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Table of Contents

• 7.1 - Transborder Transportation
• 7.2 - Globalization and International Trade
• 7.3 - Freight Transportation and Value Chains
• 7.4 - Logistics and Freight Distribution
7.1 - Transborder Transportation
International Trade, Transportation Chains and Logistics

**International Trade**

- **Origin**
- **Destination**
- Custom Procedures

**Transport Chain**

- **Composition**
- **Transshipment**
- **Decomposition**
- **Rail**
- **Maritime**
- **Road**
- **Customs**

**Physical Flows**

- **Port**
- **Rail Yard**
- **Transshipment Hub**
- **Distribution Center**

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Modal Shares of World Trade by Volume and Value, 2008

### Volume of World Trade
- Seaborne: 89.8%
- Airborne: 10.0%
- Overland: 0.3%

### Value of World Trade
- Seaborne: 72.7%
- Airborne: 14.3%
- Overland: 13.0%
Modal Shares of China Trade with Europe by Volume and Value, 2016

**Volume of Trade**
- Seaborne: 94.0
- Airborne: 1.8
- Overland: 3.9

**Value of Trade**
- Seaborne: 64.0
- Airborne: 28.0
- Overland: 8.0
## Geostrategy of International Transportation

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conquest</strong></td>
<td>Acquire and conquer oceans, territories and resources. Maritime and railroad technology.</td>
</tr>
<tr>
<td><strong>Competition</strong></td>
<td>Mean to compete on the global economy. Prevalent force in shaping modern transportation systems. Right to carry national passengers and freight.</td>
</tr>
<tr>
<td><strong>Jurisdiction</strong></td>
<td>Subject to national rules and regulations. Territorial sea (22 km); complete jurisdiction. Exclusive Economic Zone (340 km); access to resources.</td>
</tr>
<tr>
<td><strong>Cooperation</strong></td>
<td>Common interests favor agreements. Involving access to infrastructures or setting standards (river navigation, rail gauge, trade agreements, transborder transportation).</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Controlling strategic locations. Reduce vulnerability to disruptions.</td>
</tr>
</tbody>
</table>
Exclusive Economic Zones
Levels of Economic Integration

Reduction of tariffs between members:
- NAFTA, Mercosur, ASEAN (partial)

Free Trade

Customs Union

Common Market

Economic Union

Political Union

Common government

No barriers for internal trade, free movement of labor, harmonized tax rates, common monetary and fiscal policy: EU (partial)

Free movement of capital and services. Different national regulations.

Common external tariffs.

Reduction of tariffs between members: NAFTA, Mercosur, ASEAN (partial)

Level of integration

Low

High

Complexity

Low

High

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Number of Regional Trade Agreements on Customs and other Trade Facilitation Measures, 1995-2016

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Types of International Boundaries

**Antecedent**
Pre-existing; commonly corresponds to a physical feature. Rivers, Bays, Lakes, Mountains.

**Subsequent**
Set after the settlements of different groups meet. Often correspond to their respective ecumene.

**Superimposed**
Boundary is imposed by an outside force (treaty). May not reflect existing cultural landscape.

**Relic**
No longer a boundary. Often the outcome of political changes. Still a visible imprint on the landscape.
The Effect of a Border on a Transportation Network

Diagram showing a transportation network with a border and border crossings.
The Effect of a Border on Freight Distribution

Barrier

Operational Costs

Gateway
### Types of Free Zones

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
<th>Location</th>
<th>Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Port</td>
<td>Trade and logistics platform</td>
<td>Port cities or connected locations</td>
<td>Domestic, internal and export markets</td>
</tr>
<tr>
<td>Free Trade Zone</td>
<td>Trade support with entrepots and trade-related activities.</td>
<td>Ports of entry</td>
<td>Domestic and re-exports</td>
</tr>
<tr>
<td>Export Processing Zone</td>
<td>Develop manufacturing and processing</td>
<td>Varied, usually close to a major transport node</td>
<td>Exports and domestic</td>
</tr>
<tr>
<td>Special Economic Zone</td>
<td>Attract foreign direct investments</td>
<td>Commercial gateways</td>
<td>Exports and re-exports</td>
</tr>
</tbody>
</table>
Types of Free Zones

- **Free Port**
  - International Trade and logistics platform
  - Domestic Port cities or connected locations
  - Domestic, internal and export markets

- **Free Trade Zone**
  - International Trade support with entrepots and trade-related activities
  - Domestic Ports of entry
  - Domestic and re-exports

- **Export Processing Zone**
  - International Develop manufacturing and processing
  - Domestic Usually close to a major transport node
  - Domestic and re-exports

- **Special Economic Zone**
  - International Attract foreign direct investments
  - Domestic Commercial gateways
  - Domestic Exports and re-exports
# Specialized Free Zones

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
<th>Location</th>
<th>Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology or Science Parks</td>
<td>Promote technology and scientific industries</td>
<td>Adjacent to universities and research institutes</td>
<td>Domestic and export</td>
</tr>
<tr>
<td>Energy Zones</td>
<td>Promote energy industries</td>
<td>Petrochemical hubs or energy sources</td>
<td>Domestic and export</td>
</tr>
<tr>
<td>Financial Services</td>
<td>Development of off-shore financial services</td>
<td>Varied</td>
<td>Export</td>
</tr>
<tr>
<td>Software and Internet</td>
<td>Development of information technologies</td>
<td>Adjacent to universities, urban areas</td>
<td>Export</td>
</tr>
<tr>
<td>Airport-based</td>
<td>Air cargo trade and handling</td>
<td>Connected airports</td>
<td>Re-export and domestic</td>
</tr>
<tr>
<td>Tourism</td>
<td>Integrated tourism development</td>
<td>Touristic amenities</td>
<td>Export and domestic</td>
</tr>
<tr>
<td>Logistics Parks</td>
<td>Support warehousing and transshipment</td>
<td>Near transport hubs</td>
<td>Re-export</td>
</tr>
</tbody>
</table>
7.2 - Globalization and International Trade
The Rationale for Trade

### Scarcity
- Limited availability
- Concentration

### Abundance
- Wide availability
- Dispersion

#### Necessity
- Cannot be substituted
- Absolute advantage

#### Convenience
- Can be substituted
- Comparative advantage

**Resources and raw materials**

**Labor, parts and finished goods**

**International orientation of trade**

**Regional orientation of trade**

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The Flows of Globalization

**Trade**
- Flows of physical goods (mainly asymmetrical)
- Raw materials, energy, food, parts and consumption goods
- Freight transport modes (maritime, rail, trucking)
- Interconnected hub-and-spoke networks
- Ports as main hubs

**Migration**
- Flows of people (mainly symmetrical)
- Permanent, temporary (migrant workers), tourism, business transactions
- Passengers transport modes (vehicles, air, rail)
- Interconnected hub-and-spoke networks
- Airports as main hubs

**Telecommunications**
- Flows of information (mainly asymmetrical)
- Communication, power exchanges, symbolic exchanges
- Telecommunication systems (postal, internet, telephone, radio)
- Interconnected and redundant hub-and-spoke networks
- Global cities as main hubs
Economic Rationale of Trade

Without Trade
- Small national markets.
- Limited economies of scale.
- High prices and near monopoly.
- Limited product diversity.
- Different standards.

With Trade
- Increased competition.
- Economies of scale.
- Specialization.
- Lower prices and more output.
- Interdependencies.
Absolute and Comparative Advantages

**Absolute Advantages**

Country A: 100 resource units. 10 units for 1 unit of steel. 4 units to produce 1 unit of textiles.

Country B: 100 resource units. 5 units for 1 unit of steel. 20 units to produce 1 unit of textiles.

Steel output without trade (1): 5+10 = 15
Textiles output without trade (1): 2.5+12.5 = 15
Steel output with trade (2): 0+20 = 20
Textiles output with trade (2): 25+0 = 25

**Comparative Advantages**

Country A: 100 resource units. 10 units for 1 unit of steel. 10 units to produce 1 unit of textiles.

Country B: 100 resource units. 4 units for 1 unit of steel. 5 units to produce 1 unit of textiles.

Steel output without trade (1): 5+12.15 = 17.5
Textiles output without trade (1): 5+10 = 15
Steel output with trade (2): 0+17.5 = 17.5
Textiles output with trade (2): 10+6 = 16
Composition of British Trade, 1910s and 1990s

- **Imports (1990s)**: 90% Manufactures, 10% Non-Manufactures
- **Exports (1990s)**: 90% Manufactures, 10% Non-Manufactures
- **Imports (1910s)**: 30% Manufactures, 70% Non-Manufactures
- **Exports (1910s)**: 70% Manufactures, 30% Non-Manufactures

Manufactures | Non-Manufactures
--- | ---
Imports (1990s): 90% | 10%
Exports (1990s): 90% | 10%
Imports (1910s): 30% | 70%
Exports (1910s): 70% | 30%

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Favorable and Contentious Factors in International Trade

**Factor Substitution**
- Specialization promotes national productivity.
- Labor and capital cannot be easily reconverted.

**Comparative Advantages**
- Increases the quantity of goods and lowers their cost.
- Some nations have limited advantages and resources.

**Openness**
- Lower prices for consumers because of lower tariff and non-tariff barriers.
- May impact national industries and employment. Protectionism.

**Interdependencies**
- Promotes collaboration, standards and technology exchanges.
- Dependency on foreign goods and resources. Vulnerability to disruptions.
Major Global Trade Routes, 1400-1800
## Standard International Trade Classification (SITC)

<table>
<thead>
<tr>
<th>SITC Class</th>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Food &amp; Live Animals</td>
<td>Meat (01), Fish (03), Wheat (041), Rice (042), Corn (044), Orange juice (0591), Sugar (0611), Coffee (071), Cocoa (072), Tea (0741)</td>
</tr>
<tr>
<td>1</td>
<td>Beverages &amp; Tobacco</td>
<td>Wine (1121), Beer (1123), Tobacco (12)</td>
</tr>
<tr>
<td>2</td>
<td>Raw Materials</td>
<td>Rubber (23), Cotton (263), Iron ore (281)</td>
</tr>
<tr>
<td>3</td>
<td>Fuels &amp; Lubricants</td>
<td>Coal (32), Crude oil (333), Kerosene (3342), Natural gas (343)</td>
</tr>
<tr>
<td>4</td>
<td>Animal &amp; Vegetable Oils</td>
<td>Olive oil (4214), Corn oil (4216)</td>
</tr>
<tr>
<td>5</td>
<td>Chemicals</td>
<td>Salt (52332), Fertilizers (56), Plastics (57)</td>
</tr>
<tr>
<td>6</td>
<td>Manufactured Goods</td>
<td>Paper (64), Textiles (65), Cement (661), Iron &amp; Steel (67), Copper (682)</td>
</tr>
<tr>
<td>7</td>
<td>Machinery &amp; Transport Equipment</td>
<td>Computer equipment (752), Televisions (761), Cars (781)</td>
</tr>
<tr>
<td>8</td>
<td>Miscellaneous Manufactures</td>
<td>Furniture (82), Clothes (84), Footwear (85), Cameras (88111), Books (8921), Toys (894)</td>
</tr>
<tr>
<td>9</td>
<td>Others</td>
<td>Postal packets (91)</td>
</tr>
</tbody>
</table>
Changes in the Global Trade Environment

- **Immobile Factors of Production**
  - Before 1970s
  - Cope with scarcity
  - Bulk point-to-point
  - Container shipping

- **Mobile Factors of Production**
  - 1970s – 1990s
  - Promote economic efficiency

- **Global Value Chains**
  - 1990s onward
  - Added value within supply chains
  - Commodity Market
  - Supply chain
  - Global Market
Economic Integration and Interdependencies

Independent Nations

Interdependent Groups of Nations

Interdependency
- (Low)
- (High)
Trade Within and Between Corporations

Within Corporations

Between Corporations

Nation State

Trade

Nation State

66%

33%

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## GATT Rounds

<table>
<thead>
<tr>
<th>Year</th>
<th>Round</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>Geneva</td>
<td>45,000 reductions in bilateral tariffs covering 20% of world trade.</td>
</tr>
<tr>
<td>1949</td>
<td>Annency, France</td>
<td>5,000 reductions in bilateral tariffs.</td>
</tr>
<tr>
<td>1951</td>
<td>Torquay, England</td>
<td>8,700 reductions in bilateral tariffs covering a new range of goods.</td>
</tr>
<tr>
<td>1973-79</td>
<td>Tokyo Round</td>
<td>Reductions in bilateral tariffs. Procedures on dispute resolution, dumping and licensing.</td>
</tr>
<tr>
<td>1995</td>
<td>WTO established</td>
<td>WTO replaced the GATT.</td>
</tr>
<tr>
<td>2001-08</td>
<td>Doha Round</td>
<td>Divergences between developing and developed countries. Issues over agricultural subsidies.</td>
</tr>
</tbody>
</table>
Average Tariffs after the Uruguay Round (%)

- Metals: 1%
- Nonelectrical machinery: 1%
- Wood, paper & furniture: 1.5%
- Other manufactured articles: 2%
- Electrical machinery: 3%
- Chemical & photographic supplies: 4%
- Leather, footwear & travel goods: 7%
- Fish & fish products: 5%
- Transport equipment: 3%
- Mineral products: 2%
- Textiles & clothing: 13%
- All industrial products: 5%

Reduction range: 69% to 70%
Tariff range: 0% to 35%
Regional Averages in Trading Across Borders, 2012

- South Asia: Time to Import 32.5, Time to Export 32.1
- Sub-Saharan Africa: Time to Import 37.1, Time to Export 31.5
- Eastern Europe & Central Asia: Time to Import 28.8, Time to Export 27
- Middle East & North Africa: Time to Import 24, Time to Export 20
- Latin America & Caribbean: Time to Import 19.6, Time to Export 17.8
- East Asia & Pacific: Time to Import 23, Time to Export 21.9
- OECD High Income: Time to Import 10.7, Time to Export 10.5

Days

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Impacts of Integration Processes on Networks and Flows

Before Integration

After Integration

NETWORK

FLOWS

International border
### Characteristics of Free Trade Zones

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructures</td>
<td>High level of infrastructure, such as land, transport, office space, utilities, logistics services, business services and other facilities.</td>
</tr>
<tr>
<td>Regulations</td>
<td>Streamlined to improve efficiency, including custom services, labor regulation and permits.</td>
</tr>
<tr>
<td>Location</td>
<td>High accessibility location, often close to major terminal facilities such as a port, inland terminal or an airport. Location often away from conventional industry.</td>
</tr>
<tr>
<td>Export-oriented</td>
<td>Activities operating within the zone produce mainly or exclusively for foreign markets.</td>
</tr>
<tr>
<td>Incentives</td>
<td>Variety of incentives, including low cost land, infrastructures, tax and duty exemptions or various subsidies.</td>
</tr>
</tbody>
</table>
China’s Special Economic Zones

*Coastal China*
- 4 initial SEZs (1980)
- 14 coastal cities (1984)
- 3 deltas (1985)
- Hainan Province (1988)
- 6 Yangtze River ports (1992)
- 11 border cities (1992)

*Interior*

*Western China*
Value of Chinese Exports and FDI, 1983-2020 (Billions of $US)

- Merchandise Exports
- FDI Inflows
- FDI Outflows

Exports and FDI Inflows over the years (1983-2020).
# The Main Dimensions of Trade Facilitation

<table>
<thead>
<tr>
<th>Nature</th>
<th>Integration-Based</th>
<th>Distribution-Based</th>
<th>Transactions-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Compliance to rules and regulations.</td>
<td>Physical capacity to support trade.</td>
<td>Setting transactions and receiving compensation.</td>
</tr>
<tr>
<td></td>
<td>Customs procedures, regulations and handling of trade documentation.</td>
<td>Multimodal and intermodal freight transport systems. Modes, infrastructures and terminals.</td>
<td>Banking, finance and insurance activities where accounts can be settled.</td>
</tr>
</tbody>
</table>
The “Four Ts” in International Trade

- **Transaction costs**
- **Transport costs**
- **Time costs**
- **Tariff and non-tariff costs**

**Separation Factors**
- **Exogenous**
  - Distance, transportation costs, travel time.
  - Part of a trade agreement.

**Country Specific Factors**
- **Endogenous**
  - Customs procedures.
  - Performance of national transport and logistics.
### Phases of the Export-Oriented Paradigm

<table>
<thead>
<tr>
<th>Capital</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Currency devaluation. Mostly Foreign Direct Investments (FDI).</td>
<td>Surge in FDI, but growing share of national capital.</td>
<td>Pressures to revalue currency. Drop in FDI. National capital dominant. Providing FDI to other markets.</td>
</tr>
<tr>
<td>Transportation</td>
<td>Modernization of existing gateways.</td>
<td>Massive investments in new transport terminals, mostly ports and airports.</td>
<td>Focus on inland transportation.</td>
</tr>
</tbody>
</table>
Changes in the Value of World Trade per Type of Merchandise, 1950-2012 (in %)
CPB World Trade Index by Volume, 1991-2017 (2005=100)
Share of World Goods Exports, Leading Exporters, 1950-2020

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Merchandise Exports by Trade Agreement, 2015 (in billions USD)

- Andean Community: 92.4%
- Mercosur: 85.6%
- ASEAN: 74.5%
- NAFTA: 49.8%
- European Union (28): 36.7%

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## Trends Shaping International Trade

### Volume
- Peak growth

### Support
- Containerization

### Actors
- Multinational Corporations
  - Growing proportion of global trade.
  - Intermodal transport chains.
- Transnational production networks.
- Outsourcing and offshoring.

### Geography
- Export-Oriented Economies
  - Focus on exports to promote economic growth.
  - Imbalances in trade relations.

---

1980-2020:
- Population: 1.7 times.
- GDP: 7.2 times.
- Exports (value): 8.9 times.
- TEU: 20 times.
7.3 - Freight Transportation and Value Chains
Elements of an Economic System

Consumption (Demand)

Production (Supply)

Labor
Regulation
Manufacturing
Distribution

Land
Capital
The Corporation as a Decision, Management and Planning Unit

<table>
<thead>
<tr>
<th>Nature</th>
<th>Management Unit</th>
<th>Decision Unit</th>
<th>Planning Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain operational conditions.</td>
<td>Decisions about the allocation of resources.</td>
<td>Anticipate market changes and opportunities. Allocate its factors of production.</td>
<td></td>
</tr>
<tr>
<td>Production, sales, marketing, payroll, distribution.</td>
<td>Financial, labor, raw materials, research and development.</td>
<td>Economic, technological, social and political change.</td>
<td></td>
</tr>
<tr>
<td>Short term (production cycles).</td>
<td>Short to long term (product cycles).</td>
<td>Medium to long term (business cycles).</td>
<td></td>
</tr>
</tbody>
</table>
Competitive Advantages of Multinational Corporations

**Lower Production Costs**
- Core goal of a corporation.
- Exploitation of comparative advantages.
- Finding lower costs inputs (land, capital, labor).

**Price Stability**
- Low costs rationale take account of price changes in raw materials and parts.
- Risky to relocate (long-term investment) to take advantage of conditions that can change on the short term.

**Product Quality**
- Performance, service and maintenance.
- A quantitatively competitive product has limited advantages if not qualitatively competitive.

**Logistics Flexibility**
- Adapting to changes in the demand confers an advantage.
- Ability to withstand disruptions (resilience).
The Corporation and its Expansion

**Vertical Integration**
- **Nature**: Expand backward (suppliers) or forward (customers) along the supply chain.
- **Goals**: Lower costs. Enhance and protect product quality. Improve supply chain efficiency.
- **Issues**: Higher cost structure of suppliers. More difficult to adapt to changes.

**Horizontal Integration**
- **Nature**: Acquiring or merging with competitors.
- **Issues**: Different business cultures. Anti-monopolistic responses.

**Outsourcing**
- **Nature**: Some activities performed by another corporation.
- **Goals**: Reduce costs. Focus on core competencies. Increase output.
- **Issues**: Dependency. Loss of competency.
The Growth Cycle of Large Multinationals

**New Opportunity**
- New resource, technology, or product
- Technology and innovation as competitive advantage
- High profit margins

**Better Management**
- Increasing competition
- Cost as competitive advantage
- Declining profit margins
- Reliance on outsourcing

**Regulatory Support**
- Regulatory support or coercion
- Large government contracts
- Corporate socialism

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Types of Corporations by Multinational Expansion Strategy

**Raw Material Seekers**
- Lower input costs
- Resource acquisition
- First MNCs to emerge

Energy, mining, agricultural, forest

**Market Seekers**
- Achieve economies of scale
- Expand market
- Large investors

Retailing, wholesalers

**Low Cost Seekers**
- Look for comparative advantages
- Lower production and distribution costs
- Remain competitive

Manufacturing

**Knowledge Seekers**
- Look for qualified labor, techniques and processes
- Increase innovative capabilities

Information technologies, pharmaceuticals
Rationale for Outsourcing

OUTSOURCING

Firm

REASONS
- Find lower cost labor.
- Reduce or control costs.
- Free up internal resources.
- Gain access to capabilities.
- Increase revenue potential.
- Increase process efficiencies.
- Focus on core activities.
- Compensate for a lack of specific capabilities or skills.

SECTORS

Services
- IT and telecommunications.
- Business processing (data entry).
- Finance and accounting.
- Facility management.
- Call centers (technical support).
- HR (payroll and benefits, recruitment and training).

Manufacturing
- Fabrication (parts).
- Assembly and customization.

Distribution
- Transportation and logistics.
- Packaging and warehousing.

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Offshoring, Nearshoring and Farshoring

**Within the Firm**

**Outsourcing**

**Same Country**

**Offshoring**
Transfer of an organizational function to another country.

**Nearshoring**
Moving activities in a neighboring country (cultural affinity, similar time zones).

**Farshoring**
Moving activities to countries in another continent (different time zones).
The Configuration of Global Value Chains

Map 1.1 All countries participate in GVCs—but not in the same way

Figure 1.5 Country transitions between different types of GVC participation, 1990–2015

GVC linkages, 2015
- Low participation
- Limited commodities
- High commodities
- Limited manufacturing
- Advanced manufacturing and services
- Innovative activities
- Data gaps

Source: WDR 2020 team, based on the GVC taxonomy for 2015 (see box 1.3).

Note: The type of a country’s GVC linkages is based on the country's extent of backward GVC participation, measured as the portion of imports embodied in manufacturing's percentage of a country’s total exports, combined with the country's sector specialization of domestic value added in exports and engagement in innovation. Countries in the group have a small share of manufacturing exports and limited backward GVC integration. Their share of commodity exports can be low, medium, or high. Countries specializing in manufacturing GVCs engage in some manufacturing exports, often alongside commodities exports, and exhibit medium backward GVC integration. Countries specialized in manufacturing and services GVCs have a high share of manufacturing and business services exports and high backward GVC integration. Countries specialized in innovative spend a large share of GDP on research and development, receive a large share of GDP from intellectual property, and exhibit high backward GVC integration.
## Private Firms Directly and Indirectly Related to Freight Distribution

<table>
<thead>
<tr>
<th>Function</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport firms</strong></td>
<td>Modes</td>
</tr>
<tr>
<td><strong>Terminal operators</strong></td>
<td>Terminal equipment</td>
</tr>
<tr>
<td><strong>Logistic service providers</strong> (third and fourth party)**</td>
<td>Stakes in transportation assets</td>
</tr>
<tr>
<td><strong>Commodity producers</strong></td>
<td>Storage facilities and terminal equipment</td>
</tr>
<tr>
<td><strong>Manufacturers</strong></td>
<td>Distribution centers</td>
</tr>
<tr>
<td><strong>Retailers</strong></td>
<td>Distribution centers and delivery</td>
</tr>
<tr>
<td>Physical movements of goods</td>
<td></td>
</tr>
<tr>
<td>Management and operation of terminal assets</td>
<td></td>
</tr>
<tr>
<td>Management of transportation physical and information assets</td>
<td></td>
</tr>
<tr>
<td>Extraction and transformation of raw materials</td>
<td></td>
</tr>
<tr>
<td>Production of intermediate and final goods</td>
<td></td>
</tr>
<tr>
<td>Procurement and sale of final consumption goods</td>
<td></td>
</tr>
</tbody>
</table>

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Disconnection of Global Production and Distribution

- Core Base
  - R&D
  - Distribution
  - Marketing/Retail
- Manufacturing Base
Manufacturing Cost Structure

<table>
<thead>
<tr>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts and materials</td>
<td>Factory overheads</td>
</tr>
<tr>
<td>Wages and benefits</td>
<td>Administrative overheads</td>
</tr>
<tr>
<td>Operational expenses</td>
<td>Selling overheads</td>
</tr>
<tr>
<td></td>
<td>Distribution costs</td>
</tr>
<tr>
<td></td>
<td>Research &amp; Development</td>
</tr>
</tbody>
</table>

Prime Costs |
Factory Costs |
Total Costs |
Net Selling Price |
Profit
Types of Internationalization in Manufacturing

**MULTIDOMESTIC CORPORATION**
- Independent operations.
- Simple products.
- Production can be integrated globally, while the marketing is multidomestic.
- Better answer the needs of every market.
- Independency in productivity.

**GLOBALLY INTEGRATED CORPORATION**
- Production system located in several countries.
- Complex products or resources.
- Interdependency in productivity.
- Importance of logistics.

**TRADING INDUSTRIES**
- Aerospace
- Military hardware
- Diamond mining
- Agriculture

**DOMESTIC INDUSTRIES**
- Railways
- Hospitals
- Personal care

**GLOBALLY INTEGRATED INDUSTRIES**
- Automotive
- Petroleum
- Semiconductors
- Consumer electronics

**MULTIDOMESTIC INDUSTRIES**
- Retail banking
- Hotels
- Consulting

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Major Components to Price Reductions by the Chinese Manufacturing Sector, 2005

- Wages: 39.4%
- Export Industry Subsidies & Preferences: 16.7%
- Industrial Network Clustering: 16.0%
- Undervalued Currency: 11.4%
- Counterfeiting & Piracy: 8.6%
- FDI: 3.1%
- Lax Health & Safety Regulations: 2.4%
- Lax Environmental Regulations: 2.3%
Share of the World Commodity Consumption, China and United States, c2009/10

<table>
<thead>
<tr>
<th>Commodity</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>6.1%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Oil</td>
<td>10.4%</td>
<td>21.7%</td>
</tr>
<tr>
<td>GDP (PPP)</td>
<td>13.6%</td>
<td>19.7%</td>
</tr>
<tr>
<td>Wheat</td>
<td>16.6%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Soybeans</td>
<td>24.9%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Chickens</td>
<td>25.2%</td>
<td>11.3%</td>
</tr>
<tr>
<td>Rice</td>
<td>30.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Nickel</td>
<td>31.9%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>34.6%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Zinc</td>
<td>38.2%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Copper</td>
<td>39.5%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Lead</td>
<td>42.1%</td>
<td>13.7%</td>
</tr>
<tr>
<td>Steel</td>
<td>45.8%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Coal</td>
<td>46.9%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Pork</td>
<td>49.6%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Eggs</td>
<td>53.6%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Cement</td>
<td>53.6%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>54.4%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

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Sectors of American Imports of Asian Goods Through Maritime Container Shipping, 2004 (in TEUs)

- Apparel
- Textiles
- Machinery
- Electrical equipment
- Toys
- Shoes
- Tires
- Auto parts
- Appliances
- Electronics
- Furniture
- Big box retailer

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Benefits of Improved Freight Transportation on Value Chains

- Cost reductions to carriers and shippers.
- Reduced transit times.
- Increased reliability of shipments.

- Improvements in logistics and sourcing.
- Lower inventory levels and costs.

- Lower costs for suppliers and customers.
- Improved diversity of parts and goods.
The Transition Towards Manufacturing Capabilities

Comparative Advantages

Competitiveness

Capabilities

Added-value / Complexity

Share of Manufacturing

GDP per capita

High

Low
# The Value Chain (or Commodity Chain)

## Stages

1. **Commodities**
   - **Raw Materials**: Storage
2. **Intermediate Goods**
   - **Manufacturing and Assembly**: Warehouse
3. **Final Goods**
   - **Distribution**: Distribution center

## Flows

- **Bulk Shipping**: High volumes, Low frequency
- **Unit Shipping**: Average volumes, High frequency
- **LTL Shipping**: Low volumes, High frequency

Attributable to climatic (agricultural products, forestry products) or geological (ores and fossil fuels) conditions.

Transformation conferring added value. Materials and parts used to make other goods.

Goods shipped to large consumption markets (cities). Flow and inventory management.

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The Configuration of Value Chains

1. One-to-one
   Massification

2. One-to-many
   Deconsolidation

3. Many-to-one
   Consolidation

4. Many-to-many
   Distribution
Value Chains and Freight Transport Systems

- Raw materials
  - Extraction
  - Intra-industrial linkages
  - Transfer
  - Processing

- Semi-finished products
  - Manufacturing

- Manufactured goods
  - Distribution
  - Retailing
Generic Smile Curve in a Value Chain

- **Added Value**
  - **Patent & Technology**
  - **Fabrication**
  - **Brand & Service**

- **R&D** (Global Competition)
- **Marketing** (Area Competition)
The Value Chain and its Added Value

Value Chain

Added Value

Pre-Production (Intangible)  Production (Tangible Activities)  Post-Production (Intangible)

Concept  Fabrication  Logistics


1. Concept
2. Fabrication
3. Logistics

1. Pre-Production (Intangible)
2. Production (Tangible Activities)
3. Post-Production (Intangible)
Upgrading the Value Chain

1. Fabrication
   (Value chain entry)
   • Focus on fabrication; suppliers assemble inputs, following buyers’ specifications.
   • Inputs may be imported due to limited availability and quality concerns over local inputs.
   • Product focus may be relatively narrow.

2. Supply Chain
   (Functional upgrading)
   • Broader range of manufacturing-related functions, such as sourcing inputs and inbound logistics as well as fabrication.
   • The supplier may also take on outbound distribution activities.

3. Product Design
   (Functional upgrading)
   • Supplier carries out part of the pre-production processes such as design or product development.
   • Design may be in collaboration with the buyer, or the buyer may attach its brand to a product designed by the supplier.

4. Product Brand
   (Functional upgrading)
   • Supplier acquires post-production capabilities and can fully develop products under its own brand names.
   • Can be in collaboration with the buyer or by establishing a new market channel.

5. R&D
   (Product upgrading)
   • Increase unit value by producing more complex products, which requires increasing the capabilities of the firm.
   • Countries must move from low-cost commodities to higher value goods that warrant higher returns as labor costs increase.

6. Advanced Services
   (Process upgrading)
   • Improving productivity through new capital investments.
   • Improving IT and logistics.
   • Reducing lead time and increasing the flexibility of the supply chain process.
Value Creation and Capture, iPhone 4 (in USD)

- Retail ($600)
  - Distribution ($90.00)
  - Misc. ($45.95)
  - Apple ($269.05)
- USA
  - Factory Gate Price ($194.04)
  - VA ($6.54)
- China
  - Inputs ($24.63)
- Korea
  - Inputs ($80.05)
- Germany
  - Inputs ($16.08)
- France
  - Inputs ($3.25)
- Japan
  - Inputs ($0.70)
- Other
  - Inputs ($62.79)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jute (Bangladesh)</td>
<td>12.1%</td>
<td>19.8%</td>
<td>21.2%</td>
<td>44.2%</td>
</tr>
<tr>
<td>Tea (Sri Lanka)</td>
<td>9.5%</td>
<td>9.9%</td>
<td>10.0%</td>
<td>13.4%</td>
</tr>
<tr>
<td>Coffee (Colombia)</td>
<td>4.2%</td>
<td>3.3%</td>
<td>6.8%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Cocoa beans (Ghana)</td>
<td>2.4%</td>
<td>2.7%</td>
<td>6.7%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
Added Value, Supply Chains and Transport Chains

- High Value Capture / Creation
- Value Expansion
- Value Retention
  - Low

Customers
- Upward
  - Market Potential (+)
  - Distribution Costs (-)
- Downward
  - Production Costs (-)

Suppliers

- Added Value
- How?
- Supply Chain
- Where?
- Transport Chain
The Functional and Geographical Integration of Value Chains

Supplying | Manufacturing | Distribution
---|---|---
S | M | D

Origin / Destination Relationships

Physical Flows

Functional Integration

Supply / Demand Relationships

Value Chain

Global Value Chain

Regional Value Chain

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Producer and Buyer-driven Value Chains

**Producer-driven**

1. Manufacturers
2. Distributors
3. Retailers and Dealers

- Domestic and foreign subsidiaries and subcontractors

**Buyer-driven**

- Factories
- Traders
- Overseas Buyers
- Branded Manufacturers

- International
- National

- Branded Marketers
- Retailers
## Characteristics of Producer-Driven and Buyer-Driven Global Commodity Chains

<table>
<thead>
<tr>
<th></th>
<th>Producer-Driven Commodity Chains</th>
<th>Buyer-Driven Commodity Chains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers of Global Commodity Chains</td>
<td>Industrial capital</td>
<td>Commercial capital</td>
</tr>
<tr>
<td>Core Competencies</td>
<td>Research &amp; Development; Production</td>
<td>Design; Marketing</td>
</tr>
<tr>
<td>Barriers to Entry</td>
<td>Economies of Scale</td>
<td>Economies of Scope</td>
</tr>
<tr>
<td>Economic Sectors</td>
<td>Consumer Durables; Intermediate Goods; Capital Goods</td>
<td>Consumer Nondurables</td>
</tr>
<tr>
<td>Typical Industries</td>
<td>Automobiles; Computers; Aircraft</td>
<td>Apparel; Footwear; Toys</td>
</tr>
<tr>
<td>Ownership of Manufacturing Firms</td>
<td>Transnational Firms</td>
<td>Local Firms, predominantly in developing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>countries</td>
</tr>
<tr>
<td>Main Network Links</td>
<td>Investment-based</td>
<td>Trade-based</td>
</tr>
<tr>
<td>Predominant Network Structure</td>
<td>Vertical</td>
<td>Horizontal</td>
</tr>
</tbody>
</table>

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Geographical Growth of a Multinational Corporation

Basic Enterprise

1. Tariff
   - Regional
   - National
   - International

Penetration of a National Market

2. Factory
   - Distribution center
   - Representative

Penetration of Foreign Markets

3. Multinational Corporation

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Global Production Networks and Location Strategies

**Multidomestic**
- Country A
- Country B
- Country C
- Country D

**Centralized Production**

**Regional Production**

**Globally Integrated**

**Regional Specialization**

**Vertical Integration**
The Velocity of Freight

Transshipment Speed

Speed barrier

Future improvements

Logistical speed threshold

Pull Logistics

Push Logistics

Containerization

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Market Share by Freight Transport Mode, United States, 1965-2005 (in ton-miles)
Fordist and Post-Fordist Production Systems

**Fordism**
- Mass production
- Focus on supply
- Regional markets
- Expansion through vertical and horizontal integration
- Discontinuous supply chains
- Long product life cycles (years)

**Post-Fordism**
- Mass customization
- Focus on demand
- Global markets
- Expansion through outsourcing and offshoring
- Integrated supply chains
- Short product life cycles (months)
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Fordism</th>
<th>Post-Fordism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production Mode</strong></td>
<td>Mass Production</td>
<td>Mass Customization</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Structured (Pyramidal)</td>
<td>Networked (Flexible)</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Supply</td>
<td>Demand</td>
</tr>
<tr>
<td><strong>Market Reach</strong></td>
<td>Regional / National</td>
<td>Global</td>
</tr>
<tr>
<td><strong>Expansion</strong></td>
<td>Vertical or horizontal integration</td>
<td>Outsourcing and offshoring</td>
</tr>
<tr>
<td><strong>Core Resources</strong></td>
<td>Physical Assets</td>
<td>Innovation/ Knowledge</td>
</tr>
<tr>
<td><strong>Value Chains</strong></td>
<td>Discontinuous</td>
<td>Integrated (continuous)</td>
</tr>
<tr>
<td><strong>Inventories</strong></td>
<td>Months</td>
<td>Hours</td>
</tr>
<tr>
<td><strong>Production Cycle Time</strong></td>
<td>Weeks / Months</td>
<td>Days</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>Monthly / Weekly</td>
<td>Daily / Real-Time</td>
</tr>
<tr>
<td><strong>Product Life Cycle</strong></td>
<td>Years</td>
<td>Months</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>Affordable Best</td>
<td>Zero-Defect</td>
</tr>
</tbody>
</table>
Post-Industrial Revolution

**Economic Composition**
- Relative: shift from manufacturing to services.
- Absolute: growth of manufacturing.

**Capital Accumulation**
- Knowledge becomes a form of capital.
- High reliance on innovation.

**Manufacturing**
- Flexible manufacturing systems.
- Supply chain management (Just-in-time).
- Diversified trade (from resources to high value goods).

**Labor**
- Declining importance of “blue collar” tasks.
- Increasing importance of technical and creative tasks.

**Information Technologies**
- Global telecommunication networks.
- IT embedded in products and services.
Level of Embeddedness of Value Chains

<table>
<thead>
<tr>
<th>Embeddedness</th>
<th>Low (standardization)</th>
<th>Customized Standardization</th>
<th>High (customization)</th>
<th>Pure Customization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Standardization</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
</tr>
<tr>
<td>Segmented Standardization</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
</tr>
<tr>
<td>Customized Standardization</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
</tr>
<tr>
<td>Tailored Customization</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
</tr>
<tr>
<td>Pure Customization</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
<td>Design → Parts → Assembly → Distribution → Market</td>
</tr>
</tbody>
</table>

Demand Driver

- Processing without order
- Shipment to order
- Assembly to order
- Manufacturing to order
- Design to order

Push (expectation)
Pull (response)
Energy and Minerals Supply Chains

Crude Oil
- Oil Refinery
  - Storage
  - Fuel for road transport (50-70%)
  - Fuel for airplanes (5-10%)
  - Fuel for ships (10-15%)
  - Chemical industry (5-15%)

Steel Production (30%)
- Iron Ore
- Scrap
- Coal
- Energy Production (70%)

Construction
- Transport equipment
- Durable consumer goods
- Industry (40%)
- Residential and commercial (60%)
The Global Car Production Network, 2003
Supplying industries
- Steel and other metals
- Rubber
- Electronics
- Plastic
- Glass
- Textiles

Bodies
- Manufacture and stamping of body panels
- Body assembling and painting

Components
- Manufacture of mechanical and electrical components (wheels, tires, seats, braking systems, windshields, exhausts, etc.)

Engines and transmissions
- Forging and casting of engine and transmission components
- Machining and assembly of engines and transmissions

Final Assembly
- Consumer market
The Scope of a Supply Chain, Logistics Chains and Transport Chains

Supply Chain

- Extraction
- Processing
- Fabrication
- Assembly
- Distribution
- Retailing

Logistics Chain 1

- Extraction
  - Rail
  - Port
  - Maritime

Logistics Chain 2

- Processing
  - Gate
  - Market

Logistics Chain 3

- Fabrication
  - Gate
  - Manufacturing

Logistics Chain 4

- Assembly
  - Gate
  - Production

Transport Chain 1

- Extraction
  - Gate

Transport Chain 2

- Processing
  - Gate

Transport Chain 3

- Fabrication
  - Gate

Transport Chain 4

- Assembly
  - Gate

Transport Chain 5

- Distribution
  - Gate

Product Focus

Transport Focus

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Supply Chains: Alternating First and Last Miles

Logistics Chain 1
- Extraction
- Processing
- Fabrication
- Assembly
- Distribution
- Retailing

Transport Chain 1
- TC 2
- TC 3
- TC 4
- TC 5

Logistics Chain 2

Logistics Chain 3

Logistics Chain 4

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7.4 - Logistics and Freight Distribution
The Concept of Logistics

- Derived Demand
- Induced Demand

Materials Management
- Manufacturing
- Sourcing
- Inventory
- Packaging
- Recycling/Reusing

Logistics

Physical Distribution
- Transportation
- Warehousing
- Wholesale
- Retail
Logistics Goals and Operations

Fulfillment (Goals)

Order
- Right product
- Right quantity

Delivery
- Right location
- Right time

Quality
- Right condition

Cost
- Right price

Demand (Operations)

Transportation
- Handling
- Packaging

Inventory
- Production scheduling
- Warehousing

Orders
- Sales
- Purchase
Types of Packaging

**Primary Packaging**
- Packaging touching the product.
- Boxes and wraps.
- Designed for individual items.
- Designed for shelf storage/display of single item.

**Secondary Packaging**
- Packaging bundling items of a product.
- Boxes and wraps.
- Designed for shelf storage/display.

**Tertiary Packaging**
- Packaging bundling products for transport.
- Boxes, pallets and containers.
The Supply Chain and its Cycles

Supply Chain

Customer → Retailer → Distributor → Manufacturer → Supplier

Information Flow

Customer Order Cycle

Replenishment Cycle

Manufacturing Cycle

Procurement Cycle

Time

Inventory

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The “Bullwhip Effect” in Supply Chains

Customer
Retailer
Distributor / Wholesaler
Manufacturer
Supplier

Customer Order Cycle
Order 10 units

Replenishment Cycle
Order 12 units

Manufacturing Cycle
Order 15 units

Procurement Cycle
Order 20 units
Distribution and Related Logistics Activities

**Inventory**
- Supplier
- Customer

**Truckload**
- Item price list
  - Quote price
  - Receive order
  - Tender shipment
  - Schedule shipment
  - Prepare shipment
  - Load shipment
  - Trace shipment
  - Issue invoice

**Shipper**
- Carrier
  - Dispatch truck
  - Trace shipment
  - Collect delivery receipt
  - Send billing
  - Collect payment

**Receiver**
- Place order
- Pay invoice
  - Schedule dock space
  - Receive shipment
  - Unload product
  - Unpack shipment
  - Receive freight bill
  - Pay freight bill

**Rates**
- Schedule dock space
- Receive shipment
- Unload product
- Unpack shipment
- Receive freight bill
- Pay freight bill

**Information flow**
- Physical flow
Value-Added Functions and Differentiation of Supply Chains

### Value-Added Functions
- Production Costs
- Location
- Time
- Control

### Supply Chain Differentiation

<table>
<thead>
<tr>
<th>Logistics Costs</th>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Time</td>
<td>Marginal</td>
</tr>
<tr>
<td>Reliability</td>
<td>Very Important</td>
</tr>
<tr>
<td>Risk</td>
<td>Marginal</td>
</tr>
</tbody>
</table>

- Low costs and stability of cost structure.
- Inversely proportional to cargo value.
- Low inventory carrying costs and lead time.
- Proportional to cargo value and perishability.
- Stability of delivery schedule and conditions.
- Related to cargo type.
- Low cost, time and reliability deviation.
- Related to transport chain.
## Taxonomy of Logistics Decisions

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production structures</strong></td>
<td>Commercial decisions on outsourcing, offshoring and sub-contracting. Number, location and capacity of production units.</td>
</tr>
<tr>
<td><strong>Transport structures</strong></td>
<td>Choice of a freight network linking a company and its suppliers and customers. Choice of modes and terminals; the transport chain.</td>
</tr>
<tr>
<td><strong>Distribution structures</strong></td>
<td>Choice concerning the number, location and capacity of distribution centers. Frequency and timing of distribution (e.g. just-in-time).</td>
</tr>
<tr>
<td><strong>Logistics structures</strong></td>
<td>Usage of production, transport and distribution capabilities to fulfill short, medium and long term strategies (e.g. lower costs, gain market share, improve service efficiency, reduce response time, reduce environmental footprint). Usage of third party logistics providers.</td>
</tr>
</tbody>
</table>
Total Logistics Costs Tradeoff

Costs vs. Shipment Size or Number of Warehouses

- Total Logistics Costs
- Warehousing Costs
- Transport Costs
The Logistics Virtuous and Vicious Cycles

Vicious cycle:
- Low quality services
- Complex procedures
- Limited incentive to invest
- Regulatory burden
- Lack of market forces
- Protectionism
- Partial reforms
- Logistics Unfriendly

Virtuous cycle:
- High quality services
- Seamless procedures
- Incentive to invest
- Scale economies
- Logistics Friendly
- Comprehensive reforms
- Logistics Performance

Trade Facilitation
Liberalized market
Scale economies
Global Logistics Costs by Function and Mode, 2018

Logistics Costs by Function
- Transportation: 58%
- Inventory Carrying: 23%
- Warehousing: 11%
- Administrative: 8%

Logistics Costs by Mode (billions USD)
- Trucking: 4,132
- Maritime: 714
- Air: 301
- Rail: 297

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Logistics Costs, United States, 1980-2020 (in billions of $)

- Inventory Carrying Costs
- Transportation Costs
- Administrative Costs

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The Evolution of the Scope and Taxonomy of Logistic Areas

SCOPE
- Logistics
  - Warehousing
  - Material Management
  - Physical Distribution
  - Logistics
  - Supply Chain Management
- Transportation
  - Palletization
  - Containerization
  - Intermodalism
  - Cross docking
- Public Policy
  - Trade Liberalization
  - Trade / Export Promotion
  - Trade Facilitation
  - Integrated Development

TAXONOMY
- Regulations
  - Free Zones
  - Free Trade Zones
  - Export Processing Zones
  - Special Economic Zones
- Terminals
  - Inland Terminals
  - Intermodal Terminals
  - Dry / Inland Ports
  - Extended Gateways
- Activities
  - Industrial Parks
  - Logistics Zones
  - Logistics Platforms

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Anticipation Stock • Cycle Stock • Safety Stock • Pipeline Stock • Decoupling Stock
From Push to Pull Logistics

**Push Logistics**

- Supplier
- Supplier
- Supplier
  - Freight flow
  - Manufacturer
  - Distributor
  - Customer

**Pull Logistics**

- Supplier
- Supplier
- Supplier
- Supplier
  - 3PL
  - Returns / Recycling
  - Manufacturer
  - Distributor
  - Customer
  - Point-of-sale data
Warehouses and Distribution Centers

**Warehouse**
- Supply-driven (storage).
- Buffer related function (inventory holding).
- Inventory stored for weeks or months.
- Cargo ownership usually by supplier / producer.
- Consolidation of cargo.
- Limited added value outside storage.
- Coping with unforeseen demand.

**Distribution Center**
- Demand-driven (throughput).
- Fulfilling orders (processing and fulfillment).
- Inventory stored for days or weeks.
- Cargo ownership usually by distributor / customer.
- Consolidating, deconsolidating, sorting a cargo load or changing the load unit.
- Assembly, packaging and light manufacturing.
- Coping with stable and predictable demand.
A Typology of Warehousing

- **Bulk Warehouse**
  - Limited added value
  - Simple goods
  - Coal, Ore, Grain

- **Specialized Warehouse**
  - Limited added value
  - Complex goods
  - Chemicals, Cold storage

- **Distribution Center**
  - High added value
  - Simple operations
  - Cross-docking

- **Specialized DC**
  - High added value
  - Complex operations
  - E-fulfilment, Cold chain
Value-added Activities Performed at Freight Distribution Clusters

Freight Distribution Cluster

Inventory Management
Inspection / Testing
Transloading
Packing / Packaging
Labeling / RFID
Assembly / Customizing
Reverse Distribution
Specialized Storage

Suppliers

Pickup

Terminal

Warehousing

Customers

Delivery

Terminal
Changes in the Relative Importance of Logistical Functions in Distribution Systems

- **Demand Driven**
  - Inventory
  - Transport System
  - Information System

- **Supply Driven**
  - Inventory
  - Transport System
  - Information System

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Benefits of Demand-Driven Supply Systems

- Inventory turnover
- Customer service
- Labor productivity
- Capacity utilization
- Logistics costs

- Working capital
- Net income
- Operating expenses
- Return on assets
- Operating expenses

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Fragmentation of the Production System and the Logistics Industry
<table>
<thead>
<tr>
<th>Issue</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of inventory and production</td>
<td>Wider geographical sourcing and distribution of goods</td>
</tr>
<tr>
<td>Development of break-bulk / transshipment systems</td>
<td>Development of break-bulk / transshipment systems</td>
</tr>
<tr>
<td>Concentration of international trade</td>
<td>Major port and airport gateways</td>
</tr>
<tr>
<td>Development of hub and spoke systems</td>
<td>Intermediary hubs,</td>
</tr>
<tr>
<td>Time management</td>
<td>Postponement, Nominated day delivery and timed delivery systems</td>
</tr>
<tr>
<td>Rationalization of the supply base</td>
<td></td>
</tr>
<tr>
<td>Vertical disintegration of production</td>
<td></td>
</tr>
<tr>
<td>Direct deliveries</td>
<td></td>
</tr>
<tr>
<td>Green logistics</td>
<td>Reverse logistics</td>
</tr>
</tbody>
</table>

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% of Products Shipped for “Just-in-Time” Manufacturing

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Conventional and Contemporary Arrangement of Goods Flow

Conventional

- Raw Materials
- Storage
- Manufacturing
- Distribution
- National Distribution
- Regional Storage
- Local Distribution
- Retailers
- Customers

Material flow (delivery)

Information flow (order)

Core component

Contemporary

Supply Chain Management

- Raw Materials
- Manufacturing
- Distribution Center
- Retailers
- Customers

Material flow (delivery)

Information flow (order)

Core component

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### Logistical Activities Related to Containerization

<table>
<thead>
<tr>
<th>Container Management</th>
<th>Container Transportation</th>
<th>Cargo Handling</th>
<th>Container Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Broking/Leasing.</td>
<td>• Maritime shipping</td>
<td>• Loading (Packing, Palletizing and Bundling).</td>
<td>• Empty stacking.</td>
</tr>
<tr>
<td>• Inventory management.</td>
<td>(Routing, Scheduling).</td>
<td>• Transloading (Re-bundling).</td>
<td>• Inspection.</td>
</tr>
<tr>
<td>• Transport routing.</td>
<td>• Terminal operations</td>
<td>• Unloading (Unbundling, de-palletizing and Unpacking).</td>
<td>• Cleaning &amp; Repair.</td>
</tr>
<tr>
<td>• Container tracking.</td>
<td>(Transshipment, Storage/Stacking, Gate access).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquiring Company</td>
<td>Acquisition</td>
<td>Core Business</td>
<td>Estimated Acquisition Cost (US $)</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>DSV</td>
<td>UTi Worldwide</td>
<td>Non-asset-based international logistics, freight forwarding, and customs brokerage</td>
<td>$1.35 billion</td>
</tr>
<tr>
<td>XPO Logistics</td>
<td>Con-way</td>
<td>Less-than-truckload (LTL), truckload (TL), and 3PL services</td>
<td>$3.0 billion</td>
</tr>
<tr>
<td>Geodis SA (Owned by French railway SNCF)</td>
<td>OHL (owned by private equity firm)</td>
<td>Value-added warehousing</td>
<td>$800 million</td>
</tr>
<tr>
<td>UPS</td>
<td>Coyote Logistics</td>
<td>Non-asset-based truckload (TL) carrier and freight brokerage</td>
<td>$1.8 billion</td>
</tr>
<tr>
<td>XPO Logistics</td>
<td>Norbert Dentressangle (France)</td>
<td>Contract logistics, global freight forwarding, brokerage, and transportation management</td>
<td>$3.53 billion</td>
</tr>
<tr>
<td>Federal Express</td>
<td>TNT Express (Netherlands)</td>
<td>European package delivery</td>
<td>$4.8 billion</td>
</tr>
<tr>
<td>Penske</td>
<td>Transfreight</td>
<td>Automotive 3PL services</td>
<td>Private transaction; no terms announced</td>
</tr>
<tr>
<td>Kintetsu World Express (Japan)</td>
<td>APL Logistics (Singapore)</td>
<td>Global logistics services/ocean focus</td>
<td>$1.2 billion</td>
</tr>
<tr>
<td>Norbert Dentressangle (France)</td>
<td>Jacobson Companies (owned by private equity)</td>
<td>Value-added warehousing</td>
<td>$750 million</td>
</tr>
<tr>
<td>Federal Express</td>
<td>Genco</td>
<td>Product lifecycle management and reverse logistics</td>
<td>$1.4 billion</td>
</tr>
<tr>
<td>XPO Logistics</td>
<td>Pacer International</td>
<td>Intermodal services, including U.S.-Mexico</td>
<td>$335 million</td>
</tr>
</tbody>
</table>

*Acquisition involves Con-way Freight, Menlo Logistics, Con-way Truckload, and Con-way Multimodal. All will be rebranded as XPO Logistics.

**The company is being sold by the private equity company, Welch, Carson, Anderson & Stowe and Hyde Park Holdings, LLC.

***The company is being sold by the private equity firm Warburg Pincus.

**** The company was sold by Oak Hill Capital Partners.
Key Drivers for Third- and Fourth-Party Logistics Providers

**Globalization**
Supply chains and manufacturing increasingly global, requiring greater management of supply chains.

**Core Competencies**
Manufacturers and retailers are focusing on their core business and outsourcing logistics services to specialized firms.

**Innovation & Management**
3PLs becoming increasingly sophisticated in supply chain management, making investments, realizing economies of scale.

**Asset Utilization**
3PL model promotes greater asset utilization (e.g. balancing flows, backhaul, within their networks) and asset-sharing alliances.
Main Core Competencies of Third-Party Logistics Providers

- Sourcing
- Shipping
- Warehousing
- Routing

PRODUCT

TRANSPORT
## Services Offered by Third and Fourth Party Logistics Service Providers

<table>
<thead>
<tr>
<th>Standard Services</th>
<th>Advanced Services</th>
<th>Complete Services</th>
<th>Integrated Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation services</td>
<td>Vendor managed inventories</td>
<td>Order planning and processing</td>
<td>Production planning</td>
</tr>
<tr>
<td>Carrier selection</td>
<td>Stock accounting</td>
<td>Information and Communications Technologies (ICT) management</td>
<td>Global sourcing</td>
</tr>
<tr>
<td>Rate negotiation</td>
<td>Customs clearance and documentation</td>
<td>Single invoice</td>
<td>Multiple routing options</td>
</tr>
<tr>
<td>Fleet management</td>
<td>Assembly</td>
<td>Landed duty paid cost</td>
<td>Supply chain consulting</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Packaging and labeling</td>
<td>Payment collection</td>
<td>Real time supply chain monitoring and adjustment</td>
</tr>
<tr>
<td>Cross docking</td>
<td>Managing product returns</td>
<td>Real time inventory updates</td>
<td></td>
</tr>
<tr>
<td>Pick and Pack</td>
<td>Financing</td>
<td>Just in Time (JIT) inventory management</td>
<td></td>
</tr>
<tr>
<td>Distribution (direct to store/home)</td>
<td>Retail delivery, set up and on site training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispatching</td>
<td>Inventory tracking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery documentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipment consolidation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Nodes and Freight Distribution

![Diagram of nodes and freight distribution]

**Globalization of Production**
- Manufacturing
- Regional Distribution
- Global Distribution

**Globalization of Consumption**
- Retailing
- Regional Distribution
- Global Distribution

**Distribution Scope**
- Local
- Regional
- Global

**Distribution Scale**
- Production
- Consumption
The Role of Distribution Centers andWarehouses

Distribution Center

Deliveries

Distribution Center and Warehouse

Deliveries

Producers’ warehouse

Deliveries

Distribution center

Deliveries

Consignment

Delivery vehicle

Retail store

Production unit
Asynchronism and Distribution Centers

TIME
- Fluctuations
- Seasonality

Production and Consumption

Supply and Demand

DC

NETWORK
- Combination
- Cross-docking

SIZE
- Consolidation
- Deconsolidation
- Transloading

Load unit

Market Areas

TIME

SIZE

NETWORK

SCALE

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## Location and Design Criteria for Distribution Centers

<table>
<thead>
<tr>
<th>Cost</th>
<th>Price sensitivity</th>
<th>Price per square foot; Operation costs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Consolidation</td>
<td>More throughput and less warehousing.</td>
</tr>
<tr>
<td>Facility</td>
<td>High clearance; Separate loading and unloading bays</td>
<td>Improved stacking density (from 20 to 80 feet); More doors for sorting efficiency; Potential for cross-docking.</td>
</tr>
<tr>
<td>Land</td>
<td>Massification</td>
<td>Parking space for trucks (often not necessary due to high throughput); Space for expansion.</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Proximity to highways</td>
<td>Constant movements (pick-up and deliveries) in small batches (often LTL); Access to corridors and markets; Co-location with rail, air and port terminals.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Market access</td>
<td>Shorter lead times; Less than 48 hours service window.</td>
</tr>
<tr>
<td>IT</td>
<td>Automation and Integration</td>
<td>Sort parcels; Control movements from receiving docks to shipping dock; Management systems controlling transactions.</td>
</tr>
</tbody>
</table>
## Location and Design Criteria for Distribution Centers

<table>
<thead>
<tr>
<th>ATTRIBUTE</th>
<th>DRIVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Price sensitivity</td>
</tr>
<tr>
<td>Footprint</td>
<td>Massification</td>
</tr>
<tr>
<td>Facility</td>
<td>Throughput</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Co-location</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Lead time</td>
</tr>
<tr>
<td>Technology</td>
<td>Automation</td>
</tr>
</tbody>
</table>

- **Cost**: Price per square foot; Operation costs (labor, utilities, taxes).
- **Footprint**: Large surface; Parking space for trucks; Space for expansion.
- **Facility**: High clearance; Separate loading and unloading bays; Improved stacking density (from 20 to 80 feet); Potential for cross-docking.
- **Connectivity**: Continuous turnover (pick-up and deliveries often LTL); Access to corridors; Co-location with rail, air and port terminals.
- **Accessibility**: Market access; Shorter lead times; Less than 48 hours service window.
- **Technology**: Sort inventory; Control movements from receiving docks to shipping docks; Management systems controlling transactions.

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## Typology Criteria of Agglomerations of Logistical Activities

<table>
<thead>
<tr>
<th>Accessibility</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Structure</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td></td>
</tr>
</tbody>
</table>
Basic Operational Characteristics by Number of Warehouses, United States and China, 2009

![Graph showing operational characteristics by number of warehouses in the United States and China, 2009. The graph includes metrics such as average distance to customers and lead time for both countries.]

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Optimal Location and Throughput by Number of Freight Distribution Centers

3 Distribution Centers
- Bakersfield (23%)
- Allentown (31%)
- McKenzie (46%)
- Average Distance to Customers: 378 miles
- Average Lead Time: 1.29 days

5 Distribution Centers
- Bakersfield (21%)
- Summit (24%)
- Macon (19%)
- Dallas (14%)
- Average Distance to Customers: 264 miles
- Average Lead Time: 1.13 days

7 Distribution Centers
- Tacoma (5%)
- Chicago (21%)
- Summit (23%)
- Pasadena (16%)
- Gainesville (14%)
- Dallas (13%)
- Average Distance to Customers: 216 miles
- Average Lead Time: 1.07 days

10 Distribution Centers
- Tacoma (4%)
- Rockford (13%)
- Newark (20%)
- Mansfield (12%)
- Gainesville (13%)
- Dallas (12%)
- Average Distance to Customers: 173 miles
- Average Lead Time: 1.04 days
Market Area of Distribution Centers Located in the United States, 2012

- Global
- Western Hemisphere
- United States
- Half the United States
- Multi State Region
- Metropolitan Area
A Typology of Spatial Dynamics in the Location of Logistics Sites

- Multimodal transshipment centre (e.g. Container terminal)
- Logistics sites (single or multi-user)

Spatial concentration of logistics sites

- Zoning
- Polarisation

Spatial diffusion of logistics sites

- Dezoning
- Depolarisation
Cross-Docking Distribution Center

Distribution Center

Before Cross-Docking

Suppliers

Customers

LTL

Cross-Docking DC

After Cross-Docking

Suppliers

Customers

FTL

FTL
Freight Distribution and Network Strategies

Point-to-Point

Fixed Routing

Corridor

Flexible Routing

Hub-and-Spoke

- Transshipment node
- Route node
- Network node
- Unserved node

Route

Alternative route
Collaborative Distribution

Back-Haul Matching

Sequence Matching

Before

After

Supplier

Customer
## Logistical Strategies to Cope with Higher Transport Costs

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping less</td>
<td>Demand responsive systems.</td>
</tr>
<tr>
<td></td>
<td>Reduce returns.</td>
</tr>
<tr>
<td>Shipping timing</td>
<td>Allow longer shipping time and outside rush (high cost) periods.</td>
</tr>
<tr>
<td>Efficient packaging</td>
<td>Reduce the shipment size (volume) of the same load.</td>
</tr>
<tr>
<td>Modal shift</td>
<td>Use a mode that is less impacted by congestion.</td>
</tr>
</tbody>
</table>
Complexity of the Supply Chain

National Supply Chain

Multinational Supply Chain

Simple Complex

Factory Distribution center Representative High-throughput DC

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- Menlo Worldwide
- APL Logistics
- Kuehne + Nagel
- NFI Industries
- DSC Logistics
- Warehouse Specialists, Inc.
- Penske Logistics
- Ryder System, Inc.
- Atlas/Versacold (Eimskip)
- MBX Logistics, LLC
- Kenco Logistic Services
- Ozburn-Hessey Logistics
- AmeriCold Logistics, Inc.
- Jacobson Companies
- CEVA Logistics, North America
- UTi Worldwide Inc.
- Caterpillar Logistics Services
- GENCO Distribution
- UPS Supply Chain Solutions
- DHL & Exel Supply Chain Solutions

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The Evolution of Retail Logistics

1970s
Direct replenishment
- Suppliers / Wholesalers
- Stores

1980s
Rationalization
- Distribution Centers

1990s
Global sourcing
- Overseas suppliers
- Domestic suppliers
- Import Centers
- Distribution Centers

2000s
Digitalization
- E-fulfillment centers
- Parcel hubs
- Sortation centers
- Parcel delivery centers
- Local depots
- Customer home
- Collection point
- Delivery point
The Evolution of Retail Logistics

1980s
Rationalization

Global
Suppliers / Wholesalers

National / Regional
Distribution Centers

Regional supply chains, Warehousing districts

 metropolitan area
Distribution Centers

Urban Core
Stores

1990s
Global sourcing

Global
Overseas suppliers

National / Regional
Import Centers

Regional supply chains, Logistics sprawl

 metropolitan area
Import Centers

Urban Core
Suburbanization, Shopping malls and megastores

2000s
Digitalization

Global

National / Regional

Regional supply chains, Logistics sprawl

 metropolitan area

Urban Core
City logistics and fast deliveries

E-fulfillment centers

Customer home
Collection point
Delivery point

Parcel hubs
Parcel delivery centers
Sortation centers
Local depots
Collection point
Delivery point

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The Impacts of E-commerce on Freight Distribution

- Distributional consumption.
- Growth in B2C deliveries.
- Changes in last mile logistics.

- Shift of the real estate footprint from retail to distribution.
- Changes in locational dynamics.

- New logistical facilities (E-fulfillment, Sortation center, Urban logistics depot).
- Automation of fulfilment and inventory management.

- Development of 3PL and 4PL services.
- Dedicated carrier services (truck, air, non-vessel operating common carrier).
Logistics Facilities Supporting E-commerce

**Inbound Cross Dock**
- Large-sized.
- Receiving containers and holding inventory.
- Double side cross-docking configuration.
- Close to intermodal terminals.

**Sortation Center**
- Large-sized.
- Cross-docking configuration for loading trucks.
- Automated and semi-automated sortation.
- Accessibility to regional distribution.

**Local Freight Station**
- Small or micro-sized.
- Store-like facility (pickup location).
- Locker banks (freight station).
- High density neighborhood locations.

**E-Fulfillment Center**
- Large-sized.
- Single side cross-docking configuration common.
- High racks automated storage.
- Item specialization.
- Access to a major parcel hub.

**Delivery Station**
- Medium to small-sized.
- Cross-docking configuration for loading delivery vehicles.
- Periphery of metropolitan areas.

**Fast Delivery Hub**
- Small to medium-sized.
- Near large metropolitan areas.
- Limited inventory of high demand items.
- Some co-location with e-fulfillment centers.
E-Commerce Facilities Operated by Amazon in the United States, 2018

- Delivery Stations: 119 million square feet
- Sortation Centers: 42 million square feet
- Inbound Sortation Centers: 10 million square feet
- Parcel Hubs (Prime): 52 million square feet
- E-Fulfillment Centers: 169 million square feet
Retail Logistics and E-commerce

Conventional Retail Logistics

- Retailer (In store inventory)
- Suppliers
- Regional Distribution Center
- Store Deliveries
- Travel to store
- Customers

E-commerce Retail Logistics

- E-Retailer
- Suppliers
- E-fulfillment center (EFC)
- Orders
- Platform
- Online purchases
- Parcel Delivery Company
- Home Deliveries
- (Home, work or collection point)
- Customers

Procurement
Inventory Mgmt
Order Processing
Tracking
Deliveries
EFC: E-fulfillment center

EFC

Regional
Distribution
Center

Store Deliveries

Retailer
(In store inventory)

Customers

Suppliers

Customers

Suppliers
### Comparison Between Retail and E-commerce Cost Structures for a $150 Apparel Piece

#### Retail Cost Structure

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Cost</td>
<td>$12.00</td>
</tr>
<tr>
<td>Rent</td>
<td>$30.00</td>
</tr>
<tr>
<td>Distribution to stores</td>
<td>$5.00</td>
</tr>
<tr>
<td>Store Payroll</td>
<td>$15.00</td>
</tr>
<tr>
<td>Marketing</td>
<td>$10.00</td>
</tr>
<tr>
<td>Profit</td>
<td>$24.00</td>
</tr>
<tr>
<td>Other retail costs</td>
<td>$4.50</td>
</tr>
<tr>
<td>Total</td>
<td>$45.00</td>
</tr>
</tbody>
</table>

#### E-commerce Cost Structure

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory cost</td>
<td>$15.00</td>
</tr>
<tr>
<td>Operating costs</td>
<td>$30.00</td>
</tr>
<tr>
<td>Warehousing</td>
<td>$5.00</td>
</tr>
<tr>
<td>Free shipping &amp; Returns</td>
<td>$10.00</td>
</tr>
<tr>
<td>Profit</td>
<td>$45.00</td>
</tr>
<tr>
<td>Total</td>
<td>$45.00</td>
</tr>
</tbody>
</table>
## Shifts of Logistical Operations in the Internet Economy

<table>
<thead>
<tr>
<th></th>
<th>Traditional logistics</th>
<th>E-logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orders</strong></td>
<td>Predictable</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Order cycle time</strong></td>
<td>Weekly</td>
<td>Daily or hourly</td>
</tr>
<tr>
<td><strong>Customer</strong></td>
<td>Strategic</td>
<td>Broader base</td>
</tr>
<tr>
<td><strong>Customer service</strong></td>
<td>Reactive, rigid</td>
<td>Responsive, flexible</td>
</tr>
<tr>
<td><strong>Replenishment</strong></td>
<td>Scheduled</td>
<td>Real-time</td>
</tr>
<tr>
<td><strong>Distribution model</strong></td>
<td>Supply-driven (push)</td>
<td>Demand-driven (pull)</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td>Stable, consistent</td>
<td>More cyclical</td>
</tr>
<tr>
<td><strong>Shipment type</strong></td>
<td>Bulk</td>
<td>Smaller lots</td>
</tr>
<tr>
<td><strong>Destinations</strong></td>
<td>Concentrated</td>
<td>More dispersion</td>
</tr>
<tr>
<td><strong>Warehouse reconfiguration</strong></td>
<td>Weekly or monthly</td>
<td>Continual, rule-based</td>
</tr>
<tr>
<td><strong>International trade compliance</strong></td>
<td>Manual</td>
<td>Automated</td>
</tr>
</tbody>
</table>
Elements of “Last Mile” Logistics

Terminal
Capacity; turnover; gate access

Warehousing
Inventory level; lead time; transloading

Drayage
Congestion; chassis management

Deliveries
Congestion; parking
The “Last Mile” in Inland Freight Distribution

Flow Chain

Massification
GLOBAL | HINTERLAND | REGIONAL | LOCAL

Atomization

Shipping Network
Corridor
Drayage
Transloading
Customer

Gateway

Inland Terminal

Drayage
LTL
Customer

“Last Mile”

Gateway Logistics

Transport Chain

GLOBAL | LOCAL

Frequency
Volume

Maritime
Rail / Barge
Drayage (Truck)
Less than truckload (LTL)
## Main Elements in Supply Chain Integration

<table>
<thead>
<tr>
<th>Element</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Integration</td>
<td>Improving connectivity and interoperability. Synchronizing terminals and distribution facilities to increase throughput and reliability.</td>
</tr>
<tr>
<td>Commercial Integration</td>
<td>Commercial agreements, mergers and acquisitions between companies along the supply chain. Involves service level and management. Vertical and horizontal integration of actors and processes.</td>
</tr>
<tr>
<td>Work Practices Integration</td>
<td>Organizational (managing labor as a group) and skills (managing individual workers) competencies to move cargo efficiently. Involves operational window, minimal service levels and essential services.</td>
</tr>
<tr>
<td>Information Integration</td>
<td>Interconnectedness of information systems. Involves asset tracking, status monitoring, customs facilitation, freight status information and transport network status information.</td>
</tr>
<tr>
<td>Regulatory Integration</td>
<td>Promote modal choice and avoid subsidized modal preference through the harmonization of regulation across jurisdictions.</td>
</tr>
<tr>
<td>Planning and Funding Integration</td>
<td>Planning and funding of infrastructure provision from an integrated multi-modal and logistics chain perspective. Respective roles and competencies of the public and private sectors.</td>
</tr>
<tr>
<td>Customs and Security Integration</td>
<td>Harmonization of security procedures that protect cargo from theft or damage and protect the public from risks. Involves assessments of cargo contents, cargo integrity, route integrity and information integrity.</td>
</tr>
</tbody>
</table>
Main Elements in Supply Chain Integration and Connectivity

**Transport Connectivity**
- Improving connectivity and interoperability of modes and terminals (intermodalism).
- Infrastructure and superstructure improvements (capacity and throughput).
- Synchronizing terminals and hinterland flows to increase throughput and reliability.

**Commercial Integration**
- Trade and commercial agreements. Mergers and acquisitions along the supply chain.
- Cost, time and reliability of transport and distribution services.
- Vertical and horizontal integration of actors and processes (e.g. bill of lading).

**Customs and Security Integration**
- Moving cargo more efficiently across borders through prescreening and inspections.
- Harmonization of customs and security procedures.
- Assessments of cargo contents, cargo integrity, route integrity and information integrity.

**Regulatory Integration**
- Promote modal choice and avoid subsidized modal preference.
- Harmonization of regulations across jurisdictions such as for vehicles, goods handling and transport, land use, labor and finance. Promotion of standards and certification.
Main Elements in Supply Chain Integration and Connectivity

**Planning and Funding Integration**
Planning and funding of infrastructure provision from an integrated multi-modal and logistics chain perspective. Respective roles and competencies of the public and private actors.

**Work Practices Integration**
Organizational (managing labor as a group) and skills (managing individual workers) competencies to move cargo efficiently. Operational window (working hours), minimal service levels and essential services. Automation of repetitive tasks.

**Information Systems Integration**
Interconnectivity of information systems with blockchains. Asset tracking, status monitoring, customs facilitation, freight status information and transport network status information.
Expected Benefits of Blockchains on Supply Chains

**Velocity of Supply Chains**
Faster transactions.
Less latency, improving cash flow and inventory carrying costs.

**Supply Chain Visibility (Tracking)**
Track shipments along an intermodal transport chain and identify issues causing delays.
Create a market where service providers bid to handle “blocs”.

**Supply Chain Security (Tracing)**
See where, when and how a specific event took place (e.g. cold chain logistics).
Counterfeiting and the use of sub-par materials easier to detect.

**Standards and Certification Compliance**
Proof that cargo was handled by specific modes, carriers and distribution centers.
Calculate accurately energy use and environmental impacts (e.g. CO2 footprint).