

Supply Chain Management

Prepared by Dr. Tarek Mohamed

MGM 660

Lecture 10



The background features a series of vertical panels with rounded ends. The first panel shows hands typing on a laptop. The second panel has a graduation cap icon. The third panel has a play button icon. The fourth panel has a target icon. The fifth panel has an open book icon. The sixth panel has a magnifying glass icon. The seventh panel has a bar chart icon. The eighth panel has a group of people icon. The background is a mix of dark and light blue tones.

Sustainability and the Supply Chain & New trends in Supply Chains

Lecture 10

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Course Agenda

Chapter

1. Understand the importance of sustainability in a supply chain.
2. Discuss the challenge to sustainability posed by the tragedy of the commons.
3. Describe key dimensions of sustainability for a supply chain.
4. Understand the role of incentives for successful sustainability efforts.
5. What's Trending Right Now in Supply Chains
6. Major Research Themes in Supply-Chain Academia & Practice

Role of Sustainability in a Supply Chain

- *The health and survival* of every supply chain depends on the health of the surrounding world
- Expand the goal of a supply chain beyond the interests of its participants
- *Sustainable development* – development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Role of Sustainability in a Supply Chain

- Focusing on sustainability allows a supply chain to better serve more conscious customers while often improving supply chain performance
- Customers have usually backed up words about the importance of sustainability without a willingness to pay more for sustainable products.
- **Three pillars of sustainable development**
 - Economic sustainability
 - Environmental sustainability
 - Social sustainability
- **Factor categories**
 1. Reducing risk and improving the financial performance of the supply chain
 2. Community pressures and government mandates
 3. Attracting customers that value sustainability

Role of Sustainability in a Supply Chain

- In reality, actions in a supply chain improve both sustainability and supply chain surplus.
- Most effort expended in reducing risk
- Activity slow as actions may require upfront investment
- Barriers to increased focus on sustainability
 - Insufficient return on investment
 - Customers' unwillingness to pay a premium for green products
 - Difficulty evaluating sustainability across a product life cycle

Tragedy of the Commons

- Dilemma arising when the common good does not align perfectly with the good of individual entities
- Every company and supply chain faces the challenge of the tragedy of the commons as it operates in a global environment
- Difficult to imagine a sustainable solution emerging without some intervention

Solutions to this “Tragedy”

- Choose from options that are unlikely to be supported by all of their own free will
- Mutual coercion – social arrangements or mechanisms coerce all participants to behave in a way that helps the common good
 - **Command-and-control approach**
 - Government/regulators set standards
 - **Market mechanisms**
 - Cap-and-trade

Key Pillars of Sustainability

- Measuring performance along all three pillars may be required to evaluate the impact of sustainability-related efforts
- Two fundamental challenges for social and environmental pillars
 - Scope of measurement
 - Absolute of relative measures

- A firm's ability to address issues that are important for its workforce, customers, and society
- Audit and support suppliers
 - Supplier collaboration and capability building strongly associated with social and environmental responsibility performance improvement and lower operating costs
 - Benefits accrue to all customers of the supplier

- **Firm's impact on the environment, including air, land, water, and ecosystems**
 - Resource reduction
 - Emission reduction
 - Product innovation
- **Not all “green” claims are valid**
 - *Greenwashing*

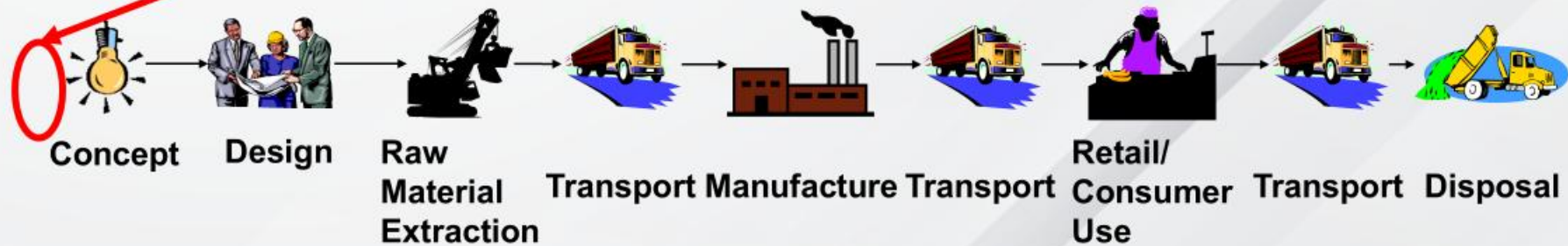
Sustainability and Supply Chain Drivers

- Match pillars with drivers
- Measure environmental impact for each driver along each of the social and environmental categories

The product life cycle is the basis of green supply chain management.

Supply Chain in the Environmental Life Cycle

Designing the supply chain concurrently with the product is a *supply chain management* best practice.



Typical Supply Chain Scope

Reverse Logistics



**Reverse logistics—
putting the supply chain
into reverse for all flows**

Material flows

- Product returns
- Repairs
- Remanufacture
- Recycling
- Recovery
- Disposal

Payments

- Credits
- Cash refunds
- Rain checks
- Discounts
- Service contract fees

Reverse Logistics

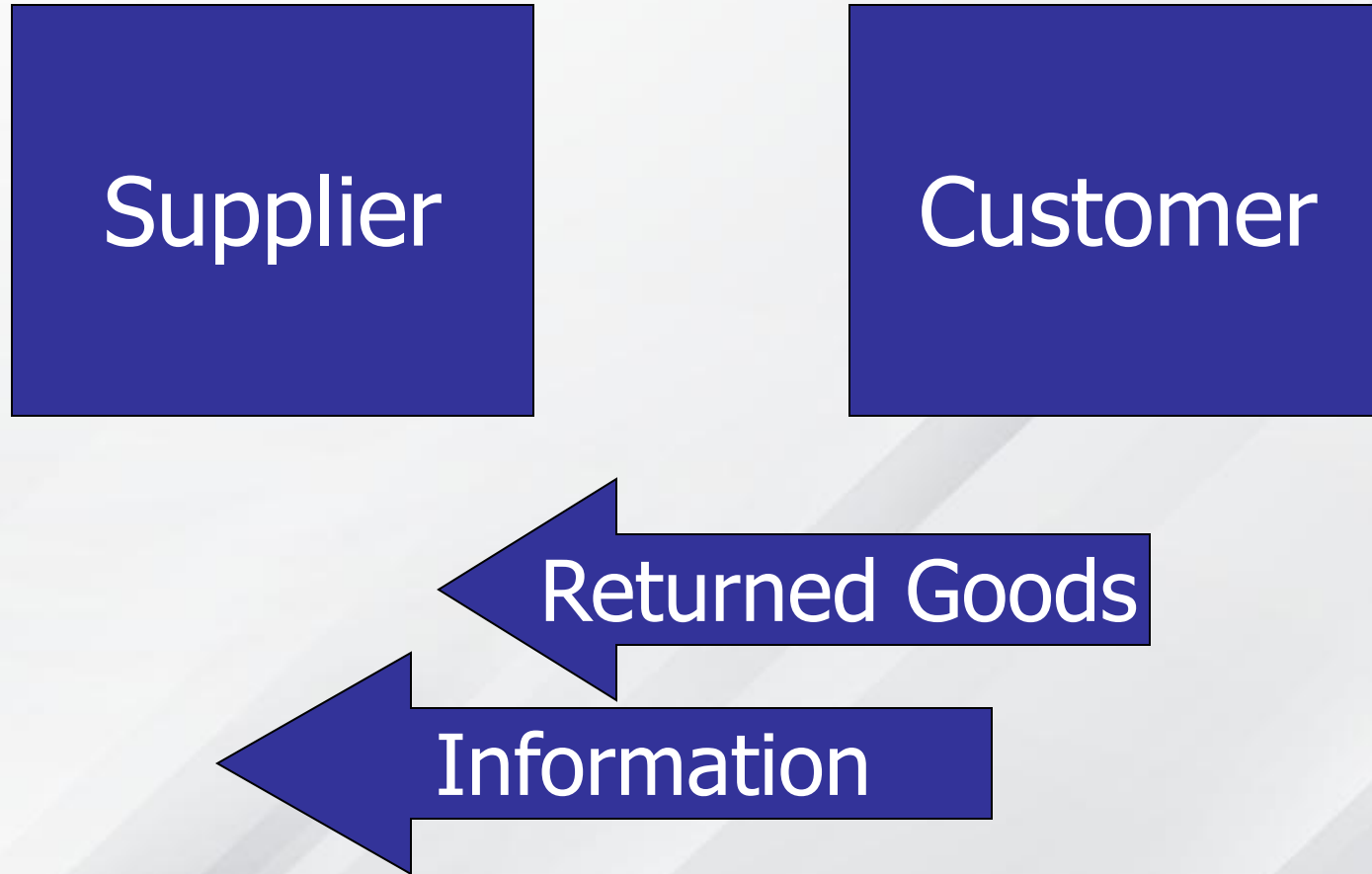
“A complete supply chain dedicated to the reverse flow of products and materials for the purpose of returns, repair, remanufacture, and/or recycling.”

- Can represent major costs to a company
- Amount of goods returned
 - up to 50% in the publishing industry
 - 90% of automotive starter motors or alternators
- Companies are taking responsibility of the return of packaging materials

Reverse Logistics - Information

- Goods are returned to supplier
- Information is also needed
 - reason / approval for the return
 - credit information

Reverse Logistics



- Return and disposal of packaging materials
- Return and disposal of environmentally sensitive materials
 - heavy metals
 - solvents
- Use of reusable (returnable) packaging

Returned Goods

- Quality demands by customers
- Damage or defects
- Excessive inventories
- Seasonal inventories
- Out-of-date inventories
- Remanufacturing or refurbishment

Returned Goods - Disposition

- Returned to inventory
- Refurbished for resale
- Sold into alternate markets
- Disassembled to retrieve components
- Sorted for material recovery



Reverse Logistics

Why have a reverse supply chain?

Aftermarket revenue



Sell recovered metals, etc., from returned products, containers.

Competitive edge



Woo consumers with promise of excellent customer service.

Pressure



Comply with “green” pressure from shareholders, consumers, regulators.

“Green” revenue



Sell into market for “organic,” “natural,” chemical-free, ecologically safe products.

Conscience



Do the right thing.

The reverse logistics hierarchy

Reduce

Reducing resource use is considered to be the most responsible “green” strategy.

Reuse

Design products for reuse of materials and components and with easy upgrades to extend life.

Recycle

Similar to reuse; product materials reprocessed into new products or components.

Recover energy

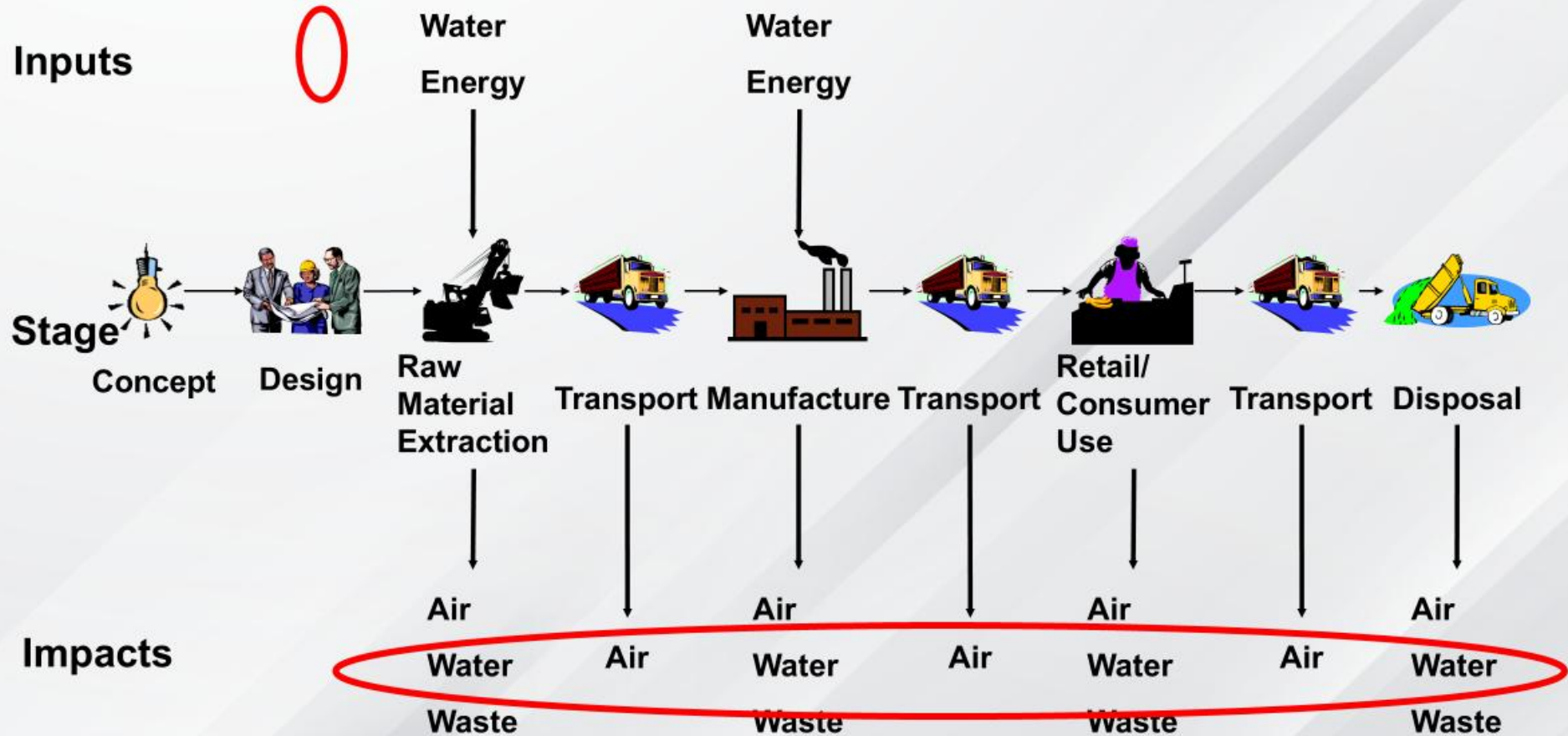
Dispose of product but recover energy in the process; e.g., “trash to energy” plants.

Responsible landfill

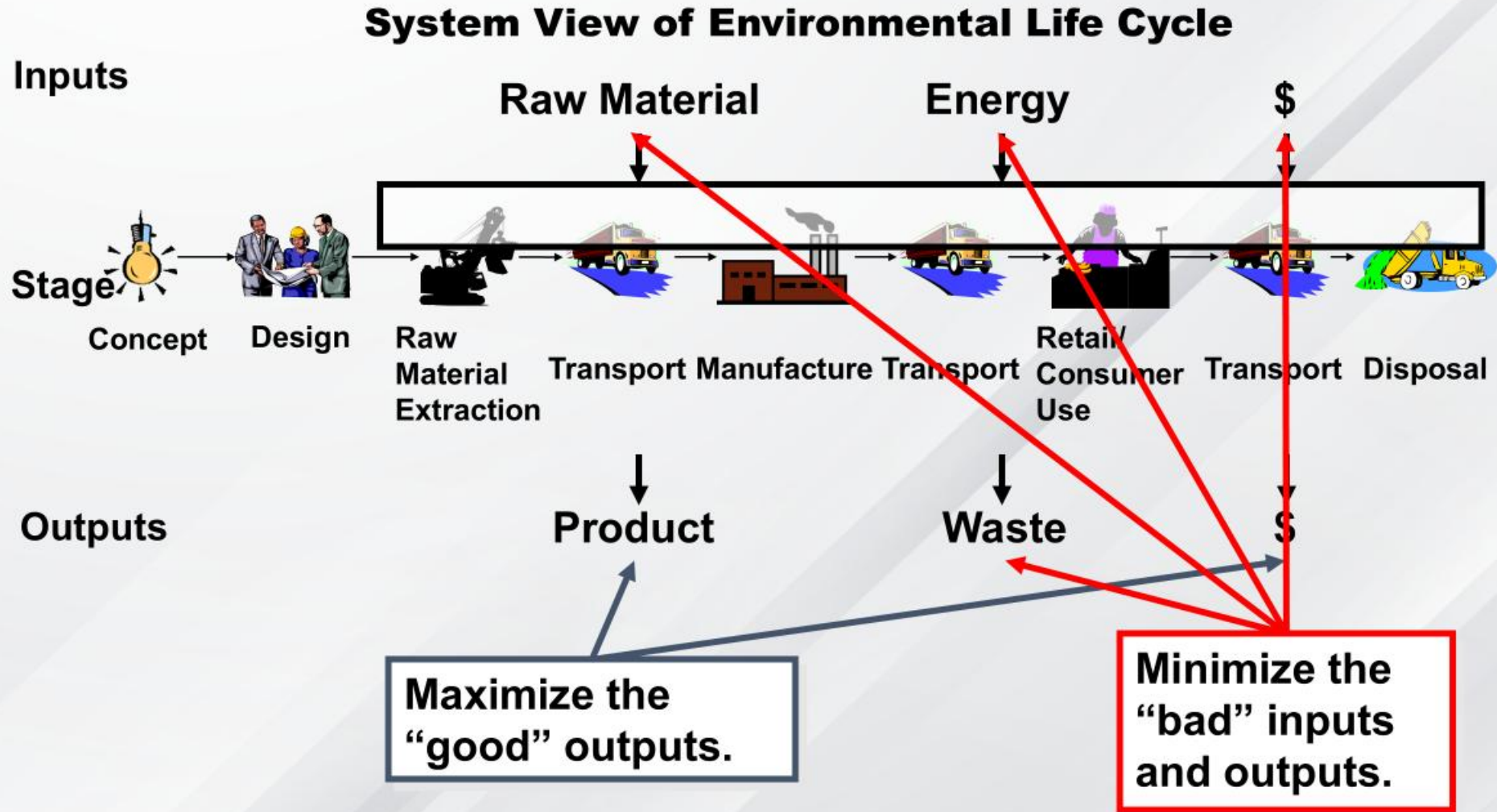
Last resort: Send unusable, unrecyclable materials and components to a responsible landfill.

The environmental impacts of each LC stage are examined for reduction.

Environmental Life Cycle



Evaluating the supply chain as a system leads to life cycle optimization.

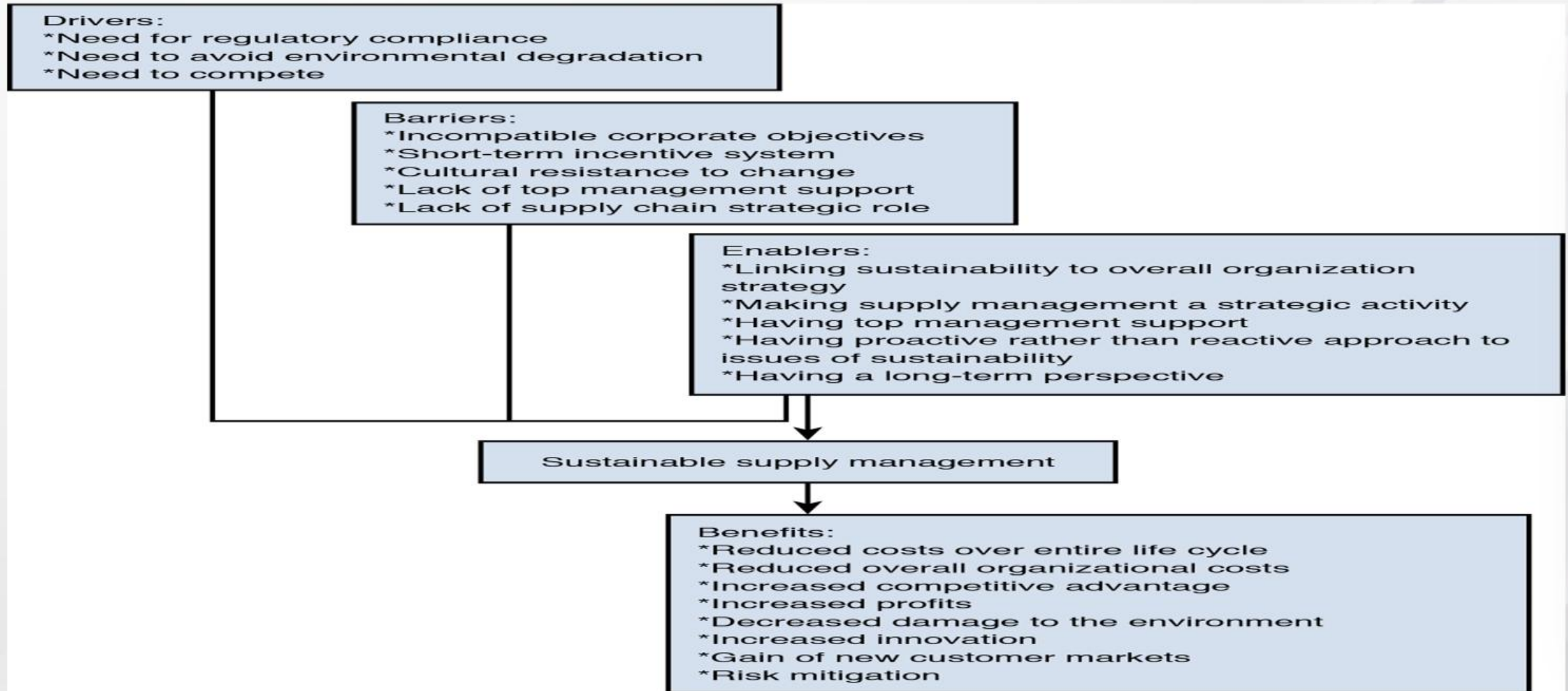


Supply chain design for reverse logistics

- **Reverse flows require their own systems.**
 - **Information flows need worldwide data warehouse.**
 - **Cash flows (credits, etc.) need customer-centered approach.**
 - **Product flows need reverse forecasting, special collection locations, processing centers, and transportation.**
- **Reverse revenues minus reverse expenses can bring profits.**
- **Life cycle design considers the 4 Rs in all phases of product life.**
 - **Design for wise use of resources, reuse of old products.**
 - **Prepare for returns before introduction.**
 - **Develop systems to support continued use, upgrades in maturity.**
 - **Be prepared for end-of-life cycle, especially with dangerous goods.**

The payoffs

- ▶ Lucrative customer service contracts
- ▶ Fewer, or no, costly returns
- ▶ Enhanced customer loyalty and reputation
- ▶ Revenues for materials in product returns
- ▶ More efficient products and logistical tactics
- ▶ New types of jobs
- ▶ More sustainable use of energy and resources
- ▶ Reduction of harmful emissions and pollutants
- ▶ Reduced need for landfills and incinerators



Facilities

- Consumers of energy and water and emitters of waste and green- house gases
- Separate the improvement opportunities into those that generate positive cash flows and those that do not
- Facilities often offer the best opportunity to simultaneously improve the environmental and financial performances through innovation

Inventory

- Most supply chains focus on raw materials, work in process, finished goods
- Inventory in a landfill
- Cost borne collectively by society
- Reduce harmful inventory, unlock unused value
- “Cradle to cradle” design

Transportation

- Improve environmental performance through resource and emission reduction
- Product design can play a significant role

Sourcing

- Greatest social and environmental impact occurs in the extended supply chain
- Impact has grown with increased global sourcing
- Verifying and tracking supplier performance with regard to sustainability a major challenge

- One of the biggest challenges to improved supply chain sustainability
- Absence of standards for measurement and reporting means that some claims of environmental improvement are not verifiable

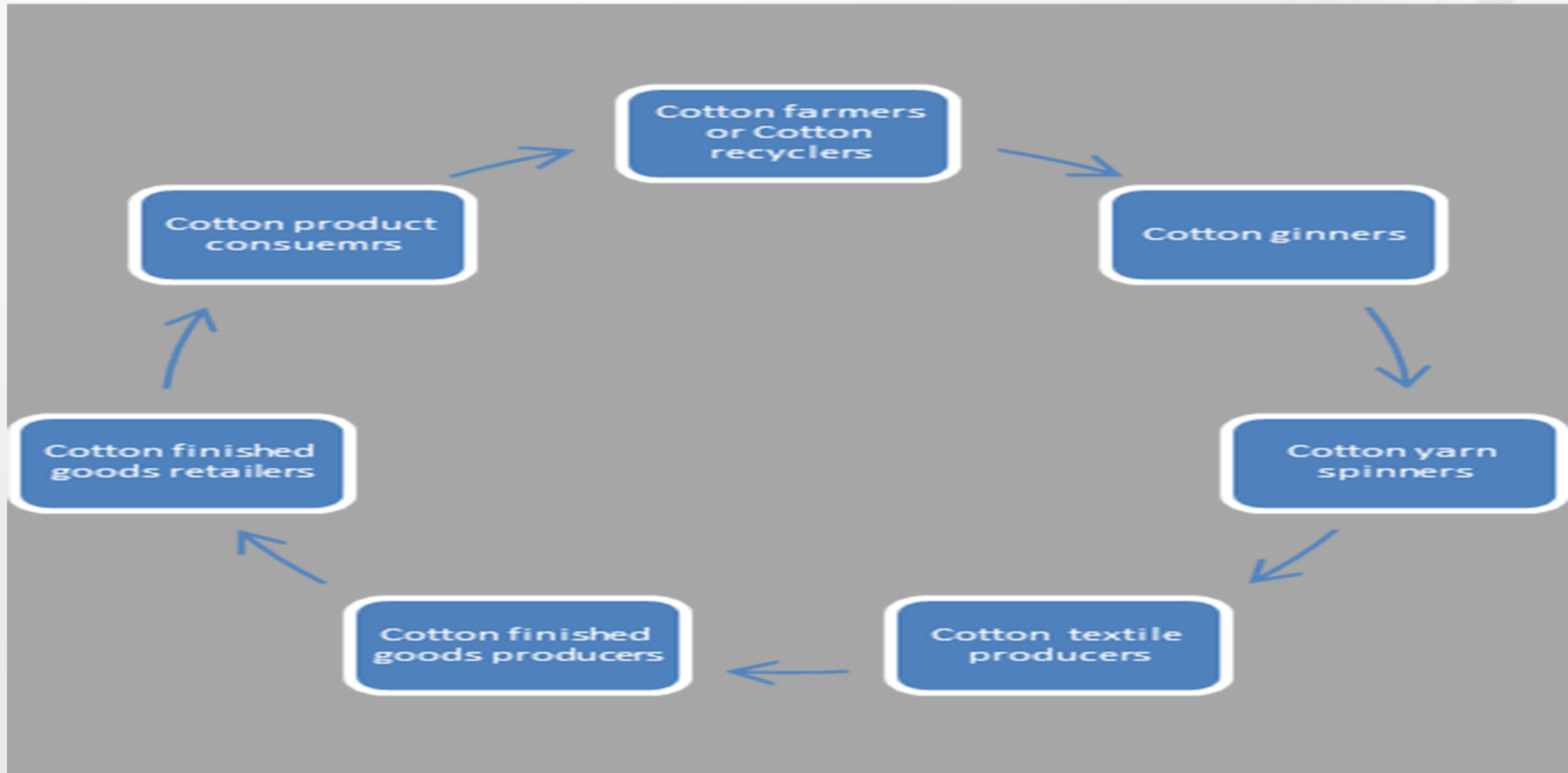
Pricing

- Differential pricing can improve the utilization of assets, leading to resource reduction
 - Delays the need for additional capacity
- Consumption visibility and differential pricing potentially lead to reduce resource consumption
- Biggest challenge is changing the customer's willingness to pay
- Government incentives can encourage customers and firms

Closed-Loop Supply Chains

- Improve sustainability by designing products that use fewer resources and can be recycled and remanufactured
- **Depends on**
 - The incentive to recycle or remanufacture
 - The cost to recycle or remanufacture
- Cannibalization of demand for new products
- Cost of recycling or remanufacturing has a significant impact on the process of recycling

Closed loop of typical cotton products' supply chain



Pricing of Sustainability

- Internalize the “monetary value” of the social or environmental cost
- Incorporate suitable prices for the social and environmental impacts of different actions
- Significant challenges to setting these prices

Pricing Emissions

- Firms will not put sufficient effort into reducing GHGs unless they are “forced” to reduce emissions or required to pay for the social cost of their emission
- **Two approaches**
 - Carbon tax
 - Cap-and-trade system

- **Evaluating pricing mechanisms**

- Cost of administration
- Price volatility
- Emission uncertainty
- New information uncertainty
- Industry competitiveness
- Wealth transfer to energy-exporting countries
- Revenue neutrality

1-AI & Autonomous Supply Chains

- Companies are moving from basic automation to AI-driven decision-making.
- “Agentic AI” can analyze, decide, and act automatically (e.g., supplier selection, risk alerts).
- Leads to smarter forecasting, planning, and real-time optimization.

Example: AI predicts demand and automatically adjusts inventory.

2. Shift from “Resilience” to “Total Value”

- Old focus: survive disruptions
- New focus: maximize overall value (cost + service + sustainability + experience)

Supply chains now aim to:

- Improve customer experience
- Increase profitability
- Support long-term strategy

3. Digital & Data-Driven Supply Chains

- Heavy use of:
 - Big Data
 - IoT (sensors)
 - Cloud systems
- Enables real-time visibility of inventory, shipments, and risks.

Companies can detect disruptions instantly and react faster.

4. End-to-End Integration & “Connected Ecosystems”

- Supply chains are becoming fully integrated systems:
 - Procurement
 - Logistics
 - Finance
 - CRM
- **Result:** “Connected Intelligence” across the business

5. Sustainability & Green Supply Chains

- Strong focus on:
 - Reducing emissions
 - Ethical sourcing
 - Waste reduction
- Governments and customers are pushing ESG (Environmental, Social, Governance).
- Companies redesign networks to be eco-friendly and transparent.

6. Regionalization & Nearshoring

- Moving away from heavy dependence on one country (like China).
- Companies are:
 - Diversifying suppliers
 - Producing closer to markets
- **Goal:** reduce risk from global disruptions (wars, pandemics, tariffs).

7. Supply Chain Visibility & Transparency

- Real-time tracking using:
 - IoT
 - Blockchain
 - Control towers
- Businesses can:
 - Track shipments live
 - Identify delays early
 - Improve coordination

Modern supply chains are becoming:

- Digital (AI, data, automation)
- Smart (real-time decisions)
- Resilient (prepared for disruptions)
- Sustainable (eco-friendly)
- Integrated (connected across the whole business)

- **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.

الموضوعات البحثية المقترحة

Sustainability, ESG, Circular Economy, and Carbon-Economics (“Carbonomics”)

Resilience & Risk Management under Uncertainty (Climate, Pandemic, Cybersecurity)

AI in warehousing and Logistics

Reshoring, Nearshoring & Geopolitical Risk / Resilience

Last-Mile & Logistics Innovation

Blockchain for Enhanced Transparency and Security in Supply Chain

Strategic sourcing and supplier management in the manufacturing industry

Global Supply Chain Integration

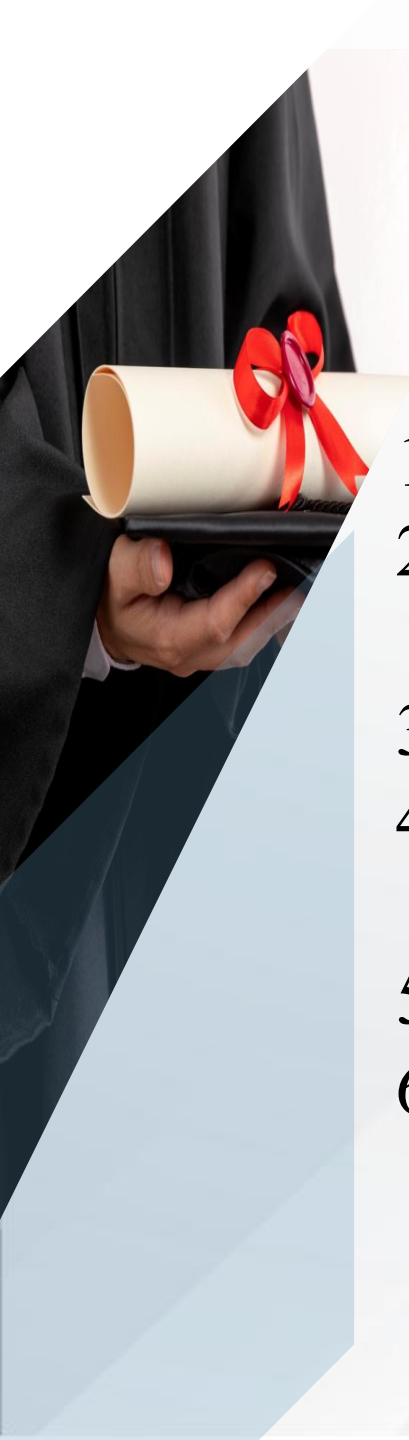
Digital Transformation in Supply Chain Management

Inventory Management and Optimization

E-commerce and Supply Chain Logistics

Supply Chain Disruption and Resilience

Summary of Learning Objectives

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1. Understand the importance of sustainability in a supply chain.
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- Supply Chain Council



Thank You