Integrated Environmental Assessment Training Manual for the Arab Region

Module 6
Scenario development and analysis

Overview

- **Session 1: What is a Scenario?**
- Session 2: Examples
- Session 3: Purpose, Process and Substance
- Session 4: Policy Analysis
- Session 5: Developing Scenarios
- Session 6: Exercise on Scenario Development
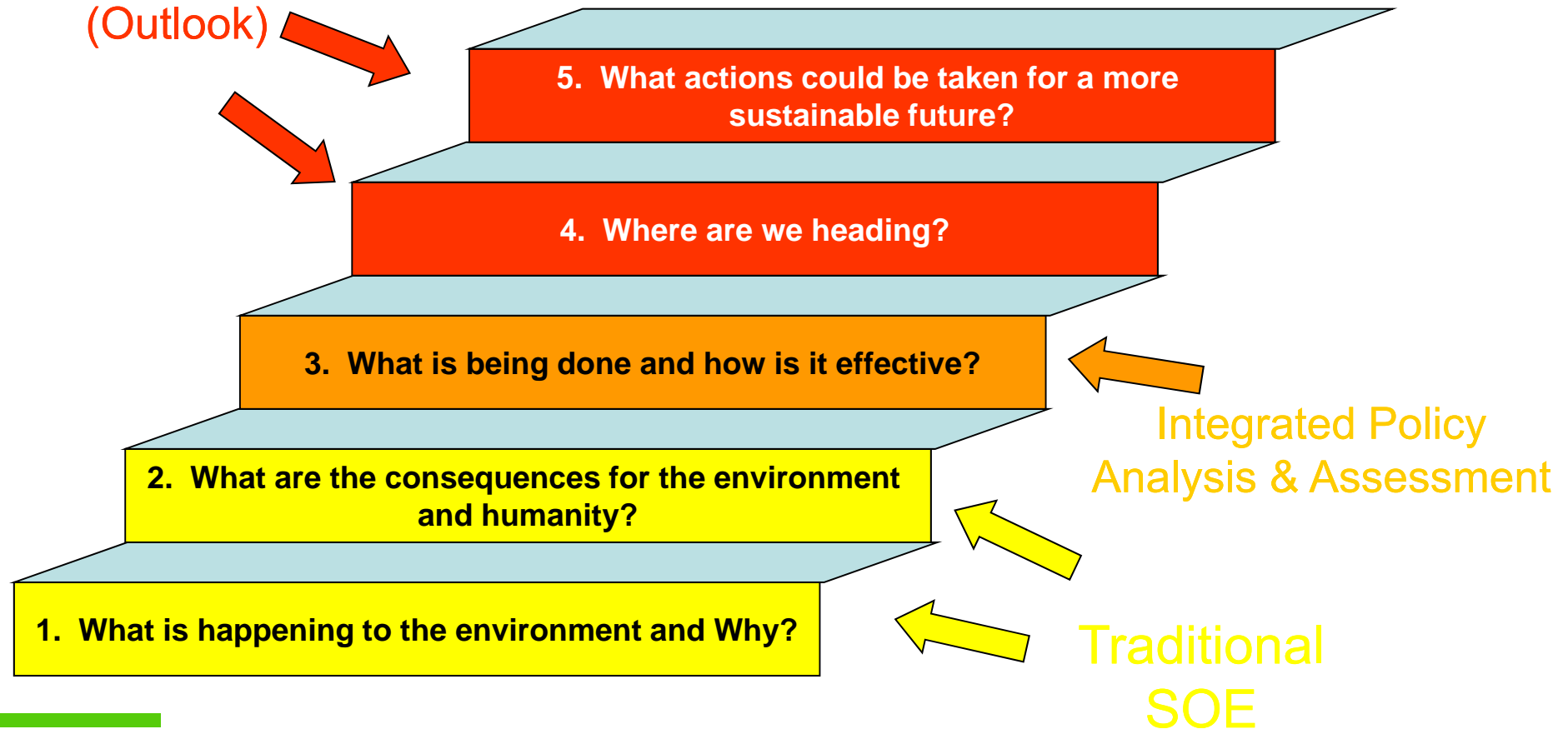
Learning Objectives

- Be familiar with the types of scenarios
- Have developed an understanding of the structure, complexity and dynamics of scenario processes
- Be familiar with the steps required for the development of scenarios
- Understand how scenarios can be used for the discussion and development of policy options
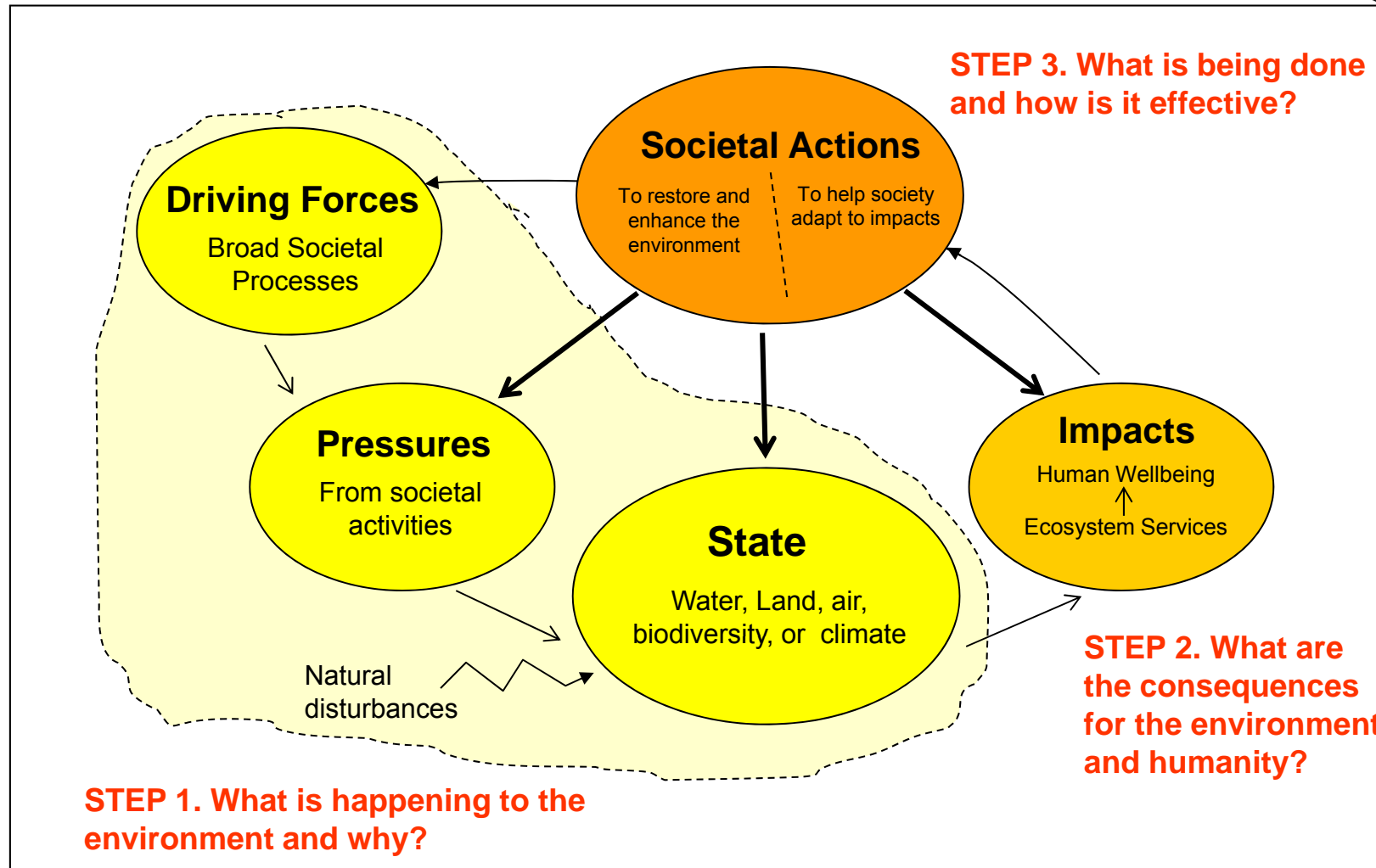
Why Future Scenarios?

IEA vs. Traditional SOE (Refer to Module 5)

Scenario Analysis (Outlook)

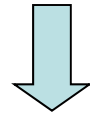5. What actions could be taken for a more sustainable future?

4. Where are we heading?

3. What is being done and how is it effective?

Integrated Policy Analysis & Assessment

2. What are the consequences for the environment and humanity?

1. What is happening to the environment and Why?

Traditional SOE

DPSIR Approach

STEP 3. What is being done and how is it effective?

Societal Actions

To restore and enhance the environment | To help society adapt to impacts

Driving Forces

Broad Societal Processes

Pressures

From societal activities

State

Water, Land, air, biodiversity, or climate

Impacts

Human Wellbeing

Ecosystem Services

Natural disturbances

STEP 2. What are the consequences for the environment and humanity?

STEP 1. What is happening to the environment and why?

DPSIR Framework for Water Resources

Demographic Economic development Technology Agricultural Policies
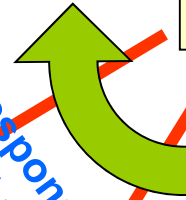
Drivers

Partial control

Responses

Policies, legislation, investments, technology, awareness, tariffs, treatment and recycling, etc.

Responses Effectiveness

Pressures

Impact

Increasing scarcity, Increasing Demands , sectoral utilization & competition, waste discharge

State

Health, ecological, economical & social losses

Resources' state variables (quality and quantity, per capita share)
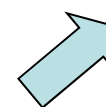
Why Do We Want to Think about the Future?

- To illuminate potential problems, and bring future problems into focus

- To explore alternatives in the face of uncertainty

- To share understanding and concerns

- To uncover assumptions and rigorously test them

- To help identify choices and make decisions

What Makes it Difficult to Think about the Future?

- *Ignorance*
  Our understanding is limited

- *Surprise*
  The unexpected and the novel

- *Volition*
  Human choice matters
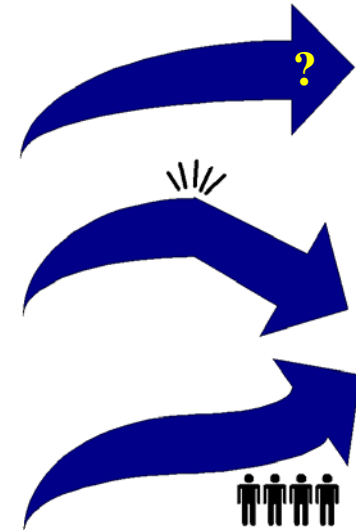
"Human beings are rarely passive witnesses of threatening situations. Their responses to threats may be unwise, but they inevitably alter the course of events and make mockery of any attempt to predict the future from extrapolation of existing trends."

René Dubos

What Does it Mean to Think about the Future in a Structured Fashion?

- Be explicit about your purpose
  - see earlier slide on why think about the future
- Be explicit about your object of study (system)
  - boundaries (time, space, . . .)
  - components
  - relationships between components
- Strive for coherence and consistency
  - of both the journey and the destination

What Does it Mean to Think about the Future in a Structured Fashion?

- Relevance of exercise to goals
- Clarity of communication
  - what the images of the future are
  - how these were developed
  - how insights/lessons derived
- Defensibility of insights
  - e.g., robustness of actions, relative "desirability" of outcomes

Some Thoughts on Thinking about the Future

"The only relevant discussions about the future are those where we succeed in shifting the question from whether something will happen to what would we do if it did happen."

Arie de Geus

"…is any purpose served by attempting long-term perspectives for a region? Yes!!! I say this not because the forecasts will necessarily be right, but because they may stimulate helpful actions – actions that may, in fact, even render the forecasts wrong."

Ramgopal Agarwala

What is a Scenario?

A scenario is not a prediction of what the future will be. Rather it is a description about **how the future might unfold**.

Scenarios **explore the possible**, not just the probable, and challenge their users to think **beyond conventional wisdom**.

Scenarios are histories of the future, telling coherent, multi-dimensional stories about how events unfold.

They include qualitative description, to capture:

Cultural influences, values, behaviors

Shocks, discontinuities

Texture, richness, imagination, insight

They are supported by quantitative analysis, to provide:

Definiteness, explicitness, detail

Consistency

Technical rigor, scientific accuracy

They are *not* predictive. They describe futures that *could be*, rather than futures that *will be*, because...

Predictions about the Future Rarely Come True!
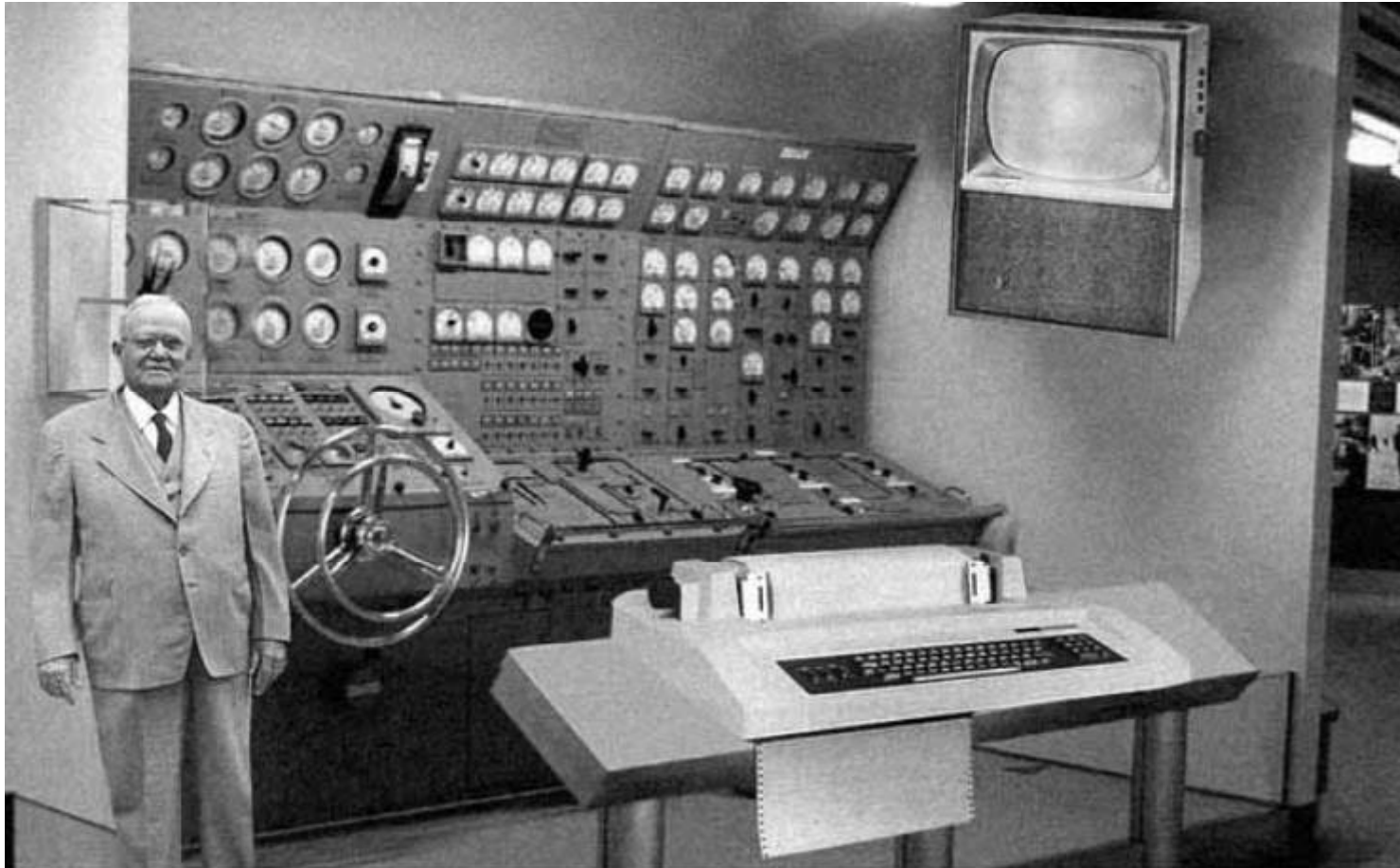
Scientists from the RAND Corporation have created this model to illustrate how a "home computer" could look like in the year 2004. However the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 50 years from now scientific progress is expected to solve these problems. With teletype interface and the Fortran language, the computer will be easy to use.

The claim that **scenario analysis*** is a non-predictive approach to the future does not imply the lack of inclusion of conditional predictions in the analysis. It does however require that the *general purpose* of the analysis is not to predict the most likely future state of the system but to assess the feasibility and desirability of different outcomes. Though the analysis is based on individual predictive calculations (e.g. the likely effect of a change in population growth rates or in technological change), the overall goal is to indicate something about the range of possible outcomes and their consequences.

Robinson, 2003

(*backcasting in original)

Scenarios for *Information*

Scenarios can be used to

- Illuminate potential problems, and bring future problems into focus

- Explore alternative responses in the face of uncertainty, and test them against different possible future paths.

- Clarify and communicate complex information and technical analysis

- Evaluate policies and help us make decisions despite the uncertain future.

Scenarios for *Participation*

Scenarios can be used to:

- Expand the range of perspectives considered;

- share understanding and concerns;

- explore and explain competing approaches to problems;

- uncover assumptions and rigorously test them;

- expose inconsistencies in thought and assumptions;

- provoke debate; and

- identify options and make decisions.

Examples of Scenarios

- **Short–term Country Scenarios:** Mont Fleur, GCC and the world

- **Medium–term Regional and Global Scenarios:** The UNEP GEO-3 Scenarios

- **Long–term Global Scenarios:** Intergovernmental Panel on Climate Change (IPCC)

Short–term Country Scenarios: Mont Fleur

- A scenario exercise carried out in **South Africa** in **1991–1992**, during a time of **deep conflict** and profound uncertainty.

- **22 prominent** South Africans from **across the political spectrum** came together to discuss possible future stories about South Africa.

- It was innovative in that it brought diverse people together to think **creatively about the future**.

Cont., Why future scenarios?

IEA vs. Traditional SOE

- Many environmental problems have to do with the **future** state of the environment and what might **emerge**

- Environmental Scenarios serve as

    - useful tools for evaluating future environmental problems and assessing current and future policies to resolve them

    - **Synthesizing and communicating complex and extensive information to decision makers and the public at large**

    - **A bridge between environmental science and policy** (synthesizing scientific knowledge in a form that can be used by decision makers to develop policies)

Cont., Why future scenarios?

Scenarios vs. Projections

- Long range future cannot be extrapolated or predicted due to indeterminacy (sources of uncertainties)
  - **Ignorance**: our understanding is limited
  - **Surprises**: complex systems can alter direction
  - **Volition**: human choice
- Scenarios start with the concept (or fact) that we cannot predict the future, However, they can inform us about what is possible in the future
- Scenarios offer a mean for examining the forces shaping our world, the uncertainties that lie before us, and the implications for tomorrow of our actions today

Cont., Why future scenarios?

Scenarios vs. Prediction

- A scenario is not a prediction of what the future will be, rather it is a description about how the future might unfold

- Scenarios explore the possible, not just the probable, and challenge their users to think beyond conventional wisdom

- They include qualitative description, to capture:
  - Cultural influences, values, behaviors, shocks, discontinuities, imagination, insight

- They are supported by quantitative analysis, to provide
  - Definiteness, explicitness, detail, Consistency, Technical rigor, scientific accuracy

- They are not predictive. They describe futures that could be, rather than futures that will be, because…

Scenario Dynamics

Ruskin, P.D. and Kemp-Benedict, E. (2002)

Intervention Policies
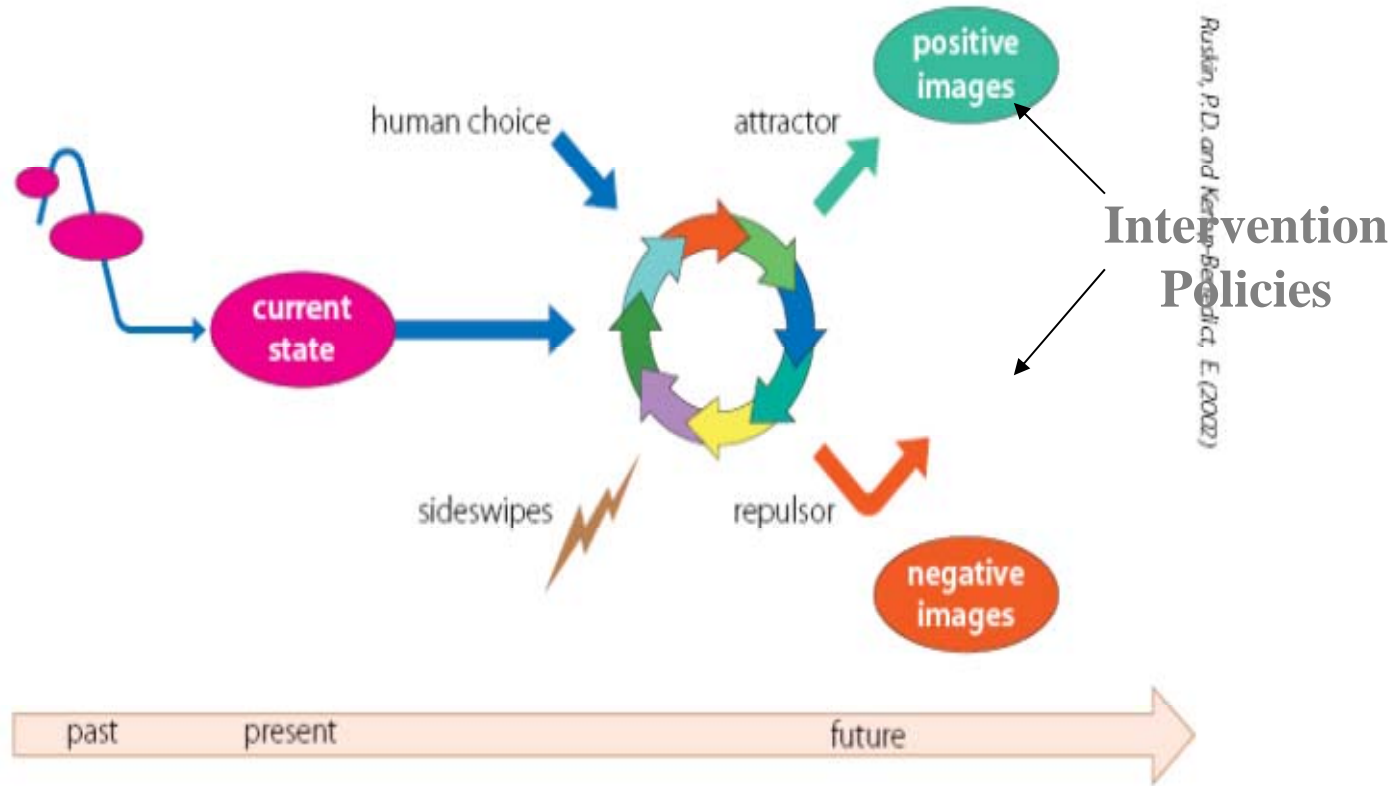
Observation and Assessment of the conditions of humans and the environmental (socio-ecological) systems

→
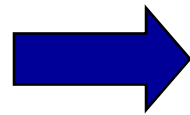
Encourage scenarios that minimize vulnerability of societal and environmental systems to unfavorable events and enhance their resilience

Elements of A Scenario

- **Current State**
  - ☐ Situation in the base year of scenario

- **Driving forces**
  - ☐ Deteminants that influence changes
  - ☐ Choices/decisions that bring changes

- **(Step-wise) changes**
  - ☐ At the core of a scenario analysis
  - ☐ Depicting how the driving forces unfold
  - ☐ Storyline highlighting key features

- **Image(s) of the future**
  - ☐ Situation in the end year of scenario

Types of Environmental Scenarios

- **Exploratory vs Anticipatory Scenarios**
  - ☐ **Exploratory scenarios**
    - Present -> future
    - To explore uncertainties/driving forces/developments
    - To test impacts of implementing specific policies
  - ☐ **Anticipatory scenarios** (also 'normative' scenarios)
    - Present <- future
    - To investigate how specific end state can be reached
    - To show how to achieve environmental targets

Forecast vs Backcast

Where is society going?
a Forecast

?
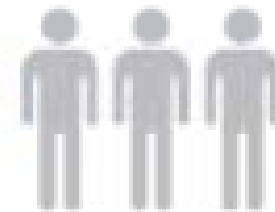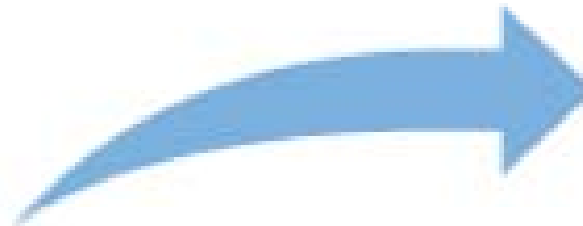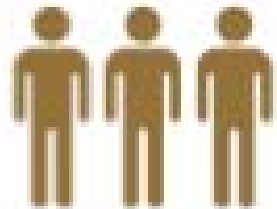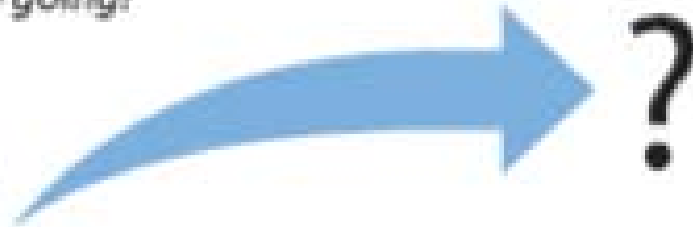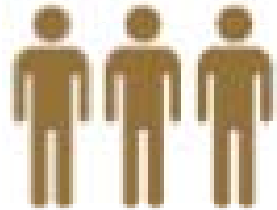
How do we get where we would like to go?
a Backcast

Source: Kemp-Benedict 2007

Baseline vs Alternative Scenarios

- **Baseline scenarios** (also 'reference' scenarios)
  - Describe a future development/state in which <u>no new policies or measures</u> are implemented apart from those already adopted or agreed upon

- **Alternative scenarios** (also 'policy' scenarios)
  - Take into account new <u>policies or measures additional</u> to those already adopted or agreed upon and/or that assumptions on key driving forces diverge from those depicted in a baseline scenario

Qualitative vs Quantitative Scenarios

- **Qualitative scenarios**
  - Are narrative descriptions of future developments
  - (i.e. presented as storylines, diagrams, images, etc.)

- **Quantitative scenarios**
  - Are numerical estimates of future developments
  - (i.e. presented as tables, graphs, maps, etc.)
  - Usually based on available data, past trends and/or mathematical models

Story and Simulation (SAS) Iterative Process

Start here

Qualitative Analysis (Story telling)

European Land Use Change Scenarios

The main *driving forces* behind land use change are climate change, population growth and technical and economic development, particularly of the transport and agriculture sectors.

The environmental *impacts* of land use change are complex, and may affect air quality, water quality and quantity, landscape structure and biodiversity ...

Adjust Qualitative & Quantitative

Review & Compare Qualitative and Quantitative

Quantitative Analysis (Simulation)

1. Are you familiar with scenarios that have been developed in the past? If so, describe those scenarios. What do you find interesting about them?

2. What do you think are the most important reasons for developing scenarios?

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Short History of Scenarios

- Formal scenarios first used after World War II as a method for war game analysis by the American military establishment

- 1960s in strategic planning applications in companies

- In the 1970s Royal Dutch Shell Oil Company refined the scenario approach

- Late 1980s GBN helped in the widespread of scenarios in the business world

- Early 1990s used as a tool for civil dialogue (e.g., South Africa, Guatemala, …), or for countries futures (e.g., The Netherlands, Scotland, ...)

- Mid 1990s onwards wide spread in NGOs and environmental agencies

Short History of Scenarios

- Today, scenario development is used in a wide variety of contexts:
    - political decision-making
    - business planning
    - Global, regional, and national environmental assessments
    - local community management

Short Term Country Scenarios
Mont Fleur: 4 Scenarios

- **Ostrich**: a negotiated settlement to the crisis in South Africa is not achieved, and the country's government continues to be non-representative

- **Lame Duck**: a settlement is achieved, but the transition to a new system is slow and indecisive

- **Icarus:** the transition is rapid, but the new government unwisely pursues unsustainable, populist economic policies

- **Flight of the Flamingos:** the government's policies are sustainable, and the country takes a path of inclusive growth and democracy

Are the government's policies sustainable?

YES

Flight of the Flamingos
Inclusive democracy and growth

NO

Is the transition rapid and decisive?

YES

Is a settlement negotiated?

YES

NO

Current negotiations?

NO

Ostrich
(Non representative government)

Lame Duck
Incapacitated government

Icarus
Macro economic population
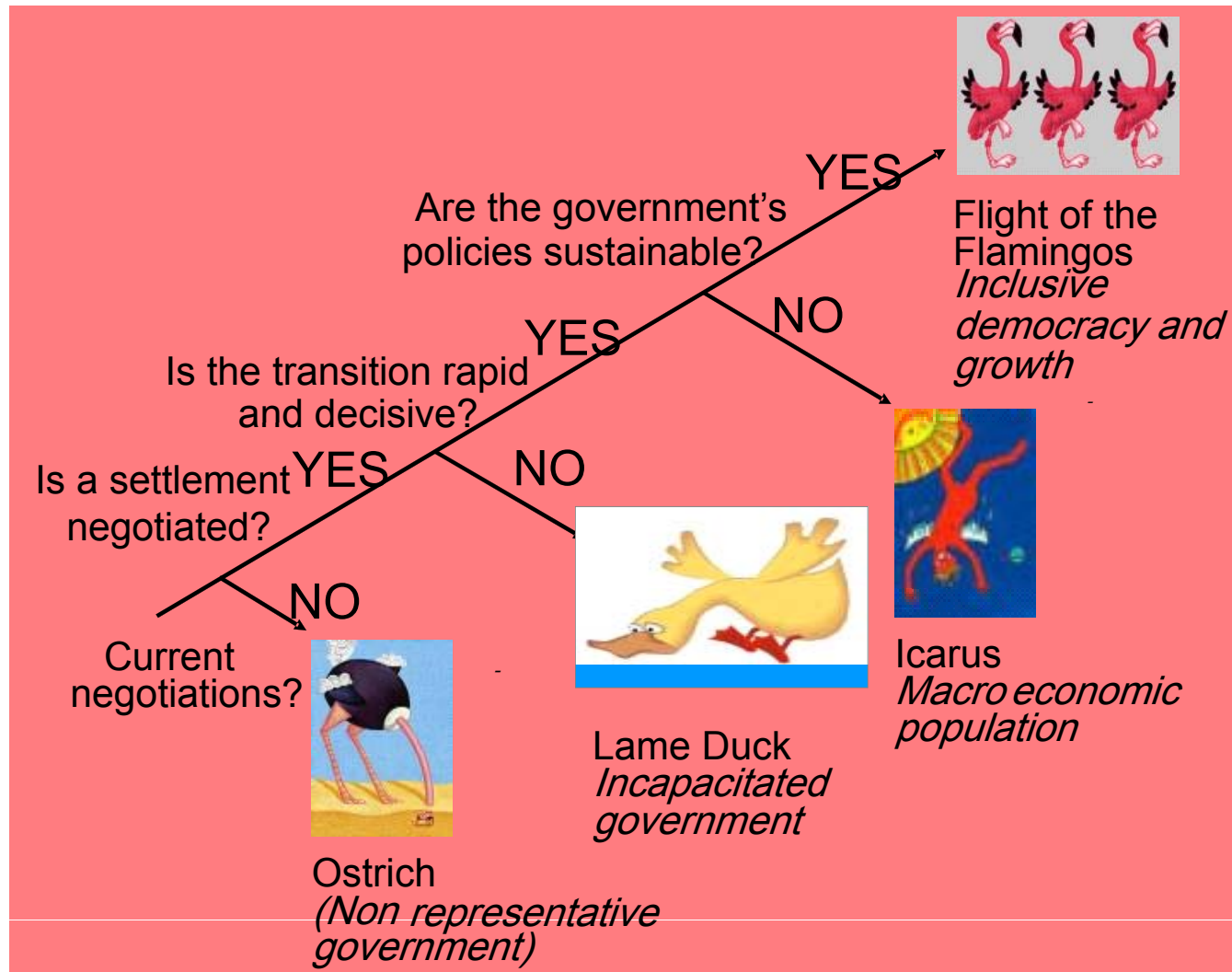
Mont Fleur: 4 Scenarios

1. **Ostrich:** a negotiated settlement to the crisis in South Africa is not achieved, and the country's government continues to be non-representative.

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3. **Icarus:** the transition is rapid, but the new government unwisely pursues unsustainable, populist economic policies.

4. **Flight of the Flamingos:** the government's policies are sustainable, and the country takes a path of inclusive growth and democracy.

Mont Fleur: Bridging Divides

- The exercise was remarkable for bringing together diverse interests, and for the **breadth of understanding** in many circles.

- It became clear that the **Flamingo** was the most feasible and broadly desired approach.

- The process resulted in substantive messages, informal networks and **changes in thinking** about the challenges the country faced.

- Developed by the World Economic Forum in 2007

- Multi-stakeholders project involving participants from the private, public and non-governmental spheres (over 300)

- Rationale:
  - The region will continue to draw the world's attention not just in terms of energy security, but also due to its fast growing capital markets and innovative cities;
  - The world needs to anticipate what may throw the region off-track and what opportunities exist to help the GCC exceed the expectations

- ## Two key questions concerning GCC future
  - Will leaders in the GCC countries be able to successfully implement the necessary and relevant economic and political reforms and enforce the rule of law, both in public and in private governance?

  - Will the GCC countries be able to maintain internal order and stability, in particular vis-à-vis a complex and uncertain regional situation?

- # Three Scenarios

  - Oasis

  - Sandstorm

  - The Fertile Gulf

- **Oasis:** regional stability continues to be a challenge, however, GCC are able to achieve substantial institutional reforms. They develop strong identities and work together to coordinate diplomatic and economic policies through technocratic governance and a stronger internal market

- **Sandstorm:** regional instability is the defining factor that affects the ability of GCC to effectively carry out necessary institutional reforms. A number of conflating factors make the surround region significantly turbulent, including conflict between the US and Iran and spillover of violence from Iraq

- **The Fertile Gulf:** rise of the GCC as innovation hubs in a global environment characterized by robust demand for energy and increasing globalization. Regional stability gives the opportunity to focus on enhancing their human capital at all levels, investing heavily in education while proceeding carefully with political and institutional reforms to support their growing economies and societies

Long–Term Global Scenarios –Intergovernmental Panel on Climate Change (IPCC)

- To provide plausible pictures of **future greenhouse gas** emissions, **four families of scenarios** were developed by IPCC.

- The scenarios were based on literature, six alternative modelling approaches, and a **participatory approach**.

- The scenarios are a basis for analysing **drivers of future emissions** and to assess associated uncertainties.

IPCC Scenario Framework
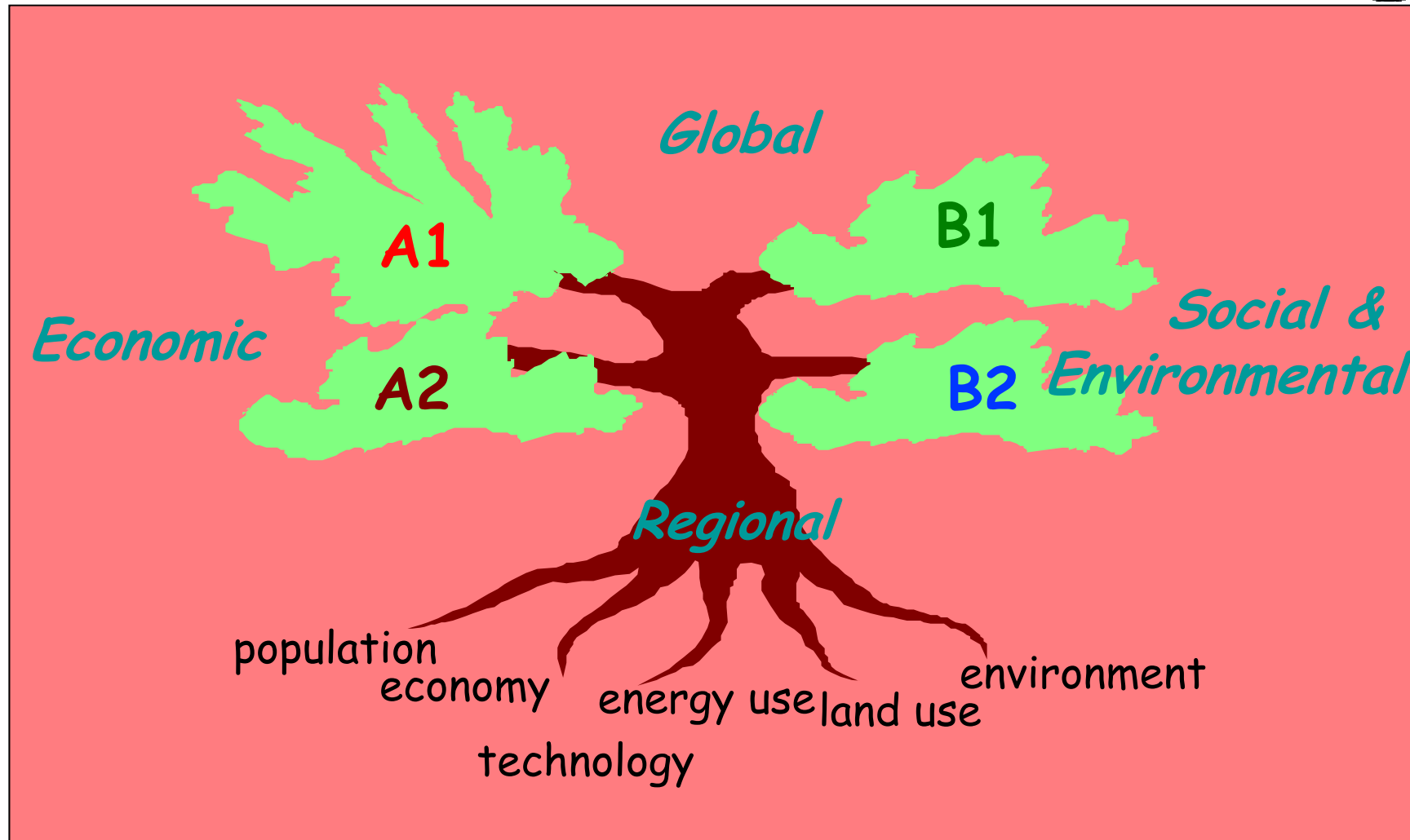
Long - Term Global Scenarios

Millennium Assessment Scenarios

		World Development	
		Globalization	Regionalization
Environmental Management	Reactive	**Global Orchestration**	**Order from Strength**
	Proactive	**TechnoGarden**	**Adapting Mosaic**

Billion persons

United Nations high scenario

United Nations low scenario

MA scenarios
Order from Strength
Adapting Mosaic
TechnoGarden
Global Orchestration
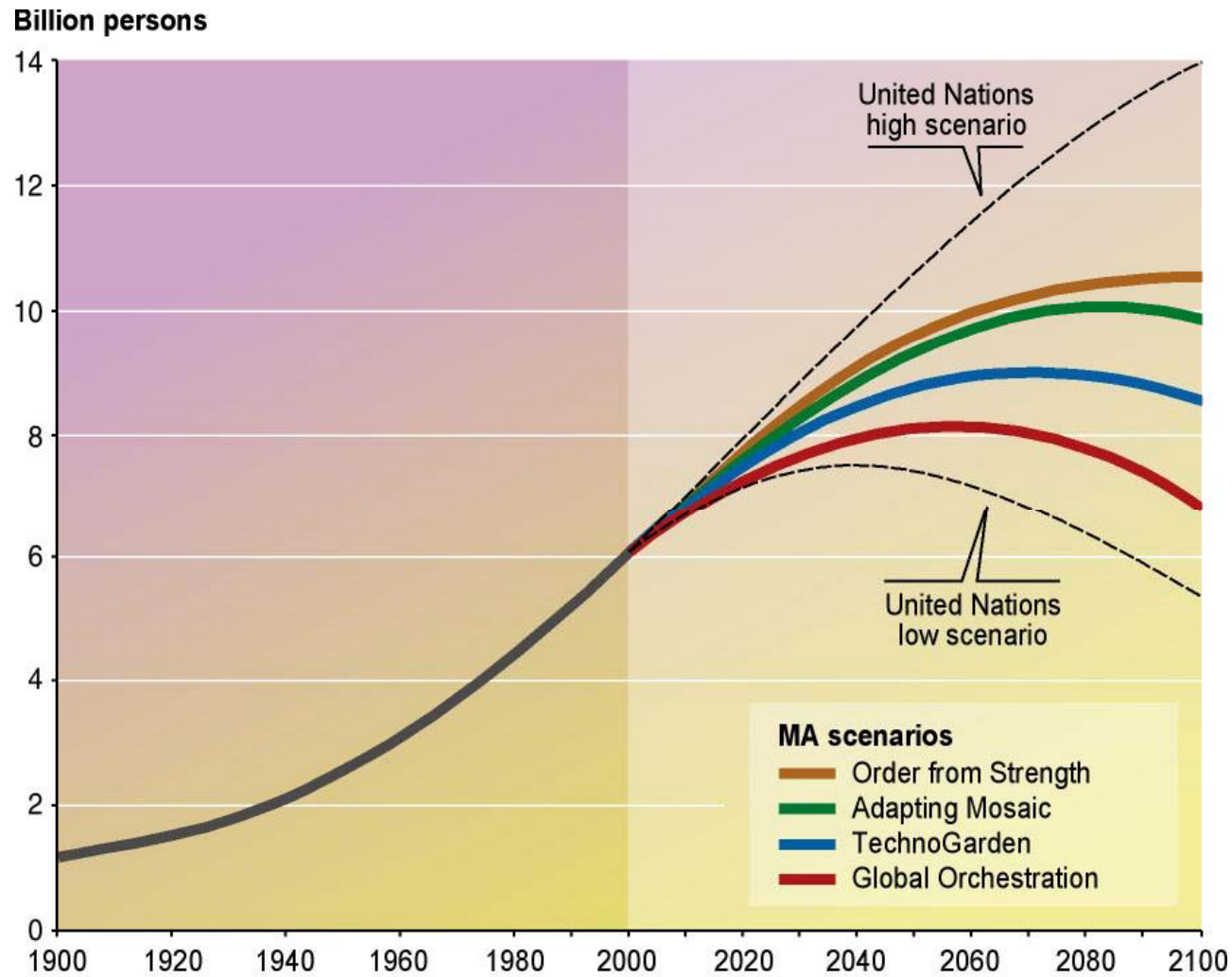
Source: Millennium Ecosystem Assessment

Changes in direct drivers: Changes in crop land and forest area under MA Scenarios

Pasture and cropland in million sq. kilometers

Developing regions

Industrial regions

MA scenarios
— Order from Strength
— Adapting Mosaic
— TechnoGarden
— Global Orchestration

Source: Millennium Ecosystem Assessment

Forest area in million sq. kilometers

Industrial regions

Developing regions

MA scenarios
— Order from Strength
— Adapting Mosaic
— TechnoGarden
— Global Orchestration

Source: Millennium Ecosystem Assessment

Changes in direct drivers:

Habitat transformation

– Further 10–20% of grassland and forestland is projected to be converted by 2050

Overexploitation, overfishing

– Pressures continue to grow in all scenarios

Invasive alien species

– Spread continues to increase

Fraction of potential area converted

MEDITERRANEAN FORESTS, WOODLANDS, AND SCRUB
TEMPERATE FOREST STEPPE AND WOODLAND
TEMPERATE BROADLEAF AND MIXED FORESTS
TROPICAL AND SUB-TROPICAL DRY BROADLEAF FORESTS
FLOODED GRASSLANDS AND SAVANNAS
TROPICAL AND SUB-TROPICAL GRASSLANDS, SAVANNAS, AND SHRUBLANDS
TROPICAL AND SUB-TROPICAL CONIFEROUS FORESTS
DESERTS
MONTANE GRASSLANDS AND SHRUBLANDS
TROPICAL AND SUB-TROPICAL MOIST BROADLEAF FORESTS
TEMPERATE CONIFEROUS FORESTS
BOREAL FORESTS
TUNDRA

Conversion of original biomes

Loss by 1950
Loss between 1950 and 1990
Projected loss by 2050[b]

MA Scenario Storylines

☐ **Global Orchestration** Globally connected society that focuses on global trade and economic liberalization and takes a reactive approach to ecosystem problems, but that also takes strong steps to reduce poverty and inequality and to invest in public goods such as infrastructure and education

☐ **Order from Strength** Regionalized and fragmented world, concerned with security and protection, emphasizing primarily regional markets, paying little attention to public goods, and taking a reactive approach to ecosystem problems

MA Scenario Storylines

☐ **Adapting Mosaic** Regional watershed-scale ecosystems are the focus of political and economic activity. Local institutions are strengthened and local ecosystem management strategies are common; societies develop a strongly proactive approach to the management of ecosystems

☐ **TechnoGarden** Globally connected world relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach to the management of ecosystems in an effort to avoid problems

Degradation of many services can be reversed by 2050

In three of the four MA scenarios, many currently degraded ecosystem services were enhanced by 2050

Changes in ecosystem services in percentage

Source: Millennium Ecosystem Assessment
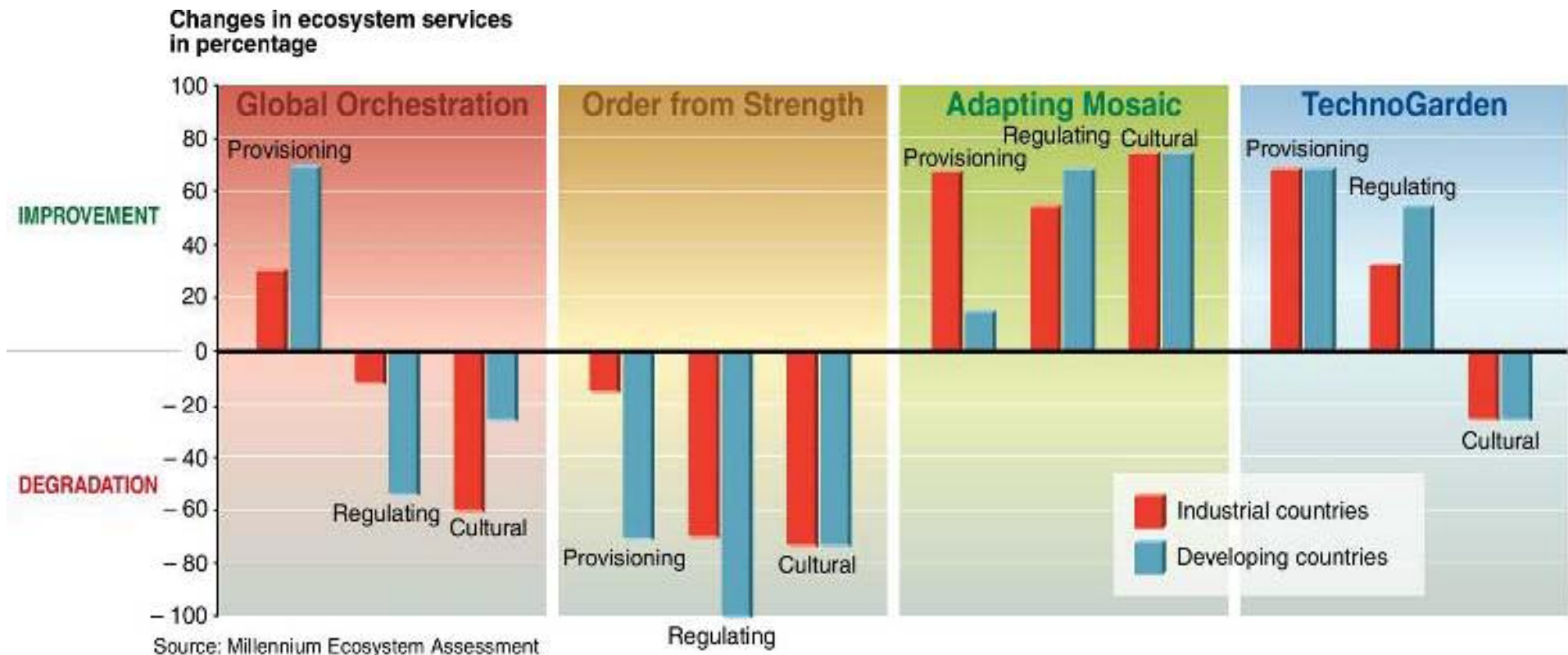
But the actions needed are significant and not underway (policies)

- Investments in public goods (e.g., education and health) and poverty reduction
- Elimination of trade barriers and distorting subsidies
- Use of active adaptive management
- Investment in education
- Investment in new technologies
- Payments for ecosystem services

MA Main Findings

- Humans have radically altered ecosystems in last 50 years

- Changes have brought gains but at growing costs that threaten achievement of development goals

- **Degradation of ecosystems could grow worse but can be reversed**

- **Workable solutions will require significant changes in policy**

Scenarios Analysis Findings

Medium Term National Scenarios
Abu Dhabi Environmental Scenarios

- Part of Abu Dhabi Emirate IEA Report (launched in 19 March 2007)

- Three Scenarios

  – Souk

  – Business as Usual

  – Zayed Vision

Three Scenarios

- ### Market Forces (Souk)
  - Development in ADE is dominated by market forces & mechanisms: **economic growth at any cost!**

- ### Policy Reforms (Business as Usual)
  - Strong policy constraints are placed by ADE government on market forces to **minimize** their **undesirable effects on human and environment**

- ### Sustainability (Zayed Vision)
  - **Proactive solutions**; human and environment are central to planning: ADE adapts **long-term integrated strategic planning** with the objective of achieving superior quality of life and healthy environment
  - Human development rather than material acquisition is advanced

What is the mechanism to reach this consensus?

Consensus Area, stable policy-Community Solidarity

ماهي الآلية للوصول إلى منطقة الاجماع العام؟

منطقة الاجماع العام والسياسة المستقرة (الحل الأمثل) — التضامن المجتمعي

المسئولين والسلطات الرسمية

التنظيم وإدارة المخاطر والتحكم

Bureaucratic Hierarchy
Regulations, Risk Managing/controlling

قوى السوق/المصالح الفردية

انتهاز الفرص/أخذ المخاطر

Market Individualism
Opportunities, Risk taking

قوى الضغط المجتمعي

أخذ الحذر وعدم المخاطرة

Activists and Pressure Groups
Cautionary, Risk avoiding

الاطار العام للإدارة والتنمية المستدامة

General Framework for Sustainable Development

- **Driving Forces Main Categories**
  - Governance
  - Demography
  - Economic Development
  - Human Development
  - Science and Technology
  - Culture
  - Regional Integration & Cooperation

Example of Driving Froce Analysis: Governance

Sub-Driver	Market Forces	Policy Reform	Sustainability
Dominant actor and power balance	Private sector with strong government support; power more to the private	Government with civil society support; power more to the government	Balanced civil society, government, and private sector, power more to the civil society
Governance approach	Top-down (with emphasis on hierarchical structures)	Top-down (but with stakeholders consultation)	Balanced Bottom-up and top-down approaches
Level of public participation	Low public participation	Medium public participation	High public participation
priority	Maximum economic growth (presumption: social and environmental concerns will naturally be dealt with)	Social development and environmental management and economic development	Social and environmental welfare with economic sufficiency
Mainstreaming of social & environmental policies	Low	Medium	High

Market Forces Scenario (Souk)

Overall Conclusion

- An environmentally depressing scenario for Abu Dhabi Emirate

- The Emirate will be facing considerable environmental problems, and the situation will deteriorate

- The environment will have least priority and will be overridden by investment and maximum economic development policies

Policy Reform Scenario (BAU)

Overall Conclusion

- Improvement of human well-being and decrease of environmental degradation due to assigning higher priority on human resources development, health, and the environment.

- However, investment and economic development policies and population growth rates continue to exert great pressures on the environment

- Governance approach remains reactive

Zayed Al-Nahyan Vision

"*We are responsible for taking care of our environment & wildlife, protect it and preserve it not only for the sake of our current generation, but also for the sake of our children and grandchildren, it is our duty to bare loyal to our ancestors as well as our successors*"

Overall Conclusion

- A balance is struck between natural and human managed ecosystem in the long-term

- Practices will lead to conservation and efficient use of natural resources and sound management of the environment, providing an ideal conditions for human wellbeing

- Although economic growth will be moderate, there will be considerable improvement in health and environmental welfare, and the cost of pollution on ADE's GDP is reduced considerably

Summary of Scenarios Impact on ADE Main Environmental Issues

Environmental Issue	Souk	BAU	Zayed
Water Scarcity & Groundwater Quality	very high	high	moderate
Land Degradation & Desertification	very high	moderate	low
Degradation of Coastal & Marine Environment	high	moderate	low
Urban Environment conditions	high	moderate	low
Biodiversity Loss	very high	moderate	low

Legend very high   high   moderate   low

- **Key Messages for Policymakers**
  - The most important choices affecting the environment in the future are not necessarily environmental choices
  - Environment policies should not be compartmentalized, they should be integrated/mainstreamed into the national socio-economic development planning
  - The path to sustainable development is long, and achieving long-term goals requires long-term thinking
  - The trend towards less environmental regulation and self-regulation (market forces scenario), can lead to the complication of many environmental problems and consequently may lead to social problems
  - There are always "short-term" trade-offs, mainly between economic growth and environmental sustainability/human wellbeing

- **Strategic Recommendations to Decision Makers**
  - Investment in Human development in the fields of education, training, and capacity building (establishing a knowledge-based society), accompanied by effective, well-planned national substitution programs
  - Investment in R&D to solve societal problems
  - Regional integration and cooperation with the GCC countries and ultimately with the Arab countries in the field of food production, R&D in desalination and water treatment technology, bio-reserves, protected areas, GMOs, and the protection of the Arabian Gulf marine environment

The Fertile Gulf

Sandstorm

Oasis

The GCC Countries and the World Scenarios to 2025

- **2 Key Scenarios Questions**
  - Will leaders in the GCC countries be willing and able to implement the necessary economic and political reforms and enforce the rule of law, both in public and in private governance?
  - How can the GCC countries maintain internal order and stability, in particular vis-à-vis a complex and uncertain regional situation?

The GCC Countries and the World: 2025

- **2 Key themes as being crucial to the future of the GCC countries, driving forces (critical uncertainties)**
  - **Education and Innovation**
    - Moving away from oil dependence; diversification, but existing skills low; little research, development and innovation; import of foreign workers and technologies; Education policies to develop an innovative-based economies that do not rely on natural resources
  - **Leadership and Governance**
    - Traditionally-organized family groups; political reforms with varying degrees; managing internal stability and reforms, and leadership will play critical role in the future

Medium Term Regional & Global Scenarios - UNEP GEO-3 Scenarios

- A set of scenarios built on pre-existing exercises including work by the **Global Scenario Group** and the **IPCC**

- Each scenario was developed at regional and sub-regional levels for the period **2002-2032**

- Scenarios included all aspects of sustainable development with an emphasis on **environmental descriptions and policies**

- **Scenario drivers** included demographic, economic, social, technological, environmental, cultural, and political

Global Environment Outlook 3
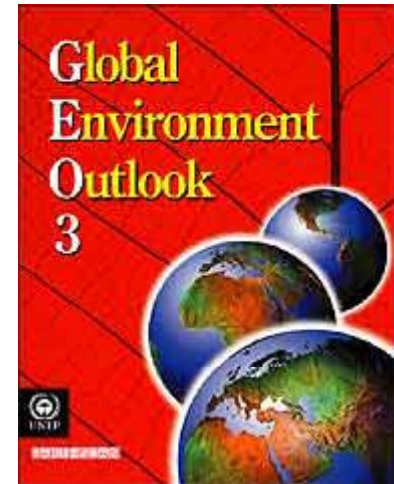
Markets First

Security First

Policy First

Sustainability First

IPCC Scenarios

A1: Rapid economic growth, a global population that peaks in mid 2100s and declines, and rapid introduction of new technologies.

A2: Heterogeneous work with themes of self-reliance and preservation of local identities. A continuously increasing global population; economic growth is regional.

B1: Rapid changes in economic structure toward service and information economy, reduction in material intensity and introduction of resource-efficient technologies.

B2: Emphasis is on local solutions to economic, social and environmental sustainability. Intermediate level of economic development, less rapid and more diverse technological change than in B1 and A1.

- A set of scenarios built on pre-existing exercises including work by the **Global Scenario Group** and the **Intergovernmental Panel on Climate Change**.

- Each scenario was developed at regional and sub-regional levels for the period **2002–2032**.

- Scenarios included all aspects of sustainable development with an emphasis on **environmental descriptions and policies**.

- **Scenario drivers** included demographic, economic, social, technological, environmental, cultural, and political drivers.

1. Market First

Most of the world adopts values and expectations prevailing in **industrialized countries**.

Trust is placed in **globalization and liberalization** as this will enhanced corporate wealth, create new enterprises and employment, and ultimately help people and communities insure against or **fix social and environmental problems**.

Economic imperatives undermine corrective influences, such as ethical investing.

2. Policy First

Environmental and social costs and gains are factored into **policy measures, regulatory frameworks and planning processes**. All these are reinforced by fiscal levers and incentives, e.g., carbon taxes and tax breaks.

International "soft law" treaties and binding instruments affecting environment and development are integrated into unified blueprints, and their status in law is upgraded. Fresh provision is made for **open consultation processes** to allow for regional and local variants.
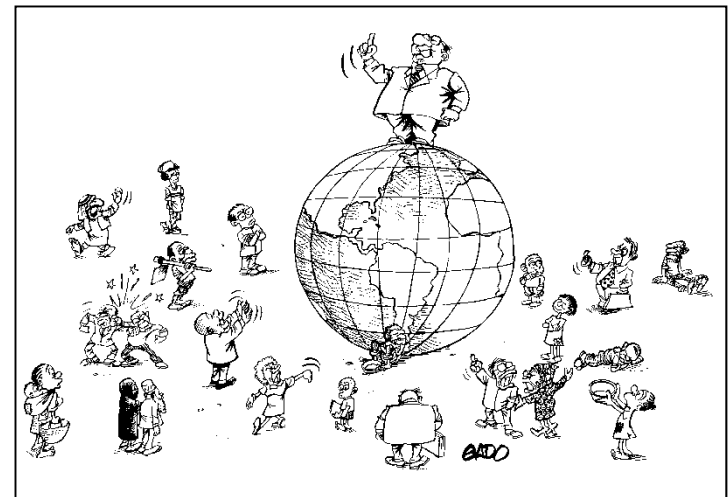
3. Security First

Assumes a world of striking disparities, where inequality and conflict prevail. Socio-economic and environmental stresses give rise to **waves of protest and counteraction**.

Powerful and wealthy groups focus on **self-protection**, creating islands of advantage. Nearby and dependent communities experience enhanced security and economic benefits, but **the disadvantaged mass of outsiders are excluded**.

Welfare and regulatory services into disuse, but markets to operate outside the
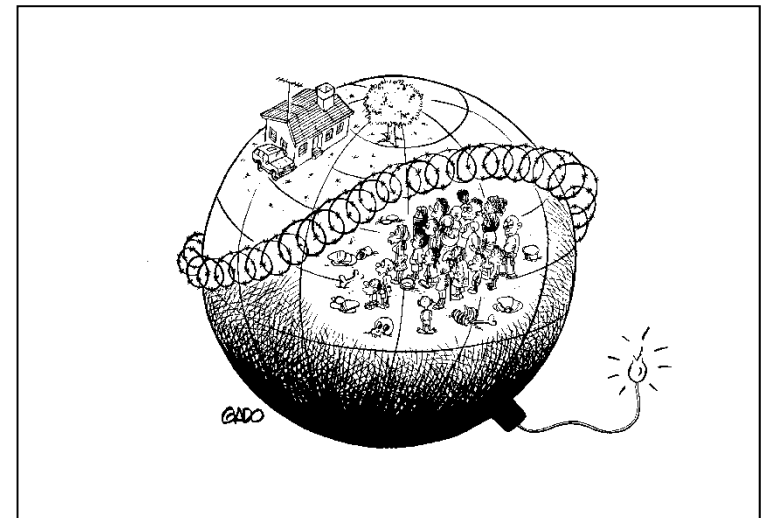
4. Sustainability First

A new environment and development emerges, supported by **more equitable values and institutions**. Radical shifts in the way people interact with one another and with the world around them stimulate and support **sustainable policy measures** and **accountable corporate behaviour**.

There is **fuller collaboration** among governments, citizens and other stakeholder groups in decision-making on issues of common concern.

A consensus is reached on what needs to done to satisfy basic needs and to realize personal goals without beggaring others or spoiling the outlook for posterity.
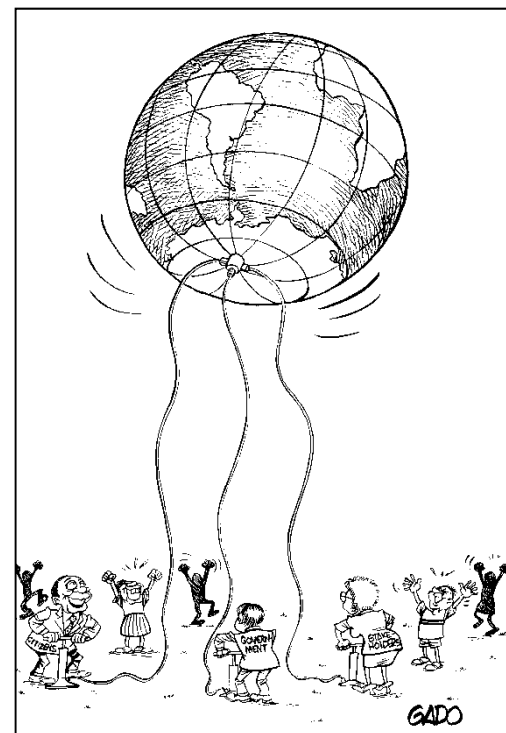
Which of the four scenarios described in GEO-3 do you feel is currently unfolding?

Illustrate this with an example of a situation or event in the recent past or present that you think represents a characteristic of the future as described by your chosen scenario.

Overview

- Session 1: What is a Scenario?

- Session 2: Examples

- Session 3: Purpose, Process and Substance

- Session 4: Policy Analysis

- Session 5: Developing Scenarios

- Session 6: Exercise on Scenario Development

Purpose, Process and Substance

Why? Purpose	Open exploration or decision support?
How? Process	Metaphorical Imagination or Cartesian (left brain – right brain)?
What? Substance	Simple or complex?

Alternative Objectives

- Exploration
  - Awareness raising
  - Stimulation of creative thinking
  - Insight into the way societal processes influence each other.

- Decision Support
  - Concrete strategic options
  - Scenarios with a range of options from desirable, middle of the road and undesirable.

Keep in Mind
  ... most exercises will have a bit of both objectives
  …especially in the former, the process is as important as the product.

Alternative Approaches

- Intuitive

  - Scenario development viewed as an art form and qualitative knowledge and insights are used.

  - Involves development of storylines, collages and interactive group sessions with diverse participants.

- Technical

  - Scenario development viewed as a rational and analytical exercise.

  - Involves use of quantified knowledge and computer models.

Keep in Mind

... the two approaches have complementary strengths and weaknesses

…most recent exercise attempt to combine the two

Alternative Levels of Detail

- Complex stories
  - intricate webs of variables and linkages, multiple issues, multiple scales

- Simple stories
  - small set of variables and few linkages, may focus on a single issue at a single scale

Keep in Mind

… theories should be as simple as possible, but no simpler (simple does not imply simplistic)

... your scenario should not be harder to communicate than the real world

- Are there existing policies you wish to explore as part of the scenario exercise?

Forecasting and Backcasting
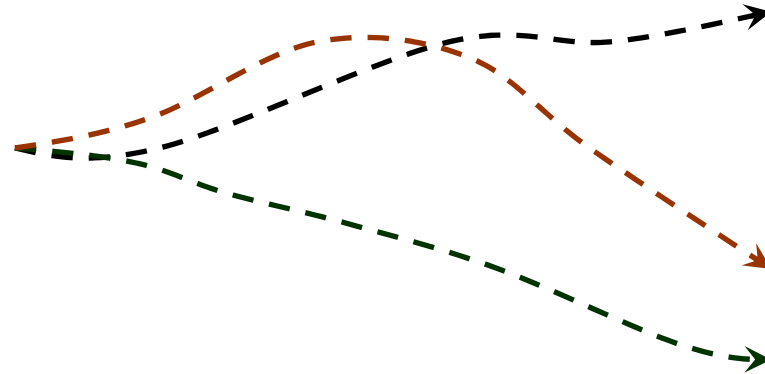
Forecasting
Where is society going?

Backcasting
Where do we want to go?
How do we *get* there?

Where do we want not to go?
How do we *avoid getting* there?
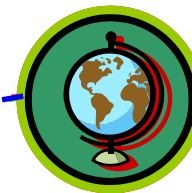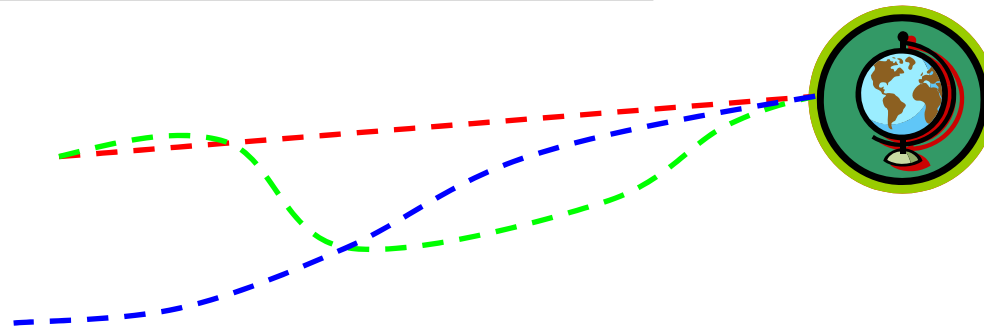
Coping and Creating

Coping

The only relevant discussions about the future are those where we succeed in shifting the question from whether something will happen to what would we do if it did happen

Arie de Geus
Former Head of Group Planning, Shell International

Creating

We resolve further to halve, by the year 2015, the proportion of the world's people whose income is less than one dollar a day

excerpt from the UN Millennium Declaration

Overview

- Session 1: What is a Scenario?
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- Session 4: Policy Analysis
- Session 5: Developing Scenarios
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Policy Analysis

- Are there **existing policies** you wish to **explore** (feasibility, effectiveness, impacts of alternative policies) as part of the scenario exercise?

- Is there a preconceived **end vision**, or at least some aspects of a vision, i.e., **specific targets**?

- Are the effects of a **policy** of such **magnitude** that they would fundamentally **alter the basic structure of the scenario**? (i.e., imposed policy, coping or creating particular situation)

Case	Existing Policies	Pre-conceived end vision?	Policies determine the scenario?	Potential Uses
A	Y	Y	Y	Test ability of policy to create conditions for success
B	Y	Y	N	Test the extent to which the policy can affect change
C	Y	N	Y	Explore role of policy in determining nature of future
D	Y	N	N	Explore effects of policies under fixed conditions
E	N	Y	Y	Identify policies that can create conditions for success
F	N	Y	N	Identify policies that can meet specific targets
G	N	N	Y	Identify policies that may influence the future
H	N	N	N	Identify policies and their implications

"*Testing policies to limit pollutant emissions from the power sector in the United States*"

- Energy Information Administration (EIA) in the United States
- Analysis of potential costs and impacts of various existing policies to limit emissions

"*Exploring the future of the environment in Latin America and the Caribbean*"

- GEO Latin America and the Caribbean: Environmental Outlook 2003

- Compared and contrasted the four scenarios

- Each scenario had significantly different implications for the environment

"*Identifying policies to achieve a 60 per cent reduction in carbon emissions by 2050 in the United Kingdom*"

- UK's Department of Trade and Industry
- work yielded a number of new policy initiatives and measures to achieve the target
- scenario analysis was model-based
- technology portfolios in each sector that could achieve the target and their evolution over time were identified, as well as cost

Exercise: Characterizing a Policy

Scenario: For your issue, a set of national scenarios is to be developed. Discuss the following:

- What existing policies would be relevant for consideration in the scenario?

- Is there an end vision for the issue, and if so, what is it?

- Would the policies determine the scenario or merely influence parts of them?

- Characterize the policy using the table

Discuss results in plenary

Overview

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- Session 4: Policy Analysis
- Session 5: Developing Scenarios
- Session 6: Exercise on Scenario Development

Tailoring Scenario Development to a National IEA

The framework for scenario development has been tailored to GEO in three ways:

1. It is explicitly policy-relevant;

2. It is intended to be comprehensive enough to allow a broad range of issues that arise in sustainability analyses; and

3. It is presented as a participatory, stakeholder-driven process.

Elaborating a Scenario

Boundaries
- Spatial
- Temporal

Critical Uncertainties
- Resolution affects future course

Story of the Present
- Historic context
- Important features
- Actors and events
- Major issues of concern

Important themes
- Important elements of the story

Driving Forces
- Trends and processes at play

Images of the Future

Narrative
- Coherent vision
- Quantification
- Technical rigor

Stakeholders

- **See the Scenario Process as Part of the Whole IEA Process:**
  In many cases, the scenario process will be nested within an overall GEO process. Thus, it should be aware of, and to the extent possible, work in concert with the other processes.

- **Recognize the Significance of Developments at Other Scales for a National Scenario Process:**
  Although the focus here is on national GEO processes, a study might be complemented by the development of scenarios on other levels: global, regional and local.

Steps in a Scenario Methodology

- **Clarifying the Purpose and Structure of the Scenario Exercise**
  - a. Identifying stakeholders and selecting participants.
  - b. Establishing the nature and scope of the scenarios.
  - c. Identifying themes, targets, indicators, and potential policies.
- **Laying the Foundation for the Scenarios**
  - d. Identifying drivers.
  - e. Selecting critical uncertainties.
  - f. Creating a scenario framework.
- **Developing and Testing the Scenarios**
  - g. Elaborating the scenario narratives.
  - h. Undertaking the quantitative analysis.
  - i. Exploring policy.
- **Communication and Outreach**

Steps in a Scenario Methodology
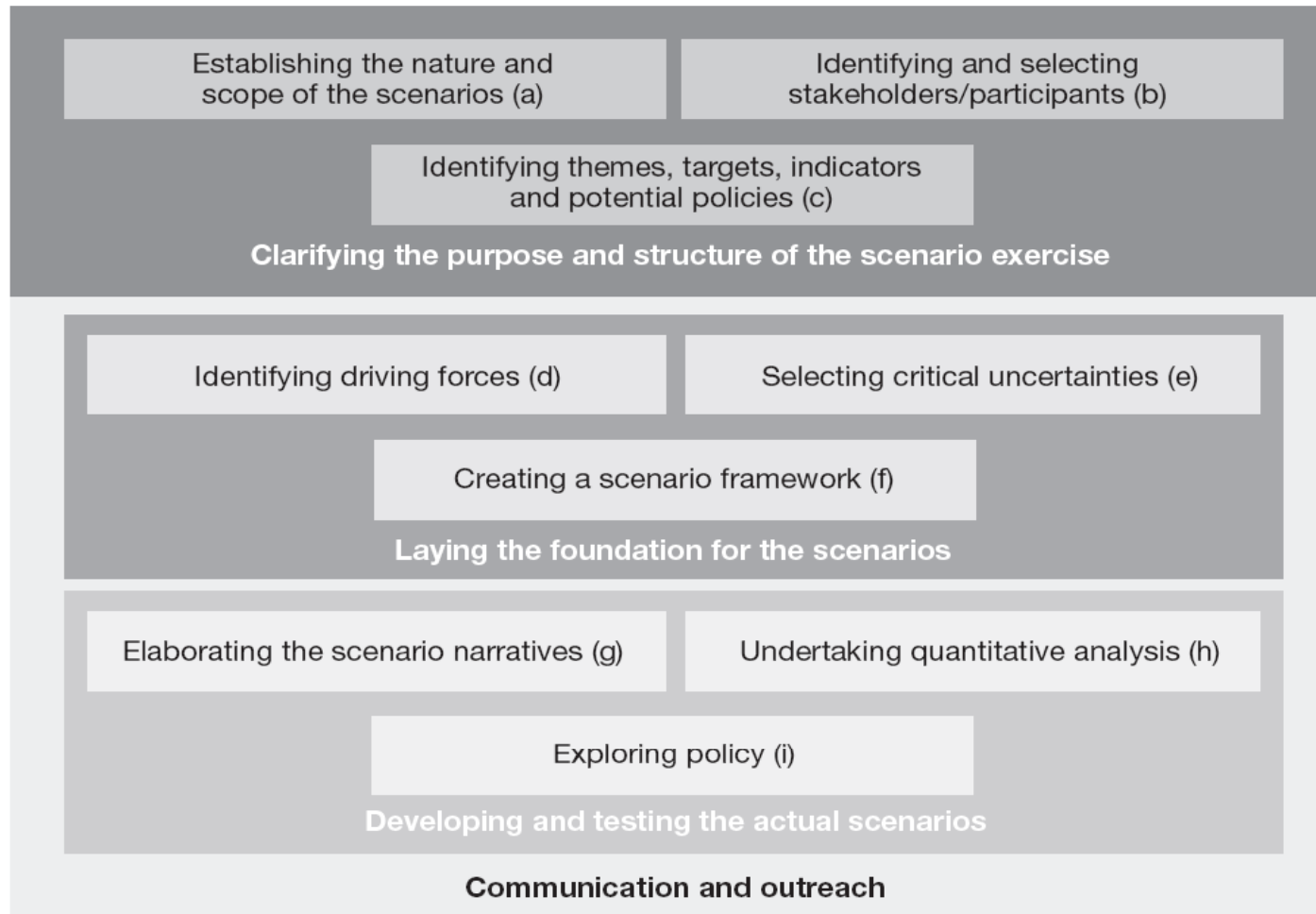
Purpose: Establish a clear view of the scenario to be used.

Output: Depending on type of scenario, could include time horizon, qualitative and quantitative balance, nature of policy analysis and available resources.

1. What is the problem that we want addressed in the scenario project?

2. Are there existing policies we wish to explore as part of the exercise?

3. Do we have a preconceived vision, or specific targets, for the scenarios?

4. Why is scenario development appropriate for dealing with the problem?

5. Who is the audience?

a) Establishing the Nature and Scope of the Scenarios – 11 Questions

6. What types of scenarios are needed? Would a backcasting or forward-looking approach be better?

7. What time frame should be considered? Should the scenarios be narrative and/or quantitative?

8. How are the scenarios to be connected with scenarios developed for higher levels (e.g., regional or global)?

9. What do we want to have achieved by the end of the scenario process?

10. What resources are needed to achieve the goal and is it possible/desirable to make that investment?

11. What are the expected roles of the scenario team and other stakeholders?

Purpose: To ensure the process benefits from a cross-section of society, improving the likelihood of buy-in from the audience.

Output: A list of participants and alternates.

- Identify which organization or institution is **convening this scenario exercise**, and consider participant(s) from this group.

- Identify other audiences by deciding **who the scenarios are intended to reach**. This could be the same audience as for the national GEO as a whole.

- Identify other key stakeholders–who has an important stake in the country's future, **who are the decision-makers**, and who are the people directly impacted by such decisions.

Figure 1. Insiders and outsiders to a hypothetical community issue.

Purpose: To provide more specific details on the scope of the exercise

Outputs:
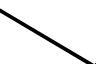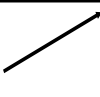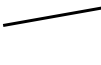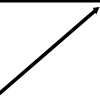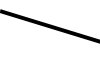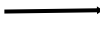
- A clearer understanding of the real-world system for which the scenario exercise is being undertaken

- Preliminary lists of: key themes, targets and goals (including constraints or thresholds to be avoided), policies to be considered, specific indicators

1. How would you describe the current social, economic and environmental situation in your country?

- What themes did you include?
- What indicators did you use?

2. How did it get to be this way?

- What other themes/issues did you need to include to explain the history?
- How did you characterize the key dynamic relationships?
- What past policies/actions/events were significant?

3. What is on the present day agenda?

- Have commitments been made/goals and targets been set?
- Have policies been proposed or put in place?
- What are people's hopes and fears?

- Identifying driving forces.
- Selecting critical uncertainties.
- Creating a scenario framework.

d) Identifying Driving Forces

Purpose: To identify the key trends and dynamics that will determine the course of the future.

Steps:

1. Review the previous discussions surrounding the past, present, and future.

2. What factors have had or could have the most influence on other parts of the system? For example, what comes across as more of a cause than an effect? (Do not ignore those that may not have had a big effect in the past.)

3. What are key trends? How persistent are they?

d) Identifying Driving Forces
A Typical Catalogue

Demographic

- Population is growing
- Urban population is increasing
- Population is aging

Economic

- Economy increasingly globalized

Social

- Increasing inequality
- Worsening poverty

Cultural

- Spread of values of consumerism & individualism
- Rising nationalist and fundamentalist reaction

Technological

- Advancement and penetration of
  - Computer and information technology
  - Biotechnology
  - Nanotechnology and miniaturization

Environmental

- Increasing global stress
- Local degradation
- Some remediation (in richer countries)

Governance

- Evolution of global institutions (e.g. MEAs)
- Spreading of democratic governance
- Expanding roles for civil society in decision-making

…but important exceptions

e) Selecting Critical Uncertainties

Purpose: To select critical uncertainties – those driving forces that are especially important in determining how the future evolves, but whose future development is highly unpredictable.

Output: A small set of critical uncertainties.

e) Selecting Critical Uncertainties

For each driving force:

1. Consider the degree of uncertainty. Is there a great deal of uncertainty, or relatively little?

2. Consider the relative impact/importance of this driving force into the future.

3. Plot the driving force on a chart of impact/importance versus uncertainty.

4. Identify the two or three driving forces that are highest impact and highest uncertainty.

high

Other Influential Factors with one likely trend – 'inevitables'

Importance

Critical Uncertainties

Hmm?

low **Uncertainty** **high**
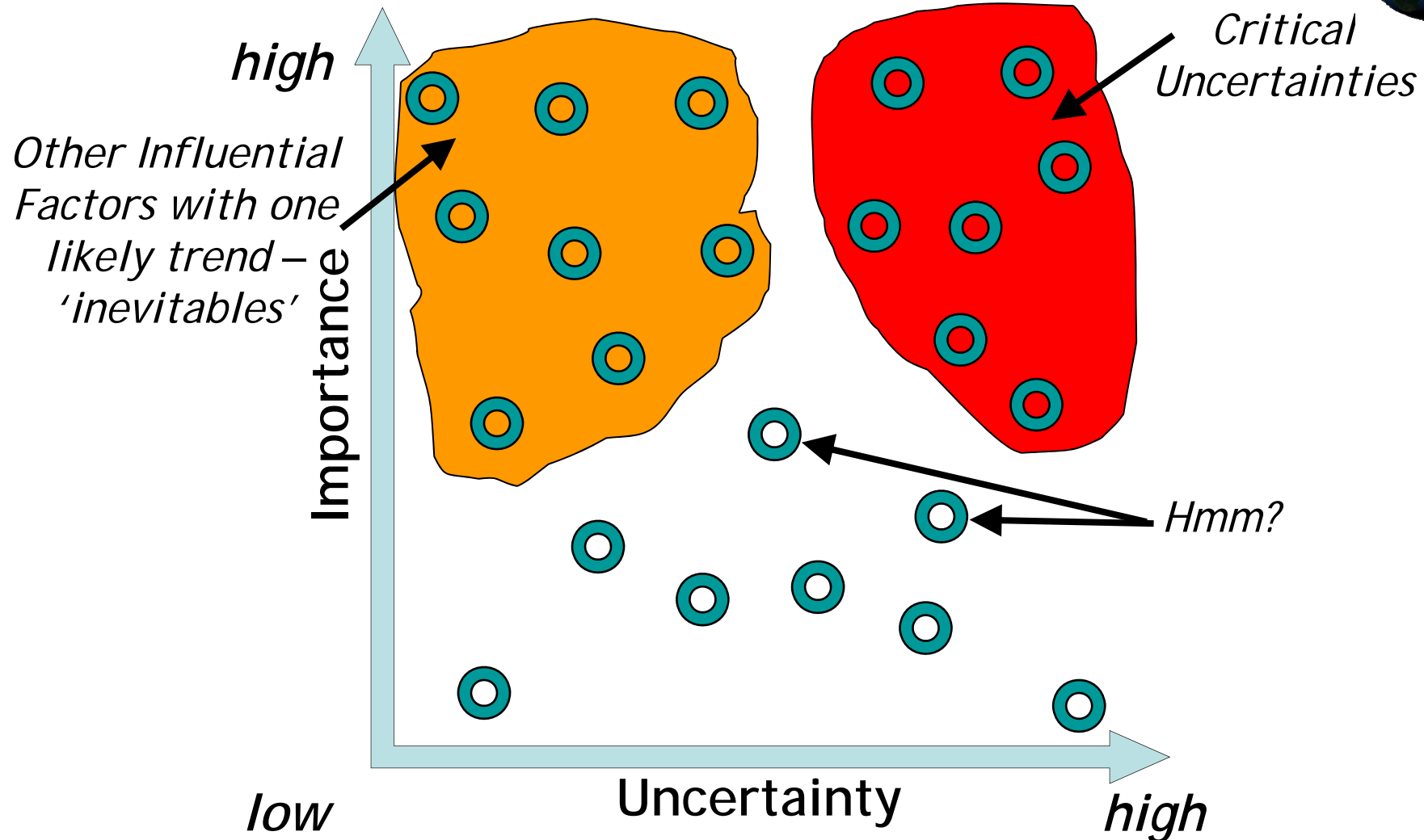
For each driving force:

- Consider the **degree of uncertainty**. Is there a great deal of uncertainty, or relatively little?

- Consider the relative **impact/importance** of this driving force into the future

- **Plot the driving force** on the chart of impact/importance versus uncertainty

- Identify the **two or three driving forces** that are highest impact and highest uncertainty

Which driving forces are critical uncertainties?
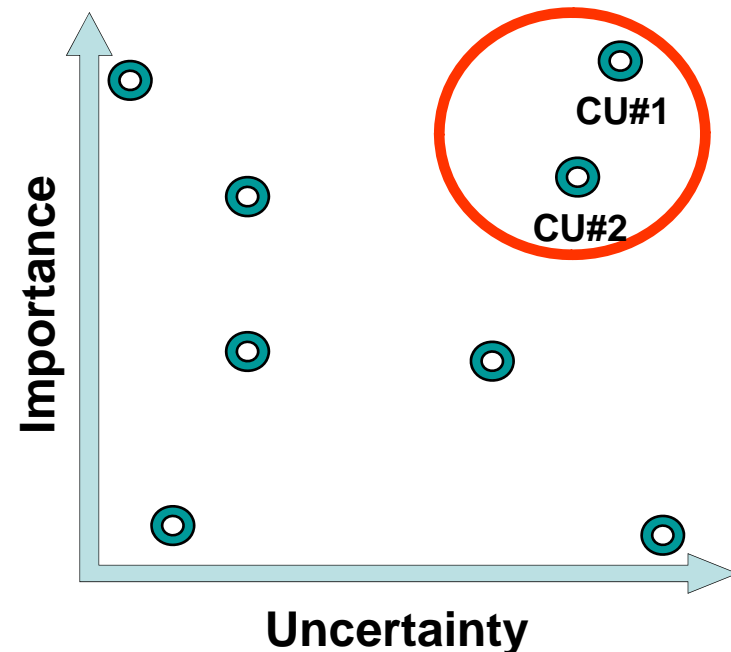
f) Creating a Scenario Framework

Purpose: To use the critical uncertainties to establish the scenario framework.

Output: A small set of clearly defined scenario "skeletons".

f) Creating a Scenario Framework

Various methods have been proposed to go from critical uncertainties to scenario skeletons; three common ones are:

- scenario axes based on two critical uncertainties

- scenario axes based on two clusters of critical uncertainties

- clustering mini-stories based on critical uncertainties into coherent scenarios

Using two of the critical uncertainties
define four possible futures

"Scenario B"

"Scenario A"

Uncertainty #2

Critical   Uncertainty #1

Critical

"Scenario C"

"Scenario D"

Same as before, but first cluster the critical uncertainties
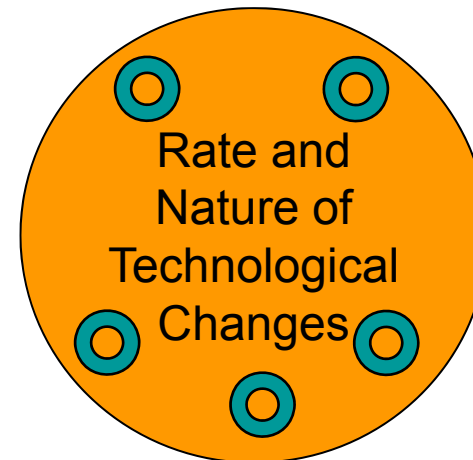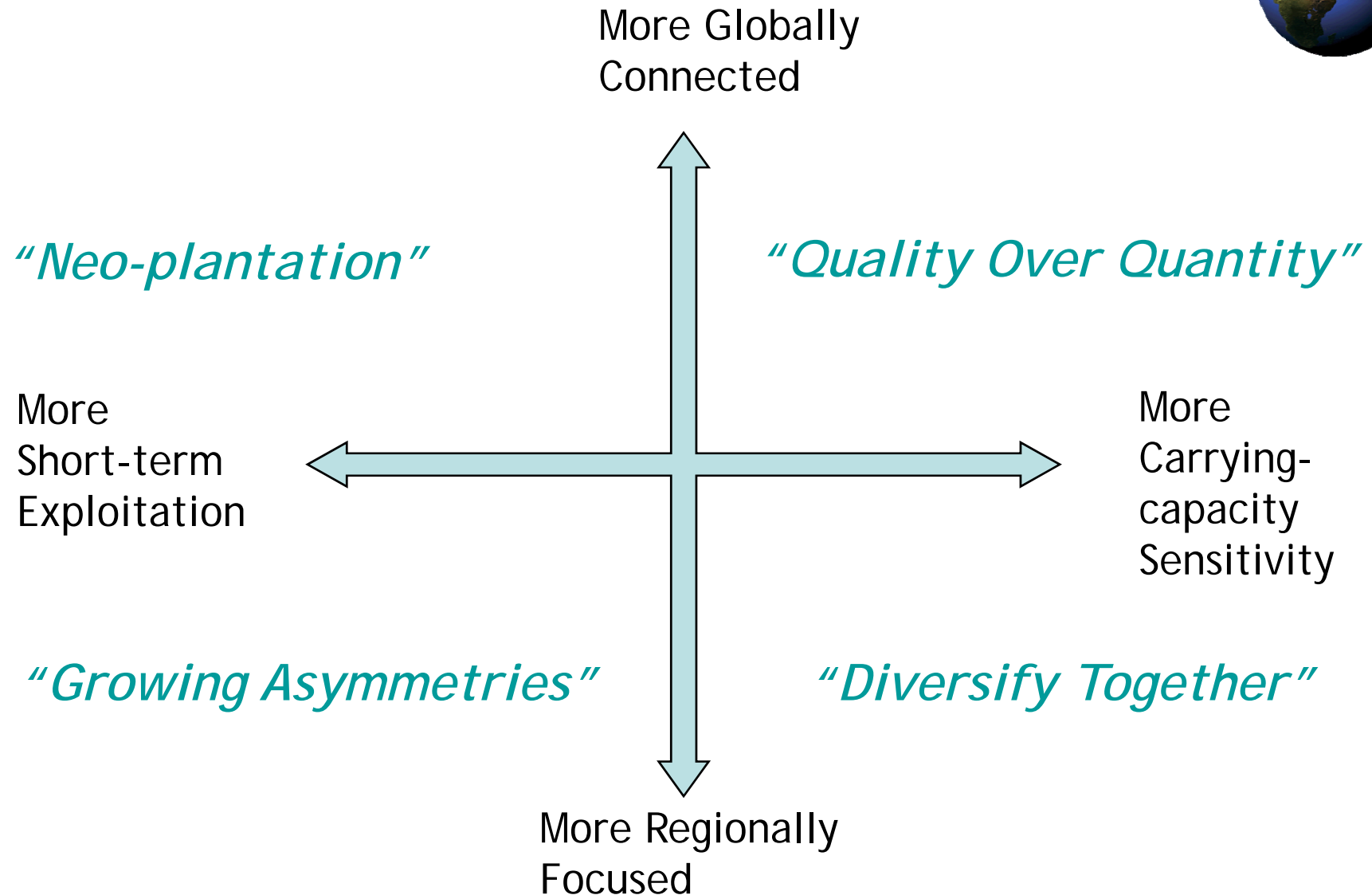
Developments in Global Environmental Governance

Rate and Nature of Technological Changes

UNEP

More Globally
Connected

"Neo-plantation"　　　　　　　　*"Quality Over Quantity"*

More
Short-term
Exploitation

More
Carrying-
capacity
Sensitivity

"Growing Asymmetries"　　　　　　*"Diversify Together"*

More Regionally
Focused

FRAGMENTATION

I Will

Ecotopia

INDIVIDUAL

COMMUNITY

Consumerland

New Civics

COHERENCE
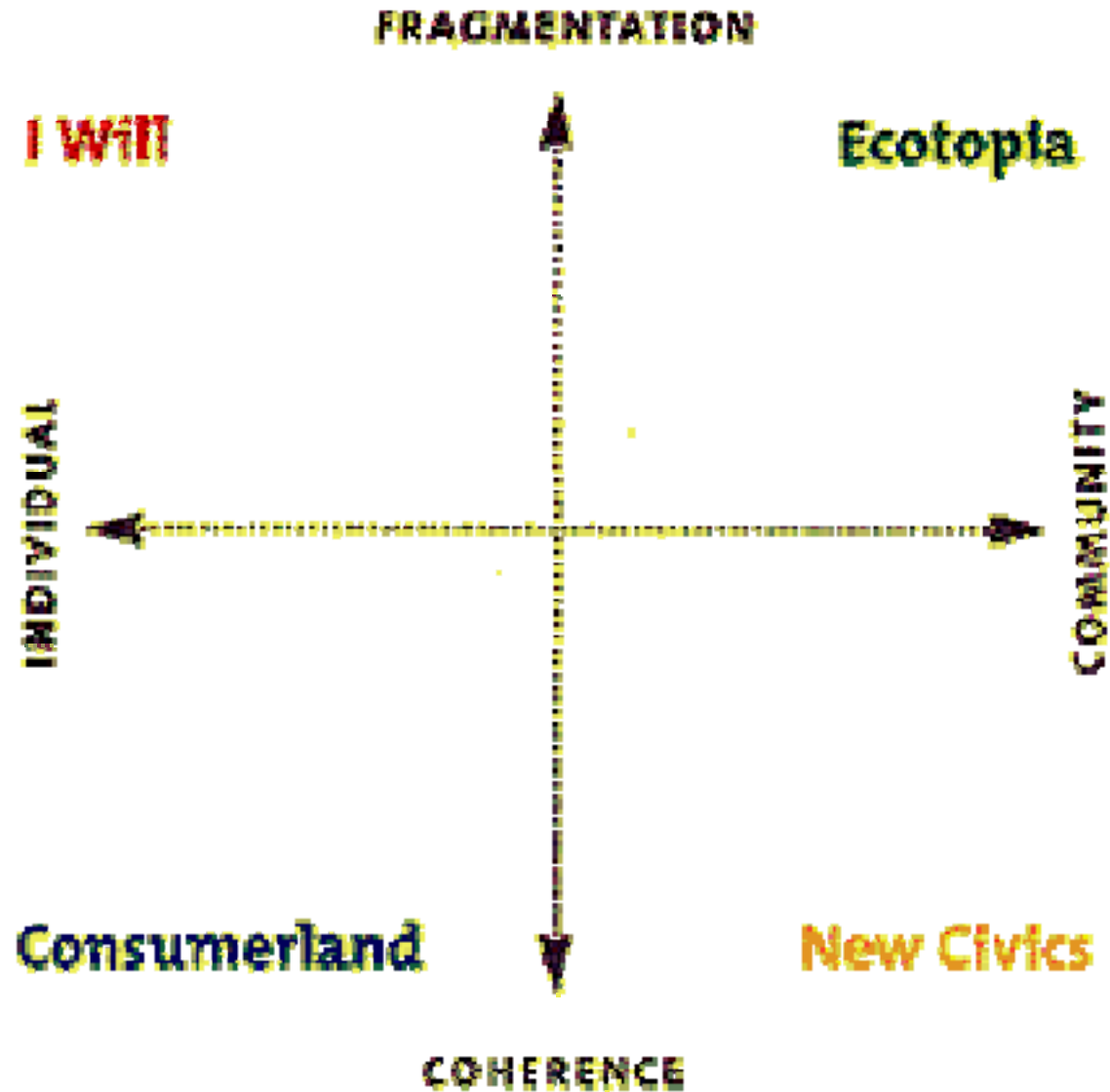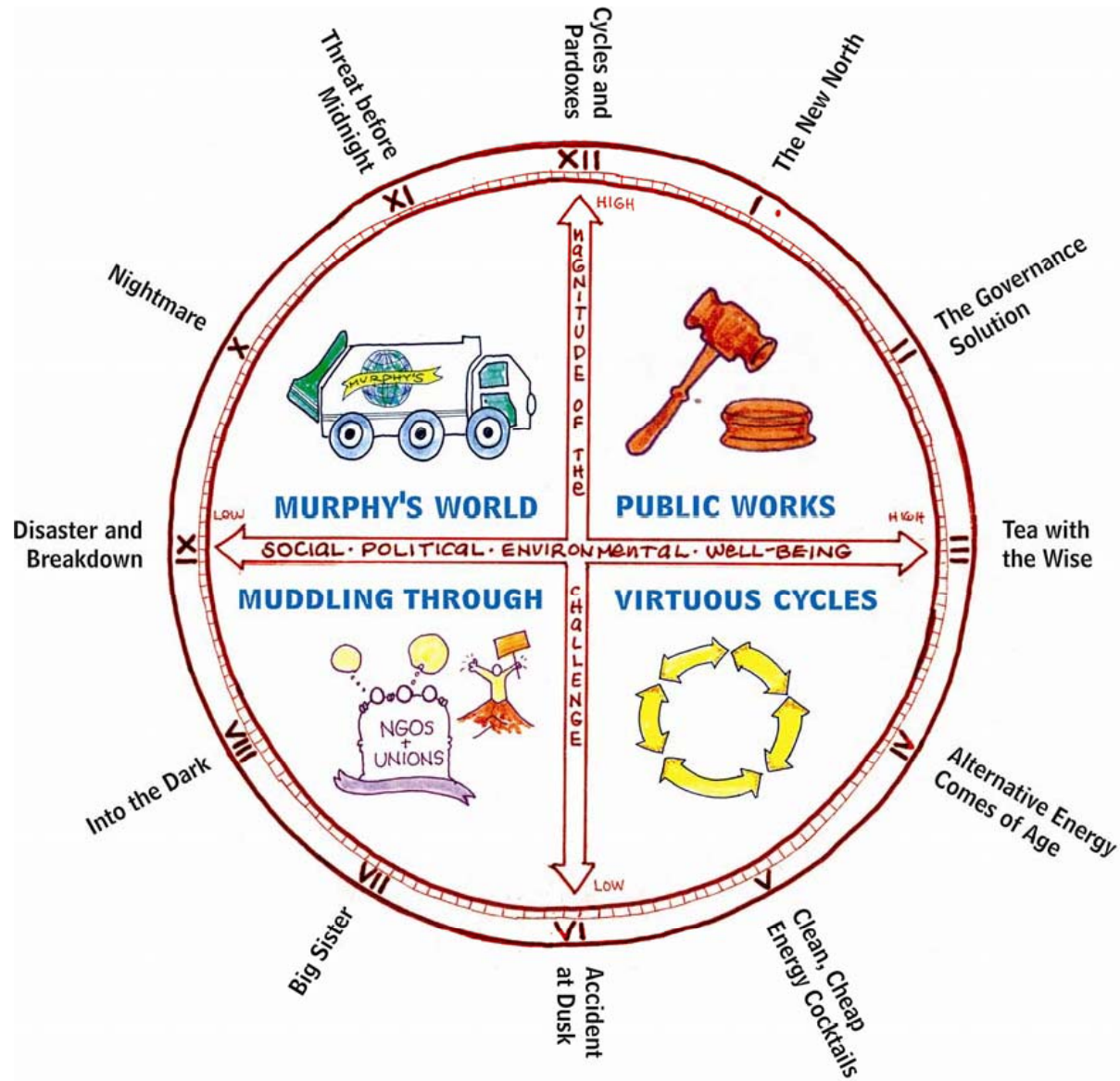
Regional Integration of
Ecosystems Management

WCS

BPS

*Current environmental
exploitation practices
persist through to the
future assuming favourable
environmental endowment
value trajectories*

*The best available technology
is used to achieve socio-
economic benefits of
environmental exploitation
with least possible ecological
degradation.*

Narrow
Economic
Objectives

Broad Social,
Economic and
Environmental Goals

*All anthropogenic
activities involving
traditional use of
environmental resources
are assumed*

*Malign environmental
management alternatives
that lead to worst possible
forms of ecological
degradation.*

NDS

CPS

Localised Ecosystems
Management

f) Creating a Scenario Framework
Clustering Mini-Stories
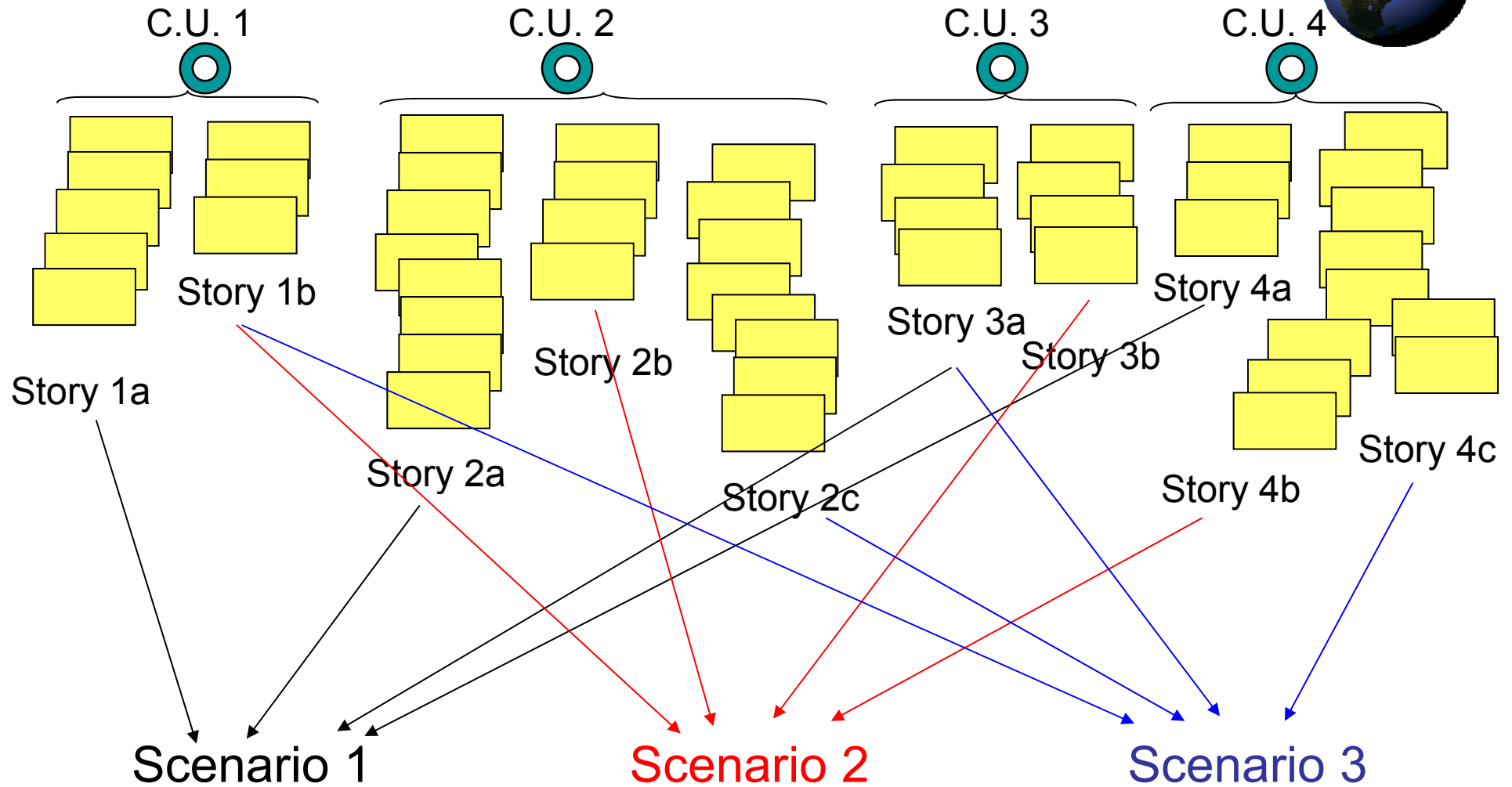
- Elaborating the scenario narratives.
- Undertaking the quantitative analysis.
- Exploring policy.

g) Elaborating the Scenario Narratives

Purpose: To create a detailed, compelling description of the scenario.

Output: A several page long scenario narrative.

For each scenario, consider five areas:

1. **Current state:** Aspects of today's world that represent characteristics of the scenario being developed.

2. **End picture:** The end vision of the scenario, assuming that critical uncertainties have been resolved.

3. **Timeline**: Connect the current state to the end picture through a plausible historical route.
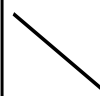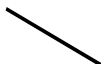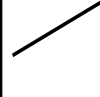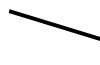
4. Create a **coherent narrative** using current state, end picture and timeline. Add detail and texture.

5. Create a **name** for each scenario that captures the essence of the scenario and differentiates it clearly from others.
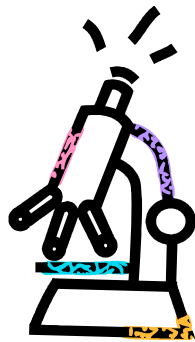
Qualitative trends for indicators

Purpose: To enhance and elaborate the scenario narrative with quantitative information.

Output: Specific, scientifically defensible quantitative information.

Steps:

1. Determine the approach to be used for quantification (e.g. what models and tools and how these will be informed by/inform the narratives).

2. Assemble the necessary data and relationships.

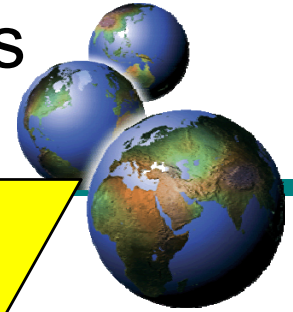3. Use the tools and models to produce the quantitative estimates.

Aim:

To numerically express inputs, science-based relationships, assumptions, and results.

Quantitative analysis should use tools that:

- Can be applied and compared across widely differing scenarios. *They should not artificially constrain your scenarios.*

- Are as simple, transparent, and user-friendly as possible. *Can yield clear, useful results.*
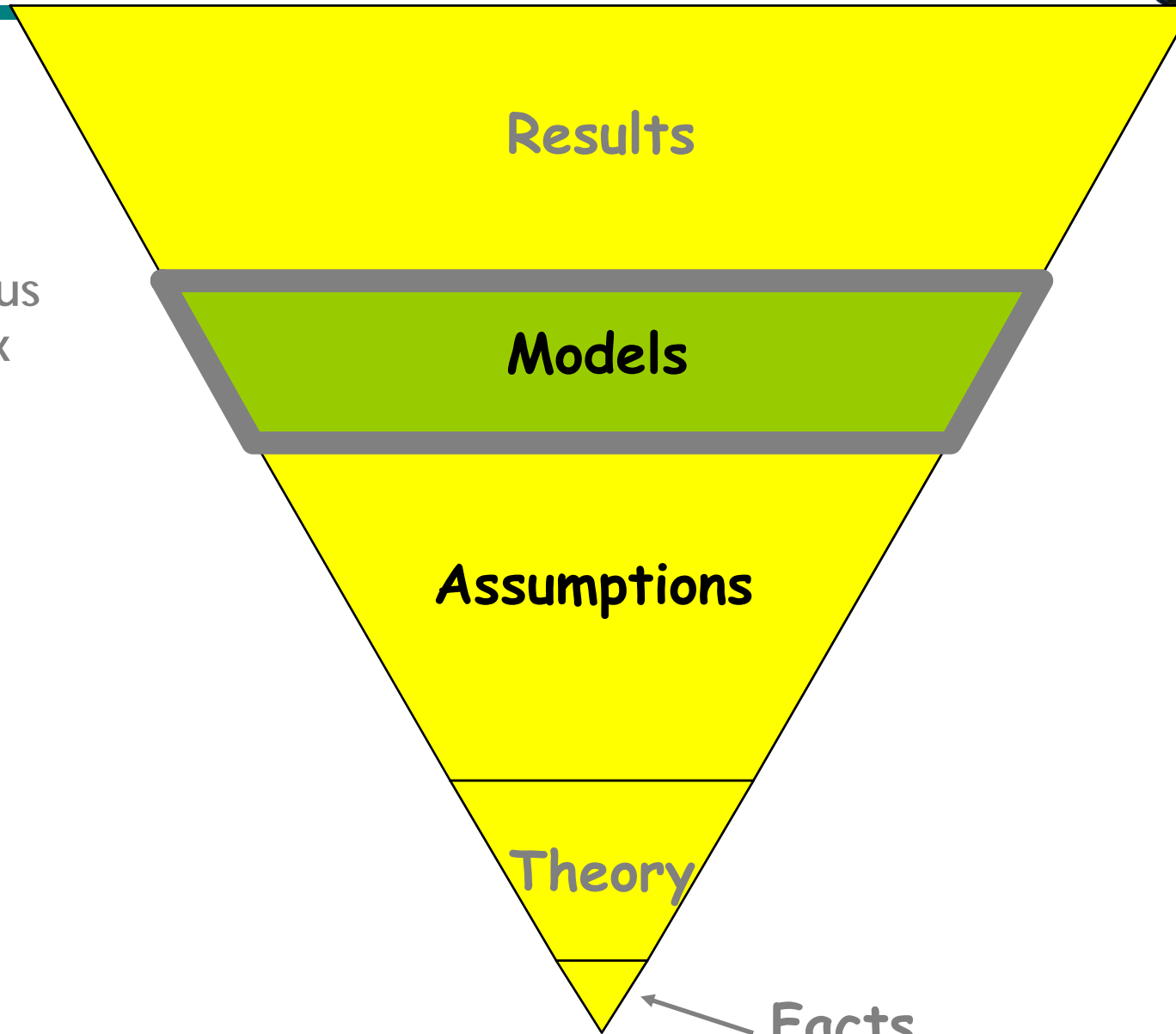
h) Undertaking the Quantitative Analysis
The Standard Approach

Results

Models

Assumptions

Theory
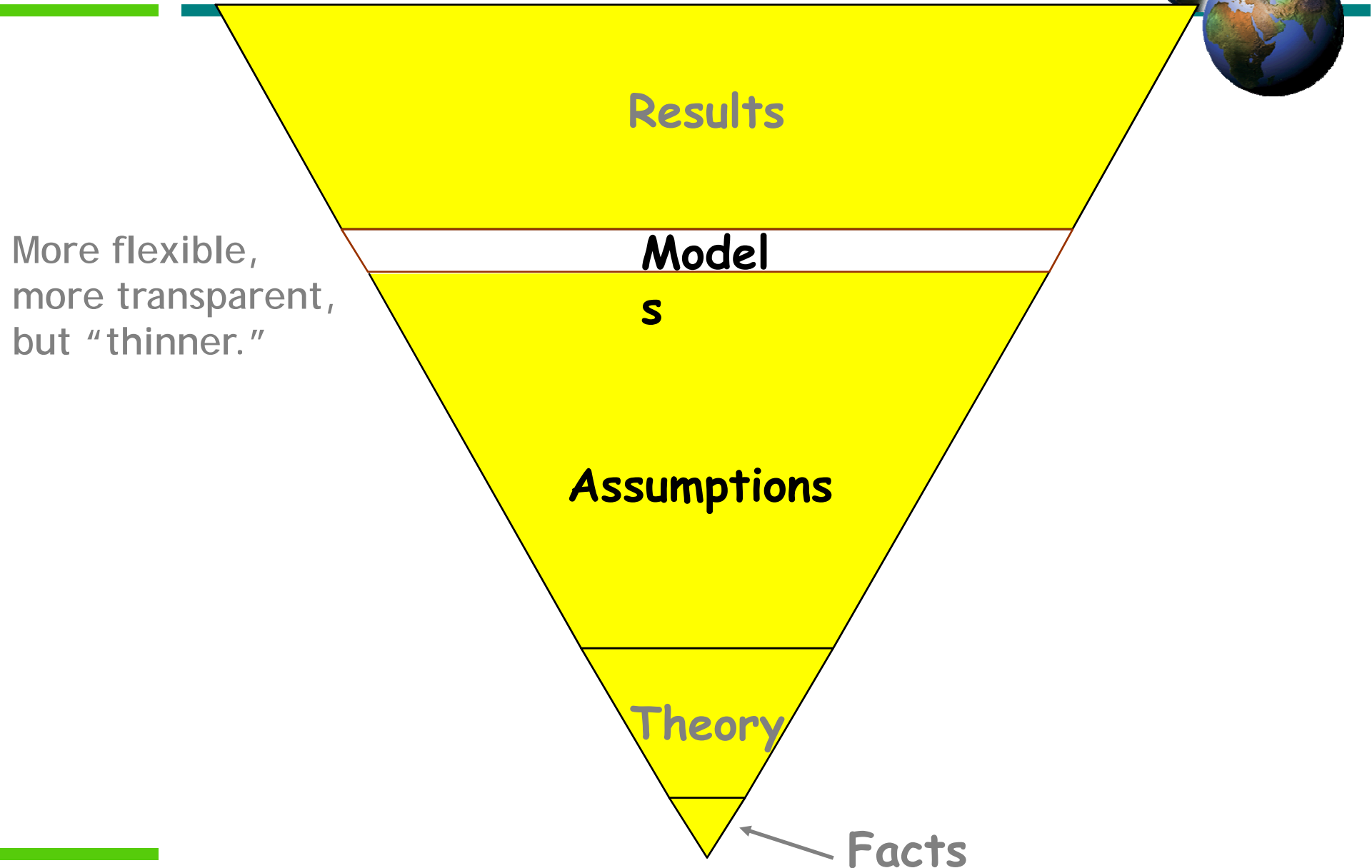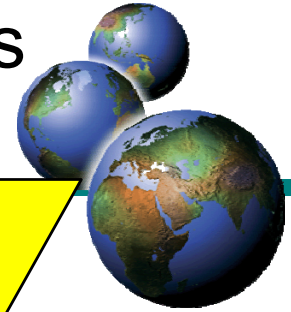
mysterious black box

Facts

Results

Models

More flexible,
more transparent,
but "thinner."

Assumptions

Theory

← Facts

Scenario Indicators Compared Quantitatively

Population (billions of people), Income ($ per capita), National Equity (income of lowest : highest average over countries), Hunger (billions of people), Food (kcal/capita/day), Water Stress (billions of people), Energy (10^{18} Joules), Forest Area (million ha), Greenhouse Gases (Carbon Emissions (GtC))
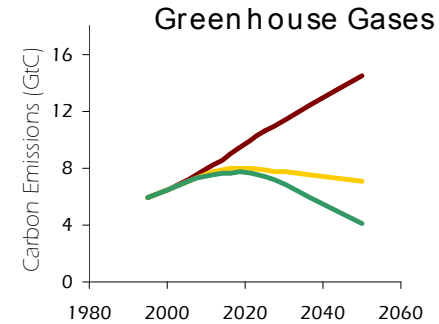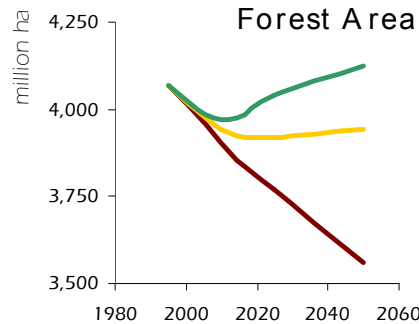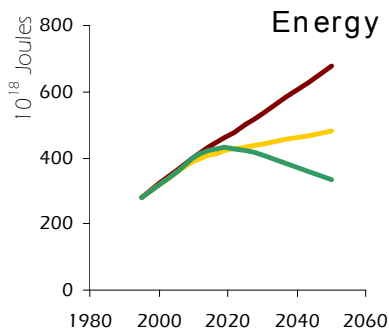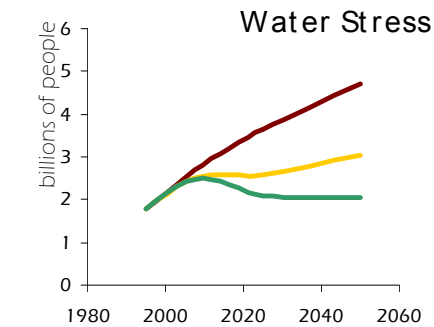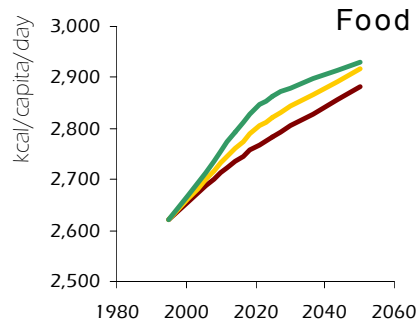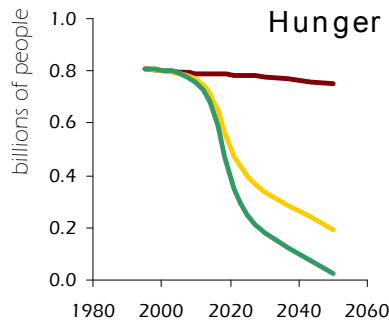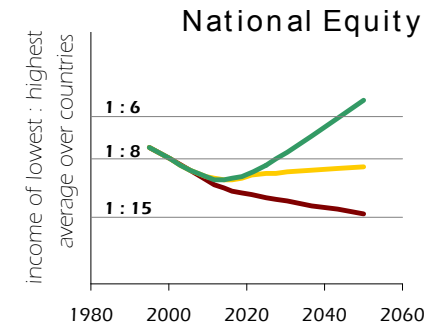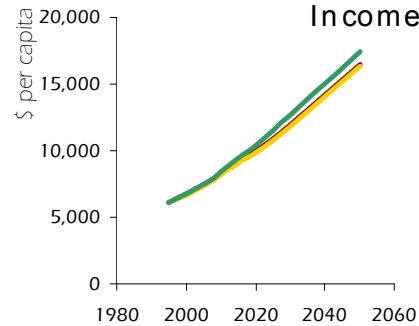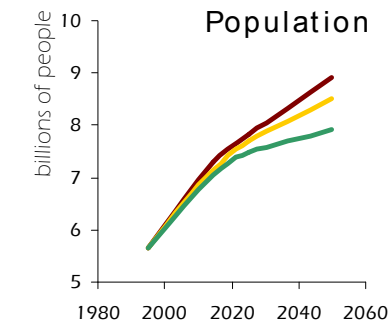
Market Forces — Policy Reform — Great Transitions

more specific

MAGICC/SCENGEN http://www.cgd.ucar.edu/cas/wigley/magicc/

WEAP http://www.weap21.org/

LEAP http://forums.seib.org/leap/

IMPACT http://www.ifpri.org/themes/impact.htm

IMAGE http://www.ciesin.org/datasets/rivm/image2.0-home.html

QUEST http://www.envisiontools.com   http://www.basinfutures.net/

IFs http://www.du.edu/~bhughes/ifs.html

IPAT-S http://ipat-s.kb-creative.net/

Polestar http://www.seib.org/polestar/

Stella, Vensim, GAMS, Matlab, Excel, etc., etc., etc.

more generic

i) Exploring Policies

Purpose: To explore the feasibility, appropriateness, effectiveness, and robustness of various policies.

Key Points:

- Policies may be introduced at an early stage and may represent an uncertainty defining a scenario,
- Policies may be introduced as part of implementing a scenario.
- Policies should be analysed, including assessment against goals and targets.

Steps in a Scenario Methodology: Communication & Outreach

- Communication of scenarios is particularly important if the scenarios are to succeed in inspiring new visions of the future.

- Example–the success of the Mont Fleur scenarios, which were published first in a newspaper and thus, widely communicated.

Steps in a Scenario Methodology: Communication & Outreach

- Outreach is important in order to generate a discussion with all stakeholder groups about the content and implication of the scenarios.

- This provides "buy-in" to the results of the scenario exercise from a group much larger than that involved in the development and analysis of the scenarios.

- It also can provide valuable feedback on the results.

- This can be achieved through a series of workshops in which the scenarios are presented and discussed.

Steps in a Scenario Methodology: Communication & Outreach

- Communication and outreach should take place throughout the scenario process, and not merely occur at the end.
- Involvement of a range of stakeholders in the various stages of the process should be seen as part of the communication and outreach effort.

Establishing the nature and scope of the scenarios (a)

Identifying and selecting stakeholders/participants (b)

Identifying themes, targets, indicators and potential policies (c)

Clarifying the purpose and structure of the scenario exercise

Identifying driving forces (d)

Selecting critical uncertainties (e)

Creating a scenario framework (f)

Laying the foundation for the scenarios

Elaborating the scenario narratives (g)

Undertaking quantitative analysis (h)

Exploring policy (i)

Developing and testing the actual scenarios
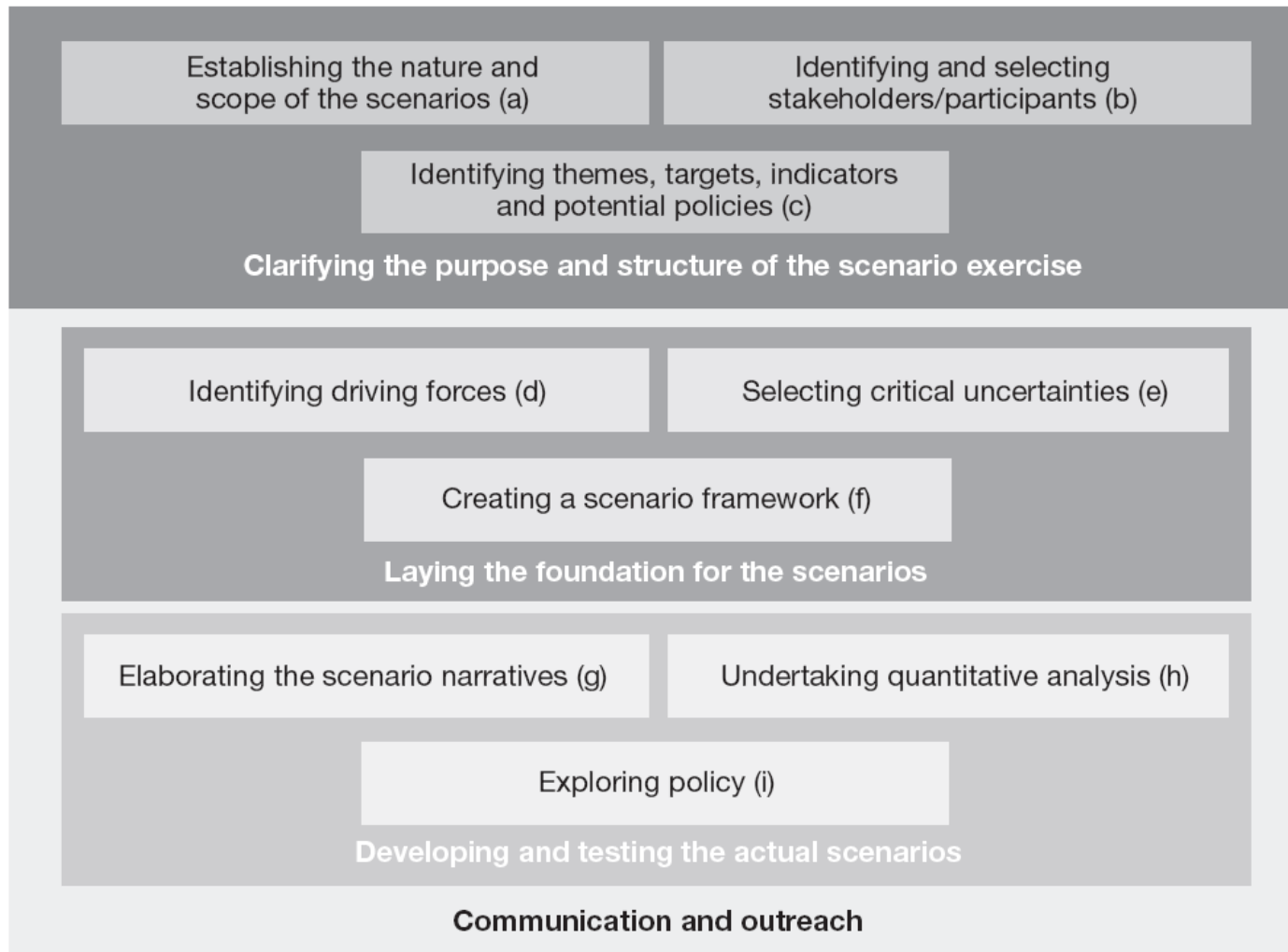
Communication and outreach

Overview

- Session 1: What is a Scenario?
- Session 2: Examples
- Session 3: Purpose, Process and Substance
- Session 4: Policy Analysis
- Session 5: Developing Scenarios
- Session 6: Exercise on Scenario Development

Steps in a Scenario Methodology

Steps in a Scenario Methodology

- **Clarifying the Purpose and Structure of the Scenario Exercise**
    - a. Identifying stakeholders and selecting participants.
    - b. Establishing the nature and scope of the scenarios.
    - c. Identifying themes, targets, indicators and potential policies.
- **Laying the Foundation for the Scenarios**
    - d. Identifying drivers.
    - e. Selecting critical uncertainties.
    - f. Creating a scenario framework.
- **Developing and Testing the Scenarios**
    - g. Elaborating the scenario narratives.
    - h. Undertaking the quantitative analysis.
    - i. Exploring policy.
- **Communication and Outreach**
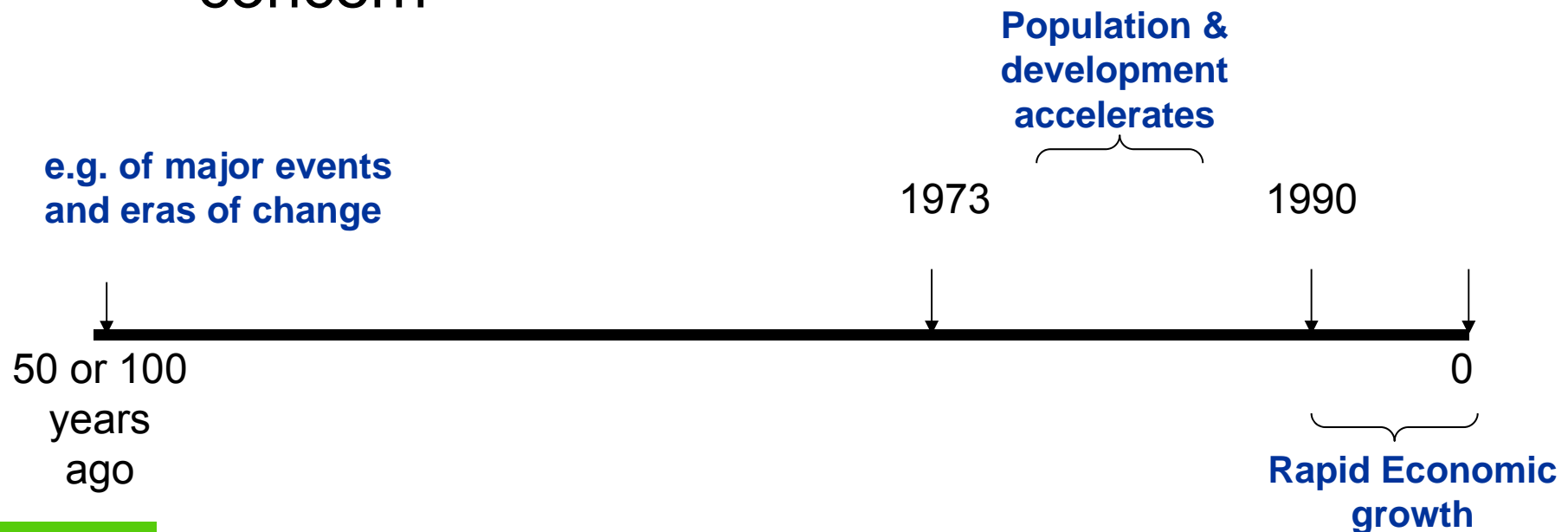
Groups Exercise

- Select a facilitator for each group to lead the discussion and report back

- Work on developing scenarios (simple "prototype" scenario exercise)

- Follow the steps

Step 1

- Identify historical areas of change and renewals within your boundary conditions
  - Create a timeline of events in the past 50 or 100 years that impacted your region of concern

Population & development accelerates

e.g. of major events and eras of change

1973

1990

50 or 100 years ago

0

Rapid Economic growth

Step 2

- Identify the focal question (write them on the board)
  - *What are the current problems in the region of concern?*
  - *What are your main concerns or issues about the future in the region of the exercise?*
- Keep these, will return to them frequently during future discussions to make sure that they stay central to the exercise

Step 3

- Identify driving forces
  - *What are the key driving forces of the past, do you think they will continue to be important in the future?*
  - *What are important changes happening in the community? What is causing those changes?*
  - *What are things that stay the same in the community? What keeps them from not changing?*
  - *List driving forces under STEEP categories, add others if there is a need*

Cont., Step 3

- Classify driving forces as certain and uncertain in the future

- Classify driving forces as critical and uncritical in the future

- Try to draw the diagram

- Select the most critical and uncertain to form the basis of the scenario framework

Importance (vertical axis)

Uncertainty (horizontal axis)
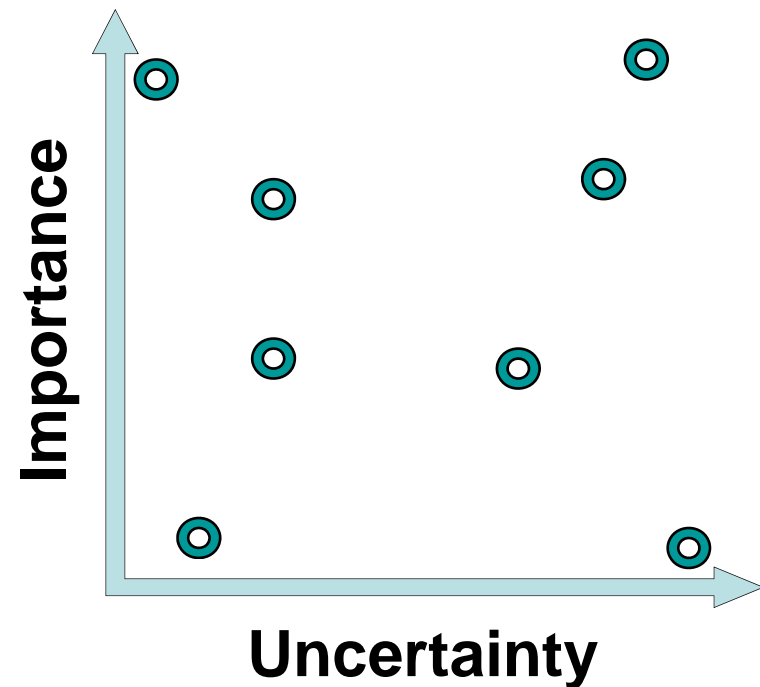
Step 4

- Define scenarios framework based on driving forces from previous step
- Define time frame

"Scenario B"   Uncertainty #2   "Scenario A"

Critical   Uncertainty #1

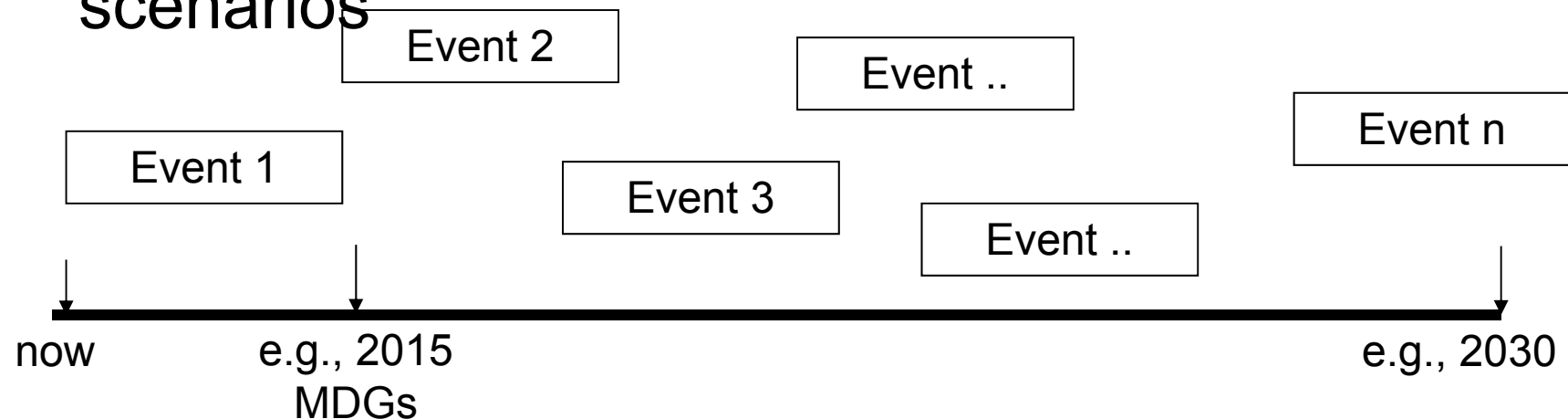"Scenario C"   Critical   "Scenario D"
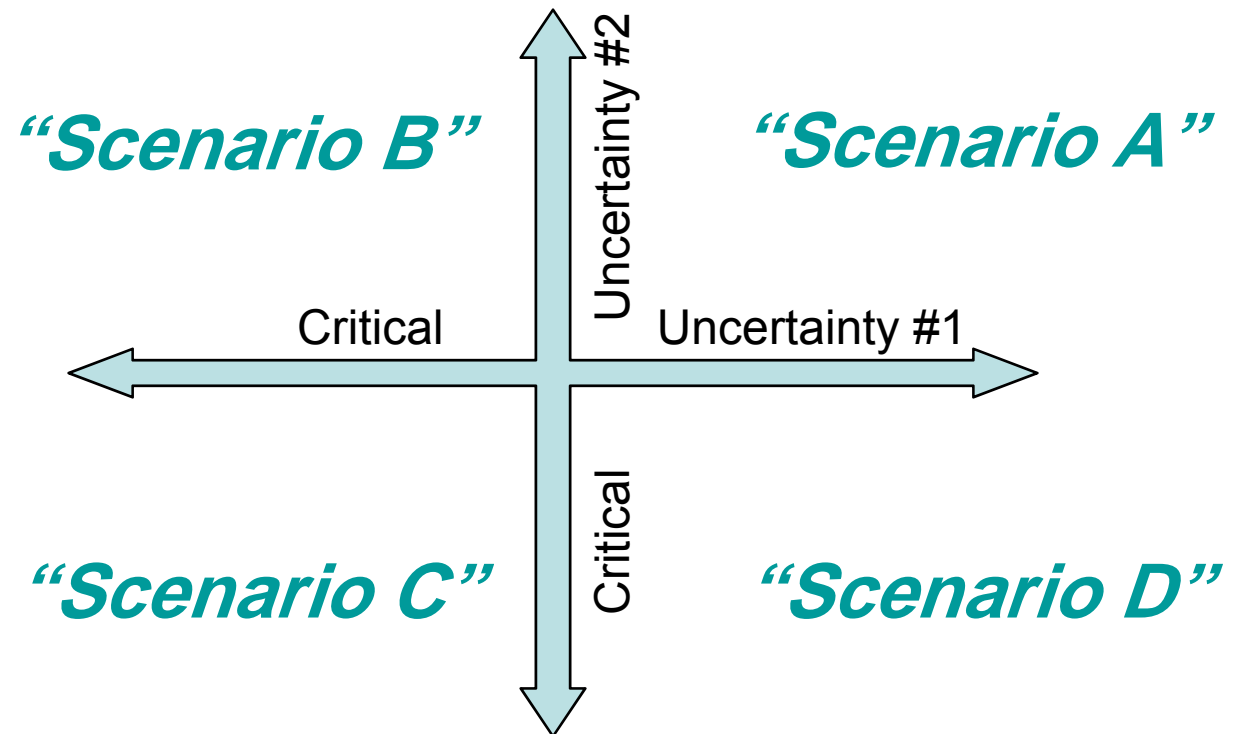
Step 5

- Discuss qualitatively trends in drivers and their impact on issues of concern in each scenario, (can use symbols as up or down or no change)

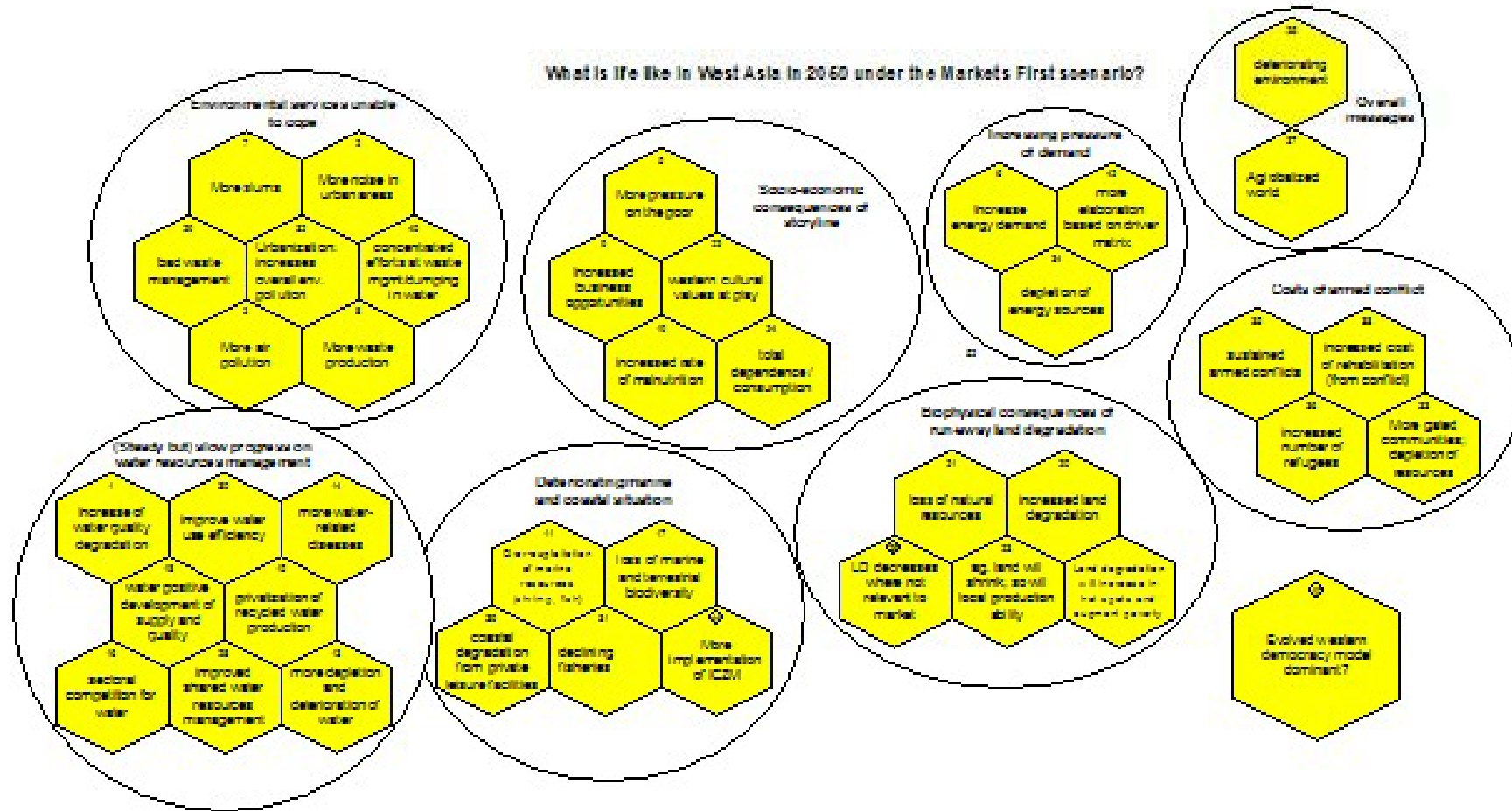| Driver/ issue	Indicator	Scenario 1	Scenario 2	Scenario 3	Scenario 4
demography	Population growth rate	Increases rapidly	Increases slowly	Increases moderately	stabilized
Economic growth	GDP per capita				
Education	Female enrollment in primary and secondary school…	…	…	…	…

Step 6

- Develop an end picture and a time line of events, their chain-reaction, and the end picture for each scenario

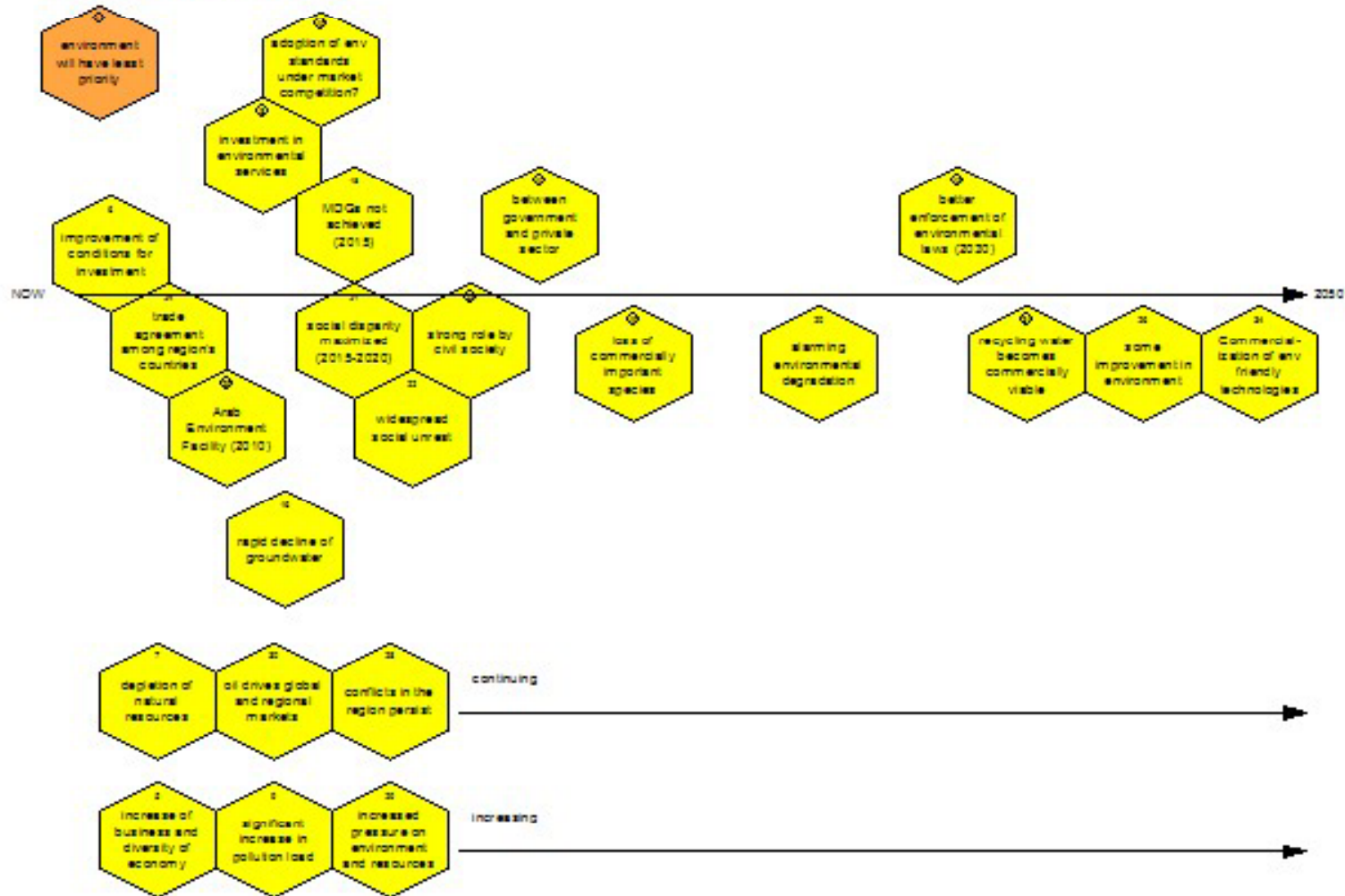- Helps in writing the narrative storyline of the scenarios

Example of scenario timeline

Markets First Timeline - West Asia

Step 7

- Write down the narrative of the scenarios (short story)
- Based on the time line and end picture and qualitative description of the driving forces

Step 8

- Identify three most important opportunities and 3 most important threats for each scenario

- For each opportunity
  - Think of how to make advantage of it
  - How to prepare for it

- For each threat
  - what need to be done to prevent it
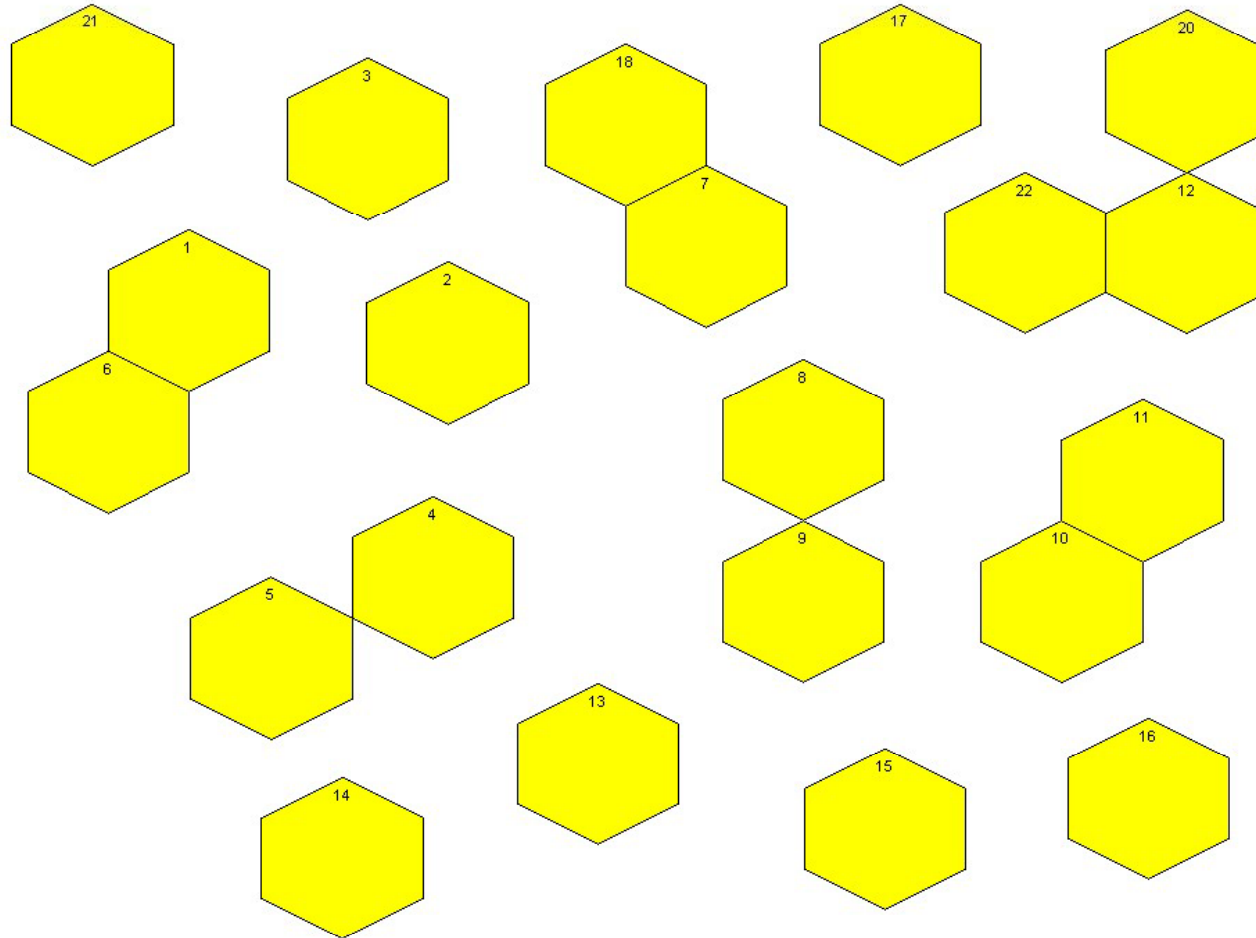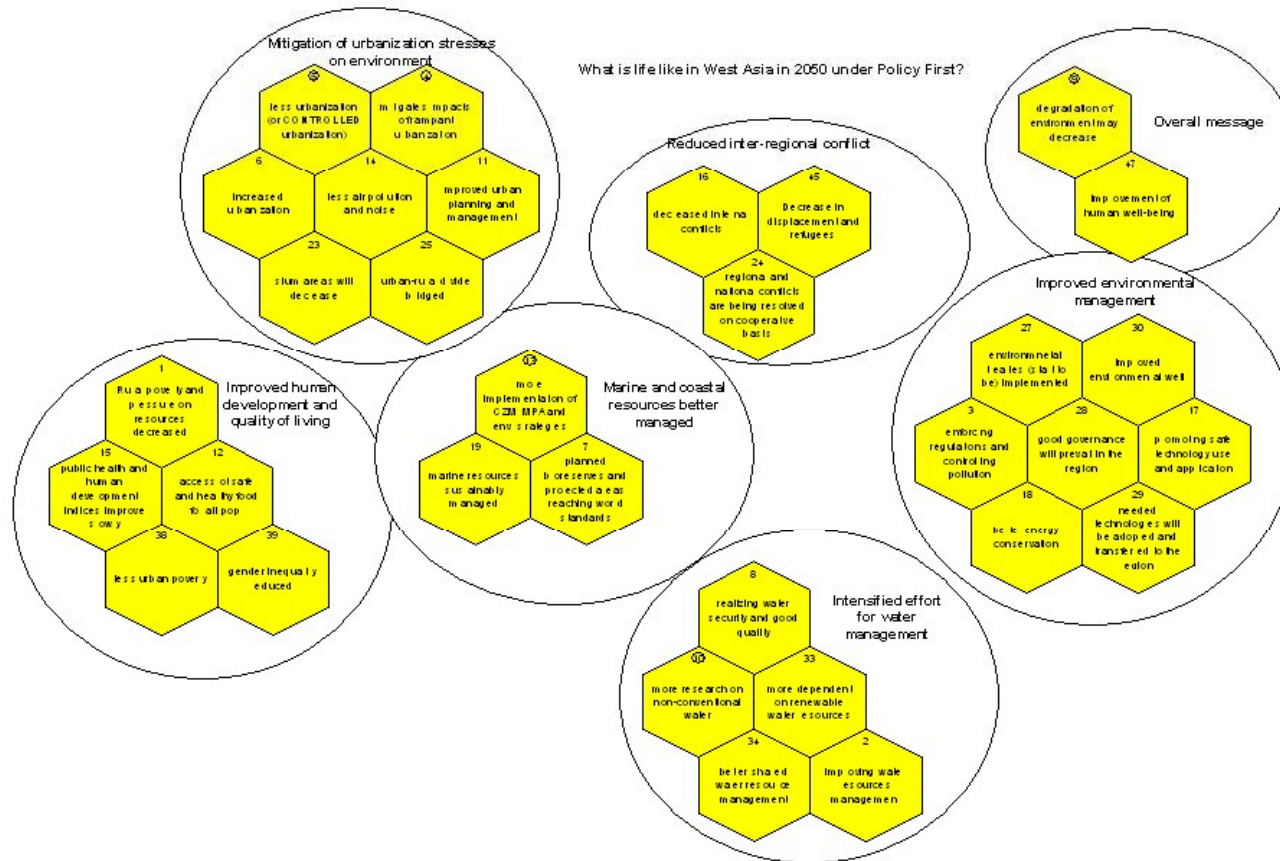 - If not possible to prevent, how to mitigate its impacts

Step 9

- Formulate recommendations to policymakers and decision makers
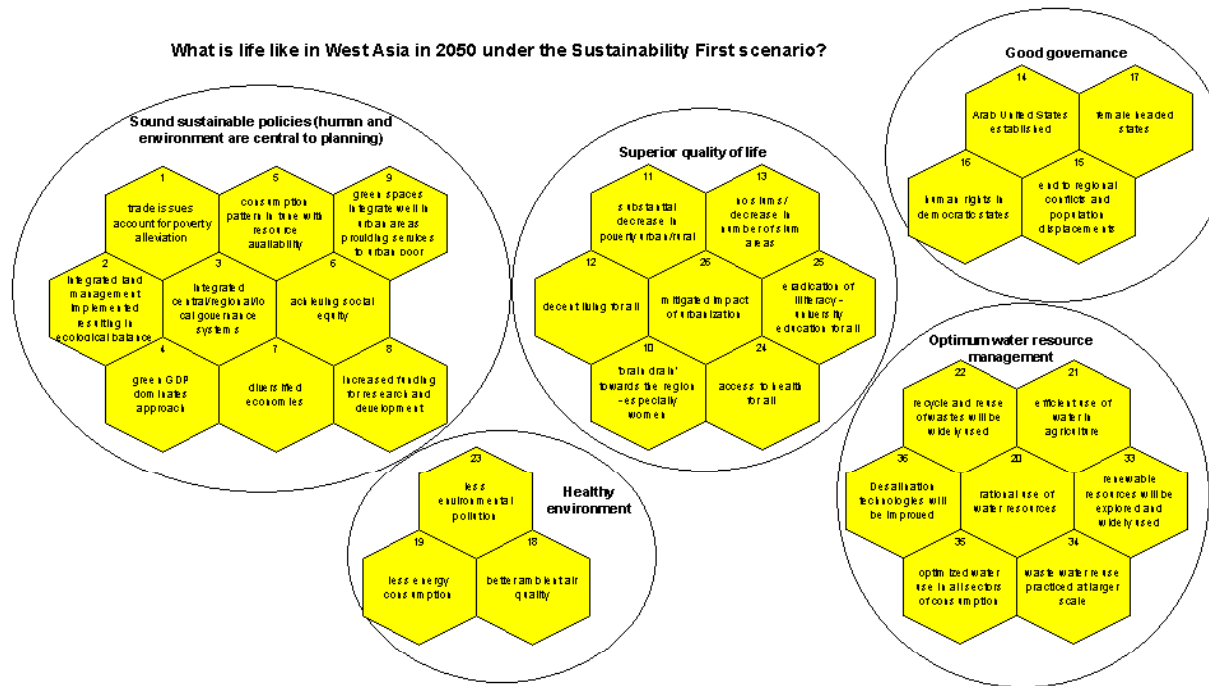 - ...
  - ....

Actual Exercises

- Three steps

  - Drivers and their impact on issues of concern.

  - End picture.

  - Time line

  - Chose one uncertainty and assess across the scenarios
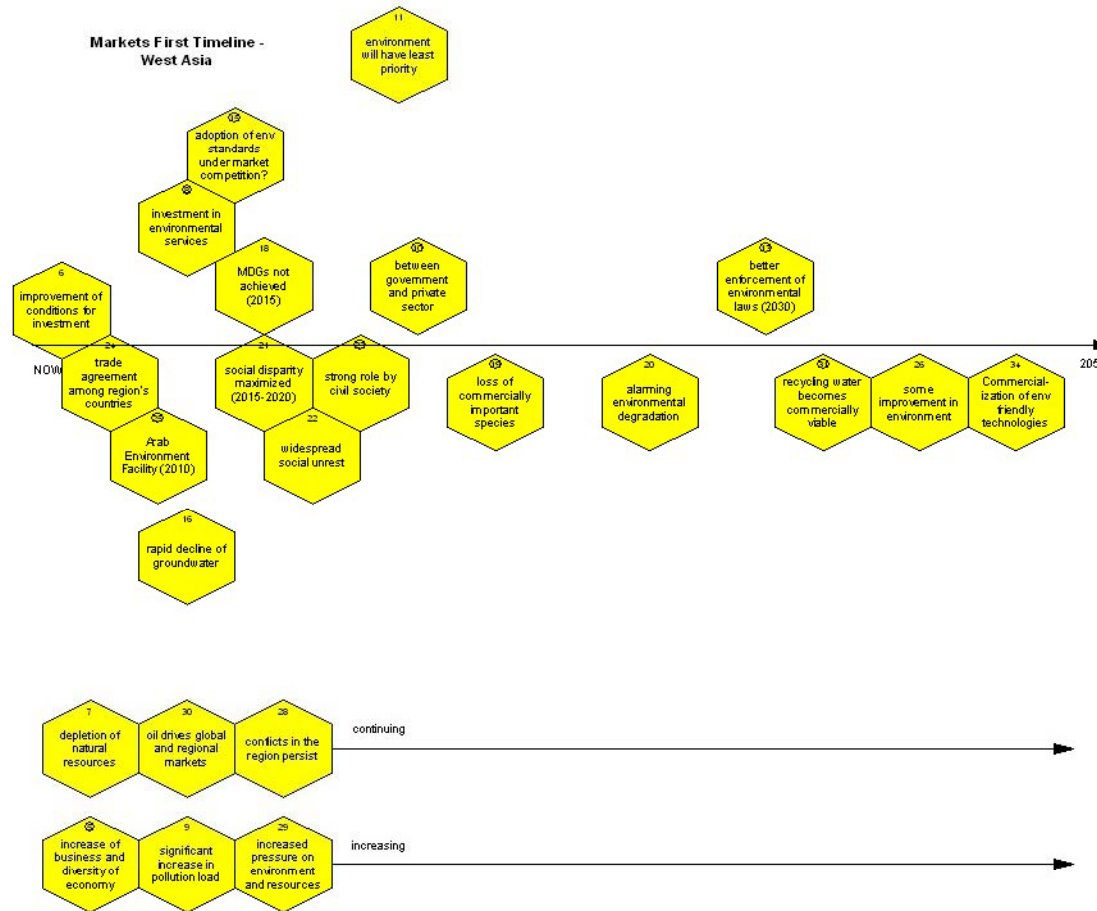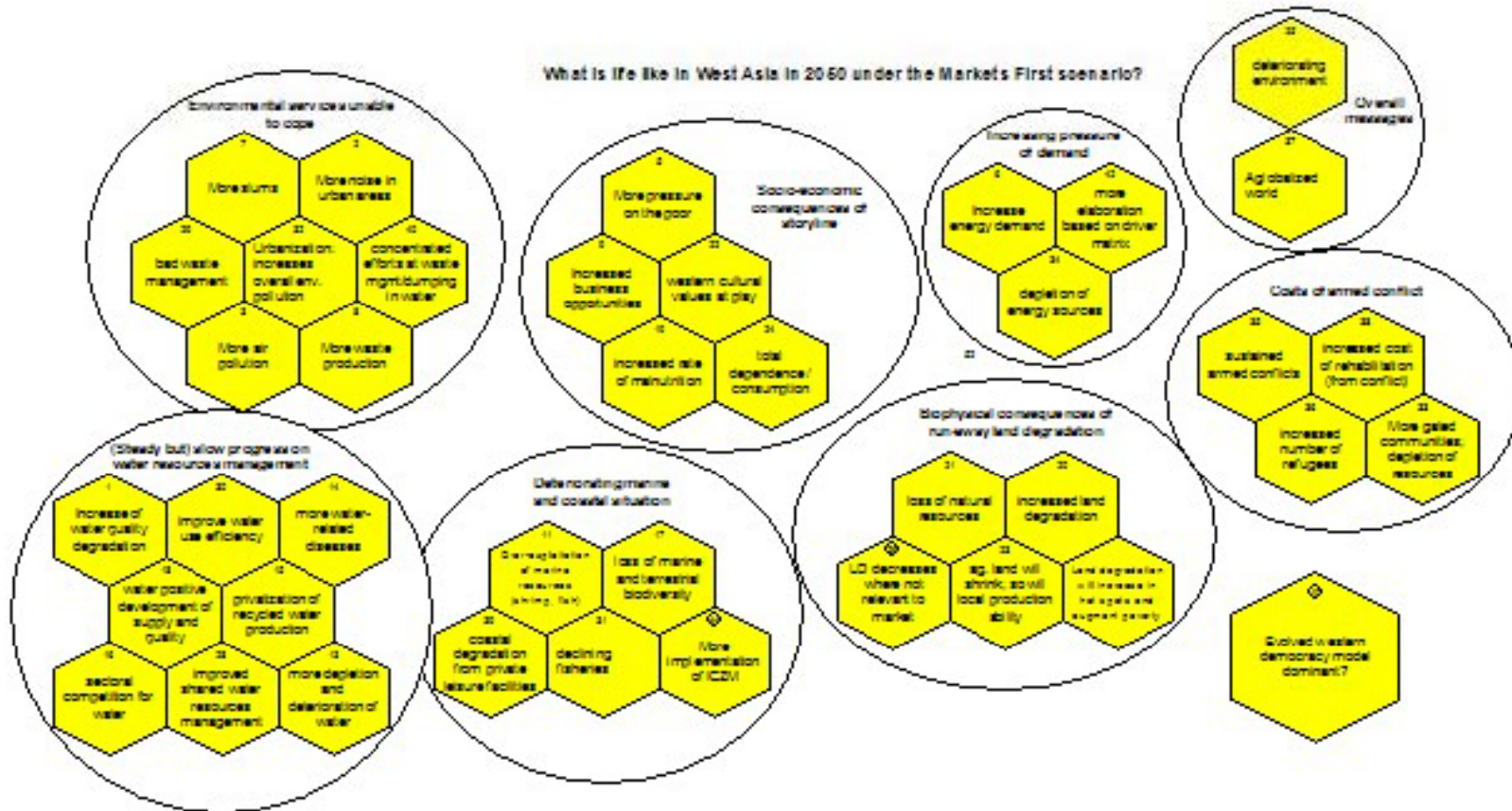
What is life like in West Asia in 2050 under the Sustainability First scenario?

Markets First Timeline - West Asia

Example of Scenario End Picture

Example of scenario timeline

Markets First Timeline - West Asia