Learning File – Block 3

For me, the notion of sustainability is that of a system that can be sustained, or can sustain itself, in a state of vitality into the future. It implies a degree of robustness to internal and external changes. So for example a sustainable energy source would be one that can keep supplying energy without being depleted itself and without depleting resources elsewhere.
From: Block 3, Webzone, Week 1, Session 1, Page 3.

A change in the dominant paradigm is often referred to as a **paradigm shift**. In other words, the ideas, beliefs and valid knowledge that are part of the dominant worldview changes, as do the questions it is possible to ask. It is important to note that a lot of environmental thinkers embrace Systems thinking as a helpful approach because it will let humans understand, and improve interactions with, natural systems.
From: Block 3, Webzone, Week 1, Session 2, Page 1.

So in the late 1980s and early 1990s there was a growing sense that understanding the **links** between **parts** of the environment may be more important than understanding them in isolation. I use the word 'parts' here to mean subsystems within a larger system, such as water and soil in a river ecosystem.
From: Block 3, Webzone, Week 1, Session 3, Page 1.

They attempted to explain to non-ecologists that the natural environment has many of the characteristics of a living system with its own requirements - and that these requirements may not coincide with immediate human requirements.
From: Block 3, Webzone, Week 1, Session 3, Page 2.

Economic activities have multiplied so much, with bigger impacts, that there are more pollutants and they can pollute faster. Under this accelerating rate of change it seems certain ecosystems may no longer have time to adapt or recover as they normally do. Policies designed to minimize the negative effects of human activity on the environment therefore need to reflect **adaptation rates** as well as threshold effects.

Policies targeted at changing indicators tend to produce unintended consequences because they have lost sight of the interconnections between subsystems in the environment.
From: Block 3, Webzone, Week 1, Session 3, Page 3.
Many groups faced with taking a collective decision will take some time to notice if there are differences in their understandings of what the real question is. All kinds of discussions and arguments will take place until this is recognized.
From: Block 3, Webzone, Week 1, Session 4, Page 4.

As explained by Hammond et al (1995, p.1):

> "An indicator is something that provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable."

From: Block 3, Webzone, Week 2, Session 1, Page 2.

Indicators therefore focus on issues that are **related to sustainability** but they do not measure sustainability as a whole. For this reason I am calling them **partial indicators**.

The indicators approach to environmental issues and sustainability led to some correspondingly **partial policies** on certain environmental themes. Partial, because they do not take account of interdependencies between environmental media - water, soil, and so on.
From: Block 3, Webzone, Week 2, Session 1, Page 5.

Partial indicators: a brief review

As you will have begun to realize by now it is a difficult task to find good indicators to measure environmental system quality and progress towards sustainability.

Nevertheless some indicators have been developed - expressed in both measurable and monetary units - and are perceived as a useful first step towards the formulation of better environmental policies.
However from a systemic perspective they have important shortcomings, which tend to be reflected in the types of policies they lead to.

- They are usually measures of specific environmental factors rather than sustainability itself.
- They do not usually capture the interrelatedness between environmental themes.
- They tend to ignore or underestimate uncertainty and the complex behaviour of interconnected systems.
- Indicators expressed in monetary terms are particularly prone to distorting the complexity of sustainability.

From: Block 3, Webzone, Week 2, Session 1, Page 5.

Define what you understand by a system.

For the purposes of this pack, and for the others in this series, the definition used has four parts:

> (i) A system is an assembly of components, connected together in an organised way.
> (ii) The components are affected by being in the system, and are changed if they leave it.
> (iii) The assembly of components does something.
> (iv) The assembly has been identified by someone as being of interest.

From: T553, SAQ 1.

What does rate of change mean?

Rate of change refers to the amount by which something changes per unit of something else. Usually, it is per unit of time. So, a familiar example is acceleration,
From: T553, SAQ 1.

Describe in words the following:

$$y = 24x^2 + 2x - 3$$

This is another equation, which formally states the relationship between two items each of which can take a range of numerical values. These two items are formally called variables, and are represented by the italicised y and x. The variable y is called the dependent variable, which is related to the independent variable x in such a way that:

The value of y is 24 times the value of x squared, plus 2 times the value of x minus 3.

The 24 in this equation is called the coefficient, or multiplier of x, and the 3 is another coefficient, this time a constant.
From: T553, SAQ 1.

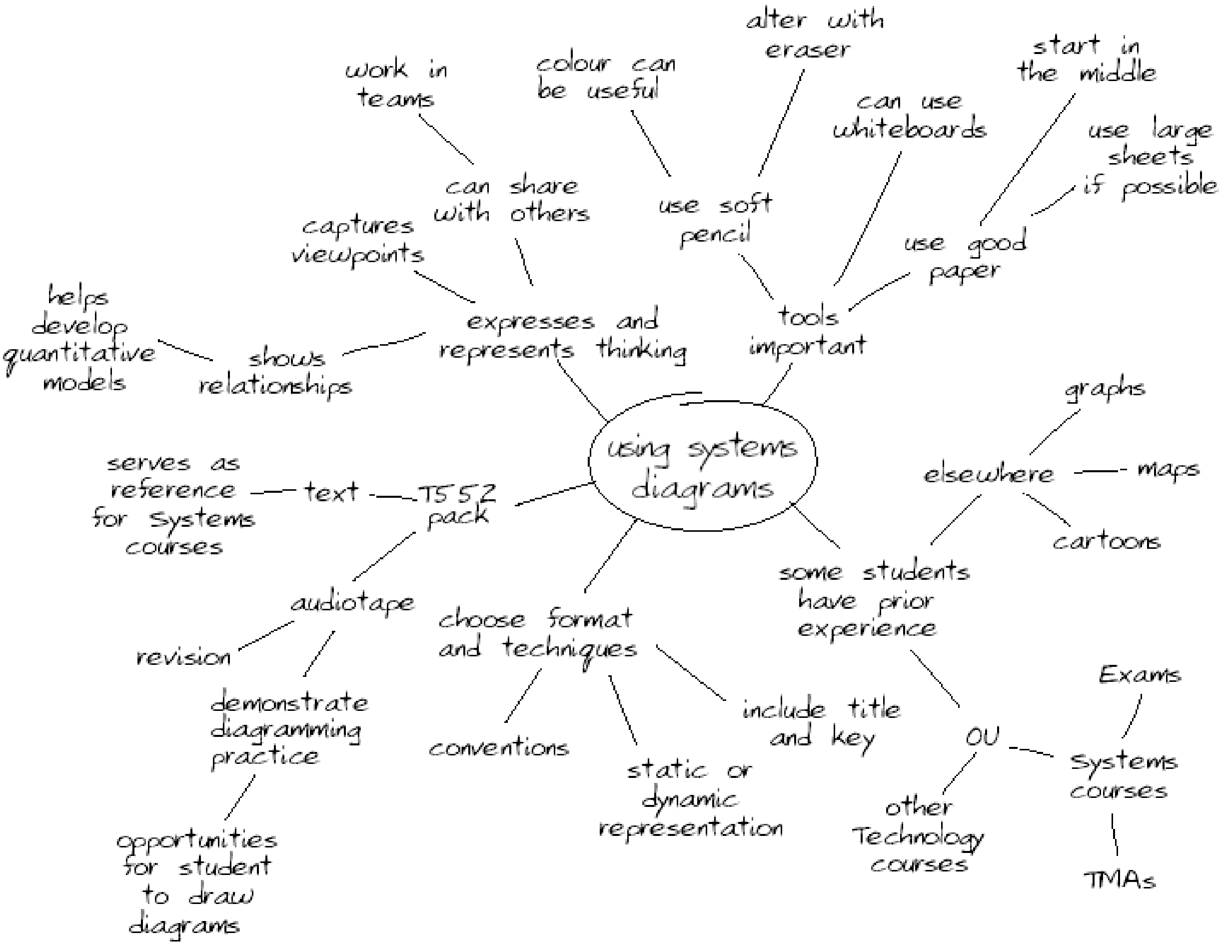
What is a model?

A simplified description of a complex entity or process
Representation of something (sometimes on a smaller scale)
A representative form or pattern
The act of representing something (usually on a smaller scale)
From: Dictionary.

A simplified representation of some person's or group's view of a situation, constructed to assist in working with that situation in a systemic manner.
From: T553, Chapter 3.

Virtually all models are so taken-for granted that we do not even realise that they are models, i.e. that they are simplifications of the complexity around us.
From: T553, Chapter 3.

So we all have these implicit mental models of things, people, organisations and so on. Because these models affect our perception of the world they become self-sealing.
From: T553, Chapter 3.



From: T552, Audio Workbook, Frame 3.

Rich picture is an attempt to encapsulate the overall complicated situation. A rich picture is drawn at the pre-analysis stage before you know which is process and which is structure (try to express both).

Thinking in flows

So far you have learned about six types of diagram, four of which consist of word nodes linked by lines or arrows - a fifth, the rich picture, can also use these elements.

The node-arrow link has a different meaning in each type of diagram.

- In spray diagrams, A → B means B is part of, or comes under, A (where B is further out on the tree than A).
- In influence diagrams, A → B means A exerts some kind of influence on B. Many different types of influence may appear, ranging from a rather abstract type such as 'authority', to more tangible types such as 'pays money to' or 'supplies materials for'.
- In multiple cause diagrams, A → B means A is a cause of B (or B is a consequence of A); or A contributes to B.
- In sign-graph diagrams, A → B means B changes in magnitude as A changes in magnitude and an accompanying sign shows whether they change in the same

direction (plus sign) or in opposite directions (minus sign).

We are now going to look at two further diagram types where the link has yet another kind of meaning.

- In input-output diagrams and flow block diagrams, **A→ B** means something flows from process A to process B. Or put another way: **→A→** shows process A with one input flow and one output flow.

From: Block 3, Webzone, Week 2, Session 3, Page 1.

Input-output diagrams are used to define and determine the **outputs from a physical or abstract transformation process given the inputs and the resources needed for the transformation process** or vice versa. They can be used to describe any purposeful activity. Although a very simple diagram to look at, it requires careful thought not to become confused over the detail of each element of the diagram.
From: Block 3, Webzone, Week 2, Session 3, Page 1.

You may often want to combine several input-output diagrams into a network where outputs of one or more transformation processes become the inputs of other transformation processes. This is then called a **flow block diagram**.

Flow block diagrams are similar to activity-sequence diagrams except the emphasis is on the pattern of the flow of a material, energy, or another specified resource through a set of stages, entities or activities, rather than on the time taken for each flow to happen.

One point to watch when constructing flow block diagrams is to make sure the arrows really are showing flows - materials, energy, information, and so on - rather than just a sequence. Obviously if you have a flow: **AB** then process B must in some sense come after process A. But if all you want to say is that B comes after A (as in 'building the roof must come after building the walls') then you will have to use different conventions
From: Block 3, Webzone, Week 2, Session 3, Page 1.

The information in this diagram can be assembled into an input-output table. The processes are represented by columns and the materials flowing through the system are represented in the rows. An input-output table for this system would therefore have columns for gas production and for the power station.

In each cell of the table outputs from processes are represented by positive numbers and inputs by negative numbers. The units of measurement should be consistent across any one row.

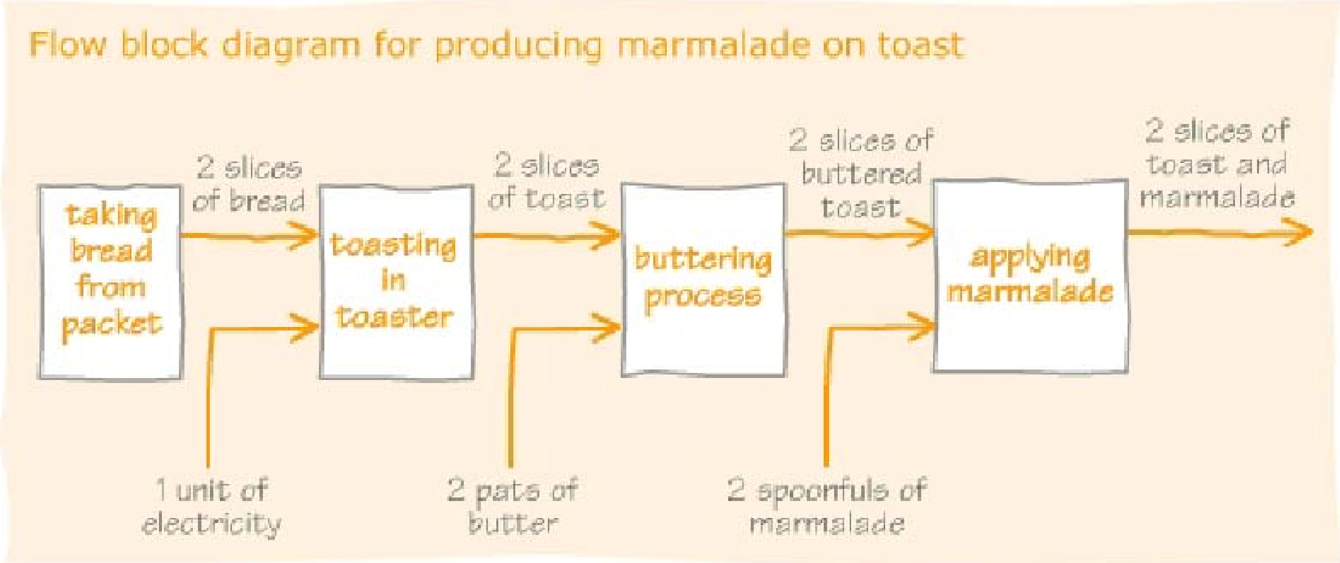
Input-output table for system producing gas and electricity

	processes		
	gas production	power station	final demand
gas (375 Mm^3)	500	- 125	375
electricity (GW h)	- 5	525	520
CO_2 (ktonnes)	33	240	–

CO_2 is recorded separately because it is an unwanted product that has to be absorbed by the environment.

From: Block 3, Webzone, Week 2, Session 3, Page 2.

Marmalade and toast diagram and table



Input-output table for producing marmalade on toast

	processes				
	taking bread from packet	toasting	buttering	applying marmalade	final demand
bread (slice)	2	- 2			0
electricity (unit)		- 1			0
toast (slice)		2	- 2		0
butter (pat)			- 2		0
buttered toast (slice)			2	- 2	0
marmalade (spoonful)				- 2	0
marmalade on toast (slice)				2	2

From: Block 3, Webzone, Week 2, Session 3, Page 3.

So in general you don't want to develop quantitative models unless you are sure it is going to be worth doing so. There are three important criteria.

- You must be able to get all the data your model needs in measurable and reliable form, in sufficient detail for your purposes, and at a cost that makes sense for the project. Even if there are only one or two variables that can't be measured that may well be enough to invalidate the exercise.
- You are trying to make decisions of a quantitative nature: how many beds does the hospital need? at what rate can I discharge pollutant *x* without causing long-term damage?
- It wouldn't be possible to visualize the behaviour of the system by just looking at a diagram. Numerical relationships between elements in the situation add enormously to the complexity. This means it may be difficult to see what's going

on, even with a good diagram. For instance if your system contains multiple feedback loops, or contains factors that vary randomly, it is usually difficult to just look at a diagram of it and get a feel for how the system would behave. You need to be able to try out the model and see what happens.

From: Block 3, Webzone, Week 2, Session 4, Page 1.

Unlike spreadsheets, systems dynamics models are fully designed to handle feedback loops and other forms of dynamic modelling where the output of a given stage loops back to become part of its input.

But the capacity to handle feedback loops also means systems dynamics models can exhibit all the unpredictability and sensitivity of any complex network of feedback loops. A systems dynamics model can often be set to show the kinds of behaviour a feedback-rich system might display. But precisely because such systems can change behaviour in complex ways as a result of small adjustments, it can rarely be used as an accurate predictor of exactly what behaviour it will show and when.

From: Block 3, Webzone, Week 3, Session 2, Page 1.

In passing, it may be worth noting that the colloquial use of the word 'risky' actually combines two separate elements, risk and **hazard**. Hazard is a measure of the damage caused to something or someone by a given event, and risk is the probability that event may occur.

From: Block 3, Decision Analysis, Page 4

Because decisions are important, decision making attracts all sorts of secondary aspects – it gives status, it justifies activities, it can look impressive, it can be reassuring, and so on. M. Jones came up with the following extended family of metaphors for decision-making procedures.[2] He argued that they could be:

- an analytic sausage machine (drop the problem in, press the button, and after a bit of whirring, out comes a neatly wrapped answer)
- a wheelchair for the mind (a procedure that supports your weaknesses, but also limits what you can do)
- a telephone (brings particular people together)
- an encyclopaedia (a way of looking up expertise)
- a round table (a way of bringing together different interests)
- a soap opera (an everyday tale of organizational folk that everyone follows)
- an outdoor activity training course (a rigorous process that tests you and builds team spirit)

- a highway code (a process that establishes protocol)
- an MOT certificate (marking your decision as 'up to standard')
- a toy (as in both 'grown-up's toy', and 'toying with the possibilities')
- a scapegoat (if it goes wrong, there's a method and/or facilitator you can blame)
- a totem (a symbol both of rationality and of group commitment)
- a placebo (it works, but not for the reasons claimed)
- snake oil (all show and no substance; nothing is achieved but you feel better).

From: Concept File 4, Reading 27, Page 123.

Returning to decisions themselves, it is perhaps useful to distinguish three broad styles of decision making: the *analytical*, the *negotiated* and the *incremental/emergent*.

From: Concept File 4, Reading 27, Page 124.

Table 10.1 The STEPS checklist and an example

The STEPS headings	Typical STEPS sub-categories	Example for a corner grocery shop in a suburb of a medium-sized town
Social factors	Demographics, values, lifestyle, age-structure of population, class and income-structure of local population	Customer catchment area, number and type of people living nearby, number of families, age groups, migration from and to the area, trends in buying patterns, car ownership, etc.
Technological factors	Equipment available, technologies, products	Availability of shop-display equipment, electronic communications possibilities for advertising, new check-out equipment (e.g. bar-code systems and automated stock control), ordering and stock control systems/ technologies, internet ordering and home deliveries.
Economic factors	Economic growth, inflation, market trends, local economic and market circumstances	Number of potential suppliers, their terms and prices, pricing strategies, advertising possibilities, purchasing quantities, information about customer demand, competitors, competitor strategies, 'out of town' shopping patterns, national economic environment, etc.
Political factors	Legislation, regulations, policies, likely developments	Sunday-opening legislation, car boot sale legislation, regulations on opening hours, Shops and Offices Act, planning restrictions, etc.
Sustainability factors	Impact of resource and climatic changes on local conditions, on remote suppliers, etc. Environmental impact of activities undertaken. Effects of cultural or value systems.	Impact of changing weather patterns, effects of local neglect, rubbish, etc. Inefficiencies in use of materials and energy. Waste disposal and/or recycling of materials sold. Concerns about the implications both of the shop's outputs for customers and the local community (e.g. food safety) and its supply chain inputs. Concerns about contributing to the 'consumer society'.

From: Concept File 5, Reading 10, Page 68.

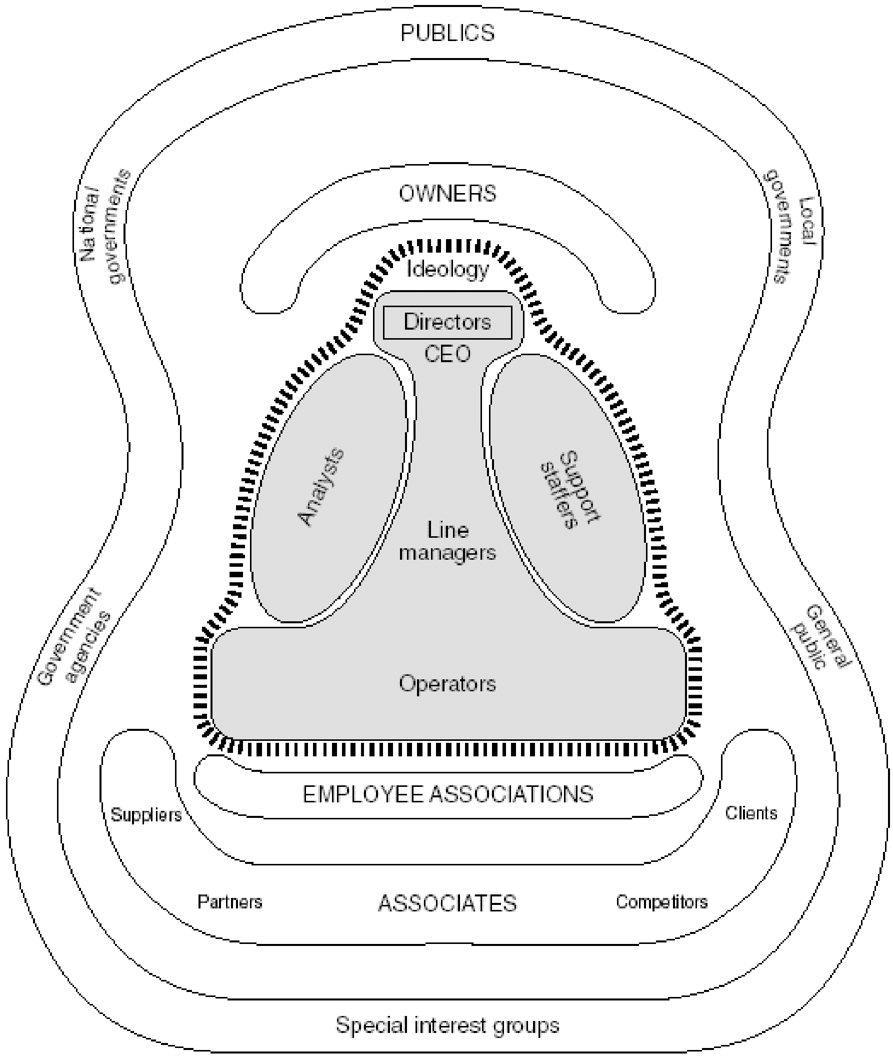
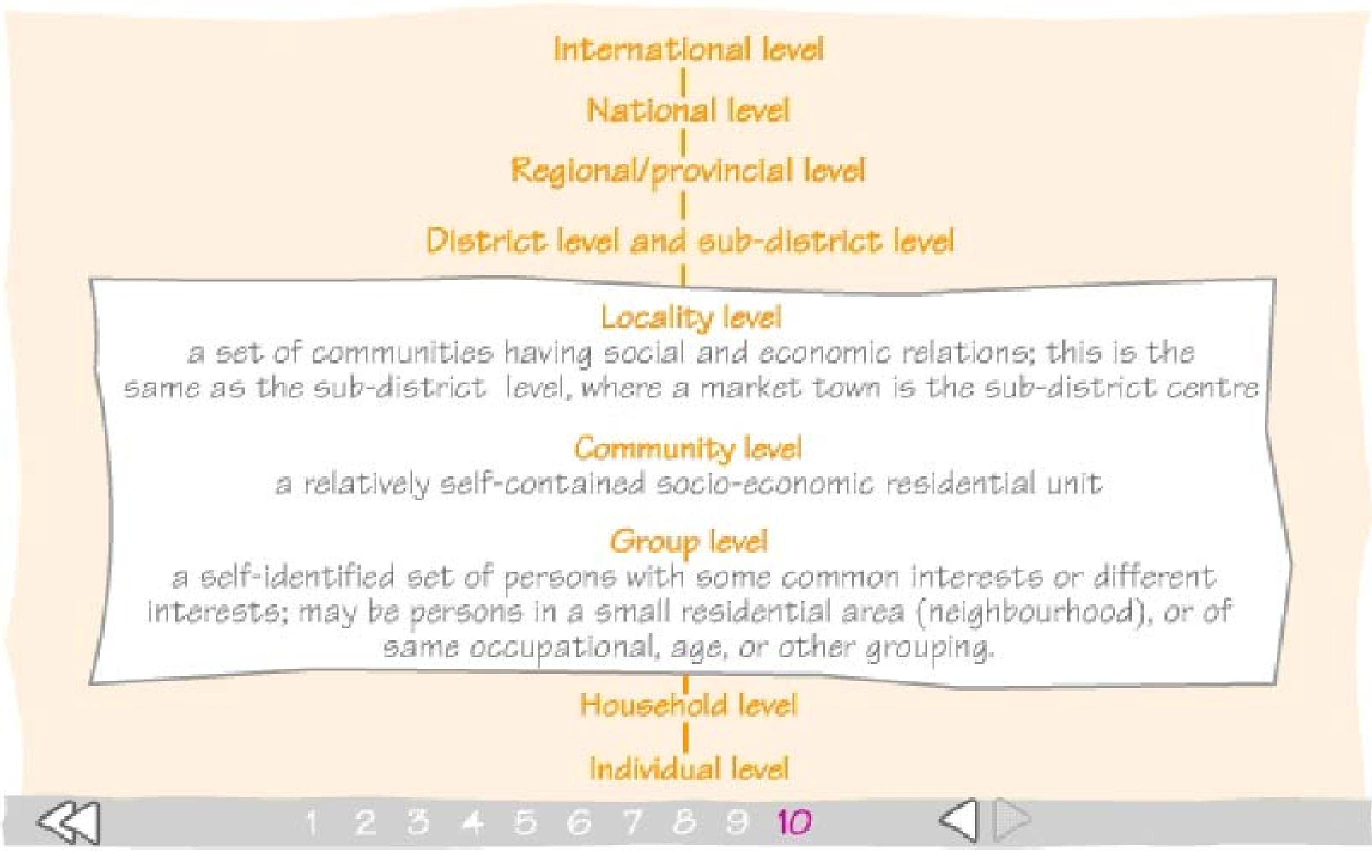


Figure 10.2 Mintzberg's Stakeholders (Mintzberg, 1983)

From: Concept File 5, Reading 10, Page 74.



From: Block 3, Webzone, Week 3, Session 4, Page 1.

Formal groups

Formal groups are used to organize and distribute work, to pool information and devise plans, to coordinate activities or increase commitment, to negotiate, resolve conflicts and conduct inquests. Formal groups are clearly an integral part of the functioning of an organization. It has been estimated for instance that most managers spend fifty per cent of their working days in one sort of group or another.

Informal groups

Informal groups are usually structured more around the social needs of people than around the performances or tasks. Informal groups usually satisfy needs of affiliation, act as a forum for exploring self-concept, help to generate support, and so on.

Teams

A team may be thought of as a particularly cohesive and purposeful type of work group. A collection of people can be defined as a team if it shows most if not all of the following characteristics:

- definable membership
- group consciousness or identity
- sense of shared purpose
- interdependence
- interaction
- self-monitoring - the team members periodically review the team's effectiveness
- ability to act together.

From: Block 3, Webzone, Week 3, Session 4, Page 3.

A grass roots community can be thought of as embedded in the fabric of the wider society and government it belongs to. The NGO, however, with its links to other NGOs nationally and internationally, represents a source of relatively independent ideas, resources, and mechanisms of accountability.
From: Block 3, Webzone, Week 3, Session 4, Page 4.

Quantitative Models: Mathematical - predicts what might happen (make use of mathematical techniques to calculate numerical values for the properties of the defined system – used to explore different results).

Qualitative Models:

Mental Models - how we act and think are shaped by these - also includes language and linguistic models i.e. metaphors Examples are 'how X will react if I ask her to do a particular job', 'what should happen if I turn up the thermostat on this heater', they are simplifications of the complexity around us. They constrain and determine what we perceive in the world about us – how we think about situations, people, organisations and problems.

Iconic Models - where physical material represents physical aspects of a situation i.e. scale models of a situation or problem being represented (think of scale model of Thames estuary from London to Southend).

Graphical Models - 2-dimensional representations e.g. photographs, maps, plans, and diagrams. Think of the London tube map as a graphical model.

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