

**Critical Complementarism
and
Information Systems**

**A Total Systems Approach to Computer-based Information Systems
Strategy and Development**

A thesis submitted for the degree of Doctor of Philosophy

by

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To Pam

and to

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Abstract

This thesis is about intervening in organisations to improve both operational and strategic computer-based information systems. It addresses a particular situation, in which human activity is seen to be a key factor in the success of the system. A stance is taken regarding current approaches to such development, supported by historical analysis of both the theory and practice of such approaches: in particular, the failure of traditional information systems development methodologies to address these situations is seen to question their validity.

A review of existing theory and practice shows that computer-based information systems development appears to be dominated by functionalist, reductionist, engineering methods, marginally challenged by soft, interpretivist approaches. Analysis of the computer-based information systems development domain shows this to be an impoverished view, and indicates that an approach based on social systems is likely to be more representative of the problem situations faced. As a result, computer-based information systems development is taken beyond the 'hard-soft' debate, into a search for theoretical underpinning and practical approaches informed from social theory. However, whilst the theory is readily available, the application of that theory to computer-based information systems development is seen to be problematic.

Potential improvement is achieved by the development of an interventionist framework which is based on a branch of social systems theory, that of critical social theory, and which draws heavily on work already undertaken in the domain of management science under the headings of critical systems thinking and total systems intervention. This framework is applied to two case studies and a major, longitudinal action research based investigation.

The findings strongly support computer-based information systems development based on social, and especially critical social, theories. These findings are critiqued within the study, and from this emerge clear conclusions, and recommendations for future development.

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List of Publications

The following papers, based on the investigations conducted in support of this thesis, have been or are soon to be published.

- Clarke, S. A. (1995). "User Involvement and Information System Success." *University of Luton, Faculty of Business Monograph Series 1*.
- Clarke, S. A. and Lehaney, B. (1995). "The Problems of Change to a Semester-Based Modular Teaching Scheme." *Innovation and Learning in Education 1(2)*: 39-45.
- Clarke, S. A. and Merchant, K. (1995). A Framework for the Design and Implementation of Distributed Information Systems. *Critical Issues in Systems Theory and Practice*, (Conference Proceedings). K. Ellis, A. Gregory, B. R. Mears-Young and G. Ragsdell (Eds). Plenum, New York: 329-334.
- Clarke, S. A. (1995). *Information Systems Intervention: A Total Systems View*. Adding Value in a Changing World. The Conference of the Operational Research Society, Canterbury, England. (Available from the Author).
- Clarke, S.A. and Lehaney, B. (1996). *A Complementarist View of Information Systems Development*. Sustainable Peace in the World System, and the Next Evolution of Human Consciousness (Conference Proceedings). Jennifer M. Wilby (Ed.). Budapest, Hungary, Omni Press, Madison, USA: 353-365.
- Lehaney, B., Martin, S. and Clarke, S.A. (1996). *Problem Situation Resolution, and the Technical, Practical, and Emancipatory Aspects of Problem Structuring Methods*. Sustainable Peace in the World System, and the Next Evolution of Human Consciousness (Conference Proceedings). Jennifer M. Wilby (Ed.). Budapest, Hungary, Omni Press, Madison, USA: 179-186.
- Clarke, S.A. and Lehaney, B. (1997). "Total Systems Intervention and Human Inquiry: The Search for a Common Ground." *Systemic Practice and Action Research (In Press)*.
- Clarke, S. A. and Lehaney, B. (1997). "Information Systems Strategic Planning: A Model for Implementation in Changing Organisations." *Systems Research and Behavioral Science 14 (2)*: 129-136.
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Glossary

<i>a priori</i>	The concept that no inquiry can be completely objective, or value free, but must be affected by pre-existing conditions. See 'false consciousness'.
Accommodation	Compromise. The adaptation by one party to the different purpose or views of another (see also consensus and tolerance).
Action research	Generic term for all forms of inquiry in which the researcher and 'research subjects' are actively involved in the research.
Closed system	A system which is not open to influence from external sources, and may therefore be regarded as deterministic.
Coercion	Controlling by force.
Complementarism	In management science: <ol style="list-style-type: none"> 1. The use of methods from alternative paradigms in a way that allows them to complement rather than conflict with each other. 2. At a theoretical level, complementarism is supported by Habermas' Theory of Knowledge Constitutive Interests.
Complementarist framework	The framework of designing, debating and disimprisoning from total systems intervention.
Consensus	Agreement toward a given purpose (see also accommodation and tolerance).
Critical social theory	The stream of social theory emanating from Kant, and particularly evident in the work of the Frankfurt School during the twentieth century.
Critical systems thinking	A body of thought in management science explicitly based on the tenets of critical social theory, and committed to complementarism, critique, and emancipation.
Critique or Critical	The exposure by critical reflection of <i>a priori</i> conditions, with the aim of overcoming false consciousness, and enabling humankind to attain its full potential.
Deterministic	The idea that, for a given problem or system, if the inputs are known, the outputs can be determined with absolute accuracy. See 'closed system'.

Dialectic	Investigating the truth of opinions by discussion.
Diversity management	The concept that both problem contexts, and the methodologies used to address them, exhibit diversity, and intervention is the process of managing that diversity.
Emancipation	Free from constraints imposed by power or coercion. Necessary in intervention so that the true needs to be addressed by debate and design are allowed to surface.
Epistemology	Theory of the method or grounds of knowledge.
False consciousness	The concept that all human action is subject to <i>a priori</i> conditions, and that failure to surface these by critique leads to a false belief in objectivity which cannot be sustained.
Functionalism	Adherence to a rational, scientific method, whereby the target is a tangible object; humankind stands in a predict and control relationship with the environment; problems are susceptible to rational solutions.
Hard or Structured	The approach informed by functionalism, generally following a problem solving method.
Hermeneutics	Of interpretation. In management studies, the interpretivist theme.
Human inquiry	Forms of inquiry or intervention where the views and perceptions of participants are central to the method of study. Often contrasted with functionalism.
Ideographic	Based on human perception or ideas, rather than identifiable objects.
Imperialist	In the adherence to theory or the use of methodology, the belief in one theory or method as pre-eminent, annexing or subsuming all others.
Incommensurability	The belief that alternative theories, or methodologies from alternative paradigms, cannot be made to work together because of their incompatible assumptions.
Inductive	Generalisation from observation or experience.

Interpretivism	Belief that phenomena should be studied by eliciting the views and opinions of those participating in the phenomena, rather than by observing tangible objects.
Intervention	In this thesis, intervention is not to be construed in the literal meaning of “interference by an individual or group to modify a result”. Intervention is seen more generally as the involvement of participants in a system to improve that system for their own benefit.
Isolationist	In intervention, the adherence to only one theory or methodology regardless of the problem situation encountered.
Knowledge constitutive interests	The three interests which Habermas sees as fundamental to the human species: technical, practical, and emancipatory.
Mess	Ackoff’s term for the set of interacting issues which characterises a problem situation. The antithesis to the view that all problems are subject to a solution.
Nominalist	The belief that reality is a product of individual consciousness.
Nomothetic	Characterised by a search for universal laws that govern the reality that is being observed.
Objective	Phenomena exist independently of human observation. There is an objective reality.
Ontology	The nature of reality: realism - that reality is external to the individual and is of an objective nature; and nominalism - that reality is a product of individual consciousness.
Open system	A system that is affected by factors external to it.
Paradigm	The framework within which a set of rules or beliefs are seen to hold true. Hence the heliocentric view of the solar system.
Pluralist	In human viewpoints, the position where there exist multiple perceptions of any given phenomena, which may or may not be subject to consensus.

Postivist	Philosophical position which recognises only positive facts and observable phenomena.
Power	Power to: The ability to undertake a course of action, unconstrained by the influence of outside agencies. Power over: Having the authority to determine the action of others, as in coercion.
Practical interest	The second of Habermas' three knowledge constitutive interests, which focuses on human interaction or communication.
Realist	The view that reality is external to the individual and is of an objective nature.
Systematic	In management studies, addressing problem situations by reducing them to components, and aiming to improve the whole by improving the components. Hence reductionism.
Systemic	The view that systems must be viewed as a whole (holistic), and that improving a systems components may not improve the system.
Technical interest	The first of Habermas' knowledge constitutive interests, which focuses on technical control.
Tolerance	To endure or permit a course of action (see accommodation and consensus).
Total systems intervention	An interventionist framework which aims to action, through a process of critique in organisational interventions, the critical social theory of Habermas and the tenets of critical systems thinking.

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Chapter 1

Introduction

1.1 Overview

The subject of this thesis is computer-based information systems in which human activity is a substantial component. Focus is on the different perspectives taken of the information systems domain, with an analysis of current practice being used to inform improvement in the future.

The domain of computer-based information systems may be perceived in a number of ways. A frequent characterisation is in the form of the hard - soft debate, in which the functionalist and interpretivist schools are contrasted. The functionalist school sees information systems in terms of technology, and favours a reductionist, systematic approach underpinned by the methods of the natural sciences. The interpretivist school takes a holistic or systemic view, focusing on systems of human activity.

Related to this is the pragmatic-theoretical argument. Pragmatic approaches use techniques or methodologies developed from practice, with limited exploration of theoretical underpinnings; an approach which proponents of theory claim to be insufficient.

This investigation takes as its theme the view that these current approaches fail to adequately address information systems development: a practical and theoretical framework is required which allows both to contribute. Since systems ideas are seen to form a key element in the development of the domain, the systems theme is pursued within this thesis.

In this chapter, an outline of the technological and human centred approaches to computer-based information systems development is given, and evidence is put forward which demonstrates their failure, and possible reasons for this failure. The objectives of the research are then given, together with research questions and hypotheses to be addressed. Finally, the structure of the thesis is described.

1.2 The Application and Failure of Technology-Based Approaches

Pick up any standard text on computer-based information systems development (CbISD) and certain factors, which indicate the approach traditionally taken, will be seen to consistently appear. The first is a strong adherence to pragmatism, with little or no explicit recognition of underlying theory. Indeed, in one key information systems text (Reynolds, 1995), the section on systems development effectively discusses methodology and technique, defining methodology as a controlled, project oriented activity (p.288).

Most often the word theory does not even appear in the *index* to information systems texts (Page and Hooper, 1992; Laudon and Laudon, 1996). One of the foremost texts on systems analysis and design (Wetherbe and Vitalari, 1994) has a section on theory versus technique, in which a case is made for the need for technique to be underpinned by theory, but this is not developed further in the rest of the text.

The second issue is one which leads on from this adherence to pragmatism, and that is the treatment generally of computer-based information systems development (CbISD) as a technical, problem solving domain. That the development of computerised information systems is frequently restricted to theories applicable to the development of computer technology is evidenced in the work of Paul (1993). The lack of theory and strong adherence to methodology leads to the development of information systems being perceived as a problem to be solved. The methodology is seen as the series of steps by which the solution can be reached, and techniques are developed as the means of achieving those steps. The result is that CbISD texts almost universally recommend the use of project management techniques in order to build an information system (see Laudon and Laudon, 1996 p.411; Reynolds, 1995 Chapter 9). McFarlan (1989) reveals (even if only implicitly) a commitment to scientific reductionism in the observation that project managers must face up to whether any given project “can or should be divided into a series of much smaller problems.” (p.25).

This adherence to pragmatic problem solving leads to tensions when the system or systems to be developed require significant user input. Just as most systems development texts stress the project management, methodological, pragmatic approach to CbISD, so they also emphasise the need for discovering the requirements of users, basing this view on the observation that systems frequently fail to meet user needs (Page and Hooper, 1992 p.503; Reynolds, 1995 p.454).

Most commonly, the incorporation of user requirements into computer-based information systems development (CbISD) is achieved by including a user analysis stage within the existing problem solving approach (Wetherbe and Vitalari, 1994 p.211; Kendall and Kendall, 1992 p.7). Advice on how to undertake this user analysis is often addressed only weakly; so although Yeates *et al* (1994), for example, devote a chapter to this, it is conducted with the computer system as a target, so it appears as a rather functionalist, problem-means-solution view of systems development; goal oriented, and with little explicit theoretical underpinning to the points made.

The position reached by the early 1990s is reflected in Boehm's work. Boehm (1989 p.28) traces the evolution of computer system development methods through a number of process models, from the earliest code and fix model to the waterfall model, which he identifies as the basis for the majority of software developments. A number of methodologies have been developed which adhere to the principles of these process models, their purpose being to provide a staged approach to software development (Boehm, 1989 p.26). Boehm's argument is essentially that the waterfall model is not a universal panacea, being ill-suited, for example, to the development of end-user systems. But equally, Boehm contends, alternative methods provide only a partial solution. So, for example, the evolutionary model, whilst dealing better with issues of flexibility and changing requirements, does so at the expense of a lack of structure and control in the development process.

Boehm's solution to these problems, the spiral model, indicates the stage of advancement to which software process models had progressed by the end of the 1980's. Computer systems development is perceived largely as a functionalist, problem solving, engineering task, and approaches such as the spiral model are geared to engineering the best solution to meet a given requirement specification within the known or anticipated constraints.

The argument for an alternative to these technology-based approaches is supported by the findings from a number of studies of systems failure. Boehm (1989 p.2) cites examples of such failures, and considers that, directly or indirectly, they contribute to as much as 50% of total systems cost. McFarlan (1989) similarly relates computer systems disasters in Fortune 500 companies, whilst the Organisational Aspects of IT Special Interest Group (OASIG) of the Operational Research Society (OASIG, 1996) concludes that up to 90% of information technology (IT) investments do not meet their performance goals. The report sees the technology-led nature of the process, and the lack of attention to human and organisational factors as a key factor in this lack of success.

In all of these instances, the systems development life cycle emerges, implicitly or explicitly, as the prime control element, resulting in a methodology which adheres to the functional engineering model, taking a structured, problem-solving approach: human complexity in the system is seen as something which can be analysed, and toward which a specification can be written. This is further confirmed by various methodological attempts to make user analysis more central to the process (Wasserman *et al*, 1986; Mantei and Teorey, 1988). Beath and Orlikowski (1994), focusing on a three-volume text by Martin (1989), mount a convincing critique of the interaction between users and systems professionals in computer-based information systems development (CbISD). Beath and Orlikowski's view is that the concentration on, and commitment to, user participation is revealed as ideological rather than actual, with users frequently shown to be passive rather than active participants in the process. They see the various systems development methodologies as containing "incompatible assumptions about the role of users and IS personnel during systems development." (Beath and Orlikowski, 1994).

Whilst the foregoing gives some indication of the approach taken to information systems development, it has been argued that such analysis is essentially normative, and is not an indication of how systems are developed in practice. Bansler and Bodker (1993), for example, offer an alternative view through a critique of structured analysis.

Bansler and Bodker (1993) argue that structured analysis differs from the received view of 'structured methods' based on the systems development life cycle model, in that, in addition to modelling both the current and intended system, it distinguishes between physical and logical models. Taking this one step further, Palmer and McMenamin (1984) refer to the "essential model", which they see to be independent of technology, describing simply *what* is done. However, from a study of nine data processing departments, Bansler and Bodker (1993) conclude that organisations often only use parts of structured analysis as required (e.g. tools, data dictionaries), and do not comply with its detailed rules and procedures, with designers typically producing only a physical model of the new system.

Their conclusion is that, by picking the elements of structured analysis as they see fit, and design them into their approach, designers are following what Naur (1972) describes as a theory building activity, whereby the 'theory' of any program contains the unexpressed knowledge of the programmer: "...the programmer's skill and intuition is the pivot upon which the program development activity turns." The contention is that this insight encompasses both technical and human aspects.

These views have subsequently formed the basis of a significant research effort, concentrated on the practice of computer systems development as a basis for theoretical development. So, for example, Jeffrey (1996) refers to the problem of distilling the essence of software, where the process of development consist of one group building a system for another group, where communication between them is seen to be problematic. Outside-in development is promoted as a potential way forward. Similarly Wastell (1996), analysing a case study in which SSADM was used, refers to the methodology inhibiting creative thinking, and insulating designers from the real issues, one of which is identified as the human dimension.

Structured analysis is seen by Bansler and Bodker, from a practical perspective, as viewing an organisation as an information processing system, in which people are ‘objects’: it takes a fundamentally functionalist approach, in which human beings are seen as mechanistic, following a view based on instrumental rationality, in which computer systems development is perceived as a problem solving activity undertaken by a rational designer using reductionist methods. They explicitly see the problem of communication with users as a key issue in structured analysis.

Through a thorough review of the information systems development literature, Lyytinen and Hirschheim (1987) make a compelling case for the argument that few computer-based information systems can be considered a success. The reason for claiming success is, they argue, largely based on an erroneous classification of how such success should be measured, which usually focuses on the extent to which the completed system meets the requirement specification laid out in advance. The main measures are negative ones, principally the so-called correspondence failure, whereby the objectives are stated in advance, and failure is defined in terms of these objectives failing to be met. Lyytinen and Hirschheim promote the notion of expectation failure, or the failure of the system to meet the expectations of the key stakeholder groups, as conveying a more pluralistically informed view, and forcing a dynamic perspective of computer-based information systems development.

If technology based approaches cannot adequately address the problems of development for human-centred systems, what alternatives are available for this purpose? Section 1.3 seeks to offer some possibilities in this regard.

1.3 People: The Human-Centred Methods

The human-centred approach to computer-based information systems development (CbISD) has given rise to the so-called ‘soft’ methods. It is argued that traditional ‘engineering’ approaches are ‘hard’ or functionalist, being based on a view of the world which sees it as composed of determinable, rule-based systems, in contrast to which the soft methods take an interpretivist, ideographic stance.

An early attempt at incorporating human issues into what was seen as a technical domain was the ETHICS methodology of Mumford. ETHICS (Mumford, 1985) was developed in the 1970s to combine organisational, administrative and quality-of-working-life factors. It is a socio-technical methodology (Effective Technical and Human Implementation of Computer-based Systems), and can be characterised as philosophically functionalist, following essentially a problem-solving approach. At the same time, Checkland (1981) and Wilson (1984) were developing soft systems methodology (SSM) as a direct response to 'hard' systems approaches which they saw as paying insufficient attention to the human activity aspects of the system. SSM incorporates human factors into the development process by taking a more holistic, systemic view:

"Focusing on one aspect or even several aspects of a situation is unsystemic, and at best systematic. The systematic nature of IT clashes with the systemic nature of IS ... coping with this tension between systematic and systemic natures is a challenge which has to be taken up by the IS profession" (Angell, 1990).

Stowell and West (1994) take up this debate, and begin by differentiating the idea of information system from that of computer system, two terms which in their view are too often viewed as synonymous. The information system is seen as a more systemic whole in which the computer system may play a part. Stowell and West promote the client led design (CLD) methodology, arguing that since the information system results from social interaction, participants in that interaction ought to be central to systems analysis and design. In their view, information systems development needs to be *driven* by interpretivism, and not, at the technical development stage, "engulfed by functionalism." (Stowell, 1991). Consequently Stowell and West are critical of methods whereby soft, interpretative approaches such as soft systems methodology (SSM) are used to front-end a technological development, arguing that once the soft analysis is passed to the technical specialists the benefits of that soft analysis are largely lost.

Avison and Wood-Harper (1991) take a similar stance in their multiview methodology. Multiview is based on the assertion that at any stage of information systems development the approach is contingent on the circumstances met at that stage. It differs from traditional systems development life cycle (SDLC) based methodologies in that it is not seen as step by step problem solving, but as an iterative process in which different approaches may be used at different times. Multiview accepts the view that no one methodology can be seen to work in all cases, and that the methodology to be chosen cannot be decided in advance of the problem situation being known, and there is explicit recognition within multiview of the need for participation. The Burrell and Morgan grid (Burrell and Morgan, 1979 p.22) is used to categorise the views which may be taken, although the movement between paradigms seems rather too readily assumed, giving rise to Jackson's (1992) critique of multiview as not resting on complementarity at the level of theory. Certainly Watson and Wood-Harper (1995) seem happier to promote multiview from a practical rather than theoretical base.

Unfortunately, as will be seen in the following section, neither technology based nor human-centred methods offer an adequate solution to the development of computer based human activity systems.

1.4 Difficulties with Technology and Human Centred Approaches

Much debate has taken place in the last fifteen years or so regarding the relative merits of hard and soft approaches to computer-based information systems development (CbISD) (Checkland, 1978; Jackson, 1982; Checkland, 1989; Checkland, 1994). This debate may be seen as having given rise to two schools of thought which only rarely combine, although attempts at unification from various perspectives have occurred (Checkland, 1971; Petheram, 1991).

This debate may be criticised, however, for giving rise to essentially *methodological* arguments: hard protagonists favouring the 'systems development life cycle' approaches under their various guises; soft thinkers promoting their own range of methods. By

focusing on methodology, both the hard and soft schools exhibit shortcomings resulting from the lack of investigation of underpinning theory. Flood and Ulrich (1990), for example, categorise hard and soft methods respectively as "non-reflective positivistic {and} non-reflective interpretivistic". Flood argues that the hard school is predominantly pragmatic, dominated by technique with limited reference to underlying theory at any level; functionalist methods prevail, giving rise to frequent challenges when applied within social contexts. The soft school attempts to deal with these social issues, but mostly operates at a methodological level, with little reference to underlying theory.

This lack of reference to underpinning theory is addressed within this thesis. The hard methodologies lack the most in this respect, being underpinned at worst predominantly by pragmatism and at best by adherence to a single methodology. However, the lack of *explicit* theoretical support does not mean that no *implicit* support exists, but simply that hard thinkers are hostage to the theories of others. The essence of this thesis is that such a base, though *explicitly* little recognised, does currently exist for CbISD: it is founded *implicitly* on scientific reductionism - a situation which is unaffected by the lack of recognition of it by practitioners. As Checkland has observed, "... all practical action is theory laden ...independent of whether the doer is conscious of the deduced framework." (Checkland, 1985).

Soft methods are promoted as a means of gaining better insight within social contexts, but their inadequate reference to the theories which support them give rise to a number of problems in application (Mingers, 1984; Petheram, 1991; Probert, 1994; Romm, 1994). Jackson (1990), for example, refers to claims that soft systems thinking can support radical change as theoretically untenable, such approaches being inherently regulative, and unable to deal with power and conflict.

Since computer-based information systems development is concerned with the development of human activity *systems*, and since neither technology based nor human-centred approaches are seen to be adequate, support from systems theory will now be sought in an attempt to throw more light on the problems encountered.

1.5 Systems

The general systems movement can be traced to Bertalanffy's work on open systems theory in the 1920s and 1930s (Bertalanffy, 1950), and his general system theory (GST) in the 1940s, the details of which were reproduced in full in 1968 (Bertalanffy, 1968).¹

The system problem is essentially the problem of the limitations of analytical procedures in science. In essence these procedures mean that an entity investigated can be constituted or re-constituted from the parts put together. This depends on two conditions which are not fulfilled in systems that consist of parts in interaction: interaction between the parts is weak enough to be ignored; and relations describing the behaviour of parts must be linear, since only then will the condition of summativity hold true.

General system properties derive from structural similarities (or "isomorphism's") which exist across different fields. Conventional physics deals only with closed systems: the second principle or thermo-dynamics states that in a closed system entropy must increase to a maximum since in a closed feed-back mechanism information may be transformed into noise, but not vice versa. The theory of open systems is an important generalisation that has led to new insights such as the principle of equifinality and the generalisation of the second thermo-dynamic principle to show the increase of order which is possible in open systems as a result of information fed into the system from outside.

In closed systems, therefore, maximum entropy defines equilibrium. Such a definition is not available for open systems, though perhaps "Prigines theorem", though not universally applicable, offers some guidance with organisational systems in stating that equilibrium in open systems is provided by minimum entropy production.

¹ For some time, doubt has been cast on Bertalanffy's claim to be the original author of the ideas underpinning GST. Recent work (Dudley and Pustylnik, 1995) suggests a prior claim by Bogdanov.

Social systems may be classified as complex adaptive systems, being seen by many as the most adaptive of all systems. Buckley (1967) believes social systems to be morphogenic (form generating) rather than morphostatic (having a set form to which they develop). This is mirrored, argues Buckley, by human psychic systems, which are extremely adaptive, and form the link between organismic and social systems.

Bertalanffy therefore saw the systems approach as attempting to tackle problems of organised complexity, which he saw as lying beyond the limitations of analytical procedures in science. The relevance of this to current organisation theory and practice, can be found in Checkland's (1981) work, where systems ideas are seen as complementary to the reductionist thinking of the natural sciences. The success of the natural sciences has been achieved by reducing complex systems to manageable parts, and, by studying the parts, inferring properties of these complex systems - so called scientific reductionism.

Whilst a reductionist, functionalist approach has achieved much success in (for example) physics, where the overriding aim can be visualised as a desire to express the workings of the world in terms of the basic particles, as complexity increases, reductionism has to be tempered with other views. Systems complexity may be seen as resulting either from the increased number of entities and interactions within the system, or from increasing levels of human activity.

Almost thirty years ago, Churchman (1968) was arguing that the application of computer systems to organisational problems did not constitute a 'systems approach'. Churchman's work built on foundations laid by Singer, and has been continued by Ackoff and other adherents to the systems school (see Britton and McCallion, 1994).

To address these issues it is necessary, therefore, to look beyond the practice of computer-based systems development, and return to the roots from which this practice evolved, thereby deriving an approach which successfully combines the human activity and technological elements of a problem situation. Within this thesis, these roots are sought in systems theory and management science, a review of which is therefore undertaken to

form the basis of this study. It is essentially a quest for this theoretical underpinning - for a means of combining approaches adhering to different paradigms - that is the concern of critical systems thinking. A critical systems approach to computer-based information systems development, by recognising the merits of both hard (functionalist) and soft (interpretivist) methods, offers a way forward from the current emphasis on, at worst, solely technological issues, and at best a technological approach which has added to it some recognition of the need to deal with human activity.

An early recognition of the theoretical validity of a critical approach to information systems development was by Hirschheim and Klein (1989), who saw neither the functionalist nor the interpretivist approach as adequate. Functionalism because it is means-ends dominated but makes unwarranted assumptions as to the extent of agreement on ends; interpretivism because it is unable to arbitrate between different interpretative viewpoints.

A case has been made for a critical approach to CbISD, informed from critical social theory and systems theory. However, before progressing to a further consideration of this in Chapter 2, the objectives of the research and structure of the thesis will be briefly outlined in the following sections.

1.6 Objectives of the Research

The basic argument of this thesis is that both functionalist and interpretivist computer-based information systems development (CbISD) give rise to information systems which pay insufficient attention to the human activity inherent in them. The trend in dealing with issues of human activity is seen to point increasingly to social theory and practice, with a movement from functional to interpretative and then to critical approaches.

This thesis therefore looks for improvements in CbISD based on the application of theory and practice from the critical social domain. Initially, theory is explored, and the theory synthesised to provide an approach which is applied to two case studies and an action

research based intervention, the purpose of the case studies being to test and refine the approach prior to its use in the action research.

The research builds on existing critical social theory, to develop, apply and critique an approach to intervening in organisational problem situations.

Research Questions

The key research question asks whether an interventionist framework based on critical social theory can be seen to give rise to improvements in computer based information systems development. Two subsidiary questions are seen as helping to inform the answer to this:

1. To what extent are the principles of critical social theory and the commitments of critical systems thinking, evident within an actual intervention?
2. Taking each of the commitments of critical systems thinking in turn, how could they be achieved without using an explicitly critical framework?

Hypotheses to be Tested

1. It is preferable that computer-based information systems which are rich in human activity are not developed using methods which fail to address critical, complementarist and emancipatory issues.
2. Using an interventionist method explicitly based on critical social theory gives rise to operational and strategic benefits which are not attainable by traditional regulative methods.
3. Negative hypothesis: all the benefits seen to accrue from the use of interventionist methods explicitly based on critical social theory are achievable by regulative means.

1.7 Structure of the Thesis

This chapter provides an introduction to the thesis. Technological and human-centred approaches to computer-based information systems development (CbISD) are outlined, together with the difficulties associated with them. An alternative view, based on a reductionist versus systemic position, is proposed and discussed. Some examples of systems failure are given, together with suggested reasons for the failure, supported by evidence from the literature. Objectives are set, and research questions and hypotheses proposed. Finally, the thesis structure is outlined.

Chapter 2 is a search for a theoretical basis on which to build a framework for the development of computer-based information systems. As a result of the human activity focus of the study, a social systems view of computer-based information systems development (CbISD) is taken, with the application of social systems theory to CbISD. Alternative paradigmatic arguments are investigated, focusing in particular on functionalist, interpretivist and radical humanist perspectives (Hirschheim and Klein, 1989). The critical approach to computer-based information systems development is assessed, drawing on the critical social theory of Habermas, and building on developments already well established in management science under the heading of critical systems thinking (CST) (Flood and Jackson, 1991a; Jackson, 1991a; Jackson, 1993a; Jackson, 1994). The practical meta-methodology of total systems intervention (TSI), itself based on CST, is discussed as a basis for the interventionist approach. The chapter concludes by outlining an interventionist framework for CbISD.

In Chapter 3, the research topic and methods are described, and, with the human activity focus, participatory methods are investigated in depth for their potential contribution to the research approach. The research methods to be used to evaluate and critique the study are described.

Chapter 4 applies the interventionist framework from Chapter 2, to two computer-based information systems case studies. The theoretical and practical approach to case analysis is discussed, and the cases assessed by comparing the original findings to the outcome of interpreting them through the interventionist framework. Conclusions are drawn individually from each case, following which an overall critical appraisal is undertaken, leading to the revision of the interventionist framework for use in action research.

Chapter 5 describes a major action research intervention at the University of Luton. The theoretical approach and the interventionist framework to be used are detailed. A brief background to the University student record systems, which are to be the focus of the study, is given, together with an outline of the current system. A schematic breakdown of the intervention is provided, and the intervention is then thoroughly described and critiqued. Finally, the research questions and hypotheses are tested.

Chapter 6 takes the work of Chapters 1 to 5 and subjects it to critical appraisal. Critiques are raised from theoretical, practical, and external perspectives, and these critiques are then responded to by reference to the action research undertaken. Triangulation and content analysis are used to assess the validity of the research.

The thesis is summarised in Chapter 7, conclusions are drawn, and suggestions for future research and application of the findings are put forward.

1.8 Conclusions

Computer-based information systems development is a domain in which functionalist methods prevail, challenged weakly by human-centred, interpretivist ones. Scientific reductionism dominates, with systemic holism providing an alternative view. The debate is focused at a pragmatic level, with argument about ‘which methodology when’ rather than a fundamental reconstruction of practice from theory. As a result, claims are made for methodologies which cannot be substantiated by reference to the theoretical underpinning.

In the development of *information systems* both the hard and soft schools of thought see the incorporation of the views of users as an important issue, but see it from different perspectives. The foregoing critique of functionalist approaches has shown them to be unsuited as a vehicle for such approaches. The promise of soft methods is restricted by their lack of reflection, and consequent inability to contribute to problem contexts where the conditions for consensus forming are not in evidence. Critical social views therefore appear as the most promising future direction.

In Chapter 2, a deeper review of the relevant underpinning theory will now be undertaken, with the objective of determining a better way forward for CbISD.

Chapter 2

Computer-Based Information Systems Development as Social Action: Theory and Framework Development

2.1 Introduction

This chapter is a search for the relevant theoretical underpinning to computer-based information systems research and practice, further expanding the views based on social theory which were shown to be relevant in Chapter 1. Information is sought from two sources. In the first place, there is the underpinning social theory itself. Secondly, the holistic intent of computer-based information systems development is pursued through a review of systems theory.

A study is undertaken of social theory, reviewing the paradigmatic arguments, and assessing potential future directions. To establish the theoretical underpinning, the relevant philosophical, ontological, epistemological and methodological issues are outlined, and placed in context with the development of the natural sciences and systems science. Systems theory is expanded and related to business organisations, which are the focus of this study. A comparison is made of the problem solving or ‘structured’ methodologies and the alternative ‘soft’ approaches in areas of computer application where there is significant human activity. Similar difficulties encountered in management science are reviewed, providing a basis for development of the relevant theoretical underpinning to computer-based information systems development.

Critical social theory has been suggested as a way forward for computer-based information systems development, but one which, while theoretically sound, lacks practicality. This chapter aims to determine a practical approach to computer-based information systems development by exploring work already undertaken in the domain of management science, where the relevant ideas have been a subject of debate since the 1960s.

This exploration begins with an outline of the branch of critical social theory to be applied, and pursues this line of reasoning through critical systems thinking to total systems intervention, relating these to the paradigm problems encountered. These views are then synthesised to produce an interventionist approach to computer-based information systems development which is true to the principles of critical social theory.

2.2 Social Theory: The Paradigm Problem

This section reviews the work of Burrell and Morgan (1979), which is used to provide a theoretical framework for the development of computer-based information systems within this thesis.

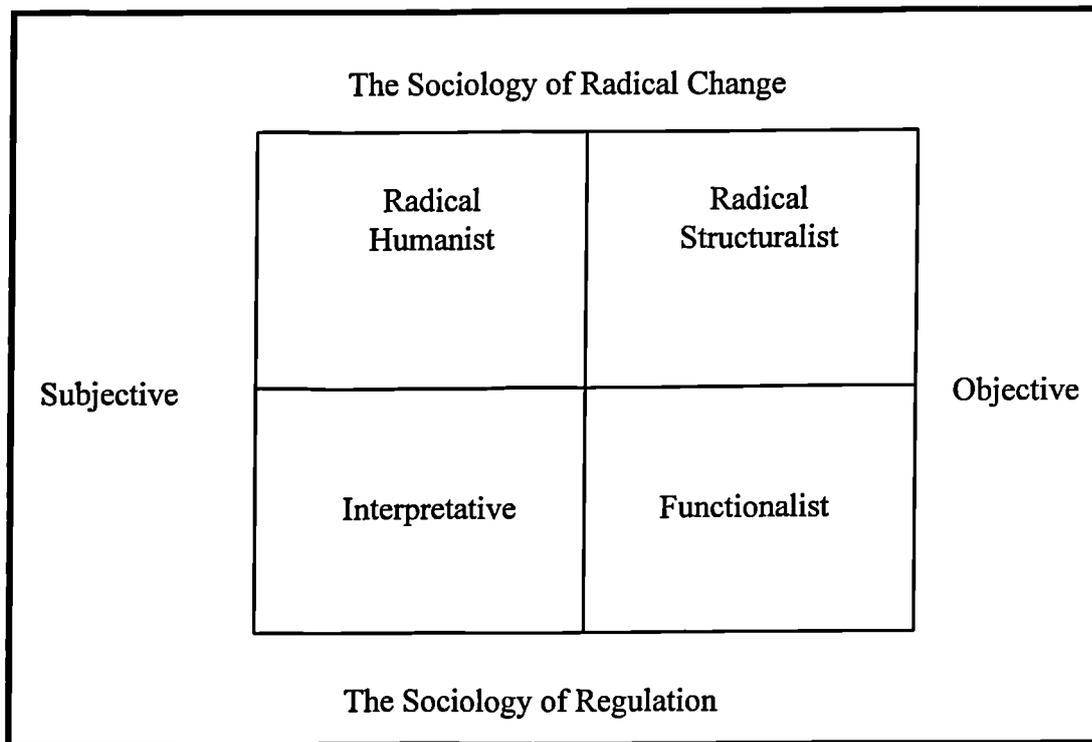


Figure 2.1 *Four Paradigms for the Analysis of Social Theory*
 (Burrell and Morgan, 1979 p.22)

Burrell and Morgan positioned all social theories into one of four paradigms: functionalist, interpretivist, radical humanist and radical structuralist (Figure 2.1), according to the extent to which they were subjective versus objective or regulative versus radical.

The subjectivist approach to social science		The objectivist approach to social science	
Nominalism	← ontology	→	Realism
Anti-Positivism	← epistemology	→	Positivism
Voluntarism	← human nature	→	Determinism
Ideographic	← methodology	→	Nomothetic

Table 2.1 *The Subjective - Objective Dimension*
 (Burrell and Morgan, 1979 p.3).

The subjective-objective dimension can be seen in terms of four elements: an ontology, an epistemology, a view of the nature of human beings, and methodology.

The ontological debate concerns the nature of reality, the two opposing extremes of thought being realism: that reality is external to the individual and is of an objective nature; and nominalism: that reality is a product of individual consciousness.

Epistemology is concerned with the grounds of knowledge, or how the world might be understood, and this understanding communicated as knowledge. The two opposing extremes are positivism: knowledge is hard, real and capable of being transmitted in a tangible form; and anti-positivism: knowledge is soft, more subjective, based on experience and insight, and essentially of a personal nature. Human beings may be viewed on a scale from deterministic: determined by situations in the external world and conditioned by external circumstances; to voluntaristic: they have free will, and create their environment.

The view taken of ontology, epistemology and the nature of human beings directly influences the methodological approach which is adopted. A realist ontology, positivist epistemology and view of human beings as largely deterministic, leaves nomothetic methodologies as the appropriate choice. Such methodologies are characterised by a search for universal laws that govern the reality that is being observed, leading to a

systematic approach. A nominalist ontology, anti-positivist epistemology and view of human beings as largely voluntaristic, indicates ideographic methodologies as appropriate: the principle concern would be to understand the way an individual interprets the world, with a questioning of external ‘reality’.

The regulation-radical change dimension (Table 2.2) was the result of Burrell and Morgan recasting the then prevalent order-conflict debate. The sociology of regulation emphasises a view of society based on preservation of the status quo, whilst the sociology of radical change is “concerned with man’s emancipation from the structures which limit and stunt his potential for development.” (Burrell and Morgan, 1979 p.17).

The sociology of regulation is concerned with:	The sociology of radical change is concerned with:
The status quo	Radical change
Social order	Structural conflict
Consensus	Modes of domination
Social integration and cohesion	Contradiction
Solidarity	Emancipation
Need satisfaction	Deprivation
Actuality	Potentiality

Table 2.2 *The Regulation - Radical Change Dimension*
(Burrell and Morgan, 1979 p.18).

The functionalist paradigm is, in Burrell and Morgan’s terms, regulative in nature, highly pragmatic, often problem orientated, and applying natural scientific methods to the study of human affairs (Burrell and Morgan, 1979 p.26).

The early application of functionalism to business organisations is to be found in functionalist organisation theory, which can be traced from the work of F.W. Taylor (1856-1915). This laid the foundation for the ‘classical school’, contributors to which have been, for example, Fayol and Gulick. In Fayol’s work, organisations are characterised in terms of a reality which can be investigated systematically, taking a highly mechanistic view of human beings, informed by an objectivist ontology and epistemology.

Asimov (1960) takes this view to its extreme in his foundation trilogy, where Hari Seldon predicts a one thousand year future for the Galactic Empire and sets about controlling its development for the benefit of mankind. In one episode we find a fourteen-year-old writing a class paper on the inevitability of the Seldon Plan four hundred years after his death. The trilogy is a classic piece of science fiction writing and, enjoyable as it is, reveals the problematic nature of the functionalist paradigm when applied to social phenomena.

Functionalist organisation theory can be identified anywhere from the most objective to the most subjective margin of the paradigm, and, from a social theoretical perspective, the objective-subjective dimension does not automatically imply a paradigm shift. The relevance of this to CbISD is that the incorporation of, for example, user requirements analysis into structured methods could be seen as simply moving the method toward the interpretative end of the functionalist paradigm. Consequently, the functionalist approach to computer-based information systems development (CbISD) does not preclude the incorporation of user or participant views, but it does determine that they are taken from a *functionalist* position. The existing structure becomes the main focus of attention: the 'real world' which exists independently of human perception. Consequently, as social theory suggests, such an approach serves to support the existing power base.

As with the functionalist paradigm, the interpretative paradigm is also regulative, seeing social reality as "...little more than a network of assumptions and intersubjectively shared meanings." (Burrell and Morgan, 1979 p.29-31). Burrell and Morgan argue that the ontological assumptions of interpretative sociologists lead them to seek an understanding of the existing social world from an ordered viewpoint, and do not allow them to deal with issues of conflict or coercion. Interpretivism suffers criticism from all sides.

Functionalists see it as finding out about problem situations without any means of solving problems or, in effect, producing any 'hard' output. Radical thinkers criticise interpretivism for its support of the status quo - the existing power base: interpretivism is fine for achieving consensus, provided the conditions required for consensus-seeking pre-exist; it has no means of overthrowing existing power structures or of resisting coercion.

The radical humanist paradigm has much in common with the interpretative paradigm, being nominalist, anti-positivist, voluntaristic and ideographic, but unlike interpretivism “emphasises the importance of overthrowing or transcending the limitations of existing social arrangements.” (Burrell and Morgan, 1979 p.32). Radical humanism aims to help humans achieve their true potential. The emphasis is on radical change and the attainment of potentiality through human emancipation, or release from ‘false consciousness’:

“ .. the consciousness of man is dominated by the ideological superstructures with which he interacts, and these drive a cognitive wedge between himself and his true consciousness. This .. ‘false consciousness’ inhibits or prevents true human fulfilment.” (Burrell and Morgan, 1979 p.32).

The radical humanist paradigm was highlighted in Chapter 1, in the form of critical theory, as a worthwhile *theoretical* direction promoted by Hirschheim and Klein (1989).

Hirschheim and Klein view functionalism as the “orthodox approach to systems development”. The paradigm is characterised as means and ends dominated but with little discussion about the ends, since these are taken as given: “there is one reality that is measurable and essentially the same for everyone ... the role of the developer is to design systems that model this reality.” But the ends can seldom be assumed to be agreed, and in modelling reality the question of whose reality becomes paramount.

Hirschheim and Klein argue that interpretivism offers an alternative to functionalism in so far as it does not accept there to be an objective reality but only socially constructed reality, but that its relativist stance makes it “ ... *completely uncritical* of the potential dysfunctional side effects of using particular tools and techniques for information systems development.” Different systems development outcomes are simply viewed as the result of different socially constructed realities. The radical humanist paradigm offers a way forward. Through critical social theory there is the possibility of moving beyond a debate located firmly in the sociology of regulation to a critically reflective, radical position.

Later it will be shown that the work of Habermas (1971a) provides the primary theoretical support which management science has taken to underpin interventionist approaches based on radical humanism. Habermas sees all human endeavour as undertaken in fulfilment of three knowledge constitutive or cognitive interests: technical, practical (in satisfaction of human interaction or communication) and emancipatory. It is these interests which can also be seen in Hirschheim and Klein's work (Hirschheim and Klein, 1989; Klein and Hirschheim, 1993). Jackson (1993b) follows the cognitive categories of Habermas, and argues that in Western industrialised society the technical interest has been accorded too much primacy. Jackson goes further in asserting, again after Habermas, that, in fact, practical questions are re-defined as technical ones, effectively blocking the separation of what we ought to do from questions of how we ought to be doing it.

This technical versus practical argument is addressed by Hirschheim *et al* (1991), who refer to the history of information systems development as progressing from a technical process, to a technical process with behavioural consequences, and finally a social process. They see the common thread as the basis in social action theory.

The radical structuralist paradigm shows similarities with functionalist theory, but advocates radical change through structural conflict (Burrell and Morgan, 1979 p.34). Whilst a tenable view for organisational theorists, its value to this study is limited, since the aim is not revolution but gradual change.

These paradigmatic considerations carry implications for CbISD, which will now be investigated in more depth in the following section.

2.3 Social Systems Theory: Its Application to Computer-based Information Systems Development

In the study of social systems, where the key to the functioning of the system is human activity, the functionalist view is therefore questioned. Experimentation is of limited value in such systems: the utility of problem solving, functionalist techniques, is diminished when dealing with ill-defined, highly complex human activity systems. As a result, 'softer' methods of approaching the issues are seen to be of value.

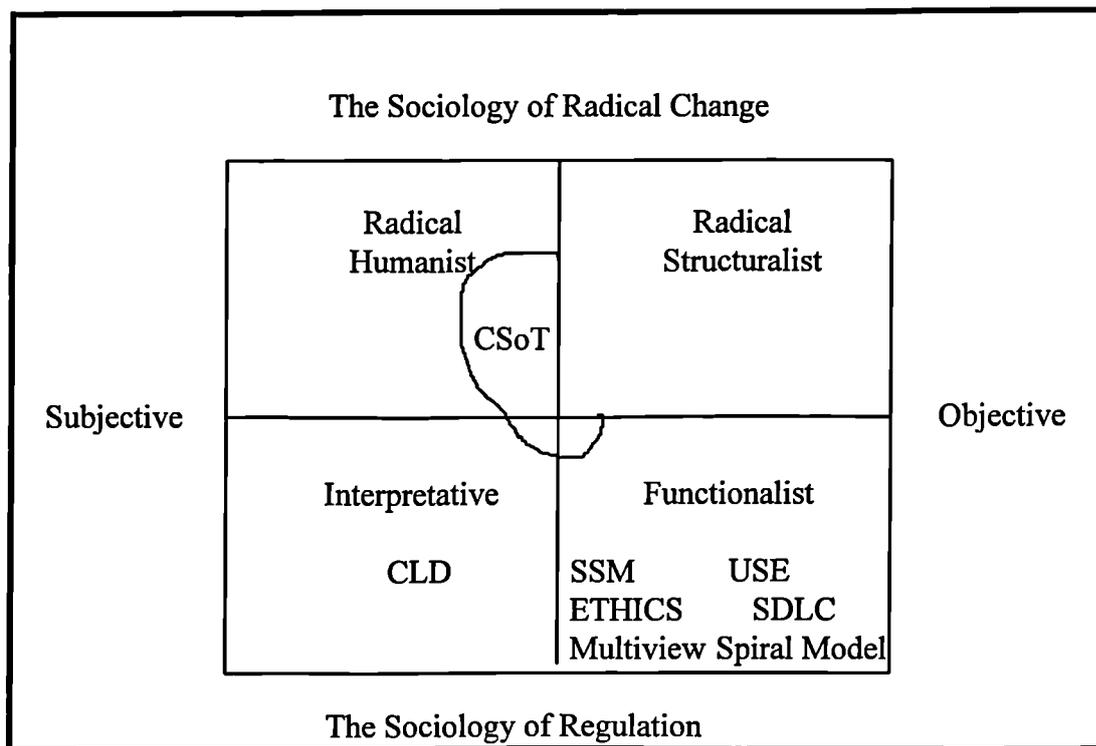
Social systems are therefore where the reductionist, functionalist approach meets its most severe challenges, and where systems views are seen to be of increasing relevance. Social science involves increasing complexity; a complexity which derives from the systemic nature of the objects of study and the introduction of human activity. The limitations of functionalism are demonstrated in the study of social systems, where predictive models may be seen to have only limited value (see Ernest Nagel, 1961: quoted in Checkland, 1994 p.67). Social action does not lend itself to study by reductionist methods, but is determined by the meaning that individuals attribute to their actions. As Checkland (1994) has commented, no agreed systems account of reality exists without a knowing observer.

This brings the discussion back to the hard-soft debate of Chapter 1, but now, with the support of social theory, this debate can be taken further and a foundation developed for CbISD. This is the direction which has been pursued by part of the systems movement, from its origins in the so called Singer/Churchman/Ackoff school (Jackson, 1982; Britton and McCallion, 1994), through to present day systems thinkers. Jackson (1982) has shown how the soft methods of Ackoff, Checkland and Churchman all adhere to some degree to the assumptions of the interpretative paradigm, and identifies a third position which distinguishes hard, soft and emancipatory systems thinking (Jackson and Keys, 1984; Jackson, 1985). The argument is for a complementarist approach, which sees the strengths and weaknesses in each of the three areas and argues that each one must be respected for those strengths and weaknesses.

All of this is mirrored in computer-based information systems development (CbISD), where the argument, which from a Habermasian (Habermas, 1971a; Habermas, 1971b; Habermas, 1976) perspective is seen as a critical social problem, is wrongly cast within the sociology of regulation.

The effect of this is illustrated, in Figure 2.2, by positioning the particular CbISD approaches discussed earlier on the Burrell and Morgan grid. Whilst not an approach to CbISD as such, critical social theory (CSoT) is placed on the grid as a potential theoretical underpinning to the approach to be developed within this thesis.

From the perspective of social theory, CbISD methodologies are mostly functionalist, with some movement evident towards the interpretative paradigm. The pre-eminent softer methods such as ETHICS and soft systems methodology (SSM) seem to locate best at the interpretative end of the functionalist paradigm. SSM, for example, though usually seen as an interpretative method, is difficult to support in these terms from a social theoretical standpoint; its purposefulness, real world - conceptual world focus, locates it as a functionalist method with high interpretative content. Certainly SSM fails to meet the test laid out by Burrell and Morgan (Burrell and Morgan, 1979 p.32), that interpretivism “question(s) whether organisations exist in anything but a conceptual sense.” Client led design surfaces as an attempt at a development approach to information systems entirely from the interpretative paradigm. Multiview is a contingent approach which relies on crossing paradigms, but its tools are regulative, and the approach is essentially means-ends dominated.



- Key:
- CLD Client Led Design
 - CSoT Critical Social Theory
 - SDLC Systems Development Life Cycle
 - SSM Soft Systems Methodology
 - USE User Software Engineering

Figure 2.2 A Categorisation of Approaches to CbISD

Critical social theory resides mostly in the radical humanist paradigm, but in addressing technical and practical interests also offers guidance in relation to functionalist and interpretivist issues, whilst signalling progression to a more radical approach. Much work in this area has already been undertaken in the management science domain, and it is from here that further support will be sought in formulating an alternative framework for CbISD.

2.4 Critical Social Theory - The Theoretical Underpinning

Critical social theory (CSoT) can be traced from the work of Kant, through Marx and the Frankfurt School. The two most widely accepted modern theorists are Foucault and Habermas, and it is to the latter that management science turned in the 1980s in order to develop a more human-centred view of its domain.

CSoT applied to the field of computer-based information systems development (CbISD) is appealing for its denial of the natural scientific principles on which study has largely hitherto been based. Seen through a scientific framework, CbISD appears as the design of a system to satisfy a known set of requirements - objective, verifiable requirements which are the same for all involved since they are independent of human opinion. CSoT refutes this, seeing our understanding of the world as determined by *a priori* conditions which are uncritically accepted. Critical theory seeks to expose these, and thereby release human beings from their 'false consciousness' to a position from which true potentiality can be attained. An alternative to the current functionalist and interpretivist approaches to CbISD may be found in developments based on the work of Habermas (1971a; 1971b; 1976), in particular his theory of knowledge constitutive interests (Table 2.3).

Knowledge Constitutive Interest	Basis of Human Interest	Type of Interaction	Underlying Paradigm	Methodological Approach
Technical (control)	Labour (Instrumental action)	Man-Nature	Functionalist	Empiricism
Practical (Understanding)	Communicative Interaction	Man-Man	Interpretative	Hermeneutics
Emancipatory (Freedom)	Authority (Power)	Man-Self	Radical/Critical	Critique

Table 2.3 *The Theory of Knowledge Constitutive Interests*
(Olga, 1991)

Habermas' three cognitive interests, technical, practical, and emancipatory, are identified in labour, interaction and power, and provide conditions for the three sciences, empirical/analytic, hermeneutic, and critical. The empirical/analytic, served by the natural sciences, is therefore seen as satisfying only the technical interest. Since, as has been argued, traditional hard approaches to computer-based information systems development (CbISD) have their roots in the natural sciences, they appear from a Habermasian perspective as an insufficient basis for CbISD. What is needed in addition is social

science, to service the practical (hermeneutic) interest in achieving communication and consensus, together with critical science to deal with issues of power and domination, serving the emancipatory interest.

From these roots came the development, in the domain of management science, of critical systems thinking, which is detailed below before moving on to the development of a critical framework for CbISD.

2.5 Critical Systems Thinking

An early recognition of the relevance of the work of Habermas to organisational studies is to be found in the work of Mingers (1980; 1992), whose insights essentially provided the initial impetus for the development in management science of critical systems thinking.

CST, it is argued, accepts the contribution of both hard and soft approaches, and, through critique, enhances awareness of the circumstances in which such approaches can be properly employed. The pragmatism of the hard approaches and the lack of theoretical reflection in the soft allow CST to expose both as special cases with limited domains of application. The value of CST in information systems interventions can be demonstrated through the Burrell and Morgan grid (after Burrell and Morgan, 1979 p.22). Burrell and Morgan's work, together with contributions from Oliga (1991), may be interpreted as shown in Figure 2.3 below.

This perspective further supports the view that traditional, structured CbISD largely emerges as serving the technical interest, with labour applied as purposive-rational action to achieve transformation by application of the means of production - in this case information technology. The alternative, evident in this domain since the 1970s but still limited in acceptance, is the service of the practical interest from the interpretative paradigm, relying on the communication of perceptions and consensus forming.

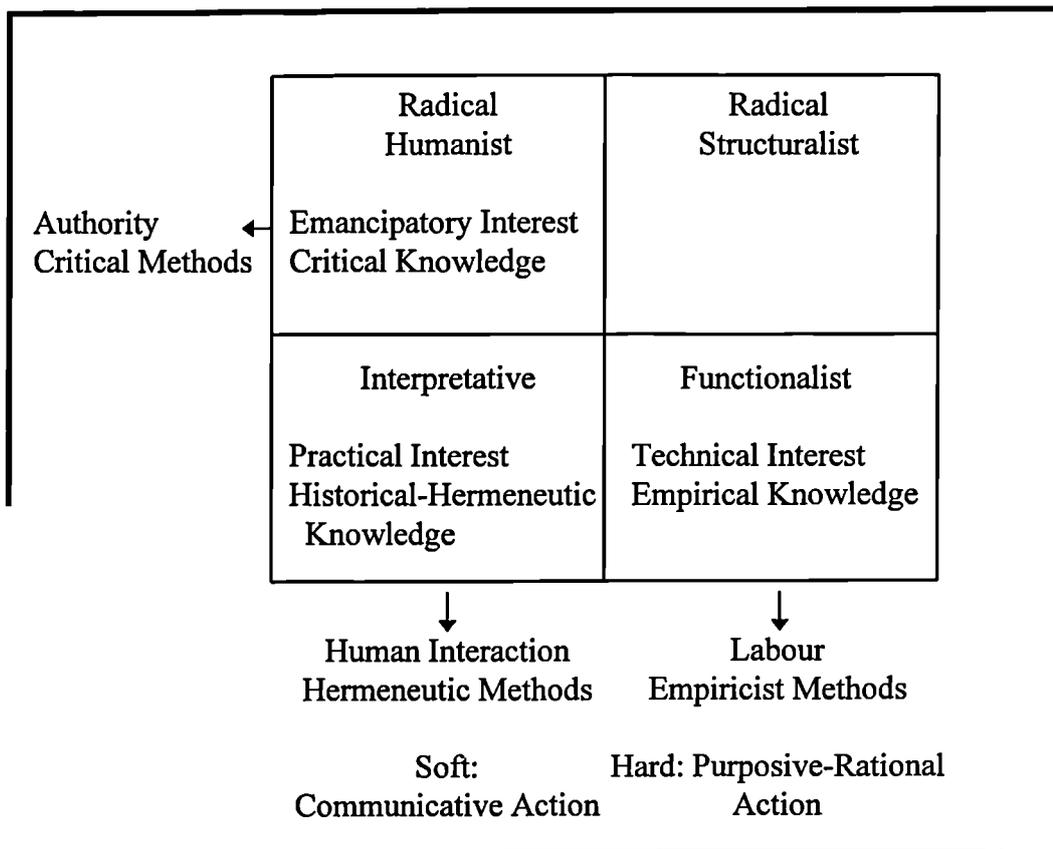


Figure 2.3 *The Social Validity of Hard, Soft and Critical Approaches*

The Five Commitments of Critical Systems Thinking

That critical systems thinking is true to the principles of critical social theory can be seen from its five key commitments (Jackson, 1991a), the relationship of which to information systems have been investigated by Jackson (1992). These commitments are critical awareness, social awareness, complementarism at the level of methodology, complementarism at the level of theory, and human emancipation.

Critical awareness “... {consists of} examining and re-examining taken-for-granted assumptions, together with the conditions which gave rise to them.” (Midgley, 1995b). Within an intervention this helps to inform the choice and mix of methodologies in relation to the changing nature of the problem contexts. Social awareness calls for the need to understand the organisational climate determining the popularity of particular systems approaches, and for full consideration to be given to the organisational consequences of the use of different methodologies.

Complementarism at the level of methodology rests on the encouragement of diversity and the concept that methodologies can do no more than "legitimately contribute in areas of specific context" (Flood, 1990b p.28), whilst Complementarism at the level of theory is supported by Habermas' knowledge constitutive interests, this commitment being more usually framed as 'theoretical commensurability'. In CbISD, my own experience of working with computer systems developers confirms communication across paradigms to be problematic - the same words often have a different meaning to each of the groups.

The objective of human emancipation, from an organisational standpoint, is to enable the achievement of human potentiality, which, it is argued, is enhanced where information systems are implemented in a way that promotes human well-being. The work particularly of Hirschheim, Klein and Lyytinen (Lyytinen and Klein, 1985; Hirschheim and Klein, 1989; Lyytinen and Hirschheim, 1989; Hirschheim *et al*, 1991; Klein and Hirschheim, 1993) gives further support to this view. Alvesson and Willmott (1992) see the emancipatory potential of critical theory as key to achieving change in organisation studies.

A Critical Framework for Computer-based Information Systems Development

As has been argued (Section 1.5, p.11), the foundations of a critical systems approach to organisational studies owes much to the work of Churchman (1968), which was built on foundations laid by Singer, and has been continued by Ackoff and other adherents to the systems school (see Britton and McCallion, 1994).

The work of Jackson and Keys (1984) proved a major turning point in the development of a critical framework which is true to the commitments of critical systems thinking. By looking at the range of problem contexts and at the systems methodologies available for addressing these contexts, Jackson and Keys provided a unified approach which draws on the strengths of the relevant methodologies, rather than debating which method is best, and argued for a reconciliation focusing on which method to use in which context, controlled by a "system of systems methodologies".

A number of developments have followed this initial work, from which Midgley (1995a) summarises the key approaches which may be seen as having adequate theoretical underpinning and practical potential as: total systems intervention (TSI) combined with SOSM (Flood and Jackson, 1991b); TSI reconstituted (Flood, 1995a); the creative design of methods (Midgley, 1990); and critical appreciation (Gregory, 1996).

In developing a framework for computer-based information systems development (CbISD), TSI in its various forms emerges as the most promising basis, offering as it does a solid framework of inquiry, design and critique which most comprehensively actions the commitments of critical systems thinking (CST). In the following section, a review of the principles and practice of TSI is therefore undertaken, in preparation for the initial development of an interventionist framework for CbISD.

2.6 Total Systems Intervention: The Practical Face of Critical Systems Thinking

The four guiding principles of TSI (Flood, 1995a) reflect the commitments of CST and its foundation in critical social theory (CSoT).

The first principle, embracing systemicity, requires that systems development problem situations are recognised as including technical and human activities. Secondly, meaningful participation requires that the perceptions of all involved must be drawn into the picture. Thirdly, critical reflection involves two issues: reflecting on the relationship between different organisational interests and thereby demonstrating where there is a dominance over people who, as a result, cannot meaningfully participate; and reflecting on the dominance of favoured approaches to intervention: demonstrating where the use of one method or a few methods dominate, leaving 'problem solvers' with limitations in their ability to tackle effectively the full range of technical and human issues. Finally, human freedom is necessary for these principles to work.

TSI is iterative and recursive. Iteration implies that the process is continuous, rather than a start-end method, which in turn means that work may begin at any point in the TSI cycle. Whilst acceptable in principle, commencement at any stage has arguably less relevance to CbISD intervention, since the analysis of any problem situation must begin with creativity. The concept of a continuous, iterative process is in contrast to the start-end, project management nature of traditional approaches to CbISD, which have been discussed as a major cause of failure (Section 1.3, p.7).

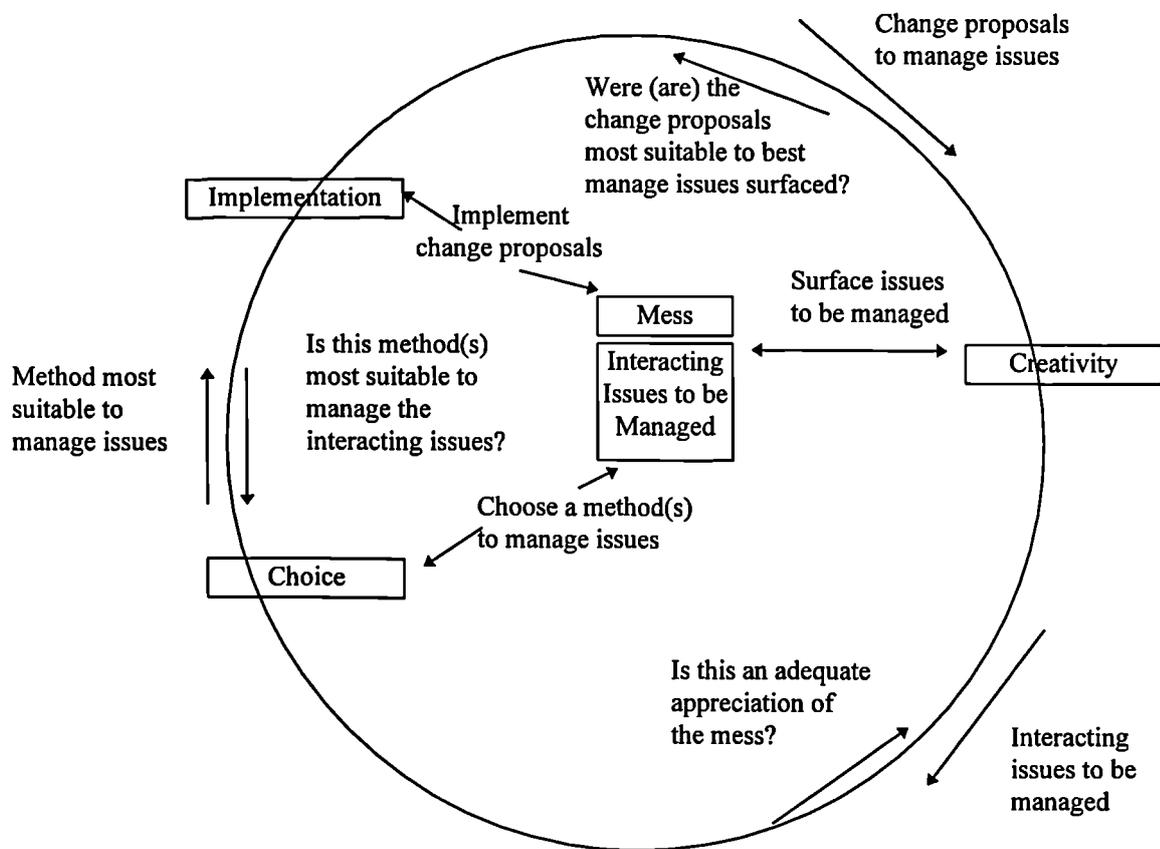


Figure 2.4 *The Process of Total Systems Intervention (TSI)*
 (Flood, 1995a)

As a complementarist approach, TSI does not accept isolationist and pragmatist arguments (Jackson, 1987). At the level of theory, Habermas' theory of knowledge constitutive interests underpins the critical system approach, enabling TSI to claim theoretical commensurability. At the level of methodology, methodological incommensurability is accepted but is not seen as problematic, since methodologies are used to address only those problem contexts for which they are suited, and not in competition with one another.

Critique is required in order that the sociological environment in which an intervention is taking place may be understood; to critically reflect on the process of intervention; and to critically review methodologies in order that no one methodology dominates.

Emancipation "seeks to achieve for all individuals, working through organisations and in society, the maximum development of their potential." (Flood and Jackson, 1991b p.49).

CbISD 'problems', it has been argued, are not amenable to engineered solutions, so developing them is not best served by systems development life cycle approaches. The TSI ideology explicitly recognises the part played by both technical and human activities in organisations, and the extent to which human interpretation may in some instances so distort the so called 'real world' that study of the latter may become meaningless.

Implementation of the principles of TSI is through the three modes of critical review, critical reflection and problem solving, and the three phases of creativity, choice and implementation (Figure 2.4).

In the problem-solving and critical reflection modes, the circle connecting the three phases of TSI is to be read in both a clockwise and anti-clockwise direction. Clockwise it directs the intervention; anti-clockwise it indicates critical reflection at each phase.

Problem Solving and Critical Reflection using TSI

Creativity

In the problem-solving mode, creativity progresses in the clockwise direction, surfacing the issues to be dealt with. In the critical reflection mode, creativity in an anti-clockwise direction receives the output of implementation, in the form of change proposals, to re-evaluate. Creativity in TSI was originally based exclusively on the use of metaphor. A key application of the use of metaphor to organisational studies has been undertaken by Morgan (1986), whose original eight metaphors, together with Flood's adaptation of them, are reproduced in Table 2.4 below.

<i>Morgan</i>	<i>Flood</i>
Machine	Machine
Organism	Organic
Brain	Neuro-cybernetic
Culture	Socio-cultural
Political	Socio-political
Psychic prison	
Flux and transformation	
Instrument of domination	

Table 2.4 *Metaphor in Organisational Analysis*

The main attributes of the five metaphors used by TSI are listed in Table 2.5 below.

Machine	Organic	Neuro-Cybernetic	Socio-Cultural	Socio-Political
Standardised parts	Needs to be satisfied	As organic but also includes:	Collaboration	Coercive conflict
Routine operations	Survival	Active learning and control	Shared characteristics: language, history, dress, etc.	Domination
Repetitive operations	Open system	Information prime		Whose interests are served?
Activities predetermined	Adaptation	Law of requisite variety	Shared reality: values, beliefs, norms Social practices	Power central issue
Goals and objectives predetermined	Organisation Feedback	Viable system Learning to learn		People are politically motivated
Efficiency	Self-regulation	Getting the whole into the parts		Power as a consequence of structure
Internal control	Passive control			
Closed system				Disintegration

Table 2.5 *The Main Attributes of Five Metaphors used in the Creativity Phase of Total Systems Intervention (TSI)*
(Flood, 1995a, p.182)

Creativity has since been expanded (Flood, 1995a) to include all techniques which may be categorised as 'brainstorming', including, in addition to the use of metaphors, lateral thinking (de Bono, 1977), idealised design (Ackoff, 1981), and phases 1 to 5 of soft systems methodology (Checkland, 1989). The creativity phase of TSI enables the

situation to be seen from a number of different angles, allowing a clearer appreciation of the system and hence a more carefully guided intervention. The output is then synthesised by the use of techniques such as metaphors and lateral thinking, and re-contextualised to make choices about the issues to be managed (see Flood and Jackson, 1991b).

Choice

Choice in the problem-solving (clockwise) mode receives the interacting issues to be applied to the problem situation, and in the critical reflection (anti-clockwise) mode reflects on whether creativity surfaced an adequate appreciation of the ‘mess’.

The choice phase of TSI aims to select appropriate intervention methodologies by employing, originally, the system of systems methodologies (SOSM) (Jackson and Keys, 1984). Recent revision of TSI (Flood, 1995a) has suggested a different approach to choice, replacing the problem context grid from SOSM with a complementarist framework of designing, debating and disimprisoning (Flood, 1993: See Table 2.6).

Designing	Debating	Disimprisoning
Machine Organic Neuro-Cybernetic	Socio-Cultural	Socio-Political

Table 2.6 The Complementarist Framework
(Flood, 1995a, p.183)

In this framework, type of method can be chosen by asking which of the following questions is most pertinent (after Flood, 1995a, p185): **How** should we do it: this is addressing issues of design, and must therefore assume that consensus already exists; **What** should we do: addressing issues of debate, and therefore assuming non coercive consensus is achievable; **Who** will benefit / **Why** should we do it: addressing issues of disimprisoning, where disagreement, power or coercion are prime.

In the creativity phase, interpretivist methods are used to surface the main issues and prioritise them. Here in the choice phase, these issues must be taken forward toward implementation.

Implementation

Implementation in the problem-solving (clockwise) mode implements the methodologies most suitable to managing the issues surfaced within the problem situation, and in the critical reflection (anti-clockwise) mode reflects on whether these were the most suitable methods.

2.7 Conclusions

Habermas' theory of knowledge constitutive interests, via the technical, practical and emancipatory interests, can be thought of as spanning the functionalist, interpretivist and radical humanist paradigms.

Since philosophically TSI is underpinned by CST, which in turn is true to the principles of Habermas' critical social theory (CSoT), TSI is of value as an approach to problem situations where a combination of the functional, interpretative and critical is seen to be important. Hence an intervention which may traditionally have been approached with a hard or soft method, or controlled from one or other of the functionalist or interpretivist paradigms with support from other methods, might be reconceptualised as belonging in the critical social area, from where it can be controlled using methods drawn in a complementary fashion from the relevant paradigms where such methods or methodologies have a contribution to make to the problem context.

In addition, from the array of systems approaches available to the manager or systems consultant, TSI, through critical review and the complementarist framework, acknowledges the value of each approach, but equally its limitations, and aims to fit the right methodology to the right problem situation.

Functionalist science, on which much of CbISD is based, can no longer be defended as objective, value free, theory neutral, but is to be seen as maintaining and strengthening existing power relations. Interpretative science recognises 'reality' as socially constructed, but is unable to overcome *a priori* conditions and false consciousness, and is therefore conservative in orientation. Critical science has the potential to overcome these limitations of functionalism and interpretivism.

This investigation of systemic intervention methods leads to a proposed framework for CbISD, which is shown in Figure 2.5 below. TSI lies at the centre of the approach, guiding problem solving and critical reflection within the intervention by use of the three phases of creativity, choice and implementation. For each of these phases, the TSI framework may again be used if required to control the application of that phase.

This framework will now be subjected to analysis and critique from the perspective of research methods (Chapter 3), before the refined model is applied to the case study and action research (Chapters 4 and 5).

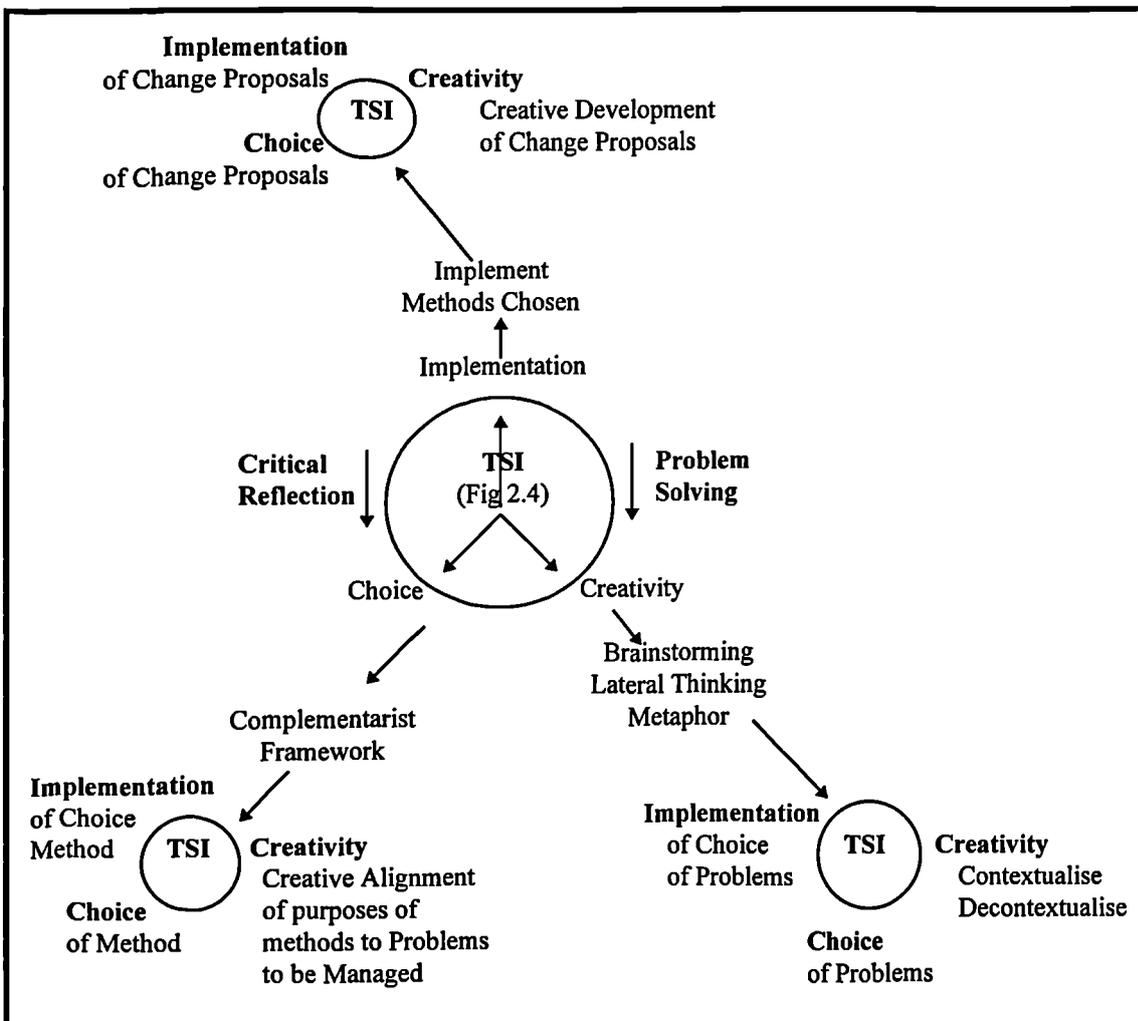


Figure 2.5 An Interventionist Framework for CbISD

Chapter 3

Research Methods

3.1 Introduction

The view of computer-based information systems development as a social domain is pursued, and is used to help inform the choice of research methods. Qualitative and quantitative approaches to research are outlined, and the links between the field of human inquiry and the combined fields of critical systems thinking and total systems intervention discussed, the key similarities between the domains helping to form a basis for the development of a combined, participatory, research method.

The research to be undertaken is outlined, consisting of case study and longitudinal participatory action research. The results of the analysis of human inquiry, critical systems thinking and total systems intervention are synthesised to produce a revised interventionist methodology for use in this research, forming the basis for the case analysis and action research.

Research methods are investigated to assist with the validation of the outcomes from the case and action research. This is approached from two perspectives: triangulation and content analysis. Triangulation of theories, investigators, data and methods are all determined as important factors in improving the validity of the research, and are built into the research method. Content analysis uses proprietary software to distil meaning from the large volume of textual data generated by the action research.

3.2 Research Methods: The Qualitative / Quantitative Debate

The view of computer-based information systems development (CbISD) on the subjective - objective dimension (Section 2.2, p.20), is echoed by the quantitative versus qualitative debate in research methodology (Figure 3.1).

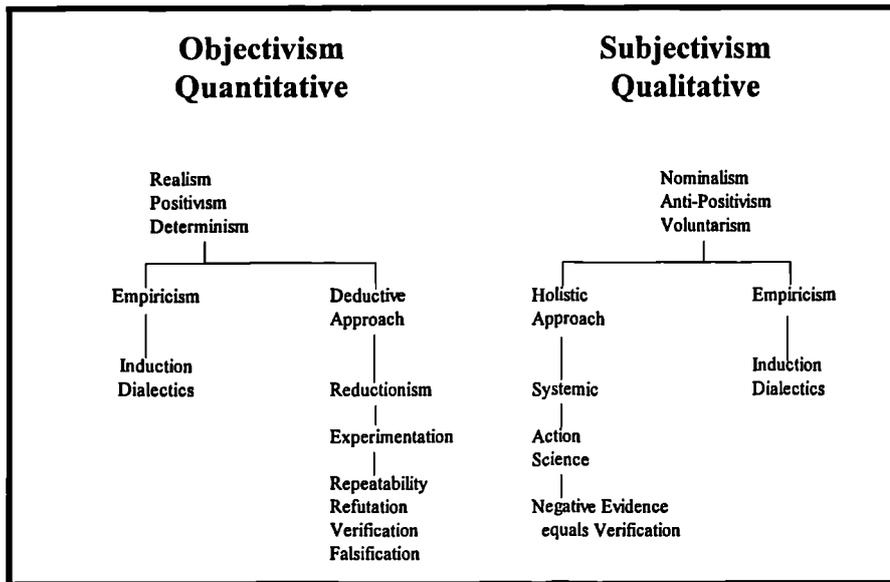


Figure 3.1 *Objectivist and Subjectivist Research Methods*

The analysis of computer-based information systems development (CbISD) carried out in the previous chapters has established the value of viewing it as socially interpreted reality. Where information systems are to be seen as social systems, objectivism, with its reductionist, problem solving focus, positivist epistemology and nomothetic methodologies may be seen as representing an impoverished perspective of the domain. This viewpoint helps to direct the research effort. Typically objectivist research would be seen to consist of hypothesis testing, making propositions for reasoning, investigation or experimentation; reductionism, the reduction of complexity under experimental conditions; repeatability, by verification or falsification; and refutation, knowledge building by the refutation of hypotheses (Figure 3.1). Such research is criticised for its claimed but arguably insupportable objectivity and theory-neutral position (Gill and Johnson, 1991). When applied to the study of human beings it assumes a high degree of determinism - that there are natural laws that govern social behaviour.

The alternative, subjectivist approach, by contrast, is accepted as ideographic and theory laden (Gill and Johnson, 1991), with a systemic, action science method being preferred.

Chapter 1 traced the roots of CbISD to scientific functionalism. Seen paradigmatically, this positivistic approach may be viewed as the received scientific perspective, relying on experimentation and verification via quantitative techniques to arrive at an objective truth

within a realist ontology (Guba and Lincoln, 1994). This reductionist approach, supported by nomothetic methodologies, has been used extensively to address problem situations in business organisations, supported by inductive (generalisation from observation or experience) and dialectic (eliciting knowledge from question and answer) methods. However, for problem situations rich in human activity, there has been a replacement of the functionalist with an interpretivist view, which sees human beings as voluntaristic rather than deterministic. Nomothetic methodologies might be viewed as insufficient in such situations, giving rise to context stripping and the exclusion of meaning and purpose (Guba and Lincoln, 1994). Ideographic methodologies, which essentially study activity and opinions, not the system in functionalist terms; the observer and his or her views, not the identifiable objects of the 'real world', are proposed as the alternative. The relationship between functionalism and interpretivism, and the objectivist and subjectivist research methods relevant to them, is thus seen to emerge, and mirrors the hard-soft debate in CbISD.

This leads to the proposition that qualitative research methods have more to offer the research conducted within this thesis than quantitative methods. Furthermore, the recommendation drawn from the review of critical theory in Chapter 2 has been that CbISD will be enhanced if undertaken under the control of TSI. But TSI is a framework for intervention in organisational problem situations, and as such may be seen as an approach to consultancy or 'action research'. There would therefore seem to be value in assessing the relationship between CST, TSI and action research (AR) in order to further develop the research methodology to be used within these investigations.

Firstly, however, an outline is given of the case study and action research undertaken, before moving on to discuss theoretical issues in case study work, and the research methodologies implicit in CST, TSI and AR.

3.3 Case Study Research

The research undertaken within this study consists of two case studies and one major action research based intervention.

Two cases have been chosen, representing interventions in a major national utility, and a community health services trust. The cases were originally approached using non-critical methods, and analysis of them has been undertaken as a formative exercise, the purpose of which is to help frame the hypotheses and refine the research approach, and as part of the overall data triangulation. Whilst the case analysis is a small part of this study, its value lies in its support for the use of qualitative rather than quantitative research methods. The lack of generalisability which is so often levied as a criticism of case study research (Stake, 1994) is not seen to be a problem in this study, since the cases are not studied in order to generalise the results, but rather to enable the synthesis of the findings from them. Denzin and Lincoln (1994 p.202) refer to the need for negative cases: one of the chosen cases is to be treated in this way.

Having determined the research to be qualitative, and discussed issues in case study research, Section 3.4 now undertakes an in-depth investigation of the methods available to support a TSI study. Since the longitudinal research to be undertaken is highly participatory, it is from the domain of action research or human inquiry that this support is sought.

3.4 Human Inquiry, Critical Systems Thinking and Total Systems Intervention: A Synthesised Research Methodology

Intervention methodologies may differ widely in their treatment of the subject of study; differences which exhibit clear parallels to the methodologies applied to research. At one extreme might be placed expert driven forms of inquiry, where a clear researcher-subject relationship forms the basis of the approach. At the other extreme are methods where the subject and researcher are indistinguishable, all appearing as co-researchers and co-subjects in the study. Reason explains this distinction, seeing participatory inquiry methods as seeking “to establish .. liberating dialogue with impoverished and oppressed

peoples.” (Reason, 1994). In business organisations we may not seem to be dealing with the impoverished and oppressed, but many groups are clearly impoverished in relation to their access to information, and oppressed in so far as they feel unable to express true opinions owing to power exercised within the organisation.

Total systems intervention (TSI) has been identified as an approach to intervening in organisational problem situations, underpinned by critical systems thinking (CST), which relies on participation and emancipation. Similarly human inquiry is a qualitative approach to research which is inherently participatory. All this points to the likely benefit to be derived from an investigation of the links between human inquiry and CST/TSI, an investigation which has already begun (Flood and Romm, 1995; Flood and Romm, 1996; Levin, 1996). The aim of this section is to move this discussion more specifically to an assessment of the potential enhancement of the inquiry approach within TSI by the application of the methods of human inquiry. Implicit in this is a need to more clearly classify human inquiry in relation to this study. Action research (AR) has been put forward as the general classification for all participatory ‘research in action’ (Argyris *et al.*, 1985), though recently the emerging field of human inquiry (Reason, 1994; Moggridge and Reason, 1996) has been identified. It is this latter field which will be shown to have most in common with TSI, and for which a more detailed classification of the various approaches will be made.

The key principles of CST are identified (Flood and Romm, 1996) as complementarity, emancipation and critical reflection. Emancipation is a principle which lies at the heart of CST (Flood, 1990b), and which is further developed in diversity management (Flood and Romm, 1995), in which the emancipatory commitment of CST is addressed and measured according to the meaningfulness of choices made by the people involved and affected by them. This strong emancipatory theme of CST has led to investigation of support which might be available from the field of human inquiry. In the recent issue of *Systems Practice* devoted to emancipatory practice (Flood and Romm, 1996), the aim was to bring forward ideas of emancipation from this field.

Levin's work on the relationship between CST and human inquiry (Levin, 1994) sees commonality in terms of emancipation and power relations, but argues for a clearer conceptualisation of them. The tension between expert and participant control is recognised by Levin, who refers to the meaning construction process, in which the researchers and the subjects of the research interact to construct a new meaning for them both. Discussions of the link between CST and human inquiry were given further impetus by a three day forum on this topic (Wilby, 1996b), supported by a number of key publications in which further information is to be found (Levin, 1994; Flood and Romm, 1995; Flood and Romm, 1996). These discussions again largely focused on the emancipatory nature of the two fields, although the work on diversity management (Flood and Romm, 1995) more explicitly develops the complementarist theme.

The three-mode and three-phase process of TSI (see Figure 2.4) is strongly supported by critical reflection. As one of the three modes, critical reflection is carried out at each of the three phases of creativity, choice and implementation. Creativity receives change proposals, and reflection is on whether these proposals are suitable; in the choice phase there has to be reflection on whether the choice made is an adequate appreciation of the problem situation; in implementation, reflection is on whether the methods chosen are suitable to manage the interacting issues surfaced. Intervening in this way implies a form of human inquiry.

Towards a Method of Human Inquiry

(The contribution of Reason, 1994 and Flood and Romm, 1996 are acknowledged in this section. Also see Clarke and Lehaney, 1997b for a detailed analysis).

Since human inquiry involves mobilising the subjects of any such inquiry to express their views and opinions, it might be expected that any such inquiry method would follow an interpretivist ontology and an anti-positivist epistemology, but this is not, in fact, what is claimed, rather that “.. concrete reality is the connection between subjectivity and objectivity, never objectivity isolated from subjectivity.” (Reason, 1994, p.232, quoting Freire, 1982). Human inquiry in these terms requires an ontology and epistemology

spanning both functionalist and interpretivist paradigms. This contrasts with the non-participatory methods of inquiry, which may be criticised as being expert driven and so serving the existing power base and maintaining the status quo (Jackson, 1990), and having the effect of excluding human participants from the inquiry process (Reason, 1994 p.325).

To determine the support for intervention available from human inquiry, four human inquiry approaches are appraised: action science, co-operative inquiry, participatory action research (PAR), and self-reliant PAR. Whilst it is acknowledged that, in making this choice, other approaches to human inquiry are left out, the chosen methods show sufficiently the diversity of human inquiry approaches in terms of what they might contribute to the process of TSI.

Action Science

Action science (Argyris *et al*, 1985) is a positivistic form of action research, central to which is the belief that it is possible to develop predictive theories (Reason, 1994 p.330). The relevance of action science to the tenets of TSI are evident in its commitment to the iterative process of action, and the need for meaningful participation and critical reflection (Argyris *et al*, 1985 p.9).

Action science sees monitoring an intervention as problematic. TSI points to the need for critical reflection at each stage of the intervention. Argyris *et al* (1985) refer to seven rules to test hypotheses in an action context, key among which are the need to make reasoning explicit and publicly test for agreement, and to actively seek disconfirming data and alternative explanations. Action science is therefore seen as relevant to a TSI study. Its combination of research and consultancy, enabling the researcher and client to develop and learn from each other during the project is an important factor. It is a holistic, co-operative approach, primarily applicable to understanding and planning change in social systems.

Co-operative Inquiry

Co-operative inquiry is an iterative cycle of action and reflection, allowing those involved to “critically see through their subjectivity” (Reason, 1994). The aim of such inquiry is to expose privileged and expert positions. Co-operative inquiry relies on the subjects of the research being integrated into the research process to the extent that they are effectively part of the research team.

Heron (in: Reason and Rowan, 1981) draws the distinction between experiential, practical, presentational and propositional knowledge. This approach to epistemology is used to support the need for co-operation in the research process. The argument is that propositional knowledge (knowledge about something) is derived from experiential and practical through the vehicle of presentational knowledge (Heron, 1992, quoted in Reason, 1994). Co-operation is the means by which this derivation is ensured, and guards against conclusions drawn by the researcher from improper bases. TSI builds this knowledge through the process of creativity, via brainstorming, lateral thinking, metaphor and so on, and can therefore be seen in this respect to depend implicitly on co-operative inquiry.

The critical self awareness essential to this mode of inquiry is classified by Reason (1994 p.327) as critical subjectivity. This need to be aware of the viewpoint from which a subject is studied, and the biases of that viewpoint, parallels with TSI’s open declaration of ideology and critical reflection.

Co-operative inquiry can be operationalised through a four phase methodology (Reason, 1994, p.326). In phase 1, co-researchers agree an area for inquiry and identify research propositions; phase 2 initiates agreed actions and records outcomes; phase 3 is where participants become fully immersed in the process, and is seen to give rise to new insights; finally, phase 4 involves returning to consider the original research propositions: “a critical return to propositional knowing.”

Participatory Action Research

Participatory action research is distinguished as the form of action research resulting from work by Foote Whyte (1996). In so far as this is a form of action research in which control is not seen as vested in the researcher, and members of the organisation are more actively involved, it can be seen to be moving human inquiry toward co-operative inquiry.

In PAR there is an underlying theme of liberation, but a need for care to be exercised if this is truly to be achieved. Reason (1994 p.334) refers to how PAR projects are dependent on people with the skill to initiate and run them, and how this, in Colombian projects, has led to outsiders being prone to impose a substitute reality in a manner which is not fully participative. So there is a need to identify whose reality is to be served. Is the reality of those affected recognised, in which case they must fully participate, or is the power base being served, in which case this dominant reality is imposed on others?

Many of the declared features of PAR show strong similarities with the features of TSI. Its commitment to both the social and technical echoes TSI's adherence to the practical, technical and emancipatory tenets of Habermas' theory of knowledge constitutive interests; its declared complementarist stance closely resembles in principle the complementarist stance of TSI; and its promotion of organisational learning through the inclusion of participants in all elements of a study, cautioning against the use of experts, and relying on the facilitator becoming part of the community, leading to joint learning by the researchers and researched, has much in common with the promotion of organisational learning within TSI.

Self-Reliant Participatory Action Research

This form of PAR has resulted in PAR generally being labelled radical. The objective is for participants to radically transform their environment (Fals-Borda and Rahman, 1991, pp.3 and 13).

In relation to TSI, self-reliant participatory action research (SPAR) differs from co-operative inquiry in that it forces the interventionist to deal more explicitly with issues of power and emancipation. This emancipation does not mean that no power may be exercised, but that all authority must be legitimate. Heron (1989) sees “distress free charismatic authority” as an essential element in the correct functioning of groups, with group dynamics being concerned with hierarchy (legitimate authority), power sharing with peers, and personal freedom. Thus participation and leadership may be seen as creating continuing tension, to which we must seek “creative resolution moment to moment.” (Reason, 1994).

One of the key features of SPAR is its radical stance (Fals-Borda and Rahman, 1991). This at once points to the benefits and problems of SPAR. Benefits in so far as it is a radical ideology, using the knowledge of the group of participants to overcome oppression deriving from the illegitimate use of knowledge by those in power. Problems arise, however, where this form of inquiry, which may be demonstrated as beneficial in underprivileged communities, is applied to Western industrialised society (Reason, 1994 p.328).

So in SPAR can be identified an approach which is not prescriptive as to method, but might be seen more as a generalised form of inquiry where issues such as communication, liberation and empowerment are prime. An approach derived from PAR and worthy of further consideration in its attempts to deal with issues of liberation, is that of militant observation (de Olivera and de Olivera, 1982). Whilst developed as a means of mobilising oppressed people, its methods are applicable in any situation where liberation is a factor in a drive for change. Militant observation accepts a participatory action research stance, but goes further in explicitly accepting that the researcher will ultimately leave (de Olivera and de Olivera, 1982).

TSI, being proposed as a way of dealing with problem situations which does not require expert guidance, recognises the need for learning so that the process can continue after the facilitator has departed. Militant observation offers recommendations claimed to enable this process, such as the formation of hypotheses prior to the commencement of the

intervention (in order that preliminary ideas may be tested in the research activity), and unstructured inquiry approaches. This allows more flexibility and the collection of richer information, basing development on “the population’s level of consciousness.” (de Olivera and de Olivera, 1982).

Summary: Human Inquiry, CST and TSI

Human Inquiry	Critical Systems Thinking and Total Systems Intervention
Participation / Emancipation	
The integration of the ‘research subjects’ to become part of the research team and to conduct their own research in their own interests.	TSI might be viewed as a combination of research and consultancy within a learning framework..
A need to expose different viewpoints and the biases inherent in them.	Can be seen to depend on emancipation, which, through the theory of knowledge constitutive interests, is needed for true participation and complementarism to be achieved.
Radical (SPAR).	Power is an integral property of any group TSI aims to ‘debate this away’ through an emancipatory methodology.
Facilitation to liberate others so that they see their own reality, not to impose a substitute reality; starting by discovery of the participants’ level of consciousness. Not expert driven.	The aim of creativity must be to mobilise the views of the population under investigation. It is therefore essential that the facilitator of any creativity session explicitly avoids imposing a ‘substitute reality’ on the group: reality must emerge from within.
A continuous, iterative process in which there is recognition that the researcher will leave, so that participants must learn to continue the process.	Iterative and continuous process, under participant control.
Critique	
Critical reflection built into the intervention process. Offer findings back to the group and seek disconfirming data.	Explicitly critical in both critical reflection and critical review modes. Underpinned by Critical Social Theory. Confirming and disconfirming data sought.
The explicit use of unstructured techniques. Not searching for ‘one truth’, but for improvements to the current situation.	
Complementarism	
Co-operative inquiry seeks to view problem situations from a mix of subjective and objective.	Creativity in TSI adopts a complementarist view of problem contexts, spanning both the subjective and objective. Underpinned by the theory of knowledge constitutive interests.

Table 3.1 Common Themes in Human Inquiry and TSI

Information collected has to be organised and offered back to the group for appraisal. The aim is to produce a perceived reality and an actual reality, between which will exist a gap. The work of de Olivera and de Olivera focuses on how to identify, understand, and use this gap, basing any action on the needs of participants. They see liberation within the group processes as a fundamental issue, and seek to bring this to the fore so that it may be confronted by the group. Properly conducted, such confrontation will have the effect, not of imposing a substitute reality from without, but rather of mobilising the group to develop an awareness of their own reality from within.

Prior to undertaking the case study and participatory research, a general, fairly simplistic view of the common issues was developed (Table 3.1) . It was this view that was used to help frame the intervention at the University of Luton, with the findings from human inquiry being incorporated, item by item, into the TSI framework.

3.5 Research Methods to Determine the Success of the Interventions

Discussion so far has focused on the research methods underpinning the interventions undertaken in applying the theoretical research to a practical area of study. However, research methods also have a part to play in post-intervention review, where a well constructed approach will enhance the interventions. The key to this is triangulation (Denzin, 1978).

Triangulation

Denzin (1978) identifies four types of triangulation, all of which have been applied within this study: data triangulation (use of a variety of data sources); investigator triangulation (several different researchers); theory triangulation (multiple perspectives on a single set of data); and methodological triangulation (multiple methods to study a single problem). Morse (1994) refers to the use of multiple methods in a complementary fashion and to the incorporation of quantitative methods into qualitative (p.224-5).

The use of two cases, one of which is a negative case, and a major action research intervention is the core of the data triangulation in this study. Within both the cases and the action research, the methods used seek out multiple viewpoints on the problem situations (by observation - including attendance at minuted meetings and use of computer systems - and structured and unstructured interview within a case or intervention), aim to further validate the outcomes.

Methodological triangulation has been achieved by the use of the interventionist framework to mix methodologies as they are seen to be relevant to the problem contexts encountered. In addition, the critical approach taken will further strengthen this by adding critique to the analysis.

Different theoretical approaches are triangulated through the application of the various paradigmatic views of the problem situations. In particular, the functionalist, natural scientific approach is compared and contrasted with that of social theory represented in the interpretative and radical humanist paradigms. Complementarist and isolationist theories are assessed and critiqued.

Finally, the use of facilitators other than the author adds the dimension of investigator triangulation. This is particularly evident in the operational intervention.

Analysis of Qualitative Data

In the course of conducting the TSI investigation, a significant volume of 'textual data' in the form of meeting notes, reports, transcripts and other written material was produced. The relatively unstructured nature of this material made it difficult to extract meaning from it in an unbiased manner. The main method recommended in these circumstances is content analysis (see Appendix XI), which is a means of analysing textual data in order to extract the underlying meaning. All of the textual evidence is collected together, categories are chosen for the text, and it is then coded and assigned to the categories. The data is then recontextualised and the 'meaning' of the text analysed (for more complete information on the techniques used, see Dey, 1993).

Computer programs are available to carry out these tasks, and for this research the package NUD-IST (Non-numerical Unstructured Data Indexing Searching and Theorizing) will be used.

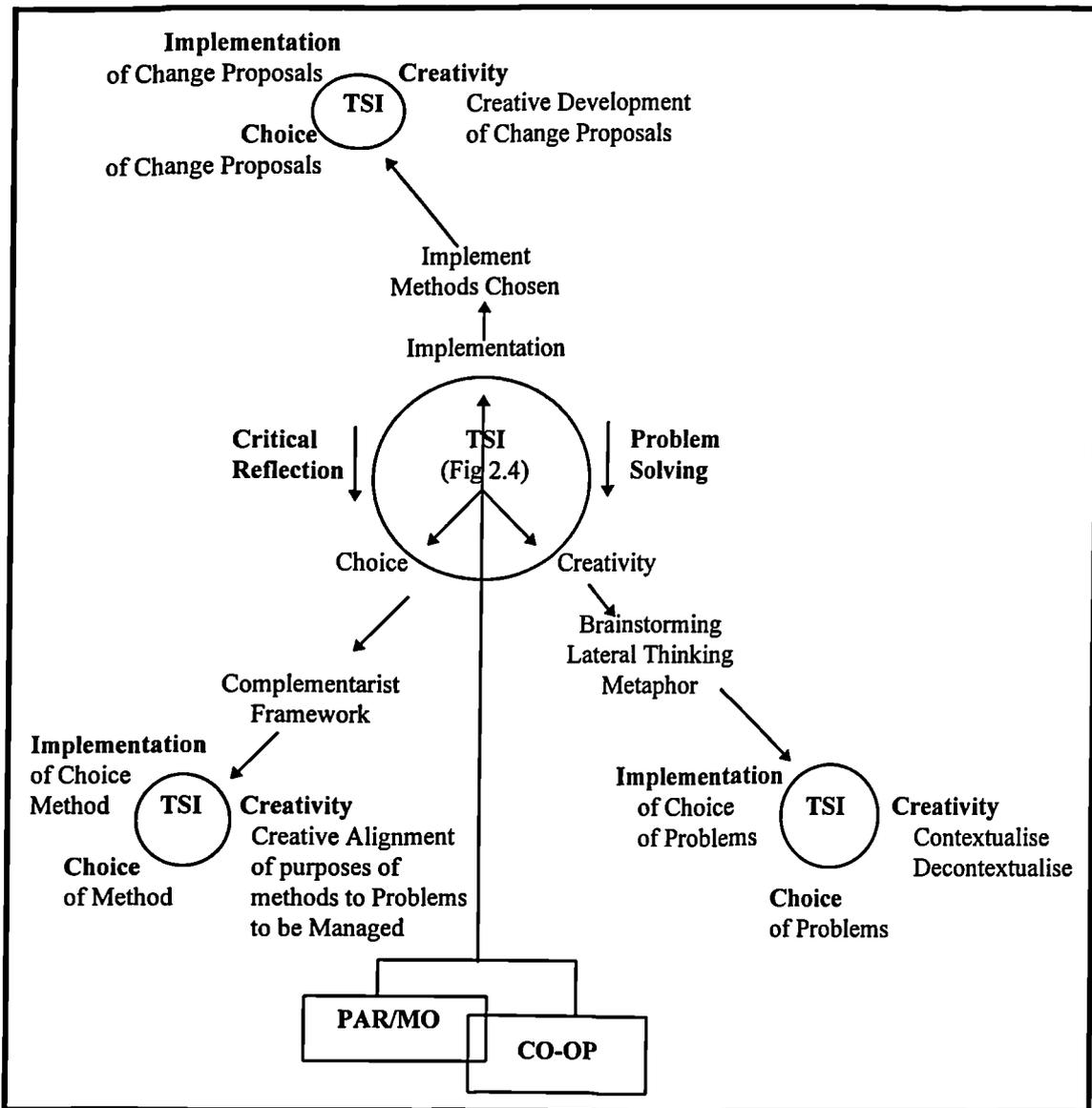
Whilst carrying out the content analysis, the general interpretation of all of the collected material has not been ignored. As has been posited earlier, the notion of objectivity in any human endeavour is a dubious one. Consequently, it is suggested, an over analytical approach to textual analysis may be seen to give a weight to the conclusions which, accepting the level of subjectivity which must be inherent in any such analysis, is misleading. The subjective nature of this undertaking is therefore accepted in this interpretative analysis, which will be undertaken from an explicitly phenomenological standpoint.

All of the qualitative analysis will be brought together to provide a view of the intervention based on triangulation of these varying approaches.

3.6 Conclusions

The interventionist framework has been amended to incorporate the conclusions drawn within this chapter from the analysis of human inquiry and its contribution to TSI (Figure 3.2), the work undertaken being a progression of the development which has occurred to date in reconciling the two fields.

In the case studies and action research, intervention and analysis will be based on TSI's iterative and recursive framework, but this is adapted to the needs of computer-based information systems development (CbISD). As far as human inquiry is concerned, this means that co-operative inquiry, participatory action research and militant observation will be used to inform the methods.



Key: TSI Total systems intervention.
 PAR Participatory action research.
 MO Militant observation.
 CO-OP Co-operative inquiry.

Figure 3.2 *An Interventionist Framework for CbISD Incorporating the Findings from Action Research*

The principles which co-operative inquiry, participatory action research and militant observation show to be necessary are:

- The integration of the 'research subjects' to become part of the research team and to conduct their own research in their own interests.
- A need to expose different viewpoints and the biases inherent in them.
- Control of the intervention vested in the research team, of which the 'research subjects' are a part.
- Facilitation to liberate others so that they see their own reality, not to impose a substitute reality; discover the population's level of consciousness.
- Recognition that the researcher will leave, so that participants must learn to continue the process.
- The explicit use of unstructured techniques.

These principles will be included in the intervention in Chapter 5. In particular:

- In participatory sessions, care will be taken to allow the participants to surface their own views of the problem situation. Guidance will be given as a facilitator rather than expert.
- Unstructured techniques will be used to add to the richness of the information.
- An attempt will be made to create a learning environment.

Chapter 4

Case Study Analysis

4.1 Introduction

This chapter applies the critical approach developed in Chapters 1 to 3 to the evaluation of two computer-based information systems. Although the potential for a critical approach to computer-based information systems development has been recognised, no evidence of a practical interventionist method incorporating this has been found; indeed it is suggested that the theoretical and normative nature of such an approach makes it difficult to see how it could work in practice (Hirschheim and Klein, 1989). Consequently this work appears to offer a new perspective on computer-based information systems development.

The chapter begins by outlining the theoretical approach to be taken, consisting of an interventionist framework based on total systems intervention.

The analysis critically reflects on two cases in which the author has been involved, the aim being to develop and test the interventionist framework to be used for action research, and assess its validity in information systems intervention. The approach taken, and a justification of this approach, is outlined, giving rise to a critical framework for case study analysis (Figure 4.1), based on total systems intervention, which is used to assess each case in turn. The relevant research questions and hypotheses are identified and tested in each of the case studies, before drawing preliminary conclusions from that case.

Following completion of the case analysis, a critique is undertaken, and overall conclusions drawn in preparation for the action research phase of the research.

The main objectives of this stage of the research are to test the research questions, hypothesis 1, and (in part) hypothesis 3 (Section 1.6, p.13).

4.2 Case Study Analysis: Two Case Studies and the Theoretical Approach

The *idea* of applying critical theory to research into and development of computer-based information systems (CbIS) is not new, but the approach used in this thesis is the first attempt at the development and application of a *practical* CbIS interventionist method which embodies the key elements of a branch of critical theory. Case study analysis is

employed to test the basic framework in order to evaluate and refine it, using cases in which the relevant problem issues of complexity, human activity and pluralistic problem contexts are present. However, since no evidence has been found, not only of the specific approach, but of *any* CbIS intervention method based explicitly on critical social theory (CSoT), existing cases were not available. To further complicate the situation, whilst the work carried out in this study draws heavily on theory and practice from management science, no explicit information systems interventions have been identified from that domain. This has meant that creative thought has had to be applied to this study in order to develop a framework for case study research.

TSI has helped to provide the solution to this dilemma. Since TSI in critical reflection mode offers a means of critically analysing a problem situation, it was decided to use this approach as a method of critically appraising existing case studies in order to test and refine the TSI methodology to be applied to the action research. To achieve this, TSI has been combined with other recent work to produce a critical framework for case study analysis (Figure 4.1). Although TSI lies at the core of this approach, significant development work has been undertaken as part of this study to synthesise a critical framework explicitly targeted at case study research.

It is not intended that this part of the research be regarded as conclusive, but rather that it be used in forming and refining the interventionist approach, and in assessing it prior to its use in action research. The strategy followed is one of replication, whereby a conceptual framework (Figure 4.1) is set up for the first case, and when used in the second case is tested for repeatability (see Huberman and Miles, 1994 p.436).

In addition, this stage contributes to the triangulation of methods and data (see Chapter 3), which add further weight to the overall findings.

Information for the case studies has been supplied in each instance by the person responsible for implementation in the organisation concerned. The nature of the information collected makes anonymity essential, but supporting records are available on a confidential basis if required.

4.3 The Interventionist Framework for Case Study Research

This interventionist framework for case analysis (Figure 4.1) has been adapted from total systems intervention (Figure 2.4). The case studies are assessed through the application of the three modes (problem solving, critical reflection and critical review) and three phases (creativity, choice and implementation) of TSI, within a recursive structure as identified in Figure 2.5.

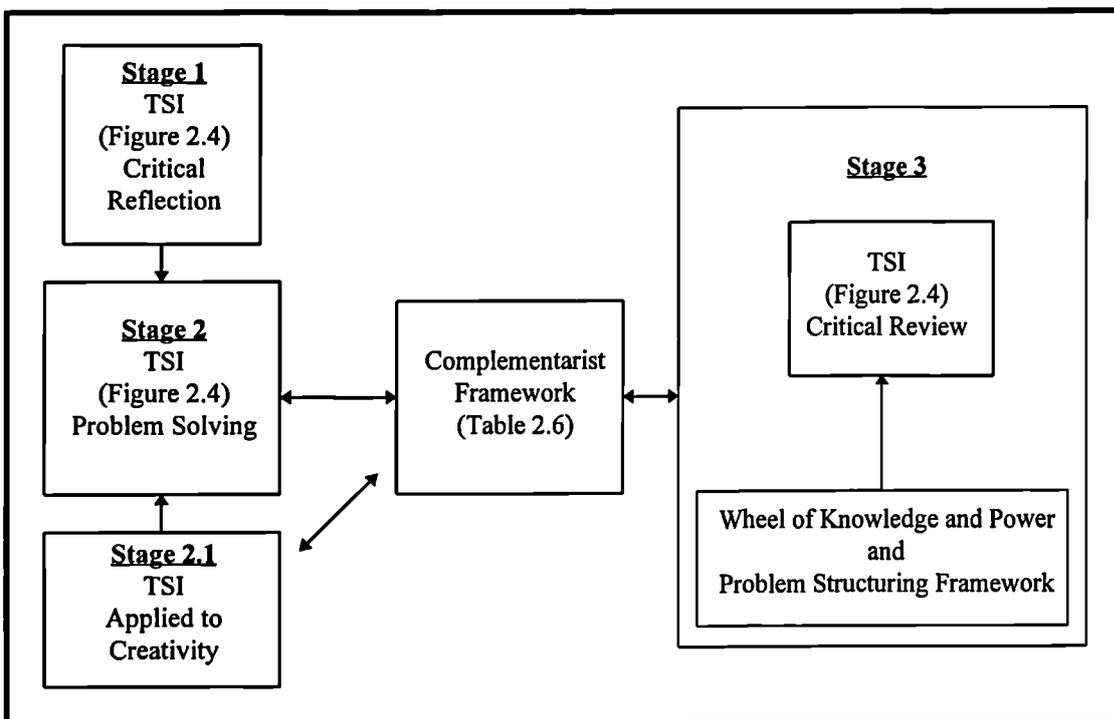


Figure 4.1 A Critical Framework for Case Study Analysis

In stage 1, **critical reflection** is used to critique the existing approach. In stage 2, **problem solving** draws on the findings of the critical reflection phase, and aims to assess how the case might have been approached if TSI had been used. The problem situation is classified in terms of the complementarist framework (Table 2.6), which is based on Habermas' theory of knowledge constitutive interests (Habermas, 1971a). Stage 2.1 applies the whole of TSI to **creativity within problem solving**, supported by critical review (stage 3) for choice of *creative method*. In stage 3, **critical review** is carried out for the intervention proper, to provide the best match of intervention methodologies to the problem context.

Critical review is used to support choice both in problem solving, and in creativity within problem solving. In both it follows the TSI framework of creativity, choice and implementation, and draws heavily on the work of Wilby (1996a) for the detailed process (see Appendix IV for a summary). The aim is to match methodologies to the complementarist framework, and it is here that help is sought from the wheel of knowledge and power (Appendix VI) and the problem structuring framework (Appendix V), which are used to categorise and measure the strength of the relevant methodologies in terms of the problem context and in accordance with the Habermasian framework.

This framework is used to analyse each of the two cases in turn. At each point of the analysis, a scale copy of Figure 4.1 is repeated, with the stage being undertaken highlighted. This stage is then expanded into an explanatory table prior to the descriptive analysis.

4.4 Case Number 1: A Community Information System for a Major Health Services Trust

The Organisation - Background

The part of the organisation concerned in this study is responsible for community health services to a trust which services a total of over 250,000 people, has an income in excess of £30 million, and employs 1200 staff. The Trust operates four hospital units and forty-five other sites, including health centres and clinics. The community information system supports teams located at each of these sites, comprising eleven multi-disciplinary community health care teams. The services provided are wide-ranging, and include health visiting, district nursing, community psychiatric nursing, chiropody, family planning, physiotherapy, and school health.

The culture of the community health care teams is a caring one, consisting mostly of community nursing and therapy staff. The views of employees are, however, highly divergent, making consensus potentially difficult to achieve.

Collection of Information

This case study is of an existing system which has recently undergone substantial redesign. Information has been collected during the course of the project by the person responsible for managing and developing the community information system (the project leader), together with the consultant engaged to assist in the development. The author's connection with the project is that the project leader was at the time, a masters student undertaking an MSc in Information Management, on which the author teaches management information systems. In addition, the author is the project leader's dissertation supervisor. In the course of work conducted for the MSc degree, the project leader, under the author's guidance, undertook a review of the community information system, critiquing it from the perspective of systemic interventionist methods. It is this review that has been used as the basis for the case analysis within this chapter.

Information collected by the project leader has therefore been at first hand, as someone actively involved in all aspects of the project. Information collected by the author has been as the result of a presentation and report by the project leader, and subsequent in-depth interviews.

The Project - Background

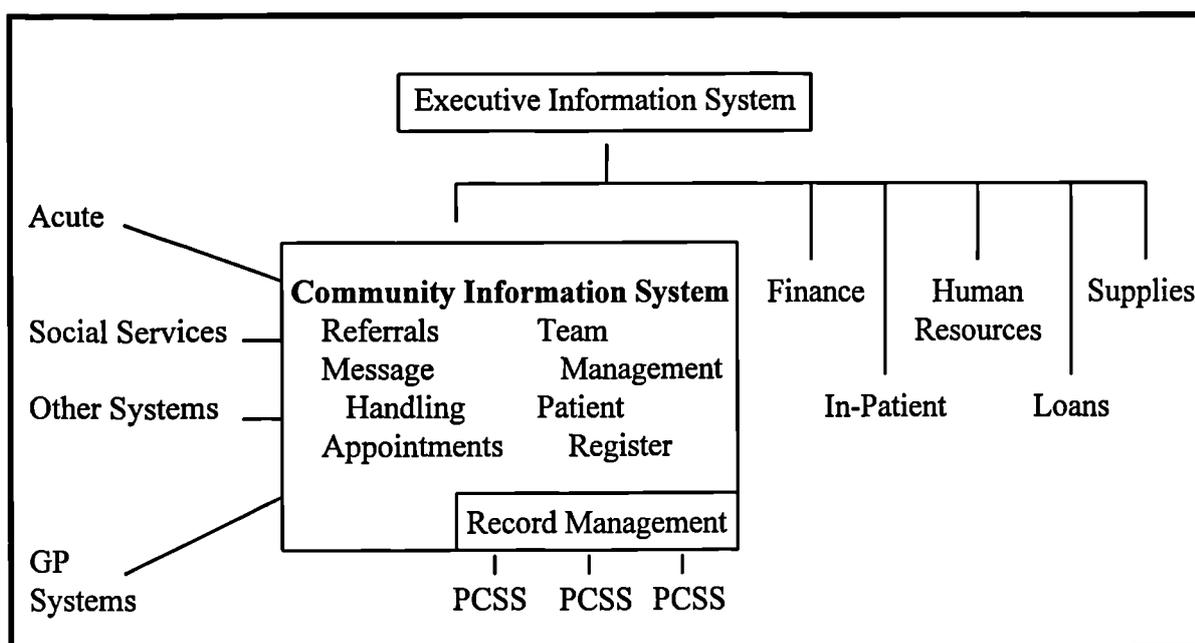


Figure 4.2 Community Information System: Structure and Interfaces

The present community information system is now eight years old, and consists of 80 terminals across thirty-four sites serving twenty-one professional groups totalling over 450 staff. The system is seen to be of little operational benefit, having as its prime task the provision of central statistical information: in the project leader's terms, a "...distraction from patient care". Figure 4.2 above summarises the project to replace this system, the main purpose of which is the facilitation of more integrated patient care with greater continuity.

The project's key aim is to provide a patient-based system, giving operational benefits to care staff, whilst still providing essential information to management and Government.

The present community information system (CIS) is the core of the Trust's existing systems. The project to replace it will keep this existing system as the core, but aims to cater more thoroughly for the needs of the operational teams, liaise with personal clinical support systems (PCSS), and, by linking to other key systems both operational and corporate, provide information to management via the executive information system (EIS). The development of this system aims to follow the stages detailed below:

- Select pilot health care team.
- Select quality control health care team.
- Study needs of health care professionals in pilot health care team.
- Consult GP practices.
- Consult managers and other directorates to draw boundaries.
- Analyse needs.
- Test at workshops.
- Specify requirements.
- Prototype the system.
- Implement pilot system.
- Implement across the Trust.

Health care teams were invited to bid to be the pilot system, and, from the bids, two teams were chosen: one to host the pilot implementation, the other to act as a quality control group to the project. Workshops were held to share findings, check accuracy and acceptability, provide the opportunity to question and raise issues, consult on outstanding issues, and to 'reassure and enthuse'.

Findings of the Implementation Team

These findings have been derived from the original intervention, and represent the views of the participants in that intervention. The information below is drawn directly from observations of the project leader as expressed in presentation and report documentation, and in interviews with the author.

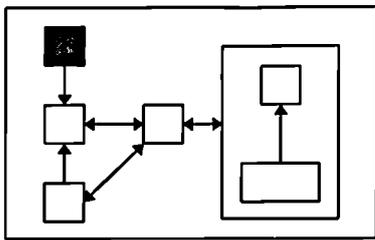
The project leader perceived the situation to be one in which a participative approach was indicated, and initially the development was pursued along these lines, aiming to determine a specification which covered the needs of users. However, following the appointment of a consultant funded by the regional head office, the intervention took a more functionalist direction. The main thrust moved to cost benefit analysis, supported by activity sampling. It was concluded that a system based on personal distributed computing, using lap or palm-top computers, would be needed.

A pragmatic, structured approach has therefore been taken, focused on specifying and developing a computer-based system. Management sought a working system, and, whilst accepting the need for it to meet the requirements of participants, saw this as a secondary goal. The problem became compounded, in the view of the project leader, by the consultant interpreting management pressure as a need to expedite the working system, and relegating participation to a status below that of the need to determine the specification for system development. The overall solution treats the problem situation as a technical one, evidenced by the time spent on hardware definition, communications design, record design, functional specifications, information flows and so on. Eliciting the views of participants is handled within this functionalist, structured framework. It is the view of the participants that management pressure has given rise to the system not delivering the hoped for benefits at an operational level.

The Problem Situation Interpreted Through TSI

This section follows the procedure summarised in Figure 4.1, a model of which is repeated in each sub-section, with the relevant stage highlighted.

Critical Reflection



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

Tables 4.1 to 4.4 below detail the procedure at each stage. In undertaking critical reflection on the existing intervention, the three phases of creativity, choice and implementation are applied in the anti-clockwise mode of TSI. The questions posed at each of the three phases are detailed in Table 4.1 below.

Stage	Mode				
1	Critical Reflection	Phase:	Creativity	Choice	Implementation
		Question:	Were the change proposals most suitable to manage the issues surfaced	Is this an adequate appreciation of the mess	Are these methods most suitable to manage the interacting issues

Table 4.1 Critical Reflection on Case Study Analysis

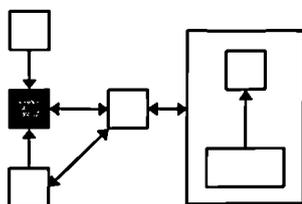
Though the issues surfaced have been mostly people related, the change proposals are very technologically focused. The interpretative views were seen as valuable by the implementation team, but this was lost in the rush to prototype and develop the ‘system’. The use of workshops has been a useful participative element, though operated from within a functionalist approach. The aims of the project are rather inward-looking, and focus on the organisation rather than being client-aware. Whilst there is evidence that the project leader and the consultant showed an awareness of the need for consultation, the outcome, partly as a result of regional office involvement, was a structured development, based on project management techniques.

Critical reflection on choice shows there to have been an inadequate appreciation of the problem situation, which can be categorised as primarily pluralist and coercive, with a mechanistic element resulting from the ultimate need to develop a computer-based system.

The approach taken, by contrast, was to choose pilot teams for which needs would be specified and tested at workshops; an approach which follows largely ‘fixed point’ principles (that systems can be developed to satisfy a specification derived at some fixed point in time - an approach that has been called into question by Paul (1993)).

In implementation, the method(s) used were ill-suited to the problem situation, and failed to manage the interacting human issues.

Problem Solving



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

If TSI had been used to ‘problem solve’ this problem situation, what might have been the outcome? Such an analysis is carried out here, drawing on the critical reflection carried out above, and again following the phases of creativity, choice and implementation; but this time in the clockwise, problem-solving mode. The questions posed in this mode are detailed in Table 4.2 below.

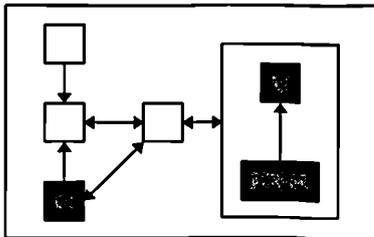
Stage	Mode				
2	Problem Solving	Phase:	Creativity	Choice	Implementation
		Question:	What are the interacting issues to be managed	What are the methods most suitable to manage the interacting issues	What change proposals will best manage the issues surfaced

Table 4.2 Problem Solving Applied to Case Study Analysis

Creativity seeks to determine the interacting issues to be managed. In critical reflection above, it has been demonstrated that the methods chosen did not fit the problem context, which is seen to contain, technical, practical and emancipatory elements. In order to undertake creativity in such circumstances, a relevant methodology for creative thinking within this context needs to be chosen. It is here that the recursive structure of TSI is

important, enabling the whole TSI process to be applied to creativity in the problem solving mode, the purpose being to determine the best method with which to undertake *creativity*. The following section carries out this analysis, before returning to problem solving mode to complete choice and implementation for the whole intervention.

TSI Applied to Creativity



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

The problem solving mode of TSI is used here to manage the creativity process, in which the questions to be answered are given in Table 4.3 below. Where choice of relevant creativity methods and critical review of methods is undertaken, supported by the problem structuring framework and wheel of knowledge and power (Appendices V and VI).

Stage	Mode	Phase:	Creativity	Choice	Implementation
2.1	Problem Solving	Question:	What are the creativity issues	What creative methods are most suitable to manage these issues	How are these methods to be implemented
3	Critical Review	Question:	Details and critiques the candidate methodologies in terms of how they address technical, practical and emancipatory issues in the problem situation	Evaluates the contribution of a methodology to: 1. Creativity, choice and implementation 2. Process, design, culture & politics 3. The TSI principles of systemicity, reflectiveness, emancipation and participation	Provides an overall critique of the candidate methodology based on the outcome of creativity and choice

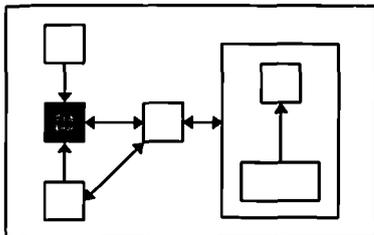
Table 4.3 TSI and Creativity

The task began with 'thinking creatively about creativity'. Informal creative thinking and critical reflection have been applied to this intervention to surface the creativity issues which need to be managed, using metaphor and the complementarist framework (Tables 2.5 and 2.6). The past of the organisation appears as bureaucratic, and governed by mechanistic and coercive influences. Key issues for the future, particularly as regards the community information systems (CIS) development, are the emergence of a stronger socio-cultural thrust, but still with mechanistic and coercive or socio-political overtones. Focus has to be on debate, but only within an atmosphere of liberation. If this can be achieved, design of effective processes can then and only then be undertaken.

Choice addresses the question of what creativity methodologies are best suited to managing the interacting issues which have been surfaced. The wheel of knowledge and power (Appendix VI) and the problem structuring framework (Appendix V) can be used to help inform this choice. The critical review questions indicate that the methodology needs to address the practical and emancipatory interests, contributing to creativity, culture and politics, and the emancipatory and participatory principles of TSI. The conclusions drawn here are indicative of the approach rather than analytical; pointing the way for the future action research based study rather than developing a comprehensive approach to this case; in any event, owing to the post-hoc nature of this analysis, the creativity methodologies chosen are not to be implemented. Were this a 'live' intervention however, it would be appropriate to investigate in more depth a blend of critical systems heuristics and one of the strongly practical methods such as interactive planning as the best vehicle for the creativity exercise.

Problem Solving (Continued)

Now that creativity in the problem solving mode is complete, the process can be taken back to choice in problem solving.



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

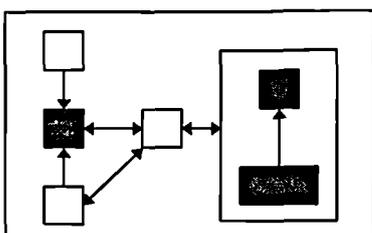
The choice and implementation questions to be answered are detailed in Table 4.2, a copy of which is repeated below.

Stage	Mode				
2	Problem Solving	Phase:	Creativity	Choice	Implementation
		Question:	What are the interacting issues to be managed	What are the methods most suitable to manage the interacting issues	What change proposals will best manage the issues surfaced

Copy of Table 4.2 Problem Solving Applied to Case Study Analysis

The methods chosen to manage the interacting issues in the intervention proper must facilitate *debate* within a coercive and pluralistic environment, but must also support a *design* process in developing the community information system. Choice of methodology now has to address these complex issues by drawing on the tools available in critical review to inform that choice.

Critical Review



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

The available methods have been assessed in depth by use of TSI in critical review mode (Table 4.4), as supported by the problem structuring framework (Appendix V) and the wheel of knowledge and power (Appendix VI).

A description of the key methodologies is given in Appendix III, and an indication of the type of problem situation to which each is most applicable can now be gained by reviewing the position of each on the wheel of knowledge and power (Appendix VI). This positioning is not prescriptive, but is a subjective view of the users of the methods, and will differ according to users and problem contexts.

Stage	Mode				
3	Critical Review	Phase:	Creativity	Choice	Implementation
		Question:	Details and critiques the candidate methodologies in terms of how they address technical, practical and emancipatory issues in the problem situation	Evaluates the contribution of a methodology to: 1. Creativity, choice and implementation 2. Process, design, culture & politics 3. The TSI principles of systemicity, reflectiveness, emancipation and participation	Provides an overall critique of the candidate methodology based on the outcome of creativity and choice

Table 4.4 *TSI in Critical Review Mode*

The most likely candidate methodologies for this intervention are those which address the practical and technical interest whilst encouraging liberation. From Appendix VI, since the issues to be resolved are practical, technical and emancipatory, there are two possible approaches to methodological choice. Either a method could be used which covers multiple problem-contexts; or the intervention could be designed around a number of methods combined under the TSI framework. This gives the possible multiple methods of client-led design, interactive planning, ETHICS, and user software engineering. The alternative is to combine critical systems heuristics and systems analysis and design, with any of the problem structuring methods.

Preliminary analysis of these methods can be undertaken using Appendix V. The decision as to which methods are favoured is a subjective judgement, but is primarily based on assessing whether the emancipatory or the technical issues are seen to dominate, and the nature of practical approach to be given precedence. As a case study to test and inform the approach to action research, in depth analysis of the reasoning behind the choice of methods is not undertaken here; in any event, these are not to be implemented.

The analysis points to a truly complementarist approach, covering technical, practical and emancipatory issues, with a combination of the relevant methodologies creatively designed to fit the problem context. The current approach seems inadequate, and risks perpetuating the existing systems problems within the organisation and failing to serve operational needs.

Testing Research Questions

Question i) To what extent are the principles of critical social theory (CSoT) and critical systems thinking (CST) seen within a practical intervention?

Critical social theory denies the possibility of arriving at objective, verifiable requirements which are the same for all involved since as such they would be independent of human opinion. In Habermasian terms, it sees human activity to be in service of three cognitive interests: technical, practical, and emancipatory.

The *present* approach largely treats the system as objective, and seeks human views within this objective framework. The *new* system similarly takes an objectivist approach. In both, the practical element operates **in service of** the technical, which is prime, whilst coercive influences prevent emancipatory issues being given sufficient consideration. The new system viewed through TSI, surfaces coercion as an important element, but confirms all effort to be in support of the technical interest, so the practical is constrained and the emancipatory suppressed.

In CST terms, there is no evidence of **critical awareness**, the participants exhibiting a 'false consciousness' in respect of their problem situation. The intervention is not **socially aware**: it implicitly assumes that the social framework will adapt to the new technology. **Complementarism** cannot be seen in this intervention, the approach being isolationist or imperialist. Emancipation is not practised, being suppressed by the coercive management style.

The development of a technological solution works within the status quo: participants believe themselves to be objective, but are failing to see the constraints imposed on them and are making 'value laden' decisions. In this way the concept of *a priori* conditions is seen to be evident in this intervention.

Question ii) Taking each of the commitments of CST in turn, how could they be achieved without using an explicitly critical framework?

The evidence of the case is that an explicitly critical framework is necessary if the five commitments of CST are to be met.

As regards **critical awareness**, there is evidence that the practitioners in this case have been self-critical, and that an awareness of the extent to which the problem situation is poorly served by a functionalist approach has surfaced. However, the case equally demonstrates the extent to which the functionalist framework suppresses this, and consequently prejudices the success of the intervention. The intervention itself seems to have been largely applied uncritically, with concentration focused on deriving a specification which could be fixed and then worked toward using project management techniques. It is difficult to see how an iterative, critical approach could be enacted in such a strongly project oriented exercise.

The objective, management driven nature of this case reveals it to lack awareness of the **social** nature of the problem context, and the social context in which the organisation is operating. The implicit assumption is that, once the system is implemented, the social structure will adapt to it.

Theoretical **complementarism** has been circumvented by working from within one theoretical paradigm (functionalism). Whilst acceptable in principle, this seems ill fitted to this particular case, with its functionalist - interpretivist - emancipatory conflicts. The need for methodological complementarism has been recognised in the use of both functionalist and interpretivist methods, but this has been applied on a contingency basis, forcing it to be targeted at the 'real world' problem (the computer system) rather than the true problem context.

The interpretative methods used (albeit within the functionalist framework) are explicitly *participatory*, but a clear **emancipatory** thrust is not in evidence. Within this case, issues of power have been surfaced, but the need to deal with these is being ignored and all effort is in support of the status quo. The current approach expresses a clear objective to serve the operational needs of participants, but lacks the safeguards necessary to ensure that this is achieved.

These two subsidiary questions contribute to the key research question, which asks whether the interventionist framework can be seen to give rise to improvements in CbISD. These findings are drawn from the section in which TSI is applied to the problem situation in problem solving mode.

The creativity exercise began by 'thinking creatively about creativity', using the recursive structure of TSI. This surfaced the creativity issues and enabled choice of creative methods. Had this been an actual intervention, these methods would then have been available to the creativity phase of the intervention proper, where methodologies with which to undertake the intervention would have been chosen and implemented. All of this raises new issues in the case: issues which ask the 'what' or debating questions, and seek to find out more about the problem context to which the new system is to be applied. This contrasts with the existing approach, which is focused predominantly on the 'how' or design questions, but bases that design on only a partial (management) view of the problem situation.

The analysis therefore suggests that, had TSI been used, the relevant technical, practical and emancipatory issues would have been surfaced and the methodological approach would have been enhanced, within an explicitly critical and complementarist framework. There remains, however, doubt as to whether it would have proved possible to *address* the emancipatory issues, even within a TSI informed process. Coercion is a significant problem, and only by trying to apply an explicitly emancipatory methodology could this issue have been tested. The evidence of the case suggests that management would be unlikely to support this.

Hypothesis Testing

To test the hypotheses, the following section first determines whether the system under development can be regarded as a human activity system. The original approach taken to the development is then compared to the interpretation of the problem situation through total systems intervention, and from this discussion the hypotheses are then tested.

One of the key aims of the new system development was to serve participant needs. Whilst this may not be seen automatically to imply a requirement to view the system as one of human activity, it is argued that, in this case, the loss of a human activity focus in the original development was a contributory factor in the failure to meet the needs of participants. The nature of those participants, comprising mostly nursing and therapy staff, plus patients and managers, gives a human activity system containing divergent views which need to be kept under constant review, and within which consensus is seen to be hard to achieve.

It is therefore proposed that viewing the system as one in which human activity is a key factor will significantly enhance the intervention.

The current approach was initially participative. No particular method was followed, but the process began with participatory discussions in workshop groups. As the development progressed, however, the participatory element was largely lost as a more structured approach was taken, leading to a hard systems focus.

Seen through TSI, a critical and emancipatory theme runs through the approach, which highlights shortcomings in the original methods. In creativity, critical reflection shows a technological focus and lack of 'client awareness', leading to the adoption of a project management solution which was uncritically accepted and applied.

Applying TSI in problem solving mode to determine a creative method to be used, shows the creative issues to be technical, practical and emancipatory. TSI enabled thinking creatively about creativity, surfacing a need for debate, but only within a liberated (non-coercive) environment. This led to choice of creative method, where the surfacing, through critical review, of emancipation and debate as prime, determined an approach based on critical systems heuristics and interactive planning as the most relevant.

In choice, critical reflection shows unaddressed coercion and pluralism within the problem situation, which has been approached with structured methods which need unitary agreement. Problem solving on choice surfaces emancipatory and complementarist issues, to which the likely outcome, it is suggested, would be continuance of the intervention with a method crafted to fit practical interest within an emancipated environment with the need to achieve a technical solution.

As a result, implementation is seen to have failed to manage the interacting human issues within this problem situation.

Hypothesis 1 It is preferable that computer-based information systems which are rich in human activity are not developed using methods which fail to address critical, complementarist and emancipatory issues.

Human activity is a key factor in this case. In such interventions, the foregoing analysis has raised a strong case for information systems development to be based on some form of social action theory. If the theoretical premises contained in Habermas' interest constitution theory are accepted, the case studied above supports hypothesis 1.

Hypothesis 3 Negative hypothesis: all the benefits seen to accrue from the use of interventionist methods explicitly based on CSoT are achievable by regulative means.

The case demonstrates that, in this particular problem situation, hypothesis 3 cannot be supported. The critical, social and complementarist commitments of critical systems thinking (CST) seem not to have been attainable under the existing structured approach.

4.5 Case Number 2: Negative Case - An Information System for Outplacement Support in a National Utility

The Organisation - Background

The organisation is a large utility split into twelve regions and a headquarters, and serviced by thirteen different systems. Vertically integrated, it has historically been highly bureaucratic, hierarchical and political, status oriented, with a blame culture. There has been little competition, forcing a rather inward focus. Staff are accustomed to high levels of job security, with the organisation being significantly overstaffed. The impact of information technology has been low.

The effects of privatisation and increased competition are forcing change, with a more outward focus (toward customers, exploration etc.). The organisation has been split into four companies, with the aim of reducing the status culture and generating empowerment within a non-blame culture characterised by open communications. The common systems necessary to these changes imply high information technology and information systems usage and lower core staffing levels.

Collection of Information

This case study is of a system which was designed to meet a specific requirement. Primarily, information has been collected during the course of the development by the person responsible for managing and developing the outplacement support system (the information systems developer or ISD). The author's connection with the project is that the ISD was a masters student undertaking an MSc in Information Management, on which

the author teaches management information systems. A presentation and report critiquing the intervention from the perspective of systemic interventionist methods was undertaken by the ISD, under the author's guidance, as part of the taught element of this course. This has subsequently been supplemented by in-depth interviews of the ISD by the author.

The Project - Background

Staff rationalisation has led to significant redundancy and staff redeployment. The organisation's outplacement support function aims to support redundant personnel through to redeployment within the organisation or placement outside. Prior to development of the computer-based outplacement support system, such support was informal, using third parties as recommended by the personnel department. The project was conceived as a result of the need to provide outplacement support for a workforce reduction of at least 25000 by the year 2000. This system must, as a minimum, supply:

- Curriculum vitae preparation.
- Counselling.
- Training.
- Job search.
- Information centres.
- Distance learning.
- Re-employment.

Since the nature of the problem was not clearly identified, the project began with the information systems developer (ISD) spending some time reflecting on the problem situation. The picture derived was of participants with little understanding of information technology (IT), but having a solid grasp of their own problems. Two exploratory sessions were set up, using rich pictures and brainstorming, to surface the issues, and a rich picture was developed by consensus. The key problems that emerged were: a need to define the specific information requirements, including the required functionality of the system; a decision regarding the number of installations and life of the system; the nature of reports required and their frequency; the external links to and from the system.

A research project was undertaken to find out what was needed. The ISD saw the problem situation as having a complexity which resulted from the human activity within the system. It was decided that two computer-based systems would be developed: one to

manage the outplacement centres and one to provide management information. The actual system was developed by prototyping. Problems encountered, most of which were the result of the organisation's old culture clashing with the new (e.g. IT departments in the organisation were resistant to the changes), were overcome participatively.

Findings of the Implementation Team

As with Case 1, these findings have been derived from the original intervention, and represent the views of the participants in that intervention. The information below is drawn directly from observations of the ISD as expressed in presentation and report documentation, and in interviews with the author.

The intervention was a mixture of hard and soft approaches, with a frequent need to cross over from one to the other. This was facilitated by an information systems developer (ISD) whose style is highly participative, reflective and self-critical. Consequently the intervention used a participative approach leading to a structured development. The problem context exhibited a complexity resulting from the high level of human activity, with the 'solution' being seen as relatively simple. The ISD perceived the problem situation to require both theory and practice - in his terminology 'thinking and doing', and he considered it to reflect the validity of the first two laws of consultancy (Weinberg, 1985):

Law 1 In spite of what the client may tell you there is always a problem.

Law 2 No matter how it looks at first it is always a people problem.

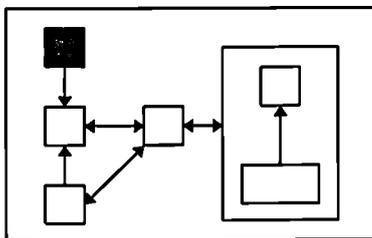
The outcome from the perspective of the participants is that they were not involved in the development of the system, which became expert focused under the control of the ISD.

The Problem Situation Interpreted Through Total Systems Intervention

This section applies the same process as that taken for Case 1, and marks the beginning of the author's interpretation of the case.

Critical Reflection

Repeated below, and in each subsequent section, is a scale copy of Figure 4.1, on which the shaded area indicates the part of the case study analysis being undertaken in this section.



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

In undertaking critical reflection on the existing intervention, the three phases of creativity, choice and implementation have been applied in the anti-clockwise mode of TSI. The questions posed at each of the three phases are detailed in Table 4.1 below.

Stage	Mode				
1	Critical Reflection	Phase:	Creativity	Choice	Implementation
		Question:	Were the change proposals most suitable to manage the issues surfaced	Is this an adequate appreciation of the mess	Are these methods most suitable to manage the interacting issues

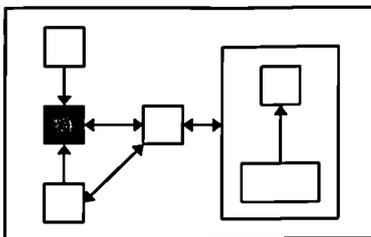
Copy of Table 4.1 Critical Reflection on Case Study Analysis

Creativity shows the problem situation to be highly human-centred, but with the objective of developing a system to meet the human needs. The choice of brainstorming techniques in exploratory sessions was very relevant to the problem context. The initial choice of participative methods did show an adequate appreciation of the 'mess'. The interacting issues which emerged during the intervention were managed by the use of the methods chosen. However, when the project progressed to systems development, a highly contingent, prototyping approach was taken. The evidence suggests that this resulted in

the specification being fixed. Subsequently the project was seen to be successful. However, the ISD, it transpired, made ongoing amendments to the specification as the system developed. The movement between paradigms was actually a contingent ‘flip-flopping’ from participative to functionalist methods, which ‘succeeded’ because the ISD took decisions to satisfy participant needs which were assumed to be unitary.

The question of how this approach managed the interacting issues is left until after the application, in the following section, of the problem solving mode of TSI to the case.

Problem Solving



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

TSI in problem solving mode is used here, drawing on the critical reflection carried out above, and again following the phases of creativity, choice and implementation; but this time in the clockwise, problem-solving mode. The questions posed in this mode are detailed in Table 4.2 below.

Stage	Mode	Phase:	Creativity	Choice	Implementation
2	Problem Solving	Question:	What are the interacting issues to be managed	What are the methods most suitable to manage the interacting issues	What change proposals will best manage the issues surfaced

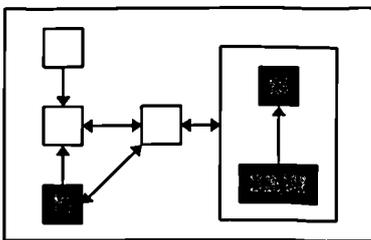
Copy of Table 4.2 Problem Solving Applied to Case Study Analysis

Through creativity the problem situation has been interpreted as human-centred but relatively simple, being characterised by an absence of coercion and strong potential for consensus. Whilst the organisation is undergoing significant change, participants in this development are assumed to be committed to that change and to have similar goals. The

interacting issues to be managed are centred on design of a system to meet these agreed objectives.

Choice of creativity method(s) would now depend on the extent to which practical or technical issues are seen to be of the most importance, and in this case the practical are prime, but with a target of producing a working system. As with Case 1, these methods can now be assessed in depth by use of TSI in critical review mode.

TSI Applied to Creativity



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

The problem solving mode of TSI is used here to manage the creativity process, in which the questions to be answered are detailed in Table 4.3 below. Where choice of relevant creativity methods is undertaken, critical review of methods is used, supported by the problem structuring framework (Appendix V) and wheel of knowledge and power (Appendix VI).

The creativity of stage 2.1 demonstrates the creativity issues as a need to address a problem situation which is moving rapidly from a bureaucratic past to a socio-cultural future, where the practical interest is seen to be prime. System development needs to be in service of this interest, and consensus forming is judged unproblematic. The general choice issues are covered in Case 1, and are not repeated here. Specifically, the critical review questions again point to methodologies which address the practical issues as prime, contributing to creativity, implementation, culture and design, and adhering to the participatory principle of TSI.

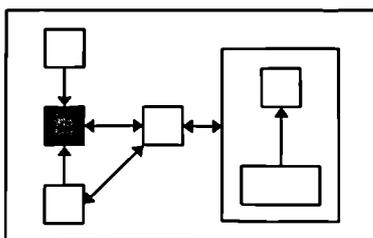
As a retrospective case analysis, the creativity process must end with choice of creative method(s), since the method(s) chosen is not to be implemented. However, from the wheel of knowledge and power (Appendix VI), the method(s) to be investigated in more depth would now be drawn from those which serve the practical interest: interactive planning, pyramids, soft systems methodology, SAST, SODA and client led design.

Stage	Mode	Phase:	Creativity	Choice	Implementation
2.1	Problem Solving	Question:	What are the creativity issues	What creative methods are most suitable to manage these issues	How are these methods to be implemented
3	Critical Review	Question:	Details and critiques the candidate methodologies in terms of how they address technical, practical and emancipatory issues in the problem situation	Evaluates the contribution of a methodology to: 1. Creativity, choice and implementation 2. Process, design, culture & politics 3. The TSI principles of systemicity, reflectiveness, emancipation and participation	Provides an overall critique of the candidate methodology based on the outcome of creativity and choice

Copy of Table 4.3 TSI and Creativity

Problem Solving (Continued)

Now that creativity in the problem solving mode is complete, the process can be taken back to choice in problem solving.



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

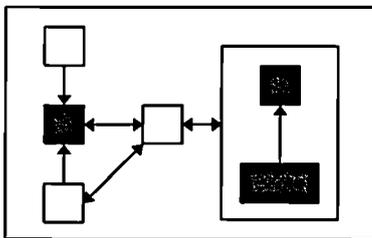
Stage	Mode				
2	Problem Solving	Phase:	Creativity	Choice	Implementation
		Question:	What are the interacting issues to be managed	What are the methods most suitable to manage the interacting issues	What change proposals will best manage the issues surfaced

Copy of Table 4.2 Problem Solving Applied to Case Study Analysis

The choice and implementation questions to be answered are detailed in Table 4.2, a copy of which is repeated above.

The methods chosen to manage the interacting issues in the intervention proper must facilitate *debate* within an environment where consensus is seen to be achievable, whilst supporting a *design* process in developing the outplacement support system. Choice of methodology now has to address these issues by drawing on the tools available within the critical review stage to inform that choice.

Critical Review



Scale Copy of Figure 4.1 A Critical Framework for Case Study Analysis

These methods can be assessed in depth by use of TSI in critical review mode (Table 4.4), as supported by the problem structuring framework and the wheel of knowledge and power.

Stage	Mode				
3	Critical Review	Phase:	Creativity	Choice	Implementation
		Question:	Details and critiques the candidate methodologies in terms of how they address technical, practical and emancipatory issues in the problem situation	Evaluates the contribution of a methodology to: 1. Creativity, choice and implementation 2. Process, design, culture & politics 3. The TSI principles of systemicity, reflectiveness, emancipation and participation	Provides an overall critique of the candidate methodology based on the outcome of creativity and choice

Copy of Table 4.4 TSI in Critical Review Mode

The approach used for the critical review of methodologies, and a critical review of selected methodologies, is detailed in Appendix IV.

The problem situation to be managed can be assessed as predominantly one in which the issues to be resolved are in service of the practical and technical interests, and the probable choice would be either client led design, or a blend of a soft methodology and systems analysis and systems engineering. This differs from the actual approach taken, in that it does not indicate a contingent method, but rather the application of the mix of methodologies in a truly complementarist fashion.

Testing Research Questions

As in Case 1, the research questions and hypotheses detailed in Section 1.6 (p.13) can now be tested.

Question i) To what extent are the principles of critical social theory (CSoT) and critical systems thinking (CST) seen within a practical intervention?

The approach taken to this project was initially highly participatory, but always governed by the need to produce, fix and meet a system specification. This resulted in a contingent, objective approach, albeit firmly rooted in a participatory inquiry. Viewing the system

through TSI, accepts that coercion or emancipation are not key issues in this intervention, but sees the need for a complementarist approach to replace the contingent one. The original approach sets design and debate against one another, with design emerging the winner, in which the participants believe themselves to be objective, but are actually acceding to a design within the *a priori* conditions: there is no *critique*. This point can be developed by looking at how the principles of CST are seen in this case.

There is evidence of **critical and social awareness** in the participatory style, but only within the *a priori* conditions of the problem situation, the participants exhibiting a 'false consciousness' in respect of this. **Complementarism** is not practised: movement from practical to technical issues is seen as unproblematic.

Question ii) Taking each of the commitments of CST in turn, how could they be achieved without using an explicitly critical framework?

As with Case 1, the evidence of this case is that an explicitly critical framework is necessary if the five commitments of CST are to be met.

As regards **critical awareness**, there is no evidence of an explicitly critical approach, the intervention having been conducted within the status quo, and focusing on deriving a specification which could be fixed and then worked toward using project management techniques. The strongly participative nature of the approach shows an appreciation of the social aspects of the problem context, whilst external linkages indicate awareness of the social context in which the organisation is operating. **Complementarism** is not practised. The intervention assumes no difficulty in crossing the functionalist and interpretivist paradigms. The methodological approach is essentially a contingent one, focusing on human elements or the 'real world' system as the circumstances dictate. Interpretative, participatory methods are employed, but **emancipation** is not seen to be a relevant issue.

As with Case 1, these two subsidiary questions contribute to the key research question, which asks whether the interventionist framework can be seen to give rise to improvements in CbISD. These findings are drawn from the section in which TSI is applied to the problem situation in problem solving mode.

Initial creative thinking (Table 4.2) revealed an absence of coercion. The objective was therefore to find a method which was primarily participatory, but which could contribute to the system design effort. What emerged through the critical review process pointed to a soft methodology at the creativity stage, and client-led design or a blend of a soft methodology with systems analysis and systems engineering for the intervention proper. Applying these in the explicitly critical TSI framework would give the iterative, recursive approach which would allow the evolving socio-cultural nature of the organisation to be kept in view during the intervention, whilst being more conducive to the development of a computer-based system for which there exists an evolving specification.

Hypothesis Testing

As with Case 1, the following section first assesses whether the system of study may be regarded as a human activity system. The original approach is then compared to the problem situation seen through TSI, and as a result of this the hypotheses are tested.

The system aims to assist outplacement, and explicitly seeks participant views on the support they need. It is therefore argued that the development is highly participant or human activity focused.

In the original approach, the problem lacked a clear definition. The information systems developer aimed to get this from participants by exploring their problems through SSM, with the objective of achieving consensus toward a unitary goal for which design could be undertaken. It was perceived, however, that although highly participative, it was necessary to adopt, within this interpretivistic context, a functionalist approach to developing the ultimate system.

The problem situation appears quite different when seen through TSI.

Firstly, in creativity, the original approach saw the problem situation as human centred, and applied what appear to be the highly relevant methods of brainstorming and SSM. However, as with Case 1, critical reflection shows these to have been uncritically applied.

The application of creativity in the problem solving mode of TSI shows the problem context emerging as human centred, but with little evidence of coercion, and a strong possibility of achieving consensus. Choice of creative method, however, needs to take account of the organisation moving from a bureaucratic past to a socio-cultural future. The practical interest needs to be the main focus.

In choice, the original intervention was split into two parts. The interpretative work aimed to derive a unitary goal, whilst the functionalist element designed to the fixed specification derived from this goal: an essentially functionalist, isolationist approach. Choice within the problem solving mode of TSI points to a method which will enable debate in a non-coercive environment and in support of a design process. Supported by critical review, this surfaces a practical and technical method such as client led design, or a blend of interpretative and functionalist methods.

Hypothesis 1 It is preferable that computer-based information systems which are rich in human activity are not developed using methods which fail to address critical, complementarist and emancipatory issues.

This was a case study in which the human activity element was of primary importance. The results of the case support hypothesis 1, and point further toward the value of pursuing this approach in a computer-based information systems intervention.

Hypothesis 3 Negative hypothesis: all the benefits seen to accrue from the use of interventionist methods explicitly based on CSoT are achievable by regulative means.

Hypothesis 3 cannot be supported in this case. Critique and complementarism is seen to be enhanced if the interventionist approach is explicitly based on CSoT, and the overall intervention surfaces issues hitherto hidden.

4.6 Conclusions from the Case Studies

Analysis of Case 1 points to benefits accruing from the critical approach which have the potential to overcome many of the problems inherent in the current functionalist dominated one. The critical, complementarist and emancipatory commitments of CST have all been shown to have value in this situation.

Case 2 confirms the validity of the TSI approach, which offers benefits not evident in the original approach taken.

Analysis of the two cases therefore points to the value of the critical approach to CbISD, with Case 1 offering stronger evidence, but further supported by the findings of Case 2.

The interventionist framework (Figure 2.5) has been shown to be of value, with the problem solving, critical reflection and critical review modes and the creativity, choice and implementation phases of TSI all making a contribution to the understanding of human-centred CbISD. *How* critique might be carried out could be debated, but decomposing the existing system is seen to be enhanced by critical appraisal; an element not explicitly provided by the original methods. In addition, the effectiveness of the iterative and recursive nature of TSI has been demonstrated.

In problem solving within TSI, consideration of alternative methods is seen to be beneficial, since otherwise the method is chosen ahead of the problem context being known. A strong argument has been raised that this choice cannot be made on isolationist or imperialist grounds. Further, whilst a pragmatist solution is possible (e.g. multiview, or simply 'pick and mix'), such an approach will, it is argued, lead to an objectivist, goal directed, focus, where the real world system is the key issue, and participant issues are hard to keep in view.

Within this case study analysis, there has been no opportunity to include the conclusions drawn from the review of action research methods in Chapter 3. Those conclusions, together with the findings of this chapter, provide the interventionist framework incorporating action research (Figure 3.2). It is this framework that is now applied to the major CbIS intervention in Chapter 5.

Chapter 5

Participatory Action Research: The University of Luton Student Records System

5.1 Introduction

This chapter applies the critical complementarist framework derived in Chapter 2, and refined in Chapters 3 and 4 (Figure 3.2), to a major action research based intervention into the student record systems at the University of Luton.

The objectives, research questions and research hypotheses (Section 1.6, p.13) are addressed, the theoretical approach to this application of participatory action research discussed, and the interventionist framework, based on total systems intervention and human inquiry, is reiterated. A brief background to the University student record systems, which are to be the focus of the study, is given, together with an outline of the current systems. Appraisal of these existing systems, and the approach adopted to developing them, demonstrates shortcomings which this new approach has the capability to overcome.

A schematic breakdown of the intervention is provided, and the intervention is then thoroughly described and critiqued. It is seen to consist of operational and strategic elements, all controlled under the overarching framework enabling a complementarist approach which facilitates cross-paradigmatic analysis.

A clear set of recommendations, already passed to the University management, is provided, research hypotheses and research questions are tested, and conclusions are drawn.

5.2 Participatory Action Research

This action research phase will address all of the research questions and hypotheses, with a particular focus on hypothesis 2, which was not addressed in the case study analysis.

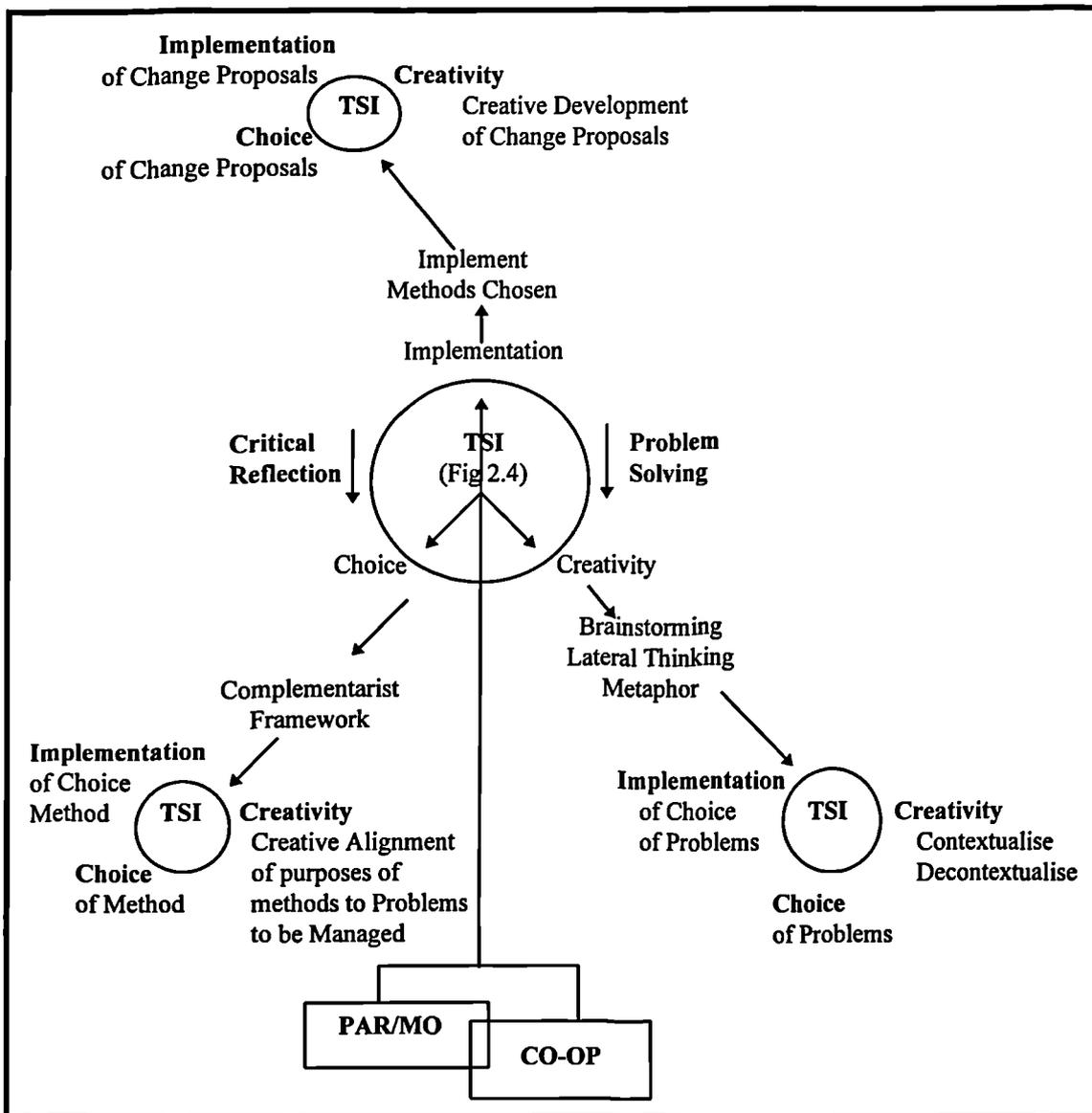
The Theoretical Approach

This thesis develops and applies a *practical* CbIS interventionist method which embodies the key elements of critical theory. The theoretical investigation and framework development (Chapters 1 and 2), and the case studies (Chapter 4), have demonstrated the

value of this ‘critical complementarist’ approach to CbISD. In particular, the critical appraisal of earlier case study work has enabled the interventionist framework to be refined (Figure 3.2 below) for application to a participatory intervention.

The Interventionist Framework

TSI is to be used as the basic framework for this intervention (Figure 3.2).



Key: TSI Total systems intervention.
 PAR Participatory action research.
 MO Militant observation.
 CO-OP Co-operative inquiry.

Copy of Figure 3.2 An Interventionist Framework for CbISD Incorporating the Findings from Action Research

Since this is a 'live' intervention, the cycle through TSI differs from that used for case study analysis (Figure 4.1), although the stages undertaken are the same. The University of Luton intervention begins with creativity within the problem solving mode, followed by critical review and critical reflection. At each phase the full TSI process is available to address the issues surfaced (so, for example, TSI in problem solving, critical review and critical reflection modes can be applied *within* creativity). This recursive application will be seen to be of particular relevance in the creativity phase of this intervention.

The detailed application of TSI to the problem situation is covered in Section 5.4 below. The framework to be used in this intervention represents a synthesis of TSI with human inquiry. The review of human inquiry, and in particular its relevance to critical systems thinking (CST) and TSI, has led to the determination of a number of key issues to be kept in view during the progress of the intervention (see Section 3.6, p.54).

5.3 The University of Luton Student Records System: Background and History

The Organisation

Figure 5.1 below shows the position of the student record system in the organisation. The system both serves the six faculties, and provides information to management for internal and external reporting. The Management Information Systems Quality Group (MISQG) acts as a filter through which the performance of the system is monitored and development is discussed. The output of the MISQG passes to the Management Information Systems (MIS) department, where decisions are arbitrated by the Finance Director.

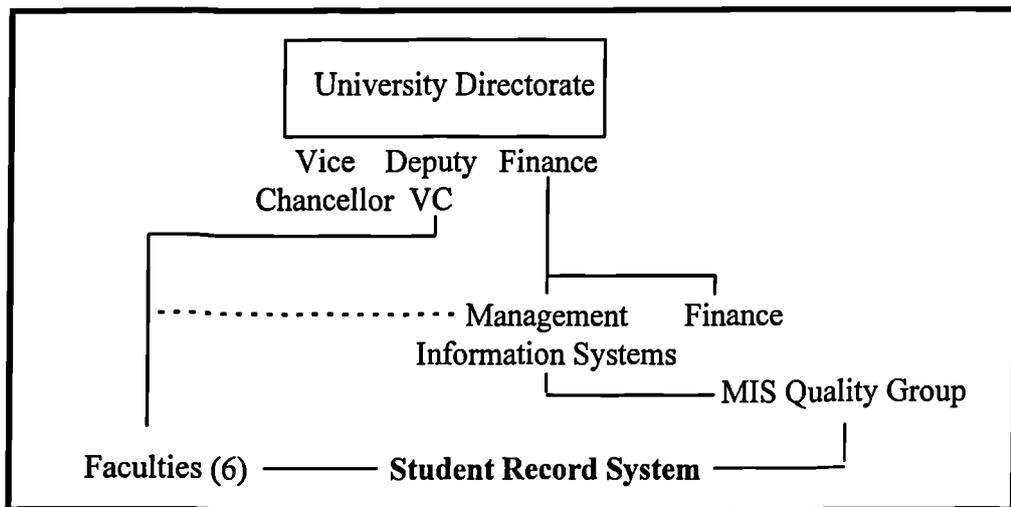


Figure 5.1 *University Organisation Chart - the Relevant Section*

The University of Luton gained university status in July 1993. In the five years prior to this, following the Education Reform Act of 1988, and in the immediate subsequent years, the University underwent extensive change. To manage this change, a decision was taken to alter the course based structure, under which programmes of study are taught throughout the three terms of the academic year, to a modular structure, with students compiling their own programmes of study consisting of modules chosen from anywhere in the University. Under modularity, the teaching year is split into two semesters each of fifteen weeks, with modules being taught and examined in a single semester. The course based structure had courses located within a faculty, and was clearly defined in terms of what had to be studied to gain the given award. Most courses were well established, with the management and delivery of them tried and tested over a number of years. The change which the new scheme has necessitated, and the management of that change, is covered in detail elsewhere (Clarke and Lehaney, 1997a), but may be summarised under four headings relevant to this study:

-
- The introduction of the modular scheme, under which faculties now offer fields of study within which are a number of modules. In principle, a student can build a study programme by drawing modules from anywhere in the scheme, subject to certain constraints.
 - Change to a semester based year, whereby each module is now studied over fifteen weeks rather than the previous thirty-six, with the attendant alterations to teaching and assessment strategies.
 - Increased numbers. The growth over the last four to five years has been from less than three thousand full-time-equivalent students to around fourteen thousand.
 - The shift of emphasis at undergraduate level to almost all degree level work.

The change was effected over a time-scale of one to two years, forcing certain key elements to be compressed into a few months, one of which has been the development, beginning in 1992/3, of a centralised management information system (MIS) to control student records.

The University of Luton Higher Education Management Information System (HEMIS) is computer software designed to control student records under a modular framework, and provide management information from those records. It is a mini-computer based (Digital VAX) system, written in Oracle (a proprietary data base). At the end of 1991 some ten higher education (H/E) institutions combined to determine what was needed, and HEMIS was the result. HEMIS was initially taken up by two H/E institutions (Luton and Nene). Implementation at Luton was completed for the academic year 93/94. so that it is now in its fourth full year of operation.

Preliminary Investigation

(The documents referenced in this investigation are listed in Appendix XI, p.299 , and copies are available on request).

The preliminary investigation (Figure 5.2) began with almost a year spent by the author assessing the strategic implications of the student record MIS (Clarke, 1994; Clarke and Merchant, 1995; Clarke and Lehaney, 1997a). During this time, the MIS Quality Group (MISQG) was formed to advise the Director of Finance on MIS matters.

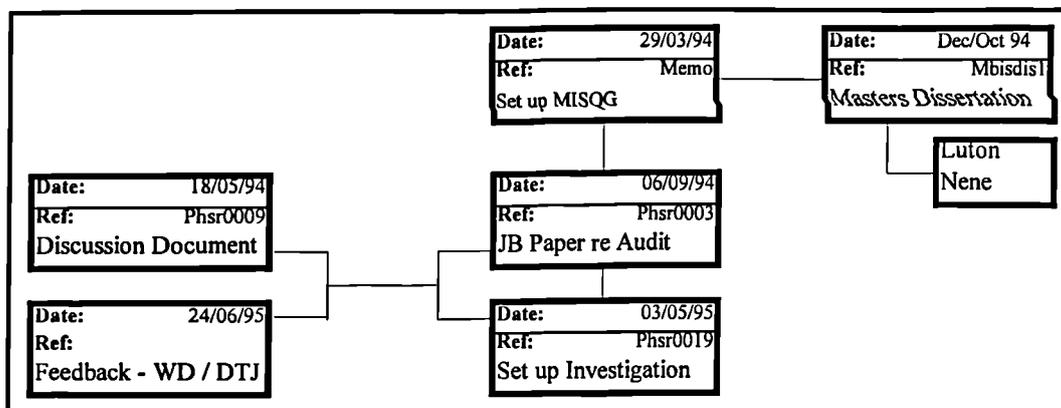


Figure 5.2 *Preliminary Investigation Prior to Action Research*

This investigation revealed that development of HEMIS to date had taken a structured approach (Clarke, 1994). The development was expert driven, under the control of The University of Luton Management Services, and EMIS Ltd, the system developers. The user was seen as The University of Luton central administration, and concentration was on supplying accurate and timely management information. This development largely succeeded in providing the information envisaged in the initial implementation phases. However, in early 1994, it became clear that more benefit could be derived from the system in terms of what it offered to end users, particularly at the faculty level, and that a greater concentration on such end user issues would serve to improve the quality of information provided in a number of areas.

A study was undertaken at that time (Clarke, 1994) from which there emerged a number of key findings relevant to this research. Primary among these was an opportunity to improve the timeliness and quality of information provided by the system, in which key factors are seen to be a reduced reliance on printed output, and increased on-line input facilities. Further, there is a belief that HEMIS could do more to reduce operational workloads, much of which are still served by personal information systems outside central control.

The Management Information Systems Quality Group (MISQG) was set up in March 1994 (for the terms of reference see Appendix VIII). Whilst its aims were framed in mostly operational terms, there quickly developed a recognition of both operational and strategic needs, the latter of which was served initially by the strategic investigation undertaken between December 1993 and October 1994 (Clarke, 1994). In September 1994, an audit was instigated by the MISQG Chair (Phsr0003), the objective of which was to derive a user view of student record MIS. Owing to a low response rate, the audit had limited success, but it was instrumental in the MISQG setting up an investigation into the needs of faculty access to the MIS. On 14 May 1995, a discussion document (Phsr0009) was circulated, and formed the basis on which approval was given to proceed with this investigation, facilitated by the author, on 7 July 1995.

Purpose and Aims of Intervention

Initially the aims were very loosely stated. The Management Information Systems Quality Group (MISQG), responding to requests from management at central and faculty levels, required greater faculty access to the student record management information systems (MIS). Faculty access was not, at this point, clearly defined, but it was accepted that it implied an investigation of 'user needs'. This required a change from the present development path, where concentration had been on a centralised information system aiming to provide accurate *management* information, and had forced a focus on structured, project management techniques. As Walsham (1993) has observed, the tendency with such an approach is to create inflexible systems, which fail to adequately serve the human participants. To enhance the approach to be taken, the system to be the subject of

the intervention needed defining; at least in terms of its boundaries, and the subsystems of which it was comprised. Such a definition is discussed below.

Student Recording and Monitoring as a System

The way in which a system such as this is perceived is a key factor in the selection of any approach to improving it. Previous approaches adopted by the University may be categorised as methodologically isolationist (Jackson, 1987), though this has been implicit rather than explicit. This structured approach is represented by Figure 5.3 below, and forces focus on to a definable problem, locating analysis in the functionalist paradigm (Burrell and Morgan, 1979 p.25 - see Figure 2.1), and leaving user issues in the role of supporting the design process from outside the system.

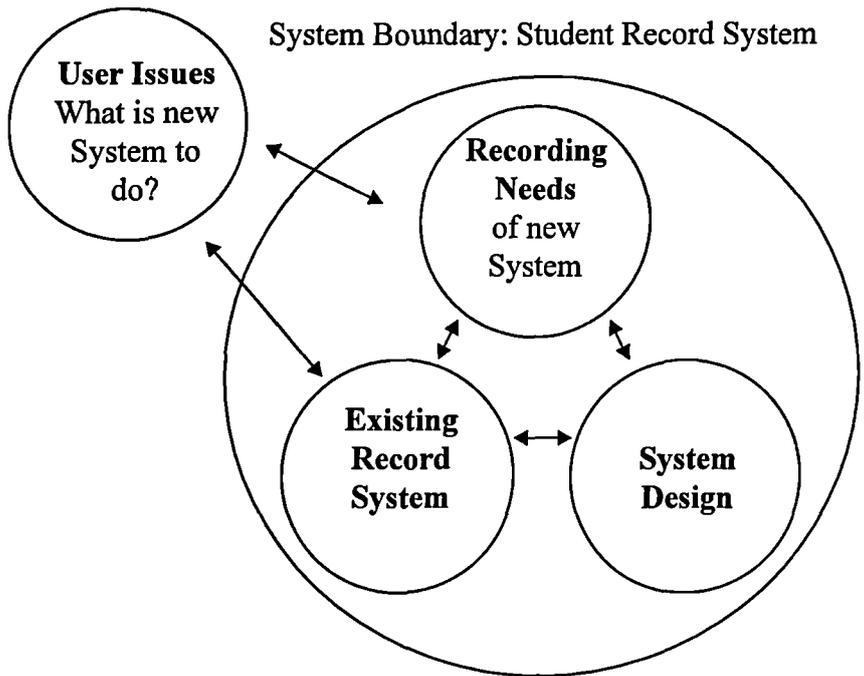


Figure 5.3 The Functionalist (Partial) Systems View

Such a view can be contrasted with the total systems view advocated here, which is shown in Figure 5.4.

System Boundary: Student Recording and Monitoring

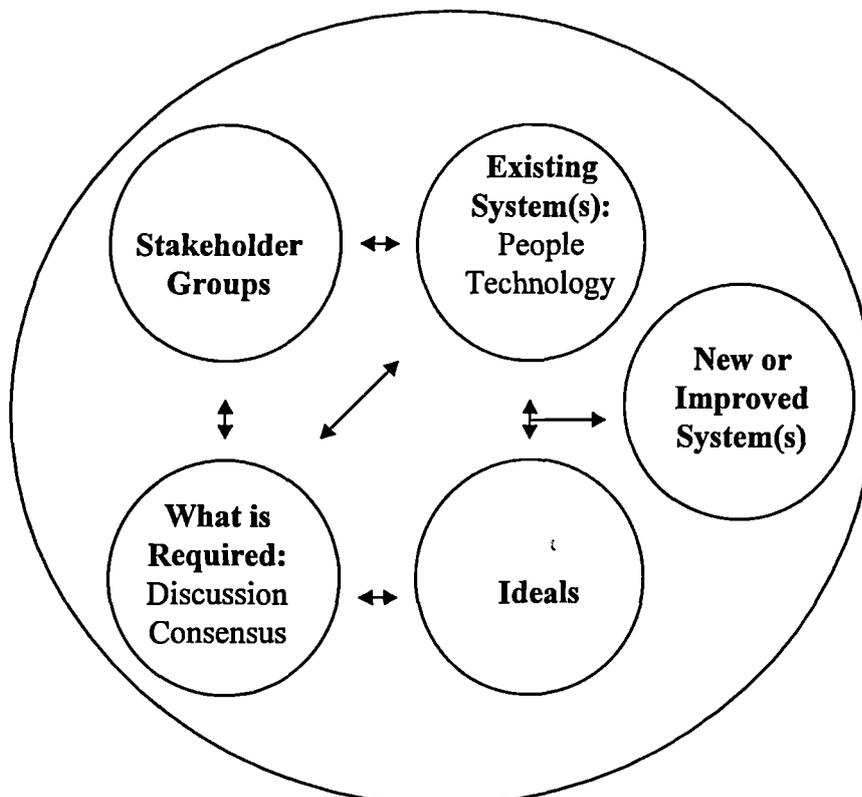
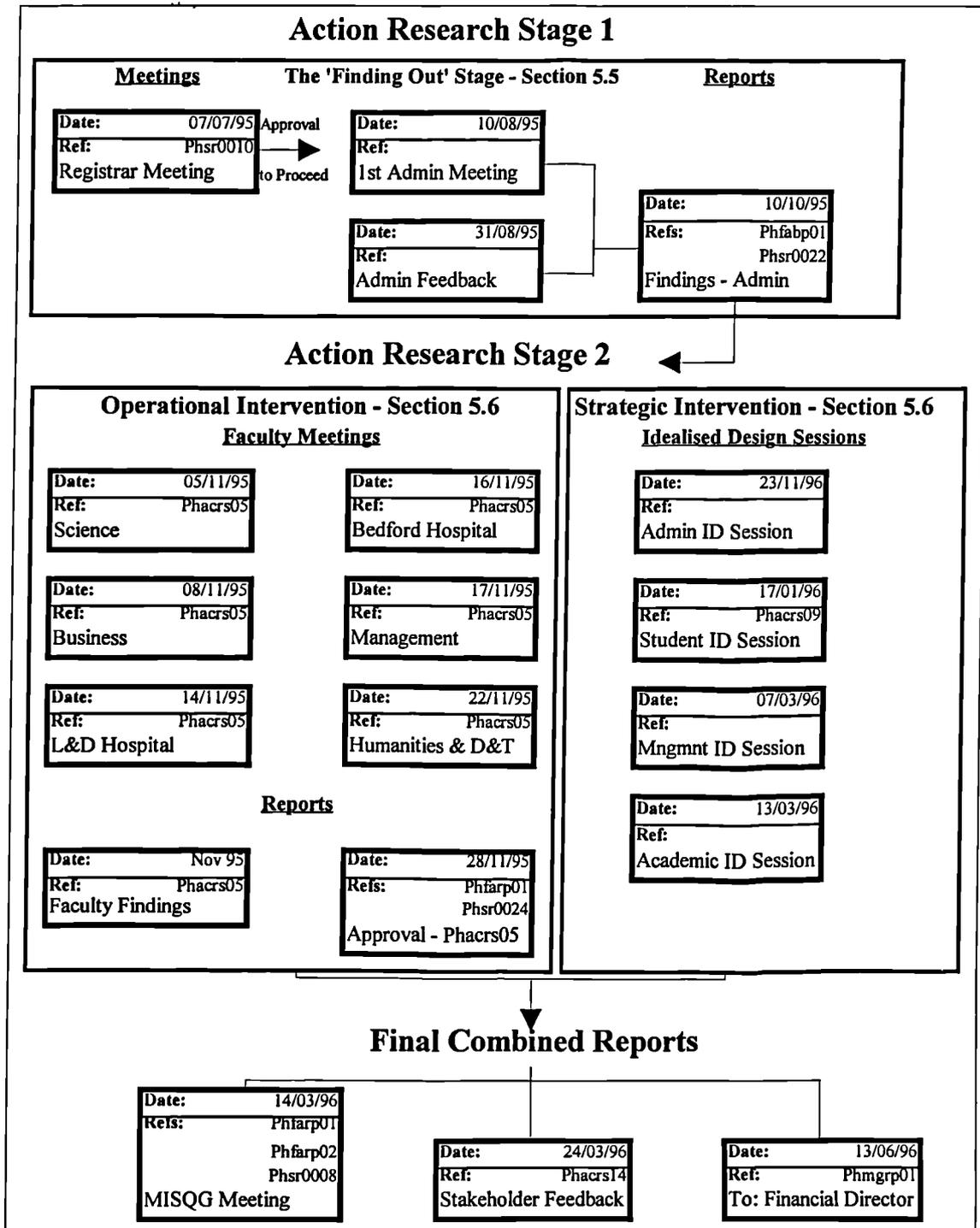


Figure 5.4 The Total Systems View

The argument derived from this analysis is that the system might be better perceived, not as a clearly defined technical or organisational problem to which a solution is to be found (a 'student record system' in the functional sense), but as a complex interaction of all the issues involved in recording and monitoring student enrolment, attendance and performance: a system of 'student recording and monitoring.' The focus in such a total systems view shifts from technology or organisational functions to the views and ideals of the stakeholder groups involved in the system. The task becomes not one of how to engineer a solution to a known and agreed problem, but how to study and improve a problem situation made up of complex interacting issues. People are not only part of the system, they are the primary focus of study.

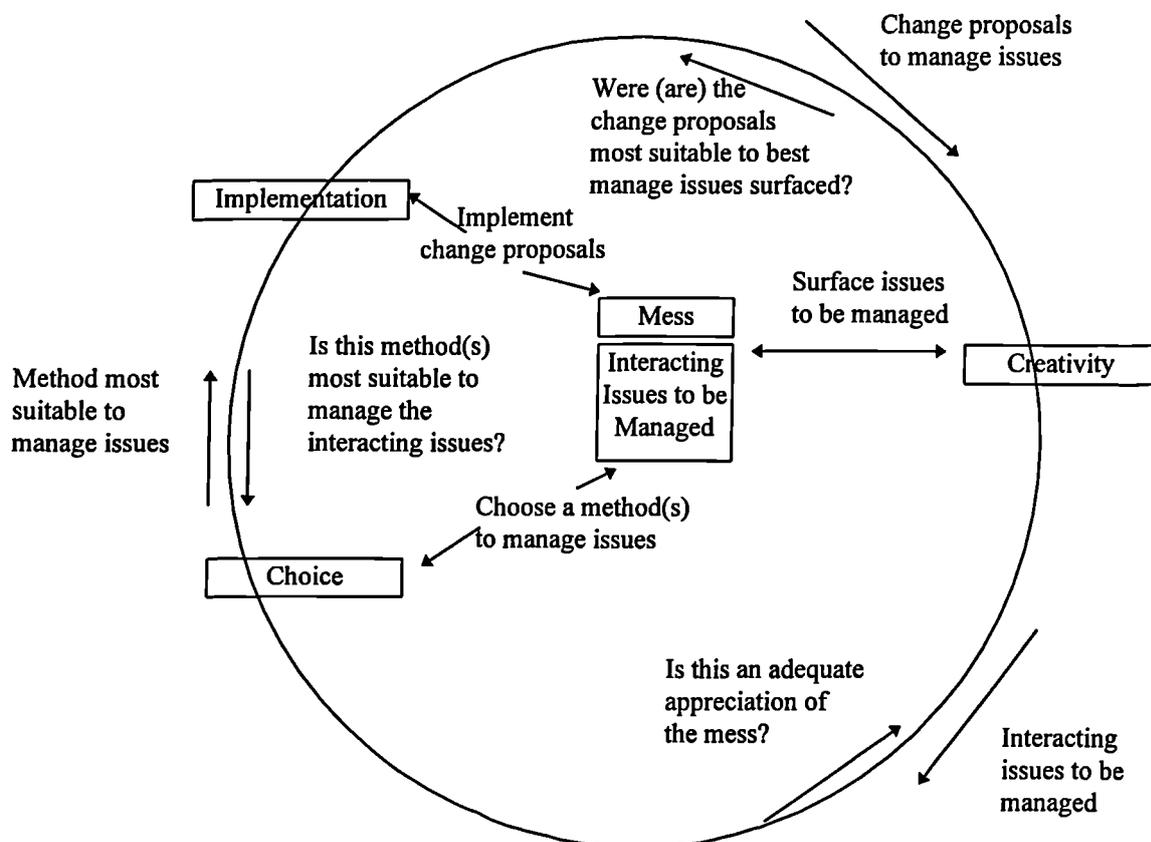
5.4 Total Systems Intervention and the Problem Situation at The University of Luton



Key: ID Idealised Design

Figure 5.5 Summary of Action Research at the University of Luton

Figure 5.5 above shows the detailed work within each stage of the intervention, and should be referred to together with Figure 5.6. The two stages of this intervention: Action Research Stage 1, the 'finding out' stage, and Action Research Stage 2, the operational and strategic intervention, arose directly from the preliminary investigation detailed in Figure 5.2. The report to the Director of Finance (Appendix X) forms a natural break point, at which assessment and critique can be conducted in terms of the objectives set both for the intervention and for this thesis. Key documents referred to in Figures 5.2 and 5.5 can be found in Appendices VIII to X, and a list of the documents referenced in Appendix XI, p.299. The process of TSI applied to an intervention is described in Chapter 2; that description is further developed here (Figure 2.4). The TSI approach is to first surface the issues to be addressed, then, having chosen appropriate methodologies to apply to these issues, implement change proposals, the whole taking place within a critically reflective framework. Implementation of the principles of TSI is through the three modes of problem solving, critical review, and critical reflection, and the three phases of creativity, choice and implementation.



Copy of Figure 2.4 The Process of TSI
(Flood, 1995a)

The application of each of the three phases of TSI within the three modes is described at each stage of the intervention. Although TSI in this research gave rise to a highly detailed intervention, it was judged important to apply the process in its entirety, so that the research objective of assessing the interventionist method could be achieved. The stages and sequence of action research undertaken were partly based on a planned implementation of TSI, and partly evolved as the research progressed. Figure 5.6 below is a reflective summary of what transpired, the purpose of which is to guide the reader through the process. The two action research stages map against the same stages on Figure 5.5, where details of the work undertaken is to be found.

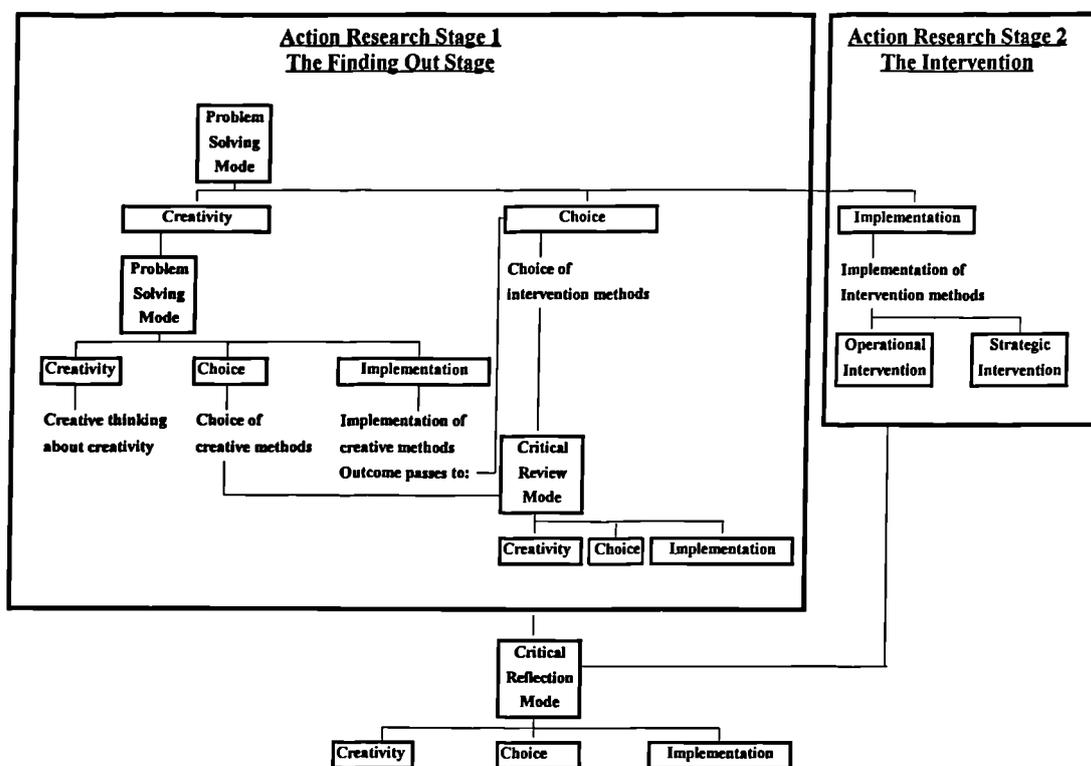


Figure 5.6 *The Use of TSI in the University of Luton Action Research*

Throughout the rest of this chapter, the first person is used where emphasis needs to be given to the author's actions as the agent of intervention and stimulator of change.

Level of Involvement

I have been involved in the student record system development since the start of modular study, prior to which systems were ad hoc and faculty based. The role undertaken has been a mixture of consultant and facilitator, with an increasing focus throughout the intervention on the facilitation of human-centred issues. The initiative to give wider

access to the existing computer-based system has been under my control since its inception in early 1995; the investigation is continuous and ongoing.

Physical Setting

The physical setting incorporates the political, economic, social, and technological environments.

The developments which gave rise to the University of Luton gaining university status and expanding to the current, complex modular undergraduate scheme of study, were precipitated by Political change. The Political environment in which the University is set is unpredictable in terms of the support made available from year to year, particularly in the nature and amount of funding, and the University must respond to this. Its success at doing so in the past has been demonstrated (Clarke and Lehaney, 1997a). However, the future is now expected to offer declining funding in real terms, against which student numbers and quality must be maintained.

In terms of economics, the University of Luton is one of the lowest funded universities, measured by funding per student, in the United Kingdom. This, together with a projected fall in funding in real terms, and limited alternative sources of income, places the University in the position of having limited resources for new initiatives. It is against this backdrop that management information systems (MIS) improvements must be set.

The micro-social environment within the University is one in which participation and involvement are the norm. This has been a major factor in determining the approach to this intervention, in which coercion and power have not been significant issues.

The University has a sophisticated technological environment on which to base its MIS. Though some upgrading and standardisation of equipment may prove necessary, the basic infrastructure required for a development of this type is available now.

Overall, the physical setting is one in which an efficient and flexible MIS is an essential factor in meeting the future needs of the University. The MIS must address the

operational and strategic needs of the University, and have the adaptability to meet future, often unseen, changes. This thesis builds on the earlier strategic study (Clarke, 1994; Clarke and Lehaney, 1997a) in helping with such a development.

Collection of Information

I have collected information by observation, attendance at meetings, structured interview, and participatory sessions using predominantly brainstorming (see Appendix I) and interactive planning (see Appendix II) techniques. I have facilitated this intervention since its inception, and all information has been collected by me or on my behalf. The different collection methods have been used explicitly to enrich the information gathered, and to achieve data triangulation (see Chapter 3).

5.5 Action Research Stage 1: The ‘Finding Out’ Stage

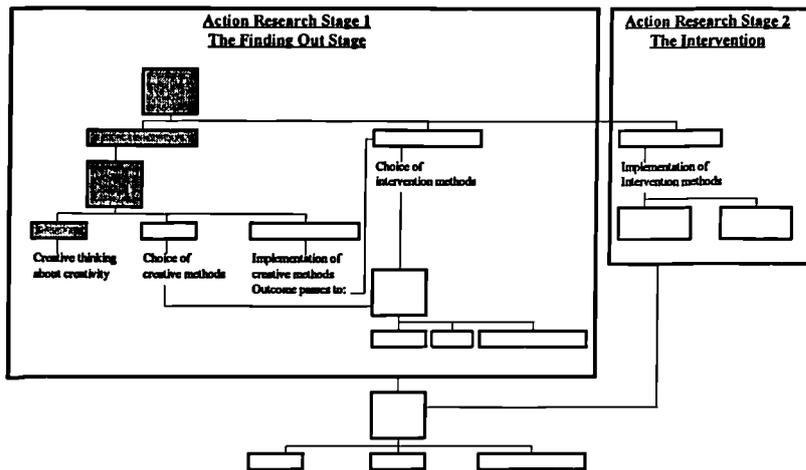
Referring to Figure 5.6, this stage of the action research undertakes all of the activities detailed in the box labelled ‘Action Research Stage 1’, plus critical reflection on that stage. At the beginning of each of the following sub-sections, a copy of Figure 5.6 is repeated, with the stage being undertaken highlighted. Where relevant, this stage is then expanded into an explanatory table or question to be addressed, as indicated by the TSI process, prior to the descriptive analysis.

In the finding out stage, I used TSI in problem solving, critical review and critical reflection modes. I began the process with creativity in the problem solving mode of TSI. The creativity exercises proved to be a major part of the intervention, and it was here that the recursive structure of TSI proved valuable.

I initially found it difficult to form a view of the problem situation in order to inform methodological choice. Taking a functionalist view led to me focusing on design: but design of what? This inability to determine initially what to design led to me considering an interpretative methodology, but there still remained the question of *which* methodology to use. In addition, assuming an eventual requirement to develop a computer-based working system, I needed to determine how the interpretative and functionalist approaches necessary to this might be combined. I concluded that work had to begin with ‘creatively

thinking about creativity'. To undertake this, the whole process of TSI was applied to creativity within problem solving.

Creative Thinking about Creativity



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

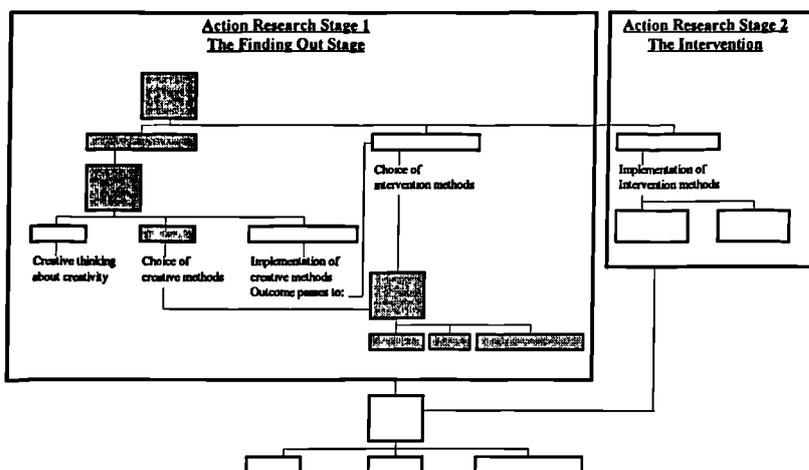
TSI question: What are the creativity issues?

To begin to unravel my confusion about the nature of the problem context, I applied informal creative thinking to it. Partly this was comprised of my own reflections on what I knew of the problem situation, and partly it was drawn from discussion with others involved. The administration of each faculty is headed by a Faculty Registrar, giving a total of six Faculty Registrars, all of whom offered a great deal of help and support at this stage of the investigation. A presentation was made to a meeting of the Faculty Registrars, headed by the Dean of Quality Assurance, on 7 July 1995, where agreement was reached on the way to progress (See Appendix VIII for details of the presentation).

The objective determined by the Management Information Systems Quality Group (MISQG) was simply stated as 'improving faculty access to the student records MIS'. Creativity in this case therefore required that the views were sought of those most likely to participate in such access; key user groups were identified as being management, faculty administration, academics and students, and of these it was decided initially to focus on faculty administration.

Choice and Critical Review for Choice of Creative Methods

In critical review, creativity points to a choice of those methods which are best able to surface the creative issues. My objective at this stage was to gain an understanding of the problem context, making available more information from which choice of an *interventionist method* could ultimately be made. It was clear to me at this stage that it would be possible to obtain representative samples of the participants in any student record system: in other words, emancipation was not appearing as an issue.



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

TSI question: *What creative methods are most suitable to manage the creativity issues?*

AR Stage	Mode	Phase:	Creativity	Choice	Implementation
1	Critical Review	Question:	Details and critiques the candidate methodologies in terms of how they address technical, practical and emancipatory issues in the problem situation	Evaluates the contribution of a methodology to: 1. Creativity, choice and implementation 2. Process, design, culture & politics 3. The TSI principles of systemicity, reflectiveness, emancipation and participation	Provides an overall critique of the candidate methodology based on the outcome of creativity and choice

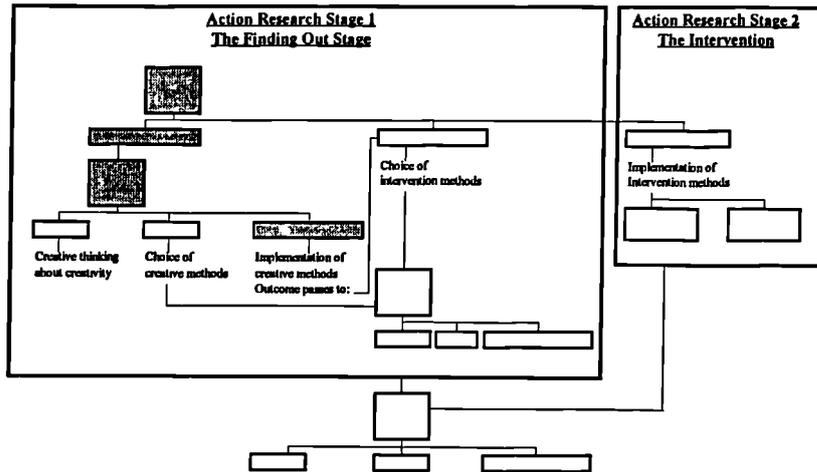
Table 5.1 Choice and Critical Review in TSI

Also, since the technical nature of the student records system development had been privileged in the past, to the detriment of the practical interest, I reasoned that more information would be forthcoming if I used methods focused on the latter. The key methods which I considered were informal creative thinking, nominal group technique, soft systems methodology stages 1-5, cognitive mapping, brainstorming, lateral thinking, and metaphor. Within this process, I would need to make the participants aware of the continuous nature of the intervention. It was at this point that the findings for human inquiry (see Chapter 3) began to be integrated into the intervention process. The first five points were key at this stage, governing the way in which the investigation was facilitated and progressed. It was important to see the participants as part of the research team, working on their own behalf and not at the request of an expert or consultant; the facilitator will eventually leave, but the process needs to continue - implying the development of a learning environment. The viewpoints surfaced needed to come from the participants' perception of reality, not a reality imposed from elsewhere. Those involved in computer-based information systems development (CbISD) 'projects' commonly expect an 'answer' to the 'problems' encountered; in this intervention participants had to accept the problem context as one requiring ongoing attention and continuous improvement.

With reference to Table 5.1, choice therefore pointed to a creative method focusing on design and culture, and acceding to the TSI principles of systemicity, reflectiveness and participation. A review of these methods (see Appendix I and Appendix III) led to the choice of informal creative thinking, supported by a synthesis of brainstorming, lateral thinking and metaphor.

Implementation of Creative Methods

The first meeting of faculty administration representatives was held on 10 August 1995. It was explicitly not required that participants had any knowledge of existing systems of control used for student records, since the aim was not to address any particular system, computer or otherwise, but to look at the whole issue of student recording. The preliminary creative thinking that I had undertaken, pointed to an approach which looked at the *needs* of participants in the faculties, unconstrained by any existing systems in use.



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

The aim was to get participants to see the situation from different viewpoints, and for this a brainstorming session was set up to encourage lateral thinking (see Appendix I for a summary of the techniques used, and de Bono (1977) and Flood (1995a) for the detailed approach). Each of the University's six faculties was invited to send two representatives to this first meeting. In the event there were fifteen participants, with all faculties represented.

Following a brief presentation to introduce the session, participants were invited to discuss the concept of 'faculty access'. Participants were invited to form two self-selected groups, each nominating its own chair and note-taker, with me acting as a facilitator and explicitly not taking on the role of expert. The central issue was stated as:

'How can monitoring and recording of students at faculty level be better facilitated by information systems?'

The only additional guidance I gave was in the form of questions to elicit how participants viewed the problem situation. In particular, participants were encouraged to consider, in terms of the past, present and future of the organisation, whether student monitoring and recording would be best perceived as a repetitive process which could be mechanised to improve efficiency, a collaborative 'social' process, or a process subject to determination by those in positions of power (corresponding to mechanistic, socio-cultural and socio-political metaphors). The session was limited to thirty minutes. Participants were invited

to send me any further thoughts before the next meeting, set for 31 August. I received some further information from participants, and from this, together with the information from the 10 August session, produced Figure 5.7 below, which shows the feedback given to participants at 31 August meeting.

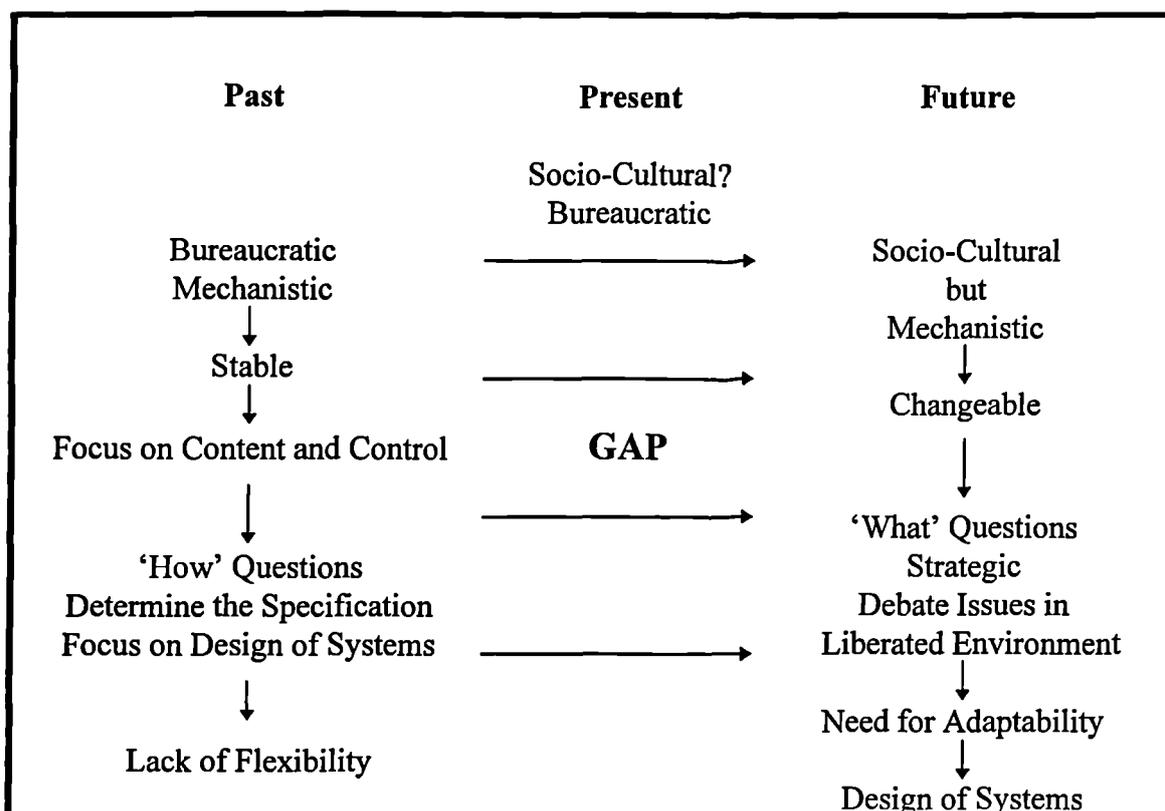


Figure 5.7 Feedback to Participants from the Initial Administration Session

Participant Views from Feedback Session 31 August

The major problem identified by the participant group was that of moving from a stable, bureaucratic past to a changeable and uncertain future. The impact of this on computer-based information systems development (CbISD) has, the participants contended, been underestimated. Prior to gaining University status, the University was structured to meet the needs of bureaucratic control from the local authority, with systems designed centrally to that end. The view of a changeable future has left the institution currently with a mix of seemingly unmanageable demands: with centralised, inflexible systems needing to adapt to the change and being ill equipped to do so. The group therefore decided that there were two main issues:

1. The need to assess the present MIS and seek improvements. Whilst it was recognised by the group that this may only be ‘doing the wrong things right’, it was seen as a necessary undertaking.
2. Instigate a wider, more strategic investigation, focusing on what is required. This requires a human-centred approach, and may yield results which negate the work carried out under 1 above. This latter was seen to be the primary need.

The *key* finding to emerge was therefore the need to debate the human and technical issues implicit in the changes affecting the organisation, and make decisions based on this debate. As a *secondary* finding, it was recognised that the current design of systems is inadequate to meet the needs of participants, and that there therefore needs to be a concentration on the design of effective processes. The emergent dominant metaphor was therefore socio-cultural, with a dependent mechanistic metaphor.

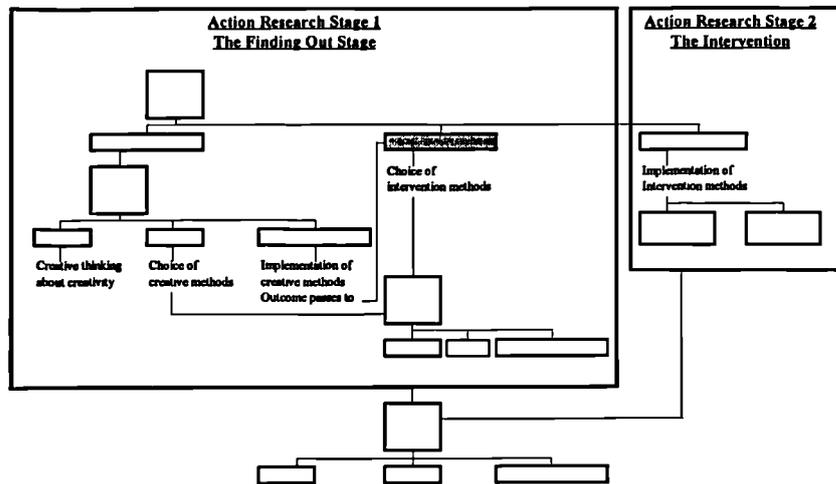
By way of confirmation, the question was fed back to the group as to whether we ought to concentrate on *how* to build the system, *what* it is we are building, or *who*'s interests are served by the undertaking. The ‘what’ questions were seen to dominate, with ‘how’ questions being of secondary importance. ‘Who’ questions assumed little importance for the group. This confirmed debate as prime, with design secondary, and little need to concentrate on disimprisoning.

Having completed the initial creativity phase of TSI in the problem solving mode, two parallel agendas emerged. That is, there was a need to continue with the creative investigation to satisfy the strategic needs, whilst moving to implementation of methods to serve the operational needs.

Choice of Intervention Methods

Having determined in general terms the nature of the problem situation to be addressed, I moved on to choice of the *type* of method(s) to be implemented. Choice in the clockwise mode receives the interacting issues to be applied to the problem situation. Since the ‘what’ and ‘how’ questions are prime, the search is for a debating and designing approach (see Table 2.6). The debate was seen to be within a non-coercive situation, in which

consensus was seen to be achievable, and needed to be linked to design of systems based on the existing consensus. Who would benefit (the disimprisoning question) and why it is done (the power or coercion question) were not seen as key to this intervention.



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

TSI question: What are the methods most suitable to manage the interacting issues?

From this point, it was necessary to move to Appendix III for a detailed description of the key methodologies, and to Appendices V and VI for an indication of the type of problem situation to which each is most applicable by reviewing the position of each on the wheel of knowledge and power, and the relative power of each methodology in addressing technical, practical and emancipatory issues.

Operational Intervention

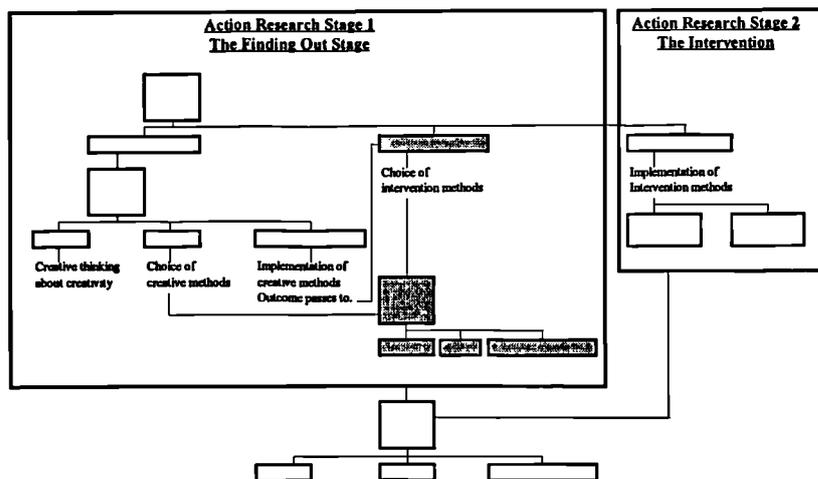
The candidate methodologies for the operational part of the intervention were identified as those which addressed the technical interests. From Appendix VI, methodologies which are concentrated in the technical area are the systems development life cycle (SDLC) approaches of systems analysis (SA) and systems engineering (SE), user software engineering (USE), and ETHICS.

Strategic Intervention

A similar analysis to that undertaken above was then carried out within the strategic study to choose a method or methods which will best address the practical interests, facilitating *debate* within a pluralistic, but not coercive, environment. Again, referring to Appendix VI, candidate methodologies were strategic options development and analysis (SODA), client led design (CLD), pyramids, strategic assumption surfacing and testing (SAST), strategic choice, soft systems methodology, and interactive planning.

I then undertook a critical review of these candidate methodologies in order to determine the detailed approach to this investigation. The approach used for the critical review of methodologies, together with a critical review of all relevant methodologies outlined above, is detailed in Appendix IV.

Critical Review for Choice of Intervention Methods



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

Methodological Choice - Operational Intervention

The choice of actual method(s) is informed by Appendix III and Appendix IV.

For the operational stage of the intervention, I chose systems analysis and systems engineering (SA and SE). The other methods reviewed made some attempt at satisfying interests other than the purely technical, and it was judged that this gave rise to confusions and shortcomings. With SA and SE, the ideological premises give rise to fewer such

conflicts. It was recognised, however, that this part of the intervention would be functionalist: the ends would be assumed acceptable to all, and the focus would be on collecting views of participants in satisfaction of those ends. The intervention would be expert driven, but, within the interventionist framework used, must be allowed to feed into the overall, more human centred activity. SA and SE may be regarded, however, as a generic approach; the actual method chosen was further informed by working jointly with a computer systems project manager on this part of the study, and is made clear in the implementation of the operational stage below.

Methodological Choice - Strategic Intervention

As with the operational intervention, the choice of actual method(s) is informed by Appendix III and Appendix IV.

Following this review, four methodologies were quickly discounted for the strategic intervention. SODA was judged to be too individually based to be applicable to such a broadly framed investigation; CLD was seen to be relatively untried, and containing paradigmatic conflicts which were as yet unresolved; SAST was considered, but its adversarial nature judged ill-suited to the problem context; strategic choice was viewed as having a common underpinning with interactive planning, but to lack its comprehensiveness. This left pyramids, soft systems methodology and interactive planning as the considered methodologies.

In many ways, any one could have been used. In the event, choice was made on the positive features of the chosen method, interactive planning (IP). IP was seen to fit well the human inquiry framework against which the investigation had been set, and to dovetail well with TSI. It is extremely strong in the area of creativity, a key requirement of this investigation, and offered the potential of a good fit with the functionalist approach chosen for the operational intervention. The only downside was its poor emancipatory potential, but this had not surfaced as an issue in this study.

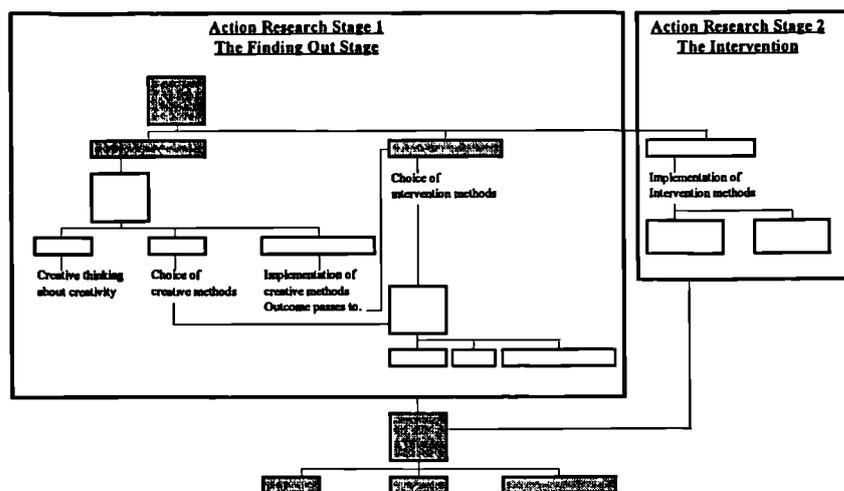
Critical Reflection on the Finding Out Stage

The process of TSI requires that TSI in critical reflection mode be applied to verify the outcome of problem solving and critical review, before progressing to implementation.

The questions posed by TSI in critical reflection mode are detailed in Table 5.2.

Creativity

The outcome of the preliminary investigation (Figure 5.2) has shown the change proposals originally adopted for this development, which viewed the student record system as a centralised computer system to fit requirements determined by management, to be unsuitable to manage the complex issues surfaced.



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

AR Stage	Mode	Phase:	Creativity	Choice	Implementation
1	Critical Reflection	Question:	Were the change proposals most suitable to manage the issues surfaced	Is this an adequate appreciation of the mess	Are these methods most suitable to manage the interacting issues

Table 5.2 TSI in Critical Reflection Mode

In the creativity sessions, the split of operational and strategic was seen by all participant groups as highly representative of the problem context, though there were differences of opinion as to which was currently the most important (interestingly, management generally favoured the operational problems and all others the strategic). The view of the organisation changing from a stable past to an uncertain future struck a chord with everyone, and current systems were seen to lack the adaptability to cope with this: the use of metaphor had proved valuable in this regard. There was no true consensus on whether the operational or strategic issues (mechanistic or socio-cultural) be accorded primary status. All participants saw a need to address both, but the general acceptance that improving the present system might be 'doing all the wrong things right' gave an indication that the strategic investigation would ultimately be the only test of how to proceed.

These creativity findings are supported by data triangulation, which was achieved by seeking a number of alternative viewpoints. Structured interviews were carried out with participants drawn from different groups in the University, with finance, faculty management, academics and students all represented. In addition, the findings were presented separately to the Finance Director, the Head of Management Services, and the Management Information Systems Quality Group (MISQG).

Choice

Four key techniques for critical reflection on choice have been developed as a result of the five years of work already undertaken using TSI. These involve checking the outcome against: the principles of TSI; the four key dimensions of an organisation; the common and distinguishing principles in the complementarist framework; and finally, investigating whether there is a better method for the task. All of these techniques were applied to this intervention.

The Principles of TSI

Within the analysis of the problem situation, every effort has been made to accede to the TSI principles of being systemic, achieving meaningful participation, being reflective, and striving for human freedom. A view is taken of the whole system (see Figures 5.3 and 5.4), with the boundary drawn around the entire system of student recording. In particular, the restricted view of the system as only a centralised computer and the elements which serve it has been exposed. Human freedom, or the freedom to express views within a non-coercive environment, has been identified as a feature of this intervention, and, together with the brainstorming approach chosen has contributed to the meaningful participation of all involved. Reflectiveness is served by the processes undertaken in this section.

The interventionist approach taken is therefore seen to have addressed the four principles of TSI.

The Four Key Organisational Dimensions

Organisational process, design, culture and politics have been identified as the four key organisational dimensions (Flood, 1996: Figure 5.8).

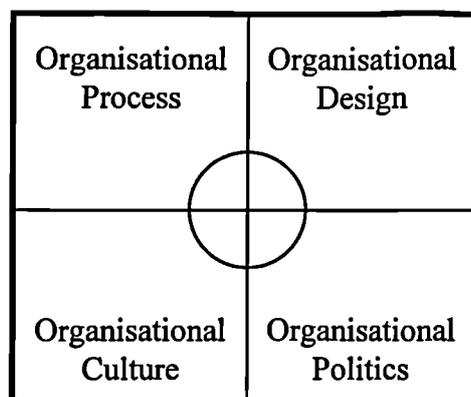


Figure 5.8 *The Four Key Dimensions of an Organisation*
(Flood, 1996)

The argument for using these in critical reflection on choice, is that, by determining which of the dimensions are served by the intervention, the choice of method can be informed or critiqued. The question to be asked under organisational process is whether the task to be addressed is simply a matter of the design of efficient processes; organisational design asks whether it is the design of an efficient organisation that is important; culture asks if

the key issue is that of 'what' needs to be done; and politics asks if the focus is whose interests are served and why the outcome is to be implemented.

In this intervention, at an operational level, the design of process related to the implementation of efficient and effective new designs, pointing to a methodology focused on designs to fit the existing organisation. At the strategic level, culture focused on the exploration and choosing of designs, where the objective is “.. to debate and come up with an idealised design free from all constraints except technical feasibility and viability.” (Flood, 1995b p.110). The perception of all participants was that coercion and power would not interfere with this part of the intervention.

In terms of serving the key dimensions of the organisation, process and culture surface as prime, further indicating a mix of methods for design and non-adversarial debate.

By reference to Figure 5.9, it can be seen that the types of method chosen were a designing method for the operational intervention, and a debating method for the strategic intervention. In the operational, the need is to design more efficient and effective processes for the control of student records. The organisational structure is taken as given, and a system designed to fit the existing organisation within its environment. In the strategic, the emphasis is on consensual rather than adversarial debate within a learning environment, the aim being to decontextualise the mess in order to enhance understanding.

	Type of Method:		
	Designing	Debating	Disimprisoning
Common Principles	Communication Control Efficiency Effectiveness Emphasis on the location and elimination of cause of error	Participation Learning Understanding	Identifying whose interests are served Linking organisational power sources to biases in society Identifying how biases are mobilised in the organisation Identifying experts and their position in the power structure
Distinguishing Principles	Emphasis on design control Emphasis on process control Environmental analysis Structure is prime Organisation is prime Emergence Hierarchy	Diversifying Attenuating Consensual debate Adversarial debate Group formation crucial	Identifying sources of motivation Identifying sources of control Identifying sources of expertise Identifying sources of legitimisation

Figure 5.9 *Principles for Intervention Linked to Three Types of Method*
(Flood, 1996)

Is There a Better Method?

The use of the following pairs of questions is suggested here (Flood, 1995b p.227):

How should the methods work?

How might alternative methods work better?

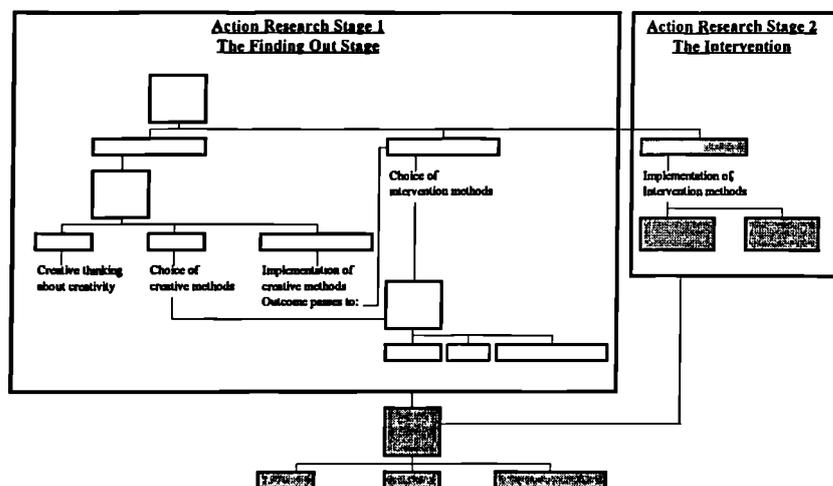
What should the methods do?

What would alternative methods have done?

In the case of both operational and strategic interventions, the *type* of method was clearly correctly chosen to fit the problem context. The *actual* method has been subjected to critical review, and the best assessment made of the correct methodology for each stage. The way in which the methods work has been detailed earlier, and gives support to the approach taken. The problem situation was seen to be predominantly concerned with participation, learning and understanding, with consensual rather than adversarial debate as pre-eminent. The subsidiary machine metaphor showed communication, control, design and structure to be important secondary issues, to which the systems analysis and systems engineering methodology is applicable. The exercise of power appears as an issue of less concern.

Alternative methods and their likely outcomes have been considered, and judged to be insufficient.

5.6 Action Research Stage 2: The Intervention



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

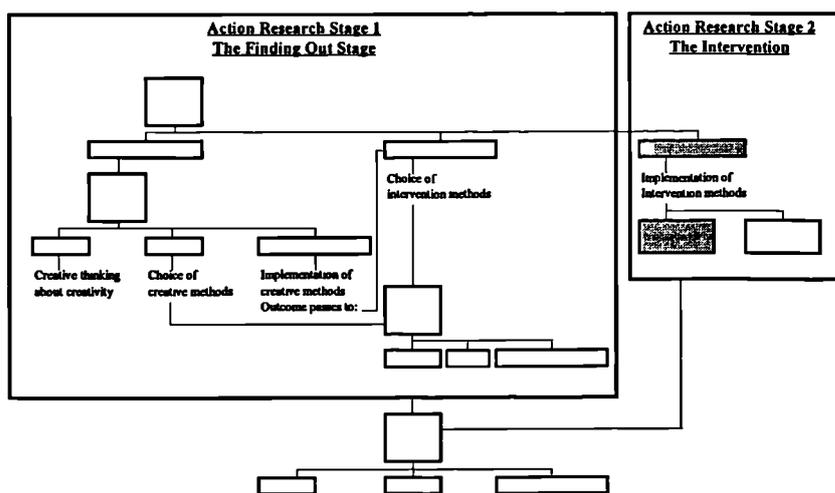
Operational Intervention

A full report on the operational stage of the investigation, and the details of the method used are given in Appendix IX.

Implementation in the clockwise, problem solving mode (Figure 2.4), implements the methodologies most suitable to managing the issues surfaced within the problem situation. Within TSI, this part of the intervention represented the outcome of the choice phase being passed to implementation. Referring to Figure 3.2, and having recourse to the recursive framework of TSI, implementation now involves the three phases of: creative development of change proposals; choice of change proposals; and implementation of change proposals.

Creative Development of Change Proposals

The investigation began with an analysis of the Higher Education Management Information Systems (HEMIS), and the facilities available within it to aid the student recording and control process. From that perspective, the purpose was to determine what access at faculty level would enable the management of students in the modular scheme. The intervention was undertaken with the help of Paul Slater, Principal Lecturer in the Faculty of Science and Computing. The procedure adopted was firstly to meet with the Head of Management Services to ascertain the functions which HEMIS is expected to provide to the faculties, and then to visit each of the faculties in order to observe users making use of the functions which they perceive to be available to them.



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

From the meeting with the Head of Management Services, the facilities to be made available to the faculties were summarised as: viewing student data, entering student results, and generating reports. Each faculty was then visited in turn (see Figure 5.5 and

Appendix IX), and users observed operating the system and questioned about the facilities available to them. In general terms, it was found that the facilities outlined by the Head of Management Services above were available to all faculties, with the exception of local printing, which was not provided to the outreach sites at the Bedford Hospital and the Luton and Dunstable Hospital. However, problems existed with the detailed provision, as summarised in Table 5.3 below.

<u>Problem Encountered</u>	<u>Problem Type</u>
Entering and Viewing Data	
Interface inconsistent between different terminal types	1
Input/enquiry screens are too cluttered and contain too much information which is not used	2
Incorrect and unknown data items need to be sorted	2
Navigating around the system requires redesigning	2
Information presented is not filtered or sorted and can be difficult to interpret	2
Insufficient ability to select ranges of students or modules	2
Some stored information is not available to those who most need it	4
Some necessary information is not stored	4
The result of choosing a menu option is difficult to predict	2
Input routines are not clearly specified	2,3
Little validation of entries	2,4
Reporting	
Print pull-down menus are confusing, with many unused options	2
All faculties are not able to print locally	2
The requirements for local printing need to be determined	2
Printouts available centrally are not clearly specified	2
General Comments	
The HEMIS system is used passively by almost all end users	4
Duplication of records within HEMIS still appears to be a problem	4
The system can be slow at important times	4
The system does not prohibit actions which are forbidden under the modular scheme	4
Non-modular students are marginalised, and often dealt with outside HEMIS	4
Ongoing training in the use of the system needs to be undertaken, and user guides must be written and regularly updated	3
Key to problem types:	
1	Problem related to hardware type.
2	Training issues.
3	Human computer interface (HCI) problems, especially menus, navigation, and routines for input and output.
4	Integrity and comprehensiveness of the HEMIS system.

Table 5.3 *Operational Problems with the HEMIS System*

Choice and Implementation of Change Proposals

The four categories detailed in Table 5.3 were seen to represent the concerns to be addressed within the operational intervention. The problem of hardware type related to the use of Macintosh personal computers as terminals into the HEMIS system, for which they provide a poor interface, and need to be phased out in favour of personal computer (PC) based or natural VAX terminals. Immediately identified problem areas relating to HCI were ergonomic functionality, access, validation, communications, print routines, and the fact that design of the system further complicates instruction and training. A significant design effort was seen to be needed in order for the system to become generally usable. After this, training and documented user instruction needed to be undertaken on an ongoing basis: user guides are required for the system, and the recommended technology standardisation would simplify their provision. Though of lesser concern, issues of performance and integrity were identified as needing to be addressed within the HEMIS system. It was felt that this work could be carried out concurrently with the work on the human computer interface.

It was discovered at this stage of the intervention that HEMIS causes considerable duplication of effort, and that users of it are generally passive. This was supported by the discovery that most of the communication concerning modular issues was outside the HEMIS system. These findings further supported the need for a thorough strategic investigation, to which this study could provide some valuable input.

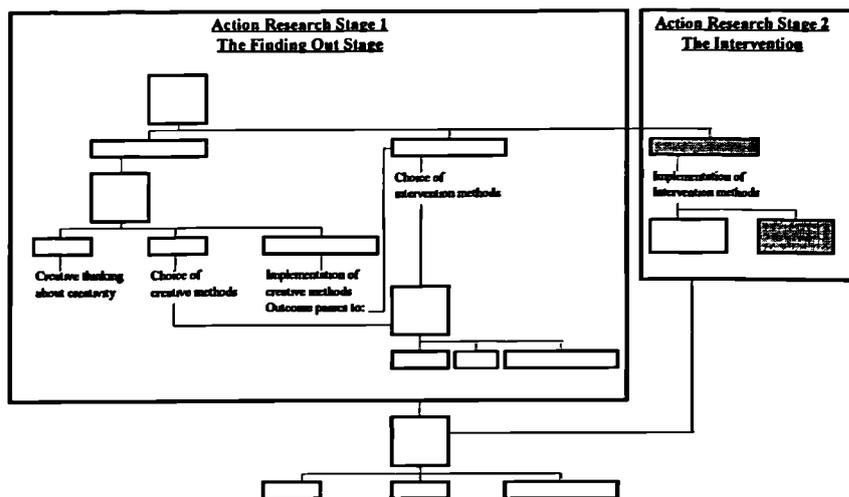
The change proposals were passed to Management Services for implementation. In the Spring of 1997 this work was progressing.

Strategic Intervention

A full report on the strategic stage of the investigation, and the details of the method used are given in Appendix X.

Details of the interactive planning (IP) approach are to be found, in the first instance, in Ackoff (1981), a summary of which, specifically related to CbISD, is provided in Appendix II. Ackoff's notion of 'mess' lies at the core of the IP approach:

"The mess that a corporation is in consists of the future that it would have if it were to continue behaving as it does and if its environment were not to change or alter its directions in any significant way. In other words: a corporation's mess is the future implied by its and its environment's current behaviour. Every system contains the seeds of its own deterioration and destruction. Therefore, the purpose of formulating the mess is to identify the nature of these often concealed threats and to suggest changes that can increase the corporation's ability to survive and thrive." (Ackoff, 1981 p.79).



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

As the 'interacting issues to be managed' the 'mess' is at the centre of TSI (Figure 2.4). Ackoff's work relates to the whole organisation and, under ends planning II (Ackoff, 1981 p.139), focuses on management systems design. In the following section, the sub-headings represent those elements in IP which are judged of particular benefit to a CbISD intervention (see Appendix II).

Formulating the Mess: Defining the System and the Organisation in its Environment

The system to be addressed is defined by Figure 5.4. The boundary is wider than that traditionally drawn around a CbISD intervention, taking into account both the technical and human issues to be considered. This system operates as a sub-system of the overall organisation. The organisation's reporting needs for student recording are currently served by HEMIS, which acts as a repository for data which is generated in each of the operating units (the faculties and administrative centres). In giving wider access and greater support to the operational needs of users, all participants are seen to be part of the recording system.

Obstruction Analysis

Obstruction analysis consists of determining organisational ends, means, resources, structure and management, and stakeholders.

In terms of organisational ends, the mission of the University commits it to a wide choice and flexibility in its courses (see Mission Statement, Appendix VIII). Any system supplying information to support these course offerings must be able to offer a flexible mix of information to students, academic staff, administrative staff and management. In so far as this is achieved, the system's ends and the organisation's ends will not be in conflict.

Organisational means relate primarily to personnel issues within the organisation. Ackoff (1981 p.88) argues that, in general, a great deal of difference exists between "what corporate personnel actually do, believe they do, are believed by others to do, and are supposed to do." Such differences may be essential for corporate survival, but must be explicitly recognised and allowed for.

The culture of the University is one of giving employees the freedom to make their own decisions about day-to-day work practices. The approach of management services, as with many computer-based departments, is to set up systems and then insist that participants

use them as instructed. This conflict must be dealt with, and generally the culture is likely to prove more difficult to change than the systems.

Organisational resources at the University are seen to be limited, but there are actually major technical, physical and human resources available to the system which are currently under utilised. In particular, end user computing is well provided for in the University, with approaching one thousand desktop computers, many of which are linked to local and international networks. There are major human resources in faculties and departments which are available to the student record systems but unused, or used inefficiently, because of centralisation. Users who need support are often prepared to pay the price of contributing their own efforts; efforts which at present are frequently channelled inefficiently into personal information systems, but which could be used in supporting a co-ordinated system.

It would be unrealistic to suggest that the bureaucratic management, required of the institution under local authority control only five or so years ago, has been entirely replaced by a more adhocratic form seen to be needed under the present regime (see Clarke and Lehaney, 1995). However, systems designed *now* must support an adhocracy, but must still supply information required in rather bureaucratic forms (the reporting requirements of central government, for example, still have a bureaucratic flavour and tend to be given, understandably, a high priority). It must be recognised that, in terms of supplying information, the perception is of a need to supply central (government) agencies ahead of all others: it is the University's key stakeholder. This has the appearance of placing internal participants lower down the order of priorities. The system must recognise and account for this.

Idealised Design

The purpose was to generate an idealised design (ID) of the student record computer-based information system (CbIS). Ackoff used interactive planning (IP) to redesign the organisation, and saw the management information subsystem as a part of this. Though acceptable in principle, the outcome is that too little attention is given by Ackoff to the design of management systems (see Ackoff, 1981 p.139ff). The opportunity to apply the

whole of IP to management information systems is not taken by Ackoff; a recursive approach which has been applied within this intervention.

Idealised design is a design not for some future projected environment, but for the current environment, and its requirements are that it be technologically feasible, operationally viable, and capable of rapid learning and adaptation. The process of idealised design involves four steps: selecting a mission, specifying the desired properties of the design, designing the system, and determining constraints. The University statement of mission (Appendix VIII) commits the organisation to the provision of a wide range of courses. Operationally this has been translated into a complex offering of modules within a modular teaching scheme, which the student record information systems have to enable. However, whilst the desired properties of the design were originally determined from the limited perspective of management reporting needs, future development requires that all participants contribute to formulation of these properties. Computer-based information system design then becomes a question of turning the 'whats' into 'hows'. Constraints are dealt with by preparing two idealised designs: one, prepared first, which ignores any constraints, and another which takes known constraints of the containing system into account, and proposes no changes to the latter. If the difference between the two systems is small, then the organisation's future is in its own hands. In defining the unconstrained system, the changes necessary to the containing system must be made clear.

Interactive Planning and the University of Luton Strategic Intervention

Four idealised design sessions (see Figure 5.5) were held over the four month period from November 1995 to March 1996, each lasting for two hours. These sessions were attended by sixty-eight participants, representing all of the identified stakeholder groups in respect of the University student record systems. Figure 5.10 shows the stages of this part of the interactive planning process, and its relationship to the stages of TSI, under which headings the intervention is described below.

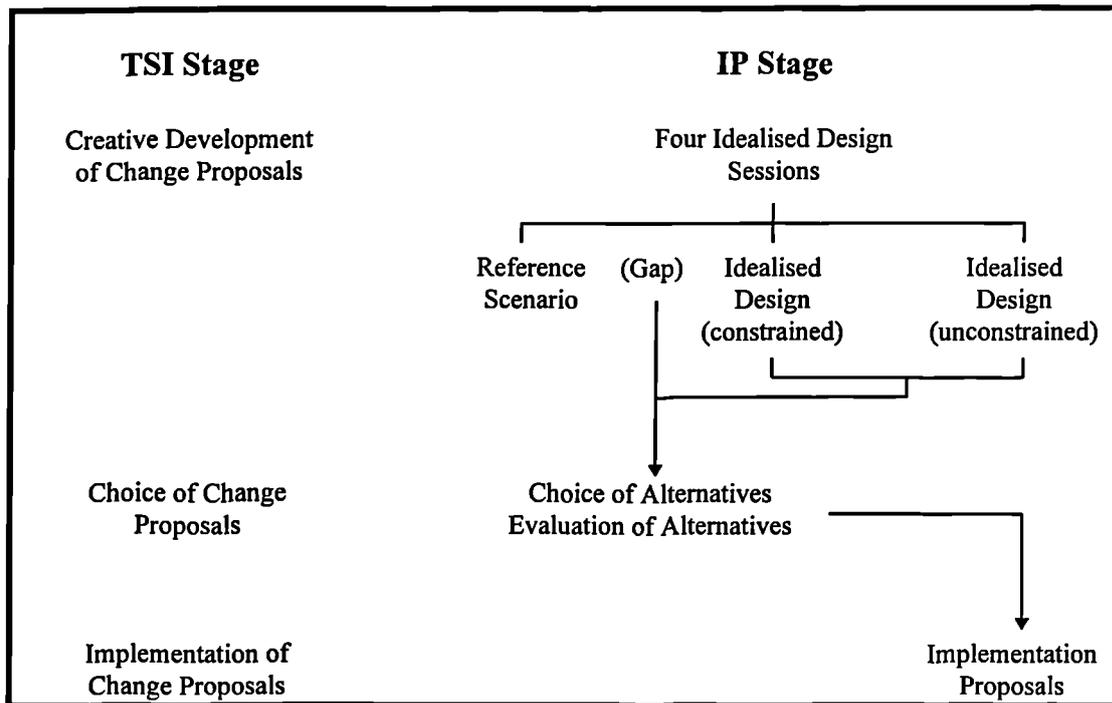


Figure 5.10 Interactive Planning and the Student Record System

Creative Development of Change Proposals

To aid the creativity process, at each idealised design session, clarification was given to participants as to what was to be considered as part of the system. Figures 5.3 and 5.4 were used for this; specifically, it was made clear that the system was to be seen as ‘the whole system of student data recording and control’, and not simply HEMIS or any other ‘administrative’ system in current use. Participants were invited to specify their ideal properties of the system. A number of headings, which were open to debate and change, were suggested for this specification; the full list of headings as changed by the participant group, and the properties under each heading, are available from the author. No other output was sought from this meeting. The findings, drawn from the participant group, were used in preparing the alternative scenarios in order to inform the way forward. Following the four meetings, the findings of the four participant groups were combined. There was little disagreement about the ideals, but in any event the consensus was fed back to all participants (reference Phacrs14), who were invited to comment on any misunderstandings or misrepresentations. Feedback was received, and was incorporated into the results before forming the necessary scenarios.

These findings are drawn together below as the reference scenario (what will happen if the organisation simply continues unchanged along its present path); the unconstrained idealised design (the likely changes if the findings of this idealised design are followed, which assumes no constraints in the containing system); the likely constraints; and the constrained idealised design (changes if the idealised design is followed, but the assumed constraints are realised).

The Reference Scenario

A reference scenario aims to determine what the outcome will be if the University system for recording student data maintains its present development path, assuming no environmental change.

The 'present development path' has been enhanced by Stage 1 of this study (see Appendix IX), and the reference scenario is therefore taken as that which will be attained after the changes recommended by that report, assuming at present that these are within the resource capability of the University. The development is of a centralised system based on VAX/Alpha computers. Use of the system will be enhanced by modifications to the input and output routines, but essentially it will remain as a central repository for student record data consolidated to be of benefit to external agencies or the University generally rather than faculties specifically. Lack of adaptability will continue to be a problem. The central system is ill equipped to deal with the changing demands of the developing modular and non-modular courses within the University.

Faculty requirements which are currently poorly catered for will continue to be so, and others will develop; this includes such issues as the poor fit of non-modular courses, difficulties in recording non-semesterised courses and so on. Faculties will still need to adapt to the central system, but it will not satisfy their operational needs. Faculty based 'personal information systems' will continue to be used, and co-ordination between these and the central system will generate the already identified difficulties of duplication and error checking.

The central system will be used infrequently, and will not be seen as the source of accurate student data at faculty level. This existence of different systems containing the same data will continue to be a quality issue, and will need to be dealt with by complex administrative procedures. Lack of participation in central systems will continue to prejudice both the perceptions of and actual performance and accuracy. The system will generate few benefits for users at an operational level; pressures from outside agencies will emphasise its objective as being the provision of management information. The conflict between central and local information systems, supplying data for use centrally, locally and externally, will remain unresolved, with central resource allocated to management rather than operational problems. Central systems risk becoming overloaded, particularly at key times (preparation of student assessments, for example).

The Unconstrained Idealised Design

"{The design of a system that} .. its designers would like to have right now, not at some future date." (Ackoff, 1981 p.105).

The system needs to be adaptable. Modular, non-standard modular (for example, different end dates; progression not at year ends), and non-modular courses need to be monitored; the tools to provide ad hoc reporting are needed. Accurate information on student monitoring is generated in the faculties: everything that happens after enrolment and module choice needs to be monitored at a faculty level. The poor performance of faculties in this regard needs to be addressed - many issues are poorly covered at faculty level (e.g. student withdrawals). The Higher Education Management Information System (HEMIS) needs to be constrained to supplying a clearly determined set of information, and its development thereby restricted to that of being the central repository for University-wide data. Design of faculty systems must be undertaken, which supply information directly to the central system. In this way, information will be recorded and controlled at its point of generation, and consistency of information will be more easily assured. Adaptability is an important issue in the design of faculty systems. In any links from local to central systems, the integrity of the central system must be maintained, and the validity of faculty generated data verified. The tasks to be assigned to central and faculty systems must be clearly defined, but some major issues have already been identified. Among these

is the need for assessment to be dealt with at a faculty level; in effect this is already done, but the systems used are neither common, consistent with the central system, nor, in many cases, even recognised. By contrast, it is likely that, with some work on the user interface, HEMIS will prove the correct system for control of enrolment details, albeit modifiable from the faculties.

The Anticipated Constraints in the Containing System

The investigations surfaced relatively few real constraints to the proposed development, although a number of perceived constraints were put forward.

The primary constraint was seen to be HEMIS itself. The nature of the University is that management reports, which are required for external as well as internal purposes, are designed within HEMIS, and it is unreasonable to expect that this will be allowed to change in the short term. Indeed, the recommendation from this study is that any such change would be too high a risk to take in the short to medium term. HEMIS therefore, for the foreseeable future, needs to retain the information necessary for these reports. Allied to this has been the change of responsibility for producing this information from being locally (faculty and department) based to being centrally based. The knock-on effect of this has been to put a strain on the resources allocated to these tasks. The culture of the University is a constraining factor which must be addressed. The current computer systems require that end users work to time-scales which serve the centre but offer little operational benefit. But faculties and departments are relatively autonomous, and clearly do not provide this unquestioning service. Either the systems must change to serve the adhocratic nature of the organisation, or the organisation must change to serve the systems.

The Constrained Idealised Design

The constrained idealised design shows little change from the unconstrained design. The constraints in the containing system require HEMIS to be at the centre, but show it to be lacking adaptability and having limited availability of development resources. However, the suggestion to develop faculty systems which link to a 'frozen' HEMIS system at once enables the adaptability required of the student record system to be obtained from the distributed development, and offers resources in the form of faculty personnel only too

willing to be involved in such a development. The cultural problems would also begin to be overcome, since commitment to the faculty systems and the operational benefits to be derived from them would ensure the timely contribution of participants, which in turn would lead to more accurate information held centrally on HEMIS.

The large gap between the reference scenario and the idealised design shows there is much work to be done, whilst the small gap between the constrained and unconstrained idealised designs demonstrates the future to be under the control of the institution.

Choice of Change Proposals: Means Planning to Fill The Gap

Further work will be needed to determine the specific objectives and goals to be pursued, within and outside the planning period, but this study has demonstrated the future development of the student record computer-based information system to be within the control of the University.

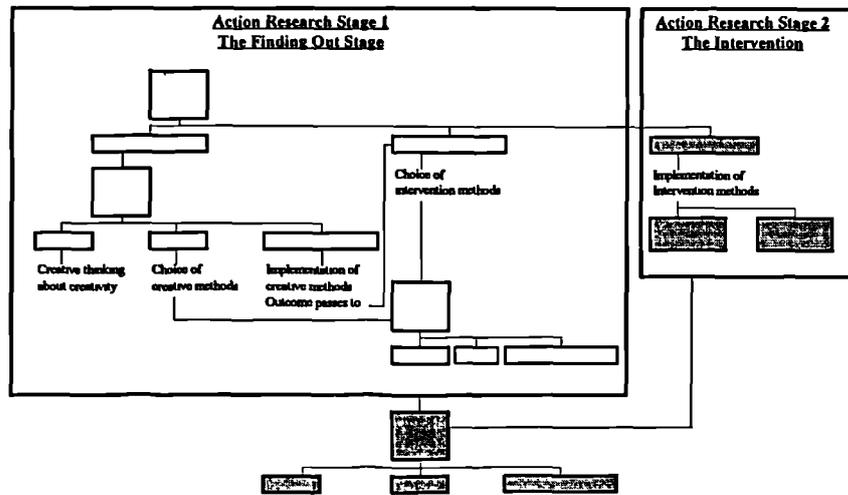
Recommendations

It is recommended that the Management Information Systems Quality Group set up a steering group, having a representation which will enable it to liaise with all participant groups, and reporting to the Director of Finance and MIS, to carry out the following tasks:

1. The objective of the steering group will be to implement and further develop the findings of this investigation, beginning with the broad picture of the gap between the reference scenario and idealised designs. A discussion of the ideal to be striven for must be part of this: in particular, to what extent is the University constrained in its pursuit of the ideal?
2. Decide the objectives and goals to be targeted. These will be derived from the ideals, and will focus on the split between central and faculty-based systems.
3. Determine the purpose and scope of HEMIS. This can be carried out as an extension of Phase I, and have the aim of stabilising the HEMIS development.

4. Assess the value and possible development of flexible, faculty-based systems. Issues to be considered include:
 1. Systems with the flexibility and user friendliness to offer real operational benefits.
 2. Where is the information generated and stored, and what is the relevance of this to systems design?
 3. Links from faculties to the central systems.
 4. Prioritisation of developments: developed by whom?
 5. Clearly define what is to be done centrally and what at a faculty level.
5. Pursue the potential strategic significance of the student record system, and establish links with other strategic groups in the University.
6. Assess the impact of any proposed changes on the containing systems. A clear definition of these systems is required, and their relationship to the systems under study documented.
7. Consider the resource issues, taking into account: inputs - materials, supplies, energy, and services; facilities and equipment - capital investments; personnel; and money. (Ackoff, 1981 p.212).
8. Once a sufficient period of elapsed time has been allowed for changes to take effect, reiterate the study with the aim of improving the now changed situation.

Critical Reflection on the Implementation Stage



Copy of Figure 5.6 The Use of TSI in the University of Luton Action Research

‘How?’ Questions	‘What?’ Questions	‘Why?’ Questions	The three questions ask if the:
How did the method achieve the output?	What did the method do?	Why did the method achieve the output?	Output appropriate?
How should the method achieve the output?	What should the method do?	Why should the method achieve the output?	Output appropriate?
How could the method achieve better output?	What could the method have done?	Why could the method have achieved better results?	Output appropriate?
How would another method achieve better output?	What would another method have done?	Why would another method achieve better results?	Method most suitable?
‘How?’ questions, ask if the output was most appropriate.	‘What?’ questions, ask if the method used was the most suitable one.	‘Why?’ questions, ask if the method used was the most suitable one.	

Table 5.4 Critical Reflection on Methods Used and Methodological Output in TSI

Reproduced in Table 5.4 above is Flood's recommended approach to critical reflection on methods used and the output of those methods within TSI (Flood, 1995b p.228). A scale copy of this table is repeated in each section below to indicate the questions being addressed.

Two sets of methods and output are to be assessed here: operational and strategic. The objective of critical reflection on implementation is to reflect on these outputs and the methods which gave rise to them.

Critical Reflection on Operational Intervention

Firstly, was the output of the methods appropriate? - The 'how' questions.

'How'	'What'	'Why'

Scale Copy of Table 5.4 Critical Reflection on Methods Used and Methodological Output in TSI

The method should have achieved, and did achieve, the output, by human-centred analysis targeted at a computer-based system. Whether this could be better still is open to debate. The output was appropriate given the highly human-centred nature of the problem situation, and, given the functionalist nature of the method, the outcome was as good as might be expected. Since methods based on systems analysis and systems engineering were used in the original development, and gave rise to the problems addressed by this intervention, the revised approach has given rise to a significant improvement in the output.

It is possible to propose how the use of another method might achieve better output. For example, client led design might give better results by maintaining an interpretative view throughout. The approach to this intervention has moved this problem to the strategic study.

Secondly, was the method used the most suitable one? - The 'what' and 'why' questions.

'How'	'What'	'Why'

Scale Copy of Table 5.4 Critical Reflection on Methods Used and Methodological Output in TSI

The method was very functionalist, but relied on user requirements analysis for a specification. A computer systems designer would be likely to argue that it should have been even more functionalist. The output was the result of seeking improvements to an existing computer system. In terms of what the method could have done, it would be possible to take a more structured approach, and 'tighten up' the specification based on the views of key participants.

An alternative method might be to ignore the idea of a specification, and just form a view of what is needed: more like the strategic intervention. Whilst the findings of this study support this, it has been decided to separate this into the longer term, strategic intervention.

Critical Reflection on Strategic Intervention

Firstly, was the output of the methods appropriate? - The 'how' questions.

'How'	'What'	'Why'

Scale Copy of Table 5.4 Critical Reflection on Methods Used and Methodological Output in TSI

The method achieved the output as it should, by use of interpretative scenarios. The result was an output entirely relevant to the problem situation.

Whether another method would achieve better output is difficult to judge without actually trying an alternative method. A functionalist approach is insufficient, and an interpretative method alone would be unlikely to improve the intervention sufficiently, since eventually control would have to pass to a functionalist method in order to develop the system. A mixture of soft and hard issues is needed.

Secondly, was the method used the most suitable one? - The 'what' and 'why' questions.

'How'	'What'	'Why'

Scale Copy of Table 5.4 Critical Reflection on Methods Used and Methodological Output in TSI

To achieve the output the method used took a very human-centred, systemic view of the problem context, but with clear goals and objectives, linking well to the ultimate need to develop a computer-based system.

Again, it is difficult to see how another method could achieve better results. A functionalist approach is not indicated, whilst an interpretative one raises the paradigm incommensurability problem. Pragmatic mixing of methods lacks the necessary theoretical understanding, and alternative mixed methodologies do not exist. The only possibility might be to creatively design a method specifically for the intervention.

Critical Reflection on Implementation: Overall Assessment

The operational intervention enhanced the specification, whilst the strategic intervention opened up issues which had previously been missed.

Critical reflection, however, points to issues which need to be addressed. The evidence is that the real benefits derive from the strategic intervention, and that the operational one is seen to be of limited use if pursued on its own. Management seem unable to comprehend this, and, whilst recognising the benefits of a strategic development, are unwilling to drop the requirement for some short term solutions.

This study suggests that the strategic thrust be accorded primacy, with operational requirements being allowed result from it. One possible answer is to craft a creative approach, by mixing methods within a complementarist framework, to fit each problem context. TSI is promoted as the only method on which this could be based.

5.7 Testing Research Questions and Hypotheses

Research Questions

The research questions and hypotheses detailed in Section 1.6 (p.13) are tested here.

Question i) To what extent are the principles of critical social theory (CSoT) and critical systems thinking (CST) seen within a practical intervention?

Critical social theory denies the possibility of arriving at objective, verifiable requirements which are the same for all involved since they are independent of human opinion. In Habermasian terms, it sees human activity to be in service of three cognitive interests: technical, practical, and emancipatory.

Development work carried out prior to this intervention gave primacy to a technological solution. Only functionalist methods were considered valid, and a unitary viewpoint assumed. Whilst this has had the benefit of quickly building a computerised system, the system built failed to serve the needs of all who participate in its use: hence the decision to open up 'faculty access'. As with the case analysis, the development previously undertaken shares the problem of working within the status quo: participants believe themselves to be objective, but are failing to see the constraints imposed on them and are making 'value laden' decisions. In this way the concepts of *a priori* conditions and false-consciousness are seen to have been evident in this intervention.

Critique helps to surface these issues. Within creativity, data triangulation has been used in conjunction with critical review, and has served to confirm the validity of the approach. Critique of choice, matching the outcome against the principles of TSI, the four key dimensions of an organisation, and the principles of the complementarist framework, has

further supported the methods used. The previous functionalist view of the problem situation has been shown to be inadequate, and has been recast as a designing - debating one. Methodological choice has been strengthened by the use of critical review, enabling this to be more informed.

An awareness of the organisational structure and culture has been achieved, which the non-reflective, structured approach failed to challenge, accepting the existing organisational environment. Critical awareness has raised this for debate, surfacing issues which, when uncritically accepted, prejudiced the success of the development.

Complementarism was not considered in the structured approach taken for the original development, its functionalist perspective having taken a single theoretical view, subsuming within it limited interpretative analysis (from one management viewpoint). The complementarist approach has exposed this weak theoretical position, and contrasted it with the need for functionalist, interpretivist and critical issues to be dealt with in satisfying the three knowledge interests. In addition, complementarism at the level of methodology has been applied, encouraging methodological diversity to address the problem situation.

Emancipation, necessary to the achievement of the other objectives, has been verified as achievable within this intervention, the conditions for participation and consensus forming being encouraged within the University. The structured approach, in not addressing this issue, failed to challenge the agreement on the problem to be addressed, and this uncritical acceptance left the view of the problem situation underdeveloped.

Question ii) Taking each of the commitments of CST in turn, how could they be achieved without using an explicitly critical framework?

The evidence of the case is that an explicitly critical framework is necessary if the five commitments of CST are to be met.

In the original approach to this intervention, **critique** has not been in evidence, and many of the problems encountered can be traced back to this. The study, as with the case analysis in Chapter 4, demonstrates the extent to which the functionalist framework suppresses a critical view, and consequently prejudices the success of the intervention. Concentration within the original approach focused on deriving a specification which could be fixed and then worked toward using project management techniques. It is difficult to see how an iterative, critical approach could be enacted in such a strongly project oriented exercise.

Theoretical **complementarism** has been circumvented by working from within one theoretical paradigm (functionalism). Such an approach has been demonstrated as ill suited to this intervention, which requires functionalist and interpretivist elements to be addressed.

Emancipation, whilst available to the original intervention within the existing culture, was simply not considered, its development thereby being left to chance. The result was that views of participants were not fully pursued, and the emancipatory commitment not followed through.

These two subsidiary questions contribute to the key research question, which asks whether the interventionist framework can be seen to give rise to improvements in CbISD. These findings are drawn from the section in which TSI is applied to the problem situation in problem solving mode.

Creativity within problem solving proved to be key to this intervention. Previous development has assumed an agreed set of goals, and attempted to project manage a way toward them. The result has been systems which clearly serve only a limited view of the organisation, compared to the views of all stakeholders which have been obtained from this intervention. The involvement of participants in the systems development process has been an important benefit: by seeing their own reality in the situation, rather than that of an expert, participants have understood and made a greater contribution to the problem context. Previous concentration has been on the development of the computer system - a realist, functionalist approach which aimed and failed in its attempt to make participants contributors to the information systems. Creativity has shown an alternative, people-centred approach, which has given a richer view of the problem situation. Problems of reconciling the University's past and future have been unearthed by the TSI method, allowing both the designing and debating questions to be addressed within one complementarist framework.

Choice of method has been an important factor in the success of this intervention. The previous approach was to assume that all 'problems' could be 'solved' using structured methods. This has been exposed as addressing only the design questions, assuming no conflict as to the target system to be designed. The methodologies surfaced in the choice phase showed this to be an impoverished view of the problem situation, and indicated debate to be the primary concern. Nevertheless, the subsidiary requirement to address design issues within the intervention was met by splitting the investigation into two parallel stages, a conclusion reached as a result of the outcomes of creativity and choice.

Implementation of the chosen methodologies has led to findings which address many of the known problems with the current system. Such problems, under existing methods, have continued to be approached by problem-solving techniques, which have been demonstrated as inadequate.

As in the case analysis, the **critical review** of methodologies has proved of immense value in addressing this problem situation. There is evidence from this intervention, however, that the process of critical review may add an unnecessary complexity at certain stages, as was the case with the choice of creative methods.

Critical reflection on creativity and choice has confirmed the validity of the choices made, and added to the confidence in the interventionist methods used. However, the circular nature of critical reflection as practised within TSI raises some concerns which will be revisited in the critical appraisal of the intervention in Chapter 6.

Hypothesis Testing

The objective of this intervention was to ‘improve faculty access’, or access for all participants in the system. Although this requirement was made explicit as late as 1995, analysis within this study shows this to have been a shortcoming of the earlier development. The identification of disparate viewpoints from a variety of stakeholder groups places human activity issues high on the agenda within this development, and, it is argued, justifies viewing the system of study as a system of human activity.

To test the hypotheses, the original approach, prior to the TSI-based intervention applied within this study, will first be outlined, together with the perceived shortcomings of this approach. The benefits seen to have accrued from the application of the critical complementarist approach informed by critical social theory, critical systems thinking, and TSI, will then be detailed. Finally, issues specific to the three hypotheses will be discussed, and the hypotheses tested.

In the original approach, the views of managers and developers were used to derive a simple unitary position to which the design method was targeted. The use of a design methodology is implicit rather than explicit, with project management techniques applied to a platform-independent oracle development. Analysis of this approach within this study suggests that this provided an impoverished conceptualisation of the development, which a more human-centred focus would contribute to overcoming.

Applying the TSI framework, creativity became the key to the intervention; but this formed little part of the original development. Choice of creative method led to brainstorming sessions which surfaced the change from a stable bureaucratic past to an unstable socio-cultural future and the dual contexts of debate and design. Overall, there emerged a conceptualisation of the system which had failed to surface from the previous three years of development.

In choice, both operational and strategic issues were surfaced, giving rise to choice of methods to address both under a TSI 'umbrella'. The use of critical review in choice of methods, and critical reflection on that choice were important elements. Similarly the complementary choice of methods overcame the original theoretically and methodologically isolationist approach.

The operational implementation developed change proposals left unaddressed by the original regulative method. Whilst it could be argued that a more thorough implementation of a structured method would have achieved this, it could not have kept the interpretative views of participants in focus at all times of the development.

The strategic implementation gave rise to benefits not perceived in the original approach. Obstruction analysis saw the previously envisaged resource limitations as largely illusory; the tensions of the organisation's residue from its bureaucratic past. Idealised design showed the future of the organisation to be within its control, and pointed to a participative approach to achieving this.

With regard to hypothesis 1, a number of benefits can be attributed to the use of the TSI framework. Firstly, in terms of critique, system boundary critique, the critical review of methods, and critical reflection on choice, have all been demonstrated as enhancing the intervention. Throughout the development, an emancipatory theme has been maintained, enabling a 'watching brief' to be kept on coercive influences. Finally, the limitations imposed by the use, originally, of only one (functionalist/isolationist) method, have been addressed by a complementarist approach, allowing control of multiple methods across different facets of the intervention.

In respect of hypotheses 2 and 3, critical reflection on the action research undertaken has looked explicitly at how another method would have achieved better output, what another method would have done, and why another method would have achieved better results. The findings all point to the TSI framework significantly enhancing the system development.

Hypothesis 1 It is preferable that computer-based information systems which are rich in human activity are not developed using methods which fail to address critical, complementarist and emancipatory issues.

The findings of this action research phase further support the outcome of the case analysis, requiring information systems development to be based on some form of social action theory. Hypothesis 1 cannot be rejected.

Hypothesis 2 Using an interventionist method explicitly based on critical social theory gives rise to operational and strategic benefits which are not attainable by traditional regulative methods.

The regulative methods of functionalism and interpretivism exhibit significant shortcomings when compared to critical approaches. Their inability fully to address cross-paradigmatic issues causes a tendency toward isolationist or, at best, imperialist methods, giving a limited perception of the problem situation. Regulative methods lack any form of critical appreciation or emancipation, and yet interpretivism relies on emancipation for its success in consensus forming. The critical complementarist approach, underpinned by critical social theory, offers a way out of this dilemma which, in this intervention, has been demonstrated as achievable. Hypothesis 2 cannot, therefore, be rejected.

Hypothesis 3 Negative hypothesis: All the benefits seen to accrue from the use of interventionist methods explicitly based on CSoT are achievable by regulative means.

The intervention demonstrates that, in this particular problem situation, hypothesis 3 is rejected. Whilst it is conceivable that an explicitly interpretative methodology linked to a functionalist one would address the issues raised, there still remains the question of how it could be known in advance that such a situation prevailed, which is surfaced only by creativity within this intervention. Clearly, the previous structured approach proved to lead to the wrong choice of method, and proved unable to address the critical and complementarist commitments of CST. Since emancipatory issues are of little importance, a mixed methodology approach such as multiview might be indicated, but the lack of critique and simplistic assumptions regarding paradigmatic conflict are problematic.

5.8 Conclusions

The participatory action research undertaken in this chapter gives further support to the view that the framework developed for intervention (Figure 3.2) has much to offer in computer-based information systems investigations. Study of existing systems, rigorous application of the interventionist framework, and critique of the work undertaken, all serve to confirm the value of this new approach. Strategic and operational issues not surfaced in earlier development work are seen to fit clearly into the total systems intervention framework, and are true to the tenets of human inquiry. The complementarist, critical, and emancipatory elements of the approach are clearly demonstrated as enhancing the intervention.

In Chapter 6, a critique of the work carried out within this thesis will be raised, in order to appraise the success of the intervention and inform future development.

Chapter 6

Critical Appraisal

6.1 Introduction

Although the student records intervention at the University of Luton is iterative and continuous, this thesis marks the conclusion of a major initial phase: a point at which all of the chosen intervention theories and methods have been considered and applied.

This chapter now reflects on the investigations to date, taking a critical perspective to appraise the study.

A critical appraisal is undertaken from theoretical, practical, and external perspectives. This critique assumes viewpoints which are opposed to those adopted in the thesis, the purpose being to question the bases and conclusions as objectively as possible. The critique is then answered, both from a theoretical viewpoint, and in relation to the practical experience gained from the study. Following this, the validation and critique of the outcomes of the study are undertaken, using triangulation and content analysis.

6.2 A Critical Appraisal of the Study

This critical appraisal takes the form of three separate critical perspectives: theoretical, practical, and external. The theoretical critique takes each of the key theoretical arguments raised within the thesis, and proposes counter arguments which question their validity and applicability. The practical critique looks at the practical application of the interventionist framework to the case studies and, particularly, the action research, and raises arguments which question the validity of the approach from a practical perspective. The external critique raises fundamental issues which may be seen as a challenge to the whole basis of the research undertaken.

The first part of the critical appraisal ('Critique') takes a deliberately polemic stance; in the second part ('Discussion and Consideration'), the findings from the critique are then discussed and considered, in relation to the intervention undertaken.

A Theoretical Perspective

A Critical Social Approach to Computer-based Information Systems Development (CbISD) is too Theoretical

Critique

The general critique is that the approach is too theoretical and normative (Hirschheim and Klein, 1989). This problem emanates from the fact that the critical social approach has its roots in theoretical rather than practical findings. As acknowledged within this thesis (see Chapter 2), the impetus for the approach came, not from practice, but from the perceived theoretical shortcomings of existing approaches, to which was proposed an alternative theoretical direction. As this development took place some fifteen years ago, its lack of impact on the information systems domain since that time may be construed as evidence of its limited practical relevance. Indeed, this could be seen as lending further credibility to the criticism, acknowledged by Flood and Jackson (1991b p.241-4), that TSI may be regarded as too philosophical.

Discussion and Consideration

The argument that a critical social approach to computer-based information systems development is normative can no longer be supported. Although poorly developed within the information systems domain, evidence from management science indicates that a practical application of critical social theory to organisational intervention exists, and is well tested. The studies conducted in support of this thesis demonstrate how such an approach can be applied to information systems, and in doing so give rise to benefits not seen from the currently favoured functionalist and interpretivist methods.

Indeed, the strong reference to theory has enabled the critical social approach to computer-based information systems development (CbISD) to be more critically reflective of its procedures and outcomes, and to exhibit an awareness, the lack of which is a recognised shortcoming of the regulative methods (the false claim, for example, of hard methods to being objective; soft to being radical).

Human Inquiry

Critique

The main forms of human inquiry applied within this study have been participatory action research (PAR) and co-operative inquiry. In PAR, the tension between participation and leadership, and the decision of when power is 'legitimate' can prove problematic, partly as a result of a research method seen as most applicable to the powerless and oppressed being applied in Western industrial society. In its most radical form, self-reliant participatory action research, human inquiry forces the interventionist to deal more explicitly with issues of power and emancipation (Fals-Borda, 1996).

Co-operative inquiry is also not without its difficulties. It is a long-term commitment in which there is a need to overcome problems of initiation, ownership and power through negotiation and confrontation (Reason, 1988, p.21). So setting up and facilitating the group requires a lot of care, and demands of the facilitator a range of skills.

Facilitation style can affect the intervention, but even if this is carefully practised, the evidence is that neither management nor participants will be openly receptive to such a liberated approach. Even if they are, the organisation's culture may well restrict its application. Furthermore, the power and emancipation issues are not as polarised as they are portrayed. In Western industrial economies, it is not simply a question of power or resistance to power; liberation or no liberation: the degree of legitimate power needs to be determined, and within the critical systems thinking (CST) and total systems intervention (TSI) framework this is simply not given sufficient attention.

Finally, the rather simplistic application of human inquiry principles to this intervention gives insufficient support, and fails to provide the necessary commitment.

Discussion and Consideration

Although open to critique, positive benefits are to be gained from a process of human inquiry. In addition to the assistance it offers in facilitation, there is also support for the critical thrust of critical systems thinking and total systems intervention.

The human inquiry critique can be summarised into problems of facilitation, emancipation, a poor conceptualisation of power, the need for iteration and long term commitment, and the argument that it provides a poor fit within a Western industrialised context.

The facilitation problem has been met within the action research conducted at the University of Luton. In terms of facilitation style, it is argued that, in action research, this rests largely with the ability of the facilitator; in particular the avoidance of claiming expert status and superimposing a substitute reality on the participants. However, the interventionist framework (Figure 3.2) has also proved of value in this respect. The version of TSI used in this intervention pursues choice and implementation through the guidance of the complementarist framework of designing, debating and disimprisoning, which itself is explicitly based on Habermas' three knowledge constitutive interests: technical, practical and emancipatory. This has had the effect throughout the intervention of 'separating out' facilitation issues related to those methodologies geared toward: *how* to design systems; *what* is the nature of the problem context; and *whose* interests are to be served. Each of these has different connotations for facilitation (e.g. in design, expert assistance is often of value, whereas in debate, it may be argued that the participants are the only 'experts'), and explicit use of the interventionist framework in this study has led, it is argued, to a facilitation style sensitive to the varying problem context. It is maintained that this same position could be reached in other interventions with careful attention to the guidance available from CST, TSI, and human inquiry.

The iterative, long-term nature of the study is problematic. The evidence of this study, and involvement in and observation of other studies within the UK and USA by the author, surfaces an overriding demand from management for answers to problems. This is

indicative of a general short-termism within British and USA management, which seems to see long term studies as procrastination. The solution within these investigations has been to divide the interventions into operational and strategic. This is seen as legitimate, since TSI is able to address operational issues through primary focus on design, and strategic through primary focus on debate and disimprisonment. In this way, the immediate needs of management are satisfied, whilst the important longer term issues, which are, in fact, strategic in nature, gain more support when presented in those terms.

Though not applied in this way within the University of Luton intervention, it is felt on reflection that a fuller integration of HI might improve the TSI process. It is recommended that co-operative inquiry be assessed for its potential to replace in its entirety the participatory stages of TSI. Such an approach could be applied to the strategic intervention in this study, with a co-operative inquiry group focusing on creativity within the problem solving mode of TSI, critical reflection, and support for the implementation of interactive planning. Since strategy is a long-term undertaking, the group would be seen as ongoing, with the objective of surfacing issues and informing the overall process. As more specific problem situations emerged, the output of the group would be used to feed into a wider, TSI-based, intervention.

The emancipatory, power-related problems are, it is proposed, more fundamental to the whole subject of human inquiry within Western industrialised organisations. Whilst not key to this intervention, theoretical problems with the emancipatory stance of CST and TSI have nevertheless surfaced, and will be dealt with in detail within the following sections.

The Ideological Premises of Critical Systems Thinking and Total Systems Intervention

Critique

CST and TSI are openly ideologically premised on critical awareness, social awareness, complementarism at the levels of methodology and theory, and human emancipation (see section 2.6, p.33 for a detailed argument of this position). This is claimed to contrast with the functionalist and interpretivist positions (Flood, 1990b p.183), which both claim to be ideologically neutral, but which in fact can be shown to be conservative; the former as a result of “technocratic control” and the latter from it being “practised in the confines of the maintenance of social order”.

Critical awareness and social awareness depend for their success on the ability of participants to contribute openly to the intervention process; or emancipation.

Complementarism at a methodological and theoretical level rests on the knowledge constitutive interests of Habermas, which in turn are heavily premised on emancipation.

Emancipation is therefore seen as key to any TSI intervention, a point which is recognised by Flood and Jackson (1991b p.244).

However, this situation, on which TSI is so dependent, is an *ideal*. If such ideal conditions do not pertain, does the interventionist refuse the work, or proceed within the less than optimal constraints (see Flood and Jackson, 1991b p.244)?

This raises an important critique of TSI. Whilst, arguably, entirely consistent within itself, and as an interventionist framework, it could be maintained that it depends for its success on *all* the commitments of CST being met within the intervention. Of these, emancipation will often prove the most difficult to attain, but if it is not attained, the whole complementarist, critical and emancipatory thrust of TSI will be lost.

Finally, in terms of ideology, the concept in CST of theoretical commensurability being at the meta level (see, for example, Flood, 1990a), has led to TSI being considered a meta

methodology, guiding the choices made between other methodologies (Midgley, 1995a). This idea of TSI being meta-paradigmatic will, it has been claimed, lead to a position where the validity of other approaches is denied (Jackson and Carter, 1991), restricting the “.. possibility that others would legitimately disagree with it.” (Midgley, 1995a). In effect, this places TSI as *the only* legitimate means of allowing a mix of approaches from different paradigms in a single intervention, since any alternatives would be resisted. This is hardly an ideal position from which to propose cross-paradigmatic conciliation.

Discussion and Consideration

The issue of what to do if all ideological conditions are not seen to exist within an intervention is a powerful criticism. Reference to interventions carried out using TSI (see Flood, 1995b, p.233-389), seems to infer that benefit can be derived from the application of parts of the TSI framework, provided the underlying principles are adhered to. However, evidence from the University of Luton intervention, it is argued, clearly demonstrates the benefit of a thorough application of all the principles and procedures. Whilst accepting that advantages are to be gained from partial applications, the view formed is that, in the longer term, rigorous application and critique of all aspects of the TSI framework in all interventions will serve to advance its implementation.

The emancipatory critique sees the whole process of TSI as *relying on emancipation*. Within the action research at the University of Luton, since coercion was not surfaced as a key issue, this problem has been addressed only to the extent of checking that the emancipatory conditions necessary to the success of the intervention were in evidence, so this key ideological element of TSI was seen to be satisfied. However, critique from this perspective is too important to be ignored, and the emancipatory problems are therefore dealt with separately below.

The critique of TSI being considered a meta methodology is accepted as well founded, and it is recommended the meta status claim be dropped. Although, within this thesis, the terminology ‘meta-methodology’ has been followed, the approach throughout has been to fully

consider alternative approaches, thereby positioning TSI as a alternative rather than meta paradigm. Such a view is seen as essential to the development of healthy debate.

Critical Social Theory and Total Systems Intervention

Critique

A major advance in interventionist approaches has been made as a result of the critical stream in management science, but, since its commencement in the early 1980s, this development has relied almost entirely on Habermas' theory of knowledge constitutive interests (KCI) for its theoretical underpinning. There is, however, a wealth of critical theory available to the interventionist, emanating from the foundations laid by Kant (1724-1803), whose exposure of 'synthetic *a priori* statements' shows how an uncritical approach may lead to a false consciousness, which a critical approach is able to expose. More recently this has been explored (see, for example, Midgley, 1995a; Brocklesby and Cummings, 1996; Probert, 1996). Brocklesby and Cummings (1996) refer to a historical development through Hegel to Marx and thereby to the Frankfurt School, the main contributors to which they identify as Horkheimer, Adorno and Marcuse. Probert (1996) queries the exclusion of Benjamin and gives more weight to the work of Adorno.

Consequently, the first criticism of using Habermas' knowledge constitutive interests (KCI) as the basis for critical systems thinking, is that it is simply temporally convenient. There is no reason to ignore all other theorists in favour of Habermas, and doing so leaves CST with a limited theoretical justification. Even if the theoretical underpinning for CST is limited to current, or most recent, influential critical thinkers, the work of Foucault, at least, cannot be ignored. Habermas has concentrated on a view of emancipation in which methods can be developed to emancipate people as a whole, which in management studies has been applied to the emancipation of groups, or emancipation within organisational interventions. Foucault, by contrast, sees emancipation as an essentially individual concept, and aims to give participants the tools by which to liberate themselves. In Foucauldian terms, emancipation of participants within an interventionist situation is simply not possible.

Even if it were accepted as justifiable to cast Habermas as currently the most significant critical thinker, the choice of his knowledge constitution theory as a basis for the development of a critical approach to organisation studies can be questioned. Midgley (1995a), for example, argues that the theory of knowledge constitutive interests supports a predict and control approach, thereby perpetuating a view of the human domination of nature which, it could be argued, will have detrimental consequences. Midgley proposes a solution based on Habermas' work on universal pragmatics, in which Habermas argues that communication aimed at reaching an understanding always involves the raising of four validity claims, which may be categorised as comprehensibility, truth, rightness and sincerity. Midgley (1995a) has undertaken some initial work to develop these as an alternative basis for a pluralist theory. Truth is seen by Midgley as relating to the objective/external world, and thereby to hard, cybernetic methods; rightness to the normative, social world, and hence soft methods; and sincerity to the subjective, internal world, and cognitive methods such as cognitive mapping and personal construct theory (see Kelly, 1955; Eden, 1988; Eden, 1994). Similarly Oliga (1996) and Foong (1997) have focused on Habermas' (1987) system-lifeworld concept, which conceptualises "society as a whole" as consisting of lifeworld: the inner needs of its members addressed via communicative action; and system: the outer needs addressed by material reproduction through labour. The outer needs are concerned with "system integration", and the inner needs with "social integration", and only if balanced, argues Habermas (1987 p.152), does society as a whole become "*.. systematically stabilised complexes of action of socially integrated groups.*" In modernity, it is argued, system dominates, with the lifeworld undermined by "transfers of communicative infrastructures to the system" (Foong, 1997).

Recent work by Hirschheim *et al* (1991) looks at the application of social action theories from Weber, Etzioni and Habermas (Weber, 1947; Etzioni, 1967; Habermas, 1971a; Habermas, 1976) as a basis for a theory of information systems development formed from seven elements: consensus, resistance, conflict, knowledge, subjective meanings, power and human interests. Knowledge and power seems central to the approach, though the work lacks advice as to practical action.

The picture that therefore emerges of CST and TSI, is of an interventionist approach which is underpinned explicitly by critical social theory, but which gives insufficient consideration to the range of critical social theories available. The adoption of an alternative (e.g. Foucauldian) perspective is seen to seriously undermine the emancipatory commitment, and thereby the whole interventionist framework.

Discussion and Consideration

The development of TSI as an interventionist approach based on a strand of critical social theory (CSoT), has given significant impetus to the critical stream in management science. Equally, it is contended, the studies undertaken within this thesis have demonstrated the value of TSI to computer-based information systems development. The extensive reading of the literature carried out during this study has given rise to a number of conclusions. Firstly, the choice of Habermas' knowledge constitutive interests (KCI) as an underpinning to critical systems thinking (CST) is neither arbitrary nor eclectic, but has arisen from careful consideration of the development of CSoT. However, the success of the critical movement in management science has given rise to a resurgence of interest in other strands of CSoT, and it is recommended that this resurgence be encouraged and supported. What is of greater concern is not that there may exist untapped veins in the critical social domain, but that, in choosing KCI, TSI might be pursuing an emancipatory theory which lacks credibility. Again, this has not surfaced as an issue in the current intervention, but more work is seen to be needed in general terms to further develop this aspect of critical management science.

Emancipation

Critique

It is in the pursuance of emancipation that CST and TSI meet their most severe challenges. TSI, dependent as it is for its theoretical underpinning on Habermas' theory of knowledge constitutive interests, strives to achieve emancipation through the emancipation of groups within the context of an intervention. But emancipation, it might be argued, is dependent on psychoanalytic theory, and is an *individual* concept (Tsoukas, 1992).

Even if a problem situation can be made more emancipatory, the current perspective of critical systems thinking, argues Tsoukas, is polarised: it is not whether or not emancipation exists, but to what extent, and how much is acceptable or necessary. This requires that issues of legitimate power are addressed. In fact, argues Tsoukas, power relations are inadequately addressed within the CST and TSI frameworks (see Tsoukas, 1992 for a critique), and while this is so, can CST's claim to being radical be sustained? Tsoukas argues that CST sees power in conflictual terms, which is too restrictive and leads to political issues being underplayed. Why not see power as an enabler? Parallels here are to be found in the work of Etzioni (1975), where the key might be seen as the view that not all response to power is alienation, but rather that a commitment may result. Similarly, Tsoukas cites Mintzberg (1983; 1984) as supporting this position.

Tsoukas accepts the critical systems perspective's critique of interpretivism and positivism as valid, but sees the critical position as normative. Hence the critique of interpretivism and positivism as accepting the status quo, whilst CST, although *promoting* radical change, shows little ability to achieve it. This view is supported, it is argued, by the identification of the systemic - coercive dimension within TSI, whilst no methodologies exist adequately to deal with it.

Midgley (1996) takes up the argument, contending that debating methods such as critical systems heuristics will not work in coercive situations, since such situations are characterised by the *closure of debate*. Even if debate is possible, argues Midgley,

participants have unequal participation in rational argumentation (caused by personal factors, lower literacy etc.), so that debate may actually increase the inequalities between them. In such circumstances, argues Midgley, political action is the only way forward.

Jackson, in a plenary paper at a recent conference (Wilby, 1996c), is equally unconvinced by the potential of critical systems heuristics, and questions whether emancipation in the Habermasian sense is achievable, replacing the emancipation of the CST and TSI frameworks with ethical alertness.

Emancipation, then, is a key commitment of CST and TSI, but in the form proposed can be challenged theoretically, and displays little evidence of practical validity.

Discussion and Consideration

Emancipation is not an 'on-off switch', but exists to a different extent in different problem situations. At the University of Luton, participants are mostly willing and able to express their true feelings, whilst management is equally happy to open up issues for debate. Nevertheless, participants have different levels of ability and commitment toward to an emancipatory process, and good facilitation and education can enhance that process within a participant group. Where the Foucauldian view is seen to be most relevant is in circumstances where absolute power is exercised and debate is not permitted. It is the author's view that such extreme circumstances are rare, but it is accepted that, with such complete closure of debate, a solution based on debating cannot succeed.

The conclusion to be drawn is that both the group and individual emancipatory approaches are valid. In most cases, benefit will be derived from emancipatory methods based on debate. Where closure of debate makes this impossible, the direct political action and campaigning advocated by Midgley may be the only solution.

Critical Reflection

Critique

Methods suggested for critical reflection (see Chapter 5) focus on the choice and implementation phases. In the choice phase, reflection is via: the underlying principles of TSI; the four key organisational dimensions; the common and distinguishing principles of TSI; and by asking the question 'is there a better method'. All of these have their own problems. The first three, in particular, seem to take the validity of the TSI approach as axiomatic, and check if it is being properly applied - a rather circular argument. The last is of value, but cannot be applied by the interventionist, whose mind-set will almost inevitably lead to the same conclusions as those reached in the intervention. If undertaken by someone independently, the paradigm incommensurability problem will again surface. So any critique undertaken by the interventionist, or another critical thinker, cannot escape the paradigm from which those persons will view the intervention, whilst critique from an 'outsider' is likely to be dismissed as being grounded in inapplicable paradigmatic thinking. This latter point applies equally to critical reflection on implementation, where reflection is on the methods used and the outputs of those methods.

Discussion and Consideration

Critical reflection has proved beneficial in the action research part of this study. The iteration, recursion and critical reflection built into the three mode and three phase process of TSI, was instrumental in moving away from the traditional problem solving approach taken to CbISD. However, it is accepted that the introspective nature of this critique, whilst internally consistent, depends strongly on the principles of TSI being accepted; the critical reflection for the most part checking that these principles have been correctly applied.

More work is needed on reflection from other perspectives. Within this intervention, alternative perspectives were adopted by the author, and were sought from colleagues known to favour alternative paradigmatic approaches. It is felt that this process

strengthened the findings, but it is accepted that the attempted adoption of alternative frames of reference is of limited success.

A Practical Perspective

This practical critique looks at the practical application of the interventionist framework to the case studies and action research undertaken, and raises arguments which question the validity of the approach from a practical perspective.

General Issues

Critique

To begin with, it seems worthwhile considering the practical critiques raised by Flood and Jackson (1991b p.241-4):

TSI has been criticised for being too structured, and for being practical or contingent at the methodological level, TSI, at each phase, passing control to a methodology. Flood (1995a p.189) makes the point that, whilst any method can be related to TSI through the complementarist framework, they are all hybrids. What is needed, he contends, is for methods to be developed from the principles in the framework, each method focusing on one purpose (designing, debating or disimprisoning), and the combination of methods thereby adequately covering all three.

A further criticism is that environmental issues are ignored. Basing the approach on Habermas' theory of knowledge constitutive interests gives rise to a view of human beings in a predict and control relationship to the environment. A better view, it could be argued, would be to see human beings in a sustainable, interactive relationship with their environment (Midgley, 1995a).

Finally, TSI is criticised for being too strongly focused on a Western industrial view, and therefore lacking applicability in other contexts.

Discussion and Consideration

In the University of Luton intervention, TSI utilised the systems development life cycle (SDLC) and interactive planning (IP) methodologies at different stages of the investigation. However, the use of the interventionist framework, developed from TSI and human inquiry, meant that the intervention was at all times under the control of TSI; in the operational intervention for example, the findings were processed through TSI at every stage. Methodologies were not chosen or applied in a pragmatic or contingent manner, but were used in a critical, complementarist way, supporting the emerging views of the participants. This was undoubtedly helped, however by the choice of methodologies, particularly IP, which fitted well with the principles and practice of TSI, and which, whilst primarily supporting debate, has good links to design, and a strong strategic thrust.

Experience with IP, linking operational and strategic issues, and dealing with problems of design and debate in the same problem situation, gives support to Flood's view that the development of methods for each purpose would prove a viable way forward, although implicit within this is the need for these methods to link together within the overall complementarist framework.

The question of environmental issues being ignored, and the Western industrial focus, are critiques which need to be addressed. The work previously referred to by Midgley (1995a), and the more general in depth revisiting of the critical social stream advocated within this thesis, are early moves within which environmental issues are seen to be dealt with more fully. The developing relationship between human inquiry and CST is of value in focusing on areas other than the industrial Western world; indeed, as has been identified within this study, human inquiry is criticised for its *lack* of applicability to the West. Additionally, work within the systems movement is looking at the application of similar ideas within other cultures (Zhu, 1996).

The Complexity of Using TSI

Critique

To use TSI requires a grasp of an approach which operates in three modes and three phases, is recursive and iterative, and is a far from simple undertaking. Reference to Chapter 5 of this thesis is testament to the difficulties encountered here. Furthermore, since such an approach is unlike the methods used by most interventionists in the information systems domain, the learning process is made even more difficult. Added to this, human centred intervention techniques, which have been shown to be dependent on theory and practice from the field of human inquiry, must be mastered. Problems with the process of critical reflection are outlined above; whilst critical review requires knowledge of a range of methods, together with practical experience of them. All of this represents a significant barrier to the use of these methods in the operational and strategic development of information systems, and the likelihood is that for the foreseeable future most interventionists will continue to use at best single methodologies in an imperialist fashion, and at worst the pragmatic techniques with which they have become familiar.

Discussion and Consideration

Applying TSI to problems of complex human activity is a difficult undertaking. This thesis seeks to follow the principles and practice of TSI 'to the letter', and in doing so builds a complex web of actions and interactions. Twelve methodologies have been identified and appraised in detail, and many more in outline; human inquiry techniques have been developed. Critical review and critical reflection have been applied extensively in an iterative and recursive framework.

But what is the alternative? The success of this intervention, and of others in management science (see Flood, 1995b p.235-389), are evidence of the value of the approach. Should TSI be ignored because of the difficulties?

Perhaps the answer lies in the nine case studies cited by Flood (1995b p.235-389). Whilst clearly demonstrating benefits deriving from the use of TSI, general principles rather than a thorough working through of its process characterise these cases. Space limitation is clearly partially responsible for this, but reading the cases implies that most focus on the *principles* of TSI. The ultimate goal (see section 6.2, p.148 ideological premises) is to rigorously apply the methods within each intervention. However, in the short term, it seems that benefits are being derived, and the development of TSI being achieved, by interventions concentrating on its principles, without necessarily undertaking the full process.

Certainly, interventionists into computer-based domains, rooted as most are in isolationist or imperialist approaches, may find the transition to a complementarist approach rather demanding. But the alternative, certainly within computer-based information systems, is to continue designing systems for which there has been no agreement to proceed, and which fail to meet the needs of the participants for whom they are designed.

System Boundary Setting

Critique

In order to conduct this study, boundary judgements have been made, bounding the context of the investigation (see Figure 5.4).

As is highlighted by Midgley (1995b), inquiry without boundaries is meaningless, whilst a too rigid setting of boundaries effectively means they are being uncritically accepted, with the consequent destructive effect on the intervention. Midgley points out that, whilst this problem is recognised, dealing with it is not built in to the TSI/CST methodology at the methodological level.

Discussion and Consideration

Setting the system boundary has been an important element of this research. Midgley (1992) recommends that this must be conducted critically, and that the process for conducting the critique begin at the margins of the system definition. Such critique gives rise to a primary and secondary boundary, between which Midgley, drawing on the work of Ulrich (1983b; 1988), sees choices of truth and rightness (see section 6.2, p.148 Critical Social Theory and TSI, for a further explanation of the relevance of these issues to critical systems thinking) being made. The elements of the system which emerge from this analysis, Midgley (1992) characterises as either “sacred” or “profane”: defining as profane an element supporting the primary boundary and sacred as supporting the secondary boundary.

Ulrich (1996) further develops this argument, suggesting that both facts and value judgements take on a different character as our boundary judgements are changed.

In this thesis, critique of boundary judgements has been carried out in developing the system boundary (see Figures 5.3 and 5.4). In Midgley and Ulrich’s terms, this is represented by Figure 6.1 below.

Boundary critique showed participants within the current system, and other potential stakeholders who were effectively not currently seen to be participants (administrative staff, students and academics), to be in the margin between the primary and secondary boundary. The new system definition (Figure 5.4) saw these as sacred, whilst the existing definition saw them as profane.

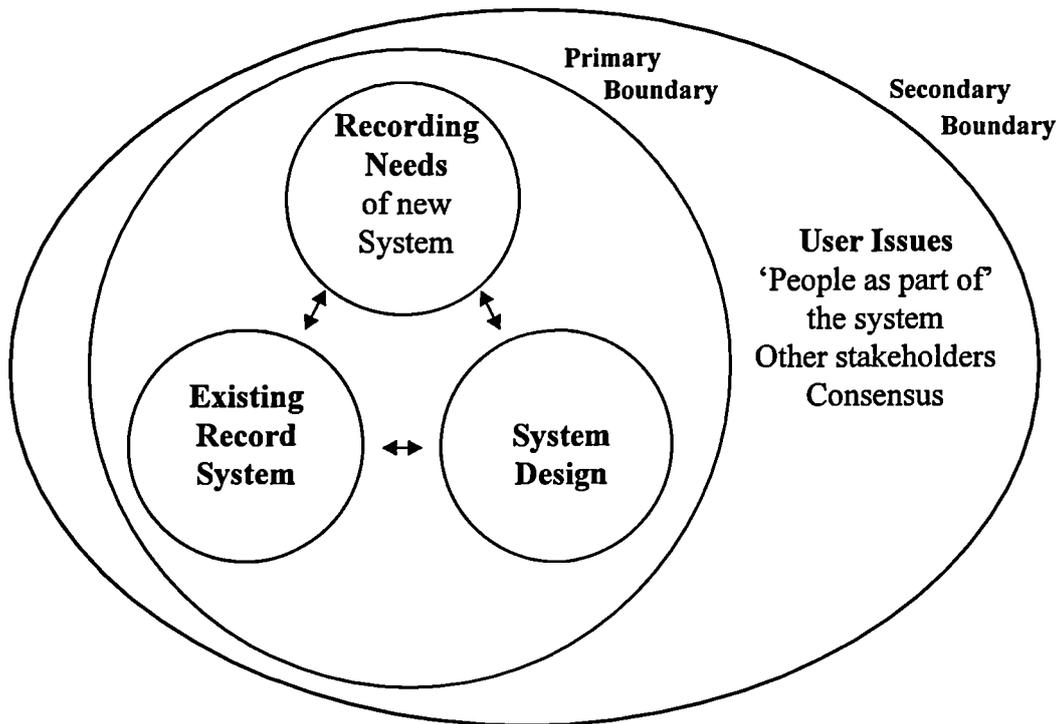


Figure 6.1 *Critique of the System Boundary*
(after Midgley, 1992)

This new conceptualisation of the system was a key element in the intervention. Clearly, further conceptualisations of the margin could be used to develop this critique, in which case Ulrich's (1996) work, suggesting the use of critical systems heuristics to surface boundary judgements would warrant further investigation.

External Critique

This external critique raises fundamental issues which may be seen as a challenge to the whole basis of the research undertaken.

Information Systems: A Pragmatic, Technological Domain?

Critique

Whilst it may be accepted that human activity systems are non-deterministic, and cannot be studied by functionalist methods, why does this require human activity to be the focus in designing a computer-based information system, or could a pragmatic, technological or

mechanistic approach be seen to be adequate? The functionalist or mechanistic approach has been used in businesses as successful as Vauxhall and Toyota, where, for example, production operatives are seen as part of the mechanised process. If, as is contended in this thesis, human activity systems are not predictable, surely the best approach is to concentrate on offering the most up-to-date technology to achieve the stated goals, and then give human actors the space in which to use this technology to its best advantage? Furthermore, many information systems developers will be focused on clearly defined ends, so design is best undertaken from a technological perspective.

Discussion and Consideration

The argument for information systems, which by their nature imply high levels of human involvement, to be viewed in pragmatic, technological terms seems hard to sustain. In Chapter 1, the structured approach is critiqued not only theoretically but practically. In Section 1.3, p.7 instances of failure are cited which, it is maintained, are due at least in part to the approach. Section 1.4, p.9 shows how theorists and practitioners in the information systems domain have been approaching these issues over the last twenty years or so. Clearly they perceive there to be a problem. This seems to further legitimise a challenge to both functionalist and interpretivist approaches to information systems, and offers support to the approach taken in this study.

The Paradigm Problem

Critique

This study has taken a position on the paradigm problem, claiming that the use of methodologies emanating from different paradigms is shown to be possible since it is undertaken in satisfaction of the three cognitive interests identified by Habermas. It meets the criteria set by Midgley (1995a), who holds that mixing methodologies must be justified at the level of philosophy. Jackson and Carter's (1991) position is even less optimistic, claiming that inhabitants of competing paradigms are unable to communicate. Seen from this perspective, the only way to resolve paradigm incommensurability under

either the Kuhnian or Burrell and Morgan framework, is by eliminating the opposition. Others contend, however, that the incommensurability thesis itself is flawed. Holland maintains that proponents of paradigm incommensurability, who purport to base their work on the writings of Kuhn, are misguided. Holland's (1990) view is that the paradigm incommensurability thesis has been seen as an escape from positivism, and has been overplayed. Similarly Willmott (1993) argues that, without recourse to Habermas, it is sensible to see the paradigms as delineated by Burrell and Morgan as arbitrary, and it is possible for example to pursue a pluralist strategy (Reed, 1985 p.209).

Weaver and Giola (1994) seriously question the incommensurability thesis. They do so firstly on the basis of common sense, and secondly it is challenged on the basis of observation in organisational studies, where cross paradigm communication is achieved on a regular basis: "To tell us that Galileo had incommensurable notions and then go on to describe them at length is totally incoherent". Weaver and Giola (1994), drawing on the work of Giddens, see structurationist inquiry as a way forward.

The question of paradigm commensurability or incommensurability is debated extensively in social science, and of necessity only a flavour of it is represented here. These findings do, however, cast doubt on the incommensurability thesis, and suggest, at least, a position from which communication across paradigms is seen to be possible.

Discussion and Consideration

Belief in the paradigm incommensurability thesis is hard to resist in the information systems domain. The incommensurable languages used by participants and developers are in daily evidence, and, it is contended, bear much of the responsibility for the hard-soft debate being destructive rather than conciliatory. However, at a practical level, meetings attended by computer scientists and administration systems users within the University of Luton, have been successful in airing common views and generating consensus on the way forward. Complementarism has been achieved in this intervention, lending weight to the view that cross-paradigm communication is achievable in a complementarist intervention.

Post-Modernism

Critique

This section takes a post-modern view, drawing on the work of Cooper, Burrell, Jacques and Lyotard (Lyotard, 1984; Cooper and Burrell, 1988; Burrell, 1989; Jacques, 1989), and particularly on the summary by Jackson (1991b p.32-37). It seeks to interpret briefly the post-modern position as a critique of the work undertaken in this thesis. The different perspectives reviewed are: modernism; systemic modernism; critical modernism; and post-modernism.

A modernist view sees the world as logical and orderly, and searches for unity and consensus within that logical order. The governing perspective is one of rationality, which, in terms of information systems, can be seen to rely on a natural scientific approach. At its extreme, this would give rise to a form of functionalism which denied the necessity to plan for human subjects, or saw them as part of the scientifically predictive world. Systemic modernism perceives a similar order to the world, but promotes a systems approach to it. People are seen to serve the system, and the assumption is that consensus can be engineered. Its parallel is to be found in an approach to information systems which acknowledges the different sub-systems which go to make up the systemic whole, including a human activity sub-system, but which views the whole system from a functionalist perspective. Critical modernism sees history and progress as humanity's progressive liberation from constraints (Jackson, 1991b p.34). Jackson goes on to cite Marxism as the best example of this. It is contended that the work in this thesis is best represented by the critical modernist view.

Post-modernism denies all of this, seeing the world as disordered and unstable. The argument is supported, post-modernists would claim, by the movement in science whereby it no longer claims to pursue objective truth; scientists seemingly now accepting a perspective closer to the post-modern: that science is just one possible view of the natural world. Post-modernists further see consensus seeking as dependent on the use of

language, which, they argue, does not provide an acceptable basis, since the use of language is distorted, and privileges certain cultures and certain classes of society.

The post-modern position therefore effectively denies the possibility of a study of science or social science as practised within a modernist framework, calling into question the basis of the work carried out for this thesis.

Discussion and Consideration

This study details work which is seen to be positioned as critical modernist, the 'emancipated utopia' on which it relies being a fundamental thrust underpinned by the knowledge constitutive interests of Habermas. Whilst understanding the position of the post-modernists, it is clear that study of the type undertaken here would not be possible within an extreme post-modern framework.

As with many of the arguments met within this research, the post-modern position seems polarised. Its value to this work lies in its exposure of disorder and instability in the world, to which interventionists from any perspective would be wise to pay heed, but post-modernism is not to be seen as completely invalidating modernist approaches.

6.3 Validation and Critique of Outcomes

Two methods have been used to validate the outcomes of this research: triangulation and content analysis.

Triangulation

The purpose of triangulation is explained in Chapter 3. Four types of triangulation have been applied to this study. Theory triangulation has been achieved by the multi-paradigmatic perspective adopted, and specifically by comparing and contrasting natural scientific and human centred approaches. Investigator triangulation has been undertaken through the use of a computing professional to undertake some of the work within the operational study in Chapter 5. Methodological triangulation has been a main feature of the intervention, with the complementarist framework of TSI providing the basis of the

approach. Finally, data triangulation has been achieved through the extensive use of different data sources; these have varied from the use of two cases and an action research intervention, to the use of varied methods within these cases and intervention, namely meetings, site-visits, brainstorming sessions, and general observation.

Content Analysis - The Background

The detailed approach to applying content analysis to the investigation is given in Appendix XI. The documents referred to in this, and subsequent sections, are listed in Appendix XI, and copies are available for inspection.

Content analysis is an aid to subjective understanding, and not an objective account of the meaning of the data analysed. The objective use of content analysis methods accounts, it is contended, for the phenomenological criticism to which it has been subjected (see, for example Miles and Huberman, 1994, p.8)

This study generated a number of reports, minutes of meetings, notes of conversations and communications, transcripts of brainstorming sessions, and notes of site visits: the purpose of content analysis is to distil meaning from these documents, thereby providing a rich picture of the meaning contained within them. Documents are split into text units, and information can be retrieved at the document or text unit level. This study generated thirty-two documents, containing a total of 3267 text units.

Index categories used in the analysis (see Appendix XI for the categories used) were generated from the data (Dey, 1993 p.97; Jones, 1985 p.104), which came from the participants as part of the participant inquiry.

Pattern coding was used for the search categories (see Appendix XI), and helped to inform the categorisation. All data was indexed back to categories identifying its source, including author (where relevant), department, and document type (meeting minutes, report, verbal communication and so on). Care was taken in abstracting the data from the documents to guard against loss of meaning as a result of insufficient context being abstracted.

Finally, index searches were used to ‘split, splice and link’ the data (Jones, 1985 p.139-140).

Content Analysis - Interpretation of the Data

Throughout this section, the 32 documents to which content analysis has been applied are referenced by number (see Appendix XI, p.299 for a list of documents). Although these are too numerous to include with the thesis, copies are available for inspection. Whilst many of the documents were produced by the author, they were prepared with the objective of representing the views of those involved. The methodologies used strengthen this possibility, and it is argued that the analysis below, when compared to the outcome of the study, confirms this to be the case. All of the outputs generated have been fed back to, and accepted by the participants involved, and the final management report has been reviewed and accepted by management, up to and including the Deputy Vice Chancellor of the University.

The approach adopted to searching was to continue until saturation point was reached; in other words, until new searches revealed no new information. The objective of content analysis is to see what the data generated during the intervention says about the changes that have taken place. This is achieved by looking for storylines or themes in the data, and seeing how the intervention has changed as a result. It is not seen to be possible to show empirically that the approach taken is *better* than any of the alternatives. The reason for this observation is that, in any intervention, once a particular course has been followed, the possibility of comparison to other approaches within the same study is lost. Inferences can, however, be drawn from comparison to similar cases, as has been done within this study, but care must be taken in drawing firm conclusions from such inferences, since this will depend on the generalisability of the study.

Following the theoretical recommendations outlined above (‘The Background’), the documents were searched using the index searching system of NUD-IST to interrogate the indexed text units (Appendix XI, partially reproduced as Figure 6.2 below). These search facilities are extremely powerful, allowing cross indexing on a variety of bases. For example, a ‘matrix intersect’ search of node (5 1) against node (4 1) gives, in a single

printout, all text units referenced by the combination of nodes: (5 1 1)-(4 1 1), (5 1 1)-(4 1 2), (5 1 1)-(4 1 3), (5 1 2)-(4 1 1), (5 1 2)-(4 1 2) and (5 1 2)-(4 1 3) (see Appendix XI for an example). In addition, simple statistical data can be extracted, which proves particularly useful where searches produce large volumes of data.

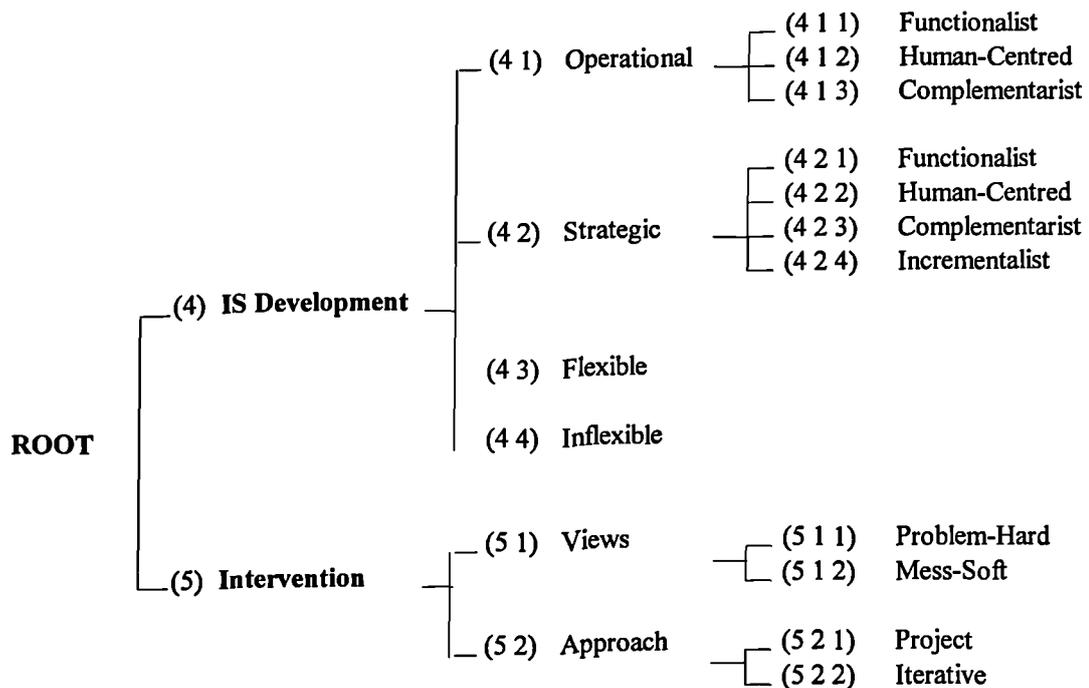


Figure 6.2 *Indexing System for Content Analysis (Partial)*
(See Appendix XI)

Questions were drawn from the data to guide the analysis. Key themes which emerged as important to search out were:

- How has the operational - strategic balance of the intervention developed?
- Do participants regard the problem context and environment to be stable or flexible, and how is this related to the interventionist approach?
- Are participant views long or short term?
- In terms of the functionalist and interpretivist paradigms, how has the intervention progressed?

Analysis of the data generated is carried out below, and takes the form of four distinct elements:

- Initial analysis of indicative statistical data.
- The outcome of searches on single nodes.
- The outcome of searches on multiple, cross referenced nodes.
- A final search to investigate issues not fully surfaced in the earlier searches.

Statistical Analysis

Matrix (1 1) (1 3)									
Values of Departmental Participants									
Participant Values	Department								
	<u>Administration</u>		<u>Management</u>		<u>Academic</u>		<u>Student</u>		
	<u>No.</u>	<u>Percent</u>	<u>No.</u>	<u>Percent</u>	<u>No.</u>	<u>Percent</u>	<u>No.</u>	<u>Percent</u>	
Functional	27	29	36	51	11	22	6	19	
Human-Centred	38	41	19	27	23	47	12	38	
Open	28	30	16	23	15	31	14	44	
Vector:									
(3 1) (4 1)									
(3 1) (4 2)									
(3 2) (4 1)									
(3 2) (4 2)									
Information Systems Development mapped against Views of the Environment									
	View of the Environment								
	<u>Stable</u>		<u>Flexible</u>						
IS Development									
Operational/Functional	34		22						
Operational/Human-Centred	1		34						
Operational/Complementarist	0		20						
Strategic/Functional	8		5						
Strategic/Human-Centred	0		21						
Strategic/Complementarist	0		22						
Strategic/Incremental	0		6						

Table 6.1 Analysis of Matrix and Vector Searches of Large Data Sets

Table 6.1 represents two searches from many carried out in the initial phases of index searching, which were indicative of the general information emanating from the early stages of content analysis in this study.

The matrix search showed the preponderance of views within each of the departmental areas. From the 245 text units retrieved, over 50% of management comments were seen to be functionalist in nature, compared to 19% to 29% for the other departmental groups. Later analysis will show how these differences emerged and were modified during the intervention, but it is important to set these changes in the context of the pre-existing imbalance of views.

Similarly, the vector search, retrieving 173 text units, showed, as might be expected, a strong bias toward a functionalist approach to information system development where the view of the environment was stable. What was of more concern was the strength of the leaning toward functional development to service a flexible view of the environment. Again, the greatest weight of opinion in this respect came from management.

Searches on Single Nodes

Most of the searches were found to be more informative if conducted across multiple nodes, but some valuable information came from single node searches on participant/name, participant/values, and data source/meeting.

Participants/AuthorName: MIS Manager

There were two important early reports from this source, dated May and June 1995 (Phsr001 and Phsr005), and these are seen as lending further weight to the conclusions drawn in the statistical analysis. All MIS development at this time was effectively the sole preserve of the MIS department, as directed by management. Content analysis shows operational problems to take precedence, with a short-term, functionalist focus. There is recognition of the need for a flexible approach to a changeable situation, but this is approached through a technical strategy of hardware independence and relational database software. Whilst this may be a necessary condition, it is not a sufficient one.

The long-term, strategic view, is pursued by planning being equated to software development prioritisation. It is explicitly recognised that there is no information systems strategy, and the proposed means for attaining it is the 'Oracle platform'.

Participants/AuthorName: Chair of MIS Quality Group

The two key documents searched here are from September 1994 and January 1995 (Phsr003 and Phsr026). The initial picture is of an MIS in crisis, and though the student record system is defined as 'not just the computer system', the focus is nevertheless on 'small scale projects' as a possible solution. The later report indicates a change in attitude. Faculty issues were coming to the fore, and the response was to instigate a questionnaire to gather strategic information for the future planning effort. This was the first move, deriving from activity within the Management Information Systems Quality Group (MISQG), toward a more user focused development.

Minutes of MISQG Meetings

The documents reviewed for this section were Phsr004, Phsr006, Phsr008, Phsr020, Phsr024, and Phsr025. By late 1994, the need for links between the MISQG and other University strategic groups was identified, but the approach was reactive. The lack of planning was affecting the success of operational systems: long term planning was seen to be needed, but solutions were short term. The information audit at the end of 1994, though of limited success in itself, was a key move toward a more strategic approach. By October 1995 both operational and strategic information systems development issues were seen to be of value.

The most significant change was seen in the functionalist - interpretivist area. The position in September 1994 was an uneasy mix, with the audit of information needs showing an interpretative focus, but the underlying aims still being to formally schedule for development of computer based systems. By October 1995 this had changed to approval for two separate investigations, one operational and one strategic.

Systems

As early as September 1994 (documents Phsr003 and Phsr004), problems were seen to exist in the system outside the computer, with a perceived need to consider systems in their widest sense. The view by October 1995 (Phsr025) was that the system included the participants, and by May 1996 (Phsr018), computer based solutions for this were being proposed in the form of user-based graphical systems. This culminated in a recent (November 1996) policy decision, that desktop computers in future would all be personal computer (PC) based, thereby improving the interface to the central systems, and giving a much needed underlying consistency on which to base the development of local systems.

Participant Values

The document searches illustrate a trend toward more human-centred views. Early in the process, functionalist views dominated the development (Phsr001). By November 1994, (Phsr020) the functional views still existed, but more interpretative, strategic views were also gaining ground. By May 1995 (Phsr009), the operational focus was becoming more clearly defined and understood, and there was increasing focus on user needs, with, for example, the identification of participant groups being raised for discussion. In October 1995 (Phsr025), the two parallel, operational and strategic, investigations were approved.

In August 1995 (Phsr028 and Phsr029), participants were voicing views that there was 'too much concentration on technology', and that 'design and debate' was needed. The task of investigating faculty access was put forward by the MISQG in September 1995, signalling a shift from a technical to a user focus in systems development. The method of user consultation was discussed, resulting in the questionnaire which had little success. This led directly to the participant investigations (Figure 5.5). By February 1996 (Phsr013), there was a growing acceptance of the need to focus on participants in order to feed strategy: the central system being seen as failing to meet operational needs. A move to graphical technologies was seen as a possible solution, to which the extensive use of Macintosh computers in University administration was seen to be a barrier, owing to their

poor interface with the central system. This barrier was removed as recently as November 1996, when the University dropped the Macintosh and standardised on the PC.

Bureaucracy / Adhocracy

A theme emerging throughout is the bureaucratic nature of current systems in tension with the adhocratic culture of the organisation. Proposals for increased user focus and flexible adaptable systems developed as a key issue, in tension with the inflexible central systems. The interactive planning sessions clearly showed that users needed more operational support from the current computer systems.

Administration, Management, Academic, Students

The process began with an entrenched position on the part of MIS management, seeing all development from a hard systems perspective. As other management became involved, through the MISQG and the participative sessions, other views surfaced. These began with a perceived need to address the 'whole system' of student recording, of which the computer system, which had hitherto been the focus of development, was seen to be only a part. Human activity was surfaced as an important issue, with the initial audit of user requirements being a management decision arising from discussions within the MISQG. Strategy was increasingly addressed, although the MIS department has largely retained its operational focus.

Administrative staff recognised the need to address debate and design issues from the beginning. Behavioural problems have been seen all along as the main issue, whilst the centre was seen to be imposing a system which did not serve the needs of users. The participative sessions therefore are seen as having been a factor in surfacing these views, and thereby affecting the development process.

Academics and students equally had a wider view of the problem context. The need to integrate administrative procedures and computing within a common operational

development and strategy was key. The participative sessions again helped to surface these views, and to allow exchange of views between groups.

Searches on Multiple Nodes

The participants who contributed to this debate had mostly never before been approached for their views on the student record information system. The information which was surfaced by this process is clearly evident in the documentation, and is uncovered by the content analysis.

Flexible / Operational

The tension between central control and the need for flexible development is again displayed here. There is a perceived need for the development to fit the strategy, and for the strategy to be determined by participative means. The types of technology available for this are identified as user based, graphical, desktop computers, linked by networks to central databases. This contrasts with the large central systems currently used for the bulk of the student record system. The need again arose for operational and strategic agendas to be managed together.

Flexible / Strategic

The student record system was seen as wider than just the central computer system currently used for the task. To further develop these systems, participant debate was seen to be key at both the operational and strategic levels. The trend in thinking was toward a more flexible, interpretative view, more able to meet the anticipated but unpredictable external change.

Views/Information Systems Development

A problem-based, functionalist view is seen to dominate at the beginning of the study, although there is evidence (in Phsr003) that the need for determining the requirements of users is surfacing even at this time. Throughout the intervention, these softer views come to dominate. Details of the text involved is already given above. The important finding here is the number of times soft issues are seen to appear. Of a total 87 text units retrieved in this search, only 28 display a functionalist, problem-solving approach, and almost all of these are to be found in documents Phsr001 and Phsr003 at the beginning of the research. The others are mess/interpretivist focused.

Values/Information Systems Development

An interesting direction shown by this search is the way in which even the functionalist values applied to information systems development have changed. Initially (Phsr001), the focus was on relational databases and hardware, but this develops (e.g. Phsr008 - March 1996) into relating hardware needs to the flexible environment, and the relationship of operational problems with strategic needs (Phsr009 - May 1995). The whole process becomes more human centred, but not at the expense of operational requirements.

The changed views of the MISQG (e.g. Phsr004 September 1994; Phsr025 October 1995) resulted in a more human centred approach which then became core to the intervention. The development of the two investigations, though facilitated by the author, came naturally from the requirements of the organisation and of the MISQG, and were readily accepted by the members.

Final General Searches

On completion of the searches outlined above, duplicated information was being retrieved, and it was therefore concluded that saturation had effectively been reached. The exception was to be found in relation to two issues which, it was felt, would benefit from further investigation. These were in the evidence of improvements resulting from, and resistance to, the interventions. Evidence of improvements resulting from the intervention is to be found in a number of documents, key among which are Phsr0008, Phsr011, Phsr015, Phsr022, Phsr024, Phsr027 and Phsr029 to Phsr030.

Document Phsr0027, dated July 1995, is a transcript of comments taken from a meeting of faculty registrars, and demonstrates strong general support from this quarter. The faculty administration meeting of August 1995 (Phsr0029) contains user comments giving further support to the approach taken, as does the Management Information Systems Quality Group (MISQG) meeting (Phsr0030) of October 1995. Documents Phsr0011 and Phsr0015, prepared by S. Clarke and P. Slater in November 1995, contain an operational review of faculty access. The comments and findings, though showing some problems, demonstrate that earlier approaches have not surfaced issues which are seen to be of value and result from this later approach. Document Phsr0022, by John Bramwell, 1995, refers to academic support systems, and calls for requirements for faculties to be generated by users. Document Phsr0024, by John Bramwell, November 1995, gives wholehearted support for the first (operational) investigation. The faculty administration meeting, and MISQG meeting of November 1995 (Phsr0031 and Phsr0032) contain comments from users which are supportive of the approach taken

In document Phsr0008, the MISQG meeting of March 96, both reports were discussed, and the whole document is strongly supportive of the work. Finally, a memo from Dr. D.T. John (Deputy Vice Chancellor), accepts the findings of the management report (Phsr0018) and proposes it is activated in the future.

By contrast, evidence of resistance to the investigations is less commonly found, with only two documents containing relatively minor comments. Document Phsr0022, by John

Bramwell, 1995, a report on academic support systems, shows a functionalist approach, whilst document Phsr0033, detailing comments by Ian Nicol in February 1996, shows concern about the accuracy of cost and resource data if entered direct from faculties.

6.4 Conclusions

The theoretical, practical and external critique raised in this chapter serves mostly to support the findings of the research, but a number of issues have been raised.

Firstly, a more integrated approach to incorporating the findings from the field of human inquiry into the interventionist framework is seen to be needed. Secondly, although the interest constitution theory of Habermas emerges as a valid basis for this form of intervention, deeper research into other areas of social theory is indicated. Emancipation and critical reflection within the framework are seen to be problematic: emancipation because of its need for debate to be possible, and critical reflection due to its rather circular nature. Complexity in the use of the framework is judged to be a barrier to its wider dissemination.

Techniques used to validate and critique the outcomes of the study have, it is contended, proved valuable in their support of the findings.

The issues raised in this and the earlier chapters will now be revisited in the final chapter to draw conclusions, and point to further research.

Chapter 7

Summary and Conclusions

7.1 Introduction

This chapter begins by summarising the thesis through a reiteration of the objectives and findings of each chapter. The main conclusions are then set out in terms of the contributions they make to the domain of study. Finally, suggestions are made for future research.

7.2 Summary

The objective of Chapter 1 is to investigate the possibilities for improvements in the conceptualisation of computer-based information systems which are rich in human activity.

The current position emerges as functionalist, pragmatic, reductionist methods dominating the domain, challenged by interpretivist, equally pragmatic, holistic approaches. The development of these two schools of thought is seen to have spawned division rather than reconciliation, with the proponents of each defending their own corner at the expense of the other. But this has obscured the shortcomings which are inherent in both of these approaches. Firstly, both hard and soft methods are just that: *methods*. They have been developed pragmatically with often little reference to the underpinning theory. This has given rise to claims being made for each which are unsustainable, an example being the claim that either can be practised with a radical commitment. Essentially, both approaches are regulative; they operate within the pre-conditions set for an intervention: within the status quo. The hard and soft methods are also often practised uncritically, lacking explicit reflection either on their success, the possible dysfunctional effects of their implementation, or the critical appreciation of a mix of methods. The background to the University of Luton student record system development (section 5.3 p.93) adds weight to this argument, and this thesis generally shows the limited nature of such a view.

Chapter 2 has the dual objectives of finding a relevant theoretical underpinning to computer-based information systems development, and building an interventionist framework which is true to that theoretical background.

It is proposed that computer-based information systems development (CbISD) be recast as a holistic domain, informed by the broader perspective of systems science, rather than the reductionist methods of natural science: the suggested object of study is open, social systems, the necessary theoretical underpinning to which is to be found in social theory. The categorisation of social theory into four paradigms is put forward as the most relevant approach for CbISD, from which perspective the current functionalist and interpretivist approaches are exposed as regulative and uncritical. But a further problem also surfaces here, that of paradigm incommensurability, whereby the subjectivist and objectivist approaches, though both within the sociology of regulation, are seen to inhabit different paradigms. The problems of inter-paradigm communication surfaced by this are evident in computer-based information systems work, and serve to strengthen the lack of conciliation seen between functionalism and interpretivism. To address these issues, critical social theory is presented as a way forward. Of the various developments in critical social theory, management science has focused on the theories of Habermas, and particularly on his theory of knowledge constitutive interests. Framework development from these roots is conducted in this chapter, based on critical systems thinking and total systems intervention.

The objective of Chapter 3 is to investigate and determine the relevant research methods in relation to the research to be undertaken.

Case study and action research is to be applied to test the interventionist framework. This, and the human-centred nature of the study, led to a search for support from the domain of participatory inquiry, from which participatory action research, militant observation, and co-operative inquiry, emerge as the most promising approaches. The principles of these methods are analysed, and their application to the intervention is considered. The chapter ends with practical considerations for the use of these participatory inquiry techniques within the intervention. Research methods to validate the outcomes of the research are also considered in this chapter, triangulation and content analysis emerging as the approaches to be used.

In Chapter 4, two case studies are undertaken, with the objectives of analysing the cases through the interventionist framework; refining the framework as a result of the analysis; and testing the research questions and hypotheses.

In both cases, the interpretation of the problem situation through TSI provided insights which had not surfaced in the original intervention. In Case 1, the original intervention is exposed as objective and serving the technical interest. The critically reflective mode of TSI identified the potential for consensus, but showed the technological approach to be the result of coercion which had not been addressed. Problem solving in TSI pointed to critical systems heuristics and interactive planning as possible remedies, but also raised questions about the possibility of a methodological solution to coercion. Generally, Case 1 showed a lack of critical awareness, social awareness and complementarism, and failed to deal adequately with the human activity in the problem situation. In Case 2, TSI shows the apparent success of this intervention to have been largely as a result of assumed unitary goals of the participants, rather than the participatory style of the facilitator. The intervention lacked a critical element, with design dominating in support of the status quo.

The objective of Chapter 5 is to undertake action research using the derived critical complementarist framework, and to surface the issues emerging as a result.

This chapter is a rigorous application of the framework to an actual intervention spanning over two years and still continuing. The student record systems were perceived in systemic terms: as a whole system including key stakeholder groups, rather than just a technical artefact. The practical application within CbISD of the knowledge constitutive interests from Habermas' critical social theory is demonstrated: the original predominantly functionalist approach, with an interpretivistic element based on the view of only one stakeholder group (management), is exposed, and is replaced with a more pluralistic view which encourages methodological diversity. The participatory and emancipatory commitment of the framework allowed participant views to be more fully pursued. The interventionist framework surfaced issues within the student record system intervention which had remained hidden during the previous three years of development

work. Critical review of the available methods, critical reflection on the intervention, and the iterative, recursive framework of total systems intervention all contributed to this.

The objectives of Chapter 6 were twofold: to pose and respond to critique from viewpoints opposed to those taken in the thesis; and to validate and critique the outcomes of the study using triangulation and content analysis.

The theoretical critique gives support to the findings of the study, but also raises questions which require further investigation. Most important in this respect was the extent to which the whole interventionist process as proposed is *dependent* on emancipation. The practical critique raises issues of the complexity of using the framework as proposed, which, it is suggested, without further development will limit its wider dissemination. External critique challenges the basis of the research from pragmatist, paradigmatic, and post-modern perspectives. Finally, it is contended that the use of triangulation and content analysis increases the validity of the findings, though caution is recommended in the extent to which content analysis is regarded as objective.

The final chapter has the objectives of assessing the contribution made by the research, and looking at possibilities for future research.

Firstly, the objectives and conclusions of each chapter are summarised. The contributions made from the theoretical research, case and action research, and the critical appraisal, are then assessed. Finally, directions for future research are proposed, in the form of extensions of the work undertaken within this thesis, and issues identified as a result of the critical appraisal.

7.3 Conclusions

This thesis is based on the proposition that the use of functionalist and interpretivist methods of computer-based information systems development are a major reason for systems failure. The objective set was the construction and testing of a development framework by reference to the theoretical underpinnings from critical social theory and practical evidence from the domain of information systems. Within the study, this

framework has been applied to two case studies and an action research based intervention. The conclusions presented here are drawn from the theoretical investigations, practical findings, and critical appraisal of the results.

The first contribution is to be found in the critical position offered by an approach from a radical humanist perspective. In the case studies, development of the critical framework enables assessment both of the approach taken and of the likely outcome of a different approach. In the action research, critical reflection on the intervention raised for discussion issues regarding the classification of the problem situation into multiple contexts; choice of methods to match the variety of contexts; and the critical review of methods using the problem structuring framework. Case 2, in which the facilitator saw the original approach as participative, and Case 1, in which the participants falsely believed in their own objectivity, support the view that both functionalist and interpretivist methods can lead to a false consciousness related to the objective nature of information systems development: a situation which the critical approach to the cases was successful in surfacing. A similar situation was found in the action research, where functionalist methods originally dominated. Shortcomings in the early HEMIS development were traced, at least in part, to the uncritical nature of that process, within which one view (that of management) was privileged, and almost all development effort was aimed at satisfying that view. The first attempt at incorporating user needs, through a questionnaire, was also unsuccessful. Only when a more critically reflective position was taken in the initial brainstorming sessions and the idealised design of the strategic intervention, did a more complete picture begin to emerge.

The way in which this study develops, tests, and supports a practical approach to computer-based information systems development, which is cast from a radical humanist perspective as a social, technical *and emancipatory* domain, provides the second contribution. Whilst this *theoretical* position has been recognised, the contribution of this study lies in its *practical* application to the domain of information systems, challenging the view that a radical humanist perspective is normative. In Habermasian terms, functionalist approaches appear as satisfying the technical human interest, and interpretivist approaches the practical interest, and in so doing they address only part of

any human-centred problem context. In the University of Luton action research, functionalism originally surfaced as a thrust to improve the existing technical system. The operational and strategic interventions undertaken surfaced important social issues to be considered in computer-based information systems development, demonstrating the relevance in an actual intervention of combining the technical and practical interests of Habermas' critical social theory. Whilst emancipation, the third of Habermas' knowledge constitutive interests, was not a constraint within this intervention, nevertheless it is argued that the value of an explicit recognition of an emancipatory commitment, in order that the technical and practical interests may be adequately served, has been demonstrated. In Case 1, objectivism was the dominant influence, with issues of coercion and power preventing a truly participative approach: a position which the critical complementarist framework was able to expose as an insufficient conceptualisation of the problem domain.

This thesis contributes to the regulative-radical debate regarding interventionist methods. Both client led design and ETHICS lay claim to a radical potential within soft analysis. Similar claims are made for soft systems methodology, with Checkland (1994 p.251), for example, referring to its ability to deal with conflict and change. Theoretical investigation and practical findings within this thesis challenge this view, with the case analysis and action research both seeing any participative analysis undertaken as regulative in orientation. The error, it is posited, is to be found in the conceptualisation of radical issues within the soft methods. Stowell promotes client led design as giving control to the user, but the lack of any critical appreciation in the approach leaves unquestioned the issue of what constraints the user is working within. Mumford, by contrast, gives explicit consideration to Habermas in a recent restatement of the ETHICS methodology, but the concentration on the ideal speech situation leaves the argument with insufficient depth to support a truly radical stance. By explicitly basing this study on critical theory, radical issues are more fully considered. It is accepted, however, that although the radical *potential* of the approach is surfaced, the view that this is a normative position is not wholly overcome.

The complementarist commitment of the critical framework used in this study provides a further contribution. Case 2 illustrated the problem of moving from a soft study to a structured development (prototyping), wherein a consensus based on unitary views was assumed, and the hard method subsumed the soft. The lack of theoretical reflection in both hard and soft methods exposes both as special cases with limited domains of application, whilst their pragmatism generally adheres them to one paradigm, which this study sees as functionalism for all but client led design. Evidence from the literature suggests that hard and soft interventions begin with methodological choice: a position supported by the University of Luton action research, in which the (largely functionalist) method was chosen in advance. Mixed methods (e.g. multiview) aim to fit the required method to the problem context in a contingent fashion, but move from one to the other as the context changes. An example of the benefits to be derived from a complementarist approach is seen in the incorporation of creativity into the information systems development process. Not only does the process begin with thinking creatively about the problem situation and the range of methods available to address that situation, but creative thinking about creativity means that it is not assumed that one *creative* method will fit all contexts: the creative method was chosen to fit a context in which design and culture were seen to dominate.

Finally, there is the contribution from the theoretical analysis and practical application of a synthesised critical systems and human inquiry research methodology, the findings from which have enhanced the participative nature of the intervention. This research points, however, to more fundamental incorporation of human inquiry into the interventionist framework: an issue which is further developed under future research below. Whilst, hitherto, analysis has focused on support for the emancipatory thrust of total systems intervention from human inquiry methods, research within this thesis suggests further commonality between the two fields in the form of critical and complementarist issues.

Conclusions Drawn from the Critical Appraisal

Critique of the intervention exposes Habermas' theory of knowledge constitutive interests as a limited underpinning on which to base a critical interventionist method, and points to the need for other concepts of social action theory to be investigated in more depth.

Allied to this, it is recognised that Habermas' conception of emancipation will not work universally, since it requires a problem context in which debate is possible. Where such conditions are not in evidence (for example, closure of debate), alternative conceptions of emancipation are needed for other problem contexts. Foucault's conception of power and emancipation has been investigated as a potential alternative underpinning to a critical interventionist approach, and this study suggests that a deeper investigation of the work of Habermas, Foucault, and other critical theorists will be of value in surfacing alternative conceptions. It is, nevertheless, a key finding of this thesis that a Habermasian approach to emancipation is valid, provided care is taken to identify problem contexts where meaningful debate can occur.

A second contribution from the critical appraisal was the recognition of the need for a wider definition of information systems in terms of systems boundaries and boundary critique. Stowell and West (1994), for example, call for a wider concept of system, but do not attempt a categorisation or suggest ways in which this may be achieved. The exploration of boundary critique within this study, and its use in the action research at the University of Luton, not only exposed the existing conceptualisation of the systems (as technical plus the views of management) as insufficient, but offered a means of determining the boundary by critique at the margins. This broader conception of the system to be investigated was an important factor in the success of the intervention, having the effect of removing artificial constraints from the debating process.

7.4 Future Research

To conclude the study, a number of directions for future research, informed by the findings and critique within this thesis, are presented below.

Intervention based on TSI has demonstrated an ability to manage parallel operational and strategic agendas within a single intervention. Information systems strategy, however, is a fragmented area of study, which lacks a unifying influence. It is suggested that both TSI and information systems would gain from a more thorough investigation of the application of the TSI framework to strategic development, following preliminary work already conducted in this field (Clarke and Lehaney, 1997a).

Within the Habermasian framework, which seeks methodological approaches to organisational problem situations, emancipation remains a theoretically and practically difficult area. This study supports the pursuance of emancipation as envisaged by Habermas in many organisational problem situations. Certainly, the idea of using emancipatory methodologies is not to be abandoned, since there is clearly significant benefit to be derived from this approach. However, where engendering debate is not possible, this method of emancipation will fail, and in these circumstances alternative approaches will be needed. The ideas of Foucault, and the incorporation of political action into the TSI framework are suggested as possible ways forward (Brocklesby and Cummings, 1996; Midgley, 1996).

Critical reflection proved difficult to achieve within this intervention. Its circular and self-fulfilling nature, treating the TSI approach as axiomatic, is a concern, whilst the use of outsiders with alternative paradigmatic assumptions raised the issues of paradigm incommensurability. More consideration needs to be given to this, and a research programme to develop it would seem worthwhile.

Research into the common ground between critical systems thinking (CST) and action research (AR) has largely focused on emancipation, although the recent work on diversity management is seeking to further develop the complementarist theme. The findings of

this study support the view that all three of the main principles of CST are also to be found in AR: namely emancipation, complementarism, and critical reflection, and that future research to develop links between the two domains on this basis would prove fruitful. This resurfaces the view, expressed by Levin (1994), and further supported by the recent research forum (Wilby, 1996b), that tracing the roots of the two traditions of AR and CST back through critical social theory would be a valuable research effort. This might yield the additional benefit of questioning whether the emancipatory dimension is being privileged in favour of the technical and practical in Habermasian terms. Further, where the relationship between power and knowledge is seen to be an important issue (as in self-reliant participatory action research), investigation of the contribution which might be made by the critical thinking of Foucault could yield beneficial results. Though not applied in this way within the University of Luton intervention, it is felt on reflection that a fuller integration of human inquiry might improve the TSI process. Co-operative inquiry could be used in its entirety to replace the participatory stages of TSI. Such an approach could be applied to the strategic intervention in this study, with a co-operative inquiry group focusing on creativity within the problem solving mode of TSI, critical reflection, and support for the implementation of interactive planning. Since strategy is a long-term undertaking, the group would be seen as ongoing, with the objective of surfacing issues and informing the overall process. As more specific problem situations emerged, the output of the group would be used to feed into a wider, TSI-based, intervention. (Clarke and Lehaney, 1997b).

That TSI takes a predict and control view of human actors in relation to the environment is clearly established. Research into alternative views, whereby the relationship is seen as working with, rather than controlling, the environment has already begun (Midgley, 1995a). This would seem to yield benefits, not only from an ethical standpoint, but in terms of the long-term sustainability of the approach.

The complexity of TSI is an issue which, it is suggested, will prove a barrier to its wider dissemination. Research could focus on means of providing a learning environment in which TSI could be introduced in stages, or on developing techniques for major areas of the methodology. Critical review, for example, has already been subjected

to significant development (Wilby, 1996a), and further extension of this to establish an approach which could be used by others is an example of the kind of development possible here.

The wider application of the critical complementarist framework developed within this thesis is needed in order to test its utility. The human inquirer is in a unique position to develop an understanding of problem situation analysis in a given intervention, thereby enabling the generation of specific (local) theory which may be tested and modified through future action. Much work needs to be done which combines the role of researcher with that of management consultant in multiple interventions, thereby enabling a theory to be formulated which may become more generally applicable.

Finally, although post-modernism has not been addressed in any detail within this study, a useful research exercise would be to view the work within the CST and TSI domain from the perspective of a disorderly and unstable world. Certainly, in many interventions, there is some element, however slight, of post-modernism; TSI would seem to be ideally placed to address this.

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Appendices

Appendix I

Lateral Thinking and Brainstorming Techniques

Appendix I Lateral Thinking and Brainstorming Techniques (After de Bono, 1977)

Introduction to Appendix I

The lateral thinking and brainstorming techniques outlined here are used explicitly within the creativity phase of total systems intervention (TSI). The purpose of creative thinking within this study lies in the need to determine *what* is to be done in advance of deciding *how* to do it. It is a central argument of this thesis that in human centred development, information systems methodologies focus on design of systems, or the *how* questions, without ever properly determining *what* is to be done to satisfy participant requirements.

Chapter 2 draws on this Appendix, and discusses the use of these techniques within TSI. Chapter 5 then applies brainstorming to the action research based intervention.

Appendix I

“Lateral thinking is closely related to creativity ... There is about creativity a mystique ... In order to be able to use creativity one must rid it of this aura of mystique and regard it as a way of using the mind - a way of handling information. This is what lateral thinking is about.” (de Bono, 1977).

The normal thinking process (‘vertical thinking’) involves a sequence of logical steps through which relevant information is sifted and irrelevant information is discarded. Such a process parallels the process of scientific thinking, and whilst valuable in many situations is too restrictive where new insights have to be generated. The relevance of this to computer-based information systems hinges on the way in which these systems take technology into fields of human activity, the human aspects of which have to date been addressed only to a limited extent. It is contended that processes of logical rational thought will not offer sufficient insight to inform the way that intervention in such problem situations should be carried out.

De Bono (1977) distinguishes between three types of problem:

1. A problem which requires for its solution more information or better techniques for handling information.
2. A problem which requires re-arrangement of information already available: an insight re-structuring.
3. A problem which is not problem.

The first type of problem De Bono identifies as the only one solvable by vertical thinking. In this thesis, the third type of problem is of particular interest. There is an overwhelming tendency to redefine the development, design and implementation of information systems in mechanistic, technological terms; in effect, turning them into a problem which is

solvable in a vertical manner. The danger is that this trivialises the problem situation, and that it results in completed systems which in no way address the needs of the human participants. The proposed solution is to use lateral thinking. Lateral thinking, unlike vertical thinking, does not rely on correctness at every stage, but aims to arrive at the correct solution at the end. Hence it is necessary to make sure that judgement is suspended during the lateral thinking exercise. The normal process of thought involves the mind recognising patterns and building on those patterns. Lateral thinking is essentially concerned with re-structuring the patterns, or looking at situations differently. One method of enabling this, which relates closely to the use of metaphors in TSI, is the use of analogy.

Brainstorming

Brainstorming places lateral thinking in a structured environment: a setting within which lateral thinking can best be practised. The setting must be formal, since this better encourages the generation of what may otherwise be considered ridiculous ideas. In addition, a conscious effort to achieve suspended judgement must be made. De Bono (1977) lays down the format for brainstorming sessions as follows:

1. Size: six to fifteen, with an optimum of twelve.
2. Chairman: elected from the group has the task of stopping people evaluating or criticising the ideas of others, and enabling all to contribute.
3. Note-taker: takes notes of the session under control of the chairman and provides a list of ideas at the end in sufficient detail to be understood long after the session is finished.
4. Time: 30 minutes is usually long enough.
5. Follow-up: participants can submit further ideas on the subject after the session. The circulation to all members of the ideas generated during the session should help this.
6. Evaluation: not carried out during the session, but later by the same or another group.

The evaluation session is in itself a creative exercise, resulting from which should emerge three lists: 1) Ideas of immediate usefulness; 2) Areas for further exploration; and 3) New approaches to the problem.

Formulation of the problem must not be too wide or too narrow. In this study, the general statement of the problem, derived from discussions with participants (see Chapter 5) was:

‘What information is required by faculties to adequately perform tasks related to student administration?’

Whilst the central issue was stated as:

“How can monitoring and recording of students at faculty level be better facilitated by information systems?”

The use of brainstorming techniques within the intervention can be seen by referring to Section 5.6 in Chapter 5.

Appendix II

Interactive Planning: An Outline of the Issues Relevant to CbISD Intervention

Appendix II Interactive Planning: An Outline of the Issues Relevant to CbISD Intervention

(After Ackoff, 1981)

Introduction to Appendix II

Interactive planning (IP) is the main methodology used for the strategic intervention into the student records systems at the University of Luton in Chapter 5. IP is particularly suited to an intervention where participant views are used to determine strategic direction, but where links to an operational development are also required. The output of IP is a system design which can be undertaken within the constraints of the organisation. Its use is informed by the creativity and choice stages of TSI, and supported by the brainstorming and lateral thinking techniques outlined in Appendix I.

Appendix II

“The way interactive planning is carried out depends on three operating principles: the *participative* principle, the principle of *continuity*, and the *holistic* principle.” (Ackoff, 1981 p.65).

Participation

“The interactivist .. asserts that *in planning, process is the most important product*. Therefore, the principal benefit of it derives from engaging in it.” (Ackoff, 1981 p.65).

The principle of participation means that no-one should be planned for; people should plan for themselves by being involved in the process.

“It is better to plan for oneself, no matter how badly, than to be planned for by others, no matter how well.” (Ackoff, 1981 p.66).

Continuity

Plans cannot be fixed. Monitoring, evaluation and modification of plans as changes are experienced in the expectations and assumptions on which they are based, must be continuously carried out. Equally, since the principal benefit of planning is engaging in it, there is no rationale for discontinuity.

Holism

Ackoff expresses this principle as consisting of co-ordination and integration.

“The *principle of co-ordination* states that no part of an organisation can be planned for effectively if it is planned for independently of any other unit at the same level. Therefore all units at the same level should be planned for simultaneously and interdependently.” (Ackoff, 1981 p.72).

“The *principle of integration* states that planning done independently at any level of a system cannot be as effective as planning carried out interdependently at all levels.” (Ackoff, 1981 p.73).

Co-ordination is necessary because problem situations may be observed (the symptom) elsewhere from their source (cause or location). So problems cannot be labelled as, for example, marketing problems, since the cure for a marketing problem may be changes in production. The necessity for integration is seen by Ackoff as self evident, since problems at any given level may be solved by action at a different level.

Interestingly, Ackoff sees no problem with conflict, simply asserting that “conflict must be removed. This can only be done by planning in a co-ordinated and integrated way.” (Ackoff, 1981 p.74). This view is, however, strongly contended within the systems community, and references to this contention, and the position taken within this thesis, can be found in Chapter 5.

Phases of Interactive Planning

Interactive Planning is an iterative and continuous process which is not to be undertaken in any particular order. The order in which the phases below are placed is specific to the current intervention.

Formulating the Mess

“The mess that a corporation is in consists of the future that it would have if it were to continue behaving as it does and if its environment were not to change or alter its directions in any significant way. In other words: a corporation’s mess is the future implied by its and its environment’s current behaviour. Every system contains the seeds of its own deterioration and destruction. Therefore, the purpose of formulating the mess is to identify the nature of these often concealed threats and to suggest changes that can increase the corporation’s ability to survive and thrive.” (Ackoff, 1981 p.79).

Formulating the mess requires the following processes of study, which are distilled from Ackoff (1981 p.80 ff) to fit the nature of the current investigation.

How is the system for which planning is to be carried out to be defined?

This should be done in systemic terms, identifying boundary, sub-systems etc. A diagrammatic approach is to be favoured. In this case, the system is less than the whole corporation.

How is the corporation organised and how does it actually operate?

The organisation of the system under investigation needs to be determined, as does its contribution to the system as a whole. This is achieved within this thesis by setting the boundaries for the intervention (Figure 5.4).

What policies, practices, strategies and tactics are currently in force?

It is necessary to determine those which affect the system.

What are the principle stylistic preferences of management?

“The point here is to put one’s finger on the quality of work life for personnel at all levels.” (Ackoff, 1981 p.83).

*What laws and governmental regulations affect the corporation and how?
Are there other environmental issues?*

These have been highlighted in the wider Political environment, and must be considered in so far as they affect the study.

Obstruction Analysis

Organisational Ends

The purpose here is to identify the true goals, objectives and ideals which the organisation espouses and pursues. Management will usually be reluctant to recognise these, and will muddy the waters with a rationalised defence of current practices. However, rationalisation does not remove the problem of the stated ends not being the true ones.

Organisational Means

“In general, there is a great deal of difference between what corporate personnel actually do, believe they do, are believed by others to do, and are supposed to do. The differences are not necessarily bad - in fact, they may be essential for corporate survival. However, if this is the case, the suppositions, beliefs, and specifications should be changed; otherwise what is actually done should be.” (Ackoff, 1981 p.88).

Organisational Resources

The differences between the beliefs about resources and the actual situation need to be uncovered.

Organisational Structure and Management

The formal and informal structures must be recognised; the gap between claimed and actual structure uncovered.

The Organisation's Stakeholders and Environment

A distinction should be drawn between the *transactional environment* and the *contextual environment*. The former is made up of those individuals or bodies with whom the organisation interacts directly; The latter is everything else, over which the organisation has no control.

Conflict

Ackoff sees conflict as existing within individuals, between individuals, between individuals and the organisation, within units, between units at the same level, between units at different levels or units and the organisation, within the corporation as a whole, and with external groups. The starting point is to recognise the important conflicts. The hard part is dealing with them!

Preparation of Reference Projections

“A reference projection is an extrapolation of a performance characteristic of a system from its recent past into the future, assuming no significant change in the behaviour of either the system or its environment. Such a projection is, in effect, a glimpse of the future that is implied by continuation of the system’s recent history.” (Ackoff, 1981 p.98).

A useful approach, and one which has been followed in this thesis, is to prepare a reference scenario, combining the outputs of the systems and obstruction analyses. The purpose of such a scenario is not to give a forecast, but to show what will happen if nothing is done.

Ends Planning I: Idealised Design

“Ends, which are intended outcomes of action taken, are of three types:

1. *Goals* - ends that are expected to be obtained within the period covered by a plan.
2. *Objectives* - ends that are not expected to be obtained until after the period planned for, but toward which progress is expected within that period.
3. *Ideals* - ends that are believed to be unattainable but toward which progress is believed to be possible.

Goals, therefore, can be considered to be means relative to objectives, and objectives can be similarly considered relative to ideals.” (Ackoff, 1981 p.104).

The procedure is worked backwards:

1. Specify ideals
2. Determine objectives
3. Identify goals

Once this is done, means can be chosen to meet the ends. So the core of the planning process lies in idealised design. This is design of a system that: “.. its designers would like to have right now, not at some future date.” (Ackoff, 1981 p.105). It is a design not for some future projected environment, but for the current environment, and its requirements are that it should be:

Technologically Feasible

Operationally Viable:

Must be capable of surviving if it were brought into existence, but there is no requirement to show that it is capable of being brought into existence (e.g. the cost may be prohibitive, but this must not be considered at this time).

Capable of Rapid Learning and Adaptation:

Particularly the system must be capable of adapting to changes in the views of stakeholders, but this might be extended to changes generally. Decisions made must also be subject to control:

“..the expected effects of each decision and the assumptions on which these expectations are based should be monitored. When they are found to deviate significantly from the actual effects or conditions, the deviations should be diagnosed and corrective action should be taken where appropriate.” (Ackoff, 1981 p.106).

Idealised Design - Selecting a Mission

This can be derived as a sub-mission from the mission statement of the University, incorporating issues of the service to be provided and to whom this is done.

Idealised Design - Specifying Desired Properties of the Design

A brainstorming session, listing the desired properties of the system, is a good way of doing this.

Idealised Design - Designing the System

This is turning the ‘whats’ into ‘hows’, and is seen to be problematic. The best way to achieve this is to start with a broad picture, and refine it into more detail until a sufficiently detailed level is reached. The whole can then be turned into a scenario of the whole system.

Idealised Design - Constraints

If possible, it is useful to prepare two idealised designs: one, prepared first, which ignores any constraints, and another which takes known constraints of the containing system into

account, and proposes no changes to the latter. If the difference between the two systems is small, then the organisation's future is in its own hands. In defining the unconstrained system, the changes necessary to the containing system must be made clear.

Why Idealised Design?

Facilitates Participation

“.. when it comes to considering what a system *ought to be*, no one is an expert at preparing an idealised design of it.” (Ackoff, 1981 p.116).

Not only does everyone have a contribution, but they learn from the process and improve their quality of life at work. This development, contends Ackoff, enriches the organisation. Ackoff's views on consensus, commitment, creativity and implementability make interesting reading and have been used to help guide the approach to this intervention:

“Idealised design generates a consensus among those who participate in it.” (Ackoff, 1981 p.118).

There is generally much less disagreement about longer range idealised issues. This percolates down to the medium and short range once long range needs have been agreed.

“Participation in the preparation of an idealised design and the consensus that emerges from it generate a commitment to the realisation of that design.” (Ackoff, 1981 p.119).

“The idealised design process stimulates creativity and focuses it on organisational and individual development.” (Ackoff, 1981 p.120).

“The idealised design process enlarges the designers' conception of what can be implemented.” (Ackoff, 1981 p.120).

Ends Planning II: Design of Management Systems

The Information Subsystem

“Contrary to the impression produced by a large volume of propaganda about MISs, relatively few have met the expectations of the managers who authorised or use them. Many of the near and far misses could have been avoided if some commonly made, false, and usually implicit assumptions underlying their design had been avoided.” (Ackoff, 1981 p.139).

Ackoff (1981 p.139 ff) refers to five assumptions which need to be dealt with.

Managers Critically Need More Relevant Information

The focus should be not on generating more relevant information, but on generating less irrelevant! So filter and condense, rather than increase: there is evidence to suggest (Ackoff, 1981 p.141) that reducing relevant printed material by as much as two-thirds has little effect on its content.

Managers Need the Information They Want

“The genius of a good manager lies in his ability to manage effectively a system that he does not understand completely. .. the manager who is asked what information he needs to control something he does not fully understand usually plays it safe and says he wants as much information as he can get. The MIS designer, who understands the system involved even less .. adds another safety factor and tries to provide everything.” (Ackoff, 1981 p.141).

The moral of this is that there is no way to effectively design an MIS without a full understanding of the system, which is to be gained from those participating in it, not only management, and certainly not the designers.

If Managers are given the Information they Need their Decision Making will Improve

This presupposes that, given all the information necessary, a manager will be able to make an improved decision. Generally this presupposition can be demonstrated to be untrue:

“ .. if managers do not know how to use the information they need, then giving it to them will only increase their information overload. If they know how to use it they can instruct someone else to use it for them.” (Ackoff, 1981 p.143).

The solution to this paradox is a learning system within which managers can learn what they need and how to use it.

More Communication Means Better Performance

This will work if the structure and culture of the organisation are right. But care must be taken if unethical intra-company practices are evident.

A Manager Does Not Have to Know How an Information System Works, Only How to Use It

Taken to its extreme, this leaves the system designers in control of the organisation!

Ends Planning III: Organisational Design

“ .. an idealised design of a system should consider how to structure a system to make it one that is ready, willing and able to modify itself when necessary in order to make progress toward its ideals.” (Ackoff, 1981 p.149).

Companies may frequently, for example, be either centralised or decentralised, but mixing the two modes is rare.

Much of this chapter is given over to discussions of possible variations on the mixing of organisational design. A key issue raised is that of *who* designs the structure and work to be done. This should not be the sole preserve of managers; if employees participate in this their jobs will be enriched and the organisation will benefit.

Ackoff also makes the point that hierarchy need not be destroyed by such an arrangement. Hierarchy and democracy only seem incompatible if authority is seen to flow only in one direction.

Means Planning I: Formulating Alternatives

Comparing the idealised design to the reference scenario generates the gap to be filled by planning. This process generates:

Goals	Attainable within the planning period.
Objectives	Attainable beyond the planning period.
Ideals	Unattainable.

In dealing with these it is necessary to dissolve rather than solve problems where possible: solved problems just recur. Determining what is and is not controllable, and identifying true constraints also needs careful examination.

Means Planning II: Evaluating Alternatives

“Choice is always based on a comparative evaluation of the alternatives, but such an evaluation can fall anywhere between the causal and the careful.” (Ackoff, 1981 p.195).

Ackoff discusses at some length the use of experiments as “not trial and error [but] *designed and controlled experience.*” (Ackoff, 1981 p.196).

Resource Planning

“Four types of resource should be taken into account: (1) *inputs* - materials, supplies, energy, and services; (2) *facilities and equipment* - capital investments; (3) *personnel*; and (4) *money*.” (Ackoff, 1981 p.212).

Required and available resource should be determined, giving a gap to be filled. The feasibility and cost of this should then be assessed.

Design of Implementation and Control

The best way to start interactive planning is to begin where you are located and attempt to diffuse it throughout the organisation.

Appendix III

Problem Solving and Problem Structuring Methods

Appendix III Problem Solving and Problem Structuring Methods

(After Lehaney *et al*, 1996)

Introduction to Appendix III

This appendix details the main methodologies which are seen to be relevant to the case study and action research undertaken. The key features of each methodology are detailed sufficiently to enable choice of a given methodology to be assessed in relation to the problem context encountered.

In Chapter 4, choice of the methods which, had TSI been used, might have been applied to the two cases, is informed partly from the analysis in this Appendix. The methodologies to use in the action research undertaken in Chapter 5 are also chosen partly by reference to their strengths and weaknesses outlined here.

The problem solving and problem structuring methods are assessed through the problem structuring framework (Appendix V), the Wheel of Knowledge and Power (Appendix VI), and the use of TSI in the Critical Review Mode (Appendix IV).

Appendix III

Problem Solving Methods <i>Functional</i>	Problem Structuring Methods <i>Interpretative</i>	Multiple Methods <i>Mixed</i>
Systems Development Life Cycle:	Cognitive Mapping	Client Led Design
Systems Analysis	Critical Systems Heuristics	Contingency Theory
Systems Engineering	Hypergames and Metagames	ETHICS
Viable Systems Diagnosis	Metaphors	Interactive Planning
Traditional Ops Research	Pyramids	Multiview
System Dynamics	Robustness Analysis	User Software Engineering
	Soft Systems Methodology	
	SAST	
	Strategic Choice	
	SODA	

Problem-Solving Methods

The functionalist, problem-solving methods are those developed from traditional scientific roots (see Chapter 1 for a detailed argument of this position). In computer-based information systems development (CbISD), the systems development life cycle (SDLC) approach, mostly represented as systems analysis (SA) and systems engineering (SE), is the most widely used of these methods.

SDLC (SA and SE) approaches cover a range of techniques and methodologies which are applied to a wide variety of problem contexts. In business organisations, the basis of these methods is the application of scientific principles to the solution of business problems. Systems analysis applies reductionist methods to break down a problem into manageable components. Each component is analysed in turn, with a breakdown of the whole system being derived from the sum of the analysed components. Systems engineering then has the task of engineering a solution to the problems identified in each of the components.

SDLC methods rely on there existing a problem to be solved, for which a step by step solution is possible. Their strengths are evident where design is paramount, and where a comprehensive, unchallenged and unchanging specification for that design can be written. Focused on the technical interest, SDLC approaches meet their greatest challenge in pluralistic and coercive situations, which they are ill-equipped to address.

Problem Structuring Methods

Cognitive mapping is a methodology which enables a model to represent the way individuals define issues, and it is amenable to formal analysis. The map itself shows a series of linked ideas, with arrows indicating how one idea might lead to another, i.e. it is a signed directed graph expressing chains of cause and effect among the issues comprising and related to the problem area. The nodes represent constructs, each expressed as a distinction or contrast between poles. The arcs represent (usually causal) links between the constructs, links being signed + or - depending on whether the first pole of one construct leads to the first or second pole of the other. So called connotative (unsigned) links can also be used, to join related constructs without implying any specific causal statement. The phrases included in a map, together with the linking arrows, are not a precise reproduction of the language used but are modified to reflect the particular situation the technique is being employed in. Thus, if being used as part of a strategic options development and analysis (SODA) approach it would reflect the need for an action orientation. It is desirable to create the map as the client speaks in order to be able to pursue immediately the implications of ideas and thus build the ideas chain, showing linkages. The mode of interaction between client and facilitator, in deriving a cognitive map, is to either move from the goal system down to particular options or vice-versa, in a ladder fashion.

Cognitive mapping retains the bipolar psychological opposites of personal construct theory (Kelly, 1955). This theory asserts that man as a scientist makes sense of his world through comparison and contrast and, through this, detects patterns and themes that enable him to manage future events. Cognitive mapping combines personal construct theory with laddering technique, in exploring causes and consequences. The cognitive maps may then be used as a means of managing the problem through analysis on an individual basis (Eden, 1988; Eden, 1994) or putting several of these maps together to form a group model or strategic map. The consultant is primarily a facilitator, helping participants explore and understand, rather than being prescriptive. Mapping is used to both capture and explore the reasoning used by individuals, and as a means of arriving at a common picture

acceptable to everyone in the group. Mappings are used to capture subjective reasoning and as such there is no 'correct' or 'unique' way of doing this.

The greatest strength of cognitive mapping is in eliciting perceptions, which suggests that it may be suitably employed in the 'finding out' stage of an investigation. It is less strong in assisting the implementation of outcomes and it has least effect as a direct tool in building conceptual models.

Critical systems heuristics (CSH) (Ulrich, 1983a; Ulrich, 1991) studies existing, or planned systems, from a point of view of discovering whose interests the system serves. It examines closely the assumptions and values associated with the system (or proposed system). It involves the use of 'boundary questions', such as "what is the actual purpose of the systems design?", aimed at the system planners and also the people affected by the system. The power of the questions to reveal the normative content of the systems design is best seen if they are put in 'is' mode and 'ought' mode. Thus, the questions, "who *is* the actual client of the systems design?" and "who *ought* to be the client of the systems design?" would be asked. The boundary questions are designed to highlight sources of control, expertise, legitimating and motivation (Jackson, 1991b p.191). These can then be used by planners and others involved in the situation to show underlying value assumptions of the system design. The purpose is to expose, and hopefully free, the design from individual, organisational, cultural, societal and political value assumptions that may be hidden and coercive. By doing this, it is using an emancipatory systems approach. This revealing of 'true' motives in a planning situation may itself lead to new planning proposals. It can be argued that this methodology does not contribute enough to how any changes, by which the design is freed of these hidden value assumptions, are undertaken. Willmott (1989) doubts the efficacy of the methodology, on the grounds that it neglects the structural aspects and development of social systems favoured in a Marxist analysis.

CSH is considered to be 'emancipatory', because of the emphasis throughout on discovering whose interests the system serves. The methodology has a relative weakness in not supporting the actions necessary to implement the identified needs for 'empowerment'.

Hypergame analysis may be employed in situations where several parties have influence over the problem situation and have an interest in the outcome. It is distinguished from other game-based approaches in that there is emphasis on the fact that actors have differing constructions of reality. There is generally an element of conflict between the participants, although of course there may be also points of agreement. This underlies one of the tenets of the process in that decisions made by one actor affect those made by other actors, often adversely. It also, in recognising that the individual's perception of a situation is unique, accepts the individual is part of a complex structure of related decisions and is affected by them. Thus, when deciding on a course of action, the first problem is a decision about who is being helped by the analysis. In situations of conflict, aid to one party can be detrimental to another.

There is a range of models used to represent interactive decisions that allow for differing perceptions of the situation. These involve, as elements, players, strategies, outcomes and preferences. Quantitative values are assigned to a player's preferences and these determine the values assigned to outcomes. It is assumed that each player knows all the strategies available, but not what others will choose to do. This may be considered a little presumptuous, but consideration of the successful spheres of application, particularly in military arenas, indicates that there are often obvious limitations on the available strategies. The games are then placed into, for example, a matrix form, that specify the strategies and preferences each player believes everyone else, including themselves, has. There are other representations available, such as 'trees' and 'tableaux', as given by Bennett *et al* (1989).

It is seen that the modelling process itself contributes to an understanding of the situation and can be iterative. Indeed the models themselves can be combined, and this mixing is an attempt to keep a complex situation, relatively simple. Having drawn up the hypergames, the technical aspects of dominance, stability and other influences are formally analysed, again placing a strong emphasis on discussion with the client.

The methodology is particularly strong in identifying the power structures and supporting challenges to them. It supports the roles of individuals and their associated perceptions of the problem situation.

Metagame analysis highlights the results of co-operation, or conflict, between actors in the problem situation. The process begins by deriving a list of actors and possible options. The options listed do not exclude each other, i.e. actors may take all, some or none of the options listed against them. Practitioners see this first stage as vital in raising the awareness of the participants to aspects of power and control in terms of what options are available to whom. As a particular theoretical course of action is tested, the figure 1 is written next to those options that would be taken and the figure zero against any other options that are declined. This listing of one's and zero's is denoted as a 'scenario'. Each scenario represents a combination of actor's plans and provides one possible line into a future state. Again, this consideration, in the preparation of differing scenarios, helps the participants focus on a wide variety of possibilities. In preparing scenarios some will be plainly infeasible, either logically or physically. Once a set of feasible scenarios is available they are classified into one of four groups, *Status Quo*, *Present Scenario*, *Positions or Compromises*, by an analysis of threats and promises, i.e. a consideration of what pressures actors can exert on each other. A fuller explanation of these categories is given by Howard (1986). Once this process is completed a strategic map showing a summation of this is produced to enable discussion of results. The whole purpose of this approach is to enable managers to recognise the importance of a consideration of human relations in their work, an integral part of a soft methodology.

This approach considers issues of control (coercive nature) during the 'finding out' stage. The building of scenarios during the 'method' stage shifts the emphasis. The methodology is relatively weak at the 'implementation' stage.

Metaphors allow the investigation of complex phenomena through the use of 'likeness'. The facilitator of the metaphor process plays the lead role in finding resonant metaphors for capturing insights into the problem situation. The success of the method is dependent upon the group's acceptance of the procedure, the relevance of the metaphor and a common objective determined prior to entering the process. The process requires a competent facilitator to break down the perceived barriers between participants in order to promote 'imaginization'. The underlying theory is that the words spoken by organisational participants are important in shaping and sharing an organisational reality, and much of what is spoken comes through expressive figures of speech, including metaphors. The true effectiveness of metaphors is their almost paradoxical ability to point up dissimilarities and contrasts between two objects, while simultaneously demonstrating that there are considerable similarities between the objects being compared. There are four main functions for metaphors: supplying actualisation of an abstract idea; clarifying the unknown; expressing the subjective and assisting thought (Weaver, 1967). The use of metaphors has been criticised. Whilst metaphors illuminate some unseen facets of an object, they also hide or obscure parts of it (Masden, 1989). Boland (1989) mentions 'two traps' in using metaphors that should be avoided. The first involves failing to reflect on how organising frames that guide our thinking are themselves metaphors that we accept too uncritically; the second is a failure to reflect how our own work takes place in the medium of language and therefore the medium of metaphor.

Metaphor is possibly the most difficult to assess in terms of position and strength. Whilst all the methodologies depend, to a greater or lesser extent, on the skill of the facilitator, this methodology is supported to a great extent by the facilitator.

Pyramids is a structured brainstorming methodology, with high levels of group member participation. The process involves persons working alone, in pairs, in quads and finally as a whole group, in a plenary session. The strength of the process lies in creating ownership of the problem situation by developing discussion and understanding of one's own and other's perspectives. At each level of the pyramid the objective is to be able to produce an agreed statement, relating to the problem situation, to be carried forward to the next stage. As in other 'soft' techniques, the process taken to arrive at the agreed statement is at least of equal import as the statement itself. The facilitator tries where possible to combine groups that share some common perspective(s). As the process develops, the choices of which groups to merge becomes fewer, but it is hoped that the participants will develop greater understanding of the problem situation and be able to accommodate more widely varying weltanschauung (Northedge, 1975).

This approach has similar strengths to interactive planning, but it offers more opportunity to raise issues of power. However, it does not possess strength in the initial stages of 'finding out'. It is also relatively weak on implementation of outcomes.

Robustness analysis provides a framework for considering problem situations where there is a high degree of uncertainty and decisions are capable of being made sequentially. It seeks to identify those decisions made early in the sequence that retain the widest range of options for later. Thus in considering a decision, it is recognised that the available choices lead to differing futures. The analysis is thus concerned with keeping flexibility for those future choices. This differs from the methods of traditional operational research, where a single optimal future would be striven for. The 'robustness' of any decision is quantified as the number of acceptable options at the planning horizon with which it is compatible, divided by the total number of acceptable options at the planning horizon. This yields a figure between 0 and 1, with values closer to zero indicating the initial decision is less influential in affecting the ability to re configure the system at a later date. The fact that different groups will determine different options is not crucial. The robustness index is a relative measure for comparison of options in a situation whose parameters are defined by the participants. It is recognised by practitioners that the quantitative measures obtained are not prescriptive. Rather they focus attention on developing perceptions about the problem situation and likely outcomes of decisions. "The robustness score is an indicator of flexibility, but its calculation does not absolve one from the need to investigate its quality and significance" (Rosenhead, 1989).

The flexibility of the methodology in retaining several 'futures' for analysis is a major strength.

Soft systems methodology (SSM) is an approach to modelling developed by Checkland (1981) and Wilson (1984). SSM enables the people involved in running a system (Actors), those responsible for controlling it (Owners), and those who receive its benefits (Customers), to participate in the process of developing a system model, which is likely to encourage acceptability of the model. Examples of applications are given by Lehaney and Paul (1994), McLoughlin (1986), Mingers and Taylor (1992), and O'Connor (1992). SSM may be used to aid the identification of system boundaries and system activities, particularly in complex systems, by means of a seven-stage process.

The initial methods were to merge elements of process and structure to gain insight to the existing culture. The gathering of information about these elements could be represented in a 'rich picture', which tries to show the problem themes that are apparent in the real world. In stage two, the facilitator attempts to forget the existing structure and define systems which arise from the input of the persons concerned with the problem area. This second stage is highly subjective. It is at this stage the facilitator begins to think of purposeful systems that are relevant to the real world. These are 'issue based': i.e. reflecting the individuals' notions, often not likely to be entrenched in the real world; or 'primary task': i.e. expressing official, uncontentious views. This approach has proved difficult, in practice, for some facilitators, due to the somewhat abstract nature of the concepts involved. In a human activity system it has sometimes proved difficult to be non-specific in dealing with emotive issues. An alternative way of covering the first two stages was to move quickly to stages 3 and 4 and build a primary task conceptual model. Now, in stage 5, when comparing to the real world, the comparison itself acts as a 'finding out' process. This approach has the disadvantage that, since the conceptual model is primary task based, it tends to focus the finding out on the existing system, thus leading to

attempts to improve an existing system rather than consider possible alternatives. It is of course a paradox that in order to follow this leap to stages 3 and 4, and then proceed to build a model that was issue based, trying to avoid the problem of being too inward looking arising from primary task definitions, the extracting of an issue based root definition needs to be done first!

A third approach to stages 1 and 2 has involved 'finding out', by recognising three related phases. The first phase takes the intervention in the situation as the subject and identifies the persons involved as 'clients', i.e. who caused the intervention; or 'would be problem solvers', i.e. who facilitates the intervention. The person who is in the latter role then identifies a list of possible 'problem owners'. This is used as a source of relevant systems for stage 3. The second phase establishes what social roles are significant in the problem situation and what parameters or performance indicators are attached to each role. This phase is a consideration of the culture involved. The final phase considers the political aspects by considering the distribution of power. In combining these three phases a rich picture is established for progression. Stage 3 involves defining some relevant systems. Initial work tended to try and establish the most relevant system, but it is now accepted that giving credence to many possible systems provides a richer insight. The root definitions, as these relevant systems are known, have evolved to become well formulated. This stage uses the mnemonic, CATWOE, for Customer, Actors, Transformation process, Weltanschauung, Owner, and Environmental constraints. In any application this stage would expect to yield both primary task and issue based root definitions.

Stage 4, the model building, records the minimum necessary activities for the purposeful system to perform as described by the root definition. These activities, which could involve such things as information, materials or time, are linked by dependencies. The model can be regarded as an account of the logical machine described in the root definition. The model is now used as the basis for debate and reflection in the real world. Stages 2, 3 and 4 can be iterative.

In Stage 5, each activity of the conceptual model is looked for in the real world. This comparison yields information on such things as deficits or under performance. This can then be carried into stage 6 where discussions on changes to the existing system are initiated. These changes can span structure, procedure and attitudes. Any restraints referred to in the root definitions need to be recognised, as does the feasibility of changes in the context of the culture given. It is of course recognised that 'culture' is not static and this process may accommodate a cultural shift. The final stage in the cycle is implementing these changes agreed. This is a far more structured problem, although SSM could itself be used to do this if their implementation is problematic. Whilst as a whole the methodology is identified as being relatively powerful, it is in the second phase that it shows particular strength, based upon the widely documented framework used and the large number, by comparison with the other methodologies, of case studies available.

Strategic assumption surfacing and testing (SAST) is designed for use with complex systems of highly interdependent problems, where "problem formulation and structuring assume greater importance than problem solving using conventional techniques" (Jackson, 1991b). The approach is aimed at groups lacking a common set of values or goals. In use, it focuses on forming sub-groups, each holding a position on which they have consensus.

These groups should be drawn from as wide a range as possible of persons associated with the problem area. Techniques are then used to 'surface' the assumptions underlying their position and to enable the sub-group to become aware of these and the *weltanschauung* that makes them meaningful. Debate between the sub-groups is then encouraged, where each position is attacked and defended. It is a key point that this debating will be adversarial in nature. This is intended to clarify for each group the differing perspectives and enable a synthesis of viewpoints, albeit temporary, which can be used as a basis for decision making. The underlying ethos is that organisations are unable or unwilling to challenge seriously the accepted policies and procedures. By providing a forum, in which sympathy is extended to ideas that diverge considerably from current practice, the underlying assumptions of that current practice can be 'surfaced' and more fully considered. In line with soft systems thinking it is the participant dimension, through human and political aspects, rather than the systems dimension that is the focus of attention (Churchman, 1979; Mason and Mitroff, 1981).

The methodology focuses on groups discovering various perceptions in the first stage and moves towards forming consensus in the final stage. The relative weakness of this methodology is in the final phase, for although it 'surfaces' the underlying assumptions of current practice, it is not as supportive in guiding implementation of change.

Strategic choice was developed during the 1960s and 1970s as part of the action research which was being undertaken jointly by the Operational Research Society and social scientists from the Tavistock Institute of Human Relations (Chrichton, 1966; Friend and Jessop, 1977; Friend and Hickling, 1987; Friend, 1990). The approach is both interactive and incremental, and it is used to help facilitate group communication about complex situations. Examples of applications are given by Hickling (1989), Moulin (1991) and Khakee and Stromberg (1993).

Strategic Choice is perhaps best noted for the incremental approach it aids, in taking decisions, by focusing on alternative methods of managing uncertainty. The process of strategic choice has four complementary modes, 'shaping' (forming an agreed view of a problem structure), 'designing' (identifying courses of action), 'comparing' (evaluating actions against criteria) and 'choosing' (agreeing on an incremental process for decision making). This can be contrasted with the majority of management science techniques that primarily only address the 'designing' and 'comparing' modes. Within these four modes there are a wide variety of techniques used to consider the problem area, with the emphasis upon the outcomes of possible decisions. A full consideration of these is given by Friend (1989). When used as an aid to participative decision making, a set of operational guidelines transcending the four basic modes are used. These are listed, in the major text on the subject, as technology, organisation, process and products (Friend and Hickling, 1987). There are three reference points for any study. The 'classification of uncertainty' contrasts uncertainties in 'the working environment' (needing analysis), 'guiding values' (needing clarification of objectives and perhaps conflict handling), and 'related choices' (needing negotiation and wider collaboration). The strategic choice approach can best be summarised in that it attempts to make explicit how best to manage uncertainty in a decision making arena. This methodology is powerful in the final two phases with the emphasis shifting slightly as the process develops.

Strategic options development and analysis (SODA) was developed at Strathclyde University as a means to cope with both the qualitative and quantitative aspects of complex, messy, problems (Eden and Graham, 1983; Eden, 1985; Eden, 1992). The approach emphasises equally the importance of discussion content and discussion process, through the use of cognitive maps, which may be developed using the computer package 'COPE'. Examples of applications are given by Ackerman (1992); Ackerman *et al* (1994); Eden and Simpson (1989); Mathews and Bennett (1986).

SODA focuses on the perceptions of individual's interpretations of the meanings given to situations by events that occur. Personal constructs are elicited and drawn by means of cognitive maps, in a participatory fashion, during one-to-one interviews (Kelly, 1955). The individual maps are merged to help facilitate the process of team negotiations which take place in workshops. A SODA workshop aims to achieve a consensus commitment to plans of action.

In considering both quantitative and qualitative aspects, SODA places equal emphasis on the process of discussion, and managing the process, as well as content. It uses a framework of four areas. These are the 'individual', whom it recognises as having a personal interpretation of the situation. The second part of the framework is a particular view of the 'nature of organisations'. It again recognises the role of the individual in decision making within an organisation, rather than working with the 'department' or 'section', as if it were an individual. By adopting this view of the organisation it tends naturally to consider power structures and relationships concerning individuals. The third part of the framework brings together the first two areas and looks at 'consulting practice', in which negotiations and commitment, relative to the problem area, are highlighted. The perspectives adopted in the three areas mentioned are consistent with viewing the organisation as a negotiated enterprise. Through a consideration of a fourth element in the framework, 'technology and technique', the whole process is facilitated. Cognitive maps are elicited, in detailing personal constructs, on a one to one basis. These maps are then merged for use with the wider group, with the emphasis on action rather than description. The SODA approach is encapsulated in that it seeks consensus and commitment, rather than compromise and agreement. It is a powerful first-phase approach, with a distinct emphasis on seeking consensus as a desired outcome.

Multiple methods

Since within the information systems domain, multiview is an application of contingency theory, the latter is not separately analysed below.

Client led design (CLD) (Stowell, 1991) sees information systems development (ISD) as a social rather than a technical problem, privileging debate ahead of design in the ISD process. It refutes the view that development can be achieved by conducting an interpretative study which then passes its findings to a functionalist development method. CLD effectively argues that ISD must be driven throughout from the interpretative paradigm, with the analyst assuming the role of facilitator, with development under the control of the client.

A methodology strongly focused on the practical interest, CLD is able to elicit perceptions and arrive at consensus, but will always operate within the status quo. Movement between debating and design issues seems rather too readily assumed.

ETHICS (Mumford, 1994) is a functionalist method into which an attempt has been made to incorporate human issues. It is oriented toward problem solving, working from a system requirements definition, but building into the process the views of participants. The theoretical support for ETHICS is weak, and this manifests itself in the practical application, where debating elements of the methodology are seen to serve the functionalist, design process. Strongly oriented toward the technical interest, but with some practical power, ETHICS is best suited to problem contexts where design of a system is the primary concern, but where this needs to be supported by debate within a non-pluralistic and non-coercive environment.

Interactive planning is the backbone of Ackoff's social systems science (Ackoff, 1981). He argues that purposeful behaviour cannot be value free. Hence, if one regards an organisation as a purposeful system itself, containing another purposeful part (the individual), but itself part of a larger purposeful system (the environment), then all three need to be served by managers, and this is best done by acknowledging their input to a decision process, and the accompanying values. Three principles provide the basis for interactive planning. The first is the 'participative' principle. It encompasses a belief that the process of planning is more important than the plans themselves. It is through the process that individuals come to a greater understanding of the organisation and their part in it. All those affected by the planning should be involved. This also acknowledges the value judgements individuals bring to the process and is consistent with Ackoff's philosophy. The second principle is that of 'continuity'. This acknowledges the changing role of individuals and their changing values. Hence any plans should be constantly revised to facilitate them. The last principle is that of the 'holistic'. Planning should span simultaneously and interdependently the various strata of an organisation. Using these guiding principles Ackoff (1981) provides five phases for the methodology. These are 'formulating the mess' (analysing threats and opportunities to provide a reference scenario), 'ends planning' (specify the objectives and goals and produce an idealised design), 'means planning' (generate policies to draw together the reference scenario and the idealised design), 'resource planning' (facilities, equipment, personnel and money) and 'design of implementation and control' (how and by whom are the decisions made to be executed?). This is a systemic process and hence the order is not fixed. Amongst the advantages of this methodology, cited by practitioners, are the involvement of all stakeholders generating consensus and commitment and the ability of the methodology to release suppressed creativity and harness it to individual and organisational development.

The desire to involve all those affected by the problem area and the acknowledgement of the role of the individual result in this methodology being relatively strong in supporting the implementation of consensually-agreed changes.

Multiview has the objective of creating a theoretical framework which attempts to take account of the different points of view of all the people involved using a computer system. It is based on the assertion that at any stage of information systems development the approach is contingent on the circumstances met at that stage. Multiview differs from traditional 'systems development life cycle' (SDLC) based methodologies in that it is not seen as step by step problem solving but as an iterative process in which different approaches may be used at different times. It also accepts the view that no one methodology can be seen to work in all cases, and further it may be contended that the methodology to be chosen cannot be decided in advance of knowledge of the problem situation. There is explicit recognition within multiview of the need for participation. The Burrell and Morgan grid (Burrell and Morgan, 1979 p.22) is used to categorise the views which may be taken, although the movement between paradigms seems rather too readily assumed, giving rise to Jackson's (1992) critique of multiview as not resting on "complementarism at the level of theory". Certainly Watson and Wood-Harper (1995) seem happier to promote multiview from a practical rather than theoretical base.

User software engineering (USE) aims to build an interactive information system with an 'outside in' approach, beginning with the user interface. It is a heavily project based, phased development methodology, which relies strongly on the evolutionary approach and the use of prototyping, and is functional in orientation. This is shown particularly by the approach to requirements analysis in which the four aspects are identified as data modelling, activity modelling, analysis of user characteristics and analysis of usage characteristics.

Appendix IV

Total Systems Intervention (TSI) in the Critical Review Mode A Summary

Appendix IV Total Systems Intervention (TSI) in the Critical Review Mode - A Summary

(After Wilby, 1996a)

Introduction to Appendix IV

TSI in the critical review mode is the final stage in the review of methodologies, following some preliminary sorting using the Problem Structuring Framework (Appendix V) and the Wheel of Knowledge and Power (Appendix VI). Critical review is used to undertake a detailed critique of those methodologies which are seen to be most relevant to the problem situation, as identified through creativity in TSI.

It is used in Chapter 4 to determine the relevant methods to be used in the cases studied, and in Chapter 5 to carry out a detailed critical review of the possible methods prior to implementation.

Appendix IV

The objective of critical review, one of three modes of TSI, is to critically assess methods that may be used in the problem solving mode of TSI. It is assumed that any candidate methodology:

1. Advocates certain forms of creativity, choice and implementation.
2. May be defined in terms of four questions:
 1. **How** is the design to be achieved: the **design** questions, linked to **organisational processes and organisational design**.
 2. **What** options are available for the design: the **debate** questions, linked to **organisational culture**.
 3. **Why** should a design be accepted and who benefits: the **disimprisoning** questions, linked to **organisational politics** and issues of **power**.

Operation of TSI in Critical Review Mode

Creativity, choice and implementation are actioned by way of six steps (Wilby, 1996a):

Creativity

Step 1 Details the candidate methodology's philosophy, principles, methodological practice and process.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

Choice

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to, using the three phases themselves as the process for evaluation.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation.

Implementation

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

Critical Review of Methodologies

(The contribution of Flood and Jackson, 1991b is acknowledged throughout this review)

Interactive Planning (IP)

(Ackoff, 1981)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is one of wide participation and involvement in planning and design; the view is that people should plan for themselves by being involved in the process.

“It is better to plan for oneself, no matter how badly, than to be planned for by others, no matter how well.” (Ackoff, 1981 p.66).

Ackoff's 'systems age' view is one espousing synthesis and holism rather than scientific reductionism; a wide, purposeful system is promoted, with consideration given to the organisation, individuals within it, and its wider environment. Planning is an interactive rather than reactive, proactive or inactive one, in which problems are dissolved rather than solved or resolved.

“The interactivist .. asserts that *in planning, process is the most important product*. Therefore, the principal benefit of it derives from engaging in it.” (Ackoff, 1981 p.65).

The *principles* are: participation - that people should plan for themselves not be planned for; continuity - continuous revision of plans in the face of continuous change; and holism - co-ordination, including as much of the system as possible in the design.

“The way interactive planning is carried out depends on three operating principles: the *participative* principle, the principle of *continuity*, and the *holistic* principle.” (Ackoff, 1981 p.65).

The *methodology* is detailed in Appendix III.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

This calls for a deeper analysis of the categorisation in Appendix VI.

The *theory* of interactive planning is based on experimentalism as a philosophy of science. Ackoff, following Singer and Churchman (see Britton and McCallion, 1994 for a summary) sees reality as an ideal to be pursued. Its attainment is governed, argues Ackoff, by *power to* rather than *power over*, and is based on a dialectical approach. This is a strong antithesis to the traditional scientific approaches, which Singer (1959) categorises as rationalism, empiricism and criticism, and gives a foundation to the participative, ideal-seeking approach embodied in interactive planning. A strong fit exists in theoretical terms with both the practical and emancipatory knowledge constitutive interests.

The *ideology* is premised on participation, continuity and holism. People should plan rather than be planned for; organisations should be seen as systems within a larger system (the environment) and containing subsystems (people). Seen in these terms, interactive planning is ideologically practical and emancipatory.

The *methodology and utility* of interactive planning is based on steps which are detailed in Appendix III. It is here that the greatest problems emerge. Where the conditions for emancipation pre-exist, the methodology's approach to participation clearly leads to a system design to which all are able to contribute. However, there are only weak procedures within IP to challenge the structure and overcome coercion.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

Within computer-based information systems development (CbISD), IP emerges as strongly oriented toward creativity. Conceptual modelling of the problem domain would not be well facilitated by IP, making it a poor contributor to the choice phase.

- Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

IP's real power lies in its ability to reorganise process, in which the commitments to continuity and participation are of prime importance. In its approach to process it deals with issues of culture, but only within existing political constraints. There is a significant impact in IP on *organisational* design, which it is felt could be used to positively influence computer-based information systems designs, although the specific design of an information system would be only partially serviced by IP, and would require support from other methodologies.

- Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

IP's strengths lie in its ability to foster systemicity and participation, making it a good fit with TSI. It is clearly committed to emancipation, and in the principle of continuity it shows some orientation toward reflectiveness, though this is seen to be rather weak.

Implementation:

- Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

Interactive planning is strongly oriented toward the practical interest. Its commitment to participation and process mark it out as a predominantly interpretivistic methodology, concerned with problem structuring and issues of debate rather than design. There is a significant emancipatory intent, enabling it to work well where conditions for emancipation exist. Its systemicity is seen to be of value in CbIS interventions which cannot be categorised simply as problems to be solved in reductionist terms.

In contrast, IP's ability to *achieve* emancipation is not evident. IP does not deal with conflict (Ackoff effectively denies its existence), and contains no remedies for the 'false consciousness' of the oppressed.

It is based on theoretical premises which are not widely accepted, and from which it inherits only a weak critical ability. There is some evidence of the technical interest, though this is more in an organisational sense than in respect of CbISD.

Generally IP fits well with TSI, and offers benefits mostly in the areas of the practical interest and creativity, but needs to be carefully married with other methodologies to fully serve in a complete CbIS intervention.

Critical Systems Heuristics (CSH)

(see Ulrich, 1983a; Flood and Jackson, 1991b)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is based on critical reflection on what *ought* to be done (making explicit the normative content), and on instrumental, practical and emancipatory reason. The approach is heuristically grounded, and aims to challenge expert knowledge and expose *a priori* concepts. It is participatory, being explicitly premised on debate: a dialectic approach including the involved and the affected.

The *principles* begin with the recognition that social systems need to be designed as purposeful systems. Systemicity and the inevitable lack of comprehensiveness in producing social systems design is recognised. CSH has as a key principle the improvement of the human condition, requiring the incorporation of all stakeholder groups - the 'involved and affected'.

The *methodology* involves firstly the use of twelve critically heuristic boundary questions in 'is' and 'ought' mode to reveal the normative content and expose presuppositions. Secondly 'polemic boundary judgements' are employed to challenge power and domination.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* of CSH is derived from critical theory of, predominantly, Kant and Habermas. Kant drew the distinction between theoretical reason, the study of truth or what 'is', and practical reason, the study of what 'ought' to be. In questioning whether what 'ought' can be any more than subjective, Ulrich argues that true objectivity lies not in truth but in dialectics, to achieve " .. normative acceptability to all concerned." (Midgley, 1996). CSH is explicitly critical, aiming to reveal and reflect on *a priori* assumptions inherent in any systems design. The concentration on 'ought' places CSH outside the technical interest, and determines it as serving the practical interest with an emancipatory intent.

The *ideology* is widely participative, critical and self-reflective. The objective is to expose value assumptions to critique.

The *methodology and utility* of CSH is explicitly emancipatory and serving the practical interest through a dialectic solution to systems problems.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

CSH is strongest on creativity, with an ability to uncover world views and coercion. In implementation, consensus is the target, with the ability to engender limited emancipation.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

Deals with unearthing issues of culture and politics, and to some extent overturning existing arrangements.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

CSH is explicitly systemic, following Churchman's approach to dealing with the whole system, and reflecting on lack of comprehensiveness in systems design. It is reflective, and committed to emancipation and participation.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

Where a communicative, debating forum exists, CSH is able to deal with coercive interests within it. Where coercion is "characterised by closure of debate" (Midgley, 1996), CSH is seen to be of limited value. Further, whilst Ulrich sees Habermas' ideas of rational argumentation as too idealistic and lacking practicality, he seems not to acknowledge that CSH will only work where "all participants are able to handle involvement in rational argumentation." (Midgley, 1996).

In the polemical employment of boundary judgements, CSH goes some way to challenging power, but, as Midgley (1996) observes, it contains no procedures for examining and overcoming the political and economic forces that lie behind taken for granted assumptions.

Client-Led Design (CLD)

(Stowell, 1991; Stowell and West, 1994)

Creativity:

- Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

CLD is *philosophically* interpretivist, the whole process being driven from the interpretative paradigm.

The *principles* of CLD are collaboration, client control of the development, expert facilitation but not expert controlled.

The *methodology* follows a five phase development:

- Phase 1 Appreciation of the problem situation.
- Phase 2 Definition and representation of the information system.
- Phase 3 Definition of technical support for the system.
- Phase 4 Implementation of proposals.
- Phase 5 Maintenance.

- Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* primarily sees CLD satisfying the practical interest. A technical solution is expected to follow this, but cannot be determined until the information system, independent of technology, has been clearly defined.

The *ideology* is of an interactive, collaborative learning process. This is firmly focused on the practical interest.

The *methodology and utility* is dependent on emancipation, but concentrates on satisfying the practical interest in search of a technical solution.

Choice:

- Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

Contributes to creativity, choice and implementation in the practical interest, aiming to work towards implementation of an optimal solution in satisfaction of the technical. Offers enhancement of emancipation where the conditions for this pre-exist, but contains no means of overcoming unequal power relations.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

The focus is on process and design. CLD reveals issues of culture and politics, but is unable to resolve them.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

CLD has a systemic intent, approached by opening up the 'whole system' for discussion. Reflectiveness is included within the iterative process, but is not explicit. Participation is a key feature of the approach, but will only work where there is freedom to participate. Where such conditions do not exist, the meaningfulness of the participation must be called into question.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

Given that the aim is to produce an information system, a goal-directed approach is clearly indicated, and preventing this from prejudicing a true client input may prove difficult. In effect, the declared collaborative intent contains few safeguards to ensure that the development does not become 'engulfed by functionalism'.

Though ideologically rooted in the practical interest, CLD requires emancipation in order for it to work, but contains no procedures for achieving this. In terms of Habermas' theories, the underpinning of this methodology appears confused.

ETHICS

(Mumford, 1985)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is based on the functionalist paradigm, the process being controlled from requirements definition. The incorporation of organisational, administrative, and quality of work factors shows a commitment to interpretivism and emancipation.

The *principles* are participation and job satisfaction in pursuit of efficiency and effectiveness in business problems.

The *methodology* is a problem-solving one, following the steps of defining the key:
 Mission (what ought to be not what is).
 Information inputs and outputs.
 Efficiency and job satisfaction contributors.
 Efficiency and job satisfaction reducers.
 Variances.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* is firmly rooted in the technical interest, taking a functionalist view. Satisfaction of the practical interest is attempted only in so far as this fits the dominant view. Emancipation is not considered.

ETHICS seeks *ideologically* to serve the practical and emancipatory interests in support of the technical.

The *methodology and utility* approaches problems from the viewpoint of the practical interest, but only within a heavily constrained functionalist framework.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

The contribution is to creativity, choice and implementation at a technical level on the problem structuring framework. It exhibits a teleological commitment (developments are seen as 'ends serving'), so at the technical level it is very implementation oriented.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

The focus is on design. There is little influence on culture or politics, on which it so strongly depends.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Of the four key principles, only participation is addressed. The extent to which this is meaningful will depend on the nature of the problem situation, since ETHICS has no power to ensure this, but works within the status quo.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

The philosophy and practice of ETHICS conflict with its principles of participation and job satisfaction, which do not sit easily with the drive for efficiency and effectiveness. The implication is that the former will only be attained within the constraints set by the latter.

It requires emancipation and true participation in order to work, but only allows them within the functionalist constraints set by reaching for a technological solution. Debate takes place only within the framework determined for design.

ETHICS is a functionalist methodology which deals with participant views better than the standard systems development life cycle methodologies, but is severely limited in its ability to engender true participation and therefore to elicit true interpretative views.

Systems Development Life Cycle (SDLC - Systems Analysis and Engineering)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

SDLC approaches are *philosophically* functionalist, with a tendency toward isolationist or imperialist application.

The *principles* are structured development from a start-end, problem-solving, means-ends dominated, goal-directed perspective.

The *methodologies* adhere to a project management approach. Design of the system is prime, with debate taking place only within the designing framework.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* is underpinned by scientific reductionism: rule-based and mechanistic. It exists to satisfy the technical interest above all, and whilst containing elements dedicated to the practical interest, these will generally operate only within the technical framework. There is no emancipatory power.

The *ideology* is one of planning toward a goal, or a problem to be solved. Common goals are assumed, so that emancipation is not considered. The practical interest is served within the constraints set by this.

The *methodology and utility* leads to domination of any intervention by the technical interest.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

Fundamentally, SDLC is concerned with creativity, choice and implementation within the technical interest. Creativity is served in the practical interest, but only within the constraints set by the technical. Consensus is assumed, but no procedures exist to build it.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

Concerned with process and design within the constraints set by politics and in ignorance of culture.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Systemicity is approached through reductionism, in the belief that once the reduced components are optimised, putting them back together will result in an optimal system. The other three principles are not part of an SDLC approach.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

If the problem situation is definable as a simple problem to be solved, on which all participants agree, so that a project can be set up to build the system required, then SDLC methods provide arguably the best choice. The danger lies in believing in the emancipatory and participative power of clearly functionalist methods, and thereby attributing properties to them which they do not contain.

The methodologies depend on there being a consensus, but assume this rather than testing for its existence. The outcome is that the existing power base is served, and cultural issues are ignored.

The reductionist approach may be problematic in complex interventions, where optimising the parts will not result in an optimal overall solution (indeed, the concept of an optimal solution arguably has little relevance in such unstructured situations). Iteration is hard to achieve within SDLC approaches, which are premised on a project management method which requires completion by stages. Participation and emancipation are necessary for some of the inputs to the process, but no procedures exist for ensuring them.

Strategic Assumption Surfacing and Testing (SAST)

(Mason and Mitroff, 1981)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is one of wide participation and involvement in planning and design; the view is that people should plan for themselves by being involved in the process.

The *principles* are:

Adversarial	complex problems surface best through opposition.
Participative	relevant knowledge is distributed among a group.
Integrative	synthesise views into a unified whole.
Managerial	exposure to assumptions deepens managers' insight.
Mind-Supporting	

The *methodology* involves the stages of:

- Group formation.
- Assumption surfacing and testing.
- Debate.
- Information requirements analysis.
- Final synthesis.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* supporting SAST is the same as that underpinning interactive planning, and therefore can be seen as supporting the practical and emancipatory interests.

The *ideology* is the dissolution of pluralistic problem situations by all groups opening up their assumptions to others.

The *methodology and utility* take the form of group brainstorming exercises.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

SAST contributes to creativity, choice and implementation in service of the practical interest.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

It is a strategic tool focused on the organisation's culture, and operating within existing political arrangements.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Systemicity and participation are engendered within an SAST intervention. Reflectiveness is encouraged within the creativity phase.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

The main problem with SAST is its concentration on the need for all groups to lay bare their assumptions. Why should those in power do this? Whilst there is reason to believe that theoretically emancipation may be engendered, the methodology does little to build on this.

Strategic Choice

(Friend and Hickling, 1987)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* owes much to the Singer/Churchman/Ackoff school. It is, however, an explicitly pragmatic approach, aiming to address issues of technology, organisation, process and product.

The *principles* relate to the facilitation of group communication and the management of uncertainty under conditions of change. It is interactive, continuous and incremental.

The *methodology* involves shaping, to form an agreed view; designing, to identify courses of action; comparing, to evaluate actions against criteria; and choosing, to agree an incremental process for decision making.

- Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* owes much to the work of Ackoff, a strong fit existing in theoretical terms with both the practical and emancipatory knowledge constitutive interests. However, this theory is not rigorously exposed within the methodology of strategic choice, with the result that it appears as an over pragmatic approach with little reference to underpinning theory.

The *ideology* is participative, interactive and continuous. The practical interest is privileged, with an apparent assumption that emancipation will be forthcoming.

The *methodology and utility* is of value where emancipatory conditions pre-exist, the power being related to the practical interest. In non emancipatory conditions the value of the methodology is likely to be limited.

Choice:

- Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

Strategic choice emerges as an aid to creativity, poorly serving the choice and implementation phases.

- Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

The key contribution is to process, though design is served at a strategic level, a factor which could be of value in computer-based information systems interventions. It operates at all times within the given political constraints.

- Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

The only real contribution is to participation, and this is only meaningful within the given power structure.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

As with interactive planning, strategic choice is strongly oriented toward the practical interest. Its commitment to participation and process mark it out as a predominantly interpretivistic methodology, concerned with problem structuring and issues of debate rather than design. There is a significant emancipatory intent, enabling it to work well where conditions for emancipation exist.

Soft Systems Methodology (SSM)

(Checkland, 1989)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* of SSM is that there exist *different* views of the *same* situation, so problems are not unique, real and solvable. Consequently focus has to be on debate rather than design, with the target of a consensus which is seen to exist within a world not riven by conflict and coercion.

The *principles* are learning (continuous and iterative), culture (cultural constraints within social rules and norms), and participation, which is seen to be necessary for SSM to succeed.

The *methodology* is a seven-stage process which aims to relate the real and conceptual world (see Appendix III for detail).

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* was not developed alongside SSM, which was initially seen as a practical endeavour. However, it has subsequently been promoted as resting on the work of Vickers (1968). In terms of social theory, it explicitly addresses the practical interest; claims have been made for SSM being radical, but it is difficult to see how these can be supported.

The *ideology* is one of participation and consensus, the aim being to change society by changing the weltanschauung (world views) of participants. Here rests a major critique of SSM, that it can only serve the existing power base, and that without addressing emancipatory issues it is unable to achieve the agenda which it lays out for itself.

The *methodology and utility*. Whilst 'agreed' changes emerge from conceptual models built according to systems logic, the changes are not tested *as a package* against an systems logic (Flood and Jackson, 1991b). The outcome is that cultural feasibility dominates, with no safeguard against this being from a dominant culture.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

SSM is clearly located as contributing only to the creativity stage.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

It is focused on process and culture, but care has to be taken in its application, since coercion and power will distort the findings, whilst SSM contains no inbuilt safeguards against such distortion.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

SSM contributes to a systemic approach, and is explicitly participative. However, the lack of any reflective (critical) or emancipatory power means that participation will only be meaningful in non-coercive contexts.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

SSM is promoted as an interpretative methodology, capable of achieving radical results. Critique exposes it as regulatory, serving predominantly the practical interest. Used carefully and with explicit recognition of its ideological basis, SSM will contribute considerably to any problem context in which coercion and power are not significant factors; that is, where the pre-conditions for achieving true consensus exist.

Strategic Option Development and Analysis (SODA)

(Eden and Simpson, 1989)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* of SODA sees the organisation as a negotiated enterprise, in which a view can be built from the personal constructs of individuals.

The *principles* are explicitly participatory, building up a map of the organisation from the individual maps of its participants.

The *methodology* is to use cognitive mapping at an individual level, and, by combining these maps using computer software, to derive a consensus map of the enterprise. The map itself shows a series of linked ideas, with arrows indicating how one idea might lead to another, that is, it is a signed directed graph expressing chains of cause and effect among the issues comprising and related to the problem area.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* underpinning SODA is the theory of personal constructs (Kelly, 1955). It aims to build a consensus from an individual level, and as such operates within the status quo, risking 'false consciousness' at that level. There is, however, some emancipatory potential, in that the individual cognitive maps are determined in isolation and may remain anonymous.

The *ideology* addresses the practical interest, but with some emancipatory potential.

The *methodology and utility* is one of using the individual cognitive maps to successively build a view of the organisation through negotiation and commitment to achieve a consensus. Again, it is the practical interest which is being served.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

SODA is a creativity tool, working within the sociology of regulation to attain a consensus which is uncritically accepted.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

Its contribution is most likely to be in the areas of process and culture, with little impact on design. Political issues could be raised as a result of the individual and anonymous nature of the methodology's application.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Participation is the primary goal, its 'meaningfulness' being dependent on the freedom of the individuals concerned to express their true views. The unreflective nature of the methodology leaves it open to the criticism that it is unable to guard against 'false consciousness'.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

It must be seen predominantly as a creativity tool, serving only the practical interest, and dependent on an emancipatory environment in order that meaningful participation might take place.

User Software Engineering (USE)
(Wasserman *et al*, 1986)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is functionalist in orientation, aiming to incorporate user needs into a structured approach.

The *principles* involve focusing on a real-world system to 'systemically develop interactive systems'.

The *methodology* is prototyping and evolutionary: structured, with admitted similarity to jackson structured development, a systems development life cycle method.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* places USE firmly in the technical domain, with an attempt to give support from the practical.

The *ideology* is technical and practical, but its ability to contribute to the latter has to be questioned on a number of counts. Primary among these is its concentration on objective reality informed from a functionalist perspective, coupled with an inability to deal with (or even recognise) emancipatory issues, leaving it open to criticism from all perspectives.

The *methodology and utility* places it firmly in service of the technical interest, ignoring the emancipatory and subsuming the practical only in so far as it contributes to technical ends.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

USE claims to combine creativity with implementation, but this cannot be supported. It contributes only to the implementation stage, and is therefore of use only in terms of design issues.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

As already determined, USE addresses design within the status quo.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Though claimed to be systemic, this cannot be supported. Reflection, emancipation and meaningful participation are not evident in this methodology.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

The lack of systemicity (though claimed), reflection, emancipation and meaningful participation leave USE as just another structured methodology attempting to service the technical interest from the functionalist paradigm, albeit with some recognition of the need for user involvement. It offers an impoverished view of problem situations rich in human activity.

Pyramids

(Northedge, 1975)

Creativity:

Step 1 What are the candidate methodology's philosophy, principles, methodological practice and process?

The *philosophy* is one of creating ownership of problem situations by discussion and understanding of one's own perspectives and the perspectives of others.

The *principles* are the development of an agreed understanding based on high levels of participation.

The *methodology* involves persons working alone, in pairs, in quads and finally as a whole group, in a plenary session. At each level of the pyramid the objective is to be able to produce an agreed statement, relating to the problem situation, to be carried forward to the next stage.

Step 2 Critiques the candidate methodology in terms of how its theory, methodology, utility and ideology address the technical, practical and emancipatory knowledge constitutive interests of the situation and its participants.

The *theory* is generally interpretative, though essentially the methodology seems to be pragmatically grounded. It's contribution is entirely to the practical interest, within the regulative domain.

The *ideology* is practical and emancipatory, but it shows no power to achieve the latter.

The *methodology and utility* marks it out as an approach in service of the practical interest.

Choice:

Step 3 Evaluates which of the three phases, creativity, choice and/or implementation, the candidate methodology contributes to.

A creative methodology, offering nothing in terms of choice or implementation.

Step 4 Asks how the candidate methodology creates a vision of the organisational ideal by assessing its contribution to the four key dimensions of process, design, culture and politics.

Addresses process and culture within the given political constraints. Its claim to emancipatory power cannot be supported, and is likely to distort its use if applied without care.

Step 5 What meaning, if any, does this candidate methodology give these four key principles of TSI: being systemic, being reflective, enhancing emancipation, and encouraging meaningful participation?

Participation is the only area addressed by pyramids; the extent to which this is meaningful will depend on the already existing emancipatory conditions.

Implementation:

Step 6 How does the information gathered in steps 1 to 5 combine to present a critique of the candidate methodology?

Pyramids is a useful technique for achieving a consensus within certain problem contexts. The context would have to be carefully chosen to ensure that the conditions were right for the approach to succeed, and it is a concern that, as promoted, the claimed emancipatory potential of the methodology is more likely to advocate its use in unsuitable situations.

Appendix V

The Problem Structuring Framework: A Framework for Assessing Individual Methodologies

Appendix V The Problem Structuring Framework: A Framework for Assessing Individual Methodologies

(After Lehaney *et al*, 1996)

Introduction to Appendix V

The problem structuring framework is used to classify the methodologies detailed in Appendix III according to which phase of TSI (creativity, choice or implementation) and which knowledge constitutive interest (technical, practical or emancipatory) they contribute to. The power of the methodology to address each of these is indicated by the depth of shading. The framework supports the critical review of methods in Chapter 4 (the case studies), where it helps in matching the methodologies to the complementarist framework, and the choice phase of TSI in Chapter 5.

The framework categorises the methodologies detailed in Appendix III, thereby enabling a rapid assessment of those methods best suited to a given problem context. Only those methodologies relevant to information systems development have been brought forward to this stage: the rationale for not continuing with a methodology is explained in the relevant section below.

Appendix V

	Creativity (Find Out About)	Choice (Methods would be chosen for ability to:)	Implementation (Expected Outcome)
Technical	Physical Structure	Build different analytical models	Optimal model
Practical	Perceptions and Weltanschauung	Build different conceptual models	Consensus
Emancipatory	Coercive influences and effects	Challenge structure	Empowerment

Methodologies can be mapped on to this matrix, with the positioning showing whether the methodology addresses best issues of creativity, choice and/or implementation, mapped against the three cognitive interests of technical, practical or emancipatory. The shading indicates the power of a given methodology.

Problem Solving Methods

Systems Development Life Cycle: Systems Analysis and Systems Engineering (SDLC: SA and SE)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Problem Structuring Methods

Some of the methodologies detailed in Appendix III have not been analysed within this framework:

Hypergames, metagames and robustness analysis are methods ill suited to information systems development.

Cognitive mapping is included as part of the SODA methodology.

Metaphors are integral to the TSI approach.

Critical Systems Heuristics (CSH)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Pyramids

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Soft Systems Methodology (SSM)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Strategic Assumption Surfacing and Testing (SAST)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Strategic Choice

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Strategic Options Development and Analysis (SODA)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Multiple Methods

As methods contingent on the nature of the real-world problem encountered, contingency theory and multiview sit uneasily within the complementarist approach of critical systems thinking and total systems intervention, and have therefore not been further assessed within this section.

Client Led Design (CLD)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

ETHICS

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Interactive Planning (IP)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

User Software Engineering (USE)

	Creativity (Find Out About)	Choice (ability to (build))	Implementation (Expected Outcome)
Technical	Physical Structure	Analytical models	Optimal model
Practical	Weltanschauung	Conceptual models	Consensus
Emancipatory	Coercion	Challenge structure	Empowerment

Appendix VI

The Wheel of Knowledge and Power

Appendix VI The Wheel of Knowledge and Power

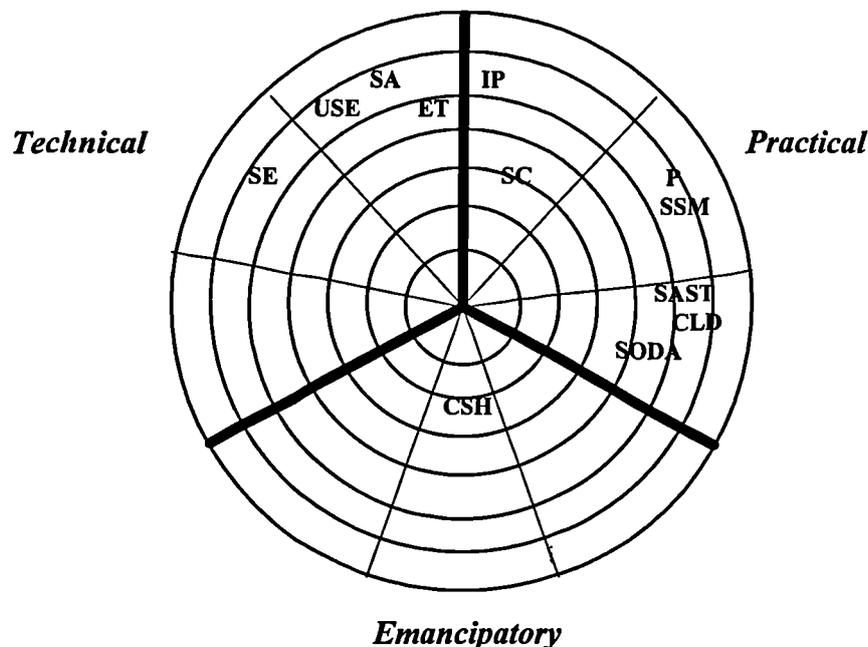
Introduction to Appendix VI

The wheel of knowledge and power is used to support the critical review of methods in Chapter 4 (the case studies), where it helps in matching the methodologies to the complementarist framework. The wheel also supports the choice phase of TSI in Chapter 5.

The methods analysed on the wheel are those detailed in the problem structuring framework of Appendix V.

Appendix VI

The wheel of knowledge and power presents, in a single figure, the interventionist's view of which of the three knowledge constitutive interests each of the methodologies in Appendix III addresses, and the power of the methodology in that context: as such, it is a single page summary of Appendix V. It is important to recognise that this is not a prescriptive categorisation, but a subjective one which will vary according to the nature of the intervention and the viewpoint of the interventionist. The further away from the centre a methodology is placed, the greater is its power, whilst the further to one side or another of a given division indicates the influence of that cognitive interest on the methodology. Thus it is seen that elicitation of 'practical' knowledge is best served by methodologies such as interactive planning, metaphors, pyramids, soft systems methodology and so on.



Problem Solving Methods <i>Functional</i>	Problem Structuring Methods <i>Interpretative</i>	Multiple Methods <i>Mixed</i>
Systems Development Life Cycle: Systems Analysis Systems Engineering	Critical Systems Heuristics Pyramids Soft Systems Methodology Strategic Assumption Surfacing and Testing Strategic Choice Strategic Options Development and Analysis	CSH P SSM SAST SC SODA Client Led Design ETHICS Interactive Planning User Software Engineering CLD ET IP USE

Appendix VII

Research Journal

Appendix VII Research Journal

Introduction to Appendix VII

This appendix gives a brief summary of the action research activities carried out in support of Chapter 5, beginning with formation of the MIS Quality Group on 29 March 1994, and concluding with the final report on the MIS intervention on 13 June 1996. It aims to add further clarity to the schematic of action research in the University of Luton, given in Figures 5.5 and 5.6.

Appendix VII

Detail of documents referred to in this appendix can be found in Appendix XI, p.299.

- | | |
|------------------|---|
| 29 March 1994 | Memo setting up the MIS (MISQG) and Finance Quality Groups. |
| 30 March 1994 | Meeting with Graham Ryder (Senior Systems Developer) re HEMIS / Student Record Systems. |
| 3 May 1994 | MISQ Meeting. Phsr0002 refers. |
| 6 July 1994 | Wendy Dunkley (Academic Registrar) at Nene College re HEMIS / Student Record Systems. |
| 7 September 1994 | MISQG. Paper circulated by John Bramwell (MISQG Chair) set the scene for MIS problems in the University, and proposed a solution via an audit of requirements. Phsr0004 refers. |
| 2 November 1994 | MISQG Meeting. Phsr0020 refers. |
| 16 December 1994 | Ian Nicol meeting re student access. |
| 4 January 1995 | MISQG Meeting. Discussion of audit. Phsr0026 refers. |
| 3 May 1995 | MISQG Meeting. Phsr0019 refers. |
| 4 May 1995 | Memo from Bill Diack (Head of MIS) outlining the procedure for requesting systems development.
This was a key impetus in looking for prioritisation methods etc, and helped lead to the later investigation. |
| 18 May 1995 | Discussion document circulated to the MISQG (Misqgdd1 refers), in response to a request at the previous meeting.
Some concern regarding the content of the briefing paper had previously been expressed by Dr. D.T. John (Deputy Vice Chancellor), but this was not regarded in a negative light by the MISQG. |

-
- 24 June 1995 Bill Diack. Meeting to discuss how to progress.
- 6 July 1995 Memo re lack of MISQG meetings and need to progress the investigations. Phsr0027 refers.
- 28 July 1995 Registrars Meeting.
- Presentation to Faculty Registrars and Richard Harris (Dean of Quality Assurance), Appendix VIII refers.
Objective to get approval and support for the intervention.
Positive response. Meeting of 10 August set up on the spot. All Faculties supporting the initiative.
Good feedback from Registrars - they see a need for better support of faculty requirements.
It was made clear that the first meeting with faculty administration would be a finding out session to determine the way forward.
- 10 August 1995 First administration meeting:
- Finding out session.
Attended by representatives of all faculties.
The technique used was seen to be effective. Visualising the organisation as 'mechanistic' or 'socio-cultural' helped bring out views of what we are trying to support.
Brainstorming was seen as a highly effective way of generating ideas.
- 31 August 1995 Second administration meeting.
- 11 September 1995 Ian Nicol Meeting re Phfabp01.
- 18 September 1995 Phfabp01 prepared for distribution.
- 25 September 1995 John Bramwell Meeting.
- 10 October 1995 MISQG.
Discussion of Phfabp01 and paper on faculty requirements.
A very positive meeting which approved the two phase investigation of MIS. Phsr0022 refers.
- 18 October 1995 John Bramwell Meeting.
- 2 November 1995 Bill Diack.
- 8 November 1995 Business Faculty administration meeting (Kelly Strachan).
- 14 November 1995 Lesley Stokes at the Luton and Dunstable Hospital.

-
- 16 November 1995 Jan Welch at Bedford Hospital.
- 17 November 1995 Jan Howlett at Putteridge Bury (University of Luton Faculty of Management).
- 22 November 1995 Faculties of Humanities and Design and Technology re HEMIS.
- 23 November 1995 Third administration meeting.
- November 1995 Phacrs05 prepared: summarising findings in Faculties.
- 28 November 1995 MISQG. Discussion and approval of Phfarp01 (distributed on this date). The response was very positive. Bill Diack, in particular, was in total agreement, and seemed happy to have confirmation of issues which he felt to be important. Phsr0024 refers.
- 9 January 1996 Memo circulated re Phase I report (Phacrs08).
- 15 January 1996 John Bramwell Meeting.
- 17 January 1996 Student Meeting.
- Idealised design session (see Phacrs09).
21 participants contributed to a lively debate.
Students had a clear perception that the previous structured approach to the problem situation had limitations, and were keen to be involved in a soft, problem structuring session.
- 7 March 1996 Central management meeting.
- Idealised design session.
11 participants contributed to a lively debate.
- 13 March 1996 Academic meeting.
- 14 March 1996 MISQG. Phsr0008 refers.
- 24 March 1996 Phacrs14 - summary report of the four stakeholder meetings for feedback. Updated by feedback received 19 April 1996.
- 25 April 1996 Phfarp03 reports on whole intervention prepared for discussion.
- 7 May 1996 John Bramwell Meeting.
- 12 June 1996 John Bramwell Meeting.
- 13 June 1996 Final management report drafted and sent to Ian Nicol (Phmgrp01 refers).

Appendix VIII

Student Records Intervention - Documentation

Appendix VIII Student Records Intervention - Documentation

Introduction to Appendix VIII

The documentation generated during the action research intervention which is the subject of Chapter 5, is too extensive for it all to be included here. All documentation is referenced in Chapter 6, in the section on content analysis, where thirty two documents have been investigated using the content analysis software (see Appendix XI). Detailed documentation is available from the author on request.

This appendix contains three key documents which are specifically referenced within the thesis:

1. The Management Information Systems Quality Group Terms of Reference, which helps to determine the aims of the intervention in Chapter 5.
2. The Presentation to Faculty Registrars, which marks the beginning of the creativity process in Chapter 5.
3. The University of Luton Mission Statement, which is used to help inform the ends to which the University is striving. These ends form part of interactive planning in Chapter 5.

Appendix VIII

Management Information Quality Group - Terms of Reference

1. To review the provision of Management Information throughout the University.
2. To advise the Director (Finance and Information) on an ongoing basis of matters of concern with regard to the provision of management information and its quality.
3. To identify critical areas related to the provision of management information which are currently causing problems and to:
 - (i) Prioritise these for remedial action.
 - (ii) Identify the action that requires to be taken.
4. To institute a regime of appraisal of management information provision which seeks to improve the quality of such information on a continuous basis.
5. To consider the inputs to MIS and their quality and the effect that they have on the expectations of quality of output.

IAN/COB 29 April 1994

Presentation to Faculty Registrars

Following are the overheads used for the presentation.

Slide 1

The Problem

Faculty Access to Student Record Systems

Advisory Group

Advises Director of Finance

Slide 3

The Principles

Not Determined by Experts

Expert Knowledge not Required

Take the Views of Those Involved

Engage in Open Debate on Issues to be Addressed

Slide 5

The Commitment

Two 1 Hour Sessions before End August

Aim to Brainstorm and Surface the Main Issues

Slide 2

The Problem Defined

What is Meant by Faculty Access?

Who Gets Access to What?

Or

What is Needed

Slide 4

The Process

Facilitated by Steve Clarke

Two People from each Faculty

Participants Knowledgeable about Student Record Administration, not HEMIS

Slide 6

What Happens Next?

Audit Current Access

Summarise User Requirements

Consult Management, Academics, Students

Decide the Way Forward

ONGOING REAPPRAISAL

University of Luton Statement of Mission

The University of Luton is committed to sustaining high-quality education and professional development, supported by a strong base of creative and applicable research.

Courses will be characterised by their wide choice and flexibility, vocational relevance, and the opportunities they provide for all students to achieve their full potential. Working partnerships with employers, professional organisations, and their stakeholders, will remain a high priority.

The University welcomes its responsibilities to contribute to the cultural and economic life of the region. It is unequivocally opposed to discrimination in all its forms.

Appendix IX

Faculty Access Report No. 1

Appendix IX Faculty Access Report No. 1

Introduction to Appendix IX

Two key reports are included as part of this thesis. The purpose is firstly to support the intervention process detailed in Chapter 5, and secondly to give an indication of the outputs generated during the intervention, further reports of which are available from the author. This first report is of the operational intervention (see Figure 5.5 to determine where this is located within the overall investigation).

As this report contains three appendices, they have been designated Appendix A to C to differentiate them from the appendix numbering used within the thesis.

Appendix IX

University of Luton

Student Records Management Information System (HEMIS)

Faculty Access Report No. 1 Access for Assessment and Enquiry

Prepared For: MIS Quality Group

Prepared By: Steve Clarke
Paul Slater

Date: 28 Nov 1995

Contents

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2		Contents
3	1.0	Summary of Main Points
4	2.0	Terms of Reference
5	3.0	The Investigation
8	4.0	Conclusions and Recommendations
10	5.0	Appendices
	5.1	Appendix A Briefing Paper: Faculty Access to MIS
	5.2	Appendix B Text of Meeting with Bill Diack
	5.3	Appendix C Faculty Meetings to Observe Use of HEMIS

1.0 Summary of Main Points

- HEMIS was originally designed for access by a small number of users through a single terminal type. Its expansion to wider access creates a number of issues which must be addressed.
- Two investigations to improve student recording and control are currently in progress, both of which are essential if the necessary improvements are to be achieved.
- The first investigation has identified the following problem areas:
 - Some work is necessary to enhance the performance and integrity of HEMIS. In respect of performance, this can be a problem particularly under peak demand. As regards integrity: investigation of errors, creation of validation routines, and clear audit trails are primary areas on which to focus.
 - For general users, the interface to HEMIS is very unfriendly. Both hardware (type of terminal) and software (especially input screens, navigation, menus and printing facilities) issues require attention.
 - All of this work will not achieve the required result unless the admissions and enrolment/modular choice functions of HEMIS are given equal attention. This should be the next major priority in the first investigation.
- The second investigation is underway, and is concerned with the future strategic issues affecting student recording. The report on this will be ready by early January, and will build on the information gathered for this report.

2.0 Terms of Reference

The terms of reference for this study are contained in the attached document reference PHFABP01 (see Appendix A), approved by the MIS Quality Group on 10th October 1995.

By way of summary, a two phase investigation was approved as follows:

1. An investigation of the present HEMIS system, initially through faculty administration.

This investigation to begin with an analysis of HEMIS itself and what is available within it to aid the student recording and control process, and from that perspective what access at faculty level would better enable the management of students in the modular scheme.

2. A longer term study to determine what is needed to support administrative control and recording of students, which initially should be carried out irrespective of the current systems.

It is expected as a result of these investigations that the dual advantage of improved present systems and better focused strategy will result.

3.0 The Investigations

3.1 THE PRESENT HEMIS SYSTEM

This has been undertaken with the help of Paul Slater, Principal Lecturer in the Faculty of Science and Computing.

The procedure has been firstly to meet with Bill Diack to ascertain the functions which HEMIS is expected to provide to the Faculties, and then to visit each of the Faculties in order to observe users making use of the functions which they perceive to be available to them.

Bill Diack (Head of Management Services)

The full text of the meeting, summarised to a page of A4, is attached (see Appendix B).

The faculty access facilities can be seen at the end of this summary, and are:

1. View Student Data Full student information, student by student.
2. Entry of Results By module or by student.
3. Reports Printed information by faculty, module, course or student.

Some reports can be printed locally on laser printers in the faculty offices.

As will be made clear later in the report, **these facilities cannot be viewed in isolation from enrolment and module choices.** Investigation of this area has not yet been undertaken, but such an investigation must be a high priority, and comments regarding the issues to be reviewed are made here.

Faculty Administration

The findings are detailed in Appendix C.

In general terms, it was found that the facilities listed above were available to all Faculties with the exception of local printing, which is not provided to the outreach sites at the Bedford and Luton and Dunstable hospitals.

Summary of Key Points

Entering and Viewing Data

- Interface inconsistent between different terminal types.
- Input/enquiry screens are too cluttered and contain too much information which is not used.
- Incorrect and unknown data items need to be sorted.
- Navigating around the system requires redesigning.
- Information presented is not filtered or sorted and can be difficult to interpret.
- Insufficient ability to select ranges of students or modules.
- Some stored information is not available to those who most need it.
- Some necessary information is not stored.
- The result of choosing a menu option is difficult to predict.
- Input routines are not clearly specified.
- Little validation of entries.

Reporting

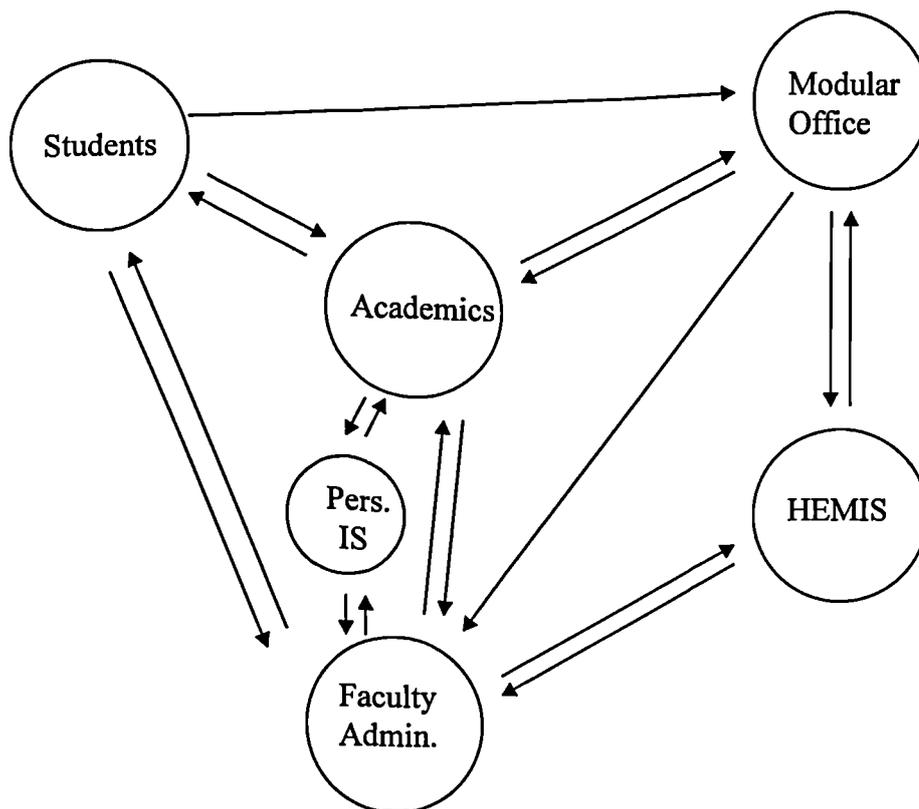
- Print pull-down menus are confusing. Many unused options.
- Not all Faculties are able to print locally.
- The requirements for local printing need to be determined.
- Printouts available centrally are not clearly specified.

General Comments

- The HEMIS system is used passively by almost all end users.
- Duplication of records within HEMIS still appears to be a problem.
- The system can be slow at important times.
- System does not prohibit actions which are forbidden under the modular scheme.
- Non-modular students are marginalised, and often dealt with outside HEMIS.
- Ongoing training in the use of the system needs to be undertaken, and user guides must be written and regularly updated.

Schematic of Points of Contact and Issues Arising

From the information collected, the links between different parts of the system have been mapped, and appear as shown on the following diagram. This shows the main lines of communication used in maintaining student records, not including the transmission of purely printed data.



By looking at this schematic of the system(s) currently employed, it becomes clear that the main activity is centred on faculty administration. Furthermore, in order to carry out the necessary functions, direct links to academics and students are used more than HEMIS links.

Personal information systems which better enable recording, control and reporting at faculty level, are of more significance in the control chain than the central HEMIS system.

This points to the need for a wider investigation, which is the focus of 3.2 below.

3.2 Future Requirements

This addresses point 2 in the terms of reference.

The investigation for this is underway, having started with a meeting of ten representatives from five Faculties (Management were unable to attend owing to work pressures) on 23rd November.

Detailed recommendations from this investigation, and its relationship to the first study, will be made early in January.

Initial indications are that this second investigation will build from where the current HEMIS study finishes, and will help to provide a strategic direction for the student record MIS in the University.

4.0 Conclusions and Recommendations

The initial aim is to provide better access to faculty users.

Faculty administration has been chosen as the initial focus of this study. The ultimate objective is to broaden access to other the groups of users (mainly students, academics and management).

For any of this access to be achieved it is essential that current routines for data entry, enquiry and printing on HEMIS are substantially reviewed.

The two main areas on which to concentrate are the human computer interface (HCI) and factors internal to the HEMIS system.

HCI

Immediately identified headings under which this should be addressed are functionality, access, validation, communications, print routines, and instruction/training.

In effect, a significant design effort is needed in order for the system to become generally usable, after which training and documented user instruction needs to be undertaken on an ongoing basis.

Internal Factors

Though of lesser concern, issues of performance and integrity need to be addressed within the HEMIS system.

This work could be carried out concurrently with the HCI.

Enrolment

As already indicated, problems with assessment recording and student monitoring occur because enrolment and module choice data does not match current activity.

There is therefore an urgent need to extend the current investigation to this area whilst the improvements outlined above are being implemented.

Further Investigation(s)

The second, strategic study, is currently underway. This will build on the first study and is essential for giving future direction to MIS developments.

5.0 Appendices

5.1 Appendix A - Document PHFABP01

Briefing Paper: Faculty Access to University MIS

Introduction

The MIS (Management Information Systems) Quality Group, now in its second year of operation, has been charged with the task of investigating faculty access to the University's MIS systems.

To commence this investigation it was agreed by Ian Nichol, Bill Diack, John Bramwell and Steve Clarke, in the absence of a formal MIS quality meeting, that some work should be carried out over the summer period to determine the nature and scope of the task.

The interest groups (those for whom faculty access could yield benefits) have been identified as potentially, management, academics, administration, and students.

The MIS systems to be investigated are many and varied, but it was agreed to start with the student record system.

Background to the study

Since the change to modular courses of study commenced, development of student record and control systems has largely focused on HEMIS (Higher Education MIS).

This focus has taken a predominantly technical view, which has enabled the system to attain its current functionality in a relatively short time.

The desire to give more access to faculties requires a clear understanding of user needs in the faculties, and in order to determine the type of access required it was agreed by the MIS quality group that some user consultation was needed.

The difficulty has been one of determining how this consultation process should be undertaken. A questionnaire has already been circulated, but, whilst generating useful information, this has not given sufficient detail to support the now anticipated development.

The purpose of the investigation to date has therefore been to decide an approach which offers the best opportunity for generating improvements to the present systems in both the long and short term.

The remainder of this paper outlines the outcomes of consultation so far undertaken. These outcomes give clear guidance to the next stage of the development, and approval is now sought for this to commence.

The Study

During August 1995 three meetings were held, facilitated by Steve Clarke, to investigate the issues and determine the way forward.

The first meeting was with the six Faculty Registrars and Richard Harris, the purpose of this being to outline the aims of the study and to gain the support of staff from administration within each of the faculties.

As a result of this meeting a session was arranged for 10th August at which two members of the administration staff from each of the six Faculties were invited. In the event on the day there were 13 attendees, with all Faculties represented.

The purpose of the session was stated as being to determine how information systems could be used to support student monitoring and control at a faculty level.

It was particularly important that participants should not pre-judge the issues involved, but should come to the sessions with an open mind bringing their own expertise in the field of investigation.

In the event the session was extremely informative (see later conclusions). It was followed up by a further session on 31st August, at which 5 of the original attendees were able to re-attend, and the views that they had expressed at the first meeting were, having been collated, fed back to the group for comment in order to arrive at the necessary conclusions.

The aim of the second meeting was clearly stated as determining the approach to be taken to faculty access.

Findings and Recommendations

The result of this investigation has been that there are really two parallel agendas to manage.

The first agenda is one of continuing to improve existing current systems, essentially by looking at the systems we already have to control and monitor students, and look at ways of using access to them to improve effectiveness and efficiency.

What has to be recognised, however, is that this is only part of the problem which needs to be addressed, focusing as it does on how to improve the design of current systems.

There is a further need to look at issues which may not be addressed by current systems, requiring an investigation focused on those developments necessary to improving the work of administration (and ultimately management, academics, students) in the future.

This second investigation is not an issue of design, but of debate, and requires an ongoing consultative process to develop the recommendations. It is also essentially a strategic agenda, based on information which can be gathered by debating these issues with the necessary interests groups.

Consequently the MIS Quality Group is recommending a dual investigation:

1. An investigation of the present HEMIS system, initially through faculty administration. This investigation should begin with an analysis of HEMIS itself and what is available within it to aid the student recording and control process, and from that perspective what access at faculty level would better enable the management of students in the modular scheme.
2. A longer term study to determine what is needed to support administrative control and recording of students, which initially should be carried out irrespective of the current systems.

It is expected as a result of these investigations that the dual advantage of improved present systems and better focused strategy will result.

With this now recognised need for an increased emphasis on strategy, the MIS Quality Group is recommending close links to be developed with other strategy groups within the University, in particular the Information Management Strategy Group recently formed.

Future Developments

Following the current investigation, the study will need to be widened to the other interest groups, and ultimately quite probably to mixed groups of participants from all areas of the University.

Furthermore the student record system is not the only system requiring investigation of this nature, and future developments should include investigation of other MIS systems.

Steve Clarke

For the MIS Quality Group
18th September 1995

5.2 Appendix B

Text of Meeting with Bill Diack

The Student Record System is part of the HEMIS database, which is a bought-in system running on ORACLE V7 on a DEC Alpha computer with remote users.

The system as bought provides several standard tables for recording and reporting information, with 4 or 8 free fields for customisation. These are used to record additional information such as assignment weighting and due dates.

HEMIS is designed to provide certain functions concerned with the collecting and recording of data that occurs in an HE institution with a modular structure.

There are three main roles:

1. Recording enrolments and module choices.
2. Recording academic results.
3. Recording and calculating fees and invoice generation.

Items 1 and 2 are not dynamically linked, but a screen has been devised to provide this.

HEMIS is used to report to several outside agencies. These reports are statutory requirements on the institution:

1. HESA HE Statistics Agency.
2. HEFC Funding statistics.
3. FEFC Funding statistics.
4. LEA Reporting eligibility to progress.
5. UCAS Verifying enrolled students.

Management services regard the internal client functions as more important than the external ones, but there are financial penalties for late information to external agencies in some cases.

HEMIS is simply a database, hence it is possible to access any of the information in any format, if a screen / form / report is generated to do it.

Management services have added several screens and reports to the standard set supplied, and can devise new ones to meet the needs of the institution.

The functions which the Student Records part of the system provides are:

1. View Student Data Full student information, student by student.
2. Entry of Results By module or by student.
3. Reports Printed information by faculty, module, course or student.

Staff in faculty offices currently have access to all three services, and have a local laser printer to produce output of reports. Any VAX/Alpha connection is capable of accessing the information, but a password is required for security.

Address labels can be printed by module or course, and are obtainable from Computer Services. Members of staff may be given a read-only account for services 1 and 3, on completion of an application form and signature by Head of Department or Dean.

5.3 Appendix C

Faculty Meetings to Observe Use of HEMIS

MIS Student Records System: Summarised Findings

Paul Slater: Meeting with Micki Ianabelli (Science and Computing)	5/11/95
Steve Clarke: Meeting with Kelly Strachan (Business)	8/11/95
Steve Clarke: Meeting with Lesley Stokes (H/C LandD)	14/11/95
Steve Clarke: Meeting with Jan Welch (H/C Bedford)	16/11/95
Steve Clarke: Meeting with Jan Howlett (Putteridge)	16/11/95
Steve Clarke: Meeting with Vicki Vidal (Humanities)	22/11/95
Steve Clarke: Meeting with D. Beetham (Des and Tech.)	22/11/95
Steve & Paul: Meeting with Bill Diack (Management Services)	2/11/95

Objective

To review faculty access to the Student Record System (HEMIS), with particular reference at this initial stage to assessment recording and reporting.

Bill Diack

The purpose of the meeting was to determine the services that the student record MIS (HEMIS) is purported to provide.

The information covering this is contained in Paul's summary (attached).

Faculty Meetings (See List Above)

There appear to be no user guides.

Many problems can be traced to issues related to this.

The system is used infrequently, as most only use it to enter data, so the interface has to be relearned.

Training appears to have been sketchy and not ongoing, so not recognising that users will change from time to time and retraining will be needed.

Users in different Faculties have very different knowledge of the system's capabilities and how to make best use of it.

Users are asked to perform tasks for which they have had no prior information (most recently, printing blank student grade sheets locally).

There are many ways to achieve the same objective, so the best way is often not known. Menu options give unclear messages as to what they provide.

The system is predominantly used as a repository for data to benefit others, not as an aid to managing student records.

Health Care operate a third semester, and also have semester end dates which do not coincide with the rest of the University. HEMIS does not seem to recognise this, and progression has to be dealt with by pathway leaders, even though the grades have to go into HEMIS.

Personal Information Systems are widely used by both administration and academics to manage the students.

Many students are not within the modular scheme; e.g: Dip HE Nursing Studies with 500 FT students.

The opening screen offers the following menu in Science (Outreach sites have no print option):

- 1 - Change Password
- 2 - Student Record System
- 3 - Print and View
- 9 - Exit

Other screens (4-8) are available to other users.

Viewing and Entering Data

Selecting 2, gives a screen full of jumble. *Far too many items to make sense of.*

There are several menus, some with *non-working items*.

It seems that the system has been designed for a VAX terminal, on which it works much better. More user interface problems occur when switching to other input units (PC and MAC).

It is unclear to the user what the items presented on the screen represent (e.g. what is "sequence 5"; why does W have to be changed to C sometimes and sometimes not?). Assessment date and status appear incorrect.

Navigating around the system is by function keys. There is a feeling that these could be better assigned or even replaced with alternative methods. In all, this process is not very user friendly.

Viewing by Student

The student's name or number can be given to bring up an individual record. A comprehensive list of module grades etc. is also available. *Need to know how to navigate through. Many features but got to know they are there. Needs a simple hierarchical system to unclutter it.*

All grades for a student are retained, but the view screen does not sort these or indicate which is current. The result is information which is often difficult to interpret.

Viewing by Module

Allows grades to be entered by module, in alphabetical or numerical order.

Information is presented by assignment number within module.

All students are listed from the beginning of the use of HEMIS (1992).

Partial selection of students is possible, but only delimited by commencing date (no way to display all of 1994 for example).

Can further delimit by semester, but requires the user to press tab 28 times to reach the required field.

Summarised results for each module are available.

*Problems: Many Fields unknown
 Weightings or average grades cannot be viewed
 Number of assessments expected unknown
 Additional students on register - needs a call to the modular office to add students
 No information about agreed extension
 No cumulative total on screen
 HND and Degree are mixed on a module, with no way of disaggregating them.*

Entering Data

Fields that can be entered all appear on the first screen, and are:

Status	Grade	Value	%
--------	-------	-------	---

Input is from hand written forms received from academic staff.
 Usually done via the "by module" screens, but can be by student.
 Same screens for view and input.

To reach assessments, the route is **enrolments, students, A/C record, assessments**.
 This seems not to express the true logic of what is being done.

Data has to input in "blocks", but the allowable size is not clear.
 If too many are entered at once, data is rejected only when committed at the end.

Once a record is entered, to move to the next record either means tabbing 21 times or using the key pad which does not return you directly to the next record (need to select the key pad option twice).

Can tab forward but not back.

At L&D, if the phone rings it interferes with the entry (which is via modem).
 L&D not aware of any other way of entering student results other than by module.

Printing

The print option offers seven pull-down menus, but most users only have knowledge of one, and only of some of the options on that.

Some print options take the user straight into SQL, but users have no training in this.

Printing is not possible at Bedford.
 At L&D, they use 'printscreen'.

The print function appears not to work in The Faculty of Business office

Printouts are done from the assessment by student screen by copying and pasting to Word.

Print turnaround reports, or student's current or history script
Can print class list (*requires an SQL command to continue, but seems to work by default*)
1 - 15 week columns would be useful, as a register.

Other Comments

Duplication of records by the system is still not sorted. One cause appears to be HND students completing and transferring to Degree, who then appear twice.

The system can be very slow at crucial times.

Would like R/O / Print access to exam board reports to give staff more time to check. Printed labels are not enough. The same information needs to be there for merging into the letter. Not possible at the moment, therefore labels hardly ever used.

Core modules are still not shown.

HND's not catered for properly. They have different marks and decisions. There is no decision column for F/P/M/D.

There appears to be no validation of data at input.

Information entered can be changed. What is the audit trail?

System does not prohibit actions which are not allowed in the modular scheme (e.g. prohibited combinations, progression of a student who has failed to satisfy the criteria).

Faculty offices cannot enter students to the system.

Many students are non-modular.

Many of these are entered to HEMIS, but only for enrolment and personal data.

D&T, for example, use a Dbase system for 50% of their students.

Health Care have major problems fitting the HEMIS system, as previously mentioned.

Appendix X

Faculty Access Report To Management

Appendix X Faculty Access Report To Management

Introduction to Appendix X

Two key reports are included as part of this thesis. The purpose is, firstly, to support the intervention process detailed in Chapter 5, and secondly to give an indication of the outputs generated during the intervention, further reports of which are available from the author. This second report is to management, and covers both operational strategic interventions (see Figure 5.5 to determine where this is located within the overall investigation).

Appendix X

University of Luton

Student Recording and Control Management Information Systems

Summary Faculty Access Report to Management

Prepared on Behalf of: MIS Quality Group
Report Date: 13 June 1996

Prepared By: Steve Clarke
Assisted By: Paul Slater
John Bramwell

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1.0 Management Summary

Current Operational Needs

The following should be prioritised for immediate action:

- Standardise the terminal type for Faculty Access, preferably to PC.
- Provide clear training and user guides to the current system.
- Tidy the screens and navigation.
- Bring outreach sites up to the level of service as near as possible to that of local sites.

In addition the following should be assessed, and if unattainable should be included in strategic plans:

- Redesign of the user interface.
- Setting up of validation routines to prohibit the entry of invalid data.
- Programming the system to prohibit actions not allowed under the rules of the courses offered.

Strategic Development

Developments based on systems other than the current database system should be considered. Future development for Faculty Access needs to be focused specifically on participant requirements, and consideration should be given to user oriented systems to meet these needs. The approaches used for this study could be used to inform this.

How best to achieve this needs to be decided. It could be pursued either by providing a centrally designed system which meets the needs of all participants whilst interfacing with the current system, or by undertaking the development of more distributed systems, based on PCs with a graphical (e.g. Windows) interface to give a better user environment.

In either event, clear devolution of *responsibility* must take place.

The main issues to be addressed are listed in section 3.0.

2.0 Introduction and Terms of Reference

This investigation has been a major undertaking, which commenced in July 1995, and has involved eight site visits, six group meetings, three MIS Quality Group meetings, and the involvement of over seventy-five participants.

My personal thanks go to all for their support and forbearance, as a result of which I believe we now have some key issues on which to move forward.

The overall terms of reference for the investigation of the University of Luton Student Record System are contained in report reference Phfarp01, which was accepted by the MIS Quality Group on 28th November 1995.

A two stage study was approved as follows:

Stage 1 An investigation of the present HEMIS system, comparing the intended system as defined by the Management Information Systems Department (MISD) with that experienced by Faculty Administration.

This investigation to begin with an analysis of HEMIS itself and what is available within it to aid the student recording and control process, and from that perspective what access at Faculty level would better enable the management of students in the modular scheme.

Stage 2 A longer term study to determine what is needed to support administrative control and recording of students, which initially should be carried out irrespective of the current systems. This study to focus on the identified stakeholder (participant) groups of Central Management, Faculty Administration, Students and Academics.

This report brings together the findings from all aspects of the investigation. The aim being to improve present systems and better focus strategy, this report is both operational and strategic.

The Structure of this Report

This report is for use by management, and the objective is to make the key findings as clear as possible. Much more supporting information has been prepared than is presented here, and is available on request from the author.

3.0 Findings

3.1 The Current Operational (HEMIS) System

Original report 28 November 1995. Action taken by MIS Department and report updated 23 April 1996.

The functions to be provided by HEMIS can be summarised as:

- | | |
|----------------------|--|
| 1. View Student Data | Full student information, student by student. |
| 2. Entry of Results | By module or by student. |
| 3. Reports | Printed information by Faculty, module, course or student. |

Some reports can be printed locally on laser printers in the Faculty offices.

3.1.1 Weaknesses in the Current System

Report 28 November 1995

In general terms, it was found that the facilities listed above were available to all Faculties with the exception of local printing, which is not provided to the outreach sites at the Bedford and Luton and Dunstable hospitals.

The use of these facilities was not, however, without its problems, the key issues relating to which are listed below:

Entering and Viewing Data

- Interface inconsistent between different terminal types.
- Input/enquiry screens are too cluttered and contain too much information which is not used.
- Incorrect and unknown data items need to be sorted.
- Navigating around the system requires redesigning.
- Information presented is not filtered or sorted and can be difficult to interpret.
- Insufficient ability to select ranges of students or modules.
- Some stored information is not available to those who most need it.
- Some necessary information is not stored.
- The result of choosing a menu option is difficult to predict.
- Input routines are not clearly specified.
- Little validation of entries.

Reporting

- Print pull-down menus are confusing. Many unused options.
- Not all Faculties are able to print locally.
- The requirements for local printing need to be determined.
- Printouts available centrally are not clearly specified.

General Comments

- The HEMIS system is used passively by almost all end users.
- Duplication of records within HEMIS still appears to be a problem.
- The system can be slow at important times.
- System does not prohibit actions which are forbidden under the modular scheme.
- Non-modular students are marginalised, and often dealt with outside HEMIS.
- Ongoing training in the use of the system needs to be undertaken, and user guides need to be written and regularly updated.

Update 23 April - Modifications since initial Faculty Visits

Following the initial report of 28 November 1995 (Phfarp01 refers), MISD made modifications to the systems, as a result of which the following improvements are evident:

Personal computers in the Faculty of Business now exhibit easier navigation. The MIS Quality Group meeting of 14 March 1996 concluded that HEMIS should be supported only on VAX terminals. However, as a result of this latest review, support should be extended to terminal emulation on PCs, but MAC support should not be undertaken.

Local printing is now operating at all but remote sites, and print guidelines given to Faculty offices have elicited positive responses from the users. These guidelines should now be incorporated into general training and user guides.

Remote sites continue to have no local printing facilities for reports. With Buckinghamshire now included (Stoke Mandeville and High Wycombe) this is a significant issue to be addressed.

It is still not possible to view printouts before committing to print or to stop the print run, which results in wastage and loss of time.

It was agreed at the MIS Quality Group meeting of 14 March 1996 that training, user guides and print guides will be written. These should be prepared for VAX and PC interfaces.

3.1.2 Possible Ways Forward

Possibility 1 - Easiest

Standardise the terminal type, preferably to PC.

Provide clear training and user guides to the current system.

Tidy the screens and navigation.

Bring outreach sites up to the level of service as near as possible to that of local sites.

Possibility 2 - Preferred (as 1 plus):

Undertake a redesign of the user interface.

Set up validation routines to prohibit the entry of invalid data.

Program the system to prohibit actions not allowed under the rules of the courses offered.

3.1.3 Recommendations

Work required under possibility 1 is essential and should be prioritised for action.

Work to satisfy the requirements of possibility 2 should be assessed. If, as seems likely at this stage, the demands of this prove too onerous, this work should be moved to the strategic review (see below).

3.2 Strategy

Over the next five years the University strategy has to meet the challenge of extensive and often unpredictable change. The impact of this on information systems in general and the student record system in particular should not be underestimated.

The environment is changing, with the growth of NVQs, outreach centres, open learning, franchises at home and overseas, short courses, consultancy, compacts, post-graduate modular studies and so on. The domination of modular, full-time undergraduate studies seems unlikely to continue.

The student record systems have to be ready to meet this challenge, and can no longer be dominated by a single viewpoint as was the case with the HEMIS development.

3.2.1 Weaknesses in the Current System

These are the result of four group meetings, one each with management, faculty administration, students and academics, attended by over seventy participants.

System Development

Development should consider the system in its widest 'global' sense, acknowledging that it is made up of a number of disparate sets of information, many of which exist in personal information systems.

This 'global' system needs to contain definitions of what is required centrally and what is required locally, and where it is made up of disparate sub-systems, the information contained must be consistent. The Faculty meeting felt strongly that Faculties should be the focus of the development effort, rather than the current perception that a system has been designed to which they have to adapt.

The central reporting needs, whilst of paramount importance, are not onerous in information terms, and are largely prejudiced by behavioural rather than technical issues. Information required centrally is mostly a summary of information required in the Faculties. The present central database (HEMIS) could continue to meet these needs, fed from linked subsystems, all of which should operate in 'real-time'.

Development must recognise the need to integrate administrative systems with computerised information systems: the former, at Faculty and central levels, should be co-ordinated with the development effort.

Central control and monitoring is essential, but must take place within the constraint of limited resources - pointing to a need to make better use of the Faculty resource.

The flexible development environment is seen as a key issue by the Faculties, being subject to significant unpredictable change (new courses, updating, revalidations and so on). Systems must therefore be adaptable to this, and development needs to be continuous and iterative.

Training, in which should be included user understanding of system capabilities, must be an integral part of any development. Handbooks and user guides need to be produced.

The system needs to be user 'friendly' - a particular issue where computers are used, implying the use of graphical interfaces which are common to all.

Functions

Current development effort is focused on providing enrolment, module choice and assessment information. Of these, enrolment seems to work well, module choice information is inaccurate, and assessment information is provided in batch mode, for consideration at examination boards. Statistical analysis is provided, but not in a timely fashion or in a very usable form. A system is required in which information is not duplicated, and, as an initial guide, there is information for:

Enrolment and withdrawal.

Timetabling.

Assessment for all courses.

Student listings and examinations

Class lists and attendance.

'Monitoring' history (an 'audit trail') of each student, showing such information as programmes of study, results, special needs, sickness, etc.

Reports, including statistical analysis, should be capable of ad hoc local generation.

These requirements need to be achieved through a system which is easy to use, and where information need only be entered once, as near as possible to its source.

The key seems to be that too much emphasis on any one viewpoint will give rise to a system not designed to meet the needs of all participants - all viewpoints must be catered for. The implication is that this will probably open up issues of feeder systems, and downloading / uploading of data. It must, however, be pointed out here that excessive use of such systems could be seen as wasting valuable resources, so a close watch must be kept on developments of this kind.

Planning

There needs to be clarity on what is to be planned for. To begin with, MIS development must fit the University strategy, so the development of an information systems strategic framework is a priority.

Most student record system development seems to assume modularity, but is this a true reflection of the University (HND, short courses, part-time students)? Also although the University offers a wide range of courses within the modular scheme, in practice most students prefer a course tailored to their needs.

A way forward could be to build on and exploit the system we already have, but with participant involvement at all stages to identify and satisfy participant needs.

A key issue to be addressed will be the fixing of responsibilities - information held centrally is often under local control.

Participation

This needs to take place throughout development, which must be a continuous, iterative process. The system should be designed to fit the needs of all participants.

There should be an operational benefit to the persons entering information into the system - if the system is used operationally on a daily basis accuracy will increase. Clearly there is centrally required information which must be supplied irrespective of the benefit perceived by the provider. However, the indications are that such information is insufficient to meet the requirements of other participants, is largely batch orientated, and that the sanctions for not supplying it are difficult to control.

Access should be given to all participants, subject to the controls necessary for security.

Quality

Quality problems are compounded by the existence of multiple systems. Once the system is clearly defined, quality can be concentrated on the accuracy of information entering the system and internal validity. Most current quality problems are the result of behavioural rather than technical problems, so the behavioural issues must be addressed.

Structure/Culture

The student record system needs to be in line with the structure of the University, but there are inconsistencies in structure across the institution. The current committee structure is not seen to have a role in organisational decision making, so perhaps the MIS efforts need a different approach.

Since the beginning of the modular scheme, centralisation of systems has created tensions with the Faculties. Faculties have to be adaptable to changes, and need systems to support this, but the centralisation of the student record system has led to less flexibility. The result has been less Faculty responsibility, students who do not have a base; the solution is seen to be more devolution to Faculties without losing central control.

Culture is difficult to change, but either it must change, or culture needs to be recognised and the systems designed to fit this culture. Views currently conflict strongly in this area, and more work is needed to define and adapt to this.

Adaptability/Flexibility

The system must be adaptable in order to cope with unforeseen change, but the current system is not seen to be so.

Ad hoc reporting is needed - not just the ability to print pre-designed reports. Personal information systems are currently widely used to fill gaps in the central provision.

Communication

Earlier issues such as more friendly systems, better access, better training, clearer output will help with this.

Remote sites need to be better catered for.
Students should be able to access information to check their status.

If proposed systems follow a more devolved approach, careful thought will need to be given to integration and communication between sub systems.

Conflicts

There are a number of issues here, but most seem to point to the need to satisfy the central information needs and the need for central control, conflicting with a belief that the system will only work if it is designed to support the participants. Allied to this is central control being in conflict with the available resource, the proposed solution being to make better use of resource available in the Faculties.

The need for a stable system in a flexible environment is a further conflict that must be considered in the development and planning processes.

The desire for wider access whilst ensuring security of data is a further issue.

Timing

As a batch system, the main loading comes at critical times, and causes problems. A more devolved, real-time system would better cope with this. On-line access to the central system may be a partial solution here.

The other timing issue raised was the mismatch of semester dates between the current system and some courses.

Real Objectives

The objective is to serve the four stakeholder groups. This requires an understanding of strategic and operational issues, but is seen to be attainable.

3.2.2 Possible Ways Forward

What is Needed

Development should be focused on the needs of all participants. There is currently no forum in the University for achieving this.

Development of the student record system (and, indeed, of all information systems) must be in line with the strategy of the University. This implies the need to be adaptable in the face of an uncertain and changeable future.

Entry of information should be as close as possible to the point of generation of that information, and ad hoc report generation should be similarly provided.

Wide access to information is needed, with ease of use a priority within the needs determined by security.

How it should be provided

- Possibility 1: Focus on the current system, and adapt it to meet the needs of all participants.
- Possibility 2: Accept that the current system is unlikely to satisfy the needs of Faculty users, and focus future development specifically on participant requirements.
- Possibility 3: Abandon the current system and implement one which better fits the future needs of the University.

3.2.3 Recommendations

At this stage, possibility 3 seems unrealistic and too high risk.

Possibility 1 could be pursued as the lowest risk option, but given the constraints of the current system it is hard to see how it could provide what is required for the future.

Possibility 2 seems the best option. This could be pursued either by providing a centrally designed system which meets the needs of all participants whilst interfacing with the current system, or by undertaking the development of more distributed systems, based on PCs with a graphical (e.g. Windows) interface to give a better user environment.

4.0 Conclusions

This investigation has been a major undertaking, supported by staff and students from all over the University.

The overwhelming view of participants drawn from the Faculties is that the nature of the current system is such that not only does it not currently meet their needs, but they are unable to see how it could be developed to do so. The findings of this report support this view and offer a way forward.

It is my belief that the commitment of these people and of the representatives on the MIS Quality Group has helped to frame the way forward for the student record systems in particular and information systems in general within the University.

The key to this success has been the participation of all involved, which I hope will now be built upon to continue the information systems improvement.

Appendix XI

Content Analysis

Appendix XI Content Analysis

Introduction to Appendix XI

This appendix gives details of the content analysis undertaken using the computer package NUD-IST (Non-numerical Unstructured Data Indexing Searching and Theorizing), which provides the information in support of the arguments put forward in Chapter 6, section 6.3.

The large amount of data generated by NUD-IST makes presentation of it within this thesis impractical. However, a list of all documents is given below, and full printouts and the data are available on request.

Appendix XI

The procedure followed is detailed below.

1. Firstly, each document was loaded into NUD-IST. This comprised thirty-two documents, containing a total of 3267 text units (the text between two carriage returns), details of which are available on request.
2. The documents were then scanned for the occurrences of the fields listed below. These fields were determined from a detailed reading and re-reading of the documents, identifying themes and issues within the data.

List of Documents

Reports

Phfabp01/Phsr0014

Faculty Access Briefing Paper
18th September 1995

Phfarp01/Phsr0015/Appendix IX

Faculty Access Report Number 1
Access for Assessment and Inquiry
28th November 1995

Phfarp02/Phsr0013

Faculty Access Report Number 2
Future Needs for Student Recording and Monitoring

Phmgrp01/Phsr0018/Appendix X

Faculty Access Report to Management
13th June 1996

Phacrs05/Phsr0011

MIS Student Record Systems: Summarised Findings
November 1995

Phacrs09/Phsr0012

Idealised Design Sessions
(See Document for Dates)

Phacrs14/Phsr0012

Findings of Participant Groups: Idealised Design Properties
24th May 1996

Documents Attached to NUD-IST**ON-LINE DOCUMENT: PHSR0001**

Document Header:

*Document Ref:	Phsr0001
*Title	Review of Software Strategy for Administration Systems
*Date	16 June 1994
*Type	Strategy Document
*Subject	Software Strategy
*Author	Bill Diack

ON-LINE DOCUMENT: PHSR0002

Document Header:

*Document Ref:	Phsr0002
*Title	MISQG Terms of Reference
*Date	29 April 1994
*Type	Terms of Reference
*Subject	MISQG
*Author	Ian Nicol

ON-LINE DOCUMENT: PHSR0003

Document Header:

*Document Ref: Phsr0003
*Title MIS Discussion Paper
*Date 6 September 1994
*Type Discussion Document
*Subject MIS Development
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0004

Document Header:

*Document Ref: Phsr0004
*Title MISQG Minutes
*Date 7 Sept 1994
*Type Minutes
*Subject MISQG
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0005

Document Header:

*Document Ref: Phsr0005
*Title Processing Requests for Systems Development
*Date 4 May 1995
*Type Procedure Document
*Subject Systems Development Request Procedures
*Author Bill Diack

ON-LINE DOCUMENT: PHSR0006

Document Header:

*Document Ref: Phsr0006
*Title Report of New Style MCS Committee
*Date 27 March 1996
*Type Minutes
*Subject MCS Committee
*Author Charles Eccles

ON-LINE DOCUMENT: PHSR0007

Document Header:

*Document Ref: Phsr0007
*Title Memo re Steering Committee
*Date 6 July 1995
*Type Memo
*Subject Proposal for Steering Committee to progress Faculty Access
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0008

Document Header:

*Document Ref: Phsr0008
*Title Meeting Notes
*Date 14 March 1996
*Type MISQ Meeting Notes
*Subject MISQ Meeting
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0009

Document Header:

*Document Ref: Phsr0009
*Title Discussion Document
*Date 14 May 1995
*Type Discussion Document
*Subject Faculty Access Proposals
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0010

Document Header:

*Document Ref: Phsr0010
*Title Memo - Faculty Access
*Date 7 July 1995
*Type Memo
*Subject Faculty Access Steering Committee Proposal
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0011

Document Header:

*Document Ref: Phsr0011
*Title MIS Student Records System Summarised Findings
*Date 6 February, 1996
*Type Report
*Subject Findings of HEMIS Investigations
*Author Steve Clarke / Paul Slater

ON-LINE DOCUMENT: PHSR0012

Document Header:

*Document Ref: Phsr0012
*Title Faculty Access Review
*Date 24 March 1996
*Type Memo
*Subject Complete Review of Faculty Access Investigations
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0013

Document Header:

*Document Ref: Phsr0013
*Title Future Needs for Student Recording and Monitoring
*Date 4 February, 1996
*Type Report
*Subject Administrative Investigation
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0014

Document Header:

*Document Ref: Phsr0014
*Title Briefing Paper - Faculty Access to University MIS
*Date 18 September, 1995
*Type Report
*Subject Faculty Access to MIS
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0015

Document Header:

*Document Ref: Phsr0015
*Title Access for Assessment and Enquiry
*Date 9 January, 1996
*Type Report
*Subject HEMIS Access
*Author Steve Clarke / Paul Slater

ON-LINE DOCUMENT: PHSR0018

Document Header:

*Document Ref: Phsr0018
*Title Summary Faculty Access Report to Management
*Date 11 May 1996
*Type Report
*Subject Faculty Access to Student Record Systems
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0019

Document Header:

*Document Ref: Phsr0019
*Title Faculty Access to MIS
*Date 3 May 1995
*Type Minutes
*Subject Faculty Access to MIS
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0020

Document Header:

*Document Ref: Phsr0020
*Title MISQG Minutes
*Date 2 November 1994
*Type Minutes
*Subject MISQG
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0021

Document Header:

*Document Ref: Phsr0021
*Title Timetables
*Date 7 July 1994
*Type Memo
*Subject Inability to Meet Timetabled Requirements
*Author Sue Peel

ON-LINE DOCUMENT: PHSR0022

Document Header:

*Document Ref: Phsr0022
*Title Implementing Academic Support Systems in 1995/6
*Date
*Type Report
*Subject Faculty Based System Requirements over the Calendar year
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0023

Document Header:

*Document Ref: Phsr0023
*Title Points to ponder
*Date 8 January 1996
*Type Email
*Subject Queries re Minutes of 28 Nov MISQG
*Author Steve Clarke / John Bramwell

ON-LINE DOCUMENT: PHSR0024

Document Header:

*Document Ref: Phsr0024
*Title Meeting Notes - MISQG
*Date 28 November 1995
*Type Minutes
*Subject Report on first investigation
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0025

Document Header:

*Document Ref: Phsr0025
*Title Meeting Notes - MISQG
*Date 10 October 1995
*Type Minutes
*Subject MISQG - Setting up the Investigations
*Author John Bramwell

ON-LINE DOCUMENT: PHSR0026

Document Header:

*Document Ref: Phsr0026
*Title MIS Questionnaire
*Date 9 January, 1995
*Type Memo
*Subject Questionnaire re SRC
*Author John Bramwell / Steve Clarke

ON-LINE DOCUMENT: PHSR0027

Document Header:

*Document Ref: Phsr00027
*Title Registrar Meeting
*Date 28 July 1995
*Type Meeting - Verbal Transcript
*Subject Introduction of intervention proposals
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0028

Document Header:

*Document Ref: Phsr00028
*Title Faculty Administration Meeting No. 1
*Date 10 August 1995
*Type Brainstorming Session - Transcript of Comments
*Subject Needs of Faculty Administration
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0029

Document Header:

*Document Ref: Phsr00029
*Title Faculty Administration Meeting No. 2
*Date 31 August 1995
*Type Brainstorming Feedback Session - Transcript of Comments
*Subject Needs of Faculty Administration
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0030

Document Header:

*Document Ref: Phsr00030
*Title MISQG Meeting
*Date 10 October 1995
*Type Meeting - Verbal Transcript
*Subject Discussion of feedback from initial investigations
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0031

Document Header:

*Document Ref: Phsr00031
*Title Faculty Administration Meeting No. 3
*Date 23 November 1995
*Type Meeting - Verbal Transcript
*Subject Idealised Design
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0032

Document Header:

*Document Ref: Phsr00032
*Title MISQG Meeting
*Date 28 November 1995
*Type Meeting - Verbal Transcript
*Subject Progress of MIS Intervention
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0033

Document Header:

*Document Ref: Phsr00033
*Title Meeting to discuss Phfarp02
*Date 7 February 1996
*Type Meeting - Verbal Transcript
*Subject Intervention Report
*Author Steve Clarke

ON-LINE DOCUMENT: PHSR0034

Document Header:

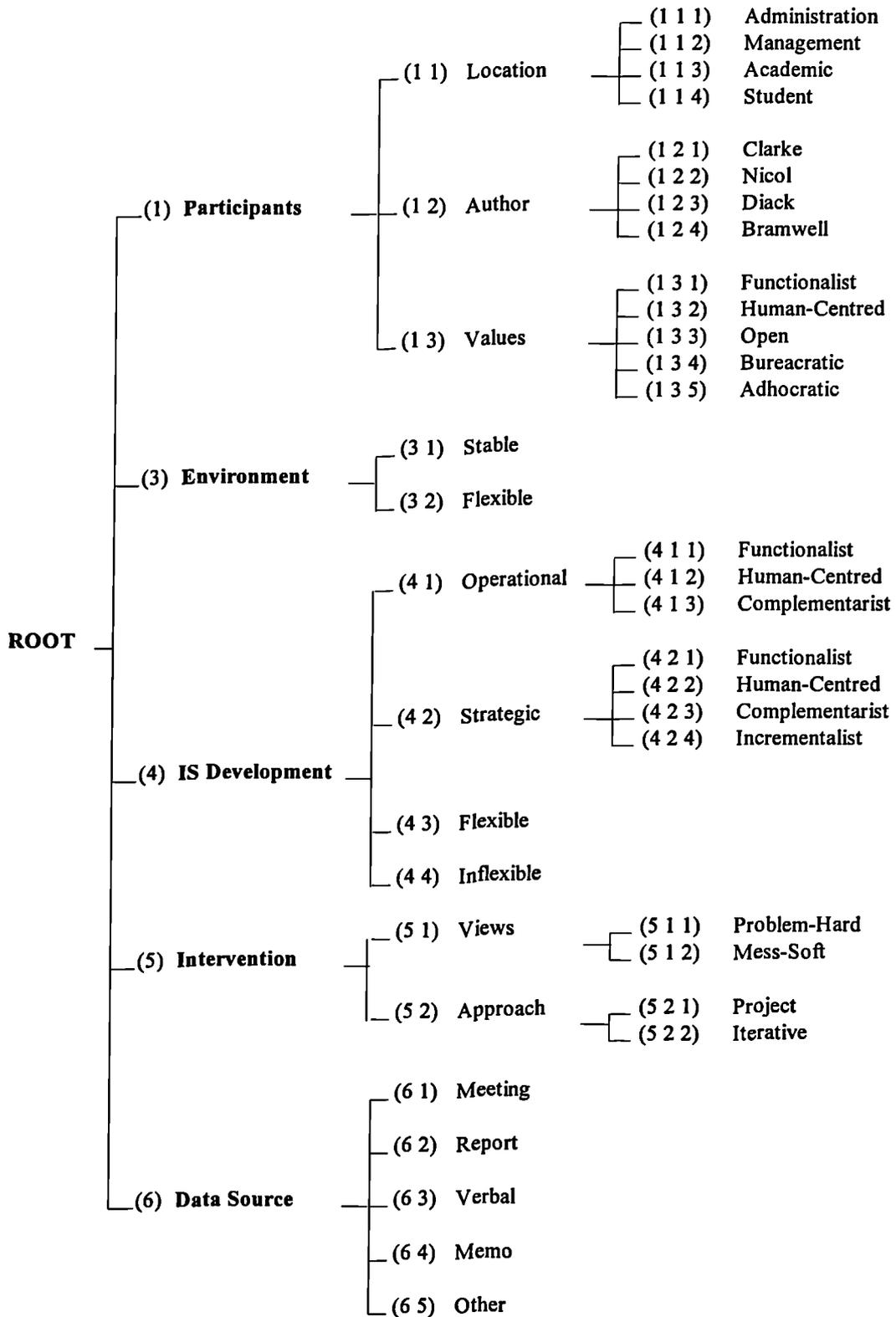
*Document Ref: Phsr00034
*Title Central Management Idealised Design
*Date 7 March 1996
*Type Meeting - Verbal Transcript
*Subject Idealised Design
*Author Steve Clarke

Fields for Searching

Function operation tech	navigation
Strateg	training user guides
problem plan	stakeholder client user
facult	stable stabil bureaucra
hard copy on-line	design debate
access	structure culture
hardware software	resource cost
security integrity	priorit
control	conflict
consensus consulta	develop
adapt flexi	upload download
conflict consensus	IT information data
validat	system
PC VAX MAC Windows	computer

3. As a result of the scans, the framework for an index system began to emerge. This was initially designed from this information, and further refined during the index search stage outlined below.
4. Each text unit found by the searches was then attached to the index system, giving almost 1500 index entries.
5. Trends were sought, related to the hypotheses of the thesis, such as increased participation, attitudes to development (strategic / operational) and the environment (flexible / static).
6. The name (where relevant), department and source of all text units were noted. Multiple searches were carried out, until saturation was reached.

Final Index System



Example Index Search

Q.S.R. NUD.IST Power version, revision 3.0.4d GUI.
 Licensee: Steve Clarke.

PROJECT: PHMIS001, User Steve Clarke, 2:12 pm, Nov 19, 1996.

(2 1) /Temporary/IndSysSrch

*** Definition:

Search for (MATRIX INTERSECT (5 1) (4 1))

Matrix Node.

#####

Cell (1 1)

(INTERSECT (5 1 1) (4 1 1))

+++++

+++ ON-LINE DOCUMENT: phsr0001

+++ Retrieval for this document: 4 units out of 343, = 1.2%

++ Text units 27-27:

Although there is no one document which states specifically what the MIS software strategy is, there are various references to MIS within the strategic plans, and the way the administration systems have been and are being developed and implemented adheres to a clear predetermined pattern which is consistent with these statements. 27

++ Text units 243-243:

This is fully operational with little activity apart from linking with the new Personnel system.

243

++ Text units 247-247:

This system has been installed but is not yet operational and no resource is currently being provided for this.

247

++ Text units 266-266:

Having looked at these problems carefully none of these are due to the packaged approach or to the use of the ORACLE development environment although it would be argued that in-house development would have resulted in a more thorough procedural analysis. 266

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+++ ON-LINE DOCUMENT: phsr0003

+++ Retrieval for this document: 2 units out of 78, = 2.6%

++ Text units 10-10:

Basic Premise (provocatively stated): The University does not possess any Management Information Systems. It operates a series of disparate systems, some of which are "computer supported". Some of these systems require significant data input but provide no information (e.g. the staff database which has yet to produce CVs for validations or HEFCE visits), some "systems" simply support an inappropriate computer software package without presenting the information in a useful format or requiring the data in an easily provided way (e.g. the timetabling system), some are vital to our success but operate with unreliable hardware and inadequate support (e.g. the modular scheme assessment information for examination boards), some are used to set institutional targets, staffing and finance but have minimal integrity (e.g. the spreadsheets used for student number forecasting which repeatedly failed to "add up" successfully), some systems operate almost successfully (by not interfacing with other systems ?) but allow duplication and inconsistency (e.g. the financial systems), some provide inaccurate and incomplete information in an unprofessional format (e.g. the SPOC return data), some systems exists as "dreams" rather than as a strategy (e.g. the campus network) All this IS correctable with a sensible strategy and appropriate mechanism for implementing it. It is recommended that implementation of a series of relatively small scale projects with almost immediate benefits should take priority 10

* the term "system" is used to mean the full flow of information and 12

++ Text units 14-14:

1. The MIS group objective is to establish the "projects" for implementation, to prioritise these in order to enable them to be estimated and scheduled, and to monitor progress against those projects. The group will also provide a forum for debate to inform those responsible for undertaking the projects of the key requirements of the "clients". It is proposed therefore that the group prepares a list of projects and prioritises these. University agencies would estimate and schedule the activities and the group would then expect a summary report on progress of these projects at each meeting (effectively operating as a "steering committee" for institutional MISs) 14

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+++ ON-LINE DOCUMENT: phsr0015

+++ Retrieval for this document: 1 unit out of 478, = 0.21%

* Ongoing training in the use of the system needs to be undertaken, and 121

++ Text units 208-208:

This focus has taken a predominantly technical view, which has enabled the system to attain its current functionality in a relatively short time. 208

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+++ ON-LINE DOCUMENT: phsr0020

+++ Retrieval for this document: 1 unit out of 58, = 1.7%

++ Text units 42-42:

2. The group welcomed the brief financial proposals for key I.T. projects in the University for 1994/95. The report had been accepted at the Academic Executive after having been prepared for the Vice Chancellors group. There was some concern expressed however that using this as the only the mechanism for approval of projects was not rigorous and may not provide the correct level of evaluation of the costs and benefits of the proposals. Whilst the group accepted the urgent need for these systems, without proper evaluation and high level planning we would simply perpetuate the sporadic and unintegrated "reactive" approach to I.T. in the institution. 42

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Cell (1 2)

(INTERSECT (5 1 1) (4 1 2))

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+++ ON-LINE DOCUMENT: phsr0003

+++ Retrieval for this document: 1 unit out of 78, = 1.3%

* the term "system" is used to mean the full flow of information and 12

++ Text units 14-14:

1. The MIS group objective is to establish the "projects" for implementation, to prioritise these in order to enable them to be estimated and scheduled, and to monitor progress against those projects. The group will also provide a forum for debate to inform those responsible for undertaking the projects of the key requirements of the "clients". It is proposed therefore that the group prepares a list of projects and prioritises these. University agencies would estimate and schedule the activities and the group would then expect a summary report on progress of these projects at each meeting (effectively operating as a "steering committee" for institutional MISs) 14

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Cell (1 3)

(INTERSECT (5 1 1) (4 1 3))

This cell indexes no documents.

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Cell (2 1)

(INTERSECT (5 1 2) (4 1 1))

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+++ ON-LINE DOCUMENT: phsr0012

+++ Retrieval for this document: 3 units out of 463, = 0.65%

++ Text units 60-60:

This 'global' system needs to contain definitions of what is required centrally and what is required locally, and where it is made up of disparate sub-systems, the information contained must be consistent. The

faculty meeting felt strongly that faculties should be the focus of the development effort, rather than the current perception that a system has been designed to which they have to adapt. 60

++ Text units 103-103:

This needs to take place throughout development, and needs to be controlled as a continuous, iterative process. The system needs to be designed to fit participant needs. 103

++ Text units 134-134:

There are a number of issues here, but most seem to point to the need to satisfy the central information needs and the need for central control, conflicting with a belief that the system will only work if it is designed to support the participants. Allied to this is central control being in conflict with the available resource, the proposed solution being to make better use of resource available in the faculties. 134

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+++ ON-LINE DOCUMENT: phsr0013

+++ Retrieval for this document: 1 unit out of 421, = 0.24%

* Readers of this report wishing simply to familiarise themselves with 49

++ Text units 109-109:

The objective is, via participant debate and consensus seeking, to determine what is required of the now more widely defined system in the future. This makes the study strategic in nature, and enables it to contribute to IS development in a different manner to the earlier study. 109

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Cell (2 2)

(INTERSECT (5 1 2) (4 1 2))

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+++ ON-LINE DOCUMENT: phsr0012

+++ Retrieval for this document: 1 unit out of 463, = 0.22%

++ Text units 36-36:

1. An investigation of the present HEMIS system, initially through faculty administration, to begin with an analysis of HEMIS itself and what is available within it to aid the student recording and control process, and from that perspective what access at Faculty level would better enable the management of students in the modular scheme. 36

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+++ ON-LINE DOCUMENT: phsr0013

+++ Retrieval for this document: 1 unit out of 421, = 0.24%

* Readers of this report wishing simply to familiarise themselves with 49

++ Text units 109-109:

The objective is, via participant debate and consensus seeking, to determine what is required of the now more widely defined system in the future. This makes the study strategic in nature, and enables it to contribute to IS development in a different manner to the earlier study. 109

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+++ ON-LINE DOCUMENT: phsr0030

+++ Retrieval for this document: 1 unit out of 25, = 4.0%

++ Text units 9-9:

Steve Clarke The current "technical" view of systems development has run its 9

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Cell (2 3)

(INTERSECT (5 1 2) (4 1 3))

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+++ ON-LINE DOCUMENT: phsr0003

+++ Retrieval for this document: 1 unit out of 78, = 1.3%

++ Text units 12-12:

* the term "system" is used to mean the full flow of information and process in support of an activity NOT simply the computer system(s) which may be associated with it 12

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+++ ON-LINE DOCUMENT: phsr0004

+++ Retrieval for this document: 1 unit out of 52, = 1.9%

++ Text units 39-39:

c) In some instances it is clear that problems arise through procedural issues rather than failure of computer programmes. In all cases it is important to consider a "system" in its widest sense, and computers only as one of the tools available to meet information requirements. 39

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+++ ON-LINE DOCUMENT: phsr0009

+++ Retrieval for this document: 1 unit out of 83, = 1.2%

++ Text units 56-56:

Initially the steering group should not be overly concerned with current systems. The purpose of its investigations should be to determine what is required to support the necessary activity at Faculty level in the institution. A number of different views should be expected to surface as a result of this type of investigation, and the major objective is likely at this stage to be resolution of conflict and determination of consensus. 56

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+++ ON-LINE DOCUMENT: phsr0012

+++ Retrieval for this document: 2 units out of 463, = 0.43%

++ Text units 58-58:

Development should consider the system in its widest 'global' sense, acknowledging that it is made up of a number of disparate sets of information, many of which exist in personal information systems. 58

++ Text units 72-72:

The system needs to be user 'friendly' - a particular issue where computers are used, implying the use of graphical interfaces which are common to all. 72

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+++ ON-LINE DOCUMENT: phsr0013

+++ Retrieval for this document: 1 unit out of 421, = 0.24%

* Readers of this report wishing simply to familiarise themselves with 49

++ Text units 123-123:

The methodology used to draw out the views of the participants, informed from the earlier meetings, was Interactive Planning (IP) (Ackoff, 1981). The objective recommended by IP at this stage is 'ideals planning', by which the participants specify their ideal system, subject to it being "technologically feasible, operationally viable and capable of rapid learning and adaptation". 123