

Mapping Sustainability

Knowledge e-Networking and the Value Chain

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Appendix A

GUIDE TO CORE CONCEPTS

This appendix presents the detailed knowledge content for each of the fourteen domains of human activity – each defined along four dimensions – consistent with the frame system and the ontology of sustainability in Chapter 1. The dimensions consist of (a) human activities and conditions; (b) sustainability problems; (c) scientific and technical solutions; and (d) social, economic, political and regulatory solutions. Each dimension is further differentiated according to the connectivity rules in Chapter 1.

The appendix is organized by individual domains. The domains are presented sequentially. The sequence is consistent with the entires in Figure 1.5, viewed counter-clockwise – from ‘population’ to ‘governance and institutions.’ The display for each content-domain begins with a brief statement of domain definition.

The indentation format represents the structure of the nested system following the frame system rules defined in Chapter 1. The entries in Figure 1.10 depict only individual items of the first order disaggregation (identified as A, B, C, etc.) in each of the dimensions (identified as I, II, III, etc.). This appendix presents the full system in its disaggregated (unbundled) form.

A.1 Population

Includes size, density, composition, and distributions of people in a given locate, as well as changes in these factors.

I. Activities and Conditions

A. Population variables

1. Size

- a. Growth
- b. Fertility, mortality, migration

2. Composition

- a. Age, gender
- b. Skills/education
- c. Socio-economic
- d. Other

3. Distribution

- a. Spatial
- b. Density

4. Changes in size, composition, and distribution

II. Sustainability Problems

A. *Social and resource constraints relative to demand*

1. **Structure of distribution**

- a. Absolute shortages
- b. Competition between present demands
- c. Competition between present and future demands
- d. Unequal distribution of resources

2. **Type of goods**

- a. Government provided goods
- b. Consumer goods, disposable income
- c. Non-renewable resources
- d. Renewable resources
- e. Space or congestion level

B. *Gender and age-specific problems*

1. **Gender inequality**

- a. Low status of women outside motherhood
- b. High fertility
- c. Female and infant health
- d. Girl education
- e. Intra-family resource competition
- f. Early marriage

2. **Aging**

- a. Dependence costs
- b. Healthcare costs
- c. Emptiness/alienation
- d. Labor effects – relative shortage of young labor force – labor imports (legal and illegal)

III. Scientific and Technical Solutions

A. *Fertility*

1. **Population awareness programs**

- a. On desired family size
- b. On child development
- c. On contraception

2. **Fertility control**

- a. Family planning
 - i. Contraceptives: costs, accessibility, acceptance
- b. Fertility enhancing technologies

B. *Health services*

1. **Technical**

- a. Improved medicine/cures
- b. Epidemic control
- c. Prevention
- d. Accessibility

2. **Organization**
 - a. Central systems
 - b. Grass-roots systems
 - c. Other
3. **Orientation/target group**
 - a. By age: infants, children, young adults, elderly
 - b. By income/social group

IV. Social, Economic, Political, and Regulatory Solutions

A. Education

1. **Type of education**
 - a. Vocational skills – traditional, apprenticeship, modern
 - b. Formal
 - c. Retraining
2. **Level of education**
 - a. Basic school education for children
 - b. Basic education for adults
 - c. Higher education
3. **Public awareness campaigns**

B. Improvement of women's opportunities and skills

1. **Legal status**
2. **Job opportunities**
3. **Skill improvement**
4. **Empowerment groups**

C. Age-specific support programs

1. **Elderly**
 - a. Pension and financial similar systems
 - b. Care system – nursing homes, live-in nurses, family help subsidies
 - c. Support of extended family
 - d. Activities for elderly
 2. **Children**
 - a. Children in poverty
 - b. Child-oriented infrastructure
 - c. Various forms for improving family life
 3. **Safety nets**
 - a. Low-cost health, housing, other services
 - b. Food aid
 - c. Income redistribution system
-

A.2 Urbanization

An increase in the number and/or size of urban areas. A profound change in the lifestyle, the economy, and the culture of a region from predominantly rural based to urban/city based.

I. Activities and Conditions

A. Urbanization

II. Sustainability Problems

A. Poverty expansion

1. **Poverty imported from other poor areas through immigration to cities**
2. **Poverty endogenously created in the city**
 - a. Business disinvestment/unemployment/underemployment
 - b. Natural growth of poor population
 - c. Infrastructure breakdown, reduction of services to the poor

B. Social stress

1. **Congestion**
2. **Marginalization**
 - a. Higher crime rate
 - b. Greater homelessness
3. **Mass political upheaval potential**
4. **Conflict due to relative deprivations**

C. Urban pollution and natural resource shortages

1. **Pollution**
 - a. Polluted mediums
 - i. Air
 - ii. Water
 - iii. Land
 - b. Pollution types
 - i. Exhaust emission
 - ii. Chemicals/toxins
 - iii. Solid and liquid waste dumping and accumulation
 - iv. Pestilence
2. **Health effects**
3. **Resource constraints**
 - a. Energy
 - b. Water
 - c. Land/space

D. Spatial dynamics

1. **Obstacles to access resources**
2. **Cities and megacities**

- a. Merging
- b. Expansion
- 3. Encroachment on non-urban areas**

III. Scientific and Technical Solutions

A. Solve high density problem/improve urban infrastructure

1. Type of infrastructure

- a. Fresh water
- b. Sanitation
- c. Drainage
- d. Waste minimization
- e. Transport system
- f. Communication
- g. Adequate shelter

2. Targeted areas

- a. General areas
- b. Marginal areas

B. Density management strategies

IV. Social, Economic, Political, and Regulatory Solutions

A. Waste management

B. Urban services

- 1. City planning and management**
- 2. Police force/law enforcement**
- 3. Health services**
- 4. Education**
- 5. Functioning market/retail system**
- 6. Others**

C. Strengthening urban communities

- 1. Community centers**
- 2. Religious organizations**
- 3. Group-specific activity groups**

D. Expand rural services

A.3 Migration and Dislocation

Voluntary and involuntary movement of people, within or across national borders.

I. Activities and Conditions

A. Type of flow

1. Refugee flows (involuntary)

- a. Political
- b. Economic
- c. Conflict
- d. Environmental

2. **Socio-economic migration (voluntary)**
 - a. Caused by wage differentials
 - b. Family/group reunion and separation
 - c. Brain drain/gain
3. **Combined rights**
- B. Direction of flows**
 1. **Internal mobility**
 2. **External mobility**
 3. **Return mobility**
- C. Characteristics of flows**
 1. **Phases of migration**
 2. **Poles of migration**
 3. **Push-pull mechanisms**
 4. **Changes in sending/receiving population-economic balances**
 5. **Duration of flows**
- D. Status and benefits**
 1. **Access to socio-economic and political benefits**
 2. **Access to citizenship benefits and responsibilities**
 3. **Access to property rights**
 4. **Access to basic rights and needs**

II. Sustainability Problems

A. *Stresses related to changes in group composition*

1. **Types of changes**
 - a. Ethnic/religious/racial
 - b. Socio-economic
 - c. Age structure
 - d. Other
2. **Effects**
 - a. Marginalization
 - b. Pressure on existing socio-economic structures
 - c. Impacts on resources
 - i. Land
 - ii. Water
 - iii. Fuels
 - iv. Forests
 - d. Changes in density and pattern
 - e. Distribution tensions
 - f. Political shifts

III. Scientific and Technical Solutions

A. *Responsive infrastructure strategies*

1. **Transportation systems affecting the costs of moving**

2. **material infrastructure affecting differential benefits of living in migration poles**
 - B. Resettlement strategies**
 1. **Forced**
 2. **Incentive-based**
- IV. Social, Economic, Political, and Regulatory Solutions**
- A. Migration policies and strategies**
 1. **Political discourse**
 2. **Restrictive, selective, or open policies**
 3. **Type of migration flows admitted**
 - B. Safeguards to human and natural habitats**
 1. **Maintain/attain a desire population distribution (protect places where people live)**
 2. **Designating places where people cannot live (national parks, wildlife areas)**
 3. **Particular regulations for vulnerable areas**
 4. **Other**
 - C. Migrant support programs**
 1. **(Cultural) integration support – to acquire new culture**
 2. **Programs to protect sending culture in receiving area**
 3. **Enhancing migrant capacity**
 - D. Legal status**
-

A.4 Consumption

Use of final goods and services, as well as basic necessities for survival by individuals as consuming entities; represents intermediate processes between population and environment includes what, how, and how much is being consumed.

- I. Activities and Conditions**
 - A. Consumption**
- II. Sustainability Problems**
 - A. Resource use and depletion**
 1. **Scarcity of goods and services**
 - a. **Availability**
 - b. **Affordability**
 2. **Livelihood and production**
 - B. Waste accumulation**
 1. **Forms of waste**
 - a. **Solid**
 - b. **Liquid**
 - c. **Gas**

2. **Type of waste**
 - a. Degradable/non-degradable
 - b. Recyclable/non-recyclable
3. **Spatial condition and distribution of waste**
4. **Mobility of waste**
5. **Effects of waste accumulation**
 - a. Nature's assimilative capacity
 - b. Human habitat
 - c. Biodiversity

III. Scientific and Technical Solutions

A. *Waste management and minimization*

1. **Treatment of waste**
 - a. Landfills
 - b. Incinerators
 - c. Recycling
2. **Waste collection**
 - a. Central collection agency
 - b. Public–private partnership
 - c. Private collection agencies
 - d. Individual disposal
3. **Waste minimization behavior**
 - a. Household disposal
 - b. Waste separation
 - c. Waste reduction
4. **Improving the production process**

IV. Social, Economic, Political, and Regulatory Solutions

A. *Changes in consumer behavior*

1. **Reduce excess consumption**
2. **Reduce luxury consumption**
3. **Purchase multi-purpose goods**
4. **Purchase goods that require less input in sue**
5. **Substitution to environmentally sustainable goods and services**
 - a. Renewable–non-renewable
 - b. Choosing products with less toxicity level
 - c. Using more homemade products
6. **Maintenance**

B. *Mechanisms for consumption change*

1. **Market system**
 - a. Relative accessibility of products
 - b. Relative price of products
2. **Regulations**
 - a. Standards
 - b. Prohibitions

- c. Taxes/subsidies
 - 3. **Value changes**
-

A.5 Unmet Basic Needs

Inability to provide for one's own and for one's dependents the food, clothing, housing, and healthcare needs due to limited income and/or resources.

- I. **Activities and Conditions**
 - A. *Unmet basic needs*
- II. **Sustainability Problems**
 - A. *Poor quality of life*
 - 1. **Insufficient personal material goods**
 - 2. **Lack of healthy and humane environment**
 - 3. **Insecurity in lifestyle**
 - a. Employment
 - b. Housing
 - c. Disasters
 - d. Education constraints
 - e. Gender and minority issues
 - 4. **Disease**
 - 5. **Gender inequalities**
 - B. *Malnutrition*
 - 1. **Income constraints**
 - 2. **Market failure distribution failure**
 - 3. **Political intervention**
 - 4. **Agricultural failures due to annual fluctuations (temporary effects)**
 - 5. **Technical failures**
 - C. *Health hazards*
 - 1. **Limited hygienic measures**
 - a. Lack of sewage system
 - b. Contaminated water
 - c. Waste management measure
 - d. Air pollution
 - 2. **Reduced immunities**
 - 3. **Pollution due to production**
 - 4. **Limitations of laws to protect sound rights**
 - D. *Environmental degradation*
- III. **Scientific and Technical Solutions**
 - A. *Access to technology and infrastructure*
 - 1. **Type of technology and infrastructure**
 - a. Knowledge
 - b. Equipment

- c. Management
- 2. Scale of technology**
 - a. Large projects with capacity to affect a region (e.g. utilities, dams, sewerage)
 - b. Individually-based technology (e.g. farming, building methods)
 - c. Reduce obstacles to
 - i. Internal development
 - ii. External access
- 3. Entrepreneurial opportunities**
 - a. Type of business
 - i. Small-scale business
 - ii. Co-op
 - iii. Informal sector
 - b. Type of support
 - i. Management/organization
 - ii. Start-up
 - iii. Product management
 - iv. Credit systems
- 4. Food Security**
 - a. Technical innovations
 - b. Distribution efficiencies

IV. Social, Economic, Political, and Regulatory Solutions

- A. Poverty alleviation assistance (i.e. income enhancement/creation policies/enhanced income opportunities)**
 - 1. Job creation**
 - a. Permanent government jobs/public services
 - b. Temporary poverty alleviation work
 - c. Improve investment climate
 - 2. Improved resource access and management**
 - a. Land
 - b. Water rights
 - c. Fishing rights
 - d. Property rights
 - e. Informal contracts
 - 3. Empowerment of women**
- B. Enhanced capacity building (i.e. enhanced income earning capabilities)**
 - 1. Institutions**
 - a. Research
 - b. Education
 - 2. Support (e.g. funding, policies)**
 - 3. Management strategies**
 - 4. Public administration and regulatory bodies**
 - 5. System and institutional structures**
- C. Improved health and environment management**

D. Responsive legal systems

1. Tax law
 2. Tenure law
 3. Labor law
 4. Property law
 5. Business law
 6. Informal regulations
-

A.6 Energy Use and Sources

Energy is generally defined as the ability to do work.

I. Activities and Conditions**A. Energy uses**

1. Direct use (fuel, wood, direct heat, steam and related)
2. Production of electricity
3. Internal combustion
4. Distribution of transportation

II. Sustainability Problems**A. Depletion of non-renewable resources**

1. Proven and estimated global reserves

B. Pollution

2. Air
3. Wastes
4. Ecological/ecosystem

III. Scientific and Technical Solutions**A. Alternative production technologies**

1. Co-generation, improved efficiency in generation
2. Improved location and extraction of resources
3. Generation choice-natural gas, clean coal technology
4. Biomass
5. Alternative fuels for vehicles, hybrid electric

B. Efficient use

1. Energy efficiency
2. DSM

C. Pollution control

1. Pre-combustion
2. Post-combustion

D. Renewable non-polluting resources

1. Solar

2. Wind
3. Geothermal
4. Hydro
5. Tidal
6. Fuel cells
7. Hydrogen

IV. Social, Economic, Political, and Regulatory Solutions

A. *Market-based policies*

1. Market-driven changes in end-use
2. Culturally-driven changes in end-use

B. *Direct regulatory control*

1. Command and control (CAA, CAAA, EPACT)
2. Government programs (DSM, LIHEAP, efficiency standards, CAFE)

C. *Government research and development*

1. Tax credits for using renewable energy (PURPA)
2. Technology transfer

A.7 Forest and Land Use

Focused mainly on forest use and land coverage by trees, underbrush, and related growth.

I. Activities and Conditions

A. *Forest uses*

1. Food
2. Fuel
3. Chemicals and medicines
4. Pulp and paper
5. Timber
6. Watershed protection
7. Absorbs carbon dioxide, air pollutants
8. Major ecosystems and wildlife
9. Genetic resources
10. Recreation

II. Sustainability Problems

A. *Forest overuse*

1. Deforestation (for food/fuel)

B. *Forest destruction*

1. Deforestation (for urbanization)
2. Rainforest destruction

3. Desertification
4. Ecosystem and biodiversity demise
5. Pollution and acid rain

III. Scientific and Technical Solutions

- A. *New techniques for forest use and reforestation*
 1. More efficient use of forest products
 2. More successful reforestation
- B. *Sustainable logging practices*
 1. Sustained yield removal of trees
 2. Thinning or patch-cutting vs. clear-cutting
- C. *Use of information technologies*
- D. *Monitoring change*

IV. Social, Economic, Political, and Regulatory Solutions

- A. *Improved legislation*
 1. Logging regulations
 2. Green labeling
 3. Determination of land-property rights
 4. Governmental departments
 - B. *Agro-forestry forms*
 1. Reforestation
 2. Tree conservation
 3. Forest protection
 - C. *Forest management programs*
 1. Transfer of finances, resources, and technology
 2. Biological diversity management
 - D. *Other*
-

A.8 Water Sources and Uses

Activities related to access and uses of the essential life-supporting liquid.

I. Activities and Conditions

- A. *Sources and types*
 1. **Non-point source**
 - a. Land runoff
 - b. Precipitation
 - c. Atmospheric deposition
 - i. Dry deposition (direct deposition from air)
 - ii. Wet deposition (from precipitation, fog, etc.)
 - d. Drainage, seepage, or hydrologic modification

2. **Point source (i.e. discernible, confined, and discrete conveyance), Including:**
 - a. Pipe, ditch, channel, tunnel, conduit
 - b. Well, discrete fissure, container, rolling stock
 - c. Concentrated animal feeding operation, vessel, and floating craft

B. Types

1. Basic forms

- a. Deltas
- b. Estuaries
- c. Coastal zones
- d. Shelves
- e. Deep seas
 - i. Animal products of the sea
 - ii. Vegetable products of the sea
 - iii. Mineral products of the sea
- f. Salt-water lakes

2. Fresh-water types

- a. Atmospheric water
 - i. Precipitation
 - ii. Water vapor
 - iii. Condensed water
- b. Surface water
 - i. Lakes
 - ii. Rivers
 - iii. Wetlands
- c. Ground water and soil water
 - i. Renewal ground water
 - ii. Fossil ground water

3. Manufactured water

- a. Desalinated water for industrial and human uses
- b. Bottled & purified drinking water

C. Manufactured water

1. **Desalinated water for industrial and human uses**
2. **Bottled and purified drinking water**

D. Uses and services

1. **Household and municipal uses**
2. **Industrial uses**
3. **Agricultural**
4. **Eco-system uses**
5. **Technological and scientific uses**

II. Sustainability Problems

A. Human impacts on sources and needs

- 1. Agricultural activity**
 - a. Land degradation
 - i. Salinity
 - ii. Toxics
 - iii. Pesticides
 - iv. Fertilizers
 - v. Domestic animals
 - b. Excessive withdrawals from aquifers and wetlands
- 2. Health and sanitation impacts**
 - a. Limited access to water
 - b. Municipal sewage
 - c. Synthetic detergents
 - d. Solids in household wastes
- 3. Industrial/commercial activity**
 - a. Diversion
 - i. Dams for hydropower
 - ii. Irrigation
 - iii. Recreation
 - iv. Industrial diversion
 - b. Acid rain
 - c. Eutrophication
 - d. Disposal (Nuclear and chemical waste treatment)
 - e. Fresh water pollution
 - f. Sea pollution
- 4. Human interactions with hydrological cycle**
 - a. Through socio-economic activities
 - b. Through recreational purposes
 - c. Through alterations of physical landscapes
 - d. Through technological interventions and practices
- 5. International water issues**
 - a. Water sharing
 - b. Upstream/downstream riparians
 - c. Transboundary pollution
- 6. Natural causes and impacts**
 - a. Droughts
 - i. Scarcity
 - ii. Famine
 - b. Floods
 - i. Water-logging
 - ii. Displacement
 - iii. Diseases
 - c. Intensification and exacerbation
 - i. Driven by socio-economic and demographic factors

- ii. Driven by public policies and decisions
- iii. Driven by international actions

7. Joint human and natural causes

- a. Deteriorating water quality
- b. Aquatic ecosystem destruction
- c. Potential climate impacts
- d. Loss of biodiversity
- e. Disappearing wetlands
- f. Accelerating degradation
- g. Other

III. Scientific and Technical Solutions

A. Supply-side alternatives

1. Water development projects

- a. Surface water
 - i. Dams
 - ii. Reservoirs
 - iii. Canals
 - iv. Ground water aquifers for reservoir use
- b. Ground water
 - i. Wells
 - ii. Pumps
 - iii. Interbasin transfers
 - iv. Recycling and reuse
 - v. Desalination
 - vi. Weather modification (cloud seeding)
 - vii. Vegetation management and water harvesting

B. Demand-side management

1. Network rehabilitation and optimization

- a. Leakage control
- b. Transferring water among alternative uses

2. Water conservation techniques and devices

- a. Metering and monitoring
- b. Improved irrigation practices
- c. Improved industrial practices

3. Water quality improvement

- a. Wastewater treatment
- b. Hazardous and municipal waste management
- c. Pollution prevention control
- d. Other

IV. Social, Economic, Political, and Regulatory Solutions

A. Planning and management

1. **Voluntary participation**
 - a. User groups management
 - b. Stakeholder involvement
 2. **Formal regulations**
 - a. Pricing, standards
 - b. Tradable permits
 - c. Taxes, subsidies
 - d. Other
 3. **Market strategies and mechanisms**
 - a. Treating water as an economic commodity
 - b. Incentives, trading, etc.
 4. **Public and private interactions**
- B. Subsidies modes**
- C. Privatization of services**
- D. Equity strategies**
- E. Improved information systems**
-

A.9 AGRICULTURE

Cultivation of the soil, producing crops, and raising livestock and fish.

- I. **Activities and Conditions**
 - A. **Agriculture**
 1. **Agricultural production**
 - a. Crop production
 - b. Livestock and feedstock production
 - c. Fisheries production
 2. **Management of supply and demand**
 - a. Management of natural resources
 - b. Agricultural science, engineering, and technology
 - c. Storage of products
 - i. Supply networks
 - ii. Inventories and storage
 - d. Processing and packaging
 - e. Shipment and distribution
- II. **Sustainability Problems**
 - A. **Impacts of chemicals and pollutants**
 1. **Impacts on land, water, and air**
 - a. Soil erosion and rangeland degradation
 - b. Erosion
 - c. Water and air pollution
 - i. Emission of nitrates

- ii. Leaching and evaporation of fertilizers
- iii. GHG emissions
 - 1. Depletion of soil organic matter
 - 2. Livestock methane emission

B. *Damage to natural systems*

- 1. Damages due to irrigation systems**
- 2. Damming/diversion of rivers**
- 3. Wasting of water via evaporation**
- 4. Impacts of production choices**
 - a. Narrow genetic base crops and loss of biodiversity
 - b. Breed substitution and crossbreeding
 - c. Destruction of local vegetation and wildlife
- 5. Ecological dislocations**
 - a. Creation of ponds for fishing
 - b. Deforestation
 - c. Erosion of agricultural capacity

C. *Socio-economic dislocations*

- 1. Economic impacts**
 - a. Income effects
 - b. Diminishing returns to intensive production
 - c. Instability of the market
 - d. Unfair competition
 - e. Induced inequalities
- 2. Social impacts**
 - a. Demographic dislocations
 - b. Social dislocations
- 3. Hazards and wastes**
 - a. Health and safety hazards
 - b. Agricultural and agro-industrial residues
 - i. Excessive use of fertilizers and pesticides
 - ii. Plastic and other debris in marine systems
 - iii. Other toxic and non-toxic wastes
- 4. Mismanagement and misuse of technology**
 - a. Heavy use of inputs, energy, and chemicals
 - b. Building of resistance in insect species
 - c. Elimination of natural enemies

- d. Faulty construction and management of services
- e. Faulty allocation of land

III. Scientific and Technical Solutions

A. *Improved agricultural practices*

- 1. Better farm machinery and irrigation systems**
- 2. Less damaging fertilizer application methods**
- 3. Improved capital/labor balances**
- 4. Minimizing use of hazardous chemicals**
 - i. Recycling and reuse
 - ii. Management of hazardous wastes and chemicals
- 5. Principles and practices**
 - a. Integrated pest management (IPM)
 - b. Total quality control measures (TQCM)

B. *Biotechnology innovations and use*

- 1. Improved genetically-engineered plants**
- 2. Improved breed productivity**
- 3. Advances in tissue culture**

IV. Social, Economic, Political, and Regulatory Solutions

A. *Improved markets and mechanisms*

- 1. Effective financial instruments**
 - a. Fees and taxes
 - b. Subsidies and other incentives
 - c. Effective pricing practices
- 2. Improved market access and performance**
- 3. Reliable sources of finance for agriculture**
- 4. Market-based measures for regulation**

B. *Government oversight*

- 1. Provision of resources**
- 2. Enforcing standards in inputs and processes**
- 3. Monitoring of stocks, performance, and quality**
- 4. Innovation in policies and credit facilities**

C. *Improved socio-economic conditions*

- 1. Reduction/termination of debt**
- 2. Improved income distribution**
- 3. Better working conditions**
- 4. Enhanced role of women**
- 5. Improved health and sanitation conditions**

D. *New policy responses*

- 1. Formal intra- and inter-national cooperation**
 - a. Technology transfer
 - b. Improved cross-border relations
 - c. Measures to alleviate debt, trade barriers, and other obstacles

2. **Informal intra- and inter-national activities**
 - a. NGO activities
 - b. Collaboration in research and development
 - c. Business measures and joint ventures
 3. **Enhanced institutional collaboration**
 - a. Intra- and inter-governmental collaboration
 - b. Activities supporting international collaboration
 - c. Activities towards new agreements
 4. **New policies and principles**
 - a. Precautionary principle (PP)
 - b. Evolution of new principles
-

A.10 Trade and Finance

Institutionalized exchanges in goods and services, including financial transfers, and investments

- I. **Activities and Conditions**
 - A. *Trade*
 1. **Who trades**
 2. **What is traded**
 3. **How it is traded**
 - B. *Finance*
 1. **Financial systems**
 2. **Investments**
 3. **Instruments**
- II. **Sustainability Problems**
 - C. *Environmental impacts of trade*
 1. **Wastes due to conventional process and production methods (PPMs)**
 - a. Product-related PPMs (PPMs transmitted by product)
 - i. Food safety and health
 - ii. Non-recyclable packaging
 - b. Non-product related PPMs
 2. **Type of environmental impact**
 - a. Transboundary pollution
 - i. Water pollution
 - ii. Air pollution
 - iii. Resource damage and depletion
 - iv. Loss of biodiversity

- b. Global environmental degradation
- c. Regional, national, and local environmental impacts

D. Impacts of trade competitiveness

- 1. Distortions in input uses
- 2. Reallocations due to environmental regulations

III. Scientific and Technical Solutions

A. Improved products and processes

- 1. Less-polluting materials
- 2. effective standards
 - a. Product standards
 - i. Sanitary measures
 - ii. Health measures
 - b. Process standards
 - i. Improved waste management
 - ii. Safe waste disposal

B. Improved packaging and shipment

- 1. Returnable and multi-life containers in packaging
- 2. Non-polluting shipment methods

C. Cleaner production

D. Eco-efficiency measures

- 1. Products and processes
- 2. Waste management and disposal
- 3. Minimizing inputs
- 4. Streamlining processes
- 5. Substitutes

IV. Social, Economic, Political, and Regulatory Solutions

A. Market strategy

- 1. Equity and efficiency
- 2. Incentives for financial and technical assistance to LDCs
 - a. Market access
 - b. Debt relief
 - c. Access to finance and investment
 - d. Access to “new” technology
- 3. Type of government intervention
 - a. Government intervention
 - b. Innovation in manufacturing process
 - c. Pricing of natural resources
- 4. Shifts in consumer behavior
 - a. Responsive investment decisions
 - b. Environmental consciousness
 - c. Consumer pressures for health and environment

- B. Novel financial instruments**
- C. Trade measures and policies**
 - 1. Trade instruments for environment**
 - a. Bans and restrictions
 - b. Trade sanctions
 - c. Tariffs
 - d. Border tax adjustments
 - e. Countervailing duties
 - f. Mandatory eco-labels
 - 2. Environmentally-sensitive trade policies**
 - a. National environmental legislations
 - b. Harmonization
 - c. Environmental agreements
 - i. CITES
 - ii. Basel Convention
 - iii. Montreal Protocol
 - iv. Other
 - d. International institutions for trade
 - i. GATT
 - ii. WTO
 - iii. UNCTAD
 - iv. ITO
 - v. Other
 - e. Voluntary arrangements and agreements
- D. Improved accounting and measurements**
 - 1. Products and processes**
 - 2. Trade and related exchanges**
- E. Provisions for dispute resolution**
 - 1. Mode**
 - a. Formal
 - b. Informal
 - c. Mixed
 - 2. Status**
 - d. Binding
 - e. Non-binding

A.11 Industry and Manufacturing

Includes mining, manufacturing, and construction.

- I. Activities and Conditions**
 - A. Industry and manufacturing**
 - 1. Final products**
 - a. Construction
 - b. Mining, extraction, processing

- c. Manufacturing
- d. Energy industries
- e. Electronics and electronic industries
- f. Paper and pulp
- g. Automotive and transport industries
 - i. Air
 - ii. Land
 - iii. Water
 - iv. Space
 - v. Underground
 - 1. Machinery and equipment
 - 2. Information and telecommunications industries
 - 3. Food and agriculture
 - 4. Service sector
 - 5. Legal and financial services
 - 6. Other services
- 2. Intermediary products and processes**
 - a. Industrial operations
- 3. Supplier systems and networks**
- 4. Waste-related industries**

II. Sustainability Problems

A. *Environmental impacts*

- 1. Impacts on land, water, air, and underground spaces**
 - a. Air pollution
 - b. Water, river ways, aquifers, and marine pollution
 - c. Soil degradation
 - d. Chemical changes
 - e. Reduced visibility and smog effects
- 2. Specific modes and mediums of pollution and dislocations**
 - a. Acid rain
 - b. Emission of trace metals
 - c. Other toxic emissions
- 3. Threats to life-supporting properties**
 - a. Los of habitat
 - b. Deforestation
 - c. Damages to marine life
 - d. Reduction of biodiversity

B. *Climate change*

- 1. Greenhouse gas emissions**
- 2. CFC impacts and ozone depletion**

3. **Interactive effects of GHG**
- C. Hazards and wastes**
 1. **Solid and non-solid wastes**
 2. **Safety, health, and related hazards**
- D. Socioeconomic dislocations**
 1. **Economic impacts**
 - a. Income effects
 - b. Employment effects and unemployment
 2. **Social and political impacts**
 - a. Demographic dislocations
 - b. Quality of life impacts
 - c. Urbanization strains
 3. **Consumption of non-renewable resources**
 - a. Energy resources
 - b. Minerals resources
 - c. Other natural resources
 - i. Wood and wood products
 - ii. Food-related products
 - iii. Providers of ecological services

III. Scientific and Technical Solutions

- A. Designing for environment**
 1. **Industrial ecology**
 2. **Life-cycle analysis**
 3. **Industrial metabolism**
 4. **Input-output mechanisms**
- B. Best S and T practices**
 1. **Substitution and design alternatives**
 - a. Pertaining to functions
 - b. Pertaining to products
 - c. Pertaining to entire production process and products
 - d. Pertaining to sales of products or of functions
 2. **Cleaner production**
 3. **Strategies toward waste and discharges**
 - a. Waste minimization
 - b. Waste management
 - c. Waste as raw material
 4. **Eco-efficiency**

IV. Social, Economic, Political, and Regulatory Solutions

- A. New principles and best practices**
 1. **Polluter pays principle (PPP)**
 2. **Pollution prevention**
 3. **Eco-labeling**

4. **Prior informed consent (PIC)**
 5. **Separate, but differentiated responsibility**
 6. **Other evolving principles**
- B. Green regulation and legislation**
1. **Formal regulations**
 - a. Improved standards and codes
 - b. Harmonization policies
 - i. National
 - ii. Regional
 - iii. International
 - iv. Sectoral
 2. **Voluntary restrictions and regulations**
 3. **Informal regulations**
- C. Market strategies**
1. **Incentives for greening**
 - a. Target of incentives
 - i. For waste minimization
 - ii. Waste management
 - iii. Other adjustments
 - b. Instrument of incentives
 - i. Financial instruments
 1. Subsidies
 2. Taxes
 3. Deposit-refund systems
 4. Experimental measures
 - a. Performance instruments
 - b. Evaluation instruments
 2. **New market instruments**
 - a. Emission trading
 - b. Financial instruments
 - c. Insurance strategies
 - d. Other instruments
- D. Full cost accounting**
1. **Targeted to activities and agents**
 - a. For economies and firms
 - b. For tradable and non-tradable
 2. **Related to requirements for undertaking full cost accounting**
 - a. Education of public and industrial workers
 - b. Training programs
 - c. Experimental and innovative accounting mechanisms
-

A.12 Mobility and Transportation

The movement of goods, services, and persons from place to place, and the various means by which such movement is accomplished.

I. Activities and Conditions

A. Mobility and transportation

1. Utilization of transport systems and modes

- a. Road transport
 - i. Motorized road transport
 - ii. Non-motorized road transport
- b. Railways
- c. Air transport
- d. Marine transport

2. Management of transportation supply and demand

II. Sustainability Problems

A. Global change and greenhouse gas (GHG) emissions

1. Broad impacts

- a. Climate change
- b. Ozone depletion
- c. Air pollution

2. GHG emissions

- a. Emissions due to mobility and transport
 - i. Carbon dioxide emission
 - ii. Methane emission
 - iii. Nitrous oxide emission
 - iv. Chlorofluorocarbons emission
 - v. Toxicity
- b. Effects of interactions among GHG

B. Environmental and health effects

1. Local and regional impacts

- a. Basic mode
 - i. Due to emissions
 - ii. Due to congestion
- b. Specific impacts
 - i. Acid rain
 - ii. Photochemical smog
 - iii. Other impacts
- c. Impacts of excessive use of fossil fuel
 - i. Health hazards in urban areas
 - ii. Concerns about energy insecurity
 - iii. Problems associated with fossil fuel dependence

C. Socio-economic dislocations**1. Problems due to mobility systems**

- a. Traffic congestion and density
- b. Poor maintenance of systems, modes, vehicles
- c. Improper manufacturing of vehicles and building of system
- d. Excessive and inefficient fuel consumption
- e. Expanded wastes and material byproducts
- f. Pollution of waterways

2. Problems shaped by physical conditions

- a. Local topographical conditions
- b. Space configurations
- c. Implications of regulatory conditions

3. Problems due to uses and users

- a. Traffic accidents
- b. Noise pollution
- c. Social strains
- d. Loss of natural habitats
- e. Loss of agricultural lands

4. Specific locations of concern

- a. Megacities
- b. Rapidly urbanized areas

III. Scientific and Technical Solutions**A. Efficient mobility systems****1. Search for alternative transport fuel**

- a. Forms of alcohol fuel
- b. Solar electric vehicles
- c. Hydrogen as fuel

2. Improved networks and transportation

- a. Rationalizing transport systems and modes
- b. Encouraging low or no fuel-based transport

B. Improved vehicles and fuel types**1. Vehicle innovations**

- a. Hybrid cars
- b. Other new transport modes

2. Cleaner fuel and chemical inputs

- a. Fuel-related
- b. Substitutions for damaging chemicals

C. Substitution of functions**1. Communication vs. transportation****2. Shifts and reduction in transport loads**

IV. Social, Economic, Political, and Regulatory Solutions

A. *Emission standards and audits*

1. **Creating and enforcing standards**
2. **Mandating and undertaking audits**

B. *Markets and mechanisms for cleaner mobility*

1. **Incentives for cleaner mobility**
2. **incentives for recycling and minimizing materials and wastes**
3. **effective fare structures and systems**

C. *Eco-efficiency and safety measures*

1. **Improved supply-demand planning systems**
2. **Encouraging investments in new technologies**
3. **Improving transport management systems**
4. **Designing and enforcing transport systems safety**
 - a. Design, manufacture, and operation of vehicles
 - b. Harmonization of policy approaches
 - i. Within jurisdictions
 - ii. Within transport systems
 - iii. Across national jurisdictions
 - iv. Across International jurisdictions
5. **Improved international responses**
 - a. Response channels and actors
 - i. Non-governmental channels
 - ii. Governmental channels
 - b. Mode and type of response
 - i. Formal and mandated
 - ii. Voluntary regulation
 - iii. Mixed types and modes
6. **Enforcing safety in transport, packaging, and storage of hazardous goods and materials**

A.13 Conflicts and Wars

Manifestations of organized goal-seeking violent behavior associated with hostility, undertaken by individual entities singly or jointly.

I. Activities and Conditions

A. *Types of conflict*

1. Scope and extent

- a. Civil vs. international
- b. Limited vs. diffused
- c. Organized vs. non-organized

- 2. Participant characteristics**
 - a. Size
 - b. Demography
 - c. Capability
- 3. Types of warfare**
 - a. Conventional
 - b. Nuclear
 - c. Terrorist activity
 - d. Guerrilla conflict
 - e. Independence movements
 - f. Combined activities

B. Causes and sources

- 1. Security concerns**
 - a. Windows of opportunity
 - b. Pre-emptive strikes
 - c. Territorial concerns
 - d. Resources
 - e. Alliances
 - f. Capabilities
- 2. Economic**
 - a. Access and control of resources
 - b. Market competition
- 3. Socio-political**
 - a. Gender issues
 - b. Nationalism
 - c. Militarism
 - d. Ideology
 - e. Ethnicity
 - f. Religion
- 4. Conflict processes**
 - a. Spirals
 - b. Arms races and competition
 - c. Collapse of empires or governments
- 5. Misperceptions vs. strategic moves**

C. Military-related activities

- 1. Military systems**
 - a. Components
 - i. Armies, navies, air forces
 - ii. Regular, reserve, and mixed
 - 1. Wants and needs of the organizations and the wishes of senior officers affect a government's policy
 - 2. The military experience affects society's values

- b. Weapons and weapon systems
 - i. Types
 - 1. Conventional
 - 2. Chemical
 - 3. Biological
 - 4. Nuclear
 - ii. Manufacture, trade, and distribution
 - iii. Disposal
 - iv. Management

II. Sustainability Problems

A. *Environmental damages*

1. **Conventional warfare**

- a. Transportation
- b. Direct impact (destruction of terrain)
- c. Indirect impact (destruction of human-made facilities)
 - i. Radiation from nuclear facilities
 - ii. Release of high-level toxins from chemical manufacturing and storage
 - iii. Release of enormous quantities of water from the destruction of dams
- d. Post-war remnants
 - i. Land and sea mines
 - ii. Duds (artillery, bombs, grenades, etc.)
- e. Seepages

2. **Possible effects of nuclear war**

- a. Immediate effects
- b. Long-term effects
 - i. Climate
 - ii. Atmosphere
 - iii. Radiation
 - iv. Biological response

B. *Social impacts*

1. **Demographic damages**

- a. Casualties
- b. Genocide
- c. Ethnic targeting
- d. Forced dislocation

2. **Refugees and returnees**

- a. Location
 - i. Internal and external
 - ii. Regional and international

- b. Extent of flow and concentration
- c. Costs and impact
 - i. On people
 - ii. On governments
 - iii. On institutions

3. Health impact

- a. Spread of disease
- b. Famine and malnutrition
- c. Psychological
- d. Physical

4. Education and human capacity

- i. Perpetuating false histories due to national policies
- ii. Diverts research towards war and military-related aims
- iii. Constraints on skill development

5. Restriction of civil liberties

C. Economic impacts

1. Economic losses from conflict and violence

- a. Farmland and pastures
- b. Forests and timber
- c. Shipping routes
- d. Crime and plunder
- e. Other tangibles and intangibles

2. Problems from wartime conditions

- a. Stricter regulation and control
- b. Higher taxation
- c. Diversion of labor and conscription
- d. Dependence of economy on defense industries

D. Impacts on sovereignty

1. Imperialism and colonialism

- a. State destruction

2. State-building

III. Scientific and Technical Solutions

A. Improved warning systems

- 1. Intelligence
- 2. Communication

B. Enhanced monitoring systems

C. Improved disposal of munitions

IV. Social, Economic, Political, and Regulatory Solutions

A. Confidence building measures and improved dispute resolution

B. Diplomacy and negotiations

- 1. Types of negotiations

- a. Formal and informal
 - b. Governmental and non-governmental
 - 2. Scale and scope**
 - a. Unilateral
 - b. Bilateral
 - c. Multilateral
 - d. International organizations
 - 3. Enhancing social contracts**
 - a. Formal and Informal mechanisms
 - b. Reinforcing accountability
 - C. Post-conflict reconstruction**
 - 1. Rebuilding**
 - a. Socio-economic
 - b. Physical
 - c. Environmental remediation
 - d. Support
 - 2. Strengthening restitution and accountability**
 - a. Repatriation and safe supports
 - b. Protection measures
 - c. Rebuilding policy
 - 3. Improved institutional forms and measures**
 - a. Legal arrangements
 - b. Institutional developments
 - c. Organizational arrangements
-

A.14 Governance and Institutions

Authoritative and legitimate modes of managing public and private interests, at international, national, state and regional, and local/municipal levels.

- I. Activities and Conditions**
 - A. Provision of public goods**
 - 1. Physical infrastructure**
 - a. Transportation
 - b. Communication
 - c. Other
 - 2. Social infrastructure**
 - a. Identity confirmation
 - b. Defining and maintaining national image
 - 3. Regulation**
 - a. Formal modes
 - b. Informal modes
 - c. Mixed modes
 - 4. Legislation**
 - a. Executive modes and decrees

- b. Legislative systems
 - i. Formal institutional
 - ii. Informal or traditional
- 5. Adjudication and dispute settlement**
 - a. Formal mechanisms
 - i. Courts of law
 - ii. Claims systems
 - b. Informal mechanisms
 - c. Traditional mechanisms
- 6. National security**
 - a. Defense from external threats
 - i. Funding of defense-related activities and research and development
 - ii. Procurement and maintenance of armed forces
 - b. Internal law and order
- 7. Distribution of benefits and entitlements**
 - a. Social security
 - b. Unemployment benefits
 - c. Insurance coverage
 - i. Medical
 - ii. Social services
 - iii. Personal damages

B. Management of interests and policies

- 1. Articulation of demands**
 - a. Balancing interests
 - b. Representation of interests
 - c. Defining authoritative preferences
- 2. Intermediation processes**
 - a. Political parties
 - b. Informal political groupings
 - c. Forms of representation
 - d. Forms of political participation
- 3. Influencing external activities and policies**
 - a. Shaping foreign and economic policies
 - b. Defining position toward globalization processes
- 4. Managing governance loads and capabilities**
 - a. Succession issues
 - b. Accountability and related issues
 - c. Policy formulation and consequences
 - d. Managing government capabilities

II. Sustainability Problems

A. Socioeconomic and political pressures

- 1. Population demands**

- a. Changes in amounts of demand for basic resources (food, energy, etc.)
- b. Demands due to rural-urban
- c. Demands due to immigration
- 2. Equity demands and pressures**
 - a. Enhanced ethnic, cultural, racial disparities in wealth and opportunities
 - b. Enhanced income and/or class disparities
 - c. Enhanced regional and/or spatial disparities
- 3. Changes in the composition of demand**
 - a. For types of foodstuffs
 - b. For energy resources
 - c. For infrastructure and services
 - d. Other

B. Challenges to legitimacy

- 1. Internal challenges**
 - a. Failures of representation
 - i. Cultural or ethnic tensions
 - ii. Tensions due to changes in demographic composition
 - iii. Pressures due to migration (internal and external)
 - b. Conflicts for control of governance
 - c. Breakdown of social order and/or the social contract
- 2. External challenges**
 - a. Foreign military activity
 - b. Competitive pressures in the international economy
 - c. Intended or unintended population inflows
 - d. Specific economic threats
- 3. Changes due to territorial boundaries**
 - a. Due to session movements
 - b. Due to territorial acquisitions
 - c. Due to unification

III. Scientific and Technical Solutions

A. Marshalling innovations for demand management

- 1. Monitoring consumer and voter behavior**
- 2. Uses of technology networks for connectivity to constituencies**
- 3. Facilitating access to benefits and services**

B. Pursuing eco-efficiency in public infrastructure and enterprises

- 1. Greening of governance and institutions**

- a. Greening of infrastructure and services
- b. Greening of physical processes and deliverables

IV. Social, Economic, Political, and Regulatory Solutions

A. *Improved conduct of collective action*

- 1. **Demand management**
- 2. **Collective security provisions**
 - a. Formal accords and agreements
 - i. Bilateral
 - ii. Regional
 - iii. International
 - 1. Informal arrangements
- 3. **Improving representation**
- 4. **Effective interest articulation**
- 5. **Routinization of responses**
 - a. Bilateral
 - b. Regional
 - c. International

B. *Effective institutional and civic feedback*

- 1. **Strengthening civic performance**
 - a. Empowering community participation
 - b. Facilitating feedback on action and decision
 - 2. **Establishing institutional accountability**
 - 3. **Commonality in reporting formats**
 - 4. **Facilitating access to financial resources**
 - a. Creation of new credit mechanisms
 - b. Expanding opportunities
 - c. Strengthening effectiveness of safety nets
-