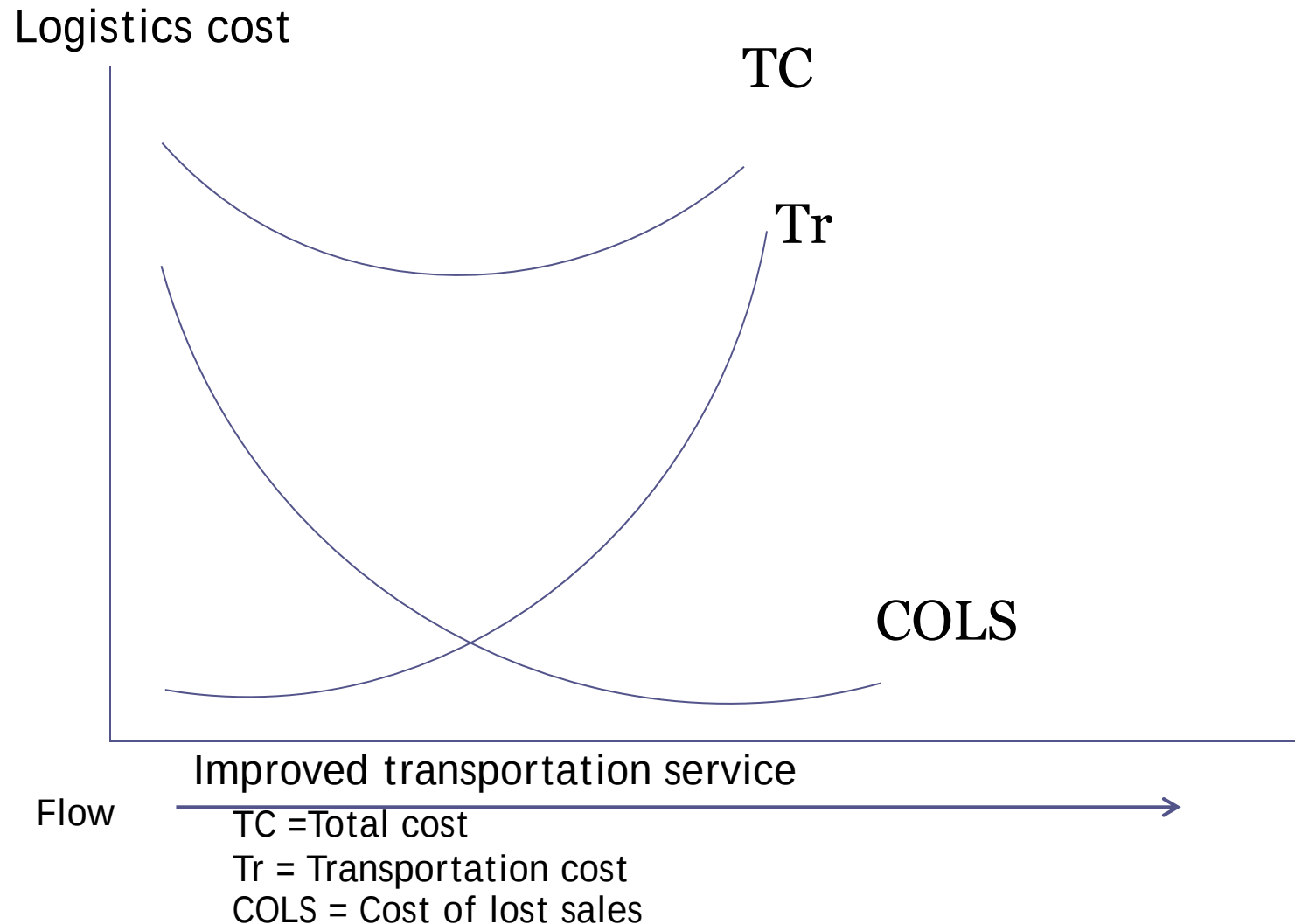


Order cycle (days)

The general relationship of the cost of lost sales to inventory cost



The general relationship of the cost of lost sales to transportation cost

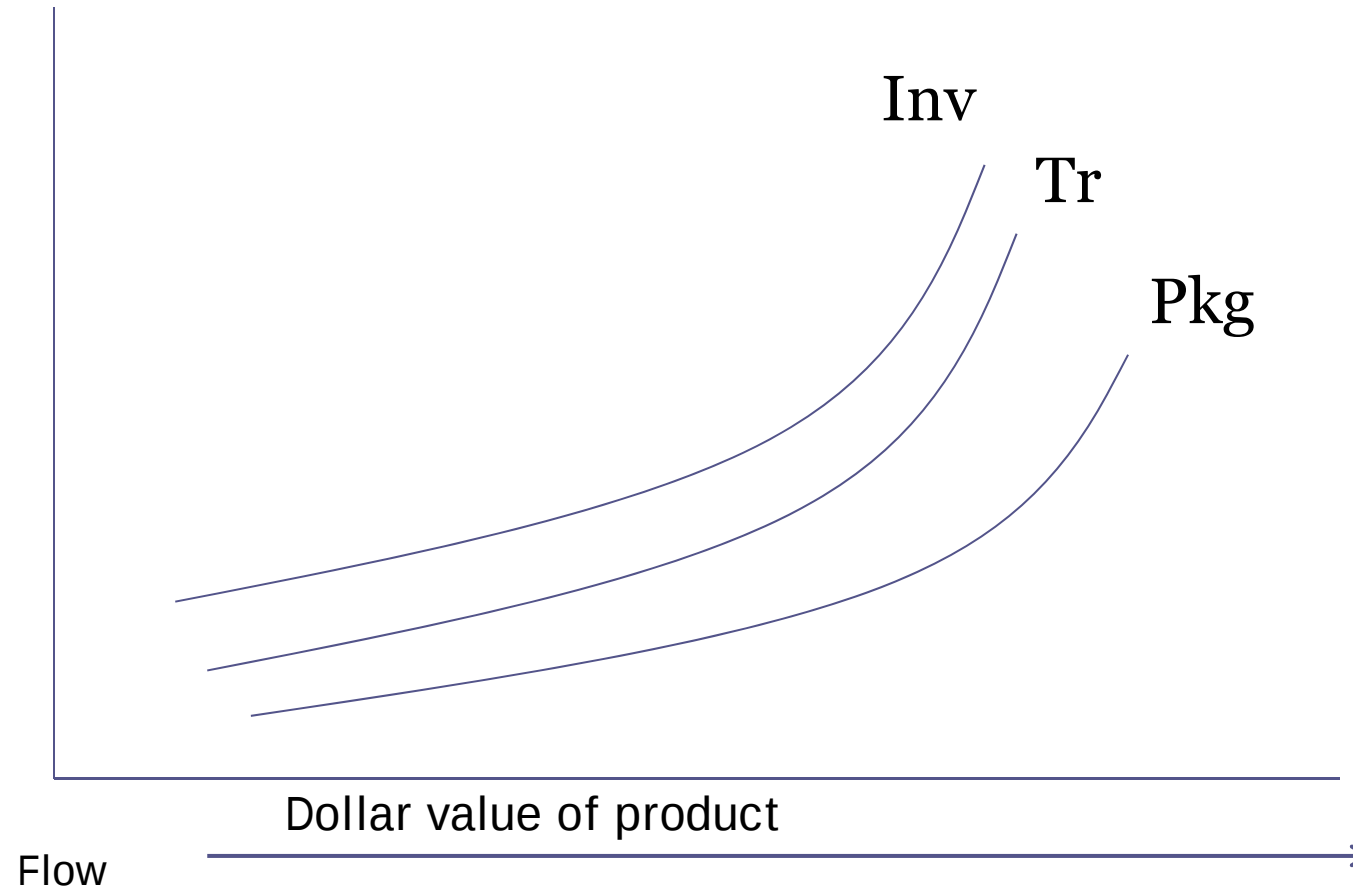


Product relationships

- Dollar Value
 - The product's dollar value typically affects warehousing costs, inventory costs, transportation costs, packaging costs, and even materials-handling costs
- Density
 - Refers to the weight/space ratio of the product
- Susceptibility to Damage
 - The greater the risk of damage to a product, the higher the transportation and warehousing cost
 - Because of a higher degree of risk and liability associated with more fragile goods, the higher are the prices charged by both transportation and warehousing providers
- Special Handling Requirements
 - Related to damage susceptibility but somewhat distinct, is special handling requirements for products

The general relationship of product dollar value to various logistics costs

Logistics cost



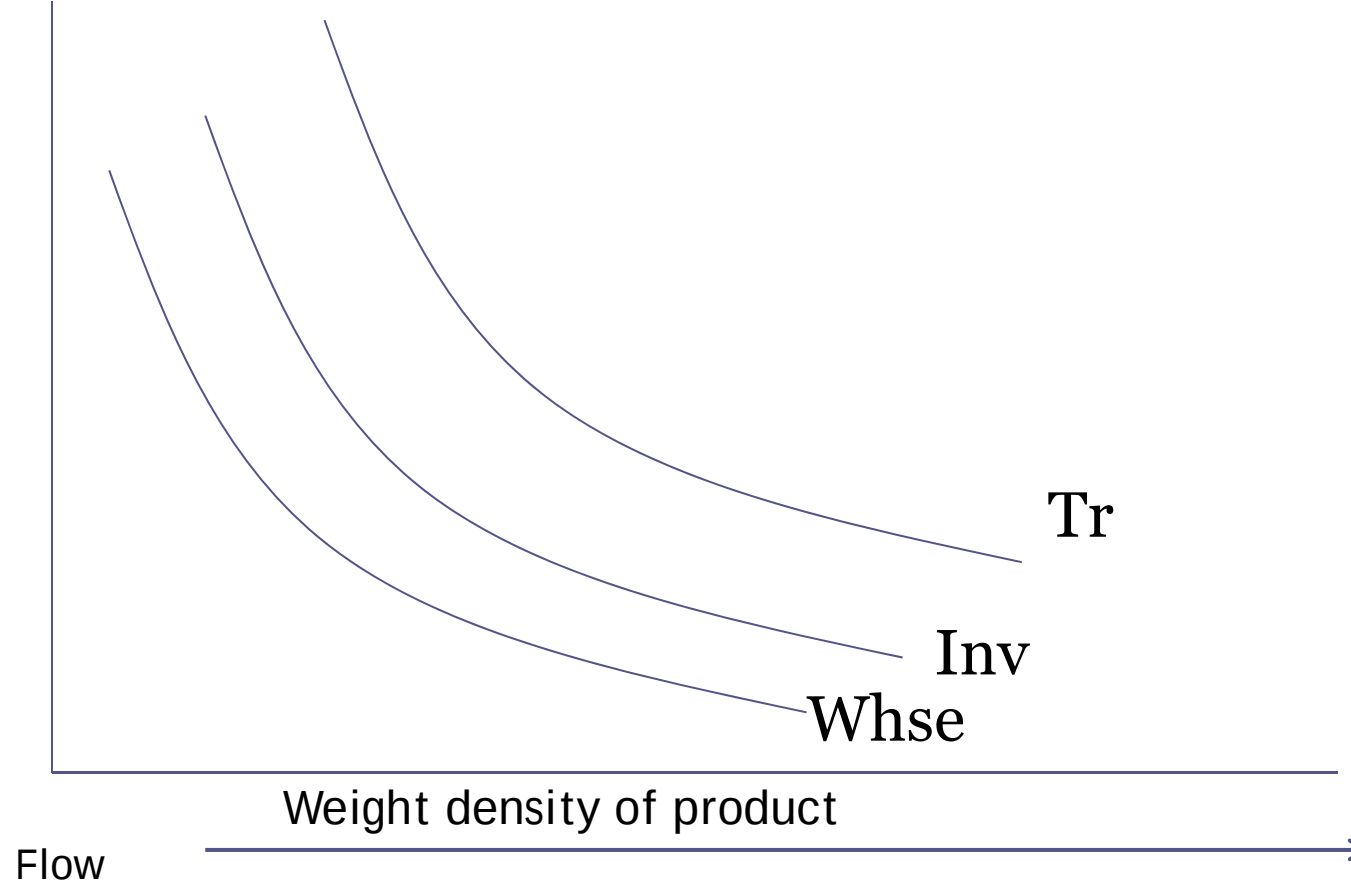
Inv = Inventory cost (including storage)

Tr = Transportation cost

Pkg = Packaging cost

The general relationship of product weight density to logistics costs

Logistics cost

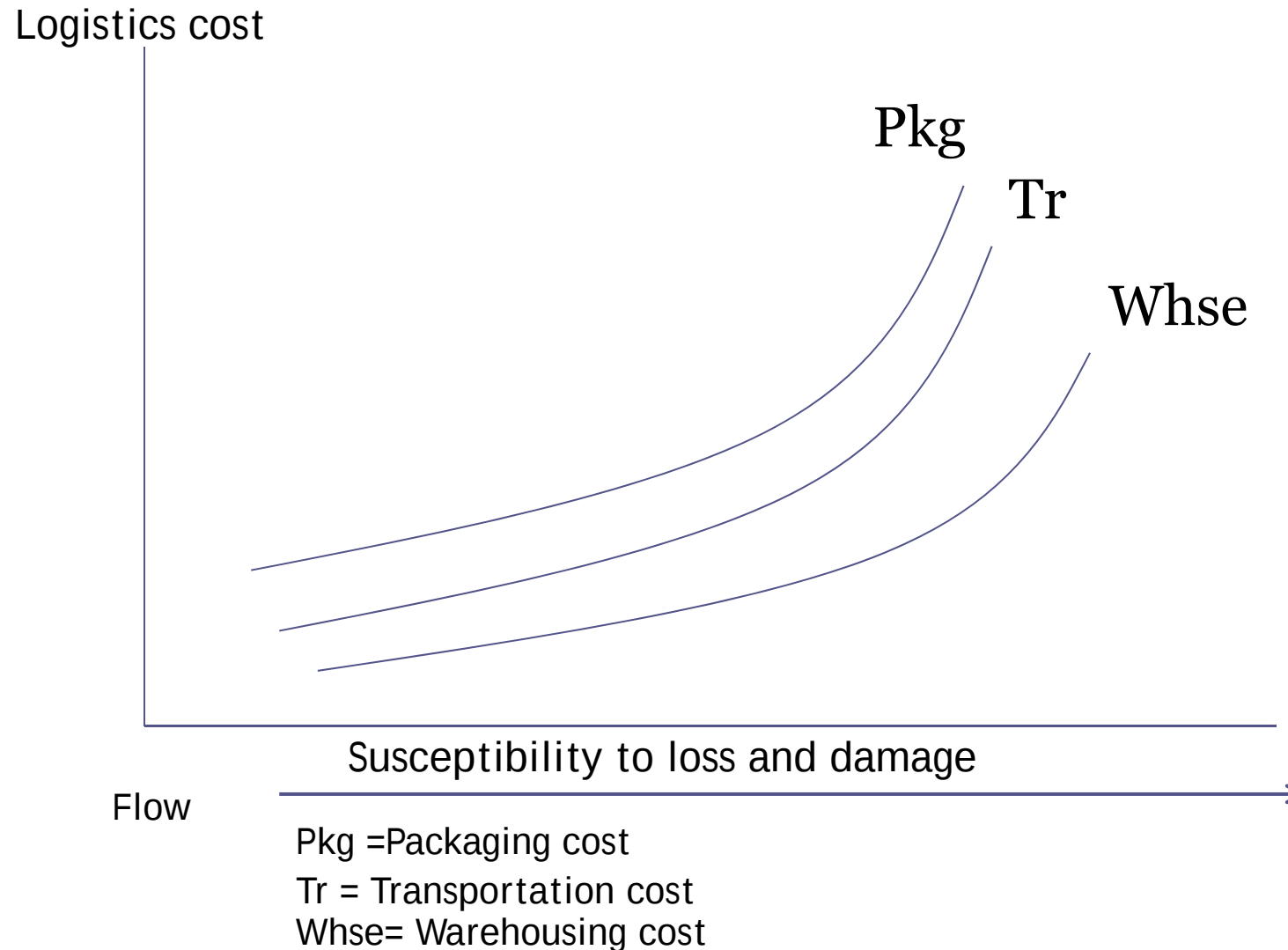


Tr = Transportation cost

Inv= Inventory cost (including storage)

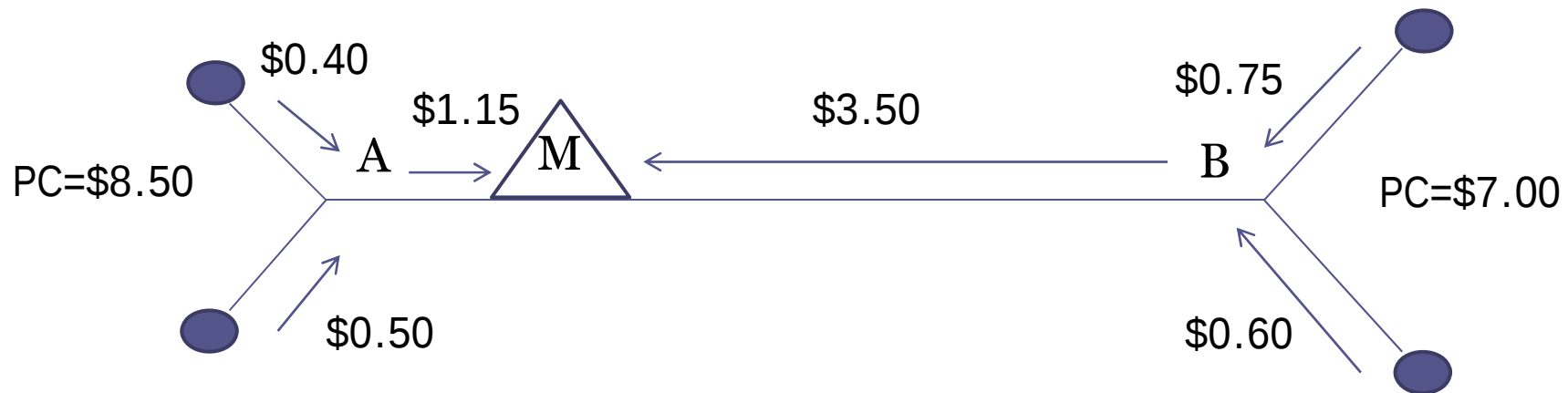
Whse= Warehousing cost

General relationship of product susceptibility to loss and damage to logistics costs



Spatial relationships

- The location of fixed points in the logistics system with respect to demand and supply points





Techniques of logistic system analysis

- Short-run/Static analysis
 - A specific point in time
 - Multiple short run analyses would be considered and then the system with the lowest overall cost would be selected, as long as it was consistent with constraints the organization imposed on the logistics area
- Long-run/Dynamic analysis



Example- Static analysis of C&B Chemical company (50,000 pounds of output)

- An organization is currently using an all-rail route from its plant and the associated plant warehouse to its customers
- At the plant warehouse, the chemicals are bagged and palletized and shipped by rail to the customer
- A proposed second system would use a market oriented warehouse
- The chemicals would be shipped from the plant to the market oriented warehouse and then packed and sent to the customer
- Instead of shipping all goods by rail, the organization would ship them by barge to the market warehouse, taking advantage of low, bulk transportation prices
- Then after bagging, the chemicals would move by rail from the warehouse to the customer

Plant logistics costs	System 1	System 2
Packaging	\$500	\$0
Storage and handling	150	50
Inventory carrying	50	25
Administrative	75	25
Fixed cost	4,200	2,400
Transport costs		
To market warehouse	0	150
To customer	800	100
Warehouse costs		
Packaging	0	500
Storage and handling	0	150
Inventory carrying	0	75
Administrative	0	75
Fixed cost	0	\$2,400
Total cost	\$5,775	\$5,950

Long-run / Dynamic analysis

- System 1

$$\text{Total cost} = \text{Fixed cost} + \frac{\text{Variable cost}}{\text{unit}} \times \text{number of units}$$

$$y = \$4,200 + \$0.0325x$$

- System 2

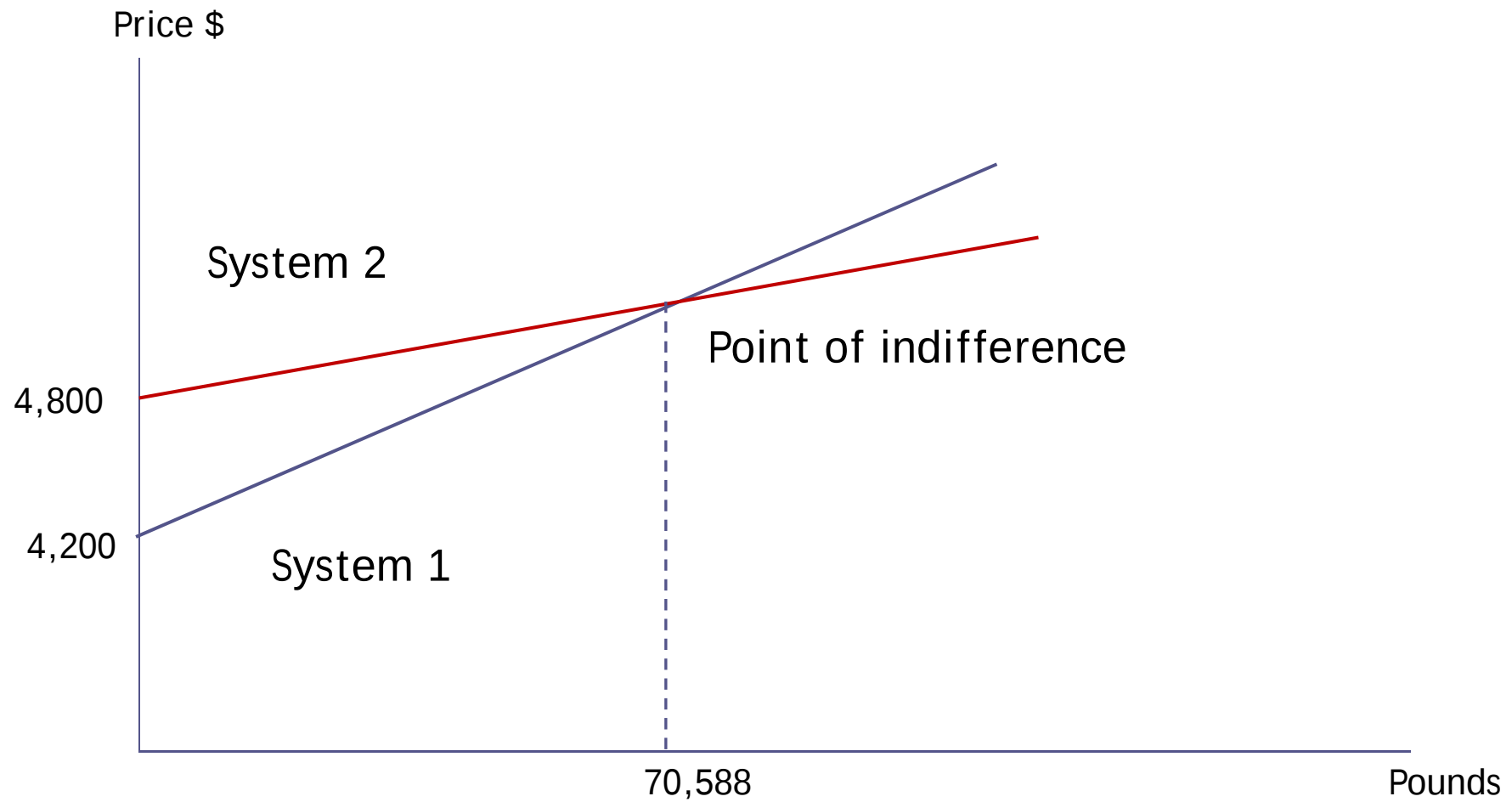
$$y = \$4800 + \$0.0230x$$

- Tradeoff point

$$x = 70,588 \text{ pounds}$$

	Total cost	Fixed cost	Total variable cost	Variable cost per pound
System 1	\$5,775	\$4,200	\$1,575	\$0.0315
System 2	\$5,950	\$4,800	\$1,150	\$0.0230

Dynamic analysis





Approaches to Analyzing Logistics System

- Materials management versus Physical Distribution
- Cost centers
- Nodes versus Links
- Logistics channels



Materials management versus Physical Distribution

- The Movement and storage of raw materials in an organization is different from the movement and storage of finished goods
- Balanced system
 - Balance flow of inbound and outbound sides of their logistics systems – they receive raw materials and components from suppliers in different locations and ship finished product to customers in various locations
- Heavy inbound
 - Heavy inbound flow and a very simple outbound flow- Boeing
- Heavy outbound
 - Heavy outbound flow - ExxonMobil
- Reverse system
 - Reverse flows on the outbound side of their logistics systems

Cost centers

Example- Analysis of Total logistics cost with a change to a higher cost mode of transport

Cost Centers	Rail	Motor
Transportation	\$3.00	\$4.30
Inventory	5.00	3.75
Packaging	3.50	3.20
Warehousing	1.50	0.75
Cost of lost sales	2.00	1.00
Total cost	\$15.00*	\$13.00*

*Costs per unit



Nodes versus links

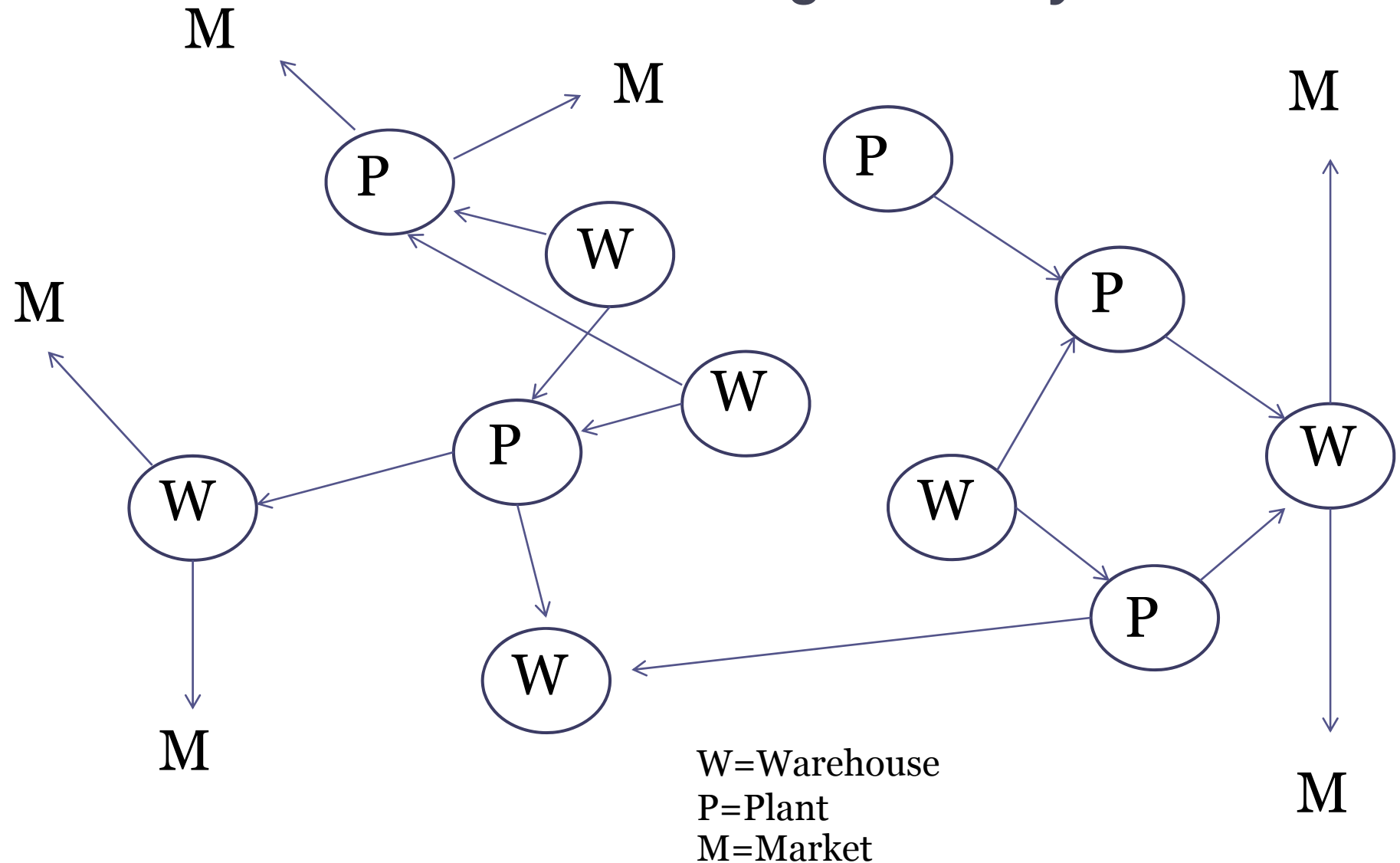
Nodes

- Fixed spatial points where goods stop for storage or processing
- Manufacturing / assembling facilities are warehouses

Links

- The transportation network and connect the nodes in the logistics system
- The network can be composed of individual modes of transportation (rail, motor, air, ocean, or pipeline)

Nodes and Links in a Logistics System

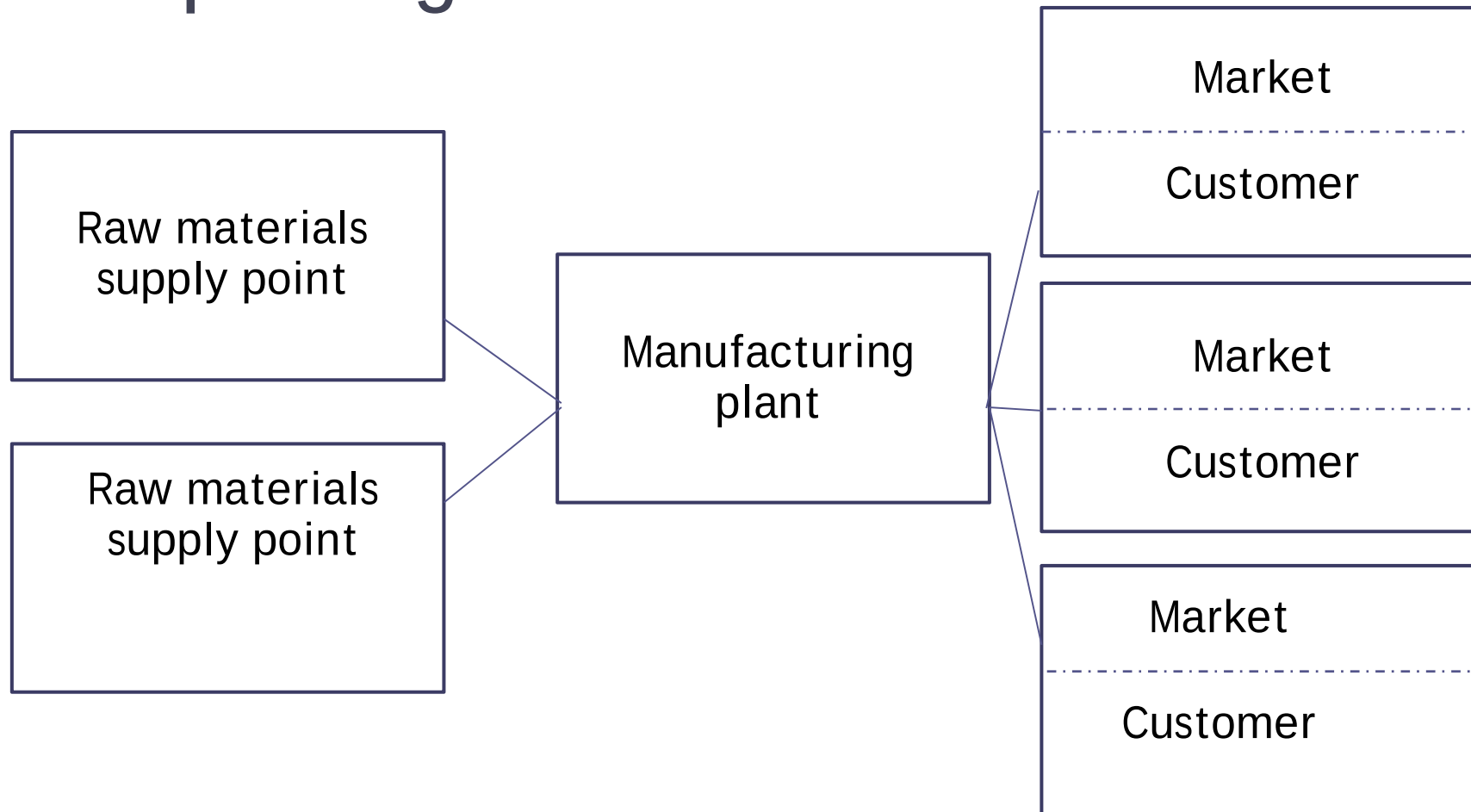




Logistics Channels

- The network of intermediaries engaged in transfer, storage, handling, communication, and other functions that contribute to the efficient flow of goods

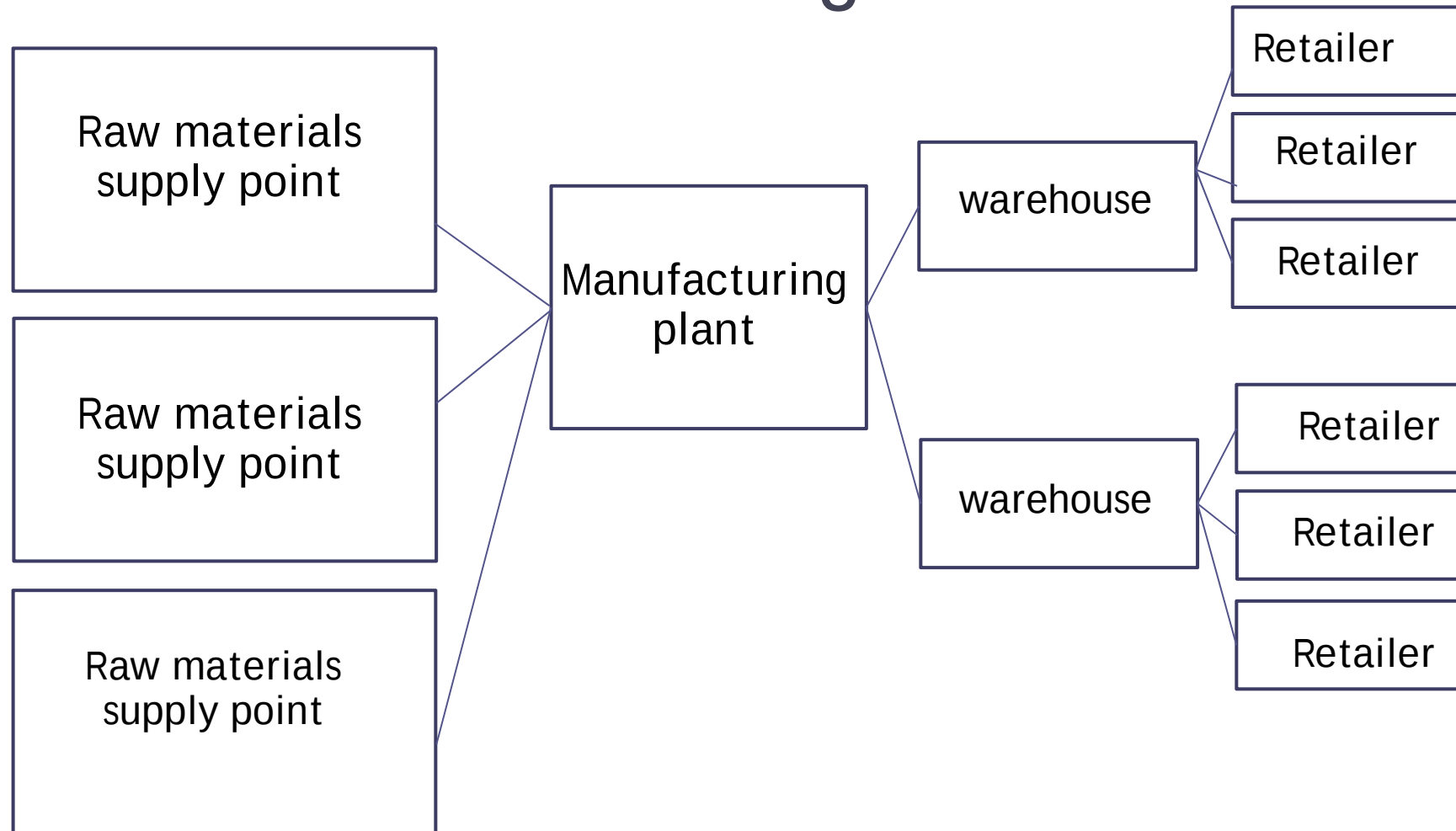
A simple logistics channel



Flow



A multi-echelon logistics channel



Flow





References

- Coyle J.J., Langley C.J. Jr., Novack R.A., Gibson, B.J. (2013). Managing Supply Chains A Logistics Approach. 9th edition. South-Western, Cengage Learning.