Global Supply Chain

Environmental Studies 152
San Jose State University

San José State University

Department of
Environmental Studies

Agenda

- Supply Chain: yesterday - today
- Corporate Sustainability Programs
- DfE/Sustainability drivers
  - Regulations
  - Economics
  - Moral
- Managing the Supply Chain re. its Social & Environmental Responsibility
  - Why?
  - Implementation & examples
  - Tools (e.g. ISO 14001; ISO 18001)

What is the Global Supply Chain

- What's "Made in America?"
  - Automobiles
    - Where does your car come from?
  - Computer
    - Where do your parts come from?
    - Where do they go at the end of life?

The World of Manufacturing

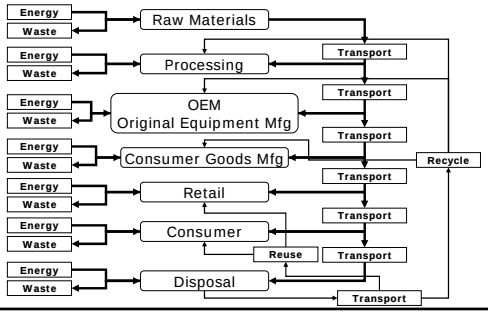
- Acme Widgets
  - The "Good Old Days"
    - Design a product
    - Build it
      - Raw materials in…much of it local
      - Manufacturing…local
      - Waste out…much of it local
    - Product sold locally + regionally (traveling salesperson)…if you got lucky and made it big, have a national sales presence
    - End of life…tossed in the garbage…landfill

The World of Manufacturing

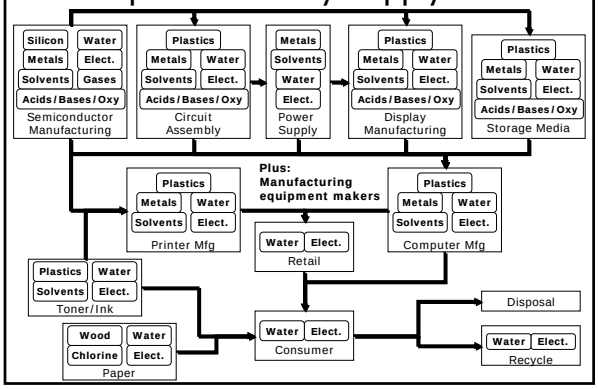
- The New World Order…as related to business
  - EVERYTHING IS INTERCONNECTED THROUGH A GLOBAL ECONOMY
  - Acme Widgets, today
    - Design a product…inputs from customers around the world, market analyses determine what's "needed"
    - Build it – what are the main drivers of company expenses?
      - Raw materials in…use material with the lowest price from around the world…if shipping is
      - Manufacturing…outsourced to global partners…labor costs is one of the biggest controllable factors
      - Waste out…waste to less "expensive" areas
        - Transboundary waste control
    - Product sold globally
      - All you need is a website and a FedEx account and the world is your market!
    - End-of-life…could end up ½ way around the world for disassembly / recycling / recovery

Global Supply Chain

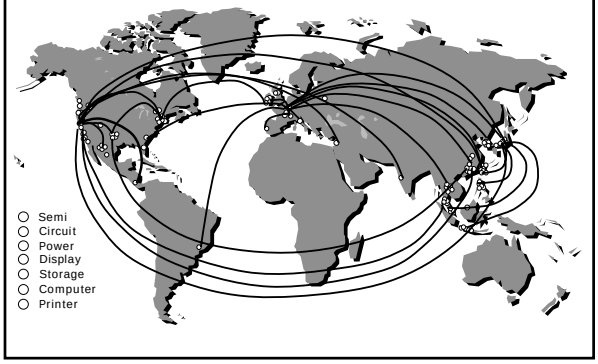
- Building blocks of global economy



Computer Industry Supply Chain



Global Distribution



Corporate Sustainability

- What is sustainability?
  - "…sustainability means integrating long term economic, environmental and social dimensions into the way we operate our business."
    Hewlett Packard

UN Global Compact

- Kofi Annan, Davos, Switzerland (1999) asked world businesses to:

- Human Rights: business to:
  - Principle 1: support and respect the protection of international human rights within their sphere of influence; and
  - Principle 2: make sure their own corporations are not complicit in human rights abuses
- Labour: business to uphold:
  - Principle 3: freedom of association and the effective recognition of the right to collective bargaining;
  - Principle 4: the elimination of all forms of forced and compulsory labour;
  - Principle 5: the effective abolition of child labour; and
  - Principle 6: the elimination of discrimination in respect of employment and occupation.
- Environment: businesses to
  - Principle 7: support a precautionary approach to environmental challenges;
  - Principle 8: undertake initiatives to promote greater environmental responsibility; and
  - Principle 9: encourage the development and diffusion of environmentally friendly technologies.

CERES

- Coalition of investment funds, environmental organizations, and public interest groups. Mission is to move businesses, capital, and markets to advance lasting prosperity by valuing the health of the planet and its people.
- Network:
  - Organizations: AFL-CIO, EDF, NRDC, Sierra Club, Union of Concerned Scientists, WWF
  - Investors: Calvert Group, Domini Social Investments, Trillium Asset Mgmt, etc.
  - Companies: AA, B of A, Ben & Jerry's, Body Shop, Coca-Cola, Ford, GM, ITT, Nike, Timberland, etc.

Largest Corporate Emitters of GWGs

- US Petro devote all efforts to finding more oil & gas v. renewable energy
- US Auto depend on gasoline SUV sales v. HEV SUVs
- US Utilities refurbishing old coal-fired plants v. new lower GWG emitting plants

Table ES-1. 14-Point Climate Change Governance Checklist

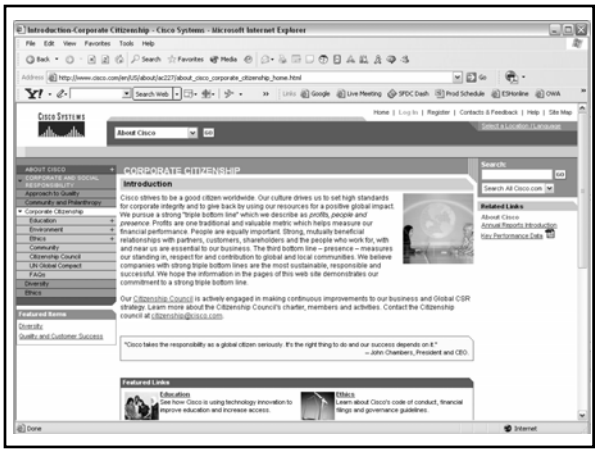
	Board		Management			Report		Emissions Data				Other		Total
COMPANY	COMM	RESPON	LEVELS	COMP	CEO	RISK	SUST	OFFSET	PERCENT	BASE	TARGET	CERT	TRADES	RENEW	Up to 14
BP	✔	✔	1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	14
Royal Dutch/Shell	✔	✔	1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	14
Alcoa	✔	✔	1	✔	✔		✔	✔	✔	✔	✔	✔		✔	12
DuPont	✔	✔	0		✔	✔	✔	✔	✔	✔	✔		✔	✔	12
AEP	✔	✔	1		✔	✔		✔	✔		✔		✔	✔	10
IBM	✔	✔	1				✔	✔	✔	✔	✔	✔		✔	10
Toyota	✔	✔	0		✔	✔	✔		✔	✔	✔			✔	10
Cinergy	✔	✔	1		✔	✔		✔	✔	✔				✔	9
Ford Motor	✔	✔	2		✔	✔	✔	✔	✔				✔	✔	9
General Motors	✔	✔	1				✔	✔	✔	✔			✔	✔	9
Honda	✔	✔	0		✔		✔		✔	✔	✔			✔	9
Int'l Paper	✔	✔	1				✔		✔				✔	✔	7
Southern			1			✔		✔	✔	✔				✔	6
Xcel Energy	✔	✔	1			✔		✔						✔	6
ChevronTexaco	✔	✔	1					✔						✔	5
ConocoPhillips	✔	✔	0			✔		✔							5
DaimlerChrysler			1			✔	✔		✔	✔					5
ExxonMobil	✔	✔	1						✔						4
General Electric	✔	✔	1											✔	4
TXU			1			✔		✔						✔	4
TOTALS (≥ 20)	17	17	19	3	9	12	11	14	15	11	8	4	7	17	—

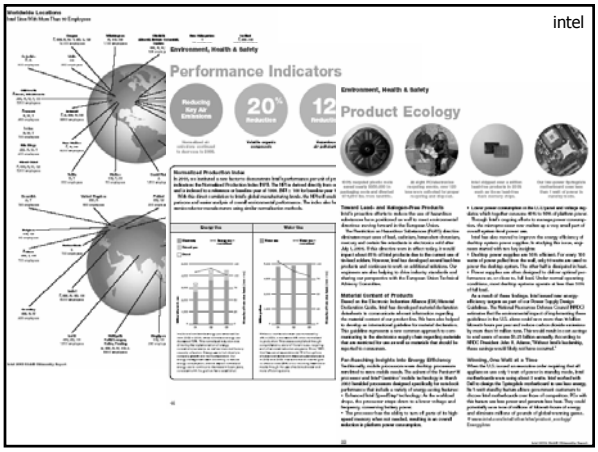
Global Reporting Initiative™ (info@globalreporting.org)

- Global Reporting Initiative (GRI): International & independent sustainability reporting institution
- Goal: framework for sustainability reporting guidelines
- Launched by CERES & UNEP in 1997; 10'000 strong worldwide network
- Seeks to harmonize & integrate:
  - Codes of Conduct
  - Mgmt. Systems & Performance Standards
  - International Conventions
  - Intangible Accounting
  - Assurance Standards
  - Issues/Sectors/National reporting guidelines
- *There are currently +300! Tools in the sustainability arena!*

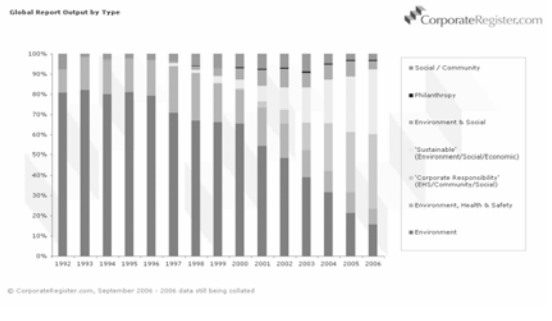
Global Reporting Initiative™ (info@globalreporting.org)

- Why report:
  - trust, identification of trouble spots, assess and measure sustainability, protect share price
- Content
  - Vision & Strategy: CEO communicates sustainability program
  - Profile: operations & scope
  - Governance Structure & Management Systems: organization, policies, management systems
  - GRI Content Index: Summary table of information
  - Performance Indicators: Economic, Environmental, Social Performance Indicators





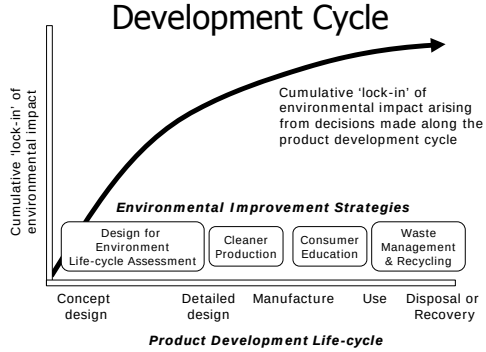
Evolution of Report Types



Design for Environment (DfE)

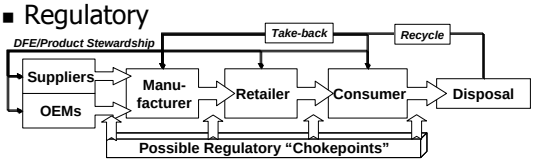
- Design products with the environment in mind
- Assume some responsibility for the product's environmental consequences throughout the product life cycle
- Evaluation of product's impact
  - Life Cycle Analysis (cradle-to-cradle approach)

DfE and Product Development Cycle



Drivers

- Regulatory



- Restriction of Hazardous Substances
  - Total bans and concentration restrictions

Drivers: Restriction of Hazardous Substances

- Metal Compounds
  - Antimony
  - **Arsenic**
  - Beryllium
  - Bismuth
  - **Cadmium**
  - Chromium
  - **Hexavalent chromium**
  - Cobalt
  - **Lead**
  - Mercury
  - Nickel
  - Organic tin
  - Selenium
  - Tellurium
  - Thallium
- Organic Halogen Compounds
  - Chlorinated paraffins
  - **Polybrominated biphenyls**
  - Polybrominated diphenyl ethers
  - Halogenated resin additives
  - PCBs
  - Polychlorinated naphthalenes (with more than 3 chlorine atoms)
  - **Polyvinyl chloride**
- Others
  - Asbestos
  - Azo compounds
  - **Cyanides**
  - **Ozone depleting substances**
  - Phthalates
  - Radioactive substances

Drivers: Restriction of Hazardous Substances

- Lead
  - Electronic circuits
- Mercury
  - Lamps, fungicides
- Cadmium
  - Stabilizer for plastics
- Arsenic
  - Electronics, tanning
- Chromium
  - Metal plating
- Nickel
  - Batteries, plating
- Formaldehyde
  - Resins, insulation
- Chlorinated Organic Solvents
  - Paints, adhesives
- Polychlorinated biphenyls (PCBs)
  - Fluorescent lamps
- Brominated flame retardants
  - Electronic products, appliances

Drivers: Restriction of Hazardous Substances

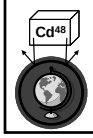
Control techniques

1. Elimination
   - Do you really need it?
     - Evaluate design and if it's not really necessary, remove it from the product
2. Substitution
   - Replace the "bad actor" with something less bad
3. Administrative controls
   - Put procedures in place to minimize harm
     - Product takeback and recycling

Drivers: Regulatory Restrictions

CASE STUDY: SONY ELECTRONICS PLAYSTATION

- Oct. 2001: shipment of peripherals stopped by Dutch authorities
- Determined that the electronic cables contained trace quantities of cadmium above the limit allowed under Dutch regulations
- Company initiated a plan to rectify the situation, which included greater testing requirements of its supply chain
- Financial Impact:
  - This affected approximately 7% of the company's models available in Europe.
  - Estimated an impact on sales of ~€110M and on operating profit of ~€52 million, including costs of rework.
  - Lost market share

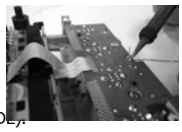


Drivers: Regulatory Restrictions

- REACH: Registration, Evaluation and Authorization of Chemicals
  - no chemical substance or product, may be imported or marketed in the EC unless it has first been registered with a new chemical authority.
  - Registration would involve prior testing ("no data, no market").
  - Burden of proof from public authorities to chemical producers to show that they are putting safe chemicals on the market.
  - REACH would place a duty on companies to assess the risks arising from the chemicals' uses
  - Would also be required to take the necessary measures to manage any risks they identify.
  - Approximately 30,000 chemical substances with production/import in excess of 1 ton!
  - Intermediates? → additional 40,000 substances

Drivers: Regulatory Restrictions

- Lead Ban: European Union
  - Since July '06 new electrical and electronic equipment (EEE) cannot contain:
    - Lead
    - Mercury
    - Cadmium
    - Hexavalent chromium
    - Polybrominated biphenyls (PBB)
    - Polybrominated diphenyl ethers (PBDE).
- How to replace this material? Huge effort undertaken by industry to accomplish lead-free manufacturing

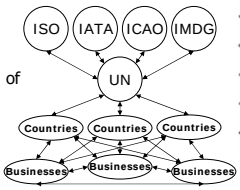


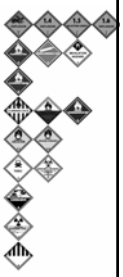
Divers: Regulatory Bodies

- International Organizations
  - OECD
  - United Nations
  - World Trade Organization
- Regional Organizations
  - European Union
- National/Federal Organizations
  - US EPA, DOT
- State/Provincial Organizations
  - California EPA
- Local Organizations
  - City & County

Drivers: Regulatory Bodies

- Transportation of Dangerous Goods
- Model Regulations (UN)
  - Classification
  - Paperwork
  - Design criteria for containers
  - Selection of containers & packages
  - Labeling & marking
  - Loading & unloading
  - Load securing
  - Transportation
  - Placarding & marking of cargo units
  - Emergency response
  - Training





Drivers

- "Moral" Drivers = Economic Drivers
  - It's the right thing to do!
  - Sustainable development for future generations
  - We're turning a corner on buying decisions being made for "green" purposes
    - Suppliers
    - Customers
    - Investors

Drivers: Economic

- Operating cost reductions: discussed previously
- Eco-Advantage Culture
  - Vision, reinforced by stretch goals
  - Practices incorporating environmental thinking
  - Incentives for engagement and accountability
  - Communication—both internal & external

Drivers: Economic

- Vision
  - Toyota: Katsuaki Watanabe, President, 2005
    - Top priority of developing environmentally friendly technologies
    - Develop a car that could "cross the U.S. continent on one full tank of gas" → 200 mpg!
  - Nike & 3M set goal of reducing VOC emissions by 90%...both achieved that target
  - Herman Miller
    - 2020 → Zero Waste and 100% emission free

If you set the goals, you better hit them:
"Once you go public, it's no longer voluntary" – Paul Tebo, DuPont

Drivers: Economic

Hurdle rate: Proposed investments must yield a minimum return rate

- Return on Investment (ROI) = $V_f \div V_i - 1$
- Time value of money: Net Present Value
  - Is investing in a project worth it?
  - NPV = $\sum[C_t \div (1+r)^t] - C_0$
    - C_t = net cash flow; C_0 = Initial outlay; r = discount rate; t = time
  - If NPV is positive, then worthwhile
  - Example:
    Installation of energy saving equipment: $250K; r = 30%; annual cost $10K; Savings = $100K/yr –
    What is NPV over 5 years?
    What if r = 15%?
- Rate can be set lower for eco-advantage

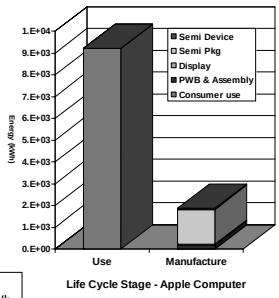
Year	cash in	cash out	net	rate:	30%
0	$0	$250	($250)	/(1.30)^0=	($250)
1	$100	$10	$90	/(1.30)^1=	$69
2	$100	$10	$90	/(1.30)^2=	$53
3	$100	$10	$90	/(1.30)^3=	$41
4	$100	$10	$90	/(1.30)^4=	$32
5	$100	$10	$90	/(1.30)^5=	$24
		Net Present Value			**($31)**

Year	cash in	cash out	net	rate:	15%
0	$0	$250	($250)	/(1.15)^0=	($250)
1	$100	$10	$90	/(1.15)^1=	$78
2	$100	$10	$90	/(1.15)^2=	$68
3	$100	$10	$90	/(1.15)^3=	$59
4	$100	$10	$90	/(1.15)^4=	$51
5	$100	$10	$90	/(1.15)^5=	$45
		Net Present Value			**$52**

- 3M: reduces Pollution Prev. Pays (3P) projects to 10% rate
- Ikea: allows 10-15 payback period
- Dupont: may reduce hurdle rate to 0 just because it makes sense from a social perspective

Drivers: Economic

- Life-cycle costs / Costs of Ownership
  - Reduction in energy costs can be significant during manufacturing
  - Potential benefit of reduction in energy use in operation is even greater
  - All other things equal, consumer should chose lower operating cost of ownership



Example:
Product A cost = $1200, 10,000 kWh, $0.18/kWh
Product B cost = $1500, 8,000 kWh, $0.18/kWh
Which is cheaper?

Supply Chain Social & Environmental Responsibility

- Welcome to the world of outsourcing
  - Good…lower prices…increased supplier competition
  - Bad…some jobs go elsewhere…risk of taking advantage of developing countries & peoples
- Industry Leaders starting to develop specific controls to minimize the risk of the bad stuff *(e.g. Electronic Industry Code of Conduct (EICC) – www.eicc.info/)*

Supply Chain Social & Environmental Responsibility

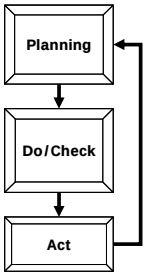
- Reputation
  - customers, current and potential employees
- Investor interest
  - growing "ethical investors" and increasing interest in non-financial issues from mainstream investors
- Quality and productivity
  - increasing interest in the negative impact of poor working conditions
- Globalization debate
  - max benefits come with high standards
- Legal Compliance
  - reduced liability

Supply Chain Social & Environmental Responsibility

- Consumer products manufacturers should take environmental, safety, and social responsibility for the entire life cycle of their products
  - Responsibility for what their suppliers do while providing them with supplies
  - Responsibility for what they do during the manufacture and distribution of their products
  - Responsibility for the end of life (EOL) consequences of their products

Supply Chain Social & Environmental Responsibility

- Implementation
  - Establish code of conduct
  - Communication with Suppliers
  - Contract language
  - Supplier and self-assessment
  - Risk analysis
  - Facility audits
  - Corrective actions
  - Industry wide approaches



Supply Chain Social & Environmental Responsibility

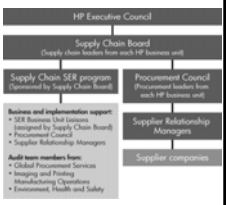
- Organizations:
  - Fair Labor Association (www.fairlabor.org): US
  - Ethical Trading Initiative (www.ethicaltrade.org): UK
  - Social Accountability International (www.sa-intl.org): SA 8000 accreditation
  - Oxfam (www.oxfam.org)
  - CAFOD (www.acfod.org)
  - BSR (www.bsr.org)
  - ISIS Asset Management (www.isiam.com)
  - International Labor Organization (www.ilo.org)
  - UN Office of the High commissioner for Human Rights (www.unhcr.org)

Supply Chain Social & Environmental Responsibility

- Why an issue?
- Example: Hewlett Packard
  - #1 in electronics material spending: $58B/yr
  - Supply chain spans about 600 suppliers worldwide, with more than 300,000 workers at the supplier sites at where products are made
  - Production:
    - Inkjet cartridges: 1.3 M/day
    - Printers: 110K/day
    - PCs: 75K/day

Supply Chain Social & Environmental Responsibility

- HP's SER compliance expectations:
  "We believe that treating workers with dignity and respect, while implementing high standards for health, safety, the environment, and ethics leads to higher quality products and reduced costs."
  - Integrate supplier SER into our sourcing operations
  - Protect worker rights
  - Improve suppliers' working conditions and health and safety
  - Reduce suppliers' environmental footprint
  - Collaborate with non-governmental organizations (NGO) and stakeholders to validate, inform and improve our efforts
  - Participate in industry-wide initiatives to leverage our efforts across the electronics sector

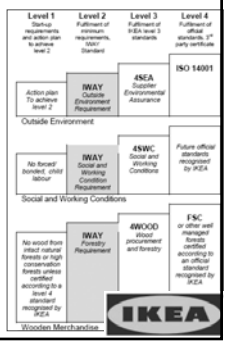


May require independent 3rd-party audits to investigate complaints. If a supplier does not demonstrate improvement in a reasonable amount of time, HP is prepared to discontinue the business relationship.

Supply Chain Social & Environmental Responsibility

- Ikea Way on Purchasing Home Furnishing Products (IWAY)
  - http://www.ikea.com/ms/en_US/about_ikea/social_environmental/iway_standard.pdf
  - Code of conduct to set standards
  - Build long-term relationships with suppliers
  - Expects suppliers to respect fundamental human rights, to treat their workforce fairly and with respect
  - Suppliers are obligated to continuously strive towards minimizing the environmental impact of their operations
  - Child Labor
  - Support & Mentoring
    - Trading Service Offices
  - Social and Environmental Projects
    - Forestry and the prevention of child labor and initiatives

http://www.ikea.com/ms/en_US/about_ikea/social_environmental/the_ikea_way.html



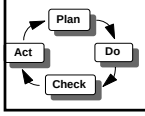
Supply Chain Social & Environmental Responsibility

IKEA

1) General Legal Requirements
2) Emissions, discharges, noise
3) Ground contamination
4) Chemicals
5) Hazardous and non-hazardous waste
6) Environmental improvements
7) Fire Prevention
8) Worker Safety
9) Provided housing facilities
10) Wages and Working Hours
11) Child labor
12) Forced and Bonded Labor
13) Discrimination
14) Freedom of Association
15) Harassment, Abuse and Disciplinary Practices
16) Routines for procurement of wood
17) Protected areas, Intact Natural Forests and High
18) Conservation Value Forests
19) Plantations in tropical and sub-tropical areas
20) High Value Tropical Tree Species

Management Systems

- ISO
  - International Standards Organization
  - Series of management system standards
    - ISO 9000: Quality Management Systems (QMS)
    - ISO 14000: Environmental Management Systems (EMS)
      - ISO 14040: LCA Standards
    - ISO 18000: Occupational Health & Safety Assessment Systems (OHSAS)



Key Benefits Associated with EMS / OSHAS

- Productivity Benefits
  - Improved worker retention and satisfaction
  - Improved EHS performance
  - Increased employee involvement
  - Improved compliance
  - Framework for continuous improvement
- Financial Benefits
  - Reduced manufacturing and operating costs
  - Fewer accidents and medical claims
  - Fewer incidents and spills
  - Reduction in lost work days
  - Recognition by insurers and regulators

Key Benefits Associated with EMS / OSHAS

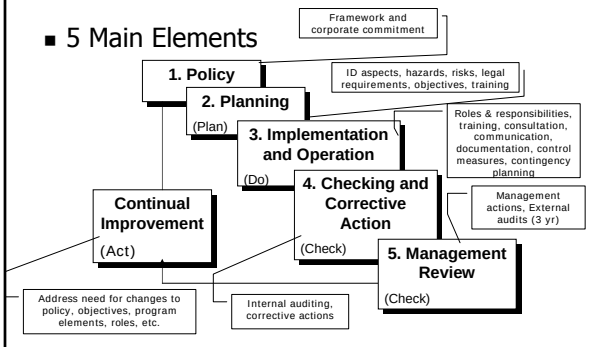
- Competitive Benefits
  - Meeting customer requirements
  - Competitive advantage
  - Enhanced customer trust
  - Improved public image
  - Improved communication of the company's HSE commitment

Primary Requirements

- 14001 *(1996, revised in 2004)*
  - Environmental Policy
  - Environmental Management System
  - Identification of Environmental Impacts & Aspects
  - Environmental Objectives & Goals
  - Training
  - Operational Control
  - Checking and Corrective Action
  - Management review
  - Continual Improvement
- 18001
  - Health and Safety Policy
  - Health and Safety Management System
  - Hazard Identification and risk assessment
  - Health and Safety Objectives and Performance
  - Training
  - Operational Control
  - Checking and Corrective Action
  - Management review
  - Continual Improvement

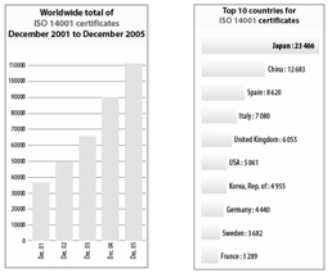
Elements of the HSE-MS

- 5 Main Elements



ISO 14001 - Worldwide

- As of Dec. 2005: +111,160 certifications in 138 Countries *



** Source: http://www.iso.org/iso/en/iso9000-14000/pdf/survey2005.pdf*

Conclusion

"Competition in the world marketplace is relentless. Those who can get the highest quality, price-competitive product to market in the least time are going to be winners."

Quote from: Carter, D. and B. Baker. 1992. *Concurrent Engineering, The Product Development Environment for the 1990s.* Addison-Welsley Publishing.