Sustainability in the Supply Chain

Chapter 5 Supplement

Learning Objectives

When you complete this chapter you should be able to :

1. **Describe** corporate social responsibility
2. **Describe** sustainability
3. **Explain** the 3*R*s for sustainability
4. **Analyse** cost-benefit design for disassembly
5. **Explain** the impact of sustainable regulations on operations

Corporate Social Responsibility

- Will products and services affect people and the environment ? In what ways?

- Stakeholders have strong opinions about environmental, social, and ethical issues - esp failed issues
- Doing what’s right can be beneficial to all stakeholders

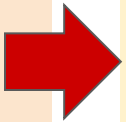
Corporate Social Responsibility

What is CSR?

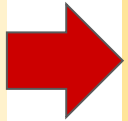
Managerial decision making that considers environmental, societal, and financial impacts.

Creating shared values. What is shared values?

TESLA , TOYOTA NISSAN - Business ?



Society health - low emission cars.to electric vehicles battery



Joint Battery Development / Shared Technology

Corporate Social Responsibility

Shared values - developing policies and practices that enhance competitiveness of an organization while advancing the economic and social conditions in the communities in which it operates

Operations functions - from supply chain management to product design to production to packaging to logistics - provide opportunity for shared value and meeting CSR goals

Sustainability

What is sustainability?

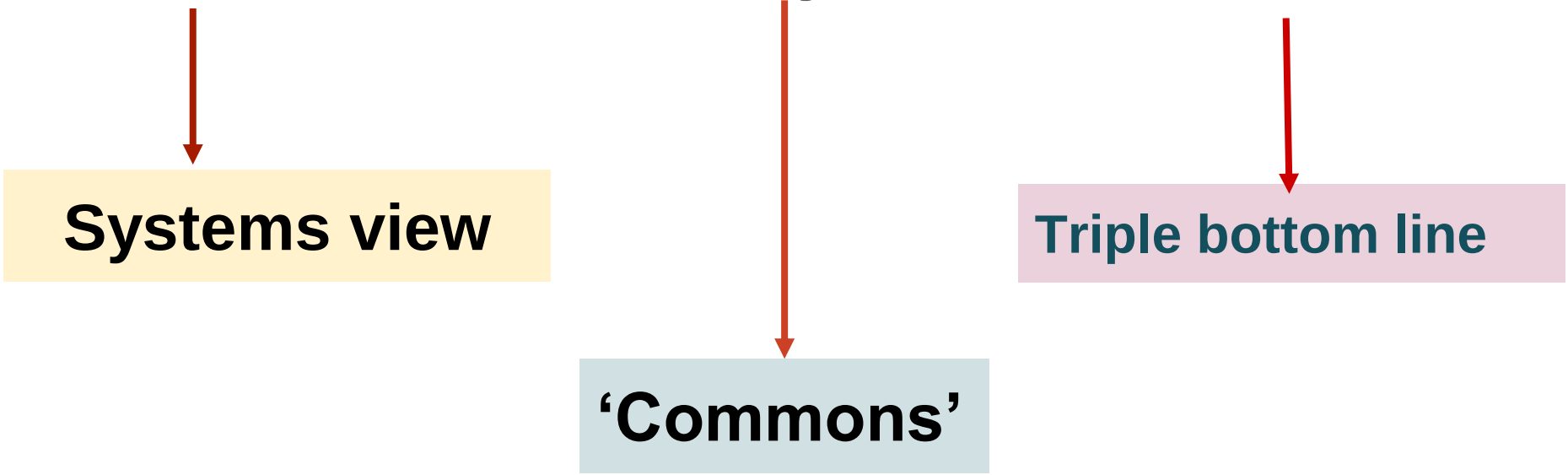
- **Often associated with CSR**

- Meeting the needs of the present without compromising the ability of future generations to meet their needs

- More than “going green”

- Includes employees, customers, community, and company reputation

Concepts helpful for making sustainability decisions



Systems View

- Looking at a product’s life from design to disposal, including all the resources required
- The product or service itself is a small part of much larger social, economic, and environmental systems
- Understanding systems allows more informed judgments regarding sustainability

Commons

- Inputs to a production system **held by the public** are called ‘commons’ resources (water, air, land, minerals)
- Common resources often misallocated
- Possible solutions include
  - Moving some of the *common* to private property
  - Allocation of rights (establish fishing boundaries)
  - Regulation -Obligation for caring the commons

Triple Bottom Line

- Consider the systems necessary to support the three *Ps:* ***people, planet***, and ***profit***

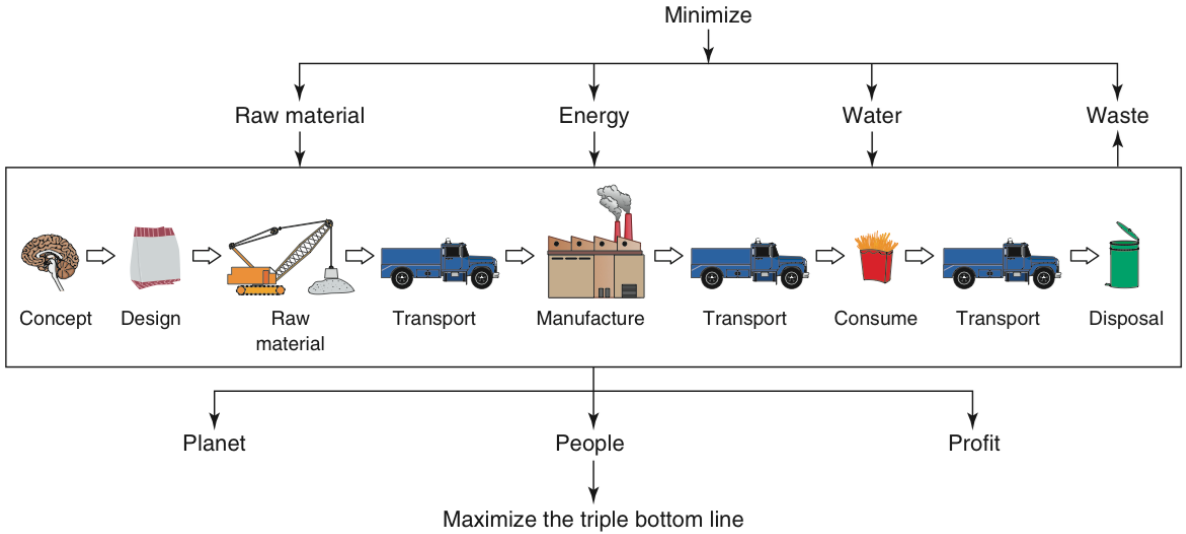


Figure S5.1

Triple Bottom Line - PEOPLE

- All decisions affect people
- Globalization and outsourcing complicate the task

- Supplier selection and performance criteria are important
- Materials must be safe and environmentally responsible

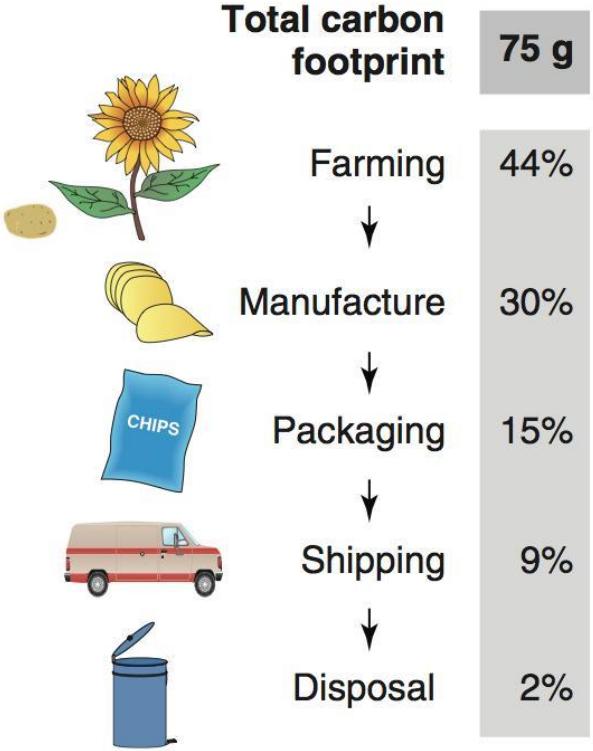
Walmart's Objectives - supplier audits

- Improving livelihoods through the creation of productive, healthy, and safe workplaces
- Building strong communities through access to affordable, high-quality services
- Preventing exposure to substances that are considered harmful or toxic
- Promoting health and wellness

Triple Bottom Line - PLANET

- The **planet's environment**
- Look for ways to reduce the environmental impact of operations
- Overarching objective is to conserve scarce resources
- Carbon footprint and greenhouse gas emissions (GHG)

Carbon Footprint



34.5-gram Bag of Frito-Lay Chips

Figure S5.2

Triple Bottom Line - PROFIT

- Social and environmental sustainability do not exist without economic sustainability
- Staying in business **requires making a profit**
- Alternate measures of success include risk profile, intellectual property, employee morale, and company valuation
- Supplement financial accounting with social accounting - brand equity, HC development and benefits, R&D, philanthropy,

Design and Production for Sustainability

- **Life cycle assessment** - evaluates the environmental impact of a product, from raw material and energy inputs all the way to the disposal of the product at its **end-of-life**

- The goal is to make decisions that help **reduce the environmental impact** of a product throughout its entire life

- The 3*R*s— ***reduce, reuse,* and *recycle***

Product Design

- Design decisions affect materials, quality, cost, processes, related packaging and logistics, and how the product will be processed when discarded or end of useful life

Product Design

- Incorporate systems view to lower environmental impact (1st R - Reduce) - reduce waste and energy costs

New detergent clean using cold water - Tide cold water - saving ¾ of energy usage in typical wash

https://www.coca-colacompany.com/news/dasani-launches-recycled-bottle-caps

Product Design

- Alternative materials
- Can be expensive
- Aircraft and automakers - constantly looking for lighter materials - fuel economy, less carbon emissions,

Examples

- Mercedes - building exterior from banana fiber - biodegradable and lightweight
- Ford using upholstery made from recycled plastic bottle , old clothing
- Boeing - using fiber , epoxy composites and taitah]nium grahire reduce weight in 787 Dreamliner

https://renewable-carbon.eu/news/banana-fiber-protects-against-stone-impact-daimlerchrysler-sets-store-by-abaca-underfloor-protection/

Design for Disassembly

Harmonizer

PART	RESALE REVENUE PER UNIT	RECYCLING REVENUE PER UNIT	PROCESSING COST PER UNIT	DISPOSAL COST PER UNIT
Printed circuit board	$5.93	$1.45	$3.46	$0.00
Laminate back	0.00	0.00	4.53	1.74
Coil	8.56	5.65	6.22	0.00
Processor	9.17	2.65	3.12	0.00
Frame	0.00	0.00	2.02	1.23
Aluminum case	11.83	2.10	2.98	0.00
Total	$35.49	$11.94	$22.33	$2.97

Design for Disassembly

Rocker

PART	RESALE REVENUE PER UNIT	RECYCLING REVENUE PER UNIT	PROCESSING COST PER UNIT	DISPOSAL COST PER UNIT
Printed circuit board	$7.88	$3.54	$2.12	$0.00
Coil	6.67	4.56	3.32	0.00
Frame	0.00	0.00	4.87	1.97
Processor	8.45	4.65	3.43	0.00
Plastic case	0.00	0.00	4.65	3.98
Total	$23.00	$12.75	$18.39	$5.95

Deciding design alternatives using "**Design for disassembly cost- benefit analysis**' - (Focus on Reuse and Recycle) **2 speaker designs**

- Collect data
- 1. Resale value of components
- 2. Revenue collected from recycling
- 3. Processing costs, incl disassembly, sorting, cleaning, packaging
- 4. Disposal costs, incl transportation, fees, taxes, and processing time

Design for Disassembly

Revenue retrieval	=	Total resale revenue	+	Total recycling revenue	–	Total processing cost	–	Total disposal cost

Revenue retrieval for Harmonizer = $35.49 + $11.94 – $22.33 – $2.97 = $22.13

Revenue retrieval for Rocker = $23.00 + $12.75 – $18.39 – $5.95 = $11.41

ANALYSIS

Harmonizer - better environmental design alternative - higher revenue retrieval opportunity.

(Note: Team is assuming both products have same market acceptance, profitability, and environmental impact)

Production Process

- Reduce the amount of resources in the production process
  - Energy
  - Water
  - Environmental contamination
- Reduce cost and environmental concerns

https://www.pepsico.com/our-impact/esg-topics-a-z/water

PepsiCo developed *Resource Conservation (ReCon*) - a diagnostic tool to reduce in-plant water and energy usage - first 2 years, *ReCon* helped global sites identify 2.2 billion liters of water savings = costs savings ~ $2.7 million

Logistics

Reduce costs by achieving efficient route and delivery networks

1. Getting shipments to customers promptly
2. Keeping trucks busy
3. Buying inexpensive fuel

Logistics

- Management analytics can help
- Evaluate equipment alternatives
- Life cycle ownership costs

OWNERSHIP COSTS

Life Cycle Ownership Costs

VEHICLE	COST TO BUY	FUEL	EFFICIENCY	OPERATING COSTS PER MILE
Ford TriVan	$28,000	Regular Unleaded	24 mpg	$.20
Honda CityVan	$32,000	Regular Unleaded/Battery	37 mpg	$.22
Annual distance = 22,000 miles		Life = 8 years	Gas price = $4.25/gallon	

$$\text{Total life cycle cost} = \text{Cost of vehicle} + \text{Life cycle cost of fuel} + \text{Life cycle operating cost}$$

Life Cycle Ownership Costs

a) Ford TriVan

$$\text{Total life-cycle cost} = \$28{,}000 + \left[\frac{22{,}000\ \frac{miles}{year}}{24\ \frac{miles}{gallon}}\right](\$4.25/gallon)(8\ years) + \left(22{,}000\ \frac{miles}{year}\right)(\$.20/mile)(8\ years)$$

$$= \$28{,}000 + \$31{,}167 + \$35{,}200 = \$94{,}367$$

Life Cycle Ownership Costs

a) Honda CityVan

$$\text{Total life-cycle cost} = \$32{,}000 + \left[\frac{22{,}000\ \frac{miles}{year}}{37\ \frac{miles}{gallon}}\right](\$4.25/gallon)(8\ years) + \left(22{,}000\ \frac{miles}{year}\right)(\$.22/mile)(8\ years)$$

$$= \$32{,}000 + \$20{,}216 + \$38{,}720 = \$90{,}936$$

BREAKEVEN AND PAYBACK PERIOD

Life Cycle Ownership Costs

b) Break-even analysis

Total cost for Ford TriVan = Total cost for Honda CityVan

$$\$28{,}000 + \left[\frac{4.25\frac{\$}{gallon}}{24\frac{miles}{gallon}} + .20\frac{\$}{mile}\right](M\ miles) = \$32{,}000 + \left[\frac{4.25\frac{\$}{gallon}}{37\frac{miles}{gallon}} + .22\frac{\$}{mile}\right](M\ miles)$$

$$\$28{,}000 + \left(.3770\frac{\$}{mile}\right)(M) = \$32{,}000 + \left(.3349\frac{\$}{mile}\right)(M)$$

$$\left(.0421\frac{\$}{mile}\right)(M) = \$4{,}000$$

$$M = \frac{\$4{,}000}{.0421\frac{\$}{mile}} = 95{,}012\ miles$$

Life Cycle Ownership Costs

c) Payback period

$$Payback\ period = \frac{95{,}012\ miles}{22{,}000\frac{miles}{year}} = 4.32\ years$$

Insights:

1. **Which is best choice?**
2. **What is Break-even point?**
3. **How long to recover/recoup investment?**

End-of-Life Phase

- What happens at the end-of-life stage?
- Closed-loop supply chains or reverse logistics
- Automakers design, incorporates disassembly, recycling, and reuse

Regulations and Industry Standards

- Product design
  - Food and Drug Administration
  - Consumer Products Safety Commission
  - National Highway Safety Administration

Regulations and Industry Standards

- Manufacturing and assembly activities - own set of standards, including
  - Occupational Safety and Health Administration (OSHA)
  - Environmental Protection Agency (EPA)
  - State and local agencies
- Regulate workers rights and employment standards

Regulations and Industry Standards

- Disassembly and disposal of hazardous products
  - EPA
  - Department of Transportation
- Design for disassembly

Regulations and Industry Standards

- Nearly all industries have regulations
  - Commercial builders required to manage water runoff and have pollution prevention plan
  - Public drinking systems must meet Federal Safe Drinking Water Act arsenic standards
  - Hospitals must meet Resource Conservation and Recovery Act - governing storage and handling of hazardous materials

International Environmental Policies and Standards

- Organizations and governments guiding businesses
  - U.N. Framework Convention on Climate Change (UNFCCC)
  - International Organization for Standardization (ISO)
  - Elimination of greenhouse gas (GHG)

ISO 14000

- Environmental management standards
  1) Environmental management
  2) Auditing
  3) Performance evaluation
  4) Labeling
  5) Life cycle assessment

ISO 14000

- Advantages
  - Positive public image, reduced liability
  - Good systematic approach to pollution prevention
  - Compliance with regulatory requirements, opportunities for competitive advantage
  - Reduction in the need for multiple audits

ISO 14000

- ISO 14001 addresses environmental management systems
- Guidance to minimize harmful effects on the environment