NCC Education
Postgraduate Diploma in Strategic Business Information Technology

Lecturer Guide

Module 1

IT – The Next Five Years/Principles of Enquiry

Modification History

Revision	Date	Revision Description
V1.0	13 August 2001	For issue.
V1.1	22 March 2002	Amendment Pages 2, 3, 10
V1.2	8 April 2002	Amendment Pages 2, 11 – timing
V2.0	September 2004	Update and full reissue

Lecturer Guide – Contents

IT – The Next Five Years/Principles of Enquiry

Lecturer Guide

How to Use this Lecturer Guide

This Lecturer Guide is in two parts:

- Notes for lecturers – This section contains information needed when teaching this module, including:
  - the syllabus;
  - the contents of the module, together with the suggested timings, are listed on Page 12;
  - teaching notes relevant to each lecture, for guidance;
  - handouts, etc.
- Lecturer/student notes – These are provided for each lecture in the form of a half page for each visual, under which notes are provided relevant to the visual. Lecturers should base their lessons on these Lecturer/Student Notes and the teaching notes provided in this Lecturer Guide. A copy of the Lecturer/Student Notes should also be provided to each student at a suitable point in each lecture (probably most suitable at the end of the lecture).
- The visuals are provided on CD in Adobe PDF format. (The visuals will open up from the CD in Bookmark mode. To view the visuals in Full Screen mode, choose Full Screen from the View Menu, then use the arrow keys to move from one visual to the next. Press Escape to get back to Bookmark mode.)

After allowing the appropriate time within the lecture for students to carry out an exercise, it is useful to spend time discussing student answers.

Notes for Lecturers

Module Specification

Duration

Module 1 consists of six lecture sessions each of 2 hours duration. Further details are provided in the syllabus, which is reproduced below for convenience. (The timings for each lecture are detailed on Page 12 of this Lecturer Guide.)

Lecturer

The lecturer must be familiar with the concepts of the session and, if not in total agreement, at least sympathetic to them.

Pre-reading of all the books recommended for all lectures in this module will be highly beneficial to all lecturers.

Method of Presentation

The lectures should be based on the visuals provided. The Lecturer/Student Notes, which consist of a half page copy of each visual with relevant notes below, are provided at the end of this Lecturer Guide. Teaching notes relevant to each lecture are provided on Pages 17 to 27 of this Lecturer Guide.

- Lecturer led.
- Lectures and workshops.
- Set of visuals for each lecture (provided on CD and in note format within this lecture guide).
- Flipchart or whiteboard work.
- Self study.

Equipment Required

The following equipment is required:

- Overhead projector and screen.
- Flipchart stand, flipchart and broad-tipped felt pens.

Objectives

The objectives are taken directly from the syllabus. The syllabus is repeated here for convenience.

Syllabus (IT – The Next Five Years/Principles of Enquiry)

Aims

- To explore the broader contexts in which information systems (IS) operate and reflect on their implications within the IS design process.
- To identify both current and prospective external events which cause uncertainty within the IS design process.
- To provide an introduction to systemic enquiry methods, in particular Soft Systems Methodology (SSM).
- To assess and reconcile 'ethical' issues, such as failure consequence, professional codes of conduct and data accessibility.
- To introduce and apply the necessary academic, enquiry and study skills demanded by Postgraduate studies.

Objectives

On completion of this module, students will be able to:

- apply and critically evaluate the approaches to problem investigation, examining key assumptions and the student's own prejudices;
- deploy SSM as an enquiry tool in the early stages of the development life cycle;
- discuss the current socio-political and economic issues, reflecting upon those which may impact the IS field;
- critically appraise current and possible future technological innovation and assess the likely impact upon formulating IS strategies;
- assess and reconcile the potential positive and negative impacts of IS implementation, in terms of ethical and legal aspects;
- critically assess the need to integrate real-world pressures and constraints into IS strategic planning, and IS development, using appropriate criteria to select and adopt appropriate methods.

Outline Syllabus

The Nature of Information and Systems

- What is a system?
- What is information?
- 'Difficulties' and 'messes'.
- How can we know what we need?

Principles of Enquiry

- Enquiry and enquiry systems.
- Taxonomy of enquiry.
- Inductive-consensual (agreement).
- Analytic deductive (analysis).
- Multiple realities.
- Dialectic (conflict).
- Unbounded systems thinking.

Principles of Systems Thinking

- Systems theory.
- Themes.
- Hard verssus soft engineering.
- Human activity systems.

Soft Systems Methodology

- Overview.
- Rich pictures.
- CATWOE analysis.
- Root definitions.
- Conceptual models.
- Comparing the models with reality.

The State of the World

- Globalisation.
- Strategic planning.
- Political, economic, social, geographical, technological and sector-specific aspects.

Technology Conflicts

- Dilemmas.
- The nature of risk.
- System operational states.
- Legal and ethical aspects.

Assessment Methods

The module will be assessed by means of coursework and an assessed seminar. The assessment criteria will be based on the learning objectives.

Teaching and Learning Strategies

The module will be based on a combination of lectures and seminar activity. Lectures will provide the overall rationale of the approach, and provide an introduction to both the Principles of Enquiry topic and the review of prevailing world economic issues.

The focus of the seminars will be on possible future technology-related environments, making extensive use of scenario analysis techniques. Within the context of a given scenario, students (working in groups) will prepare and give seminars on the range of possible consequences of a significant change to any one of the major components of the scenario. This technique will ensure that students are alerted to those factors outside their control, which may affect the system under consideration, and internalise the need for continuous risk management.

Students will be expected to undertake a wide lecturer/self-directed literature review, making significant use of the Internet sites to investigate what current technology offers, market pressures, etc. They will also be encouraged to join and contribute to relevant special interest groups/discussion groups.

Indicative Workload Breakdown

Lecture/seminars/tutorials:	48 hours
Coursework:	22 hours
Directed study:	140 hours
Total:	210 hours

Suggested Reading List

O C Ferrell, Geoffrey A Hirt, *A Changing World*, 4th Edition, 2002, Mcgraw Hill, ISBN 0072552735.

Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World*, 1996, Bantam Doubleday Dell Books, ISBN 0385267320.

Peter J Denning (Editor), *Invisible Future*, 2001, McGraw-Hill Education, ISBN 0071382240.

Ian Mitroff, Harold Linstone, *The Unbounded Mind: Breaking The Chains of Traditional Business Thinking*, 1996, Publisher: Oxford University Press, ISBN 0195102886.

John Ward, Joe Peppard, *Strategic Planning for Information Systems*, 2002, John Wiley and Sons Ltd., ISBN 0470841478.

David Boddy, Albert Boonstra and Graham Kennen, *Managing Information Systems*, FT Prentice Hall, ISBN 0273655957.

Peter Checkland, *Systems Thinking, Systems Practice*, 1999, John Wiley and Sons Ltd., ISBN 0471986062.

Ian McDermott and Joseph O'Connor, *The Art of Systems Thinking*, 1997, HarperCollins, ISBN 0722534426.

Harvard Business Review on the Business Value of IT (The Harvard Business Review Paperback series), 1999, Harvard Business School, ISBN 0875849121.

D Leebaert, *The Future of Software,* MIT, 1995, ISBN 0 262 12184 0.

Mason, Mason & Culnan, *Ethics of Information Management,* Sage, 1995, ISBN 0 8039 5756 4.

The Economist Review, The World in xxxx, http://www.theworldin.com/

Module Contents and Timings

The above syllabus has been expanded into the following lectures, providing a total of 48 hours lecture, workshop and discussion time.

Lecture 1	The Nature of Information and Systems	*2 hours*
	Plus workshop and discussion time	*6 hours*
Lecture 2	Principles of Enquiry	*2 hours*
	Plus workshop and discussion time	*6 hours*
Lecture 3	Systems Thinking	*2 hours*
	Plus workshop and discussion time	*6 hours*
Lecture 4	Soft Systems Methodology	*2 hours*
	Plus workshop and discussion time	*6 hours*
Lecture 5	The State of the World	*2 hours*
	Plus workshop and discussion time	*6 hours*
Lecture 6	The Conflicts of Technology – Risks and Consequences	*2 hours*
	Plus workshop and discussion time	*6 hours*
Total		*48 hours*
Coursework		*22 hours*
Directed Self Study and Tutorials		*140 hours*
Overall Total		*210 hours*

Visuals List

Lecture 1 – The Nature of Information and Systems

1.1 Introduction
1.2 Basic Questions
1.3 What is a 'System'?
1.4 Definitions – 1
1.5 Definitions – 2
1.6 A Hierarchy of Understanding
1.7 Definitions – 3
1.8 Information Systems Development – the Systems Approach
1.9 The Nature of Difficulties
1.10 The Nature of Messes
1.11 'Messy' Problems
1.12 The Fundamental Question

Lecture 2 – Principles of Enquiry

2.1 Introduction
2.2 Enquiry
2.3 Enquiry Systems – 1
2.4 The Learning Cycle (Kolb)
2.5 Enquiry Systems – 2
2.6 Inductive-Consensual Enquiry
2.7 Analytic-Deductive Enquiry
2.8 Multiple Reality Enquiry
2.9 Dialectic Enquiry
2.10 Unbounded Systems Thinking
2.11 The Multiple Perspective Concept

Lecture 3 – Systems Thinking

3.1 Introduction
3.2 Methods – 1
3.3 Methods – 2
3.4 Methods – 3
3.5 Systems Thinking
3.6 Themes in Systems Thinking
3.7 Hard Engineering
3.8 Soft Engineering
3.9 Hard and Soft Systems
3.10 Human Activity Systems Approach – 1
3.11 Human Activity Systems Approach – 2
3.12 Merging Hard and Soft Approaches – 1
3.13 Merging Hard and Soft Approaches – 2
3.14 System Thinking – Summary

Lecture 4 – Introduction to Soft Systems Methodology (SSM)

4.1 Introduction
4.2 Systemic Enquiry
4.3 The Basic Shape of SSM
4.4 SSM – Analysing Complex Systems
4.5 SSM
4.6 Approach
4.7 Situation Analysis
4.8 Rich Picture example
4.9 Rich Pictures
4.10 CATWOE Analysis
4.11 CATWOE Mnemonic
4.12 Customers
4.13 Actors
4.14 Transformations
4.15 Transformation
4.16 Weltanschauung
4.17 Different Perspectives
4.18 Multiple W's
4.19 Owners
4.20 Environment
4.21 Root Definition
4.22 Systemic Modelling – Root Definition
4.23 CATWOE Derived from Root Definition
4.24 Conceptual Models
4.25 SSM – The Role of Conceptual Modelling
4.26 Conceptual Model Example
4.27 Comparing the Models with Reality
4.28 Future Analysis – Change and Organisational Culture

Lecture 5 – The State of the World

5.1 Introduction
5.2 Why is this Important?
5.3 'Hard' Strategic Planning
5.4 'Messy' Strategic Planning
5.5 Aspects of the Mess
5.6 Political
5.7 Economic
5.8 Social
5.9 Geographical
5.10 Technological
5.11 Market Sector Specific

Lecture 6 – Technology Conflicts – Risk and Consequence

6.1 Introduction
6.2 The Dilemma
6.3 Asimov's Three Laws of Robotics

Bibliography

Lecture 1 – The Nature of Information and Systems

R L Ackoff*, Towards a System of System Concepts,* Management Science, 17, 11, 83-90, 1971.

R. Ackoff, *Ackoff's Best*, p.48. 1999, Wiley, New York

W R Ashby, *An Introduction to Cybernetics,* New York: Wiley, 1959.

Lucas D Introna*, Management, Information and Power: A Narrative of the Involved Manager, London: Palgrave Macmillan, 1997.*

G C Burch & G Grudnitski, *Information Systems : Theory and Practice*, New York: Wiley, 1989.

A Wildavsky, *Information as an Organisational Problem*, Journal of Management Studies, Vol. 20, No.1, 1983.

F Brooks, *No Silver Bullet: Essence and Accidents in Software Engineering,* IEEE Computer, April 1987.

R K Miles, *Computer systems analysis: the constraints of the hard systems paradigm*, Journal of Applied Systems Analysis, Vol 11, 1985.

J Gaarder, *Sophie's World*, London: Phoenix, 1995.

Lecture 2 – Principles of Enquiry

D Kolb, Experiential Learning, Englewood Cliffs: Prentice Hall, 1984.

Mitroff & Linstone, The Unbounded Mind, OUP, 1993.

Carl R Rogers & H Jerome Freiberg, *Freedom to Learn*, 3rd Edition, Prentice Hall,1994, ISBN 0024031216.

C Churchman, *The Design of Inquiring Systems*, New York: Basic Books, 1971.

Lecture 3 – Systems Thinking

R L Ackoff, *Towards a System of System Concepts*, Management Science, 17, 11, 83-90, 1971.

W R Ashby, An Introduction to Cybernetics, New York: Wiley, 1959.

F Brooks, *No Silver Bullet: Essence and Accidents of Software Engineering*, IEEE Computer, April 1987.

P Checkland & J Scholes, *Soft Systems Methodology in Action*, Chichester: Wiley, 1990.

P B Checkland, *Systems Thinking, Systems Practice*, Chichester: John Wiley, 1981.

B Cox's, *There Is A Silver Bullet*, BYTE, October 1990.

Mitroff & Linstone, *The Unbounded Mind*, OUP, 1993.

Lecture 4 – Introduction to Soft Systems Methodology (SSM)

P Checkland & J Scholes, *Soft Systems Methodology in Action*, Chichester: Wiley, 1990.

P B Checkland, *Systems Thinking, Systems Practice*, Chichester: John Wiley, 1981.

Lecture 5 – The State of the World

Mitroff & Linstone, *The Unbounded Mind*, OUP, 1993.

Lecture 6 – Technology Conflicts – Risk and Consequence

Immanuel Kant, *A critique of pure reason.*

Mason, Mason & Culnan, *Ethics of Information Management*, London: Sage, 1995. Mitroff & Linstone, The Unbounded Mind, OUP, 1993.

US Software Engineering Institute's Capability Maturity Models (FTP/Web - available from the SEI at sei.cmu.edu).

P L Bernstein, *Against the Gods,* New York: Wiley, 1996.

Teaching Notes

Note: Pre-reading of all the books recommended for all lectures in this module, not just those pertaining to this first lecture, will be highly beneficial to all lecturers.

Lecturers should base their lesson on the teaching notes contained here and the Lecturer/Student Notes provided immediately after this Lecturer Guide.

Lecture 1 The Nature of Information and Systems

This first lecture is effectively in three sections:

- *Introductions of Lecturer(s) and Students*

  (30 minutes)

  This lecture is the point of departure from which students will begin the studies leading to the achievement of their postgraduate diploma. It is important that this is seen as a team task - students working with and learning from their tutor, their lecturers and each other. Establishment of this principle at the earliest possible stage will be critical to course success, and the tutor must make very effort to develop it whenever the opportunity arises. The introductions should therefore not be rushed – students will have experience derived from many varied situations in Information Systems (IS) environments, and this will be very valuable as a context within which the various topics and learning issues can be viewed and the theory grounded. The tutor should make every effort to draw this experience out by asking students to introduce themselves, talking about their previous experience in addition to their reasons for undertaking the course, their expectations from it and any concerns they have about the course or their ability to be successful.

- *Introduction to the Course*

  (30 minutes)

  This should be given by the designated course tutor. It includes a description of all the course modules, including their purpose and how each relates to each other. In particular, it is important to emphasise the philosophy underpinning the overall course design *i.e:*

  – to address issues rather than technological detail;

  – to emphasise the relation of Information Systems (IS) to the broader organisational context and the world at large;

  – to encourage and develop the critical abilities of students and to equip them for positions requiring strategic thinking and a significant degree of responsibility for medium to long term planning.

- *Introductory Lecture – The Nature of Information and Systems*

(1 hour)

This initial presentation should also be given by the course tutor as the second half of the first lecture session. It is intended to both stimulate and challenge the new students in terms of their current perceptions and opinions regarding the role and purpose of *information*, and the systems which use it, at the beginning of the new millennium. Whilst not necessarily recommended for student use, the tutor may find that a useful background to preparation (and a thought-provoking stimulus for her/his own understanding) is *Management, Information and Power: A Narative of the Involved Manager*, Lucas D Introna, London: Macmillan (1997).

Although it may be delivered as a straight lecture, the tutor will probably find it to be considerably more effective if she/he delivers the material interactively, asking students their own opinions and definitions, capturing these on a whiteboard or flipchart and developing the argument by comparison with the definitions given in the presentation material.

The material covered and the issues discussed should be recorded and used as the basic input to the Principles of Information Systems topic in Module 2.

Note: In many ways, this lecture is the most critical to the success of the entire course. Students will come with a set of assumptions and experiences, probably from disciplines and environments which are based on a belief in the adoption of a hard, systems engineering approach to the things they do.

For this reason, the course tutor must be familiar with the concepts behind the lecture and, if not in total agreement, at least sympathetic to them.

Lecturers should base their lesson on the Lecturer/Student Notes provided, together with the Teaching Notes provided here.

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

Relating to Visual 1.2

The lecturer should endeavour to draw out current views from the students in answer to the questions posed in the visual, capturing these views on a whiteboard or similar.

It is likely that, at least initially, students will restrict their thinking to technologically-oriented answers. These should be challenged by the lecturer in order to get the students thinking on a much broader scale.

The lecturer may also have to deal with accusations of being too philosophical – and this would be a good opportunity to suggest that the majority of difficulties with Information Systems in the past have occurred because those involved were not *philosophical* enough. In other words, they did not think about what they were trying to do, but simply connected some available technologies together, with resultant disaster.

Relating to Visuals 1.4

The definitions given in the visual may be supplemented with some from the lecturer's own reading and experience. *Ask the students for input.*

Relating to Visual 1.5

Again, the lecturer may wish to supplement the definitions given in the visual with other definitions and relate back to the students' own definitions given earlier.

Relating to Visual 1.6

It should be made clear to students that concepts of knowledge, and especially wisdom, are outside the capability of current technology – despite claims to the contrary.

Some examples could be given here. Any story in which computers have acted with gross stupidity will suffice – and there are many of these.

Relating to Visual 1.7

Discussion should include the idea of *interconnectedness* – the mutual dependence of all systems which make up an organisation, not just those which are computerised. This should lead into the next visuals which address the concepts of *difficulty* and *mess.*

Relating to Visual 1.11

It may be useful to distribute the Fred Brooks' paper *Essence and Accidents in Software Engineering* (IEEE Computer, April 1987) at this point, to underpin the concepts introduced. Having read this, students would be better informed and prepared to take part in the discussion in Lecture 3.

Relating to Visual 1.12

After this first lecture, the lecturer should reflect on its reception. If students engaged fully in discussion, all well and good. If not, or if they appeared to struggle with the argument, it may be appropriate to offer a tutorial in which they might explore their difficulties on a more informal basis.

Issue the Lecture 1 notes to students.

Lecture 2 Principles of Enquiry

(2 hours)

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

The purpose of this lecture is to introduce the students to the different ways in which issues can be viewed and investigated. It should encourage them to develop an approach

in which they can explore their own unacknowledged assumptions and apply objective critical analysis in a *problem* situation.

While based largely on H Mitroff, and I Linstone, The Unbounded Mind, New York: Oxford University Press (1993), the lecturer may also find the following helpful:

- C Churchman, The Design of Inquiring Systems, New York: Basic Books, (1971).

Relating to Visual 2.1

Lecturers should strive to challenge student preconceptions – particularly in the case of students from a business background, who will very probably have been encouraged by their previous environment into a single approach to enquiry. Such people are likely, initially, to be reluctant to accept that there may be other approaches of equal, or greater, validity.

Relating to Visual 2.3

Issue Handout 1 which contains the Preferred Learning Styles self-test.

Students should be encouraged to answer the question posed in the visual for themselves. It may be helpful to ask them to complete the Preferred Learning Styles self-test (Handout 1) as a means of opening the discussion.

Regarding the Preferred Learning Styles self-test, some lecturers may prefer to suggest that students do this in their own time as it also offers a contribution to some later modules, particularly the module concerned with reflection.

Points to be brought out should be placed in the context of the Kolb Learning Cycle discussed on the next visual. Lecturers may wish to add other models of which they are aware and which might provide additional insight – see particularly the work of Carl Rogers, especially Freedom to Learn, 1969, Ohio.

Relating to Visual 2.5

The following visuals concentrate on each of the enquiry systems discussed in the Mitroff & Linstone text book.

Lecturers should be familiar enough with this material to be able to offer their own examples, lead discussion and answer questions on each approach.

The notes below each visual therefore, are intended as a guide rather than to be used verbatim.

Relating to Visual 2.6

Students should be asked to identify the weaknesses with this approach, and their answers should include the need to define the problem very tightly; the likely inaccuracy of historical data; prejudices (and unreliability, cf. the Asch effect) of experts; forced analogy when the variables and environment are different or poorly understood; and, most

significantly, the inherent inaccuracy (but because it derives a single answer, the apparent precision) of the method.

Relating to Visual 2.8

Discussion of this approach may extend to consideration of the nature of *truth* and, if so, students could be encouraged to read around this issue in their own time.

The complex enquiry systems we are now talking about give potential for multiple answers and, therefore, decisions based upon them seem more risky. Is this true? *Ask the students.*

Relating to Visual 2.9

A short class exercise may be useful here; the example of homelessness given in the textbook may be used. However, a more contentious and, therefore, potentially more participative idea, may be to split the class arbitrarily into two; one group should be asked to defend, the other to attack, the legalisation of so-called *soft* drugs as a means of reducing the problem of drug dealing among young people.

Using the same approach, an equivalent IS example may be to ask the two groups to debate the need (or not) for an independent, separate IS department in a business organisation.

Whatever question is posed, the lecturer should ensure that the process of dialectic enquiry is observed in action, and that students have the opportunity to discuss the method as well as the issue under debate.

Relating to Visual 2.10

As a conclusion to this session, it would be useful, at least, to give the students an overview of the multiple perspective method discussed in the textbook

Issue the Lecture 2 notes to students.

Lecture 3 Systems Thinking

(2 hours)

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

This lecture aims to place a rationale behind the need for new methods of enquiry and new approaches to systems development.

It is increasingly clear that *hard* engineering is rarely applicable to the type of systems which will be demanded in the future. The era of the bespoke system, rigorously specified to address a structured problem situation, is over. The commercial drivers clearly indicate a move towards an environment demanding increased component reusability; IS

development will almost inevitably become a process of assembly rather than creation from scratch. The *soft* paradigm which can support this is based on the systemic process of enquiry, which this lecture will introduce.

Lecturers will find much of the necessary background in P B Checkland, Systems Thinking, Systems Practice, Chichester: John Wiley (1981). The best additional material to this are the well-known papers by Fred Brooks No silver Bullet: essence and accidents of Software Engineering, in IEEE Computer (April 1987), and Brad Cox's response to this There Is a Silver Bullet in BYTE (October 1990). Short case histories of the London Ambulance and Taurus Stock Exchange systems are provided with the lecture notes for use as discussion material, but lecturers may wish to supplement or replace these with localised case histories of systems which have *failed* due to lack of consideration at the systemic level.

Relating to Visual 3.4

As we shall see, there are some very significant differences in the underlying value systems of those methods drawn from a 'hard' Software Engineering paradigm, as opposed to the softer interpretive methods that have emerged from the social and management sciences. If analysts do not appreciate such differences of perspective then there is a danger that they will apply everything at the level of *technique*, rather than fully exploiting the power of the methods to help in understanding complex problem situations.

Lecturers should take care to make sure that students fully appreciate the significance of this issue, and reinforce it throughout the following two lectures.

Relating to Visual 3.7

Regarding the examples given in the last paragraph of the notes, i.e. M25, the Channel Tunnel, the Avon Bridge, or the Millennium Dome, *lecturers should replace these examples with local examples wherever possible.*

Relating to Visual 3.8

A related point is to ask who says that any given situation is a problem? For example, truancy might be considered to be a problem by teachers and the police, but not by the truants themselves if they are bored by school and see no benefit in the education they are receiving. Equally their parents may or may not see it as a problem depending upon the benefit they receive from having a child absent from school during the day (e.g. child minding, doing the shopping, or guarding the home).

Issue the Lecture 3 notes to students.

Lecture 4 Soft Systems Methodology

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

(2 hours)

One of the major approaches to the study of complex situations in a systemic (as opposed to a systematic) manner is that of Soft Systems Methodology (SSM). Although SSM is not the only such approach it is probably the most widely known and the most generally used. SSM is relatively easy to understand and to grasp its underlying principles, but it is much more difficult to apply in practice. The difficulty arises because people often confuse the notion of 'methodology' with that of 'method', and thus treat SSM as some kind of problem solving 'cookbook' or 'toolkit' for dealing with complex systemic situations. The lecture demonstrates that SSM is truly a 'methodology', based on a set of underlying principles rather than simply being an aggregated set of techniques.

As with any methodology, a lecture can only introduce concepts – it is in the practical application that the learning will take place. In addition to the discussion suggested, therefore, students should also be encouraged to apply SSM in a number of different situations as part of their self-study, bringing their findings back and discussing them in workshop or seminar sessions.

The two Checkland textbooks Systems Thinking, Systems Practice and Soft System Methodology in Action should be regarded as mandatory reading for lecturers and suggested further reading for students.

Relating to Visual 4.20

*Ask students to identify a number of elements in the **environment** of the prison systems.*

Relating to Visual 4.26

Discuss the conceptual model in the visual. Ask students to:

- identify the activities that depend upon the particular example given;
- identify the generic systemic activities shown;
- draw a *conceptual model* of a *system to choose and acquire a new car*.

Relating to Visual 4.28

Finally whereas *hard* systems approaches to IS development tend to emphasise that change should be *systemically feasible* and *culturally desirable*, the rubric of SSM is quite the opposite in that change should be *systemically desirable* and then *culturally feasible*.

- Discuss with students the differences to the role of the Information Systems professional implied by this switch of emphasis in feasibility and desirability.

Issue the Lecture 4 notes to students.

Lecture 5 The State of the World

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

(2 hours)

The aim of this lecture is to encourage students to relate their local activity to a broader perspective, exercising the Unbounded Systems Thinking techniques covered earlier in the module. Globalisation, or *interconnectedness* as Mitroff & Linstone call it, is becoming an increasing influence on business strategic planning activity even at the level of small to medium sized organisations. The issues covered in this lecture will be shaped by current events, and lecturers must ensure that they maintain topicality – but the general principles derived will be common whether the discussion centres on a conflict in the Middle East, a financial crisis in the Pacific Rim or the European Monetary Union.

Lecturers may wish to approach this lecture using innovative techniques such as role play, timing it to coincide with a newscast, producing an invented newspaper headline or whatever - and then asking the questions prompted by this, for example:

- How will this affect your system?
- Will prices escalate?
- Is the business case invalidated?
- Should we delay or accelerate the development?

Relating to Visual 5.4

Speaking in 1987, Michael Hammer, the Business Process Re-engineering (BPR) guru, said:

"The challenge is not to automate the past, but to invent the future."

Lecturers may find it interesting to gather student reaction to this statement (progress, etc).

Relating to Visual 5.5

The role of the lecturer in the remainder of this lecture is to act as facilitator. The students should be given the opportunity to discover *interconnectedness* for themselves. They should be asked to identify chains of possible consequence, starting with changes in any of the areas listed in Visual 5.5, and identifying how these may affect the Information Systems with which they, or their organisation, are (or could be) concerned.

Experience has shown that this part of the lecture may start with students making a few frivolous statements. This is a positive sign, and will soon lead to serious, but light hearted, contributions and a much wider understanding of the issue. Lecturers should, therefore, be careful not to stifle the debate by approaching it in an over-formal way.

The notes below Visuals 5.6 to 5.11 in the Lecturer/Student Notes are intended as a guide only, and lecturers should tailor the lists under each heading according to their local situation and understanding of the issues. Their very interconnectedness means that some may be validly classified under one or more of the different headings.

Relating to Visuals 5.6 to 5.9

Initiate discussion on the questions raised in the Lecturer/Student notes relating to these visuals.

Relating to Visual 5.10

Lecturers should constantly review the press for instances of the issues mentioned in this visual.

Although quoted in 1997, the following statement from Bill Gates still holds true:

> "We usually overestimate what we can do in two years and underestimate what we can do in ten".

A good illustration of this would be for the lecturer to offer some examples from the trade press of ten years previously.

Relating to Visual 5.11

Lecturers may wish to tailor this list in the light of local industry and tradition.

Issue the Lecture 5 notes to students.

Lecture 6 The Conflicts of Technology – Risks and Consequences

Inform students that a handout containing a full set of visuals together with notes will be provided to them at the end of this lecture.

(2 hours)

The previous lecture investigated aspects of the influence which wider, *global*, issues may have upon Information Systems. In contrast, this lecture is intended to raise awareness of the effect of technology upon the world, and thus complements Lecture 4, and may even proceed from it. Again, local or current case histories of systems failure causing severe business or environmental problems may be used; Year 2000-related issues look to be well placed to provide a rich source of such material. The questions posed should be around the method and nature of consequence analysis and its place in the development and design process.

Many of the themes are explored further in Mason, Mason & Culnan, Ethics of Information Management, California: Sage Publications (1995); this may need to be supplemented by some reading around the topic of risk, upon which there is a large body of literature. An innovative – and very readable – approach to the risk issue can be found

in P L Bernstein, Against the Gods, New York: Wiley (1996). Although this is not specific to Information Systems, it can actually be used as a further means by which the close-coupled relationship of IS and the broader business world can be underlined.

Relating to Visual 6.7

Lecturers may wish to invite student opinion at this point, before proceeding with the more detailed examples which follow.

Relating to Visual 6.8

There are many other stories which lecturers may wish to use. Many other stories can be found in Mason, Mason & Culnan, Ethics of Information Management, London: Sage (1995).

Relating to Visual 6.12

At this point, lecturers may wish to bring a practical note into the lecture by stimulating student discussion around the following topic:

- The willingness or otherwise of senior, sponsoring business management to allocate resource to performing a *consequence analysis process*. This process may be both very time-consuming and expensive, only to provide negative or inconclusive results.

Relating to Visual 6.15

If there is time left at the end of the lecture, it would be useful to quote from these and discuss the way in which they could be modified to become more specific and relevant to the Information Systems area.

Issue the Lecture 6 notes to students.

Seminar Plan

(Target Duration of 2 Hours)

The focus of the seminars will be on possible future technology-related environments. Within the context of a given scenario, students (working in groups of two/three) will prepare and deliver seminars on the range of possible changes to any one of the major components of the scenario, and the significance of these. This technique will ensure that students are alerted to those factors outside their control which may affect the system under consideration, and will internalise the need for risk management to be continually performed.

An example topic would be as follows:

> *Your group is invited to produce and deliver a presentation (of one and a half hours duration plus 30 minutes for questions) supported by a written report (which should be as detailed as you feel appropriate in the given circumstance) to*

> *the full executive board of a manufacturing company which works in all aspects of the telecommunications sector. All aspects of the significant and likely changes in the field of Information Systems over the next five years which you feel may be relevant to the company should be discussed. The board intend to use this as a basis for their corporate strategic planning, including possible acquisition and disposal planning. The board will also expect to be appraised of the probability of each of your projections and any factors which may influence this probability either within or without the company's control.*

Assessment of the seminars will be performed by the course tutor and one other person who the students should ideally not have met during their course so far – a representative from a local business would be ideal for this role.

Marking should be performed by both assessors, taking into account breadth and depth of thought, validity of extrapolation from the given scenario, and the level and appropriateness of the chosen method of enquiry – for instance, use of the Internet, making a direct approach to actual manufacturers, and the application of lateral thinking and creativity.

The target student preparation time for the seminar will be 40 hours, and the seminar content should reflect this.

Handout 1 – Preferred Learning Styles Self Test for Lecture 2 (Preferred Learning Styles)

Everybody, over time, develops learning preferences according to their personality, culture and background. Within a team environment, it is very beneficial to have a mix of different types of people - invariably, teams that don't *function* are found to have a preponderance of people with similar character attributes. However, this does tend to mean that applying a common learning approach benefits some more than others, and thus the learning process is not as effective as it should be. This questionnaire enables learning preferences to be reflected in the type of training and education provided - sometimes this can mean individual people being offered different approaches to the same subject, but more usually it enables the training designer to make sure that there is an appropriate balance in the programme.

There is no time limit on the questionnaire, but it should not take more than 10-15 minutes. If it does, it probably means that you are thinking too hard about each question, whereas your initial reaction is probably more reliable. The questionnaire is totally confidential, and there are no right or wrong answers, so please be honest with yourself.

Look at each statement in turn, and if you agree more than you disagree with it, tick the open box ❑. If you disagree more than you agree, don't tick anything - simply go on to the next statement.

☒ ❑ ☒ ☒ I have strong beliefs about right and wrong, good and bad

☒ ☒ ☒ ❑ I often act without considering the possible consequences

☒ ❑ ☒ ☒ I tend to solve problems using a step-by-step approach

☒ ☒ ☒ ❑ I believe that formal policies and procedures inhibit people

❑ ☒ ☒ ☒ I have a reputation for saying what I think

☒ ☒ ☒ ❑ I often find actions based on feelings are as sound as those based on careful analysis

☒ ☒ ❑ ☒ I like the sort of work where I have time for thorough preparation

☒ ❑ ☒ ☒ I regularly question people about their basic assumptions

❑ ☒ ☒ ☒ What matters most is whether something works in practice

☒ ☒ ☒ ❑ I actively seek out new experiences

❑ ☒ ☒ ☒ When I hear about a new idea I immediately start working out how to apply it in practice

☒ ❑ ☒ ☒ I am good at self discipline such as taking exercise, dieting, sticking to a fixed routine

☒ ☒ ❑ ☒ I take pride in doing a thorough job

☒ ❑ ☒ ☒ I get on best with logical analytical people

☒ ☒ ❑ ☒ I take care over the interpretation of data available and avoid jumping to conclusions

☒ ☒ ❑ ☒ I like to reach a decision carefully after weighing up many alternatives

☒ ☒ ☒ ❑ I am more attracted to novel, unusual ideas than to practical ones

☒ ❑ ☒ ☒ I don't like disorganised things and prefer things to fit into a coherent pattern

❑ ☒ ☒ ☒ I accept and stick to laid down policies and procedures
☒ ❑ ☒ ☒ I like to relate my actions to a general principle
❑ ☒ ☒ ☒ In discussions I like to get straight to the point
☒ ❑ ☒ ☒ I tend to have distant, rather formal relationships with people at work
☒ ☒ ☒ ❑ I thrive on the challenge of tackling something new and different
☒ ☒ ☒ ❑ I enjoy fun-loving, spontaneous people
☒ ☒ ❑ ☒ I pay meticulous attention to detail before coming to a conclusion
☒ ❑ ☒ ☒ I find it difficult to produce ideas on impulse
❑ ☒ ☒ ☒ I believe in coming to the point immediately
☒ ☒ ❑ ☒ I'm careful not to jump to conclusions too quickly
☒ ☒ ❑ ☒ I prefer to have as many sources of information as possible
☒ ❑ ☒ ☒ Flippant people who don't take care over things usually irritate me
☒ ☒ ❑ ☒ I listen to other people's views before putting my own forward
☒ ☒ ☒ ❑ I tend to be open about my own feelings
☒ ☒ ❑ ☒ In discussions I enjoy watching the manoeuvrings of the other participants
☒ ☒ ☒ ❑ I prefer to respond on a spontaneous, flexible basis rather than planning things in advance
❑ ☒ ☒ ☒ I tend to be attracted to techniques such as network analysis, planning and scheduling
☒ ☒ ❑ ☒ It worries me if I have to rush a piece of work to meet a deadline
❑ ☒ ☒ ☒ I tend to judge people's ideas on their practical merits
☒ ☒ ☒ ❑ Quiet, thoughtful people tend to make me uneasy
☒ ☒ ❑ ☒ I often get irritated by people who want to rush things
☒ ☒ ☒ ❑ It is more important to enjoy the present than worry about the past or future
☒ ☒ ❑ ☒ I think that decisions based on thorough analysis are better than those based on intuition
☒ ❑ ☒ ☒ I tend to be a perfectionist
☒ ☒ ☒ ❑ In discussion I tend to produce lot of spontaneous ideas
❑ ☒ ☒ ☒ In meetings I usually put forward practical realistic ideas
☒ ☒ ☒ ❑ More often than not, rules are there to be broken
☒ ☒ ❑ ☒ I prefer to stand back from a situation and consider all the perspectives
☒ ❑ ☒ ☒ I can often spot inconsistencies and weaknesses in other people's arguments
☒ ☒ ☒ ❑ On balance I talk more than I listen
❑ ☒ ☒ ☒ I can often see better, more practical ways of getting things done
❑ ☒ ☒ ☒ I think written reports should be short and to the point
☒ ❑ ☒ ☒ I believe that rational, logical thinking should win the day
☒ ☒ ❑ ☒ I tend to discuss specific things with people rather than engaging in social discussion
❑ ☒ ☒ ☒ I like people who approach things realistically rather than theoretically
❑ ☒ ☒ ☒ In discussions I tend to get impatient with irrelevancies and digressions
☒ ☒ ❑ ☒ If I have report to write I tend to produce many drafts before settling on the final version

❑	☒	☒	☒	I'm keen to try things out to see if they work in practice
☒	❑	☒	☒	I'm keen to reach answers via a logical approach
☒	☒	☒	❑	I enjoy being the one who talks a lot
❑	☒	☒	☒	I find I am usually the realist, keeping people to the point and avoiding speculation
☒	☒	❑	☒	I like to ponder many alternatives before making up my mind
☒	❑	☒	☒	In discussion I often find I am the most objective
☒	☒	❑	☒	In discussion I am more likely to adopt a low profile
☒	❑	☒	☒	I like to be able to relate current actions to a longer term bigger picture
☒	☒	☒	❑	When things go wrong I tend to shrug them off and put them down to experience
❑	☒	☒	☒	I tend to reject wild, spontaneous ideas as impractical
☒	☒	❑	☒	It's always best to think carefully before talking action
☒	☒	❑	☒	On balance I do the listening rather than the talking
☒	❑	☒	☒	I tend to be tough on people who find it difficult to adopt a logical approach
❑	☒	☒	☒	Most of the time I believe the end justifies the means
❑	☒	☒	☒	I don't mind hurting people's feeling as long as the job gets done
☒	☒	☒	❑	I find the formality of having specific objectives and plans stifling
☒	☒	☒	❑	I'm usually one of the people who puts life into the party
❑	☒	☒	☒	I do whatever is expedient to get the job done
☒	☒	☒	❑	I quickly get bored with methodical, detailed work
☒	❑	☒	☒	I am keen on exploring the basic assumptions, principles and theories underpinning events
☒	☒	❑	☒	I'm always interested to find out what people think
☒	❑	☒	☒	I like meetings to be run on methodical lines with a clear laid down agenda
☒	❑	☒	☒	I steer clear of subjective or ambiguous topics
☒	☒	☒	❑	I enjoy the drama and excitement of a crisis situation
❑	☒	☒	☒	People often find me insensitive to their feelings

Now please total the ticks in each column and enter the numbers in the boxes below:

				Totals
P	T	R	A	

		General Norms (Preferences from general sample of professional workers)				
		Very Low	**Low**	**Moderate**	**Strong**	**Very Strong**
		Lowest 10%	***Next 20%***	***Middle 40%***	***Next 20%***	***Highest 10%***
P	Pragmatist	0 to 8	9 to 11	12 to 14	15 to 16	17 to 20
T	Theorist	0 to 7	8 to 10	11 to 13	14 to 15	16 to 20
R	Reflector	0 to 8	9 to 11	12 to 14	15 to 17	18 to 20
A	Activist	0 to 3	4 to 6	7 to 10	11 to 12	13 to 20

Learning Style Preferences

Pragmatist	*Most preferred:*	Linkages between subject and objective clear
		Opportunity to tackle real problems
		Opportunity to practice with coaching
		Repeatable models
		Immediate opportunity to implement
		Concentration on practical issues
	Least preferred:	Talk and chalk
		No direct or apparent relevance
		Theoretical emphasis
		No clear guidelines
		Apparent lack of progress
		Political, managerial or personal obstacles to implementation
		No apparent reward from learning activity
Theorist	*Most preferred:*	Structured situation
		Clear purpose
		System, model or method offered
		Opportunity to analyse and generalise
		Opportunity to question and probe basic precepts
		Intellectually stretched
		Well argued ideas or concepts
		Interesting concepts (not necessarily directly relevant)
		Complex situations
	Least preferred:	Emotional situations
		Lack of context
		Open ended or irreconcilable problems
		Incompatible and/or contradictory approaches / techniques
		Being out of tune with others
		No basic policy, principle or concept
		Lack of depth, ‘Overview’ level
		No intellectual peers, no like-minded people
Reflector	*Most preferred:*	Stand back and observe
		Opportunity to review learning
		Making decision in own time
		Allowed to think before commenting
		Opportunity for painstaking research
		Structured discussion

	Least preferred:	Instant reaction required
		Cut and dried instruction
		Rushed activities
		Forced into a prominent role
		Given insufficient data
		Forced to do a superficial job in the interests of expediency
Activist	*Most preferred:*	New experiences
		Ideas without constraint
		In at the deep end - challenges
		Games, Competitive teamwork
		Excitement, drama, crisis
		High personal visibility
	Least preferred:	Listening how to do - passive roles in learning
		Data assimilation
		Solitary work
		Setting specific learning objectives
		Repetitive activity
		Precise, rigorous specification
		Attention to detail and follow through

Effective learning involves four stages, each of which is more suited to a particular learning style. These stages are:

- having the experience;
- reviewing that experience;
- concluding from that experience;
- planning the implementation of the lessons learned.

These stages tend to map on to the Activist, Reflector, Theorist and Pragmatist styles, in that order. If your results in the above exercise show a balanced, all-round style (*i.e.* where all scores were roughly at the same norm), you are likely to manage each stage of the cycle effectively. If you showed a marked preference for one or two styles, with a commensurately lower preference for the others, you should be aware of the need to address the blockages associated with these styles and by being conscious of the need to display the attributes of that style, attempt to approach issues in the most appropriate way according to the stage of learning.

Please keep this questionnaire for future reference.

Handout 2 – Case Studies for Lecture 3 (LAS & Taurus)

IT Project Case History

1. The London Ambulance Service

The London Ambulance Service (LAS) is the largest of its kind in the world, carrying over 5000 patients per day and covering an area of over 600 square miles. It is a quasi-independent body whose management have a considerable degree of autonomy but ultimately report into the South West Thames Regional Health Authority (RHA); it also has a reporting line into other RHAs in the area.

In the late 1980s, like the rest of the NHS, LAS had to adapt to major upheavals in the way health care is purchased and provided, following the shift to greater use of an *internal market*, more oriented to business processes and goals. It also had to cope with the aftermath of a damaging national pay dispute with ambulance staff and was faced with pressure from RHAs, politicians, the public and media to improve response times in getting to incidents. The prevailing organisational situation was perceived as poor in terms of both operational and financial performance.

A new LAS management team was appointed in 1990 to address these problems. They decided to adopt a radical and fast-moving agenda of change in order to meet these challenges. A key part of this would be a new *state of the art* Computer Aided Despatch (CAD) system. This would help to decide which vehicle to send to an incident and communicate relevant information to the appropriate crew. A previous CAD system, estimated to cost about £7.5 million, was abandoned in 1990 after tests had found it could not cope with likely demand. Work on the new system began in the Autumn of 1990. Consultants Arthur Andersen estimated it would cost £1.5 million and take nineteen months if it could be based on a packaged solution. It warned that these figures should be very significantly increased if a suitable package could not be found.

The project was chaired by the Director of Support Services and two key players were the LAS Systems Manager (a career ambulance specialist, not an IT specialist) and a contract systems analyst. Representatives from training and other areas helped prepare the requirements specification. However, recent industrial relation problems resulted in a lack of involvement by ambulance crews, although the system substantially affected the way they would work. This was perceived by the Unions to be intentional, as a way by which managers could further undermine Union authority and influence.

A packaged solution was rejected because the LAS requirements were seen to be unique in terms of the scale and degree of automation expected. A £1.5 million budget ceiling and a non-negotiable implementation date of 8 January 1992 for the full system remained key criteria used for assessing responses to an Invitation To Tender (ITT) in February 1992.

The successful bid came from a consortium consisting of a small software house, a larger hardware manufacturer and a communications supplier. It was for just less than £1

million, about £700,000 cheaper than the next nearest bid. (The highest bid, for over £7 million, was made by a subsidiary of British Telecom). RHA standing financial instructions stated that the lowest tender had to be accepted unless there were "good and substantial reasons to the contrary". The software house was made responsible for managing the project, and the UK government standard for managing IT Projects, PRINCE (Projects IN a Controlled Environment) was to be used for the development.

In mid-December 1991 the team accepted it could not meet the deadline as the system was still incomplete and largely untested. Instead, a partial, semi-manual solution was implemented during January and gradually expanded over the next nine months.

When the system went live in full automation mode on 26 October, 81 Project Issue Reports (PIRs), which detail problems with system quality, were still unsatisfied. Of these, 48 were identified as potentially having serious consequences. On that day and the next, ambulance response times became unacceptably long. As a consequence of this, it was later alleged that twenty people had died. Semi-manual operation was resumed. At about 2 a.m. on 4 November, the system stopped completely, with over 600 emergency calls outstanding. Staff reverted to a fully manual system, which then remained in place for at least two years.

The Public Inquiry found the following:

- There was no evidence of key questions being asked about the winning bid, such as why it was so much lower than the others. Insufficient care was also taken in checking references for the software supplier, whose size and experience indicated it could be over-stretched in managing such a large and critical project.
- Doubts raised by other suppliers were not heeded, such as concerns about timescale, budget and ability of the communication system to handle the potential load.
- The Andersen warning that not using a package would increase budgets and timescales was not at any time shown to the Director of Support Services who would manage the project. *When the packaged solution was rejected, the advice was not acted upon.*
- The senior LAS managers directly involved in the project did not have sufficient IT expertise. The Director of Support Services acted as project manager in addition to other duties, although he had never managed a major software development project.
- The team's morale and motivation was undermined because the Systems Manager had been told by the chief executive that he would be made redundant when a properly qualified replacement was found. A new systems manager was recruited but never worked directly on the project.
- A review by this new systems manager in March 1992 raised serious doubts about progress over six months before the major failures - but this was never submitted to the board. Instead it was used as input to a report by the LAS Chief Executive Officer (CEO) which stated:

"There is no evidence to suggest that the full system software, when commissioned, will not prove reliable".

- Formalised Quality Assurance (QA) procedures did not exist during the development. The software house often circumvented problems recorded in Post Implementation Reviews (PIRs) by responding directly to the user's wishes.
- The PRINCE methodology was not applied in a structured way throughout the duration of the project. There was no evidence that concerns expressed at a project meeting on 17 June about a lack of clarity in applying PRINCE were communicated to senior management.
- A proposal from an external consultancy to perform an independent QA inspection was not taken up because the LAS project team decided the software house should do its own QA to avoid additional cost.
- There was no evidence of ambulance staff being given a sense of joint ownership of the system at any stage.
- Training was inconsistent and not sufficiently comprehensive. Some training was carried out early leading to *skills decay* by the time of implementation.
- The changes introduced with the system were resented by ambulance crews because they created considerable inconvenience, less flexibility and a generally more impersonal system. For instance the algorithm used for deciding which crew to send did not take account of previous practices which had aimed to ensure crews ended shifts as close to their home base as possible.
- It is probable that some early system failures and slow responses resulted from the use of the then unproved combination of Windows 3.0 and Microsoft Visual Basic.
- The final crash on 4 November was caused by a small piece of code which caused the system to eat up all available memory. A programmer had left it in the system 3 weeks before. It would probably not have been detected by conventional testing methods, but could not have occurred if QA procedures were being followed.
- Overall, the enquiry felt the unstable industrial relations environment provided an unsound base on which to build a new system.

The Enquiry said it understood the intense pressures on the project team to achieve a quick and successful implementation. However, it found difficulty in understanding why the final decision to go ahead was taken when there were so many outstanding imperfections in the system. The closest the enquiry came to explaining this was to argue that the management changes over the previous few years had led to a *fear of failure* culture, blinding people to fundamental difficulties which, in retrospect, seemed obvious.

"Many managers and staff saw deadlines set by the top level of management as being rigid, inflexible and, more importantly, not to be challenged - only at the risk of losing one's job or being moved sideways."

"Resistance may be suppressed, but this can mean that any problem is exacerbated and no attempt is made to recover from failures, thereby magnifying consequences."

ESRC policy research paper No.33.

IT Project Case History

2. TAURUS

In 1979 the UK Stock Exchange introduced the computer-based Talisman system to help automate the share settlement processes between stockbroking firms. Its success prompted the formulation of a proposal in 1981 to extend automation to other activities by using a centralised computer record of shareholders and encouraging *paperless* trading between all players in the process. This concept, which became known as TAURUS (Transfer and Automated Registration of Uncertified Stock) was rejected by existing share registrars, who got paid to hold such records for listed companies, and feared they would be put out of a job. As a result, the proposal received little further top management attention for a number of years, although some system design work was done.

The TAURUS idea was revived by the Stock Exchange in 1987, when the recent privatisation of major UK utilities generated a sharp increase in share transactions. This had built up huge processing backlogs at stockbrokers. The financial *Big Bang* in 1986 had also opened up the exchange to electronic trading and many leading stockbrokers had been taken over by banks with highly automated financial systems.

The climate for progressing with TAURUS seemed ripe. But the share registrars raised the same objections as before. In 1989 the Bank of England therefore established the Securities and Investment Steering Committee on TAURUS (SISCOT) to try to find a solution acceptable to everyone in the industry.

The appeal of a centralised system began to fade when it was estimated that it would cost about £60 million. Instead, SISCOT began to favour a solution based on distributed databases across hundreds of sites, employing many different hardware and software systems, linked *via* a communication network in which the Stock Exchange would act as the hub.

The UK Department of Trade and Industry (DTI) sought to give investors a high level of protection, including strict data encryption to protect information. The DTI was also involved in negotiations about the legal framework in which TAURUS would operate because the effect of re-engineering all share transaction processes had very wide impacts.

TAURUS was officially launched in 1990 with an estimated budget of about £50 million. It was decided to base the development on a market-leading package from Vista Concepts of New York. The UK government-approved SSAD million approach was to be used to define the steps to be followed in the development.

The date for TAURUS paperless trading to go live gradually slipped and the predicted cost rose to £75 million. In the autumn of 1992 Andersen Consulting, who had been chosen to run TAURUS when it went live, reviewed progress and revealed that the design of the system's underlying architecture had not been completed.

Industry-wide testing of some elements began early in 1993, although the design had still not been completed. However, a new full review of the project in January 1993 decided the underlying problems were so serious that the project would take a another three years

to finish, and costs could double. On 12 March 1993 the Stock Exchange announced that work on TAURUS was to be abandoned. By then it had cost a total of about £400 million; around £14 million of this was for modification to the software, which was almost three times more than initial estimates.

Causes cited at the Forum of the TAURUS collapse included the following:

- There had been no meaningful resolution of conflicting views among the many parties involved, who had very diverse interests. SISCOT tried to reach consensus among the main stakeholders, who included market-makers, share registrars, banks and investors. However, as one of the members of the review group commented:

"The system was not designed to meet multiple objectives. It was simply trying to avoid clashing interests".

- The many concessions that resulted from such clashes led to frequent changes to requirements. By the time the system was abandoned, a full design had never been completed and the core part of the system had not been built.
- The carefully structured rules of Structured Systems Analysis and Design Methodology (SSADM) were not followed. This was made worse by the varying stakeholder interests. Stakeholders felt they had a right to demand changes regardless of the project schedule.
- A variety of groups had responsibility for overseeing the project. These included the Stock Exchange Settlement Board, a committee of the Stock Exchange's main board, a monitoring group involving people with extensive experience of technology projects in the securities industry, and a number of management consultancies.
- The untried database technology was still unknown territory and the Stock Exchange had no experience of such a complex approach.
- External factors also impaired progress. For example, DTI's insistence on sophisticated encryption techniques created much extra cost and more complexity to produce a level of information protection most experts felt to be totally unnecessary.

"The sheer energy involved in the tortuous decision process - the committees and subcommittees, the arguments, the back and forth debates - was highly instrumental in making top management want to carry on once they thought they had a solution. The time and costs invested in this process added weight to the momentum. In this context, the emergence of a solution is especially significant. Participants adopted a posture of *where there is a way there is a will*. Any requests to think again then usually get swept aside."

"A recent Ministry of Defence (MoD) study could not find any feasibility study whatsoever in the last thirty years which had come up with the politically unacceptable conclusion that the project would not be feasible."

ESRC policy research paper No.33