

Project Procurement and Supply Chain

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PMG 433

Lecture 1



Introduction to Supply Chain Management

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Course Agenda

Chapter

- 
- 1-Discuss the goal of a supply chain and explain the impact of supply chain decisions on the success of a firm.
 - 2-Identify the three key supply chain decision phases and explain the significance of each one.
 - 3-Describe the cycle and push/pull views of a supply chain.
 - 4-Classify the supply chain macro processes in a firm.
 - 5- Applications of Artificial Intelligence.



Raw Materials



Supplier



Manufacturing



Consumer

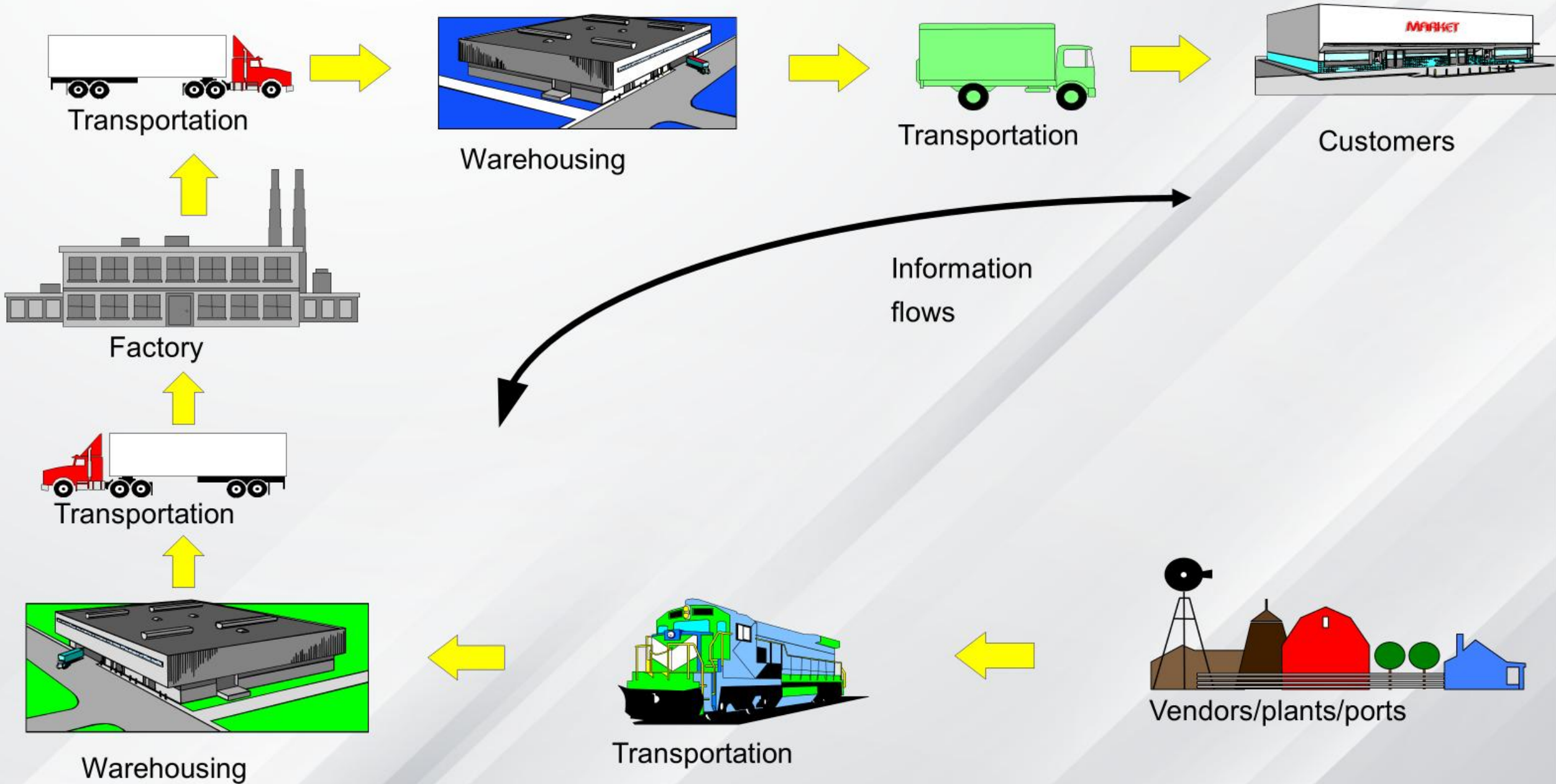


Customer

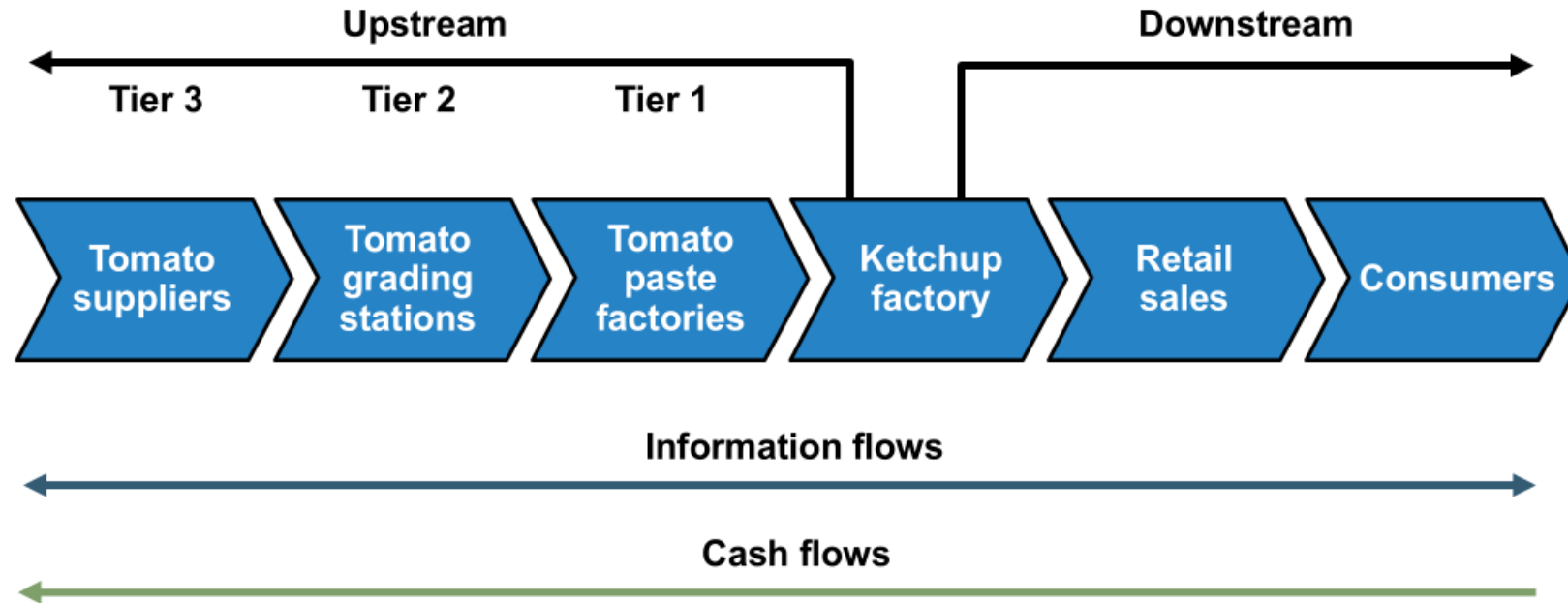


Distribution

The Immediate Supply Chain for an Individual Firm



SUPPLY CHAIN INTEGRATION



Supply Chain for a Ketchup Factory

- ❑ **Supply Chain Management (SCM) Goals**
- ❑ **Efficiency:** Minimize costs and maximize productivity
- ❑ **Reliability:** Ensure consistent quality and delivery
- ❑ **Resilience:** Adapt to disruptions and risks
- ❑ **Sustainability:** Reduce environmental impact
- ❑ **Customer Satisfaction:** Meet demand and expectations

❑ **Key Components**

- ❑ **Supply**: Raw materials or inputs
- ❑ **Manufacturing**: Production process
- ❑ **Distribution**: Logistics, transportation, and warehousing
- ❑ **Retail**: Sales and customer service
- ❑ **Reverse Logistics**: Returns, recycling, and waste management

❑ Supply Chain Types

- ❑ **Just-In-Time (JIT):** Producing and delivering just in time
- ❑ **Just-In-Case (JIC):** Maintaining inventory for potential demand
- ❑ **Hybrid:** Combining JIT and JIC approaches
- ❑ **Agile:** Responding quickly to changing demand
- ❑ **Lean:** Eliminating waste and optimizing processes

❑ **Technologies Used**

- ❑ **Enterprise Resource Planning (ERP):** Integrated software
- ❑ **Supply Chain Visibility (SCV):** Real-time monitoring
- ❑ **Internet of Things (IoT):** Connected devices
- ❑ **Artificial Intelligence (AI):** Predictive analytics
- ❑ **Blockchain:** Secure, transparent transactions
- ❑ **Cloud computing:** Scalable, flexible infrastructure.
- ❑ **Radio-frequency identification (RFID):** Inventory tracking.

❑ **SCM Techniques**

- ❑ **Just-In-Time (JIT):** Producing and delivering just in time.
- ❑ **Total Quality Management (TQM):** Ensuring quality throughout.
- ❑ **Lean management:** Eliminating waste.
- ❑ **Six Sigma:** Data-driven quality improvement.
- ❑ **Agile supply chain:** Responding quickly to changes.

☐ **Benefits of Effective SCM**

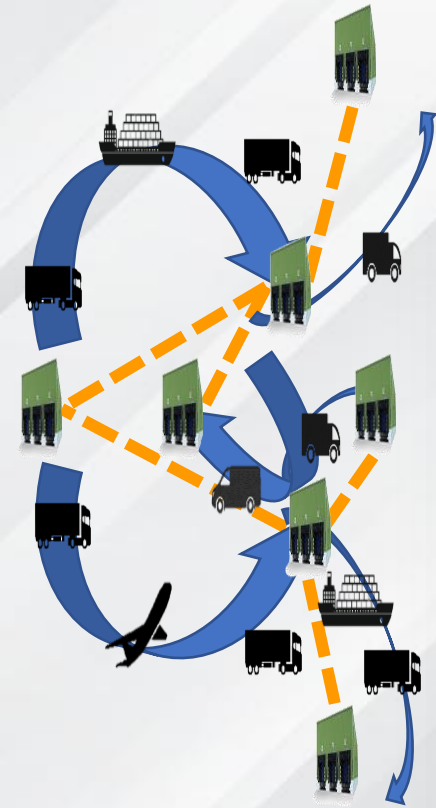
- ☐ Improved customer satisfaction
- ☐ Increased efficiency
- ☐ Reduced costs
- ☐ Enhanced competitiveness
- ☐ Better risk management
- ☐ Improved sustainability
- ☐ Increased transparency

What is Supply Chain Management

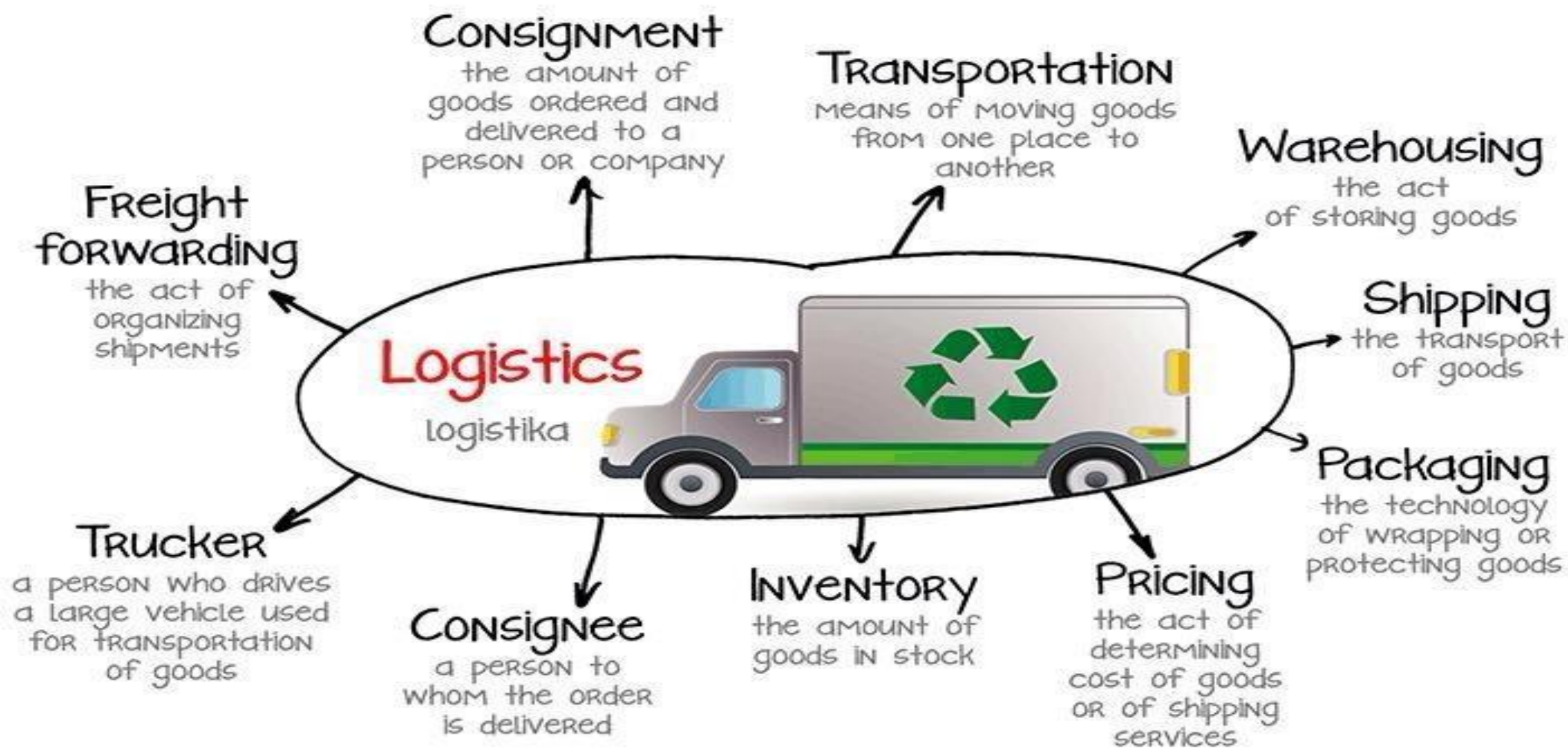
- ❑ **All stages involved, directly or indirectly, in fulfilling a customer request.**
- ❑ Within each company, the supply chain includes all functions involved in fulfilling a customer request (product development, marketing, operations, distribution, finance, customer service).
- ❑ All facilities, functions, and activities, associated with the flow and transformation of goods and services from raw materials to customer, as well as the associated information flows.
- ❑ Supply Chain Management involves both upstream and downstream relationships
- ❑ An integrated group of processes to “Plan,” “Source,” “Make,” and “deliver” products to customers.

Logistics Management

- **Logistics management** is that 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 management** is an integrating function which coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions, including marketing, sales, manufacturing, finance, and information technology.



Goods
Locations
Vehicles
Routes



What is Supply Chain Management

- ❑ **Customer** is an integral part of the supply chain.
- ❑ Includes movement of products from suppliers to manufacturers to distributors and information, funds, and products in both directions.
- ❑ May be more accurate to use the term “supply network” or “supply web”.
- ❑ Typical supply chain stages: customers, retailers, wholesalers/distributors, manufacturers, component/raw material suppliers.
- ❑ Supply chain performance should be evaluated from an end-to-end perspective rather than by considering only one firm's performance
- ❑ All stages may not be present in all supply chains (e.g., no retailer or distributor for Dell).

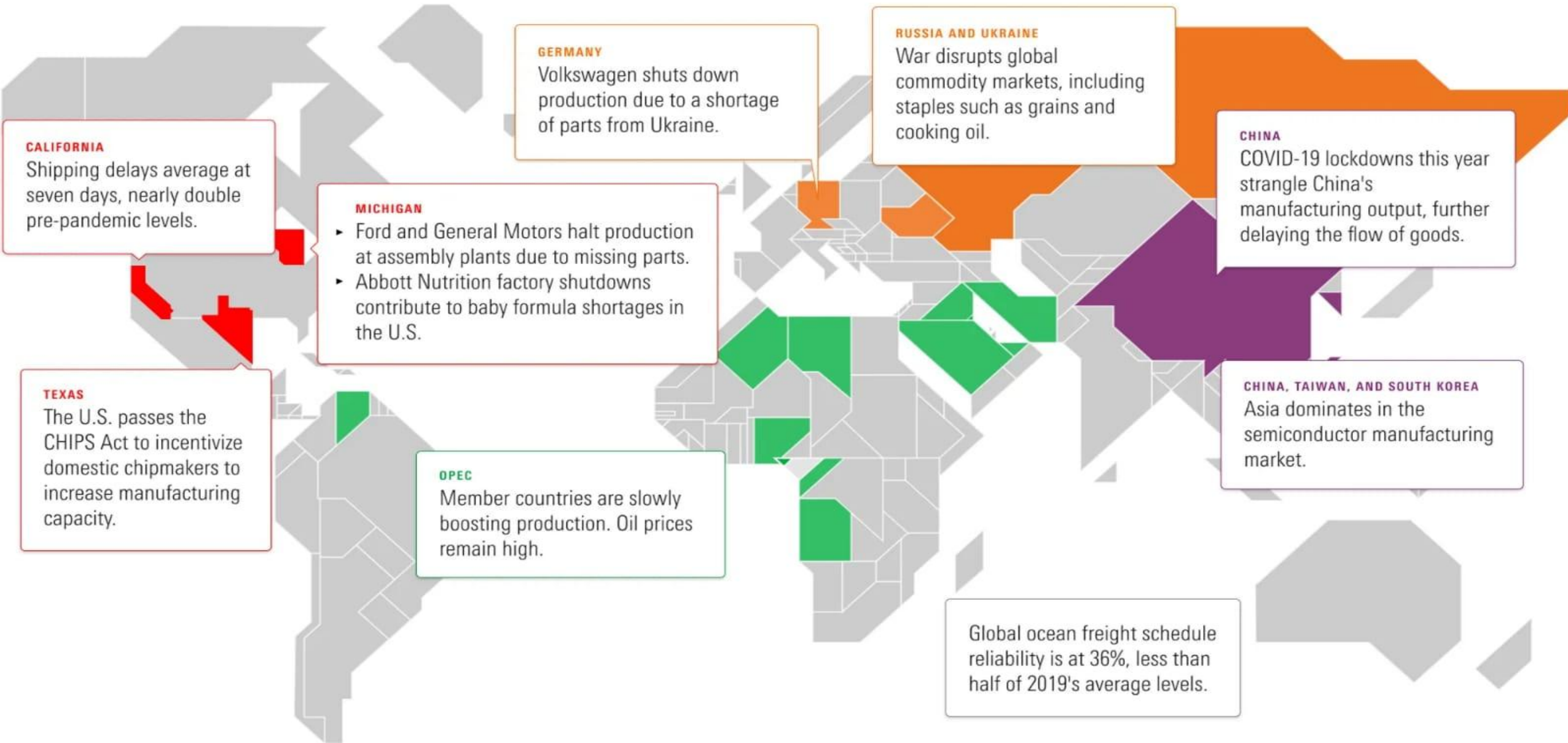
Importance of Supply Chain Decisions

- ❑ Maximize overall value generated.
- ❑ Supply Chain Surplus = Customer Value – Supply Chain Cost.
- ❑ Example: a customer purchases a router from Amazon for \$100 (revenue).
- ❑ Supply chain costs include (information, storage, transportation, produce components, assembly, etc.)
- ❑ The difference between \$100 and the sum of all of these costs is the supply chain profit.
- ❑ Supply Chain Management seeks to increase total supply chain value while balancing cost and customer service
- ❑ Supply chain profitability is the total profit to be shared across all stages of the supply chain.

Importance of Supply Chain Decisions

- ❑ **Dell**, \$56B in **2006**, by adopting new supply chain strategies to \$102.301 B in **2023**, \$88.425 B in **2024**. \$95.6 B in **2025**. \$113.54 B in **2026**.
- ❑ **Wal-Mart**, \$1B revenue in **1980** jumped to \$648 B in **2024**. \$681.30 B in **2025**. \$713.16 in **2026**.
- ❑ **Boeing**'s annual revenue, \$101B in **2018** to \$73.293 B in **2024**, \$89.5 B in **2025**
- ❑ **Apple**, \$65 B in **2010** to \$391 B in **2024**, \$ 416 B in **2025**. \$ 466 B **2026**.
- ❑ **Amazon**'s annual revenue, \$ 34 B in **2010** to \$ 637 B in **2024**, \$ 719.9 B in **2025**. \$775.68 B in **2026**.

Supply Chain Disruptions Across the World



Environmental Risks

Natural disasters, Weather-related incidents, Geopolitical risks, Terrorism, War, Regulatory changes, Pandemics, Strikes, etc.

Supply Chain Configuration Risks

Insufficient industry-level connection, Insufficient coordination among supply chain members, Insufficient visibility in supply chain, Insufficient collaboration, Cyber security issues, Intellectual property rights (IPR) protection, Asymmetric power relationships, Social & Environmental Sustainability-related issues, etc,

Supply Risks

Supply uncertainties
Disruption due to pandemic
Dependence on key suppliers
Geographical concentration
Quality management issues
Erratic lead-times
Unexpected price increases
Duties & tariffs
Exchange rate fluctuations

Internal Risks

Labor shortages
Process disruptions due to social distancing, safety
Equipment breakdowns
Yield variability
Lengthy setup times
Inflexible processes
Bottlenecks
Disruptions in outsourcing

Demand Risks

Demand volatility
Unexpected market shifts
Forecast errors
Panic buying
Dependence on few customers
Short life cycles
Increased product variety
Competitor actions

Logistical Risks

Port congestion, Disruptions in port operations, Air/Ocean/Rail/Road accidents, Truck driver shortage, Container shortage, Insufficient warehouse space during demand surge, etc.

Types of disruption risks in supply chains

Types of disruption risks in supply chains

Supply Chain

Disruption Risk

Example

Toyota

Supplier disruption

Production was affected after earthquakes in Japan and shortages of semiconductor chips.

Apple

Supplier and manufacturing disruption

Factory shutdowns and chip shortages delayed production of some products.

Nike

Manufacturing disruption

Factory closures in Asia during the COVID-19 pandemic disrupted production and deliveries.

Walmart

Transportation disruption

Port congestion and shipping delays affected inventory availability.

Tesla

Component shortage

Global semiconductor shortages affected vehicle production schedules.

Starbucks

Logistics and sourcing disruption

Supply shortages and transportation issues affected product availability in some locations.

Unilever

Raw material disruption

Rising commodity prices and supply shortages increased costs and affected operations.

Samsung Electronics

Manufacturing disruption

Factory shutdowns and chip supply constraints affected production.

- ❑ **Toyota** has one of the most robust risk management strategies in the automotive industry. After the 2011 earthquake and tsunami in Japan, which disrupted their supply chain.
- ❑ **Toyota** implemented a strategy called "Resilient Supply Chain" that included having backup suppliers, maintaining higher inventory levels, and ensuring supplier geographic diversification.
- ❑ This enabled **Toyota** to recover quickly from supply disruptions, keeping their production lines running.

Types of disruption risks in supply chains

- ❑ **Unilever** experienced significant challenges during the COVID-19 pandemic.
- ❑ With spikes in demand for hygiene products like soap and sanitizers, and a dip in demand for other categories, **Unilever** had to quickly adapt its supply chain operations.
- ❑ By redirecting resources and production capacity to meet hygiene product demand, Unilever demonstrated flexibility in its demand management.
- ❑ **Unilever** uses currency hedging to protect against the effects of exchange rate fluctuations in its global supply chain.

- ❑ During the COVID-19 pandemic, **Procter & Gamble (P&G)** faced significant demand uncertainty for essential products like paper towels and hand sanitizers.
- ❑ **P&G** responded by ramping up production capacity, working closely with suppliers, and ensuring that production facilities could meet the surge in demand without overproducing other items with declining demand

- ❑ **Samsung** experienced supply chain disruptions in 2020 when the COVID-19 pandemic led to semiconductor shortages.
- ❑ To mitigate such risks in the future, Samsung has diversified its supply chain by working with multiple suppliers and investing in building its own semiconductor manufacturing capabilities.

- ❑ **Boeing** faces high risks in sourcing specialized aircraft components, as it often relies on single or limited suppliers.
- ❑ To mitigate risks, **Boeing** develops contingency plans, diversifies its supplier base, and maintains buffer inventories for critical components.
- ❑ **Huawei** faced significant geopolitical risk when the U.S. government-imposed sanctions, leading to disruptions in its global supply chain.

- ❑ **Coca-Cola** has dealt with geopolitical risks in several markets, including Venezuela and Russia, where political instability has affected its ability to operate smoothly.
- ❑ **General Motors** mitigates risks related to component shortages by maintaining a diversified supplier base and investing in contingency stock to ensure uninterrupted production during supplier disruptions.
- ❑ **Netflix** uses data analytics to identify potential service disruptions before they affect users, often resolving issues before customers even become aware of them.

- ❑ **Ford** faced significant production delays in 2021 when a major semiconductor supplier experienced shortages, impacting Ford's ability to manufacture vehicles. This dependency on a few key chip suppliers created bottlenecks throughout the auto industry.
- ❑ **Nike** faced supply chain disruptions in Vietnam due to labor strikes and factory closures caused by political unrest and COVID-19 lockdowns. Vietnam is a key manufacturing hub for Nike, and these events affected production timelines.

- ❑ **Shell** frequently uses scenario planning to anticipate geopolitical risks and fluctuating energy markets. The company prepares for possible outcomes like changes in trade regulations or supply shortages by running multiple scenarios.
- ❑ **Pfizer** uses quantitative risk analysis when evaluating risks associated with pharmaceutical supply chains, particularly for drug development timelines. This approach allows them to predict potential delays and make data-driven decisions.

- ❑ **Supply chain strategy or design**

- How to structure the supply chain over the next several years

- ❑ **Supply chain planning**

- Decisions over the next quarter or year

- ❑ **Supply chain operation**

- Daily or weekly operational decisions

- ❑ **Decisions about the configuration of the supply chain, allocation of resources, and what processes each stage will perform.**
- ❑ **Strategic supply chain decisions**
 - Outsource supply chain functions
 - Locations and capacities of facilities
 - Products to be made or stored at various locations
 - Modes of transportation
 - Information systems
- ❑ **Supply chain design must support strategic objectives**
 - Supply chain design decisions are long-term and expensive to reverse – must take into account market uncertainty

For decisions made during this phase,

- The time frame considered is a quarter to a year. Therefore,
- The supply chain's configuration determined in the strategic phase is fixed.
- The goal of planning is to maximize the supply chain surplus that can be generated over the planning horizon

- ☐ Definition of a set of policies that govern short-term operations.
- ☐ Fixed by the supply configuration from the strategic phase.
- ☐ The goal is to maximize supply chain surplus given established constraints.
- ☐ Starts with a forecast of demand in the coming year.

☐ **Planning decisions:**

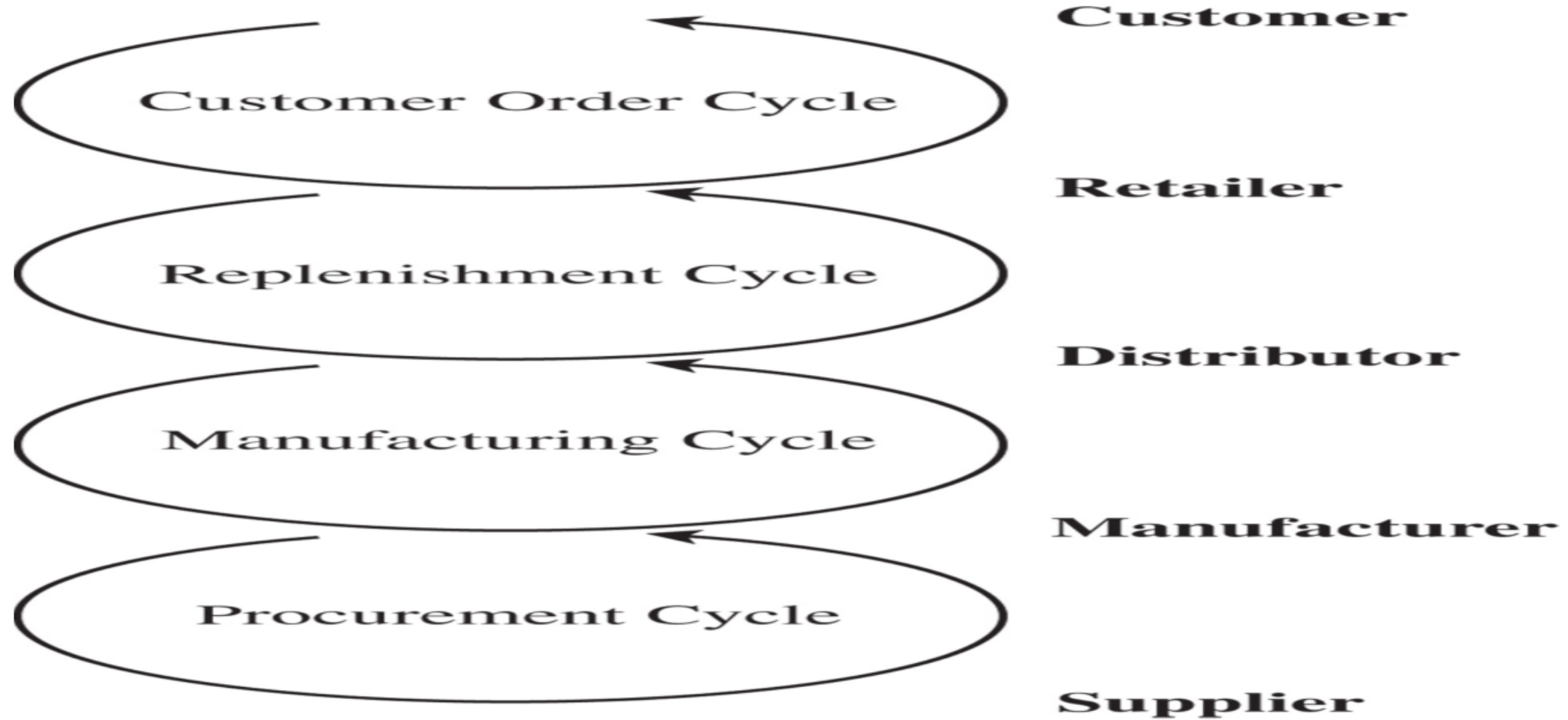
- ☐ Which markets will be supplied from which locations
- ☐ Planned buildup of inventories
- ☐ Subcontracting
- ☐ Inventory policies
- ☐ Timing and size of market promotions
- ☐ Must consider demand uncertainty, exchange rates, and competition over the time horizon in planning decisions

- ☐ The time horizon is weekly or daily
- ☐ Decisions regarding individual customer orders
- ☐ Supply chain configuration is fixed, and planning policies are defined
- ☐ The goal is to handle incoming customer orders as effectively as possible
- ☐ Allocate orders to inventory or production, set order due dates, generate pick lists at a warehouse, allocate an order to a particular shipment, set delivery schedules, place replenishment orders
- ☐ Much less uncertainty (short time horizon)

- ❑ A supply chain is a sequence of processes and flows that take place within and between different stages and combine to fill a customer's need for a product.
- ❑ There are **two** different ways to view the processes performed in a supply chain.
- ❑ **Cycle View**
- ❑ **Push/Pull View**

- ❑ **Cycle View:**
- ❑ The processes in a supply chain are divided into a series of cycles; each performed at the interface between two successive stages of the supply chain.
- ❑ Given the five stages of a supply chain, all supply chain processes can be broken down into the following four process cycles.
- ❑ A typical supply chain may include:
Supplier → Manufacturer → Distributor → Retailer → Customer
- ❑ **Customer order cycle**
- ❑ **Replenishment cycle**
- ❑ **Manufacturing cycle**
- ❑ **Procurement cycle**

Cycle View of Supply Chain Processes



- ❑ **Customer order cycle**

All the processes directly involved in receiving and filling a customer order

- ❑ **Replenishment cycle**

All the processes involved in replenishing retailer inventory

- ❑ **Manufacturing cycle**

All processes involved in generating the product that will fill the customer, retailer and distributor orders. It is driven by the actual orders placed with the manufacturer, forecasts for expected future demand, and the current product availability in the manufacturer's finished-product warehouse.

- ❑ **Procurement cycle**

All the processes necessary to ensure that materials are available for manufacturing to occur according to schedule.

- ❑ Each cycle occurs at the interface between two successive stages of the supply chain.
- ❑ Not every supply chain will have all four cycles clearly separated. For example, a **grocery supply chain** in which a retailer stocks finished goods inventories and places replenishment orders with a distributor is likely to have all four cycles separated.
- ❑ Dell, in contrast, bypasses the retailer and distributor when it sells servers directly to customers (**Direct Channel**).

Process Views of a Supply Chain

Supply Chain Cycle	Between	Main Activities
Customer Order Cycle	Customer ↔ Retailer	Customer places order, order fulfillment, delivery
Replenishment Cycle	Retailer ↔ Distributor	Retailer orders replenishment and distributor fulfills it
Manufacturing Cycle	Distributor/Retailer ↔ Manufacturer	Production based on demand and replenishment requirements
Procurement Cycle	Manufacturer ↔ Supplier	Ordering and receiving raw materials/components

- ❑ **Example**

- ❑ When a customer buys a laptop:

Customer orders → Retailer replenishes inventory → Manufacturer produces laptop → Manufacturer procures components from suppliers

- ❑ Each interaction between two consecutive stages represents a process cycle.

❑ **Push/Pull View:**

The processes in a supply chain are divided into two categories, depending on whether they are executed in response to a customer order or in anticipation of customer orders.

Pull processes are initiated by a customer order, whereas **Push processes** are initiated and performed in anticipation of customer orders.

Push/Pull View of Supply Chain Processes

- ❑ **Supply chain processes** fall into one of two categories depending on the timing of their execution relative to customer demand.
- ❑ **Pull**: execution is initiated in response to a customer order (**reactive**).
- ❑ **Push**: execution is initiated in anticipation of customer orders (**speculative**).
- ❑ **The Push/pull boundary** separates push processes from pull processes.

- ❑ **Pull**: execution is initiated in response to a customer order (reactive).
- **Dell** assembles its computers to order and therefore, all processes except for those involved in the procurement cycle are “pull”.
- **Example:**
- ❑ Customer places an order → Retailer requests product → Supply chain responds.
- ❑ Pull processes are therefore **demand-driven**.

- ❑ **Push:** execution is initiated in anticipation of customer orders (speculative).
- **Compaq:** All processes except for those involved in the customer order cycle are of “push” type.
- **Example:**
- Manufacturer forecasts demand → Produces products → Stores them in inventory → Customers purchase later.
- Push processes are therefore **forecast-driven**.

Key Difference between Push/Pull View of Supply Chain Processes

Cycle View

Focuses on **who interacts with whom**

Divides processes into cycles

Customer order, replenishment, manufacturing, procurement cycles

Useful for understanding supply chain **interfaces and activities**

Push/Pull View

Focuses on **what triggers the process**

Divides processes into push and pull processes

Forecast-driven vs. demand-driven processes

Useful for understanding **demand responsiveness and inventory strategy**

Simple Example of Push/Pull View of Supply Chain Processes(Amazon)

- ❑ **Customer orders product** → Amazon fulfills order → Amazon replenishes inventory → Manufacturer produces product → Supplier provides components
- ❑ **Customer order fulfillment:** primarily pull, because it responds to an actual customer order.
- ❑ **Inventory replenishment** based on demand forecasts: may involve push processes.
- ❑ **Production** based on forecasts: generally, push.
- ❑ **Procurement** based on expected production requirements: generally, push, although some procurement can be demand-driven.

Supply chain processes discussed in the two views can be classified into

1. Customer Relationship Management (CRM):

All processes at the interface between the firm and its customers.

2. Internal Supply Chain Management (ISCM):

All processes that are internal to the firm.

3. Supplier Relationship Management (SRM):

All processes at the interface between the firm and its suppliers.

The **three** macro processes manage the flow of information, products, and funds required to generate, receive, and fulfill a customer request.

- **The CRM macro process** aims to generate customer demand and facilitate the placement and tracking of orders.
- **The ISCM macro process** aims to fulfill the demand generated by the CRM process in a timely manner and at the lowest possible cost.
- **The SRM macro process** aims to arrange for and manage supply sources for various goods and services.

How They Work Together

The three macro processes must be closely integrated.

For example:

Customer demand information

↓ CRM identifies customer requirements

↓ ISCM translates requirements into production and inventory plans

↓ SRM ensures suppliers provide the required materials

↓ Production & distribution

↓ Customer fulfillment

- **AI optimizes inventory management** . This is done by analyzing sales data, supply chain dynamics, and external variables to maintain ideal stock.
- **Demand forecasting**. AI-powered demand forecasting enables companies to predict future demand for products with high accuracy by analyzing a wide range of data sources.
- **Improved warehouse efficiency**. AI, specifically ML models, helps lay out warehouses more efficiently by being able to evaluate the quantity of materials
- **More-timely deliveries**. Manufacturers that assemble products via complex supply chains are especially dependent on timely and well-coordinated deliveries .
- **AI can help make supply chains more sustainable** by optimizing routes and reducing carbon emissions through smart logistics.

Summary of Learning Objectives

Chapter

01

- 1-Discuss the goal of a supply chain and explain the impact of supply chain decisions on the success of a firm.
- 2-Identify the three key supply chain decision phases and explain the significance of each one.
- 3-Describe the cycle and push/pull views of a supply chain.
- 4-Classify the supply chain macro processes in a firm.
- 5- Applications of Artificial Intelligence.

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Thank You