

The Natural Step Framework and Pollution Prevention



Chad Park & Pong Leung

The Natural Step Canada

7th Canadian Pollution
Prevention Roundtable

Calgary, Alberta

June 12, 2003

- Introduction
- What is sustainability?
- How can we use it for planning and decision making?
- How can we use it for the design and selection of tools?



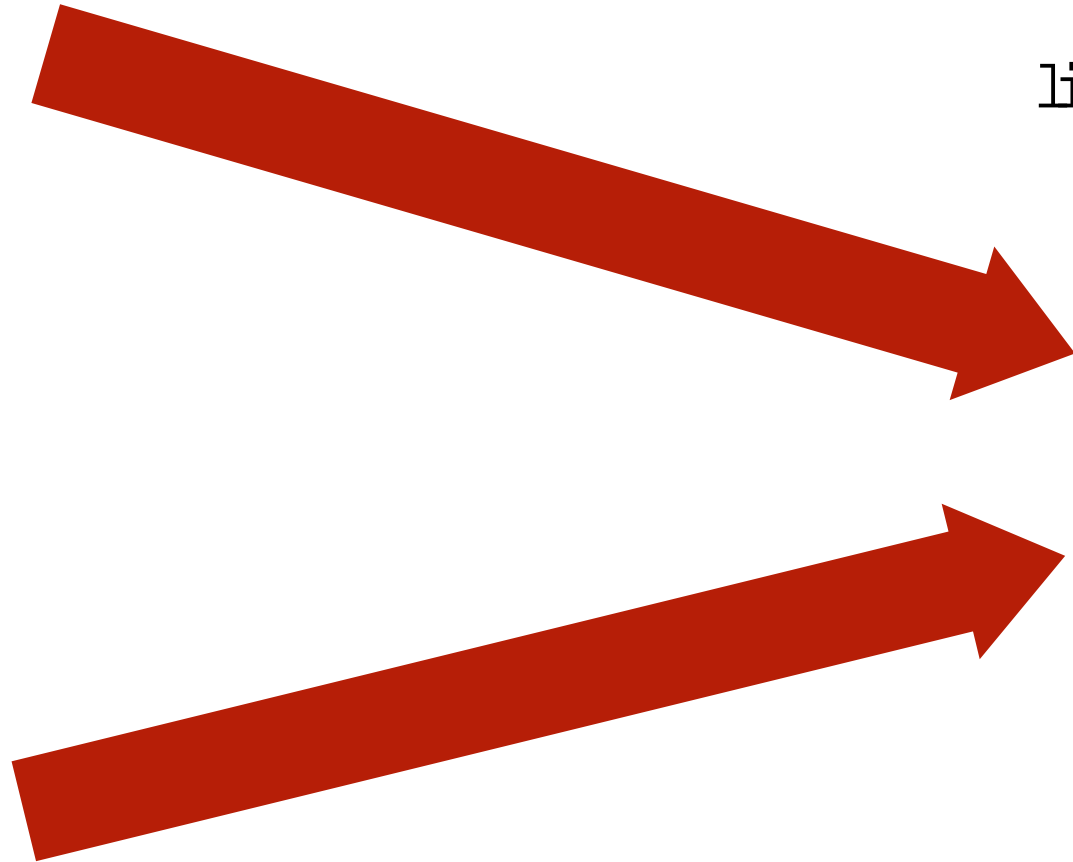
The Natural Step

- Swedish roots
- International NGO: Sweden, U.S., U.K., Canada, Australia, New Zealand, Japan, South Africa, Israel
- Scientific consensus
- Framework for strategic decision making
- Role models





The Funnel Paradigm



life supporting resources

declining

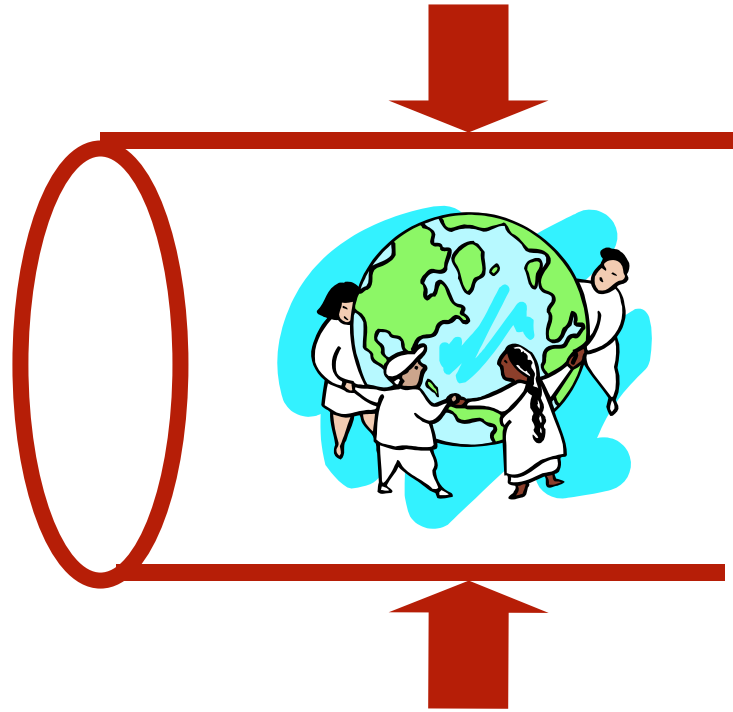
consumption of
life supporting
resources

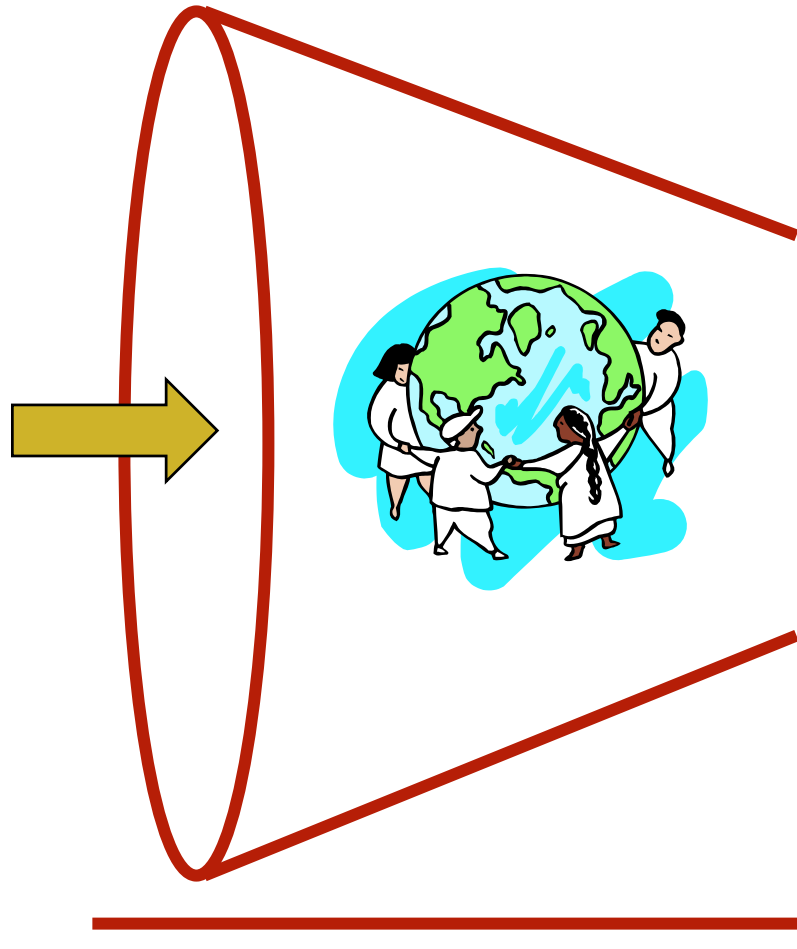
increasing



The Cylinder Paradigm

**= impacts seen as
trade-offs for successful industrial society...**



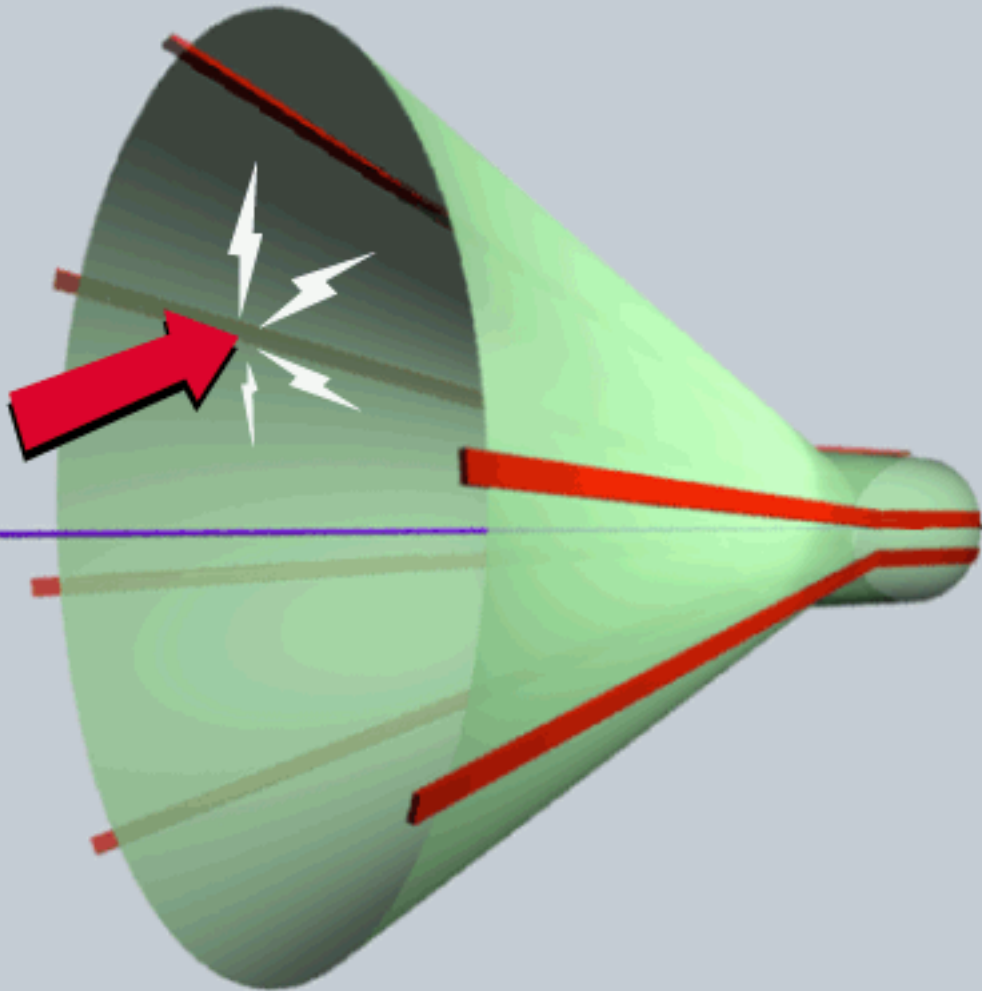


Cropland
Forests
Marine production
Climate
Pollution
Population





Don't hit the wall!



Foresee changes:

- **Resource costs**
- **Waste management**
- **Tax, legislation, insurance, loans**
- **International agreements**
- **Credibility**
- **Employees**
- **Community**

Cylinder → Funnel

- Impacts come and go
- Impacts isolated
- Sustainability idealistic
- Measures cost
- Cost/benefit
- Ethical issue
- Middle management

- Declining potential
- System errors
- Sustainability benchmark
- Investments
- Lowest cost
- Strategic issue
- Top management

Impacts in rear-mirror – lost in the leaves...

**-Mankind
can not save
every other
beetle**

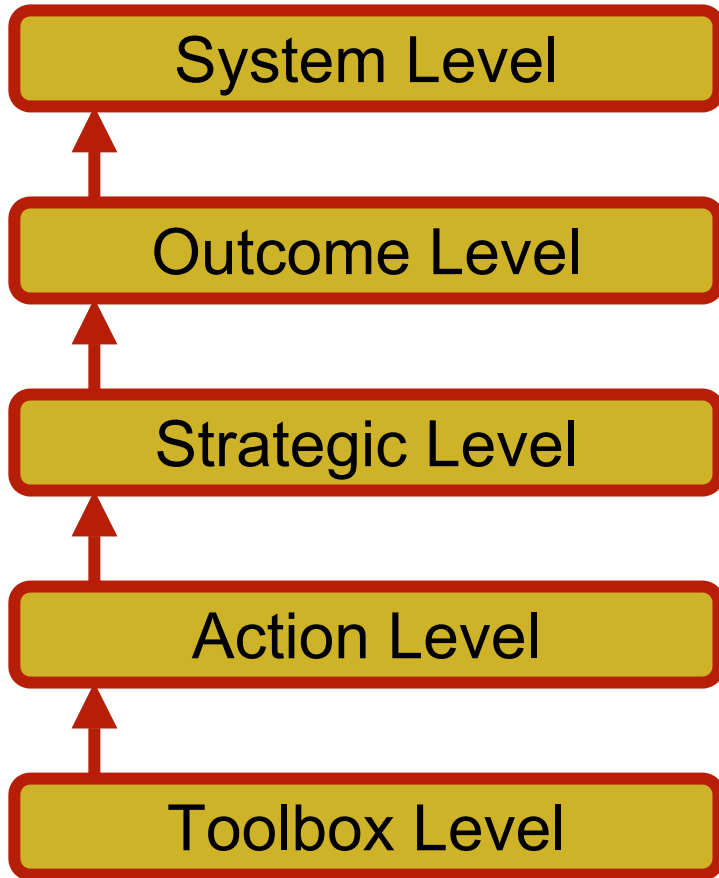
**“Global warming
– no issue”**

**“Scientists
disagree”**

**-There is
no ozone
hole!**

**-Can we iron out the
greenhouse effect?**

Level 1: The System

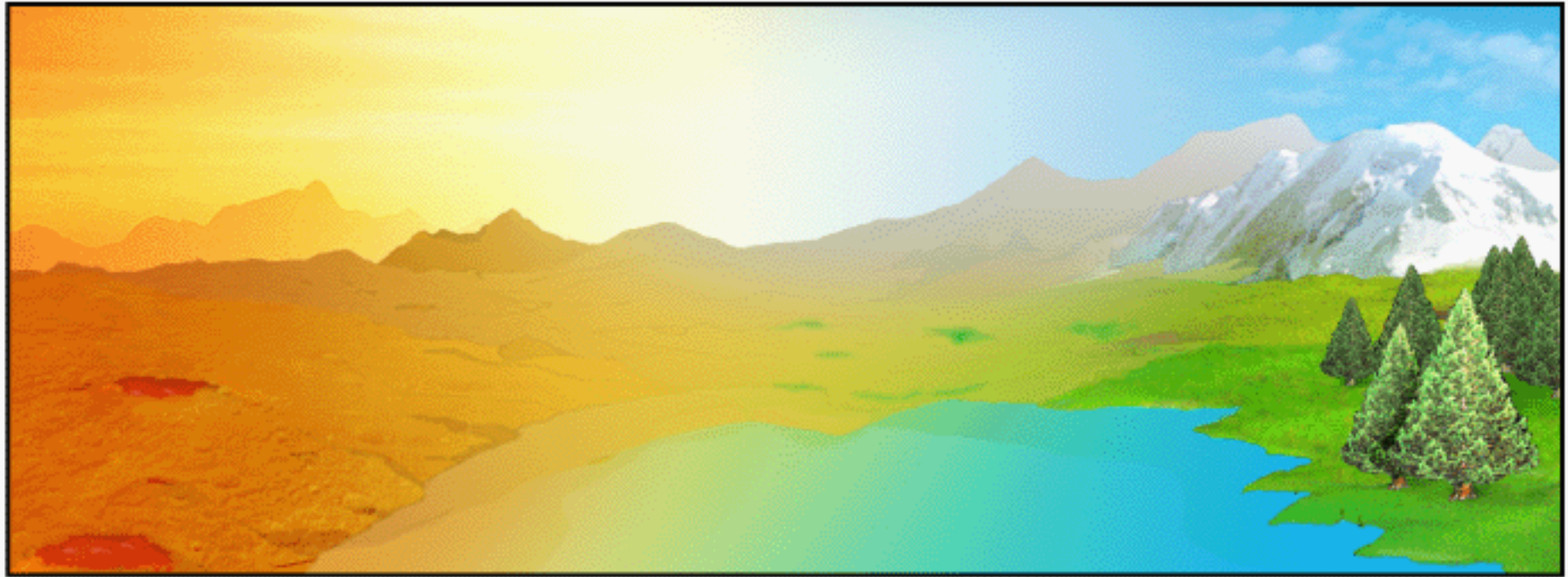




- Matter and Energy do not disappear
(Conservation Law)
- Matter and Energy tend to disperse
(Entropy Law)
- The Order, Concentration, and Structure of matter
determines Material Quality
- Photosynthesis is the principle process by which
net order is produced

Natural Cycles

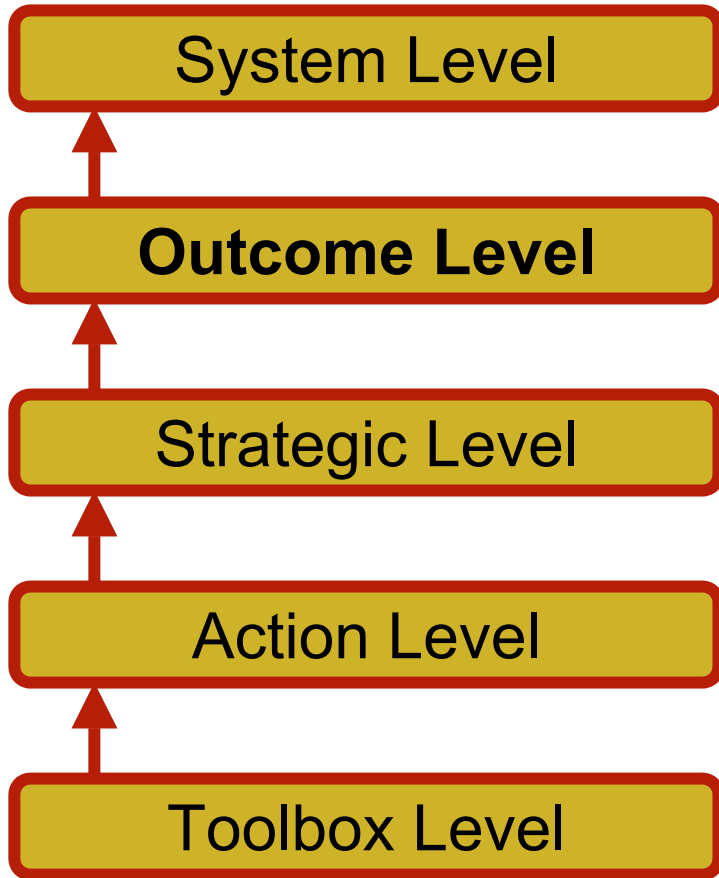




System
Society and Ecosystem

(Level 1)

Level 2: Success



Success =
Sustainability





What is Success in Sustainability?

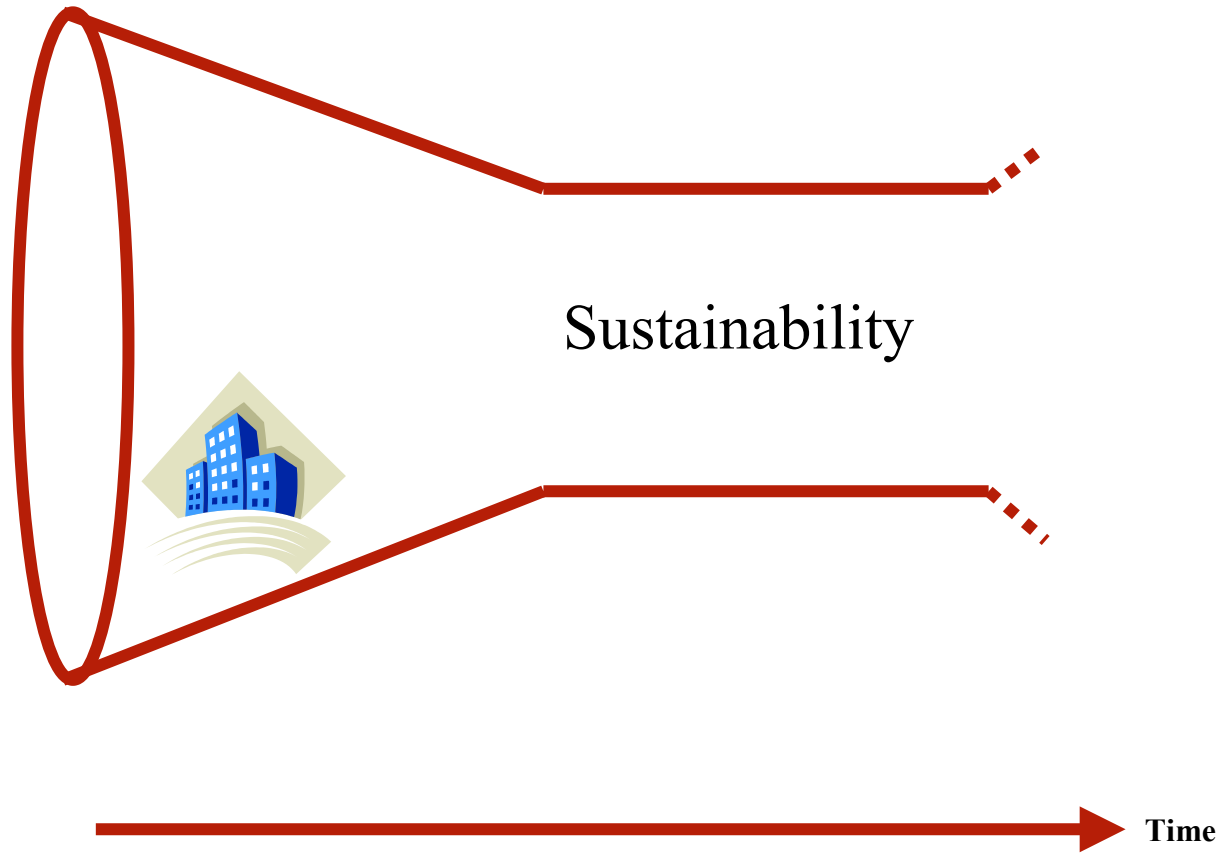


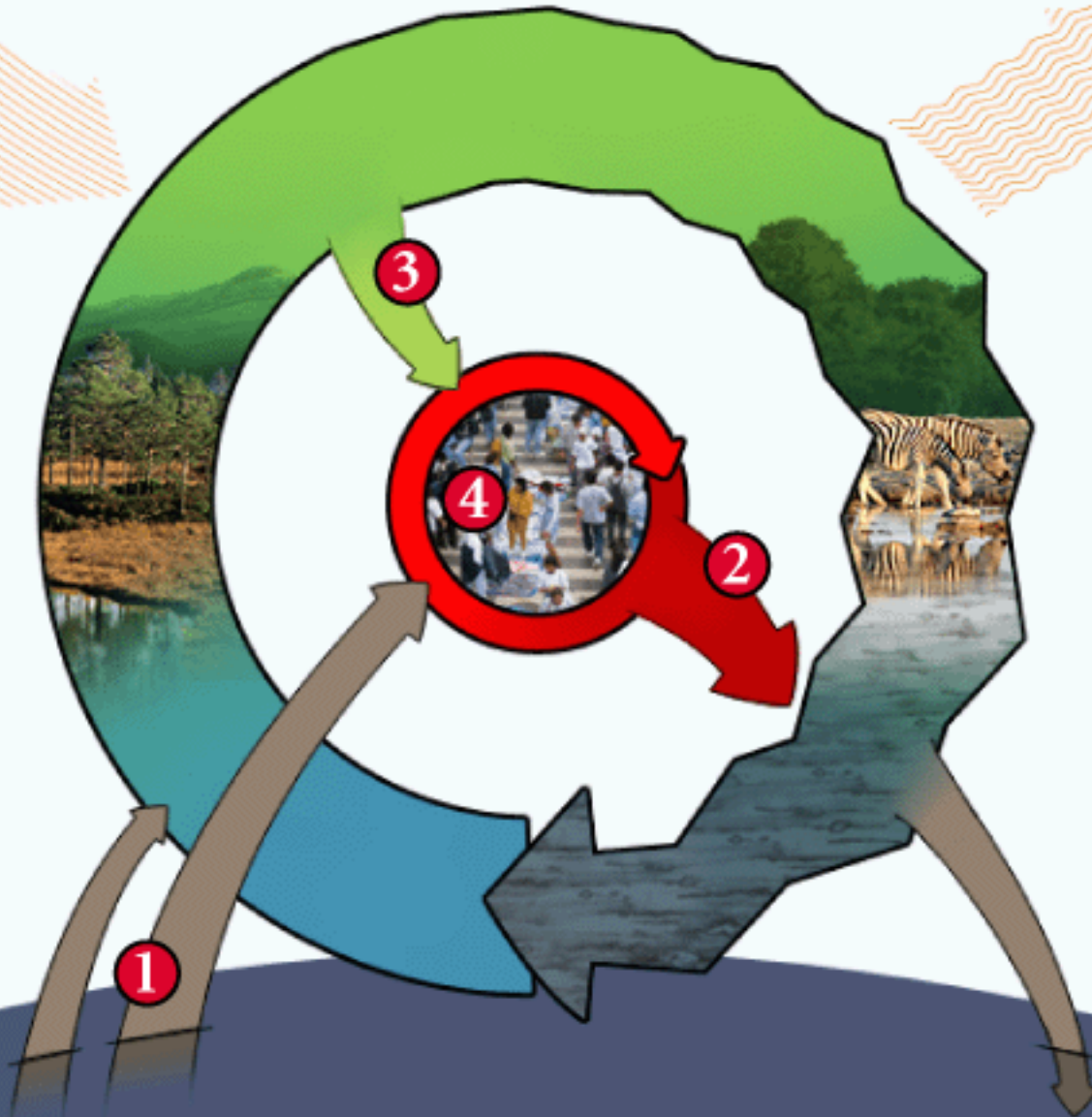
Principles of Sustainability Should:

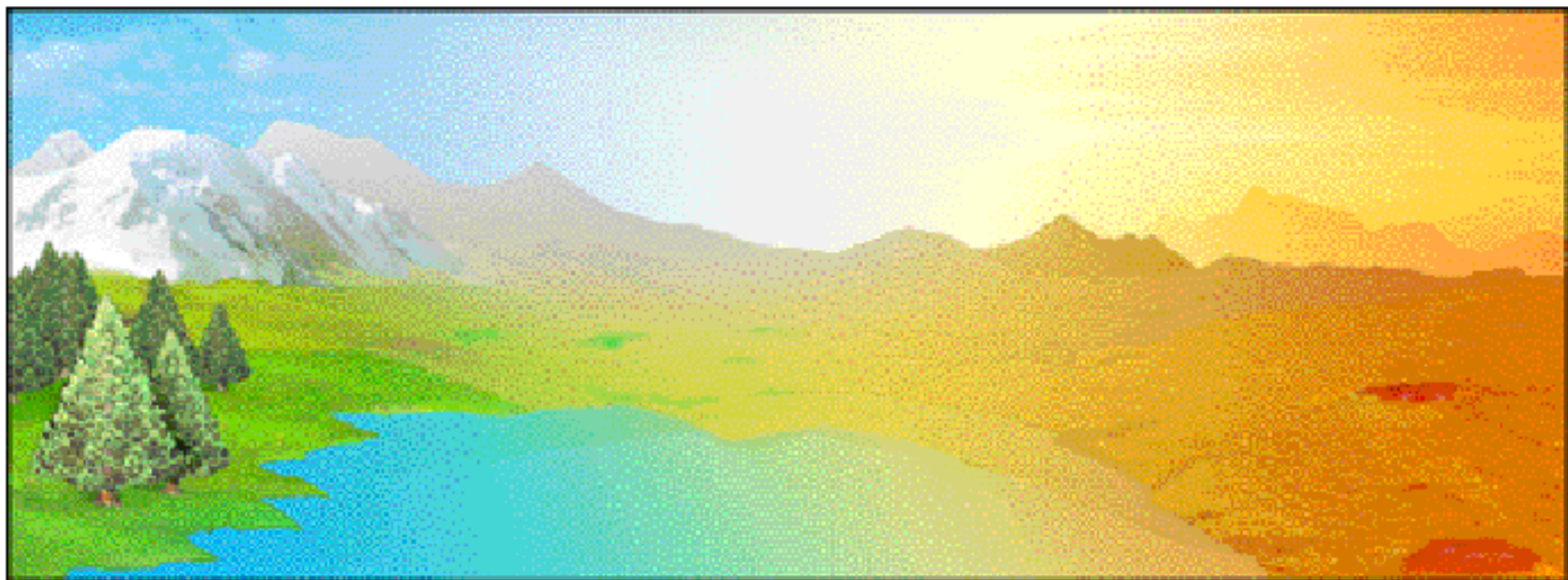


- Cover the successful outcome (i.e. sustainability)
- Be general enough (to be independent of scale)
- Be concrete enough (to guide problem analysis and creative solutions)
- Be non-overlapping (to support comprehension and monitor progress)











In a sustainable society, nature is not subject to systematically increasing:

... concentrations of substances extracted from the Earth's crust;

• HALOGENATED COMPOUNDS

chlorodifluoromethane
chlorotrifluoromethane
dichlorofluoromethane
chloromethane
trichlorofluoromethane
dichloroethylene
Freon 113
methylene chloride
chloroform

1,1,1 - trichloroethane
carbon tetrachloride
trichloroethylene
chloropentane
dibromochloromethane
tetrachloroethylene
dichloropropene
chlorobenzene
iodopentane

3-methyl-1-iodobutane
chloroethylbenzene
dibromodichloromethane
dichlorobenzene
chlorodecane
trichlorobenzene

• ALDEHYDES

acetaldehyde
methyl propanal
n-butanal
methylbutanal
crotoaldehyde
n-pentanal
n-hexanal
furaldehyde
n-heptanal
benzaldehyde
n-octanal
phenyl acetaldehyde

n-nonanal
methyl furaldehyde
n-decanal
n-undecanal
n-dodecanal

• KETONES

acetone
methyl ethyl ketone
methyl propyl ketone
methyl vinyl ketone
ethyl vinyl ketone
2-pentanone
methyl pentanone
methyl hydrofuranone
2-methyl-3-hexanone
4-heptanone
3-heptanone
2-heptanone
methyl heptanone
furyl methyl ketone
octanone

acetaphenone
2-nonanone
2-decananone
alkylated lactone
phthalide

• OXYGENATED ISOMERS

C4H6O
C4H8O
C5H10 O
C6H8O
C6H10 O
C6H12 O
C7H10 O
C7H14 O2
C6H6O2
C6H14 O2
C6H16 O

C7H8O2
C7H10 O2
C9H18 O
C8H6O2
C10H12 O2
C10H14 O
C10H16 O
C10H18 O
C10H20 O
C10H22O
C9H8O2
C11H20O

• ALCOHOLS

methanol
isopropanol
2-methyl-2-propanol
n-propanal
1-butanol
1-pentanol
x-furfuryl alcohol
2-ethyl-1-hexanol phenol
2,2,4-trimethylpenta-1,3-diol
x-terpineol

• ACIDS

acetic acid
decanoic acid

• SULFUR COMPOUNDS

sulfur dioxide
carbon disulfide
dimethyl disulfide
carbonyl sulfide

• NITROGEN COMPOUNDS

nitromethane
methyl acetamide
benzonitrile
methyl cinnoline

• ESTERS

vinyl propionate
ethyl acetate

ethyl-n-caproate
isoamyl formate

• ETHERS

dimethyl ether
dihydropyran

• EPOXIDE

1,8-cineole

• FURANS

furan
tetrahydrofuran
methyl furan
methyl tetrahydrofuran
ethylfuran
dimethylfuran

2-vinylfuran
furaldehyde
2-n-butylfuran
2-pentylfuran
methylfuraldehyde
furyl methyl ketone
benzofuran

• ALKANES

13 in the group
• ALKENES
11 in the group
isoprene

• ALKYNES

7 in the group

• CYCLIC

cyclopentane
methyl cyclopentane
cyclohexane
C10H14 isomers
C10H16 isomers
limonene
methyl decalin
x-pinene
camphene
camphor
e. methyl cyclohexane
• AROMATICS
benzene toluene

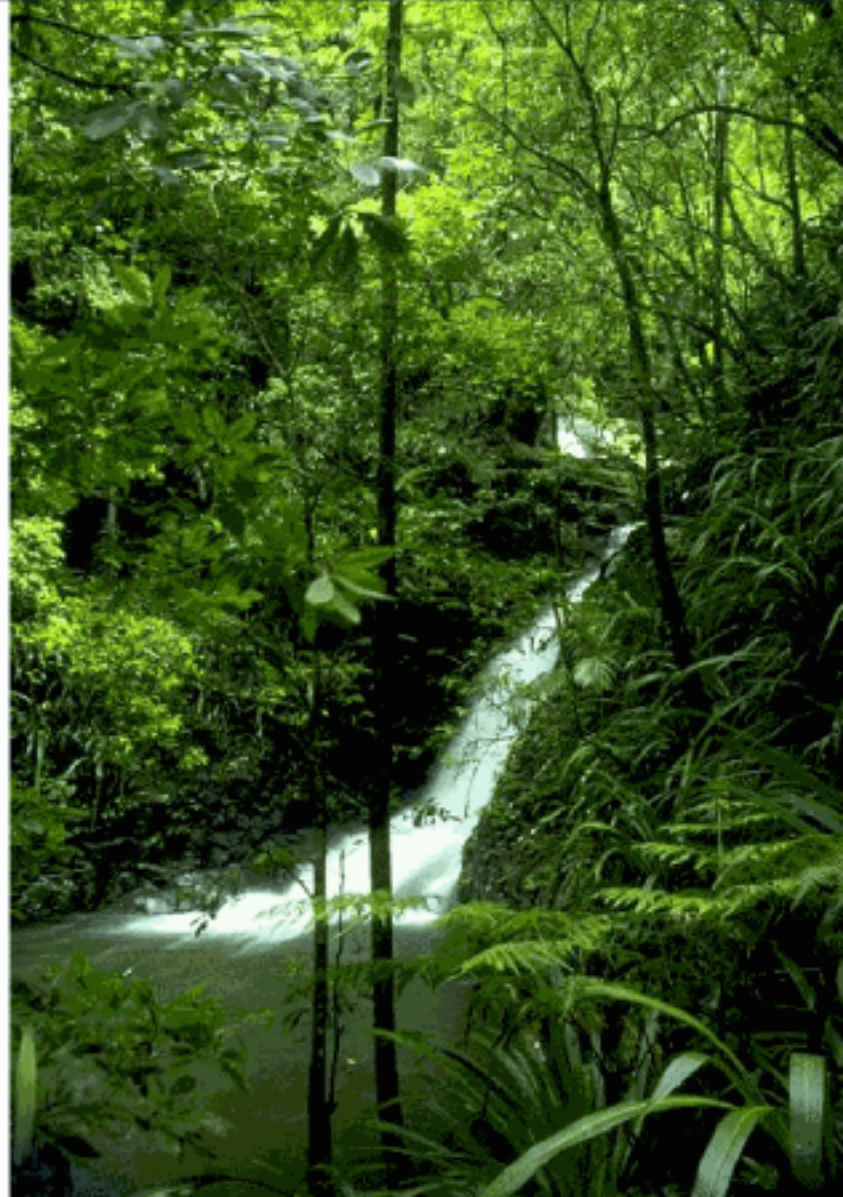
ethylbenzene
xylene
phenyl acetylene
styrene
benzaldehyde
methyl styrene
dimethyl styrene
C5-alkylbenzene isomers
naphthalene
C6-alkylbenzene isomers
C3-alkylbenzene isomers
C4-alkylbenzene isomers
© Paul Hawken, Karl-Henrik Robert, and The Natural Step

In a sustainable society, nature is not subject to systematically increasing:

... concentrations of substances produced by society ;

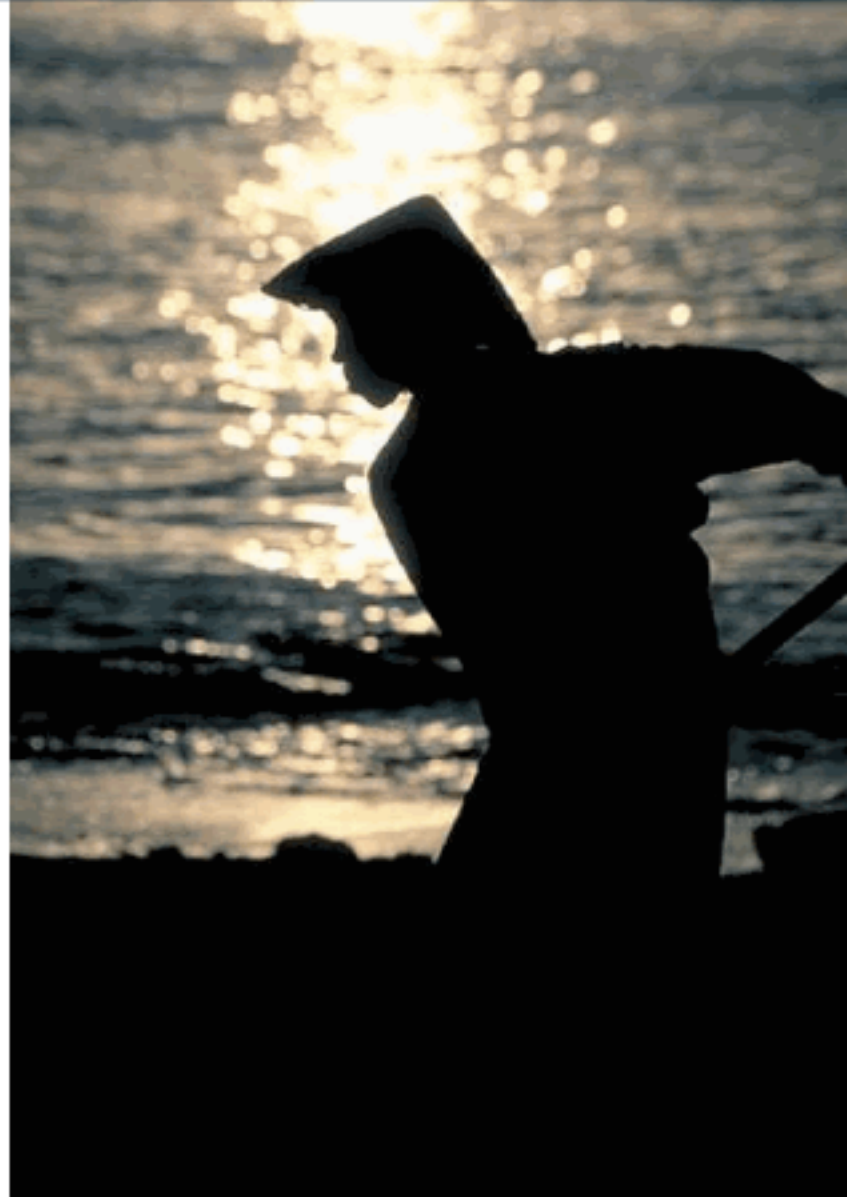
In a sustainable society, nature is not subject to increasing::

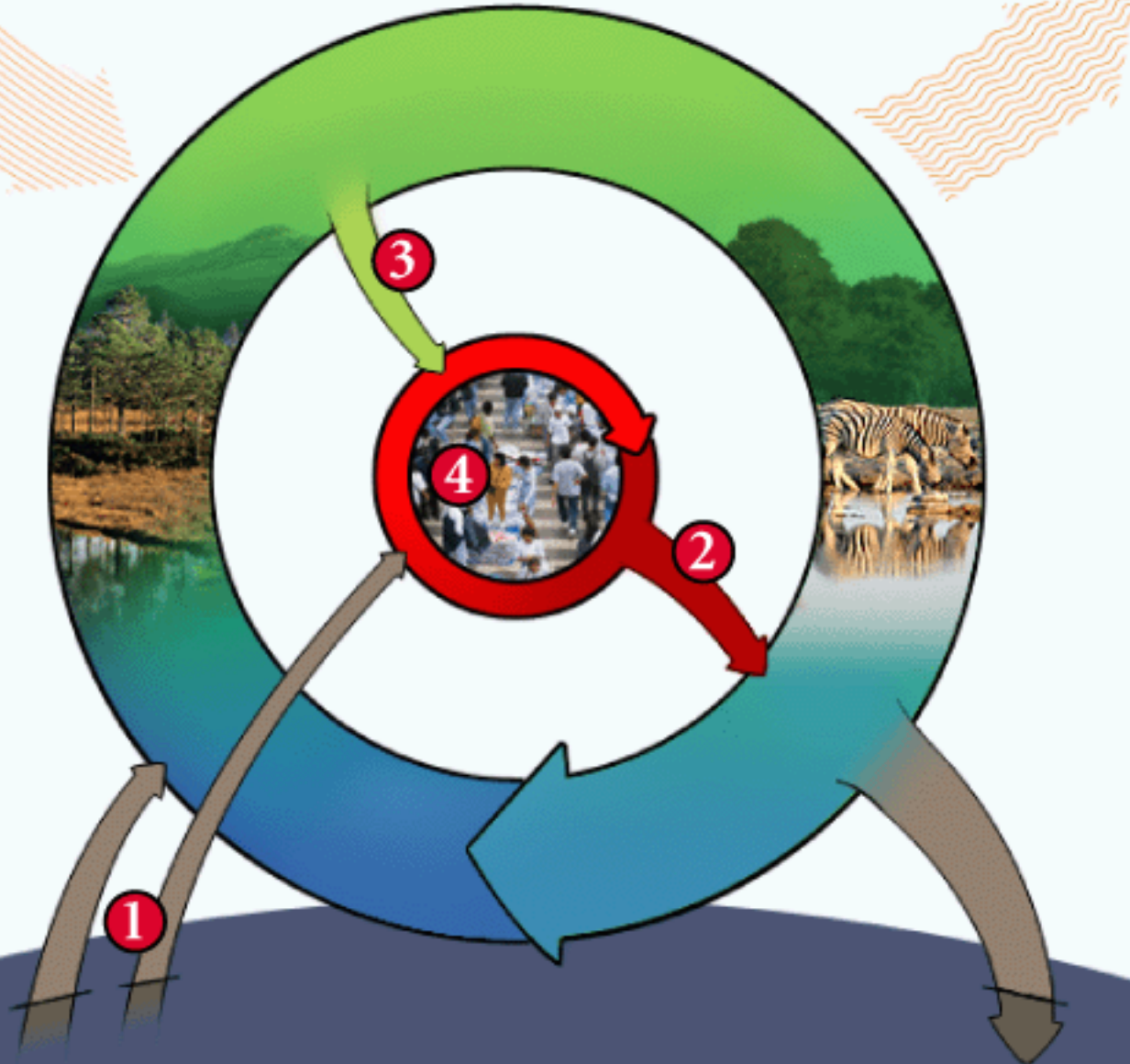
... degradation by physical means;



In a sustainable society, people are not subject to:

conditions that systematically undermine their capacity to meet their needs.





Our ultimate sustainability objectives are to:

- 1 ... eliminate our contribution to systematic increases in concentrations of substances from the Earth's crust.**
- 2 ... eliminate our contribution to systematic increases in concentrations of substances produced by society.**
- 3 ... eliminate our contribution to systematic physical degradation of nature through over-harvesting, introduction and other forms of modification.**
- 4 ... eliminate our contribution to systematic undermining of people's capacity to meet their needs.**

First Order Principles allow us to think upstream

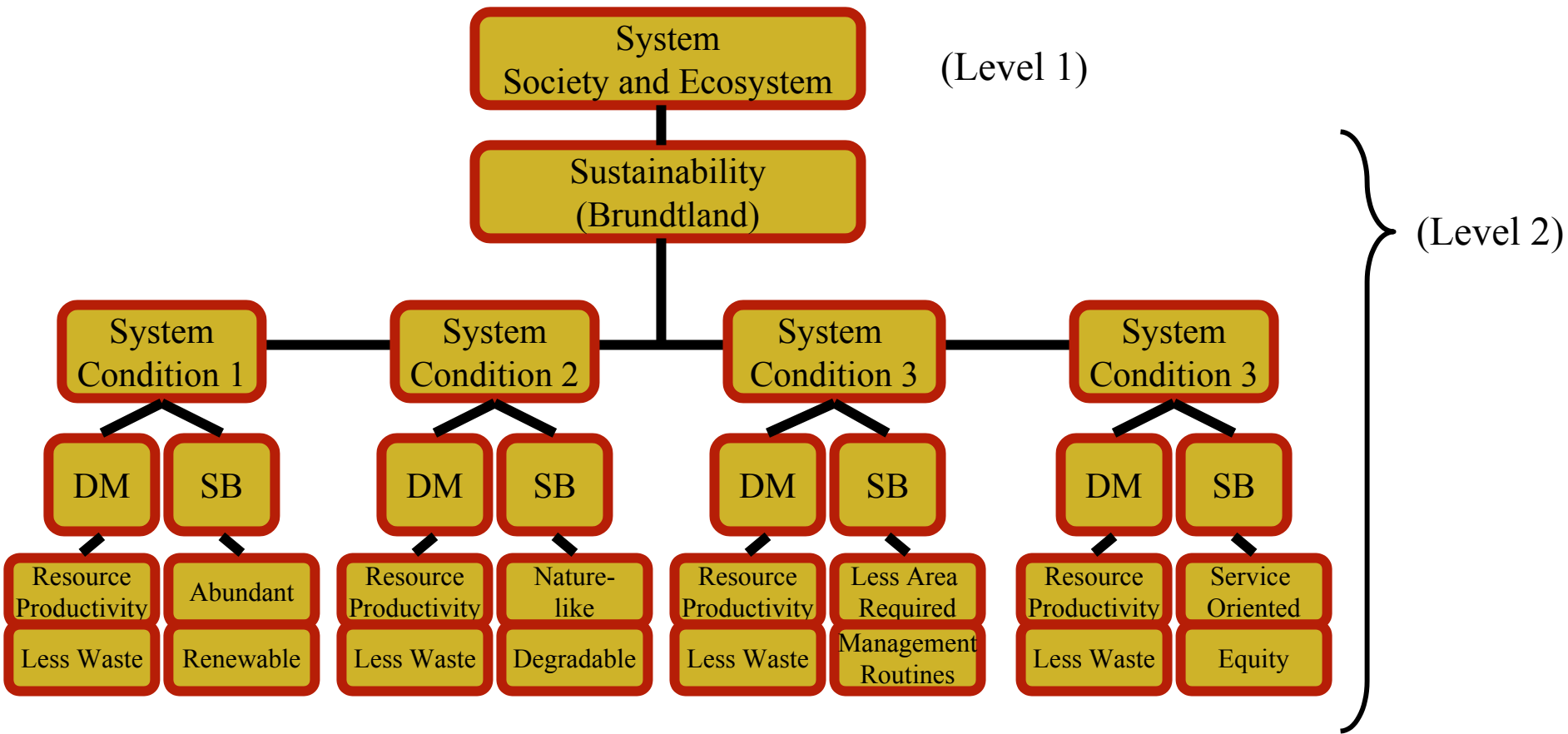


	S.C 1	S.C 2	S.C 3	S.C. 4
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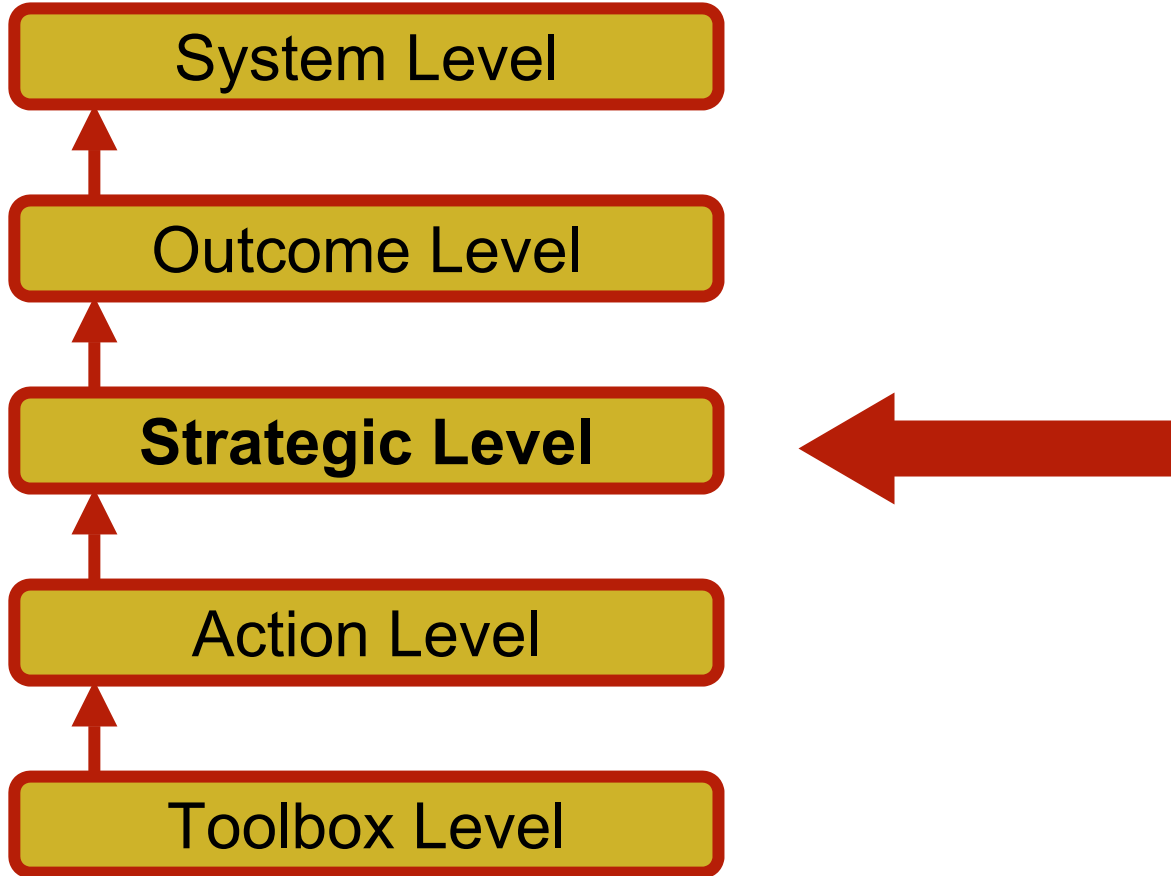
Dematerialization
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Substitution
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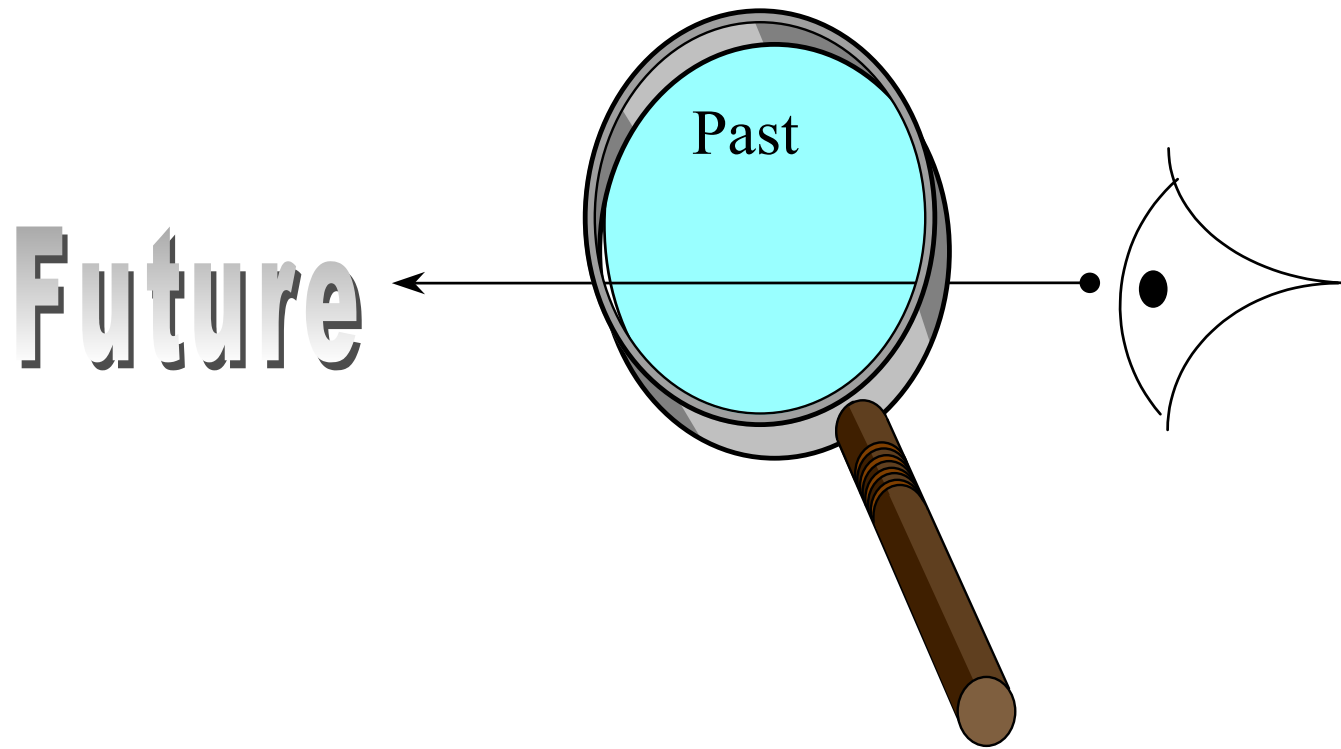




Level 3: Strategic Guidelines



“The future is often viewed through the mirror of the past.”



Backcasting

A method in which the future desired conditions are envisioned and steps are then defined to attain those conditions



Backcasting from scenarios (like jigsaws)



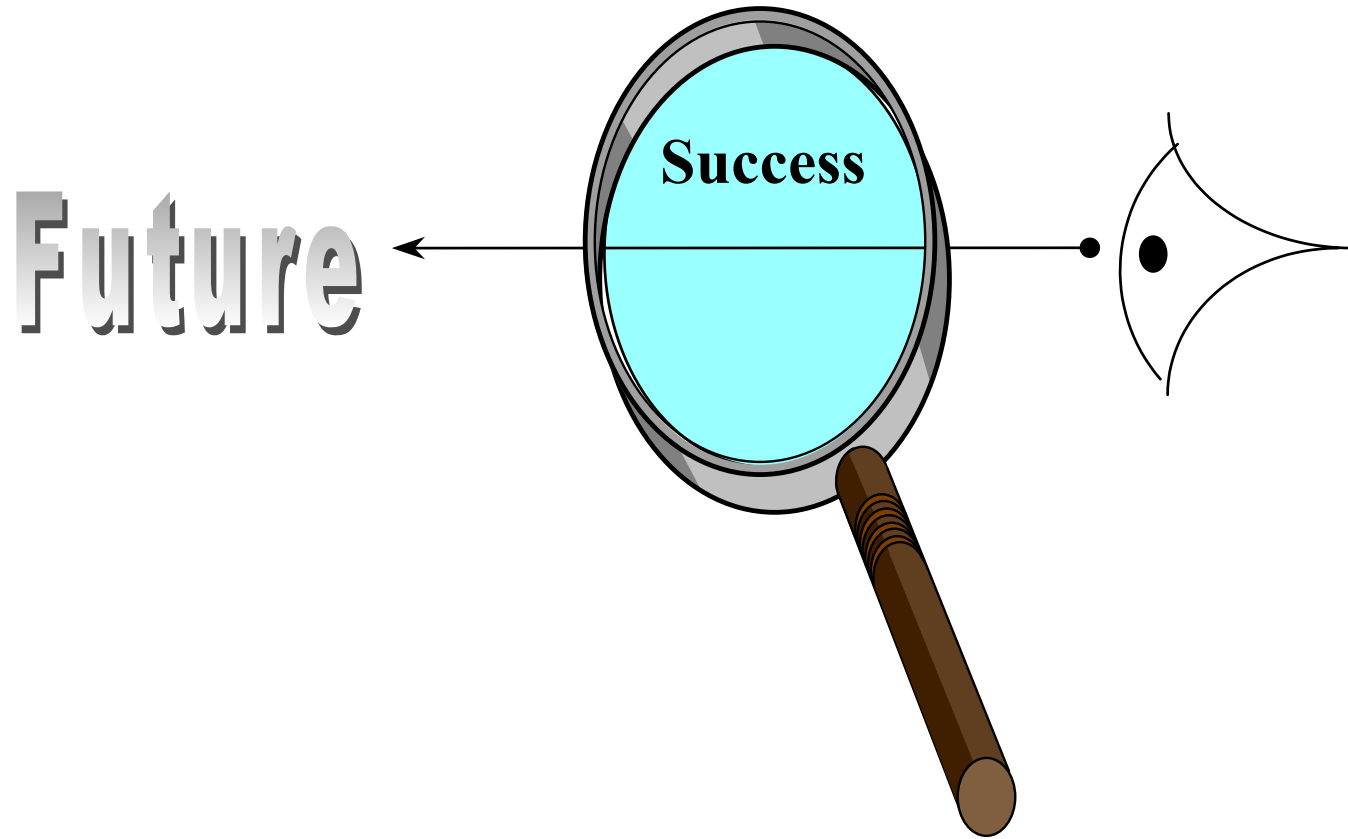
- Agree on details?
- Technical development?
- Really sustainable?



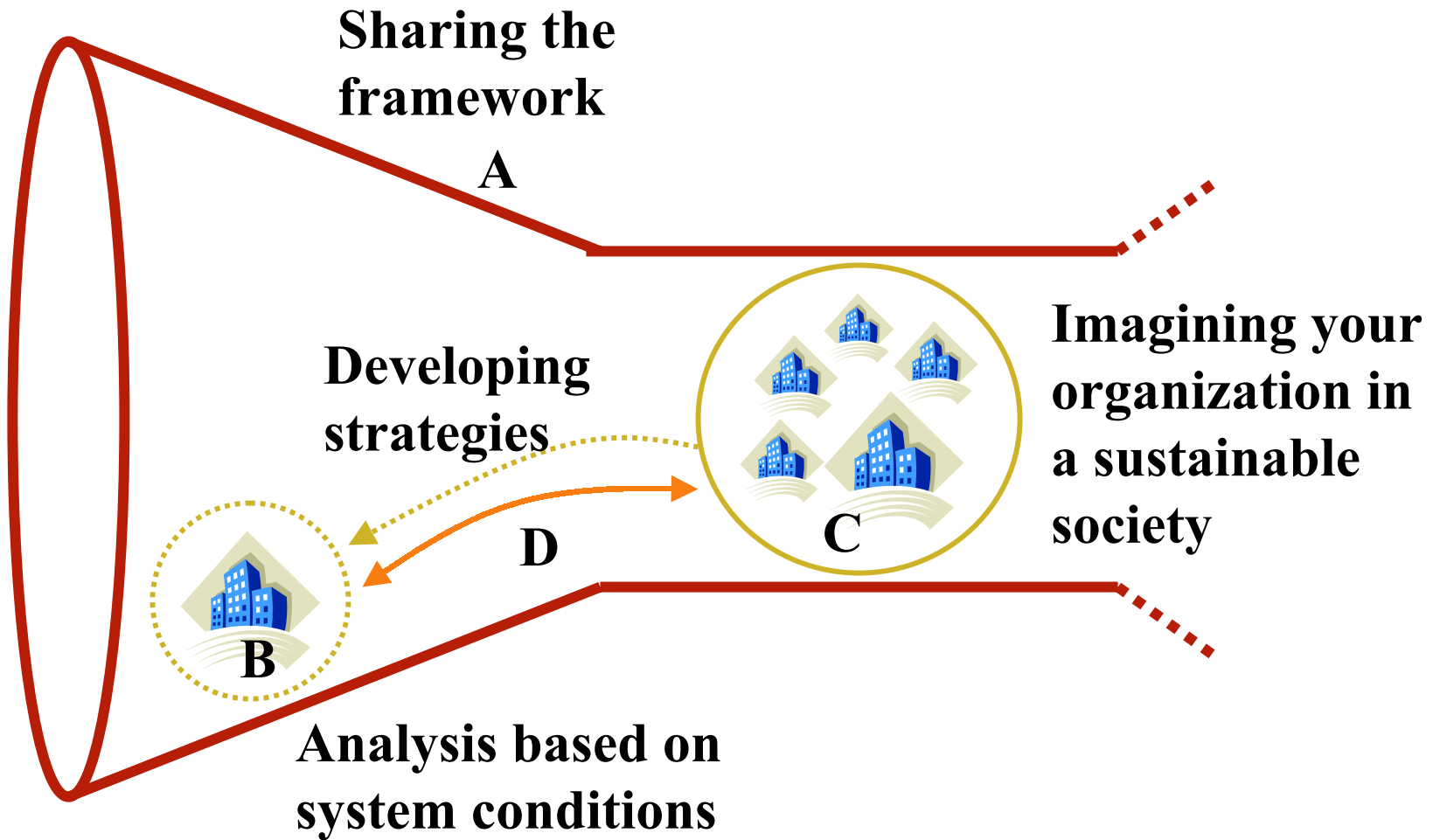
Backcasting from principles (like chess)



Backcasting



Sustainable Development

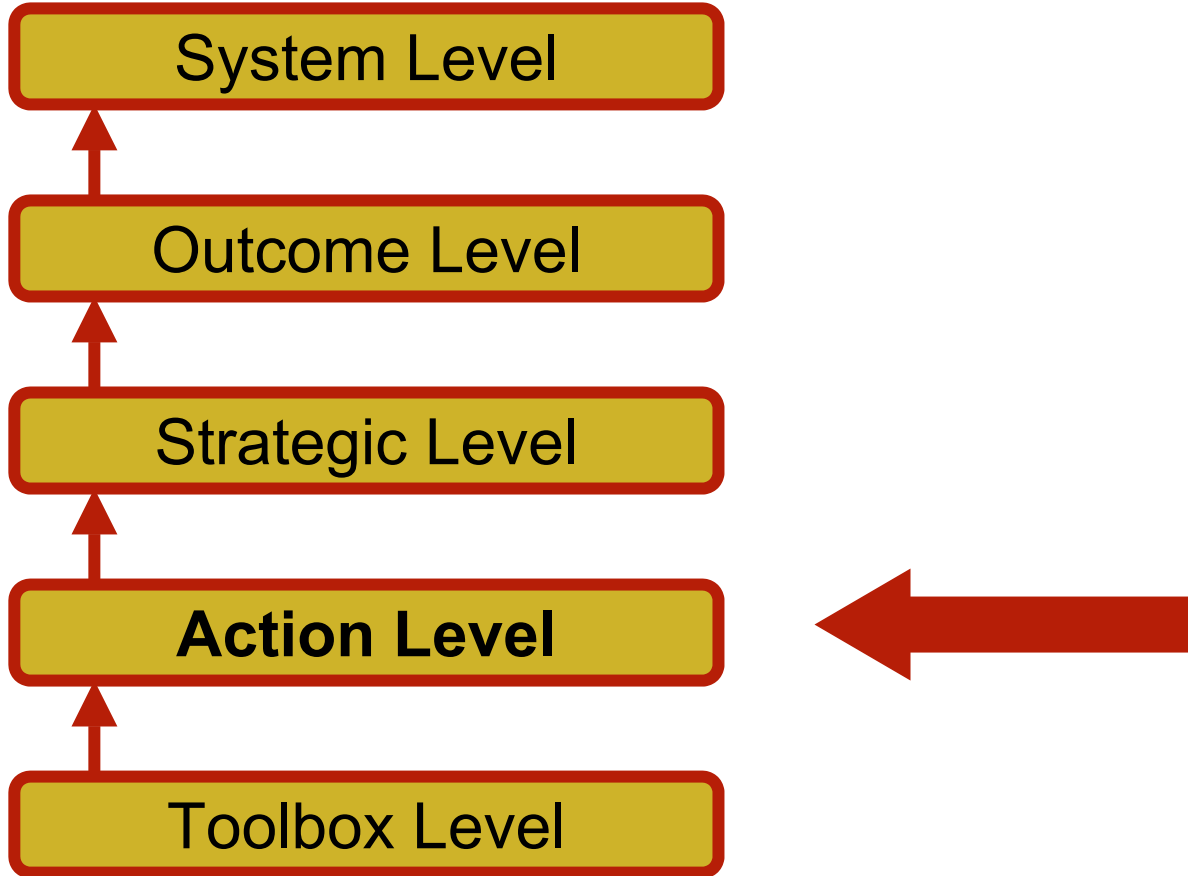


D) Strategy for Action

Every measure is checked against three questions:

- 1 Does this measure move us in the right direction with regards to the principles of sustainability?
- 2 Does this measure provide a steppingstone for future improvements?
- 3 Is this measure likely to produce a return on investment soon enough to fertilize the further process (according to 2)?

Level 4: Actions



Scandic Hotels

- Top management seminar
- Education of teachers
- Education of employees
- 1500 measures within a year
- Listing of measures on waiting list

Scandic Hotels

- Top management seminar
- Education of teachers
- Education of employees
- 1500 measures within a year
- Listing of measures on waiting list



Wooden panels
S-Cond.1,2

Wooden hangers
S-Cond. 1,2

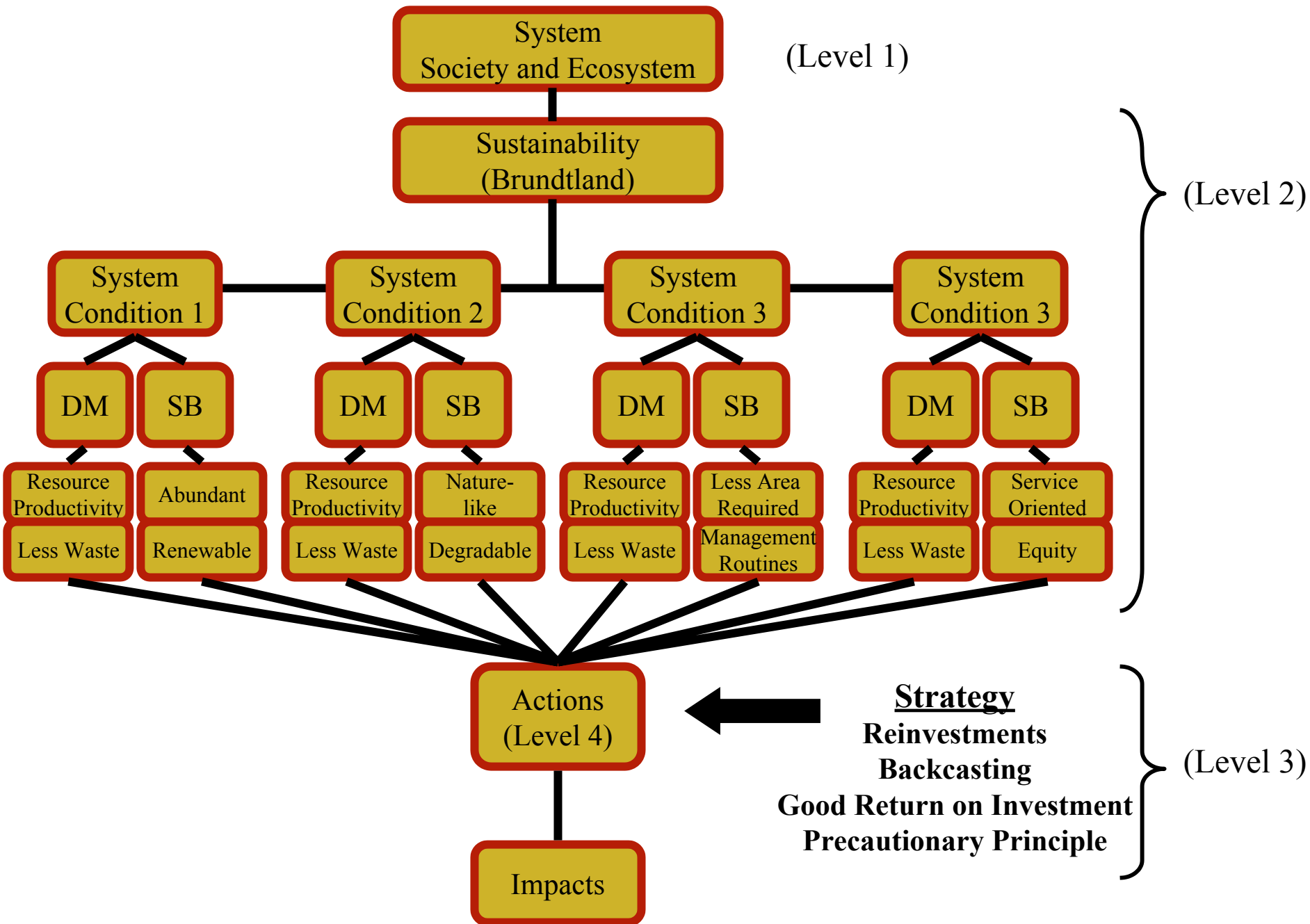
Low energy bulbs
S-Cond.4

Waste basket
S-Cond. 4

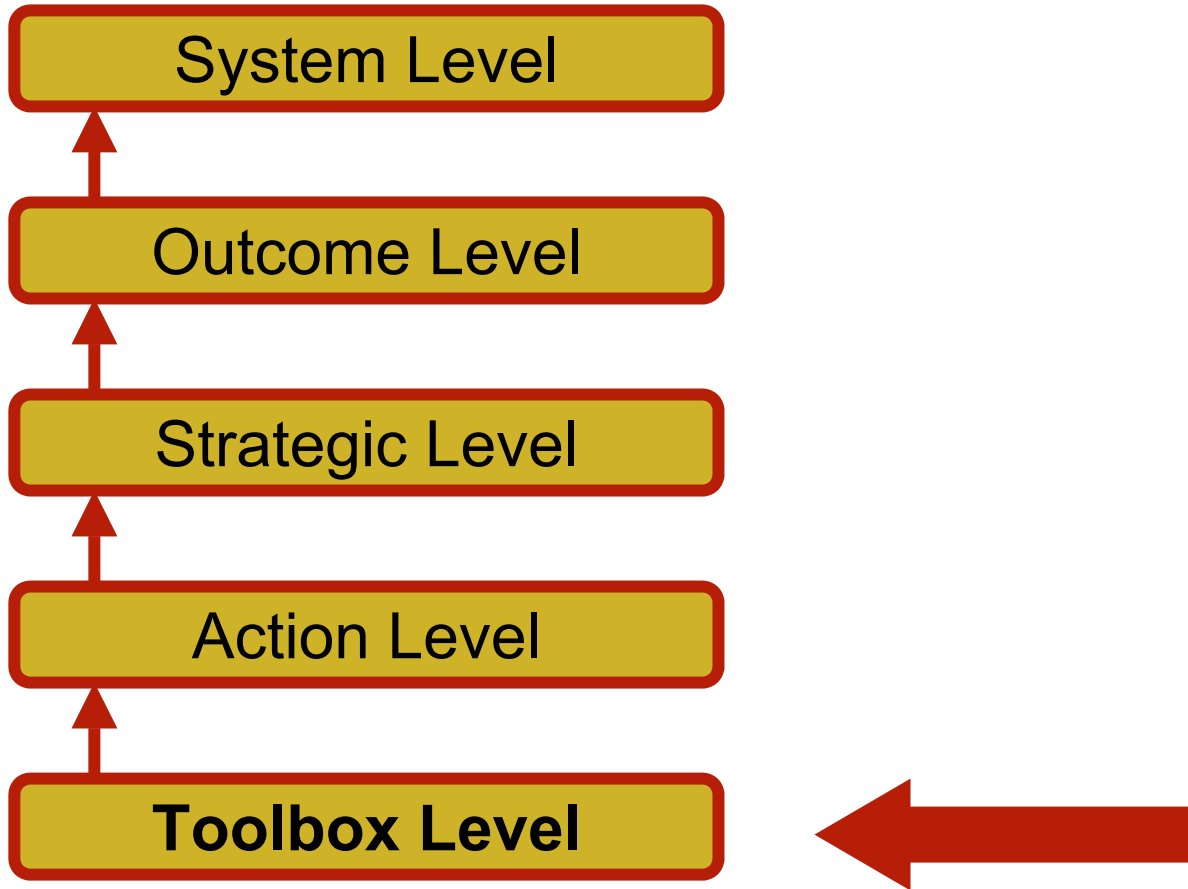
Springbed
S-Cond.1,2

Wooden Floor
S-Cond. 1,2,4

**Armchair w/
wooden frame**
S-Cond. 1,2



Level 5: Toolbox



A framework helps you select & develop tools -

Management Systems

Indicators

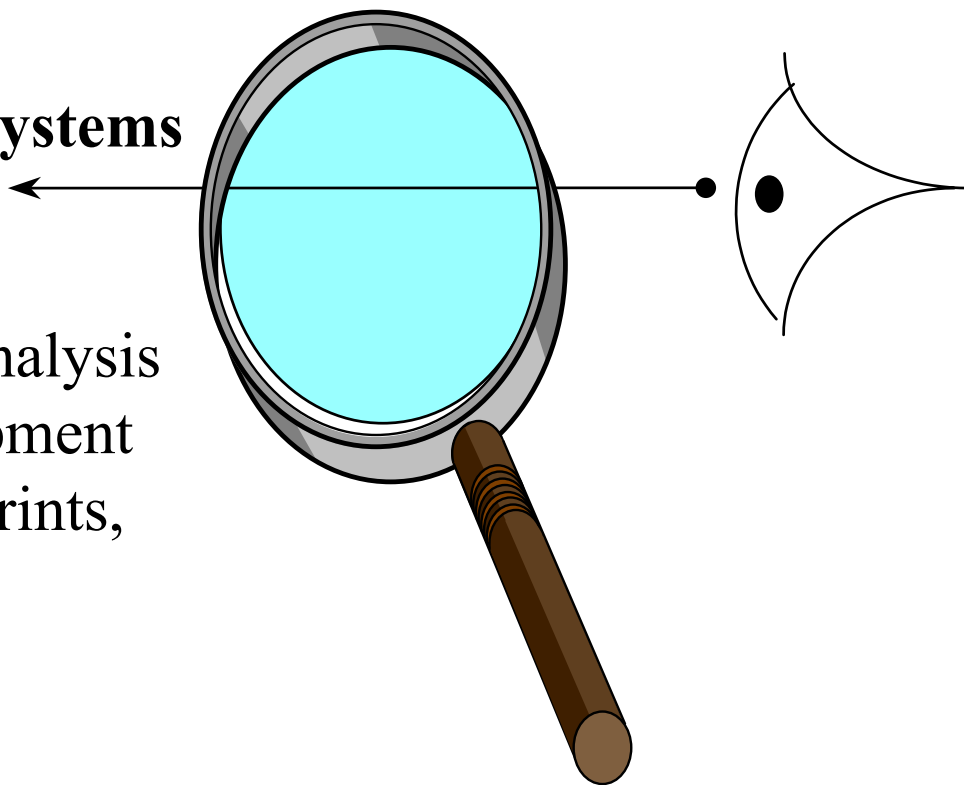
LCA

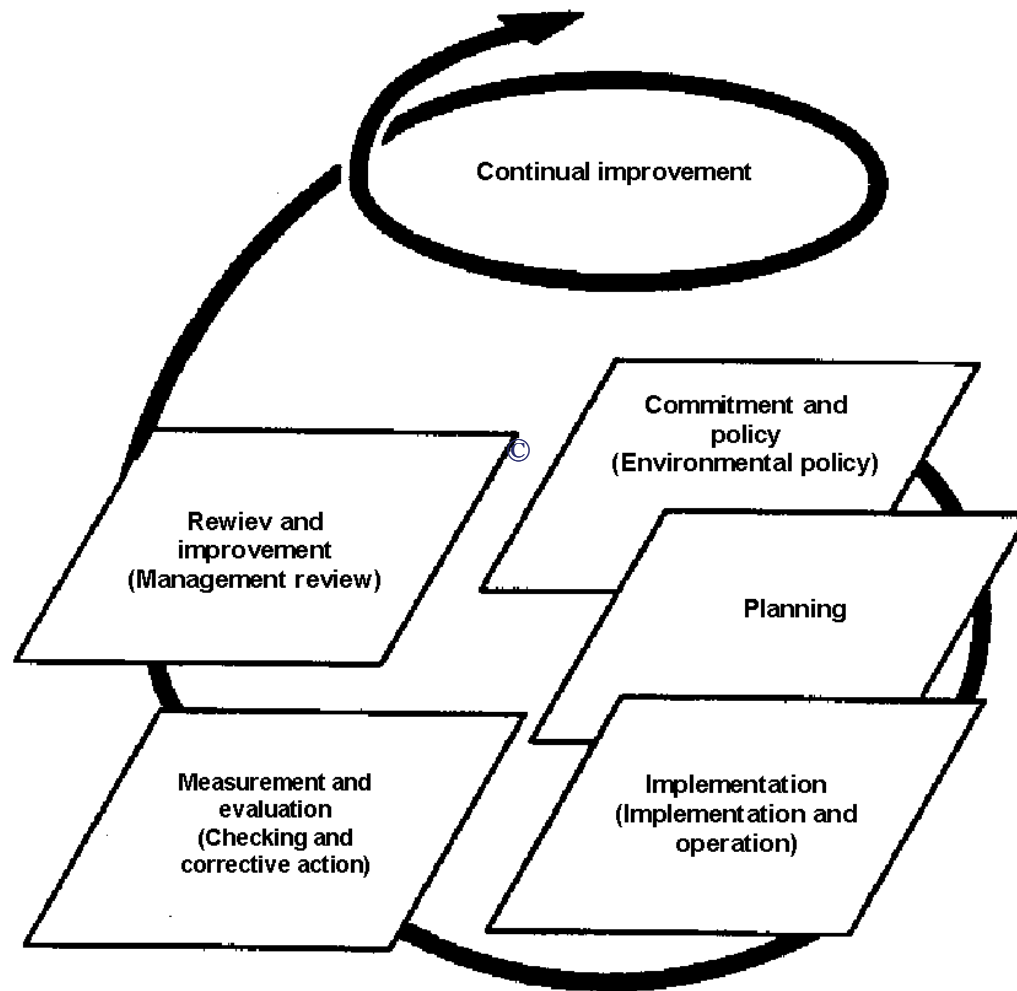
Sustainability analysis

Product development

Factor X, Footprints,

...

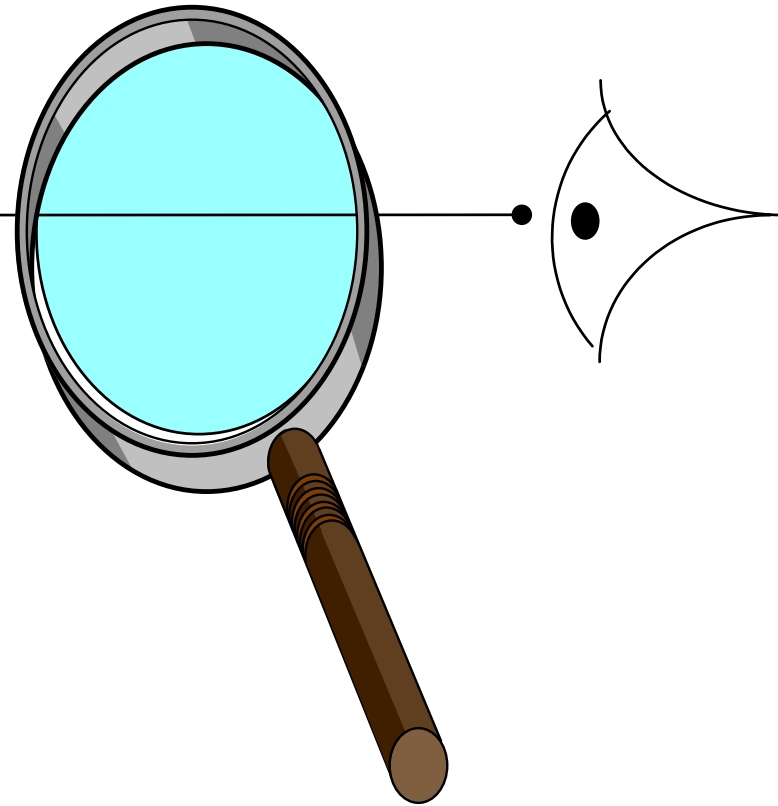




Dealing with Trade-offs

- an example from IKEA -

Management systems
Indicators
LCA
Sustainability analysis
Product development
Purchase
Factor X, Footprints...



S.C 1 S.C 2 S.C 3 S.C. 4

Dematerialization

...

Substitution

...



Framework for analysis of concepts - an example from pioneers -

Leadership

Management

Indicators

LCA

Sustainability analysis

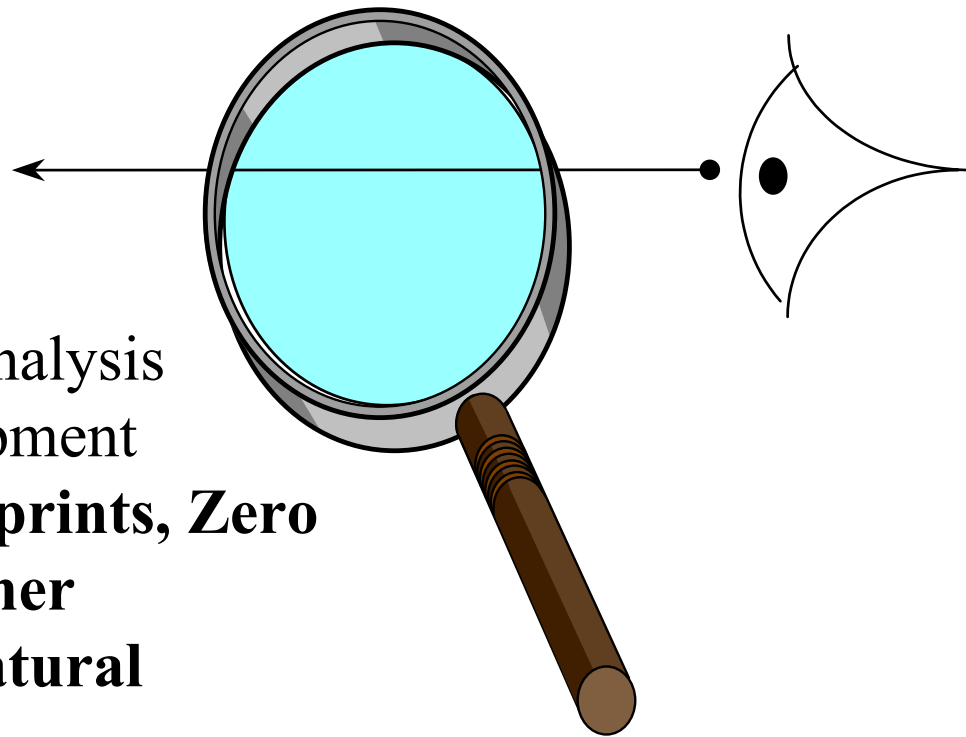
Product development

Factor X, Footprints, Zero

emission, Cleaner

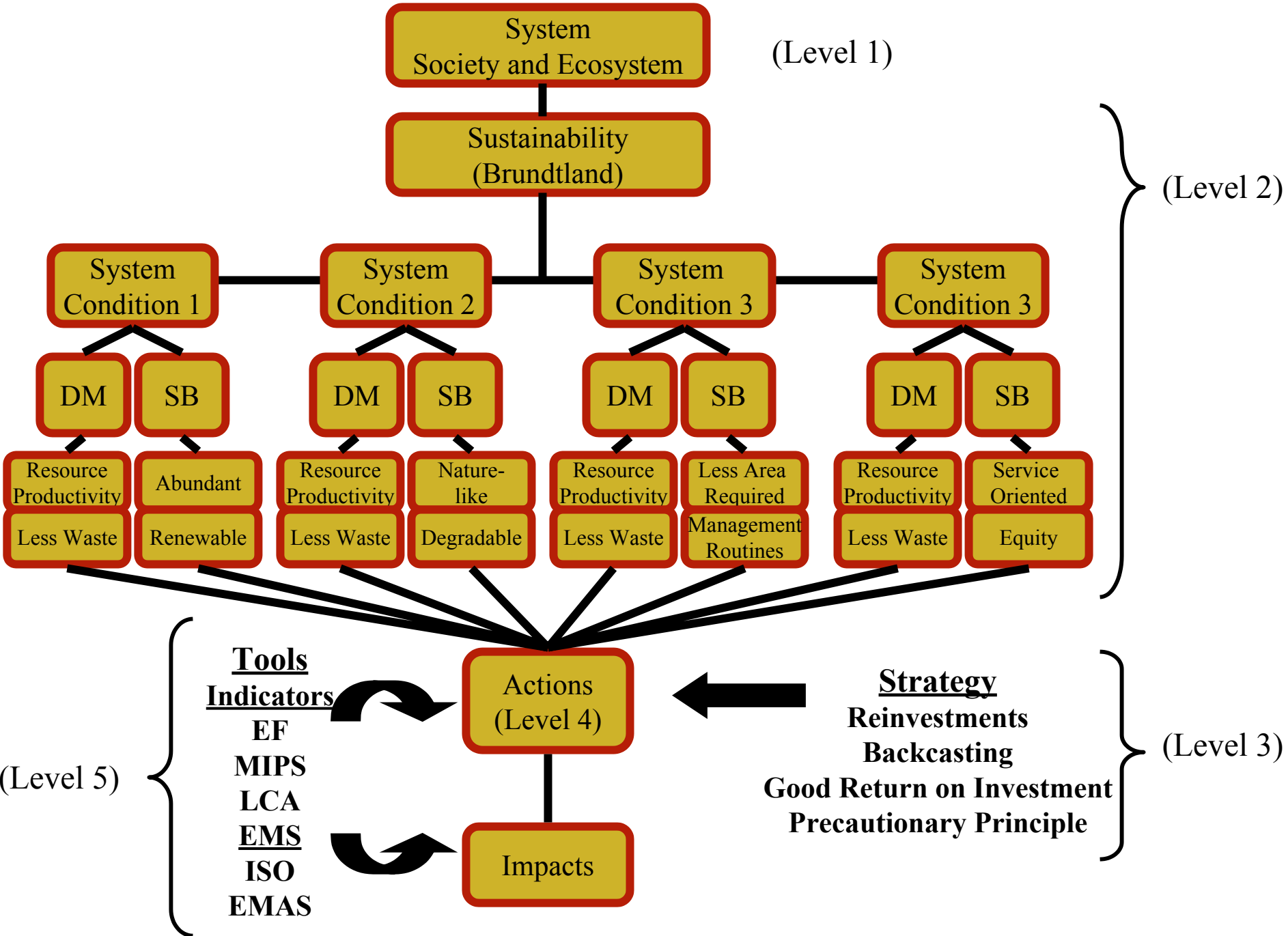
Production, Natural

Capitalism...



Many good concepts and tools:

- Primary focus on different things
- Cover different aspects of sustainability
- Complementary
- Framework is needed for:
 - selection
 - design
 - bringing it all together



Zero Emission

System
Society and Ecosystem

(Level 1)

Sustainability
(Brundtland)

(Level 2)

System
Condition 1

System
Condition 2

System
Condition 3

System
Condition 3

DM

SB

DM

SB

DM

SB

DM

SB

Resource
Productivity
Less Waste

Abundant
Renewable

Resource
Productivity
Less Waste

Nature-
like
Degradable

Resource
Productivity
Less Waste

Less Area
Required
Management
Routines

Resource
Productivity
Less Waste

Service
Oriented
Equity

Tools
Indicators
EF
MIPS
LCA
EMS
ISO
EMAS

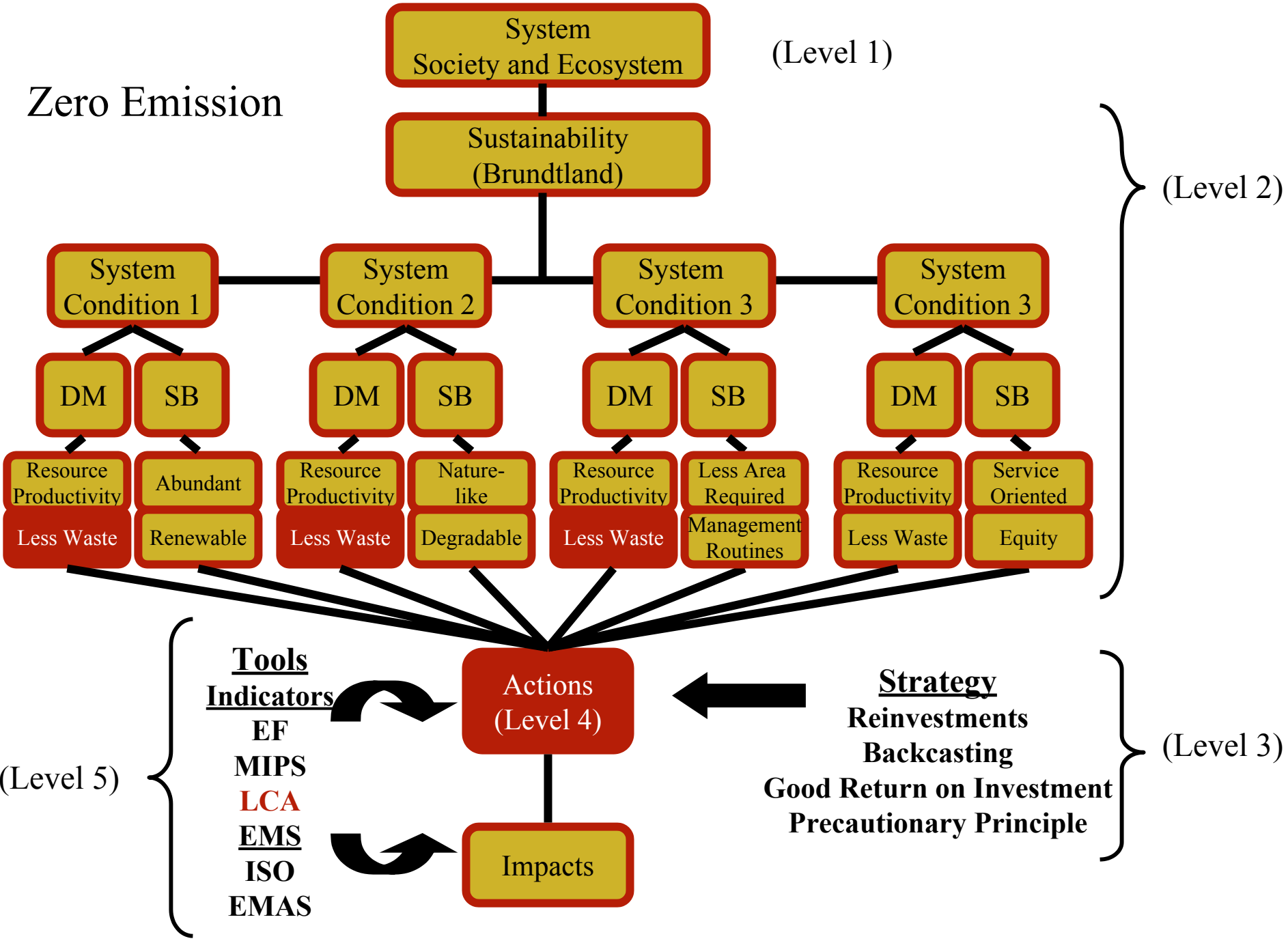
(Level 5)

Actions
(Level 4)

Impacts

Strategy
Reinvestments
Backcasting
Good Return on Investment
Precautionary Principle

(Level 3)



Factor 10

System
Society and Ecosystem

(Level 1)

Sustainability
(Brundtland)

(Level 2)

System
Condition 1

System
Condition 2

System
Condition 3

System
Condition 3

DM SB

DM SB

DM SB

DM SB

Resource Productivity
Less Waste

Abundant
Renewable

Resource Productivity
Less Waste

Nature-like
Degradable

Resource Productivity
Less Waste

Less Area Required
Management Routines

Resource Productivity
Less Waste

Service Oriented
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Tools
Indicators

Factor X
EF
MIPS
LCA
EMS
ISO
EMAS

Actions
(Level 4)

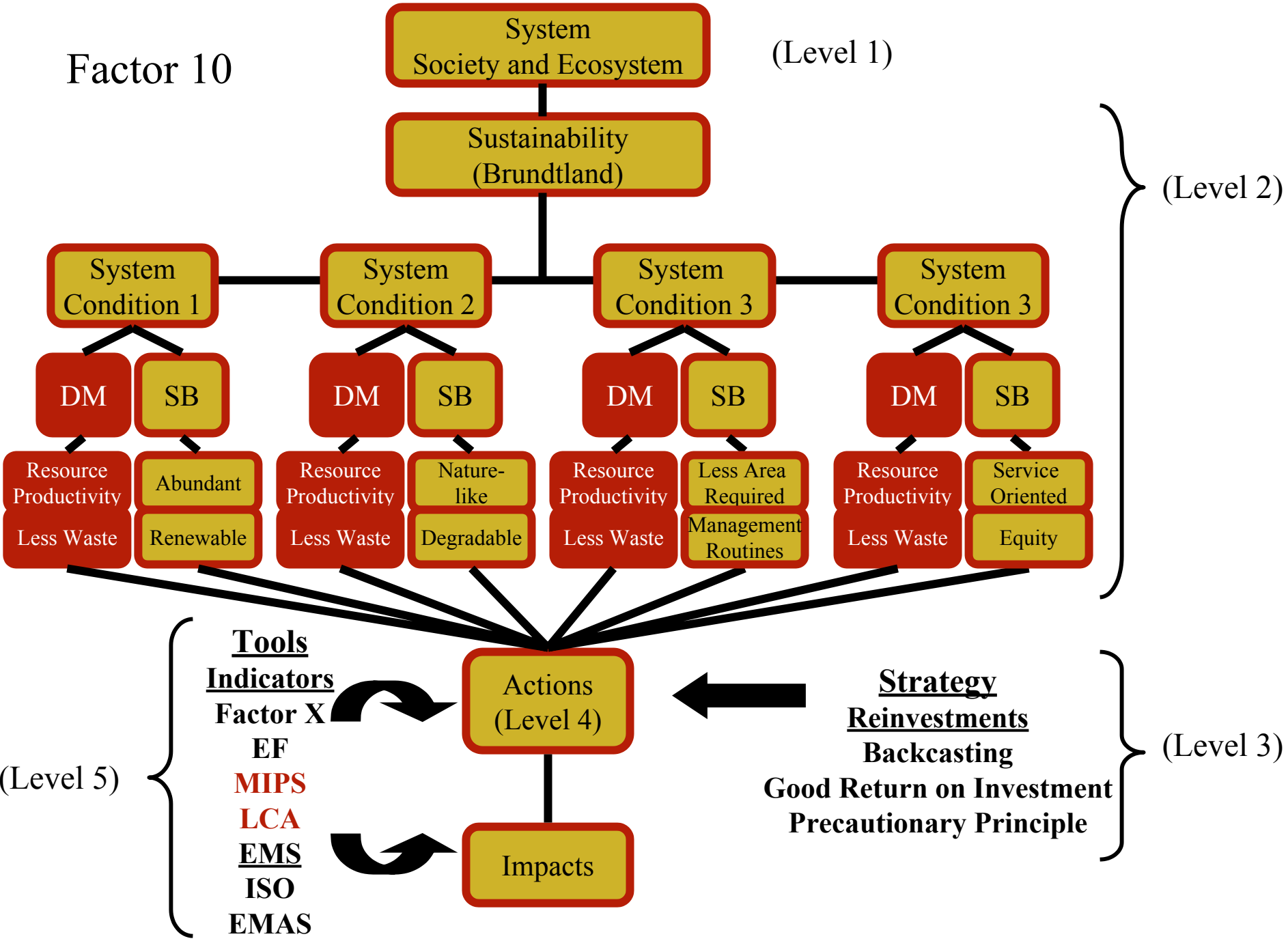
Impacts

Strategy
Reinvestments

Backcasting
Good Return on Investment
Precautionary Principle

(Level 3)

(Level 5)



Framework for...

- **Full systems perspective (sufficient dematerializations, substitutions, land-use, social)**
 - **Correcting problems at source**
 - **Avoiding unknown problems**
 - **Unbiased evaluation of potentials**
 - **Trade-offs**
 - **Linking today with future**
 - **Strategic leadership**
 - **Relevant tools for transition**
 - **Shared mental model for community building**
- Overview not alternative to data, concepts and tools!***



The Natural Step Framework & Pollution Prevention

- Sustainability as a game of Chess -

Chad Park & Pong Leung

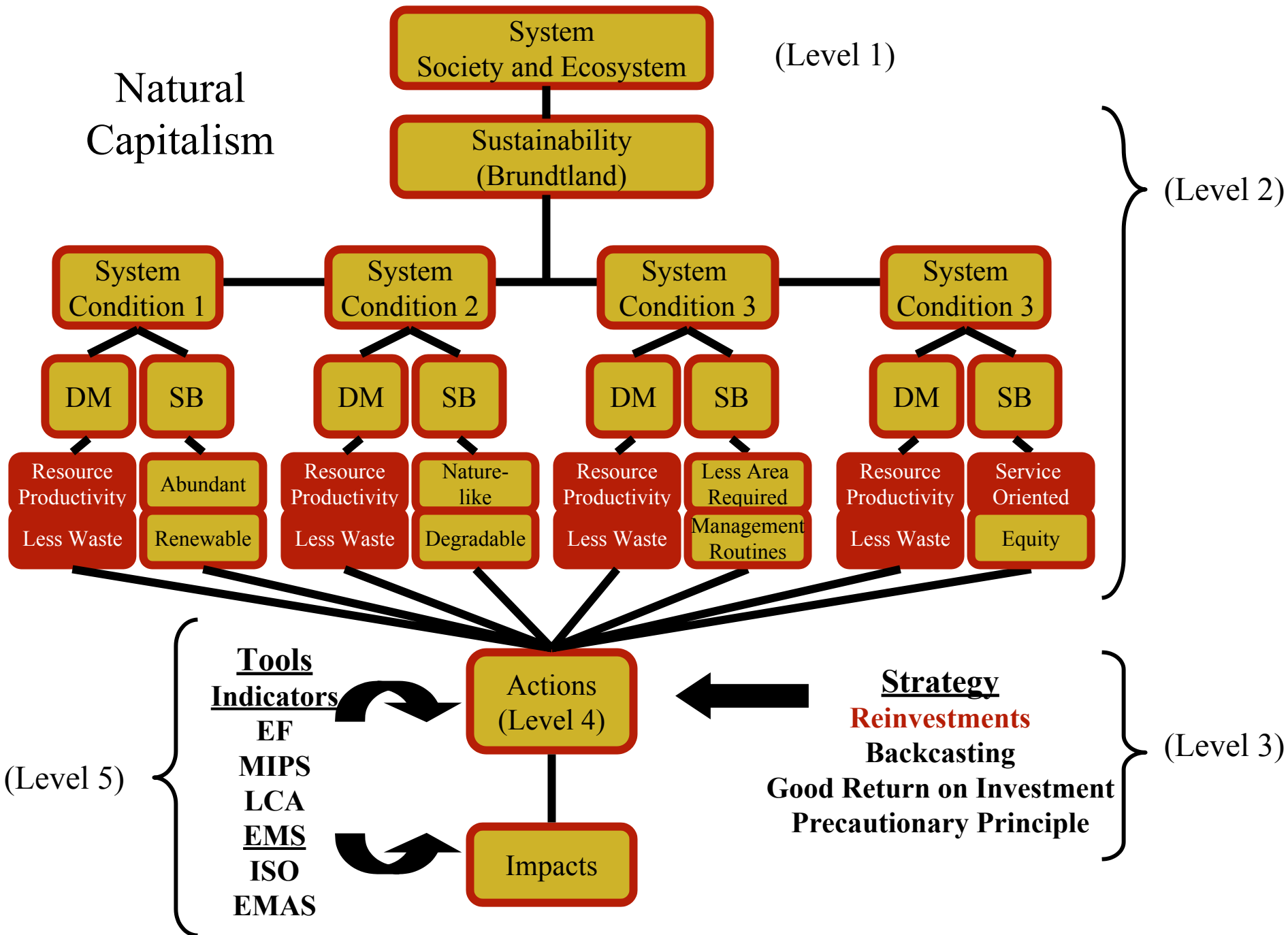
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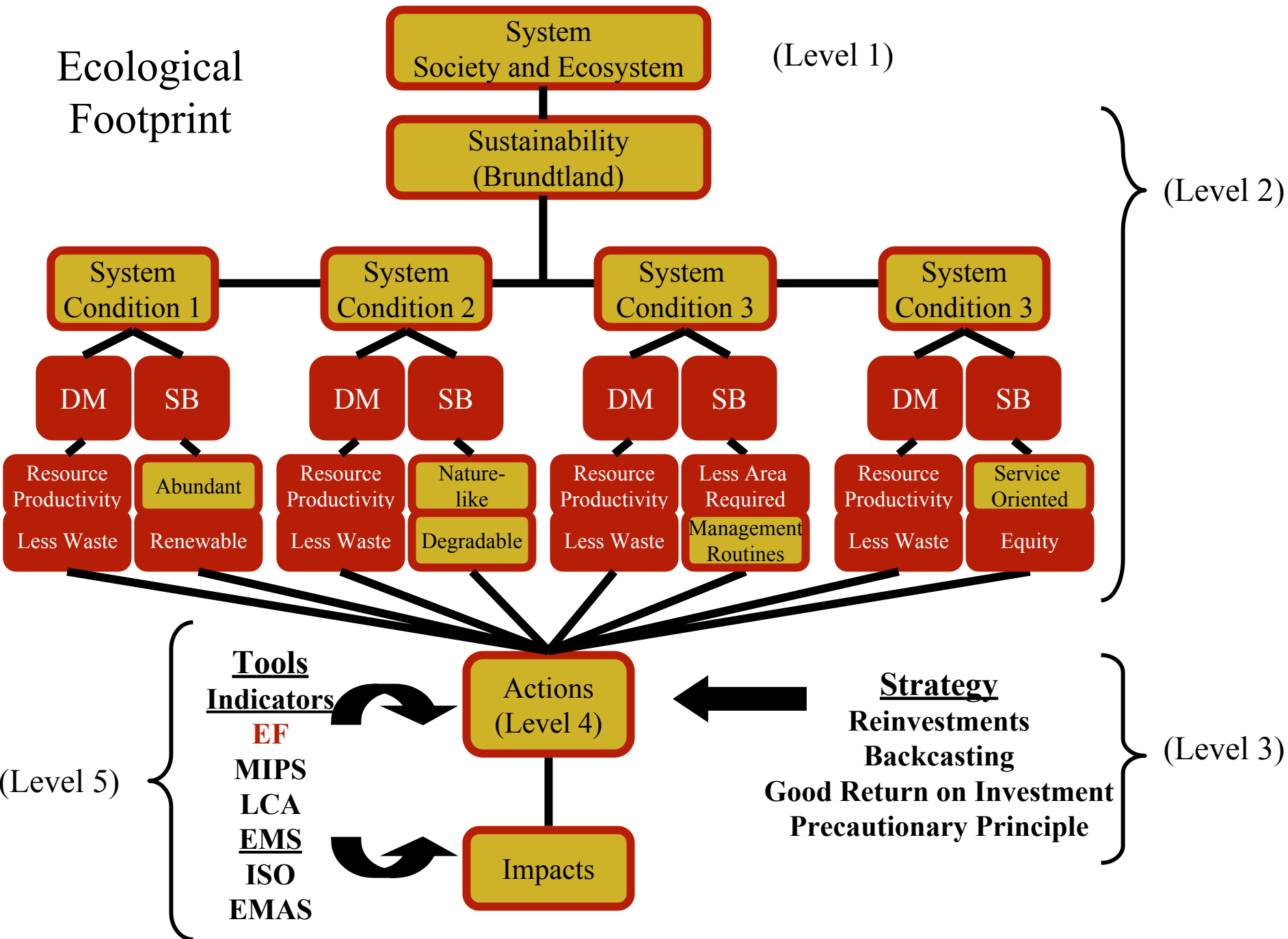
Calgary, Alberta

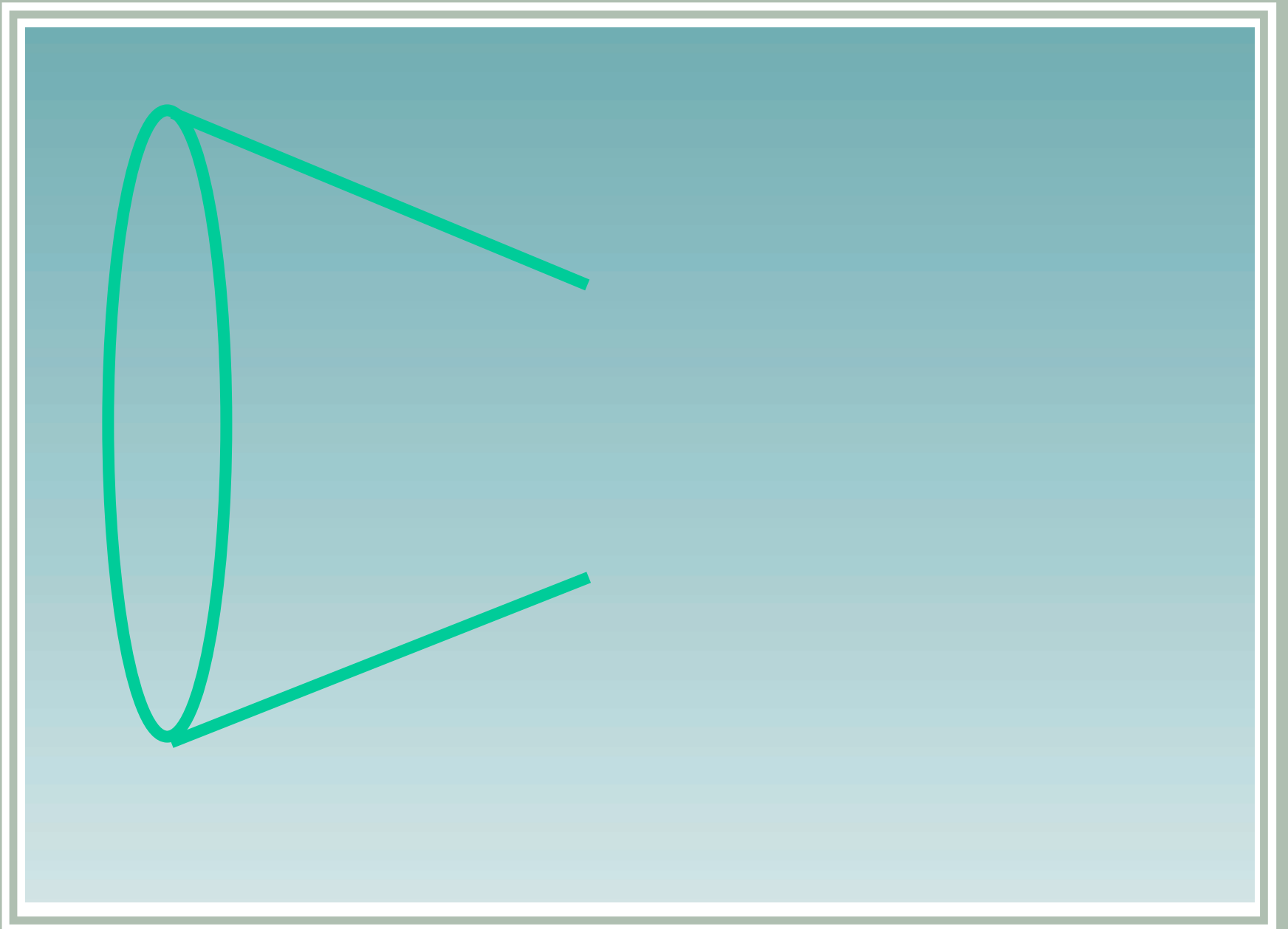
June 12, 2003

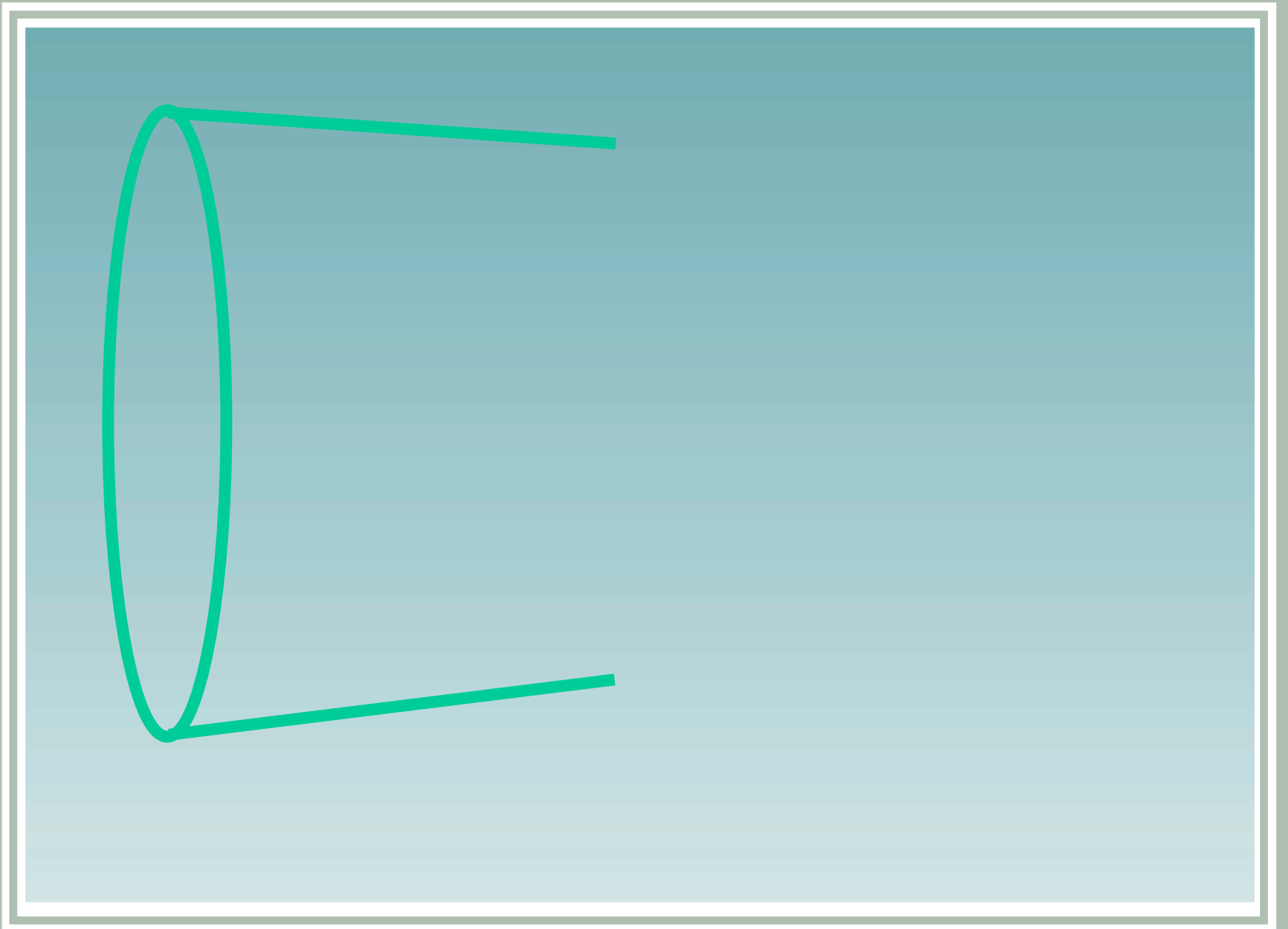
METAL	IN TOP SOIL (MG/KG)	WEATHERING (W) (KTON/YEAR)	MINING (M) (KTON/YEAR)	FOSSIL FUELS (F) (KTON/YEAR)	(M+F) / W
Al	72 000	1 100 000	18 000	34 000	0.047
Fe	26 000	390 000	540 000	34 000	1.5
Ti	2 900	44 000	2 500	1 700	0.095
Cr	54	830	3 800	34	4.6
Cu	25	380	9 000	55	24
Pb	19	290	3 300	85	12
Cd	0.35	5.3	20	3.4	4.4
Hg	0.09	1.4	5.2	10	11

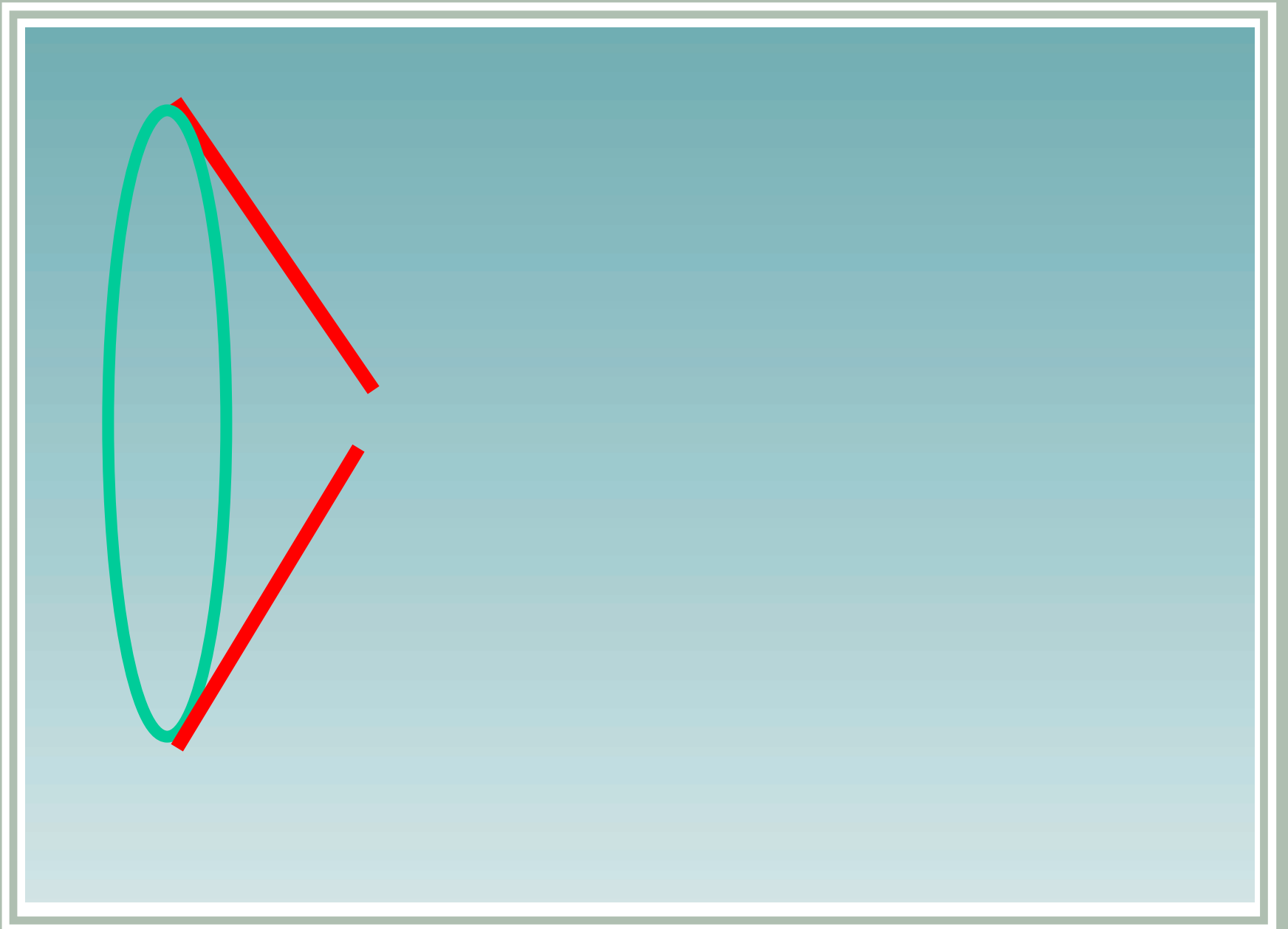


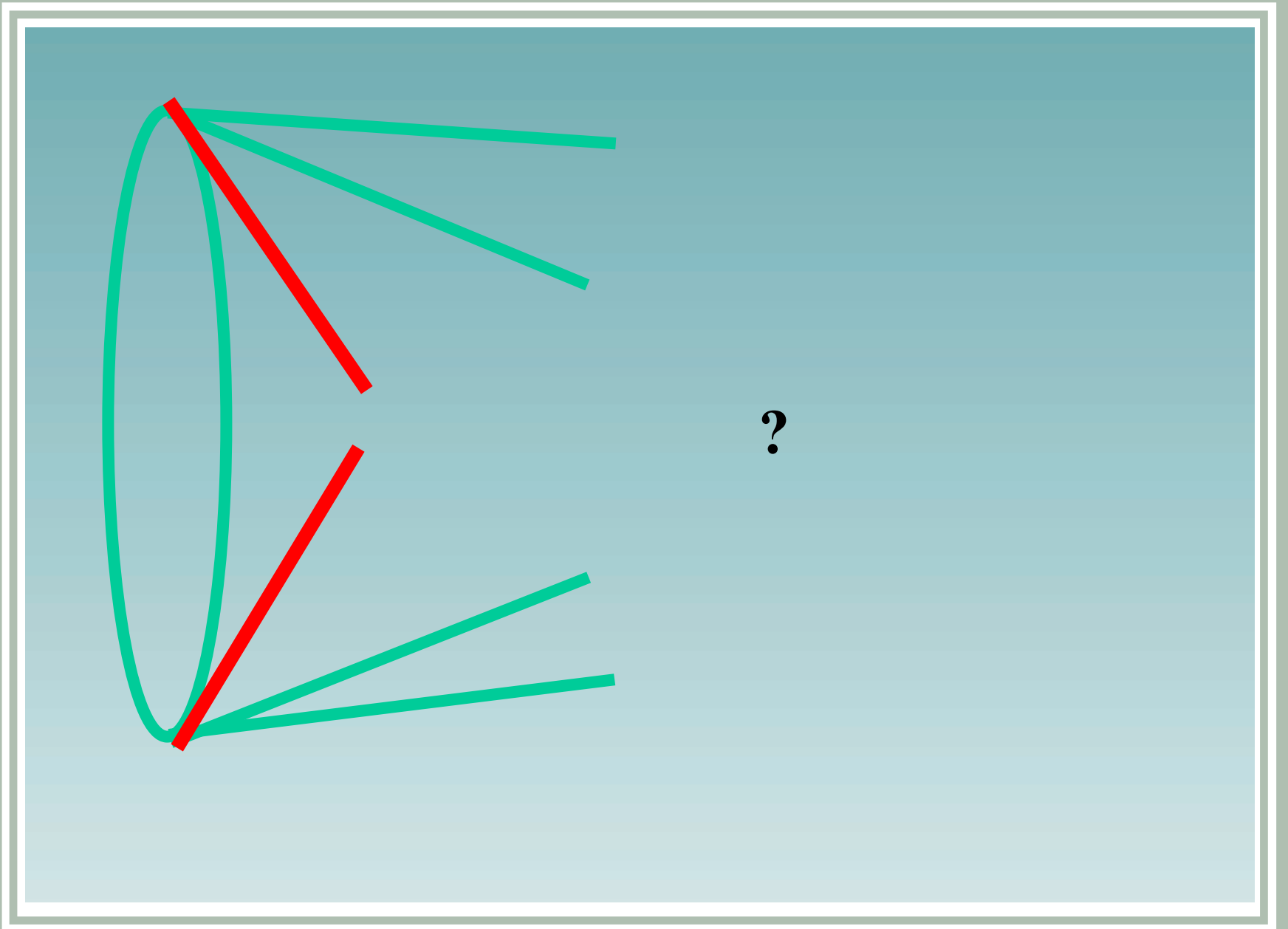
Ecological Footprint













What is success in a jigsaw puzzle?



What is success in chess?

Framework and Sustainability analysis

- an example from Matsushita/Panasonic -

Leadership

Management

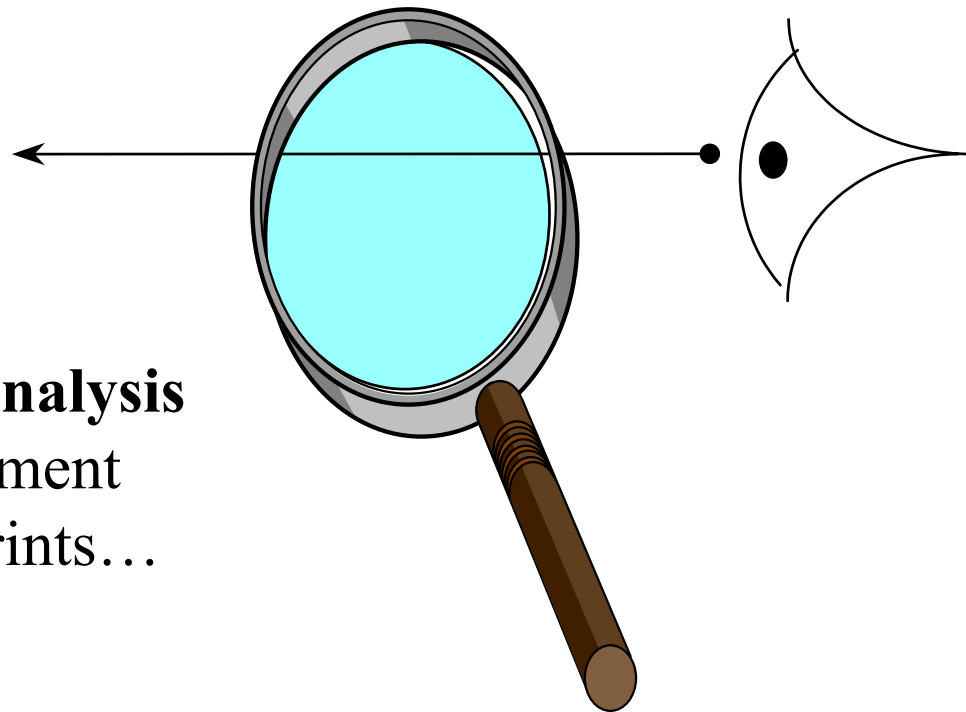
Indicators

LCA

Sustainability analysis

Product development

Factor X, Footprints...



Need

Principle product

Use in Society

•

Bm. ?

.....

?

.....

?

C.

Cm. ?

.....

?

.....

?

Dm. ?

?

?

