Learning with Information Systems

Learning cycles in information systems development

Simon Bell

Routledge Studies in International Information and Library Management Systems

ROUTLEDGE

LEARNING WITH INFORMATION SYSTEMS

Information technology has revolutionised commerce, industry and education in Europe, the USA and Japan. Such technology is primarily associated with these developed nations, yet it is ubiquitous and therefore has an important role in the developing world also.

In *Learning with Information Systems* the author takes the developing world as the context and through a series of case studies develops a commonly used systems analysis methodology. He demonstrates in a learning process how methodology can evolve and adapt as new ideas become prominent. Issues of practitioner development through learning, sustainability of information systems, participation in systems design and user ownership of systems are all examined.

This book does not attempt to be prescriptive for all practitioners, nor does it focus on any particular technology. It addresses the essential questions and offers practical approaches which will help in the avoidance of the worst forms of disaster associated with planning information systems for any context.

Simon Bell has made a study of the process of evolving systems analysis methodology—specifically with the needs of the user in mind—both as consultant and researcher in developing countries, and as a lecturer in universities and industry in the United Kingdom. In his earlier, co-authored book *Rapid Information Systems Development,* he explored the possibilities of making a standard methodology for information systems analysis and design quick and systematic in its application.

ROUTLEDGE STUDIES IN INTERNATIONAL INFORMATION AND LIBRARY MANAGEMENT SYSTEMS

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Logistically this book would not exist without the help of numerous individuals in the development profession, both in donor agencies and in developing countries. Over the compilation of this work I have made many friends in many parts of the world: to all, many thanks.

Academically I am indebted to Pam Mayhew, Trevor Wood-Harper, the long-suffering Gilroy Coleman, Liz Orna, Richard Heeks, Tony Wright, Tony Barnett, Steve Biggs, Bob Galliers and Deryke Belshaw.

Finally, the core of this book rests upon a wide foundation from development studies to information-systems design. There are several pillars who are in part indicated in the bibliography but who have also provided insights through conversations and mimeographed material. It is therefore appropriate at this point to indicate some of the centres which are involved in aspects of the current work and which have made substantial contributions to the body of academic material and experiences in closely related fields.

1 The work of R.J.Bawden and colleagues at the University of Western Sydney, Australia has contributed a rich vein of insights into the three areas of soft systems methodology, action research and experiential learning. In particular, their work has provided further views of the integration of systemic research methods and more specifically has indicated that practice is the final arbiter of the value of a methodology.
2 C.Avgerou and J.Liebenau (and numerous faculty and student colleagues) at the London School of Economics have provided useful comparative work in the area of information-technology adoption in developing countries.
3 G.Walsham (formerly of the University of Cambridge, now at Lancaster University) and colleagues have produced useful material about public-sector adoption of information technology and information systems in developing countries.
4 A.T.Wood-Harper at the University of Salford has been working on the Multiview methodology for several years. His thinking on the development of multiperspective methodologies and his willingness to think outside the narrow confines of specific methodology have been of great assistance in this work.

Although arising from psychoanalysis, I feel that the following quote sums up my own experience of the learning set out in this book:

certain gains are beckoning to those who are capable of self-analysis which are more spiritual in character, less tangible but not less real. These gains can be summarized as an increase in inner strength and therefore of self-confidence. Every successful analysis increases self-confidence, but there is a certain extra gain in having conquered territory entirely through one's own initiative, courage and perseverance. This effect is the same in analysis as in other areas of life. To find a mountain path all by oneself gives a greater feeling of strength than to take a path that is shown, though the work put in is the same and the result is the same. Such achievement gives rise not only to a justifiable pride but also to a well founded feeling of confidence in one's capacity to meet predicaments and not to feel lost without guidance.

(K.Horney 1994, *Self Analysis* London: Norton, p. 34)

ABBREVIATIONS

CATWOE	client, actor, transformation, worldview, (problem) owner and (problem) environment
CI	critical indicator
CPAG	computer policy advisory group
DC	developing countries
HCI	human/computer interface
IS	information systems
IT	information technology
M&E	monitoring and evaluation
MIS	management information systems
PI	performance indicator
R&D	research and development
R&U	risk and uncertainty
SA&D	systems analysis and design
SSADM	Structured Systems Analysis and Design Method
SSM	Soft Systems Methodology

SUMMARY OF CONTENTS

This research explores the issues of eclectic methodology development and introducing information systems in developing countries. It will be argued that available methodologies for information-systems analysis and design need to be used with due regard to context and to the predispositions of the analyst/researcher. Developing countries are currently receiving large numbers of computer systems as part of aid from major aid agencies. The systems are often completely unplanned and yet they are provided in high-risk environments and are expected to produce high-value returns. Existing methodologies which could be (and in some cases are) used in systems planning are expensive in personnel costs, and many focus on technical issues whilst often ignoring the critical social and political contexts which ultimately determine systems sustainability.

The core question to be investigated in this research is: 'Is a flexible, eclectic systems analysis and design tool such as Multiview an appropriate planning and development methodology for introducing information systems into developing countries?'

The fieldwork in this research makes use of Multiview and, following an appraisal of its value, provides a series of adaptations in terms of techniques and tools. It is argued that these adaptations provide the methodology with greater flexibility within the context of the developing country environment and the human resources potential. The adaptations, it is further argued, provide the methodology with features which are akin to those of Rapid Rural Appraisal, a method already tried and tested in developing countries in the rural development planning context.

The structure of the research is:

- a discussion of the general background and context for developing countries with regard to the rapid planning and development of information technology and information systems
- the introduction of a research question with regard to the need for methodology adaptation
- three action-research field studies where adaptations took place
- a discussion of the nature of the adaptations
- a discussion of further lines of enquiry.

The conclusions of this research indicate that methodology needs to perform a difficult balancing act. It has to be capable of providing rigour and discipline in potentially chaotic situations. On the other hand it has to be able to adapt to changes in environment (both physical and social), technology and the predisposition of the analyst/researcher.

In Part I (Chapters 1 and 2) a wide and inclusive approach is adopted, bringing in such diverse issues as views on development and information systems, risk and uncertainty in developing countries, types of

systems-analysis approach and the history of planning in developing countries. The point of Part I is to note and illustrate key issues, specifically the value of eclectic methodology and Rapid Rural Appraisal.

In Part II (Chapters 3 and 4) the issues introduced in Part I are brought together to form the background for the research question. Chapter 3 formulates the research question in terms of a methodology to be tested. Chapter 4 outlines how that methodology, Multiview, is to be tested.

Part III (Chapters 5, 6 and 7) reports on what happened when the Multiview systems-analysis approach was applied in three separate pieces of action-research fieldwork.

Part IV (Chapters 8 and 9) presents an analytical overview of the lessons from the fieldwork, draws final conclusions, and indicates future areas for research work.

Part I

INTRODUCING THE CONTEXT

1
INTRODUCTION AND BACKGROUND

Examples of issues in information systems

Kathmandu area, Nepal, 1989. A road construction site some way from the city. Yet another landfall has occurred which has brought the road construction operation to a standstill. The road is closed but business goes on. In this area, so distant from modern forms of communication, within minutes hoards of sherpas have appeared and are carrying goods from stranded lorries, around the precipitous fall which has opened in the newly made road, and on to awaiting transport on the other side. The sherpas (the ones carrying cement sacks are snow white from the dust) appear to need no command hierarchy or logistics systems; they appear and disappear as the road network (or lack of it) requires and demands. Computers are used for the engineering side of road construction. The one in the site office is at this moment printing out a ten-page report detailing the nature and degree of the landfall. The indigenous system gets on with keeping business moving.

Lagos, Nigeria, 1992. The Head Office of one of the major banks. The bank is full of people attempting to do business. The temperature and humidity are making life very uncomfortable for those attempting to transact business. Queuing is the norm. Everyone queues for every item. You need to queue to get the approval of a bored and discourteous bank official in order to gain access to the next queue which might lead to the next bored person whom you actually need to do business with. Bribery (or 'dashing') or having a close relation who works in the bank helps. Overseeing the sweltering, uncomfortable bureaucracy hierarchically and literally from their gallery are a cadre of senior officials. They apparently have little to do. Indeed the bank seems to offer a paradox, queues of people being served by bored and underemployed staff. The interest of the senior staff is only kindled when there is a foreign currency transaction. Computers are around the place but seem to be underused. Business is done but it can take eight hours to withdraw a small amount of money.

Ethiopia, 1987, at the head office of an international agency on the outskirts of Addis Ababa. A meeting is taking place between a consultant and an agency official concerning the need for geographic information systems (GIS) to enhance the agencies' analytical and organisational performance. The official turns to the consultant and says: 'I'm sorry, I really do not have time for all this. We are dealing with crisis management not new toys. Why do you think we need GIS? The present crisis in Ethiopia would not have been helped by GIS. Everyone knew the famine was coming. It was political will which was required not technology'.

The three examples set out above indicate some of my experiences of information systems issues in developing countries. A vital point to identify at the outset is that the world is full of working, functioning

information systems. Technology has opened up the possibility of automating and computerising these existing functions. What we have not effectively realised or planned for is that most computerised systems, real or proposed, are expected to replace and improve upon systems which may have been functioning (formally or informally, badly or well) for some considerable time. New information systems need to be sustainable, to be capable of adapting to changing circumstances. In these circumstances quick fixes and technical solutions are rarely effective or of lasting value.

Primarily this book is concerned with the evolution and development of an analysis and design methodology for introducing information technology (IT) to meet the needs of some contexts in some developing countries (DCs) and for providing an information system which will be sustainable and adaptable. Central to the research on which it is based is the linkage between the systems analyst, the methodology applied by the analyst and the context in which analyst and methodology operate. Initially, the book focuses on clarification of some key terms and ideas and, essentially, the linkage between information systems, systems theory and development studies theory[1] (see Figure 1.1). Although this book concentrates on the practical matters involved in information systems adoption and methodology adaptation, the nature of the context in which these activities take place needs to be set out. It is important to realise that behind the manifestation of problems in new systems adoption in developing countries, three lines of thought converge.

In Figure 1.1 the three lines are shown interacting in the process that represents the unravelling and development of the subject of information systems in developing countries. This chapter and the next review some of the issues within these three, and at the end of Chapter 3 some of the major elements are drawn out as aspects of the research question explored in the fieldwork. This chapter explores the nature of information systems, systems approaches and development studies.

THE DEVELOPING COUNTRY CONTEXT

The developing country context is central to this work. An underlying contention is that there are specific factors at work in developing countries that require the reconsideration of methodological approaches to sustainable information systems provision.

Information technology, and therefore information systems, have a growing presence in developing countries. The introduction of any new technology can be expected to bring with it a range of problems, and information technology is no exception:

> Many developing countries are now waking up to the potential of information technology and the role it plays in the pace of development. In an effort to bridge the gap that exists between them and the developed societies, many developing countries resort to hurried actions and formulate policy which may not have the desired impact.
>
> (Bhatnagar and Bjørn-Andersen 1990, p. vii)

The comments cited above raise many issues, including the ideas that:

- Developing countries have a unique experience of both the value and impact of new technology.
- The importation of such technology to developing countries is an aspect of this unique experience.
- The formulation of policy for technology planning is also a major element of the experience.

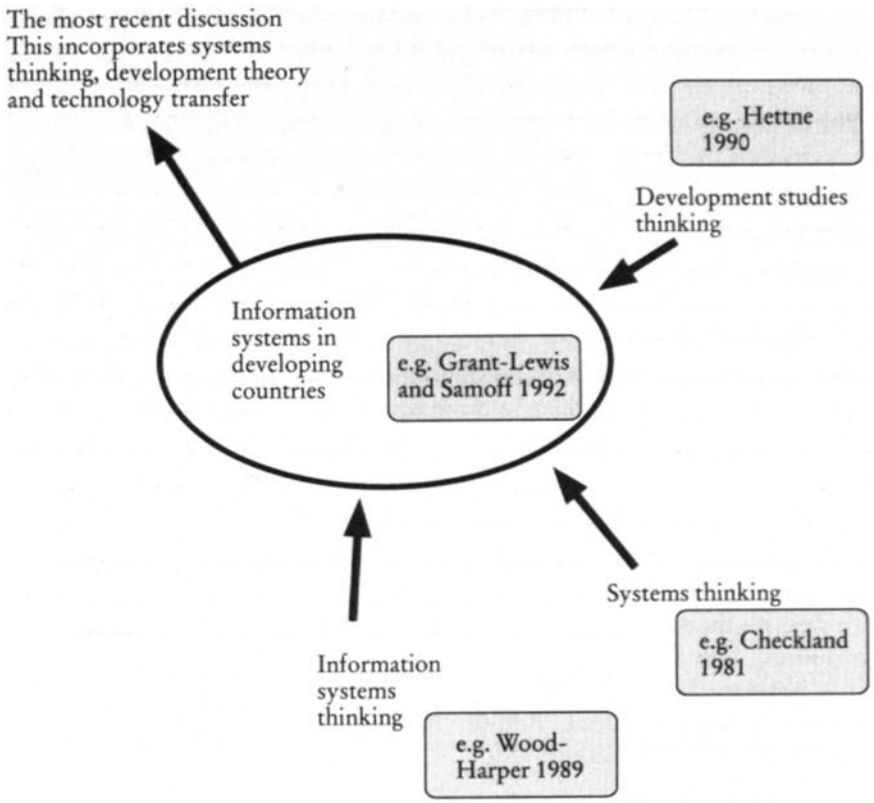


Figure 1.1 The linkage between development, systems and information systems theory

The latter two of these issues are developed more fully on pages 11–15 and 15–17. Before looking at them in more detail I will venture to discuss briefly the meaning of the ambiguous term 'developing country'.

What are the `developing countries'?

Various attempts have been made to block together the nations of the world into generalised groupings (e.g. developed and underdeveloped, Frank 1978). To describe the economically less powerful nations, terms such as 'developing countries', 'less developed countries', and 'Third World' have been created. It is, however, becoming increasingly difficult to put groups of nations, for example Kenya, Malaysia, Bolivia, Argentina, Botswana, under a single heading. Harris (1988) argues that:

> The Third World is disappearing. Not the countries themselves, nor the inhabitants, much less the poor who so powerfully coloured the original definition of the concept, but the argument. Third Worldism began as a critique of an unequal world, a programme for economic development and justice, a type of national reformism dedicated to the creation of new societies and a new world. It ends with its leading protagonists either dead, defeated or satisfied to settle simply for national power rather than international equality.

(Harris 1988, p. 200)

Therefore, according to Harris, concern over national power (e.g. power over food production, education, health) is now the fundamental attribute of a Third World nation (or a developing country). If developing countries require 'national power', then it can be argued that its achievement will in part depend on an interventionist, development policy which will provide national wealth where at present there exists poverty, homelessness and disease. The understanding of development policy will be shown to be critical in understanding where the adoption of information technology fits into the process of development as a whole. However, if the idea of a discrete unity called a developing country is problematic, is development theory itself any easier?

How is `development' perceived?

Perceptions and related value judgements colour individual actions: we see the world differently. It is argued here that the individual's perception of the values and problems implicit in development will structure his or her approach to specific development projects and issues. A number of development theory schools of thought which attempt to explain the nature and consequence of development activity have arisen to accommodate generalised views of development. Authors have attempted to organise taxonomies whilst recognising the difficulty of the task. Hettne (1990) provides us with an 'attempt at outlining the birth, evolution and transformations of this nebulous branch of social science: development theory' (p. 232). He categorises development studies in terms of two dimensions:

- Positive Normative, where positive 'deals with the world as it is' and normative 'as it should be' (p. 234).
- Formal Substantive, where formal 'is defined in terms of a limited number of universal goals and quantifiable indicators which can be combined in a predictive model' and substantive is 'where development involves historical change of a more comprehensive, qualitative and less predictable nature' (p.236).

Hettne combines these in the model shown in Figure 1.2. His diagram is instructive in indicating the number and range of theories which attempt to describe development. So (1990) organised development theory along chronological lines. He is not interested in bracketing all theories in development into three pigeon holes but refers to there being three dominant schools of thought in development studies:

> In the late 1950s, the field of development studies was dominated by the modernization school. In the late 1960s, this school was challenged by the radical dependency school. In the late 1970s, the world system school rose up to offer an alternative perspective from which to examine the issue of development.
>
> (p. 12)

Each school of thought has distinct features and comprises a number of different theories. For example, the modernization school was derived from social scientists in the USA:

> Heavily influenced by the evolutionary theory…(it saw) modernization as a phased, irreversible, progressive, lengthy process that moves in the direction of the American model…. American social

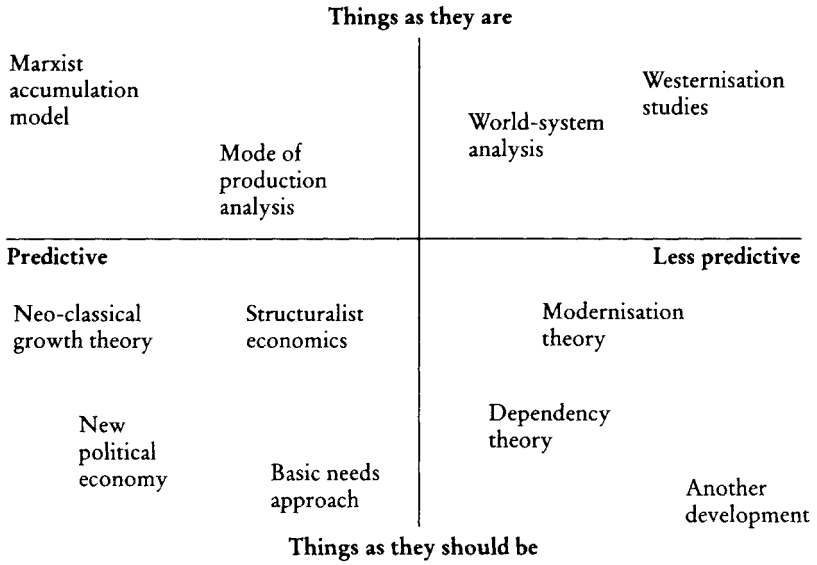


Figure 1.2 A tentative summary of orientations in development theory

Source: Adapted from Hettne 1990, p. 240

> scientists proposed that Third World countries should copy American values, rely on US loans and aid, and transform their traditional institutions.
>
> (pp. 261–262)

In contrast the dependency school 'had its roots in the Third World': 'the dependency school conceptualized the linkages between Western and Third World countries as a set of externally imposed, exploitative, dependent, economic relations incompatible with development' (p. 262).

Finally So examines the world-system perspective. In this case:

> Researchers emphasized the need to examine the totality and the *longue durée*. The unit of analysis thus should be the world economy, a historical system composed of three strata: the core, the semiperiphery, and the periphery. The world-system school contended that by the late twentieth century, the capitalist world-economy would reach a transitional stage at which real choices might be made to change the path of human history.
>
> (p.262–263)

Both Hettne and So show that the idea of development is not a fixed thing, either intellectually or chronologically. In this book it will be argued that the development idea or view which is subscribed to, dogmatically or loosely, consciously or unconsciously, will determine whether development activity is seen by the actor primarily as (for example) a result of political manipulation, an evolving historical process or a planned intervention.

At the outset of the research which forms the basis for this book, in order to demonstrate the range of views and thus the complexity of the developing country context, three separate approaches to development

were selected and reviewed at random: those of Apthorpe (1984), Cole (1983) and Kitching (1989). The purpose was to demonstrate that:

- Development is perceived in different ways.
- The resulting descriptions indicate a number of other issues, for example the ideology behind the development process.
- These, often subliminal, ideas behind development policy are at least as important in the task of effective information systems development as physical phenomena (e.g. power supply and dust exclusion).

A planning and rural development approach

Apthorpe (1984) deals with three different ways of looking at rural development planning policy, through three separate discourses: physicalism, institutionalism and distributionalism. Each discourse provides a line of approach to the business of development and each has its priorities. The critical point here is that, depending upon the discourse subscribed to, different items will assume differing degrees of importance. The focus will change and a different world view will arise. Clay and Schaffer have described this as follows: 'Each looks at things differently and also looks at different things' (Clay and Schaffer 1984, p. 11). They go on to argue that: For physicalism, the crucial scarcity is found in land—water relationships. For institutionalism, the crucial scarcity is 'the human factor'…. The distributionalist, however, looks at agriculture above all in terms of incomes from assets and occupations' (ibid.).

Apthorpe is dealing with the issue of intervention in developing countries in terms of agricultural development policy within the overall theme of development planning. Policy formulation can be resource-, culture- or income-based. Irrespective of the number of possible discourses or whether Apthorpe is correct in his attribution of certain features to each, his paper of 1984 indicates the widely divergent approaches which can underlie any given development policy at the national, regional or local planning level. The planning and adoption of information systems, as a relatively new feature of development activity, will be subject to perceptions based on an existing set of views, for example information systems as a basic resource, as a means for social development, or as an aid to economic efficiency. The importance of these perceptions will be returned to in Chapter 2, and examples of various perceptions of information technology will be dealt with in depth in the fieldwork in Chapters 5, 6 and 7.

An economic approach

The previous section described Apthorpe's approach to rural development policy. Another important development issue is that of macro-economic policy. As one example, Cole (1983) and later Cole, Cameron and Edwards (1983) have described the historical process of development theories as falling into three schools of thought: subjective preference, cost of production and abstract labour. Each can absorb the same economic information but each will interpret it in different ways.

Like Apthorpe's, Cole's work demonstrates that new theories and technologies will be assessed in the light of complex existing discussions. A single development project related to information systems is likely to be viewed differently by each of these approaches, and the difference will arise from political judgements and result in political acts.

An historical process of development approach

The third overview of development studies which we look at here is provided by Kitching (1989), who demonstrates a historical approach to the process of development. His view of development subdivides into traditional industrialism, populism and neo-populism. As a warning to those seeking to produce a new development theory Kitching notes: 'Ideas in this field are often dressed in a new vocabulary and hailed as original, when often they are little more than elaborations of or slight variations on ideas a century or even two centuries old' (Kitching, 1989, p. 2). Given the proliferation of jargon in the information systems field, this might have been written with information systems professionals in mind.

Kitching is concerned with the movement and direction of development effort over time and with the labels which define the underlying meaning of movements within the historical process, aside from those determined by ideology.

The three views outlined above reflect different views of the core subject of development. They expect different things from development and accommodate actions under different headings. They all assume that development requires intervention from government and other national and international agencies.

The academic reflections of development are echoes of activity in the world, and this means that action in the world on development projects will be perceived differently by different people. Perceptions of priorities and problems will vary with individuals. This will have implications for those involved in planning information systems and related development projects, and in particular for those attempting to make systems involving computers produce effective results in developing countries. In Chapter 2 these perceptions will be shown as being important in the approach to information systems.

Whatever the approach to understanding development, one common feature of interventionism within development, which is particularly relevant to information systems, is the process by which technology is transferred from one part of the world to another. It is a critical point that technology is being exported rapidly to developing countries (see the following section); this process is fundamental to methodology development in the planning of information systems.

Technology transfer

This section looks at the current process of technology transfer to developing countries, with specific regard to information technology transfer.

The evidence for technology transfer

Odedra (1992) argues that there are four areas of transfer: acquisition of equipment, technical assistance, education and training, and direct foreign investment. She suggests that technology transfer is at present quite a small business and that the minimal skills base in the developing countries is a significant problem. This in turn is due in part to the lack of books and training material available in-country, and in part to the poor record of consultants and of many of the Western agencies involved in passing on skills and Western attitudes ('modern colonialism'). Odedra goes on to suggest that a number of changes need to occur before the transfer of technology (e.g. the development of computer awareness and of an infrastructure for support).

Odedra's argument can be accepted so far as the effectiveness and sustainability of transfer is concerned, but there is a substantial body of evidence that transfer is taking place and that its rate is increasing. The beginnings of information technology transfer can be traced to the early 1950s (Han and Walsham 1989). In the 1950s and early 1960s technology transfer reflected the then state of the art in computer systems, and

thus the majority of computing facilities imported to the developing countries were mainframe systems. These were expensive and required sophisticated support in terms of finance and environment. It could be argued that they were designed to operate in conditions outside the capacities of the developing countries. They required air-conditioning, a clean power supply, and hard currency for support and parts; and they were often inappropriate to the needs of the receiving institution in terms of size, capacity, power supply, effect on local labour, etc. (see for example Balasubrahmanian 1986, Joshi and Sauter 1991). With the advent of the microcomputer, the trickle of computer facilities increased to a steady flow (see for example Bell 1987a, Siddiqi 1990, Newton, Roy *et al*. 1990, Meulen 1990 and Olukoshi 1990). The evidence for the flow is supported by Grant Lewis and Samoff (1992):

> A 1982 survey found just 37 microcomputers in use in Africa in projects funded by US AID…. In 1986 Grant Lewis and Sheya found nearly that many in US projects in Tanzania alone.
>
> (Grant Lewis and Samoff 1992, p. 15)

> It is estimated that in 1981, Botswana had six personal computers. In 1990, there were at least 300 Apple II computers, 500 Apple Macintosh sites, and 45 Novell local area networks (LANs), varying in size from four to seventy machines.
>
> (ibid.)

Daly too (1992) has supported the view that technology transfer is increasing rapidly:

> it has been estimated that the UN Development Programme (UNDP) funded some 1500 projects with information technology components between 1975 and 1987, and that the World Bank financing for information technology has been growing at 30 percent per year for the last decade…
>
> (Daly 1992, p. 154)

World Bank investment in information technology is also growing rapidly: 'lending for information technology…rose from $79 million in 1986 to $90 million in 1991, a 235 percent increase—six times the 39 percent growth in total Bank lending over the same period' (Hanna and Boyson 1993, p.vii).

It was during the 1970s that the rapid expansion in the sales and use of microcomputers became apparent in the industrialised world. Companies such as Apple Corporation and Osborne were in evidence with their small 8-bit micros using a range of new software packages designed to make computer facilities more accessible to a new range of users.

In the late 1970s and early 1980s the trend towards extending the user base beyond a narrow range of experts continued; in response to the expanding market, and the profits to be made therein, some of the large multinational computer mainframe corporations, often previously dismissive of the micro-computer market, became more involved. IBM (International Business Machines) most notably had been increasing its market share at a rapid rate (see, for example, the annual figures produced by Internation Ltd. Data Corporation 1986, or ITP Africa File 1991).

While over the last twenty years computer facilities have been made more accessible to non-computer specialists through the advent of the micro-computer, it can be argued that there has not been an equal development in making planning and development methodologies available to practitioners to help make the systems more effective. This is evident, for example, in the current shortage of texts designed to assist non-experts in planning information systems.

The evidence of technology transfer problems

As already noted, the flow of information technology to the developing countries is quite a recent phenomenon. Since the mid-1950s there has been a steady trickle of computing facilities into the DCs as a whole (see Kaul and Han 1988 and Robertson 1987). The impact of information systems and information technology in all their forms on DCs is increasingly documented, particularly as such technology is a major component of World Bank 'Structural Adjustment Programmes' (SAPs) in the guise of management information systems. Grant Lewis and Samoff (1992) argue that 'not only is loan-financed IT essential for the success of structural adjustment, it is frequently used to sell the structural adjustment programme' (SAP) (p. 6). SAPs are designed to reduce public expenditure and increase control over it, and to improve the effectiveness of economic management. Increasingly, public-sector information systems projects are computer-based.

The work so far carried out on the issues involved in the adoption of information technology in developing countries is characterised either by a lack of developmental detail from fieldwork, or by a resorting to generalisation (notably the books by the Ad Hoc Panel 1986, Damachi, Souder and Damachi 1987 and Woherem 1993). The lack of relevant information in the literature has not, however, stopped aid and donor agencies from putting in more and more technology. The attitude of the aid donors demonstrates their interest in the provision of technology to developing countries; the theme of how this feeds back into information-technology policy formulation is developed on pages 15–17.

The focus appears to be on hardware and software rather than on the context in which they will be applied or the sustainability of the system which is to be based on the technology. This point is further demonstrated in a survey carried out by the ITP Africa File Ltd (1991) of electronic data-processing products imported to Africa, excluding South Africa (see Table 1.1).

Table 1.1 Imports of EDP equipment and parts in Black Africa (millions US $(rank ordered by growth rate)

	1987	*1988*	*1989 (est.)*	*1989/87 Growth rate (%)*
West Africa	28.8	43.1	47.7	65.6
Southern Africa	20.9	20.2	26.9	28.9
East Africa	34.0	32.3	39.7	16.7
Francophone Africa	83.2	87.4	89.1	7.1
Total	166.9	183.0	203.4	21.9

Source: ITP Africa File Ltd, 1991, p. 17

The table shows increasing exports of electronic data-processing equipment from the industrialised countries to the developing countries of Africa, especially most recently in West Africa. This, along with the literature already cited (especially Kaul and Han 1988 and Robertson 1987), provides some basis for two important contentions advanced in this book: that computer technology transfer to the developing world is on the increase, but that there is evidence of a lack of interest or commitment to related analysis and design or planning for this technology transfer. Turn, writing as long ago as 1979, attempted to structure the pattern of technology movement in information products. His work demonstrated that the prevailing flow of finished technology products is to the developing countries and the prevailing flow of raw material (in this case in the form of data concerning information needs and information problems) is from the DCs. The developing world is thus being subjected to flows of information technology products. This point is supported by such authors as Siddiqi (1990), Olukoshi (1990), Forsyth (1990), Eres (1981) and Drummond

and Stefanovitch (1991), who go on to argue that the export of technology is not duly supported by planning and design capability. Bessant (1987) concurs, and argues that:

> The fact that operations carried out in 'black boxes' are invisible and require specialist support and maintenance means that there will be minimal technology transfer or opportunity for 'unbinding'–breaking the package down into elements more suitable for assimilation in developing countries. Perhaps most significantly, control is retained by the supplier, and the opportunities for imitation by developing countries are reduced.
>
> (Bessant 1987, p.166)

This indicates the lack of indigenous capacity to deal with technology as it is currently supplied (a point also made by Odedra 1992). If the technology remains a black box, so much more so will the analysis and design and assessment of technology capacity. Some authors argue the need for the development of indigenous capability to plan and design systems. Siddiqi (1990) in particular draws attention to the dangers of technology transfer without planning or support. Dangers which arise include:

- inappropriate systems which are soon redundant
- systems which break down and are not repairable locally
- local management not brought into the planning process and then being unable to manage the new facility
- dependency on an untested and high-risk technology.

(The above points have also been developed in Bell and Wood-Harper 1988 and Bell and Shephard 1990b; they are further discussed in Chapter 2.)

There is evidence that unplanned or poorly planned systems are on the increase (see Dykman and Robbins 1991, Kettelhut 1991).[2] The reasons for this include the fact that 'On average, hardware (including parts) still represents 75 percent of global spending, with PC sales around 30 percent of total hardware value' (ITP Africa File 1991, p. 5); and that user training and support has tended to be badly organised and comparatively underfunded. The ITP report notes this in terms of expenditure on all matters other than hardware: 'Maintenance, software, consultancy and training represent the remaining 25 percent of global spending' (ibid.).

These issues are explored further in Chapter 4 (in relation to the research approach) and in Chapters 5, 6 and 7 (the fieldwork).

The crux of the technology transfer section is the issue of what is thought to be important? What is the boundary of the area of interest and concern? Is it the hardware and software or a wider perspective encompassing both technology and human support for that technology? This returns the discussion to the points made on pages 7–10, to the issue of the underlying thinking behind any development action—in short the perception which gives rise to action.

Information systems, development policy and perception

So far we have discussed:

- The meaning of the term 'developing country'. It has been seen that this is a term with no conclusive definition. It is often used to describe nations seeking power over their own affairs.

- What is development? It has been argued that this is a complex idea which can be perceived from a number of different angles, for example planning, political and historical. Common to all such approaches is the need for intervention by the state, usually in the form of mobilisation of resources in a 'development' process.
- Technology transfer. It has been shown that this is a factor in the process of information technology adoption in DCs.

Understanding the perception or ideology behind the computer assistance policy of the major donors is of critical importance to development and technology transfer. It was of core concern and informative to the research which this book describes in Chapters 5, 6 and 7. In the following section the case of the United Kingdom as recently as 1991 will be briefly considered.

The Overseas Development Administration (ODA) of the United Kingdom is the central government authority with responsibility for funding overseas development work. Its mission statement might be expected to reveal something of the Administration's perception of the guiding ideas behind development policy. In its mission statement in 1991 the ODA separates 'issues' (e.g. agriculture, management, education) from 'cross-cutting issues' (e.g. the environment and gender) in order to specify priority areas for applying the limited resources available. The adoption of information systems did not figure either as a cross-cutting issue or as an issue in itself. However, its significance as a topic of importance was the core concern of a meeting of professionals concerned with information systems development in the developing countries. The meeting was held at the ODA headquarters in 1991. The following questions were outlined as being of special concern:

- Is there an IT policy in the United Kingdom for developing countries?
- What are the underlying assumptions of those administering the policy or non-policy?
- What is seen as being most important with regard to the present situation on information technology:
  - applications? e.g. spreadsheets, databases, etc.
  - theory? e.g. appropriate technology
  - systems thinking adoption? e.g. developing sustainable systems
  - education? e.g. basic, advanced, specialised, etc.
  - applied technology, e.g. management information systems (MIS)?
- What are the current problems with the policy/non-policy?
- What changes are coming or need to be planned for?

The general response of the Administration at that time can be noted as follows:

- There were very few IT projects. IT was a component of other projects.
- There were no discernible patterns to the use of computers in projects.
- Projects which had computer-related components were largely designed by 'lead advisers'[3] from sectors such as agriculture and management. The Adviser rarely had a systems background.
- There was no information-systems policy.
- Hardware and software rather than the actual information system was usually the central area of interest on the part of both the donor and the recipient.
- There was no specific project evaluation for IT.

- There were no general statistics on the impact and success of existing IT inputs.

Overall, the questions and the answers to them indicated a number of issues. They also suggested the nature of the ODA's perception of them:

- Information-systems development had a lower priority than that of cross-cutting issues.
- A lack of interest in the importance of analysis and design appeared to be part of this low priority. In the section on technology transfer (pp. 11–15) this approach was shown to raise problems. Chapter 2 deals with the topic of planning, and in particular rapid planning.
- Agencies such as the ODA, in 1991, had no overall approach to information-systems adoption on projects; this implies *ad hoc* arrangements.
- Large numbers of IT applications have been set up in a piecemeal fashion. Authors such as Siddiqi (1990), Dykman and Robbins (1991) and Kettelhut (1991) might argue that such an approach is liable to lead to the risk of systems failures and organisational chaos.
- Information systems supplied by the ODA up to 1991 appear to have rarely been planned and they were not effectively monitored and evaluated for performance.

In conclusion, the meeting of 1991 indicated that information technology (let alone the systems which it produces) was not perceived as a major issue by the United Kingdom's major donor agency to developing countries at that time, and that planning for and monitoring of computers and related facilities was very limited. This perception is in strong contrast to the views set out on pages 11–15; it will be shown to be a particular problem in cases of risk and uncertainty (as set out in the following section) and in the literature concerning analysis and design in developing countries which is discussed in Chapter 2.

It should be noted that since the 1991 meeting the ODA has made great efforts with regard to IT, most specifically with regard to the level of planning and monitoring which takes place in the adoption of information systems (IS) in all manner of development projects and the recognition of the complex institutional and social issues which IS embraces. At present, the ODA is developing a strategy for IS through practical implementation. However, from an historical perspective, the lack of concern for systems planning indicated in the 1991 study showed a potential source of myopia with regard to the policy makers of the ODA and their perception of the importance of computers and related technology to development. This can be seen to be a phenomenon not restricted solely to the ODA. In 1993, a report by Hanna and Boyson relating to improving the developmental impact of IT in World Bank loans indicated that the study was the 'first of its kind' (p. vii).

The issue of information-systems planning by leading aid donors to developing countries introduces the second major issue to be discussed here, that of risk and uncertainty as related to information systems.

RISK AND UNCERTAINTY

There is a great deal of information concerning the high risks of life in developing countries in terms of poverty, joblessness, crop failure, famine, etc. (see for example Harrison 1984, pp. 33–128, or Barnet 1980, pp. 15–21). The topic of risk and uncertainty (R&U) in developing countries has been argued and documented pragmatically by agricultural economists (see for example Upton 1979).

Risk and uncertainty in development

Martin Upton has defined risk and uncertainty as follows:

> risk and uncertainty, the former referring to situations where the outcome is not certain but where the probabilities of the alternative outcome are known, or can be estimated. For instance, if a farmer knows that his millet crop is likely to fail one year in four, then this is a case of risk…. Alternatively if the farmer has no idea of the probability of crop failure he is in a state of uncertainty.
>
> (Upton 1979, p. 91)

From Upton's description it can be argued that the key factor differentiating risk from uncertainty is knowledge. This can in turn be seen as a twofold lack of knowledge: lack of knowledge of key factors and/or lack of know-how about how to gain such knowledge and about its relative value.

In the case of information systems, risk may be defined as a state where the user knows that all systems are liable to fail but that measures exist to reduce the catastrophe of such a failure (e.g. uninterruptible power supplies and back-up systems). Therefore, if the user who knows the environment in which a system will be operating is involved in the analysis and design process, the risk can be minimised. Uncertainty implies that it is not known when, how and to what extent the system will fail. This in turn implies that the second kind of knowledge prevails and that those concerned do not know how to get the necessary knowledge and are unaware of its value. The need for and extent of contingency planning is very hard to assess in this situation. Uncertainty is a greater peril than risk for information-systems design in developing countries. Calhoun and DeLargy (1992) argue that:

> computerization makes significant demands on environments. Unfortunately, the planning of many systems *presumes settings like the United States, Western Europe or Japan, where a high level of environmental support can be taken for granted*. Failure to think through the special challenges of early applications in a 'system poor' environment is an important cause of failure and/or under utilization.
>
> (Calhoun and DeLargy 1992, p. 35; emphasis added)

Much of this Chapter has been used to indicate that the countries of the developing world do provide a 'system poor' environment. The implications of uncertainty and risk in relation to computer-based technology are reviewed in the next section.

Risk and uncertainty factors in information technology

Eres (1981) has produced a table of factors which could affect risk and uncertainty and which inhibit the transfer of information technology to developing countries (see Table 1.2). Under the headings of Economics; Manpower; Physioecological; Cultural; Demographic and social; Political; and Existing information infrastructure, she underlines the conditions in the developing countries.

This list is a generalisation of the conditions prevailing in developing countries. It can be criticised for being simplistic, for stereotyping these countries and expressing conditions as being homogeneous (such a criticism might arise from a reading of Harris 1988).

Table 1.2 Factors inhibiting information-technology transfer

General factors	*Conditions in DCs*
1 Economic	Labour-intensive society Low availability of capital Inability to absorb recurring costs Expense of international activities Lack of internal competition
2 Manpower	Lack of available trained personnel Low prestige of information professionals Difficulty in recruiting specialists Lack of continuing education Inexperience of working in teams
3 Physical	Limited resources Geographic isolation
4 Cultural, demographic, and social	Large percentage of unskilled workers Language barriers Fear of modern technology Inaccurate expectations of technology Information-seeking behaviour of scientists
5 Political	Unstable governments Need for tight security Constantly changing priorities Centralisation of decision makers Lack of scientific impact at the highest levels of government
6 Existing information infrastructure	Poor quality of telephone services Inadequacy of postal services Tight customs service

Source: Adapted from Eres 1981, pp. 97–102

On the positive side Eres is attempting to deal with the problems which information technology both produces (among potential users) and encounters (from potential users) in a total[4] fashion covering economic, social and technical issues.[5]

It is important to note that many of these issues are crucial factors for a large number of developing countries but are not so relevant for the industrialised nations (e.g. labour-intensive society, large percentage of unskilled workers, etc.). These factors and their interrelationships, which amount to aspects of added complexity for the context, need to be taken into consideration when planning information systems. Issues of added complexity are discussed in greater depth in Chapter 2.

So far this introduction has focused on the context factors at work in the perception of, and projects in, the developing world. As outlined in Figure 1.1, we are concerned with the relationship between the context and the perceptions and methodological structures in information-systems planning and development. Chapter 2 develops this topic; meanwhile, the following section presents general background themes about systems analysis and design. It is concerned most specifically with the way information systems are viewed and the implications for systems analysis and design in developing countries.

AN OVERVIEW OF THE PROCESS OF SYSTEMS ANALYSIS

Systems analysis and design is the term used for the planning and development of information systems and forms part of the activities of the 'systems development life-cycle' (Avgerou and Cornford 1993). These authors set out the life cycle as follows:

- identification of a problem, pressure or opportunity;
- determination of general requirements;
- feasibility study to explore possible approaches;
- systems analysis to determine detailed requirements;
- systems design to show how requirements are to be met;
- programming and hardware configuration;
- systems implementation;
- operation and maintenance.

(Avgerou and Cornford 1993, p. 18)

Avgerou and Cornford's model shows that the life cycle contains analysis and design between the initial feasibility study of approaches and the programming of the ultimate system. One underrepresented issue in the model is the specific value of monitoring and evaluation of the final system— a point seen to be of major importance in the fieldwork discussed in Chapters 5–7. The stages of the life cycle produce the final information system, which has been defined as follows:

> Information System—A computer based system with the defining characteristic that it provides information to users in one or more organisations.
>
> (*Dictionary of Computing,* Oxford, 1986, p. 183)

An information system, if it is to be sustainable, not only requires the smooth function of a technical process; it also needs to be valued, accepted and participated in by people normally referred to as 'users'. Hirschheim (1989) has noted that participation on the part of the user improves the integration of the human and technical aspects of the system (a point to which we shall return many times). However, if information is:

- poorly gathered and sorted
- inadequately edited
- incorrectly analysed
- badly presented

the information system will fail in its primary function. This has a knockon effect on decision making, the results of which feed through to the effectiveness of the organisation as a whole. Therefore any information system needs to be carefully planned in relation to:

- the ultimate decision-making process which is thought by the major stakeholders of the system to be the purpose of the system (the type of decision to be made or action to be taken will determine the type of information to be compiled)
- the data to be gathered which will enable the information to be provided (for whom, by whom?)

- the information products to be delivered by the system (what information for which user and in which form?).

The terms 'data', 'information' and 'decision making' have variable meanings depending upon who is setting the agenda for the system. They are not definite fixed terms[6]. This in turn means that systems planning needs to take into account the meaning and thinking at work behind the planning. Planning for information systems is usually presented as being factual and free from value judgement. As will be seen, the basis of the process is often confused because different theorists use the same term to mean different things.

Systems approaches to systems analysis

It is impossible to gather data and information from complex situations for the practical purposes of decision making without having a method for the process. One such method is systems thinking. The exponents of systems thinking see it in different ways according to their backgrounds (for a fuller description and historical review of the development of systems thinking, which goes into depth on the various strands, see Checkland 1981). The basis for systems approaches lies in the General Systems Theory set out by Ludvig von Bertalanffy; Avgerou and Cornford (1993) present the major features as defined by the theory as:

• Interaction with the environment	This is not the system itself, being outside it, but it does affect it.
• Identification of a boundary	This defines the system as distinct from its environment.
• Being closed or open	Relates to the interrelation of the system with what lies beyond its boundary.
• Goal seeking	A system is capable of changing behaviour to produce an outcome.
• Being purposeful	Systems select goals.
• Exerting control	A true system retains its identity under changing circumstances.

(Adapted from Avgerou and Cornford 1993)

These are the major features of the systems approach.

To illustrate the level of discussion on this subject, and the variety of conceptions arising from it, it is worth comparing the views of three authorities. Other views could be given but these three are representative of some of the main lines of thinking. The writers represent three schools which are defined here as being soft,[7] structured[8] and functional.

The soft approach

To paraphrase Checkland and Scholes (1990b) writing on the 'soft' side of systems, systems thinking is concerned with a number of key points: wholes, models, 'hard' and 'soft' approaches, 'holons'[9] and interpretations.

The soft approach to information systems design is quite specific in that it is focused on drawing out tasks and issues from complex social situations. However, 'system' can mean very different things, depending upon the intellectual standpoint of the practitioner. As the Oxford *Dictionary of Computing* puts it: 'System…. In computing the word is widely used with many shades of meaning'.

The views of major authors writing on the harder side of analysis and design underline the divergent nature of these shades of meaning, and contrast sharply with the vision set out by Checkland and Scholes.

A structured approach: Structured Systems Analysis and Design Method (SSADM)—the United Kingdom standard

Ashworth and Goodland (1990) describe systems as 'Whatever is within the boundary of a study' (p. 272). This is a much more general definition which does not differentiate between a system as such and an entity. All wholes are systems. This perspective must result in removing some of the meaning from the word 'system'. SSADM has been described by Downs (Downs, Clare and Coe 1988) as being both mechanistic and prescriptive. While it can be argued that advocates of the soft approach are interested in making models or holons which represent reality as set out in systems, proponents of SSADM wish to define activities within artificial boundaries of study. In this way they impose order on the area of study by reducing its scope, but potentially deny the importance of the interlinked nature of systems (the concept of 'open systems') and therefore arguably reduce the importance of the context within which information systems have to work (this point is developed in Chapter 2, pp. 34–37). SSADM has been adopted as the analysis and design standard by the Civil Service of the United Kingdom, and it is possible to argue that this pragmatic view of systems thinking is represented in the majority of systems work being undertaken today (although there are many proprietary views of SSADM which all vary among themselves).

A functional approach to systems

In similar vein to the SSADM-type approach, Lucas (1985) is representative of another strand (see also Lucas 1973, 1976, 1982). Lucas describes a system as 'an organized, interacting, interdependent and integrated set of components or variables' (1985, p. 5). In the same text he describes organisations as 'a rational co-ordination of activities of a group of people for the purpose of achieving some goal' (p. 13).

This view tends to a rationalistic, functional theme to the idea of systems and organisations. Arising from this Lucas indicates that his interest is in the area of 'formal information systems', which he defines as the information which can be processed on computers. To this end he makes extensive use of formal analysis and design tools and techniques. The ideas of system, organisation and information come together in analysis and design, in what Lucas describes as a 'conventional' view, as follows:

> We begin at a high level of abstraction; for example, the first conceptualization of the system may be as general and broad as saying that we are dealing with inventory control. At each subsequent stage more and more details are developed. The lowest level of detail is the computer program and manual procedure level.
>
> (Lucas 1985, p. 89)

The resulting analysis and design is centred primarily on 'top-down', formal, conventional organisation aspects.

The three types of approach set out above are not definitive, but these three expositions of concepts underlying systems analysis could be said to represent three levels of perception (see Figure 1.3). They are not mutually exclusive but they do underline a range of possible views or tendencies within systems analysis which extends from metaphysics to mechanics. The soft view involves a process of making models which are useful for organising thinking and which are relevant to reality. The soft approach is concerned with

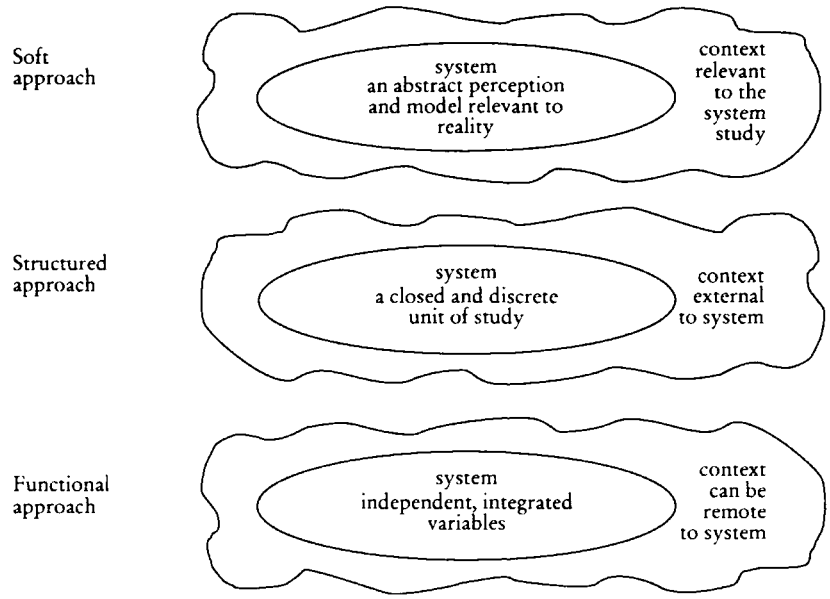


Figure 1.3 Three views of systems

constructing and comparing models based upon perceptions derived from reality. The structured view is focused on information systems and sees systems as those entities and actions which occur within an area of study. Extension of the system or reactions to it arising outside the area of study are not relevant. The functional approach seems to build on this: the components of systems are logically and rationally seen as operating together. It could be argued that this could lead to an uncritical view that there is little difference between the reality which we perceive and the real world (paying little attention to personal perception and subjective values). Taken to an extreme this could lead to the view that models, if carefully and diligently described and constructed, are absolutely true.

The three views of systems can be accommodated in the approaches to information systems distinguished by Avgerou and Cornford (1993):

• Functional	Systems as required for supporting specific tasks
• Technological	Systems as related to the description, specification and construction of technology
• Organisational	Systems orientated towards organisations' structures and goals
• Human-perspective	Systems to deal with the needs of individuals

(Adapted from Avgerou and Cornford 1993, p. 9).

The soft approach can be argued to adhere to the human and organisational perspective, structured to function and organisation, and functional to function, organisation and technology. The point which emerges from this comparison is that information systems as objects of study can be seen as being remote or proximate, as metaphors or as reality, as practical tools or as abstract qualities, as open and all-embracing or as narrow and fixed on a specific point. There is no reason why these views cannot be held concurrently by the same information-systems scientist or systems analyst.[10] Each of the views carries with it assumptions

about the world and assumptions about the nature of human action, a point which will be developed in Chapter 2.

This trinity of views on systems approaches can be considered in relation to a similar trinity, discussed on pages 7–11, concerning development. Various combinations of systems approaches and views on the nature of development will lead to a range of perceptions and resulting interventions. The systems and development approaches are brought together in Chapter 2.

How to set about systems analysis and design?

The above discussion illustrates a range of views on the nature and form of analysis and design. A general if limited definition of the process has been given by Bell and Wood-Harper (1992) in the form of a set of stages:

- Discover what the information problems are.
- Discover the setting for the problems.
- Identify the resources and constraints.
- Identify the major information components.
- Structure the problems into a model.
- Design model solutions to the problems.
- Test and cost the model.
- Implement the model as appropriate.
- Monitor and evaluate.

(Adapted from Bell and Wood-Harper 1992, p. 15)

There are numerous methodologies which undertake these stages in various ways, emphasising different aspects. They share one common feature, however, as Downs, Clare and Coe (1988) have suggested: being originally designed for large automated procedures, they all take a lot of time (often six person-months and more).

What should be the result of systems analysis?

In Avgerou and Cornford's model of the system's life cycle, the process of analysis and design should lead to programming and then to the implementation of information systems which support the information requirements of the organisation in question. There are two arguments against this model, which relate specifically, though not exclusively, to developing countries. First, systems for developing countries often develop on an unplanned and unstructured basis with little or no overall planning (see Shitima 1990, Okuwoga 1990, Quarshie 1990). Second, analysts tend to be overly technocratic and thus focus on the technical and not the social sides of new systems (see Kumar and Bjørn-Andersen 1990). These arguments are explored further in Chapter 2. Here, it is useful to review the issue of best practice in analysis and design. What does it mean and how is it intended to ensure systems success?

GUIDELINES FOR EFFECTIVE PRACTICE IN SYSTEMS ANALYSIS

What constitutes good practice?

Good practice in any professional area is based upon agreed and enforced standards of behaviour. In the United Kingdom standards for analysis and design are set by the British Computer Society (BCS) which is the professional body representing the various aspects of the computing profession, and by a government agency called the CCTA (previously known as the Central Computing and Telecommunications Agency). The BCS has a code of conduct which all members are obliged to abide by; its other activities include setting out and agreeing standards in the vast range of areas encompassed by modern computing. The CCTA has been instrumental in producing the Structured Systems and Analysis Design Method (SSADM), which is expected to act as the standard for analysis and design in all government agencies, although it is not mandatory.

Technical emphasis

Both the BCS and the CCTA have been concerned with standards and the need for precision in the generation of new information systems. The CCTA's work with SSADM in particular has been focused primarily on the need for structured, technical tools to produce technological systems. SSADM does arguably provide for both of these requirements. There are negative features, however:

- the length of time required to undertake an analysis[11]
- the associated cost of such work
- the lack of focus on social issues such as those embraced by the soft methodology (a point which has recently begun to be addressed—see CCTA 1993).

Social sensitivity

The technical nature of design procedures is questionable in terms of the growing body of opinion that social issues are paramount in systems development. Avgerou and Cornford (1993) have argued that: 'It is now widely recognised that the processes of information systems development and management are primarily political, driven by the concerns of the social actors that participate in them' (p. 217).

Hirschheim and Smithson (1987) concur: For information systems evaluation to be meaningful, both non-technical (i.e. social) and technical criteria must be included' (p. 379).

Bell and Shephard (1988) criticised SSADM on a number of counts. Altogether they amounted to a critique of the lack of social sensitivity in the overall approach and the problems of using such an approach in situations of complexity other than technical complexity. Others, for example Mumford (1979, 1981a, 1981b), Checkland (1981) and Checkland and Scholes (1990a) argue for the inclusion of social and cultural issues in any analysis of organisational requirements. This theme is developed in Chapters 3 and 4.

Systems analysis and perception

So far this section has discussed:

- What is meant by systems analysis and design? This has been defined from a number of different perspectives—soft, structured and functional.
- How analysis and design for information systems works. This has been defined in general terms as the process of arriving at an information system following a process of problem definition and model building.
- The issue of good practice and the resulting initiatives by both BCS and the CCTA to set out analysis and design methodologies which encompass this.

As has been emphasised earlier, it is of critical importance to information systems development and good practice to understand the perceptions and assumptions behind policy. Calhoun and DeLargy (1992) argue that:

> while computerization may cause or shape a variety of social changes, it is not the prime mover in any such process. The factors that lead to computerization, the conditions under which it takes place *and the specific design decisions of those who implement it* are the crucial determinants of its effect.
>
> (Calhoun and DeLargy 1992, p. 26; original emphasis)

It has already been shown from the three approaches set out on pages 21–25 that perceptions of information systems vary. Madon (1992) suggests that an information system comprises many such views of development, from the most political to the most pragmatic.

Here it is useful to draw out the following themes. First, analysis and design is not a fixed, single science. It has a range of interpretations, and the background preference of the analyst (organisational, technological, functional or human aspects) will tend to influence the choice of approach. Second, the history of analysis and design has tended to be technically orientated, focusing on the technology and data rather than on social issues. Other approaches do exist, but they have largely been outside the mainstream. The next section looks briefly at some of these other approaches, which offer the possibility of analysis and design gaining the benefits of both and hard and soft methods.

ECLECTIC TOOLS FOR ANALYSIS AND DESIGN

The previous sections of this chapter demonstrate that both information-systems design and the context in which it takes place in developing countries are complex. To deal with complex system contexts, systems designers have constructed approaches which bring together both technical and social perspectives. The review of the developing-country context indicated that politics, resource use and the process of industrialisation (as noted in the three approaches set out on pages 9–11) combine to produce a picture of multi-layered factors reacting with each other. This in turn indicates the need to combine both technical and social issues in any analysis and design. This kind of eclectic approach to information-systems analysis and design in developing countries merits investigation. Two methodologies which embody this approach are ETHICS (Mumford and Weir 1979) and Multiview (Avison and Wood-Harper 1990).

Blending hard and soft tools

While neither ETHICS nor Multiview is as well established as SSADM in the United Kingdom (although ETHICS has been in use for a considerable time and has a broad global clientele), they do offer an alternative means of analysis and design.

ETHICS has been represented as containing fifteen stages and is designed to result in a mix of social and technical elements for an information system. The approach as set out by Mumford (1981a) and Mumford and Weir (1979) is intended to be participative, so that the users and the analyst work together towards a system specification. Spectacular successes have been claimed (see Avison and Fitzgerald 1988, p. 242) but the process can be very lengthy.

Multiview, as set out by Wood-Harper (1989), Avison and Wood-Harper (1990), and adapted in Bell and Wood-Harper (1992) is a five-stage process which includes both soft and hard systems approaches, for example soft systems methodology review of the human-activity system, and information modelling for entity, attribute, event and function modelling.

Both ETHICS and Multiview attempt to link together technical and social views of systems, and both attempt to understand the problem context in more depth than a single technical perspective could accommodate. These wider views of context may be of value to analysts working in developing countries, but there are important questions to answer. For example:

- How well do these methodologies transfer to a different culture?
- How well do they adapt to minimal time for development?
- How well do the social and technical aspects link together?

These questions will be reviewed in more depth in Chapter 2 and in presentation of the fieldwork in Chapters 5, 6 and 7.

SUMMARY

Both development processes and information systems involve complex issues. This chapter has outlined these two sets of issues and has indicated that they need to be brought together into a single framework if information systems are to be effectively planned and developed in developing countries. Figure 1.4 shows the main components discussed. In the context of developing countries, uncertainty and risk are key elements requiring careful consideration. In terms of information systems, the selection of an appropriate approach (structured, soft, functional, etc.) is of critical importance for effective systems analysis and design. Eclectic approaches including many of the best features of structured and soft offer one possible way forward. The following chapters will show whether such approaches have potential for application to the minimal planning which has been evident in information-systems development in the developing countries. This chapter has argued that all systems developments are ultimately dependent upon the predispositions and preferences of the analyst/researcher.

In particular, if information systems are to be sustainable given the high levels of risk and uncertainty in the developing world (as indicated on pages 17–20), there is a need to examine:

- How analysis and design deals with complexity (most critically matters relating to risk and uncertainty). Do eclectic approaches offer any advantages?
- What is the existing form and value of planning tools in developing countries; specifically are there practices from which information-systems planners can learn?
- What current practices of information systems planning and development are evident in these countries ?

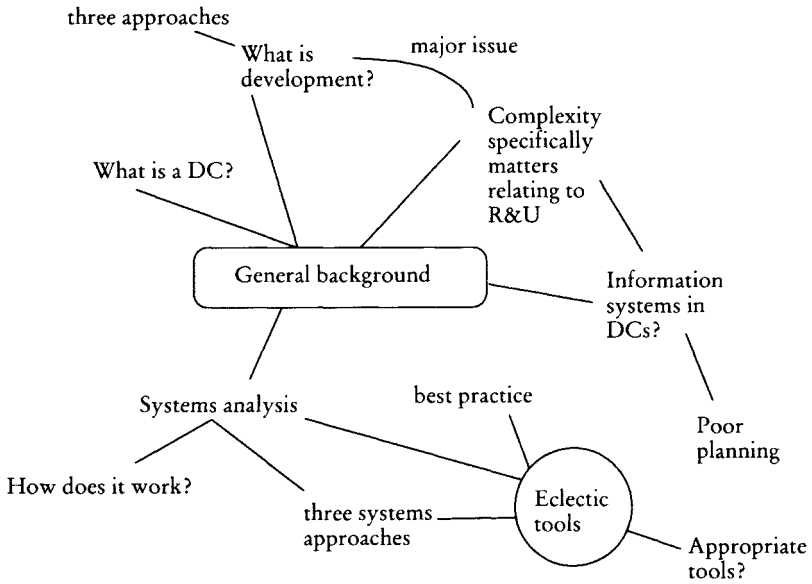


Figure 1.4 Spray diagram summary of Chapter 1

2
INFORMATION SYSTEMS AND PLANNING IN DEVELOPING COUNTRIES

The purpose of this chapter is to discuss, first separately and then collectively, the literature on the two critical factors of information systems and planning in developing countries. The questions tackled in this chapter are drawn out from the general issues covered in Chapter 1:

- Recognising that situations in the developing countries can be complex because of risk and uncertainty, what systems approaches are available to deal with such complexity?
- How does the analyst select a methodology and what weight does subjective preference have in dealing with the selection?
- What are the essential characteristics and assumptions of hard and soft (or quantitative and qualitative) approaches?
- How are eclectic approaches intended to improve upon hard and soft approaches? In this section Multiview, discussed briefly on page 28, is discussed in more detail.
- What can be learnt from the previous experience of planning in poorer countries? First the experience of agricultural research science is reviewed. Second the planning of rural development as a whole is considered.
- What points arise from existing information on analysis and design in such countries?

Figure 2.1 shows these questions leading off from the themes of Chapter 1.

ANALYSIS AND DESIGN AND COMPLEXITY

There is a wealth of material on how systems methods can be applied in complex situations in order to solve problems (see, for example, a selection of the papers in Knight 1989 on user participation; Checkland and Scholes 1990a; Avison and Wood-Harper 1990; or Avison and Fitzgerald 1988). A framework for reviewing systems methods in terms of their capacity to deal with complexity has been developed by the Systems Group at the Open University; it is described in detail in the third-level course T301 (Open University 1987).

The Open University course discusses various systems approaches at a high level of abstraction and generalisation, although some specific and practical examples are also given. Much of the material focuses on soft (qualitative) and hard (quantitative) systems methods, and on 'failures' (an approach which is largely descriptive in systems terms).

Methods are, however, only one of the three elements with which systems approaches are concerned: the problem context, the method and the analyst. Figure 2.2 shows that 'the interaction between the three

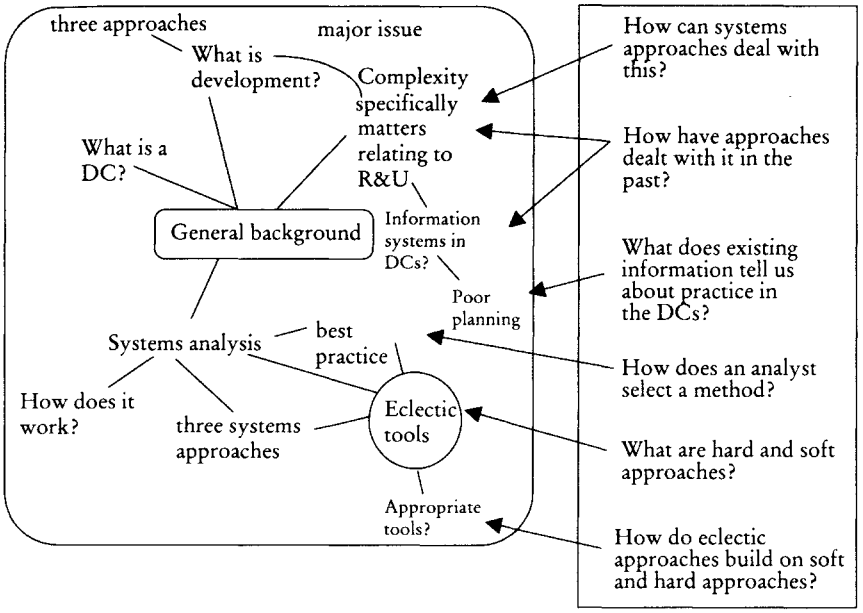


Figure 2.1 Themes and questions

factors of the analyst, the method and the problem and its context are the crux of the question of which approach to choose' (Open University Systems Group 1987, Block V, p. 12).

- The context. The environment in which the problem manifests itself. A number of elements are concerned in the understanding of the context (e.g. technical, social, political, etc.). How much time and space does the problem occupy? To whom is it a problem? To whom is it not a problem? How structured or unstructured is the problem?
- The method. A description in general terms of the major characteristics of the hard and soft systems methods which comprise the analyst's approach.
- The analyst. The nature and predispositions of the analyst are a critical factor. They are described later in this chapter and discussed in more depth in relation to the fieldwork in Chapters 5, 6, 7 and 8.

The Open University model provides a useful structure for reflection on the relative values of the specific hard and soft methods discussed later in this chapter.

In Chapter 1 various approaches to development studies and systems were discussed. The purpose was to demonstrate that different people may use the same language to describe a phenomenon and yet may see the issue under discussion quite differently. In the more specific case of the systems analyst or systems researcher or planner looking at a problem with an intention of creating a new information system, the view of the problem may vary considerably between analysts, and therefore the chosen method and the solutions sought will vary accordingly. The subjective nature of problem diagnosis has been set out by the T301 Group of the Open University in these terms:

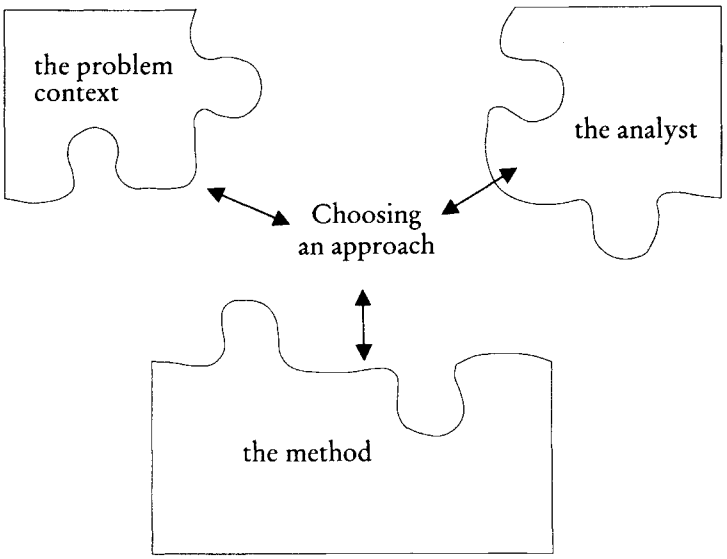


Figure 2.2 Context, method and analyst

Source: Adapted from Episkopou and Wood-Harper 1986, and Open University Systems Group 1987, Block V, p. 12

> problems are not things lying around waiting to be discovered, described and categorised in some neutral, objective language. They are instead, inventions or creations of human intellects that are, for one reason or another, concerned about them.
>
> (Open University Systems Group 1987, Block V, p. 12)

There will always be a degree of subjective preference in the mind of the analyst and this will be important in understanding the nature of the context and the method to be used. For example, in Chapter 1, three approaches to development and three approaches to systems were discussed. Whilst recognising that other interpretations might be derived from a review of the two subject areas (systems and development), if one generalises broadly from the approaches and mixes the resulting six interpretations of the approaches together it produces a wide variety of possible tendencies in terms of how the situation in which systems are to be developed might be appreciated. For the purposes of demonstrating the different tendencies which might arise from the different types of view held by the analyst Table 2.1 sets out one interpretation.

Table 2.1 A table of tendencies

		Development approaches		
		Political	Planning	Historical
Systems approaches	Soft approach	*social forces*	*human resources*	*change*
	Structured approach	*conservative*	*organisation resources*	*equilibrium*
	Functionalist approach	*functionalist*	*technical resources*	*status quo*

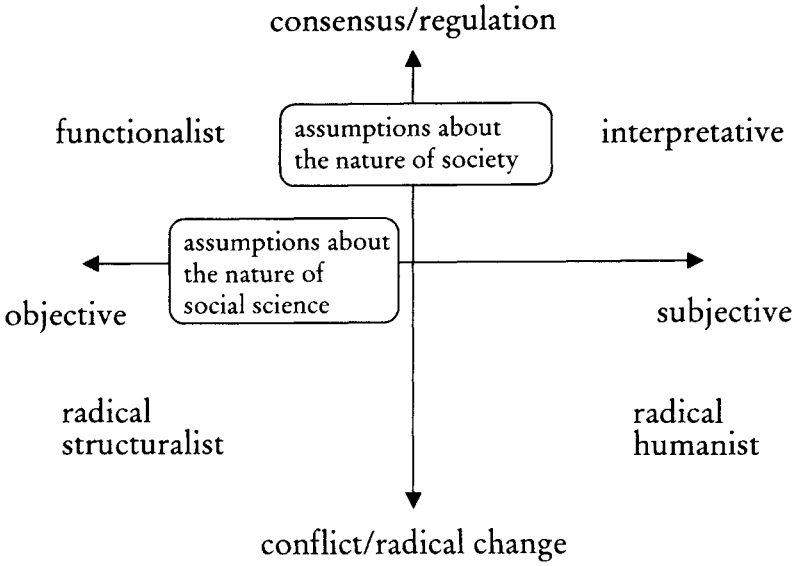


Figure 2.3 The Burrell and Morgan framework: social science and society

Source: Adapted from Burrell and Wood-Harper 1992, p. 27, building on Burrell and Morgan 1979

The italicised cells in the table indicate factors which might be emphasised by particular combinations of systems and development perspectives. Broadly speaking the three systems views (soft, structured and functional) combine with the three development approaches (planning, political and historical) to provide a range of initial assumptions which can form the basis for information-systems action in the developing countries. The views or perspectives set out here range from the soft, political focus in the top left corner to the functional and historical in the bottom right. Between these two, broadly soft and hard, extremes lies the structured and conservative centre ground. This table is not intended to be definitive; it simply makes the point that views will vary with background assumptions of analysts and that this will have an effect upon the way in which individuals consider contexts (specifically potential system contexts in developing countries). Others, for example Burrell and Morgan (1979), have tried to systematise the views of individuals into a more general table based upon views on social science and the nature of society[1]. Figure 2.3 illustrates the model they advanced.

Burrell and Morgan produce a classification which will accommodate the activity of the analyst (here set out as types of social-action, for example functionalist, interpretative, etc.) according to personal assumptions about the nature of society and social science. This model will be used to develop ideas about assessing both the analyst and systems approaches in the following sections.

Only when the analyst, the context and the approach are brought together can there be appropriate activity towards problem solving. The means by which problem solving comes about is an important element in understanding the success or failure of any analysis and design intervention.

The next three sections review and compare the hard, soft and eclectic approaches to systems development with respect to the nature of the various approaches, the nature of the analyst undertaking them and the context in which they operate. Table 2.1 and Figure 2.3 will be used in the assessment of the analyst.

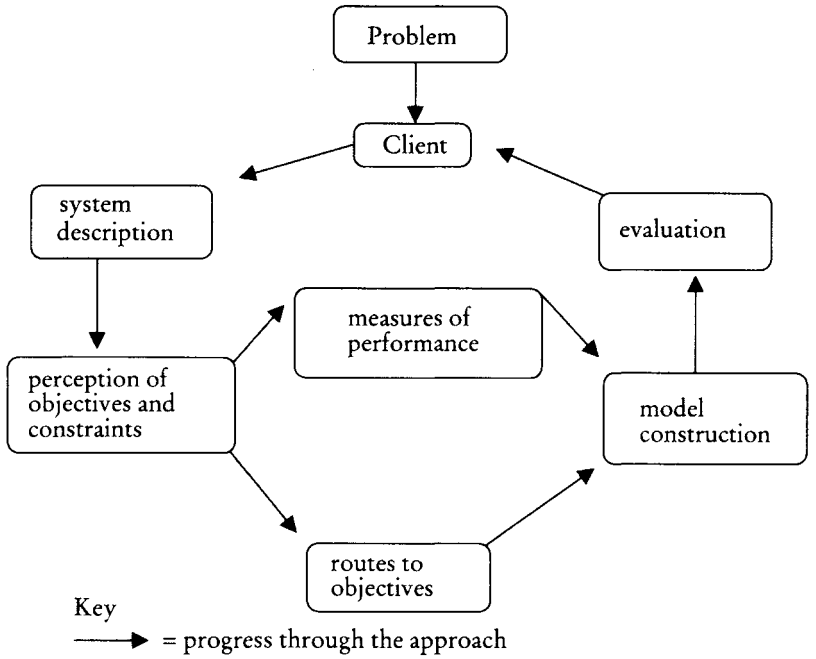


Figure 2.4 The hard method

Source: Adapted from Open University Systems Group 1987, Block III, p. 13

Hard approaches: the relative strengths and weaknesses

The approach

Some of the assumptions behind hard and soft methods have already been described in Chapter 1 (pp. 22–24). The hard method, at its broadest, is essentially quantitative (in terms of being data-orientated), using mathematical tools to measure efficiencies in information or data flow. Figure 2.4 is one representation of the hard method as a systems model.

The important aspect to note about this model is that it is essentially systemic in form, taking a wide view of organisational requirements in the systems description, and then focusing on specific routes to objectives and measures of performance. Ideally this means a movement from the general to the particular. As compared to this, most specific hard approaches are aimed more at a narrower range of issues pertaining to data and information processing (see for example Wood-Harper 1989, pp. 58–65). Wood-Harper (1989) distinguished three types of information-systems approach within the hard school structured systems approaches (e.g. DeMarco 1979), data analysis (e.g. Avison 1985) and technical specification (e.g. Martin 1985). All focus primarily on data (including functions, entities and events) rather than social process. More recently approaches such as SSADM (Ashworth and Goodland 1990 and Downs, Clare and Coe 1988) have continued the trend. All these specific methods are hard in that they are focused on technical not social issues.

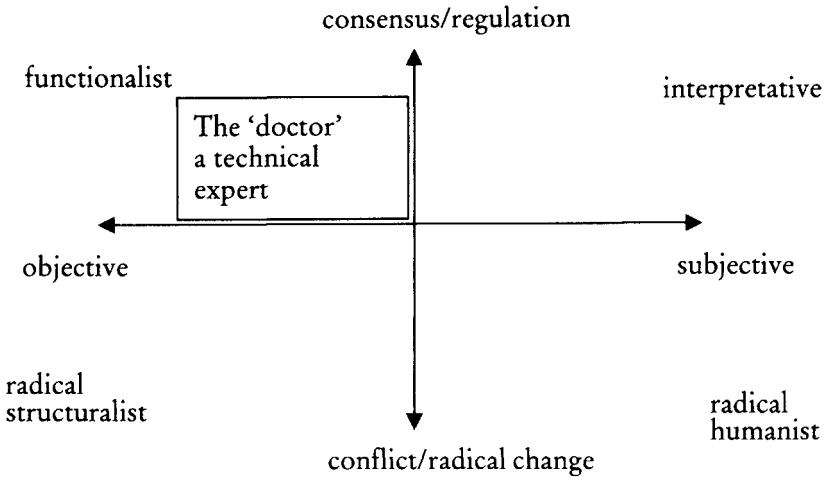


Figure 2.5 The hard analyst

The analyst

Hard approaches require technical efficiency, using quantitative methods in objective measurement and forecasting. Adapting the Burrell and Morgan (1979) diagram set out in Figure 2.3, Avison and Wood-Harper suggest metaphorical types for the different perspectives. Hard approaches fit in with objective and consensus/regulation sectors, as shown in Figure 2.5.

The functionalist metaphor of the doctor carries with it a set of assumptions about what problem contexts require *prior to the review of any specific example,* and so the assumptions may be inappropriate to the problem in question. This point is critical. The structured and mechanical views of systems could be argued to fit into this model, and a brief review of the focuses in Table 2.1 indicates some of the potential tendencies (see Table 2.2). The implications of Table 2.2 are that the social and political elements of organisations are at best left aside as not relevant and at worst ignored in favour of functional and organisational objectives aimed at economically viable 'solutions'.

Table 2.2 The hard analyst

Structured approach	conservative	organisation resources	equilibrium
Functionalist approach	functionalist	technical resources	status quo

The Open University Systems Group (1987) says of the hard assumptions that they imply:
The belief that there are people in organisations:

- who know what is going on
- who can identify problems and objectives clearly
- which they can put into operational and/or quantitative terms
- and who have the controls and resources to implement solutions they accept;

and that:

– defined problems can be 'solved' by people with appropriate expertise.

(Block VI p. 43)

This expresses a potential weakness of the hard approach: the assumption that problems are clearly definable and amenable to expert diagnosis. Whether this is generally the case will be discussed in the next section.

The context

Given the nature of the approach or method and the characteristics of the likely analysts, the appropriate context for the hard approach can be defined. Objectivity linked to technocratic functionalism is most effective in controlled environments where social and political forces are not major issues. The approach would be able to deal with all manner of technical complexity and change but would not be adapted to deal with non-technical issues. This is a weakness, and it has implications for hard approaches where they are used specifically to deal with uncertainty (as discussed in Chapter 1) and when their application impinges on political and cultural forces.

Strengths and weaknesses of soft approaches

The approach

The soft approach is distinct from the hard approach in that, although there are numerous elements to the approach which are common to several methodologies, there is also *the* soft systems methodology (SSM), for which there is no single hard equivalent. As described in Chapter 1, the approach is based on the perception and understanding that views of reality are complex and vary between viewers. The overall approach as set out by Checkland in 1981 and adapted by Avison and Wood-Harper in 1990 is shown in Figure 2.6. The soft systems method focuses on grasping soft, intangible issues, drawing out tasks and issues and deriving purposeful systems, forming these into root definitions and expressing the complexity of problems in conceptual models. Therefore SSM accepts that reality is full of problems, but recognises within it structure and processes. The problem situation is relatively unstructured when SSM is used. Boundaries are mobile and they may or may not coincide with organisational boundaries.

Some of the actors in the situation will be obvious, others will materialise later in the process of analysis. Stakeholders involved in analysis will often be aware of improvements which are possible. The approach breaks down to a five-phase structure (Wood-Harper, Antill and Avison 1985):

- Perceiving. Appreciation of the situation. No framework is imposed at this stage: elements 1 and 2 of Figure 2.6.
- Exploring. Systems models are constructed: elements 3, 4 and 5 of Figure 2.6 (root definitions and conceptual models are dealt with in Chapter 3).
- Comparing. Systems models are compared to perceived reality: element 6 of Figure 2.6.
- Deciding. What changes are desirable and feasible: element 7 of Figure 2.6.
- Acting. Implementation of a decision: element 8 of Figure 2.6.

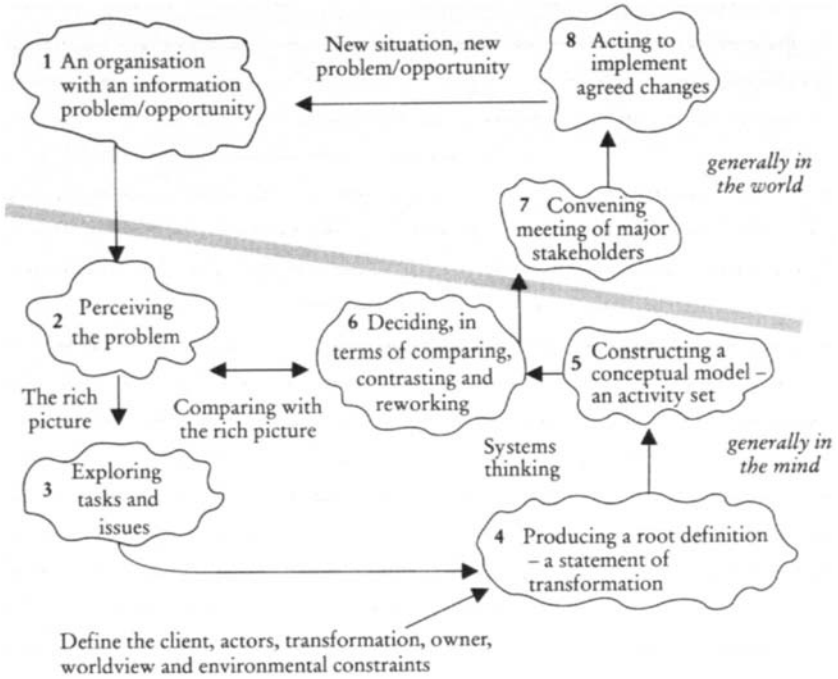


Figure 2.6 The soft approach

Source: Adapted from Avison and Wood-Harper 1990, p. 27

The analyst

The SSM analyst tends to seek meaning and to be involved in the participative evaluation of meaning in complex situations. This means that the analyst is prepared for the subjective view but still tends to work within the organisational constraints. From Avison and Wood-Harper's (1990) point of view this means that the analyst would relate most closely to the metaphor of the teacher, a facilitator seeking meaning. If we link this to Table 2.1, the row relating to the soft approach is applicable (see Table 2.3).

Table 2.3 The soft perspective

Soft approach	social forces	human resources	change

The context

In contrast to the hard approach, SSM is designed to operate in situations which are messy and where objectives are not clear. The approach is subjective and qualitative, being related explicitly to the views and assumptions of actors in the problem context. This in turn indicates a potential weakness; it might prove to be inappropriate in situations where quantitative objectivity is required. A further weakness expressed by Avison and Fitzgerald (1988) is that of the difficulty of knowing when any stage of the analysis is completed.

The development of an eclectic approach

The approach

In Chapter 1 two eclectic approaches were briefly introduced: ETHICS and Multiview. Multiview is reviewed here in greater detail. The main reason for the choice of Multiview is its explicit use of SSM combined with a variety of hard approaches, including aspects derived from SSADM. This makes it more readily comparable to approaches as reviewed separately above. The methodology is not restricted in the manner of its application (stages can be used in or out of sequence); this might make it flexible in developing-country contexts.

Multiview as variously described (Wood-Harper, Antill and Avison 1985; Avison and Fitzgerald 1988; Wood-Harper 1989; Bell and Wood-Harper 1992) comprises a five-stage methodology with component parts ranging from the soft to the hard. To the extent that these parts are used in an integrated fashion, the approach is eclectic. Figure 2.7 shows Multiview as set out by Avison and Wood-Harper (1990). The five aspects can be described as follows:

1 Analyse `Human Activity System' (HAS) This component is derived from Checkland's work on soft systems methodology (Checkland 1981, Checkland and Scholes 1990a). The HAS is in turn composed of three core items. The first, the rich picture, is devised to show the principal human, social and cultural activities at work in the perceived environment.

The rich picture usually includes the structures and processes at work in an organisation. The second element is the root definition, which, by identifying the key clients, actors, things to be done, assumptions, problem owners and environments, attempts to structure the results of the rich-picture analysis into a common perception by analyst and clients (sometimes known as 'stakeholders') of 'what we can do about the problem'. The conceptual model is the third element. This model is used as a simplification of the key tasks and areas involved in the new improved information system. The conceptual model is an outline of the proposed system.

2 Information modelling The second stage of the analysis is information modelling. In this stage the analyst adopts a more hard and technical approach. the aim of this stage is to develop the conceptual model,defind as an idea which requires structuring, into a workable system. Information modelling attempts to draw together the major entities, the functions of these entities, the events which trigger the functions and the attributes of the entities.

This stage is necessary in order to translate the key points identified in the conceptual model into a set of human and computer-related functions and entities which can be designed into a new system.

3 Social and technical requirements The third stage requires the analyst to attempt to bring together the optimum mix of social (human resources) and technical (information technology, other technology) aspects, taking into account costs and constraints. Here the costs and constraints of the key hardware and identified human alternatives are integrated. This stage should provide the appropriate mix of technology and person power to implement the system outlined in stage 2. The approach is closely related to the work carried out by Mumf ord in the ETHICS methodology briefly described on page 28 (see for example Mumf ord and Weir 1979).

4 Human/Computer Interface The fourth stage deals with the human/ computer interface (HCI). This involves designing the means by which the two aspects of the proposed information system (human being and technology) can best communicate with each other. This stage is usually concerned primarily with the technical interface operating through screen dialogues, but the social impact of technology in the workplace and issues of data security can also be included here.

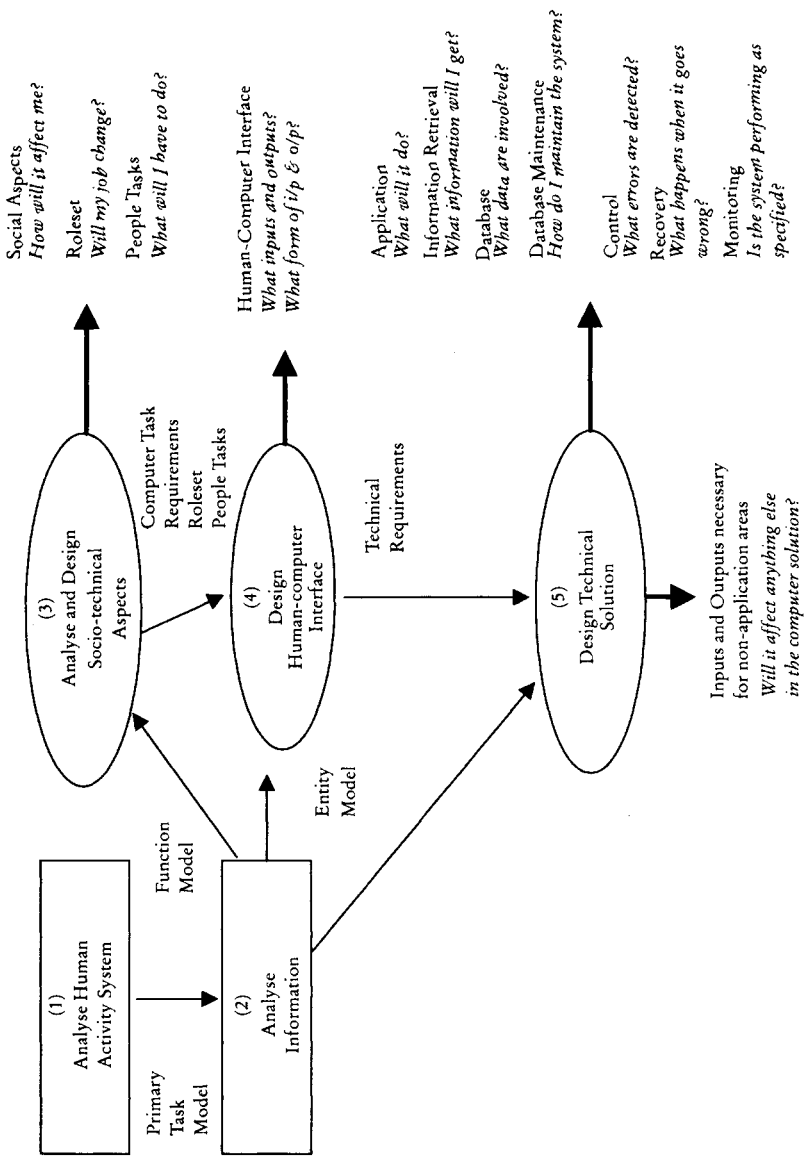


Figure 2.7 Multiview

soures: Adapted from wood-Harper 1989,p.83

5 Technical solution The fifth and last stage involves the design of the necessary technical aspects which combine to produce the overall technical structure. These aspects include management and control, database, retrieval and application. The major technical aspects shown in Figure 2.8 are arguably the core of any information system.

The various aspects of the technical solution can be described as follows. The *applications* aspect deals with transactions within the computer (updating records, gathering data elements for print-out). *Retrieval* focuses

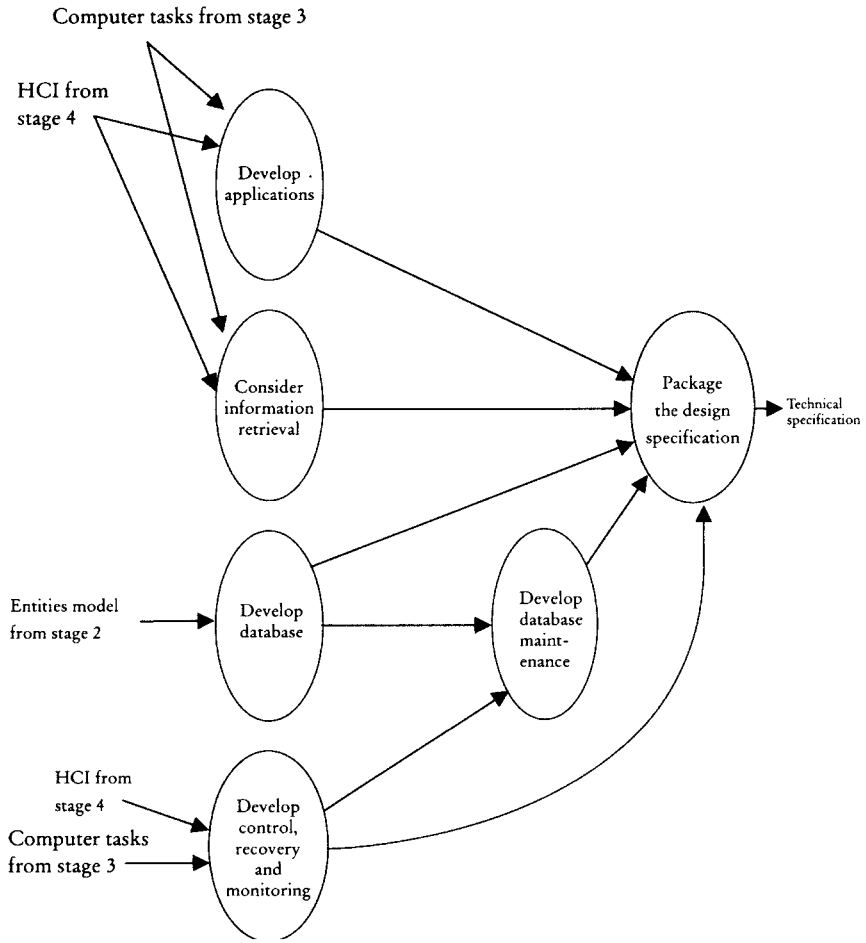


Figure 2.8 Multiview's technical aspects

Source: Adapted from Avison and Wood-Harper 1990, p. 200

on the output from the system. The *database* is the core structure containing entities of the computer system. *Maintenance* deals with such activities as inserting, editing and deleting records. *Control and recovery* is concerned with the overall information system process within the organisation context. Finally, *monitoring* deals with the effective performance of the system and ensuring that lessons are learnt.

Multiview appears to be complete in terms of offering a wide range of tools and techniques for analysis and design, but its wide-ranging structure might prove to be difficult to apply in practice. The complexity of Multiview requires the analyst to develop skills in undertaking all the various 'views'. The Multiview approach has been criticised by Jackson (1992) who argues that Multiview does not offer a linkage of soft and hard approaches in an eclectic whole ('complementarism' of different methodologies in Jackson's terminology) because: '"soft" rationalities can only be distorted by the expectation that they will lead to a more structured intervention, and "hard" rationalities distorted because they operate in an hermeneutic climate' (Jackson 1992, p. 90). In response to this argument it has been attested by Wood-Harper that Multiview is a

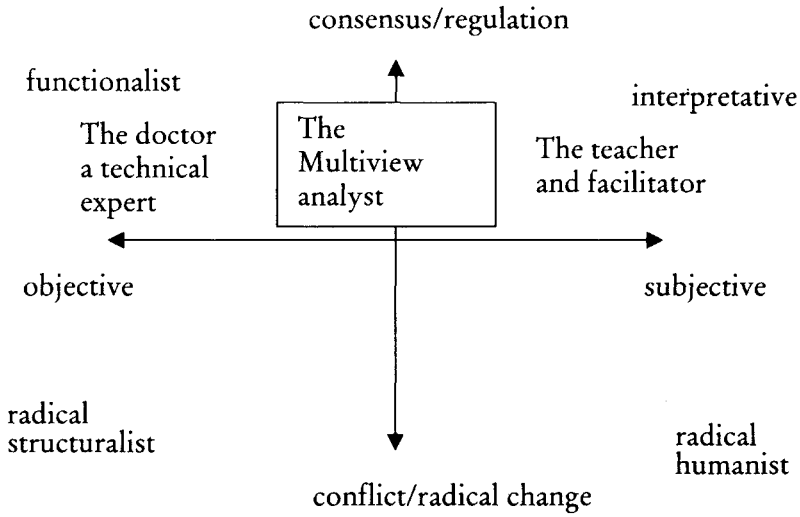


Figure 2.9 The Multiview analyst

practical tool, and that practice demonstrates the capacity of the various tools to work together[2]. The present research explores the question of Multiview's value.

The analyst

Avison and Wood-Harper argue that Multiview requires 'both technically orientated analysts and human/socially orientated analysts' (Avison and Wood-Harper 1990, p. 14). The role of the Multiview analyst is to assess which tools should be used, and in what order in the problem context. The analyst can be as deterministic in driving the analysis and design as in SSADM, or as facilitating and participatory as with ETHICS. Either way the analyst's role includes that of selecting the mix of hard and soft analysis and of design tools available in the full methodology.

If we adopt the Burrell and Morgan (1979) model as introduced in Figure 2.3, the analyst is situated somewhere between the objective and the subjective as shown in Figure 2.9. Questions arising from this include: how able is the analyst to change his or her approach to a problem, and how easily can one

Table 2.4 The Multiview perspective

social forces	human resources	change
conservative	organisation resources	equilibrium

balance the soft and hard tools to hand? If we look at the appropriate cells of Table 2.1 (see Table 2.4) it seems that the analyst has to accommodate a range of views . How capable are analysts of making highly personal alterations in emphasis and focus? In Table 2.4 the range is narrowed by the removal of the mechanistic approach, but the range of possible conflicting views is still large. These questions will be addressed in more depth in Chapters 4, 5, 6 and 7.

The context

Multiview does not just require exceptional versatility from the analyst. Its structure encourages the belief that it can deal with complexity and variety in the problem context. It attempts to merge the strengths of hard approaches (objectivity, rigour, quantitative measures of performance) with those of the soft method (flexibility, robustness, qualitative issues).

By virtue of its eclectic 'views' Multiview is intended to overcome the weaknesses of an exclusively hard or soft approach. The five stages can be used with changing emphasis depending upon the needs of the situation. Situation-specific use of methodology is the benefit which Multiview is intended to provide. The action-research field studies in Chapters 5, 6 and 7 examine this claim.

Conclusion to the review of the approaches

The purpose of the foregoing section has been to introduce hard, soft and eclectic views of systems. The flexibility of the eclectic approach suggests that this might be a useful way of planning information systems in the developing-country context. The analyst has a critical role in the selection of the method or approach to be used (pp. 30–34). At the root of this critical role are the assumptions which the analyst brings to the problem context. The assumptions bring together generalisations derived from the trinities of approaches outlined in Chapter 1:

Systems approaches	*Development approaches*
Soft	Political
Structured	Planning
Functionalist	Historical

The view subscribed to, for example 'I see development as a process requiringaccurate planning and therefore structured intervention', or 'I see development as a political process requiring a mechanistic approach', will be highly influential in determining the type of analysis and design subscribed to. Although the examples given here are simplified, they introduce the importance to analysis and design of understanding the *analyst*. This is a point which will be returned to throughout this book.

The next aspect of background to review is the experience of other forms of planning- and technology-related analysis in the context of developing countries. This will cast light on the problems which analysis and design methods might be expected to encounter.

DEVELOPING COUNTRIES AND PLANNING TOOLS

The problems of professional approaches in relation to technology products in developing countries are well documented (see for example Biggs 1982). Among the best documented areas is agricultural research, and this might provide valuable insights for the design of information systems.

The experience of the agricultural research systems

A major theme of Biggs (see Biggs 1989b, 1990; and Biggs and Farrington 1990) relates to the observation that research scientists working on agricultural research stations in developing countries are remote from the user community, i.e. the local farmers who are supposed to be the major recipients of their work. There is a detailed history of research based on agricultural research stations being misdirected and misapplied. Biggs

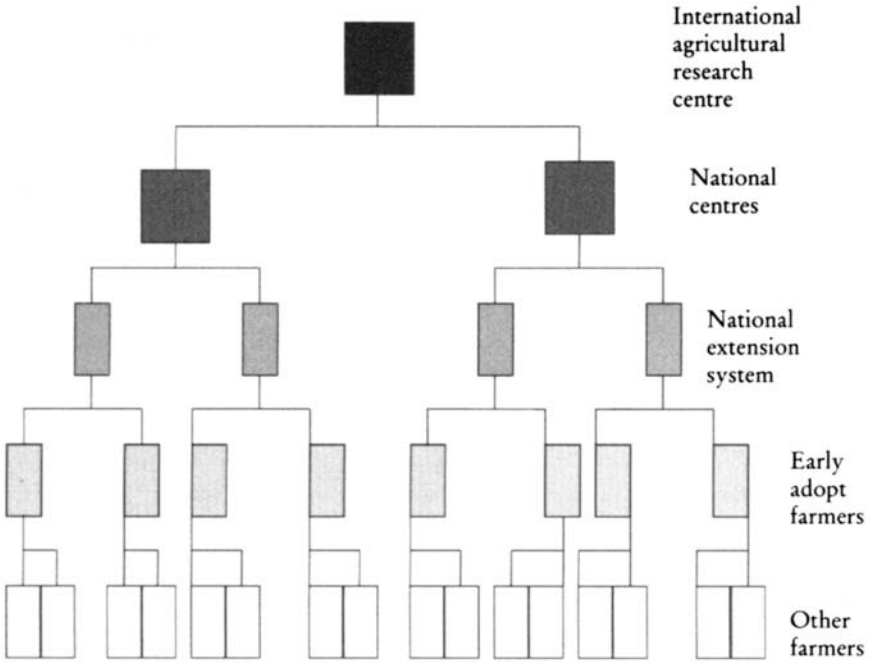


Figure 2.10 The hierarchical structure of central source of innovation model

Source: Adapted from Biggs 1989a, p. 53

argues that this is because scientists base their work on professional assumptions about problems rather than on problems actually faced by farmers (see also Richards 1979) and on how farmers have dealt and are dealing with them. In ascertaining why much research-station-based technology is not successful with local farmers, Biggs addresses two issues: first, the process of technology adoption and questions relating to the value of experts' work when divorced from local needs and aspirations; and second, the capability and willingness of farmers to make use of 'solutions' not tested and improved by themselves. The core of this work refers to two apparently opposed views of the process of technology adoption. Biggs has called the two approaches 'Central Source of Innovation' and 'Multiple Sources of Innovation'.

Figure 2.10 demonstrates the normal form of a Central Source of Innovation approach. This is a traditional form of hierarchical distribution of knowledge; it is top-down and embodies the implicit belief that information and good knowledge are distributed downwards (farmers are at the bottom of the model). Following his research Biggs (also see Richards 1979) countered this approach with the Multiple Sources of Innovation model (see Figure 2.11). This model shows that over a thirty-year period at the International Rice Research Institute (IRRI) sources of innovation have been drawn from both formal (e.g. research-station results) and informal (e.g. indigenous knowledge) channels. The thickness of the arrows indicates the relative influence of the innovation source. Biggs's model would imply that informal research diffusion capability, including farmers doing their own research, is as important in terms of innovation diffusion as that derived from the work of the IRRI itself although it was not recognised by the IRRI to be of such importance. The multiple sources of innovation model contradicts some of the basic assumptions of the central source model, which sees innovation as flowing downward within organisations rather than as

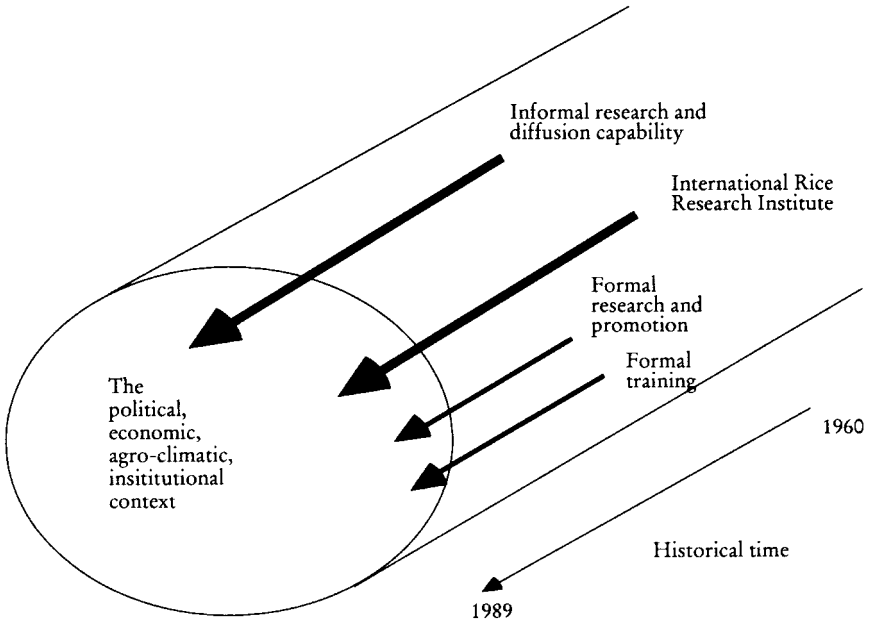


Figure 2.11 The multiple sources of innovation model

Source: Adapted from Biggs 1989a, p. 54

informally percolating from a wide range of sources, and which Biggs argues is generally adopted by the scientific community. Richards (1979) went further in his work, in demonstrating the value of what he called 'People's science'; here he extolled the superiority of local communities' evaluations of problems to those of 'experts' brought in for short periods. (For a fuller argument concerning the types and values of research and consultancy inputs in rural development see Chambers 1981.)

Lessons to be learned

From Biggs's work we can draw some conclusions which reflect directly on the work in hand:

- The Biggs and Richards experience indicates (from the traditional central model) that most technocratic development work is top down.
- This approach tends to minimise the importance of local people and the value of their participation.
- This tendency leads to problems in development work especially in making technology solutions work in practice.
- The multiple model in contrast works from both the bottom up and the top down; it implicitly values the participation of local people, which if encouraged may improve the adoption of technology because such technology is locally specified and its purpose is defined by users.
- This suggests that it is especially important for information systems analysis and design to draw on multiple sources of innovation and to be participative.
- The need for a multiple sources of innovation type approach in analysis and design strengthens the argument for the use of eclectic methodologies which focus on soft and hard issues.

The research perspective adopted in this book is further developed by certain key issues derived from Biggs:

- Local people should be explicitly involved in research practice to provide a rich 'multiple' source of innovative ideas (this pro-participation view is linked with the view of Checkland and Scholes 1990a).
- Both formal and informal channels of change and development should be investigated in the research process. This supports the soft approach and also the work of Kling (1987) in systems work. Kling argued in terms very similar to Biggs's central and multiple sources of innovation models that systems are more successful if based on 'web' modelling which incorporates formal and informal information sources rather than the traditional 'discrete entity' approach which focuses on a narrow band of technical features.
- There is a need to maintain flexibility in both the approach and the application of scientific methodology (this supports the case for eclecticism in methodology, a point also to be developed in the next section, on the Rapid Rural Appraisal method).

In terms of the Burrell and Morgan (1979) model, the agricultural scientists, as discussed by Biggs, appear to conform to the expected behaviour of the quadrant relating to objectivity and consensus regulation. Similarly the focuses appear to be technical systems and narrow mechanical assumptions of success. Significantly this is characteristic of the hard approach as set out on pages 34–37. The problems which this type of approach encounters can be taken into account in the development of an approach to analysis and design, as will be reflected in Chapters 4, 5, 6 and 7.

Biggs noted that research in developing countries needs to be people centred and capable of adaptation in context. One attempt to express these ideas in terms of planning in developing countries was developed as the Rapid Rural Appraisal method, by Robert Chambers (1981).

Rapid Rural Appraisal

The Rapid Rural Appraisal approach is focused on the needs of the context in which planning and analysis takes place. The value of this approach to information-systems development in the developing world is summed up by Lind (1991):

> The way to more effective computer usage must start here, with the development of models that reflect local needs and conditions. This development must be based on reality rather than on foreign models as long as the foreign models do not correspond with actual reality and, in particular, as reality tends to be set aside as soon as formal theory is adopted.
>
> (Lind 1991, pp. 156–157)

The point made by Lind indicates the need for planning tools which are appropriate to the reality of developing country environments. The selection of planning tools has a long history. Possibly one of the most common approaches used in developing countries is in fact Chambers's Rapid Rural Appraisal (Chambers 1981, 1992). Chambers's approach is much debated among the development community (see for example Belshaw 1979; Biggs 1980, Carruthers and Chambers 1981; Conway 1987, Grandstaff and Grandstaff 1985) but nevertheless it can be used as an interesting point of comparison in understanding information-systems planning in developing countries. The Rapid Rural Appraisal approach was developed in the light of observed problems encountered in existing appraisal. Chambers refers to three possible forms of appraisal.

The 'quick and dirty' form, also known as 'development tourism', involves a brief visit which can be useful but can also be the cause of various biases (Chambers 1981, p. 96). The second approach is 'long and dirty'. Chambers refers to this in the following terms:

> Social anthropologists perpetuate their ritual immersion in alien cultures; sociologists and agricultural economists plan and perpetuate huge questionnaire surveys…generating huge mounds of data and papers which are likely to be an embarrassment to all until white ants or paper shredders clean things up.
>
> (Chambers 1981, p. 98)

The problem of over-lengthy and over-detailed approaches to planning will be shown (in the case studies in Chapter 5) to be a feature which rural development planning shares with much analysis and design work. In Chapter 1 it was noted that many methods take six months and more to complete. The third approach, which is the basis of Rapid Rural Appraisal, is 'fairly quick and fairly clean'. This requires the planner to ignore the 'hegemony of the statisticians', and to focus on the twin issues of 'optimal ignorance' and 'proportionate accuracy'. This in turn shows a tacit recognition of the fallibility of methods and the need to compromise in terms of acceptable levels of ignorance. The Chambers approach focuses on qualitative and quantitative information (hard and soft) but in the context of time available.

Lessons to be learned

The principles of the Rapid approach are expected by Chambers to overcome (in part at least) the difficulty of limited time for the planning process. Furthermore, the approach has five principles which are intended to remove bias or selectivity of view on the part of the planner. These are:

- Optimise trade offs ('relating the cost of learning to the useful truth of information').
- Offset biases (listening not lecturing).
- Make use of triangulation (variety of methods applied to double- and triple-check information—providing a *multitude* of *views* of the context).
- Attempt to operate by learning with people.
- Involve people in learning rapidly and progressively.

Thus the Rapid approach is similar in some respects to the eclectic systems-analysis approach set out on pages 27–28, in particular in the focus on a number of triangulated views (multi-views?) of contexts and on the need for participation. In Chapter 5 it will be argued that further adaptations can be made to such analysis and design approaches as Multiview, assimilating them to the rapid and participatory approach indicated by Chambers (1992).

Chambers's approach arose as a consequence of the perceived weaknesses of lengthy and detailed quantitative and qualitative studies undertaken in developing countries. These studies were thorough in themselves and were carried out correctly in terms of the relevant research requirements, but, because of the time taken in their production and the detail included in their findings they were in fact often ignored by those for whom they were produced. The Rapid Rural Appraisal (which could be referred to as a 'minimalist' tendency in planning terms) is highly relevant to the planning of information systems. Another issue, further developed in Chapters 4 and 5, is that the Rapid approach is based upon the understanding that a range of

views can be successfully embodied in a single planning framework and that these views can be integrated within a limited time through applying Chambers's five principles.

SUMMARY

The above sections have developed some of the issues outlined in Chapter 1 specifically related to different types of systems approaches to problem solving. In the first section systems approaches were reviewed. In the second section previous experiences of work undertaken in the developing world of technocratic change and planning were discussed. Lessons so far indicate that:

- Hard and soft methods have their benefits and weaknesses. Both deal with complexity as they themselves define it. Both approaches contain associated assumptions.
- The Multiview eclectic approach attempts to integrate the perceptions of hard and soft but it requires a degree of flexibility on the part of the analyst's assumptions which in itself may pose problems for impartial analysis and design.
- In the past, technocratic approaches to agricultural research in the developing countries have been associated with problems which might be replicated in technocratic approaches to systems development.
- Previous planning tools have often appeared to be either verging on tourism or overly detailed. A Rapid Rural Appraisal approach has been proposed. This may again be a valuable lesson for systems planning in the resource-poor context of many developing countries.

The next section examines the literature on systems approaches to information-systems development in developing nations with a view to seeing whether it supports the conclusions from the survey, in the first two sections of this chapter, of systems approaches and of planning and technical change in developing countries.

REVIEW OF PRACTICE IN ANALYSIS AND DESIGN IN THE DEVELOPING COUNTRIES

One of the major problems for the research presented in this book has been the lack of literature on the subject of information-systems development in developing countries. So far this chapter has reviewed approaches to systems and to development, and the critical factor of the analyst and his or her subjective preferences in the selection of method. The questions addressed in this section are:

- Who does analysis and design for information systems in the developing countries?
- Who pays for the analysis and design and what is their interest in the process?
- Who benefits from the analysis and design?

To attempt to answer these questions two lines of enquiry were followed: first, an on-line review of a wide range of literature sources; and second a review of available literature not covered by the databases.

On-line search: analysis and design in developing countries

An on-line search (1991) produced a short list of only fifty items (from several million). Only six of them were found to deal explicitly with the core subject (systems analysis in developing countries). The other forty-four

related to agricultural systems. Of the six, only three were relevant in terms of reflecting the issues which such analysis and design yields, and of the three none were concerned with problems of adoption from the perspective of the developing countries themselves. In conclusion the search was not of value to the discussion engaged on in this book. Further, the search indicated a dearth of literature in journals on the subject of analysis and design in developing countries. Some of the reasons for this are dealt with in the next section.

Available literature

The majority of literature on the topics sought so unsuccessfully by the online search appears to reside in grey or 'fugitive' forms (see Posnett 1980 and Posnett and Baulkwill 1982) such as conference and seminar reports, consultancy reports and in-country studies not published internationally.

Posnett has argued that this type of non-conventional literature is often the key to understanding complex development issues but it is often either difficult and costly (in-country studies) or impossible (consultancy reports) to discover. This is thought to be a major reason for the lack of quantity and quality yielded by the literature review.

The following review focuses on the work of one group in particular: the International Federation for Information Processing (IFIP) Working Group 9.4. This group has organised a number of conferences directly related to social issues in computer adoption in developing countries and has published their proceedings.

Issues addressed in the literature

The first area reviewed was at the policy level in respect of computer adoption. A keynote to almost all the methodology-orientated papers reviewed is summed up by Bhatnagar (1990):

> In exploiting IT for a social impact there is some part of technology that developing countries can borrow rather than reinvent (for example sophisticated hardware and low level software), and some aspects of technology which must be adapted to local cultural environment (for example methodology and approach to MIS design).
>
> (Bhatnagar 1990, p. 11)

The need for methodology to be culturally sensitive, to take into account local factors, is repeated in other texts (e.g. Mohan *et al.* 1990, Robey, *et al.* 1990, Walsham *et al.* 1990, and Davies and Wood-Harper 1990). At the time of the IFIP 1992 Conference the same aspects are highlighted (for example in the papers by Walsham 1992, Neko 1992, Rykegham 1992 and Avgerou and Land 1992). Walsham does indicate some practical measures for helping to make large-scale systems more effective in developing countries through decentralisation (although some of his casework is drawn from the United Kingdom), and Avgerou and Land indicate that the soft approaches of Checkland and Mumford might be appropriate in developing awareness of local issues. Korpela (1994) is unique in attempting to understand how and why computer professionals work as they do in developing countries.

The papers indicate that a great deal of the investment for computers in developing countries comes from outside donors, but that this is linked to a growing interest in investment (specifically in small systems) by the governments of such countries. A further observation arising from the literature is that a comparatively high percentage of the available literature is about high-level information-technology policy. The same

degree of concern is not shown at a lower level in relation to actual methods and techniques to transform policy into practice. This theme is further developed in the next section.

System-specific issues

In the context of specific systems there is very little in the literature to point to constructive ways forward. Madon (1992) indicates that top-down approaches to systems planning are highly problematic, as they reinforce existing power structures. Jain (1992) indicates that there is a lack of planning guidelines of any kind for informations-systems projects. Mansaray (1992) echoes the observations of Shitima (1990) relating to problems of hardware acquisition as well as access to systems professionals of any description.

Of the country-specific case studies which exist (e.g. Shitima 1990, Okuwoga 1990, Quarshie 1990, Siddik 1990, and Correa 1990) there is no descriptive detail relating to the types of systems methodology applied and no critiques of such approaches. Most of the papers indicate that the recipients of systems are largely public-sector agencies and that most experience problems with the technology, with respect either to the effectiveness of new systems or the capacity of DC institutions to continue to support them once installed. Cyranek notes:

> An examination of the African Experience with IT projects reveals many devastating failures…. Among the reasons for these failures are:
>
> - The realisation half-way through project implementation that the projects are not technically feasible.
> - The application of IT to automate functions which should not be automated given the organisational context.
> - The application of IT without adequate staff training.
> - The new systems rely on software which is not readily available in Africa.
>
> (Cyranek 1992, p. 11)

These observations indicate the need for effective planning in the first place.

The most methodology-focused paper presented at the 1992 IFIP Conference was that produced by Waema and Rodriguez (1992). This looked at the issue of an admissions software application for the universities of Kenya. The analysts made use of structuration theory, as developed by Giddens (1984) as a means to integrate social and technical issues within the organisational context. Although the paper presented the first social, structuration element and the second system-specification element as discrete aspects and did not tie them together, the authors indicated the need to bring the two together, and this gives some support for the use of more eclectic methodologies. In line with the concern over the integration of social and technical issues, the work of Lind (1991) is instructive. Lind was working at the E1 NASR Automotive Manufacturing Company (NASCO) in Egypt, and his book is as much a study of industrialisation as of computerisation. He does note the importance of uncertainty as a fact of life in organisation decision making in developing countries, and the problems which Western practitioners can have when dealing with complex developing country situations. His conclusion following the application of Western, hard modelling techniques for NASCO, is that any development (including the development of information systems) has to be based on models which correspond with actual reality.

Overall the available literature does indicate certain strong themes:

- the need for social and technical themes to be encompassed by methodology
- the problems of top-down approaches
- the potential of existing eclectic approaches
- the need for models to correspond to DC realities.

Further work, such as that by Avgerou and Land (1992), indicates an interest in appropriate technology and appropriate methodology. Their research suggests that, in the search for systems and their effective planning, the donor and the recipient need to share one view of the proposed changes to be brought about. The nature of change needs to be agreed and needs to be appropriate to the capacities of the receiving institution.

CONCLUSIONS OF THE REVIEW

The literature review indicates a considerable degree of interest in high-level policy concerns for information-system adoption in developing countries but less concern for the specifics of analysis and design methodology, although some of the more recent literature does refer to the appropriateness of methodology. Points highlighted earlier and re-emphasised here include:

- Planning and developing systems for developing countries has been a difficult process.
- The minimal literature available gives some indication that linked soft/hard approaches may be relevant.

SUMMARY OF THE ARGUMENT SO FAR

Chapter 1 introduced some of the major themes of development and information systems. Chapter 2 has focused on such key issues as:

- What are the appropriate approaches to dealing with uncertainty and risk? This matter was dealt with by observing the capacity of different approaches to deal with complexity. The indication at this stage is that soft and hard approaches each deal with complexity at a different level. Each is important; each has value; the vital issue is the context in which they are applied.
- How has complexity been dealt with in the past? The experience of both the agricultural research institutes and the rural planners is reviewed. Experience here indicates, on the one hand, that methods need to take into account formal and informal aspects, and, on the other, that lengthy methods need to be cut down to manageable proportions. Rapid Rural Appraisal offers some insights into potential analysis and design procedures.
- The existing literature firmly sets current interest at the level of policy formulation rather than actual planning. The limited amount of literature which deals with analysis and design does show some interest in eclecticism.
- How are methods selected by analysts? The answer to this still seems vague. Evidence from the hard and soft review on pages 30–39, in relation to the perceptions set out in Chapter 1, would appear to indicate that subjective preference towards certain views of systems (technological or social) and development situations (e.g. viewed as social planning situations or political contexts) will have an impact upon what decision is finally made. In short the methodology selection process is far from being a clear-cut or objective process.

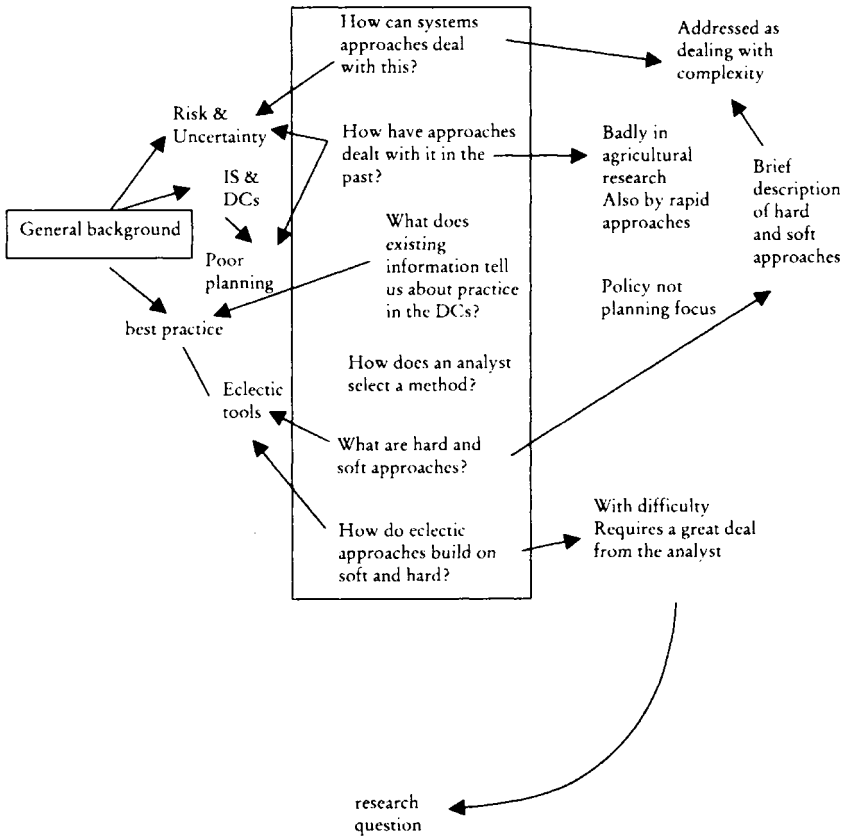


Figure 2.12 The development of the discussion

- The eclectic approaches (such as Multiview and ETHICS) briefly described in Chapter 1 and developed in this chapter do offer hard and soft combinations of methodology tools but require considerable flexibility and analytical honesty (in being able to apply and integrate the various tools) from the analyst.

Figure 2.12 summarises the development of ideas in this chapter in relation to the questions posed in Figure 2.1.

The literature review seems to confirm the existence of the types of problem which were outlined in Chapter 1. To test this further a research question is set out in Chapter 3 and related to a research approach to fieldwork in Chapter 4.

Part II

THE QUESTION AND THE APPROACH

3
THE QUESTION FOR THIS BOOK

This chapter sets out the research question which was tested in the fieldwork reported in Chapters 5, 6 and 7.

BACKGROUND TO THE QUESTION

So far three core themes have recurred in relation to the application of analysis and design techniques in the developing countries:

- the context in which analysis and design takes place
- the method and/or methodology adopted for the analysis and design
- the predispositions and views of the analyst who undertakes the analysis and design.

The elements of the main research question relate to these three themes; they are developed below in terms of context, method and analyst-based elements.

Context-based element 1: computer export Information technology is increasingly being exported to the developing countries, partly in relation to aid programmes related to structural adjustment. The section on technology transfer in Chapter 1 presented evidence from the literature from developing countries and the ITP survey in particular which indicates that this export is continuing to expand.

Context-based element 2: risk and uncertainty The environment in developing countries contains high levels of risk and uncertainty for technology adoption. The Eres table (Table 1.2) provides a structured description of a wide range of factors which can pose problems for information systems. It was argued in Chapter 1 that these factors impart a particular degree of complexity to existing information-technology and information-systems issues in developing countries.

Method-based element 1: systems planning, rapid approaches From the evidence of the Overseas Development Administration (pp. 15–17) and a selection of the literature (pp. 52–54), it would appear that information systems are usually introduced without any planning and are not seen by the major aid donors as being worthy of a great deal of expense. One possible way forward in this regard, borrowed from the rural development planners, is the Rapid Rural Appraisal method. The features which this method shares with the themes of eclectic approaches to systems development (see below) suggest possibilities for integration.

Method-based element 2: eclectic analysis and design Chapters 1 and 2 (pp. 21–29 and 34–35) indicated that the prevailing tendency, in the United Kingdom at least, is towards hard approaches to analysis and design. These approaches tend to be insensitive to non-technical issues and require a great deal

of logistical effort and clarity over aims, objectives and data if they are to be implemented effectively. Previous planning experience, as set out in the section on Rapid Rural Appraisal (pp. 48–50), indicates that time is usually a scarce resource and that developing countries are rich in non-technical issues for new information systems. Such issues are an appropriate case for soft approaches. The eclectic approaches offer both technical precision and social sensitivity. Such approaches (typified, for example, by Multiview) appear to offer the potential for effective systems planning in developing countries.

Analyst-based element 1: analysis and design practitioners In Chapters 1 and 2 (pp. 26 and 34–37) it was argued that many analyst/designers are very technical in their outlook. A technical outlook in itself imposes a specific range of constraints on the manner in which complexity, particularly complexity relating to soft factors, is perceived and dealt with. The proliferation of non-technical issues in developing countries has been discussed in Chapters 1 and 2. The question then arises of whether planners who are technically focused can make adequate provision for new systems in developing countries. This issue is closely linked to that of eclectic approaches discussed above.

Analyst-based element 2: traditional planning in developing countries Chapter 2 (pp. 48–50) indicated that planning in general has a chequered record in developing countries; certain themes which may be of use to analysis and design are, however, discernible. In particular the principles of Rapid Rural Appraisal seem appropriate for evaluation in this context. Of the analysis and design approaches reviewed so far, Multiview appears to have some affinity with Rapid Rural Appraisal (as noted in Chapter 2).

THE QUESTION FOR INVESTIGATION

Given the above, the two most significant elements are:

- the potential value of the use of eclectic methodology
- the possibility of applying it by building on the Rapid Rural Appraisal form.

If we accept the premise that systems in developing countries do need analysis and design the research question can be formulated in these terms:

> ‘Is a flexible, eclectic systems analysis and design tool such as Multiview an appropriate planning and development methodology for introducing information systems into developing countries?’

Specific questions derived from this formulation include:

- Are analysts able to cope with the range of hard and soft tools within Multiview?
- Can Multiview be used so as to promote participation and involve users in the planning process?
- Can Multiview be adapted to take an approach similar to that of Rapid Rural Appraisal in situations where only a short time is available for analysis and design?
- Can Multiview produce sound analysis and design?

The next chapters are devoted to testing the research question and eliciting key themes for developing a relevant methodology in the light of the experience of the fieldwork.

SUMMARY

Part I of this book has considered a range of systems and development issues which impinge upon the process of analysis and design. Analysis has produced a short list of elements of importance and these in turn have focused attention on an application of one type of eclectic methodology: Multiview. Previous experience in the developing countries indicates that, for many forms of planning, methodologies need to be capable of rapid application. In the fieldwork described in the next chapters the ideas behind the Rapid Rural Appraisal approach are tested.

The remainder of Part II will be devoted to a discussion of the research approach to be used in the following fieldwork.

4
SELECTING THE RESEARCH APPROACH

This chapter discusses various research approaches which are available for testing the question set out in Chapter 3 and examines their respective values in general terms. Leading on from this, an action research framework is established, within which the Multiview methodology, as detailed in Chapter 2, will be applied. Chapters 1 and 2 discussed the importance of the analyst as part of the research process. This chapter introduces a self-analysis tool which provides information on how the researcher has arrived at the current situation and the types of prejudices and assumptions which he or she may bring into the research context. It is argued that these factors are important in understanding the nature of analysis and design undertaken in the field, and they are shown to be valuable in developing and modifying the researcher's approach. The self-analysis tool is developed in the course of Chapters 5, 6 and 7 and evaluated in Chapter 8.

APPROACHES TO RESEARCH: REDUCTIONISM AND HOLISM

The purpose of this chapter is to set out the nature and value of the research approach used in the fieldwork. Understanding and applying research techniques within a research approach is important for the main task of defining, developing and implementing working information systems. Setting up an information system requires the analyst to undertake research. Research skills are needed in order to understand problems, deduce the strengths and weaknesses of the environment, plan a new system and test it prior to implementation.

The term 'research' means 'to search, examine or study with diligence or care' *(Webster's New International Dictionary)*. The assessment of research approaches has been an undervalued element in research on information systems development in the past. Galliers (1992) has stressed its importance, noting that 'The state of much information systems research has been criticised from the perspective of the almost unthinking use of a particular approach that happens to have been found favour in one's research institution' (Galliers 1992, p. 162).

Unless the research approach is considered for each separate research context, the resulting analysis risks being poorly formulated. Many different methods are available for research into the application of systems analysis and design (see Douglas 1976, Galliers 1985, and Wood-Harper 1989, pp. 161–176). The methods all have their own strengths and weaknesses. They vary along the lines of the research approach and training of the individuals who produced them, and therefore differ in their implicit assumptions (see the discussion in Chapters 1 and 2 on development and information systems). Of key interest in the present context is the divide between, on the one hand, traditional science (the reductionist tradition) and, on the other, elements of

social science and the tradition of holism. Understanding the disciplines and requirements of these two broad schools of thought is fundamental to deciding the way research should be carried out.

Reductionism

Reductionism is the core of most of the 'hard' sciences and hard methodologies; it is centred on the philosophical teaching of positivism.

> All genuine human knowledge is contained within the boundaries of science. That is, the systematic study of phenomena and the explication of the laws embodied therein. Philosophy may still perform a useful function in explaining the scope and methods of science, pointing out the more general principles underlying specific scientific findings, and exploring the implications of science for human life. But it must abandon the claim to have any means of attaining knowledge not available to science.
>
> (Flew 1984, p. 283)

A reductionist approach rejects ideas about the reality and importance of 'unscientific' aspects of life (hunches, guesswork, instincts for rightness, and even in certain circumstances illogical activity, i.e. activity which is not consistent with narrow definitions of efficiency). The universe is seen through empiricism as fixed, knowable, measurable and, therefore, predictable. This may be a generalised definition of positivism but, in that it defines the way in which some practitioners view the world, it is arguably the traditional basis for much modern science and the structure of thinking behind many analysis and design methodologies.

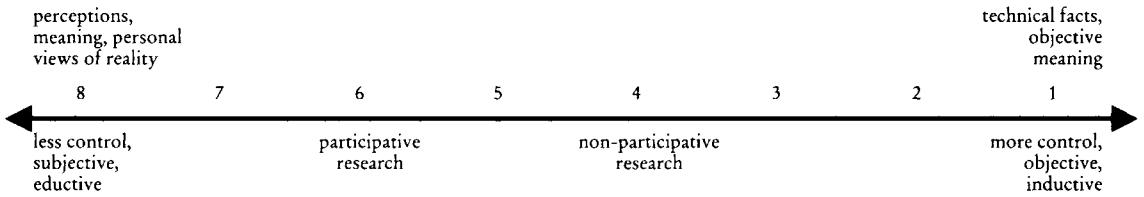
Reductionism operates by closing down the field of enquiry to a narrow, measurable range of variables. Traditionally this means that research must conform to principles of reducibility, refutability and repeatability (a potential problem for research in social, information-systems and development contexts as noted by Galliers 1985).

Holism and systemic approaches

Holism has been defined as 'the theory that the fundamental principle of the universe is the creation of wholes, i.e. complete and self-contained systems from the atom and the cell by evolution to the most complex forms of life and mind' *(Chambers Twentieth Century Dictionary)*.

The systemic approach has developed from ideas of holism as a means for modelling and diagnosing complex situations as wholes. The systemic approach, although also usually empirical in its nature, can be ill-defined and poorly structured both in the definition of problems and in application. Users of the systemic approach are involved in the subjective world of human activity. Central to the approach as used in systems analysis is the idea that forces outside narrow definitions of technical systems (e.g. social and political) will and must interfere with any technical information system because they are part of the same whole (as noted in the discussion of the three approaches to systems thinking in Chapter 1). The information-system planner will impose opinions and beliefs upon technically well-defined new systems which are being planned. The systemic view is often characterised by an interdisciplinary approach. Two of the analysis and design approaches which have been discussed illustrate holism in practice: Soft Systems Methodology (SSM) and ETHICS. Holistic approaches to research might therefore be expected to work well in investigations of the use of this type of approach.

Holism often appears to open up the field of research enquiry with its inherent bias towards the interconnectedness of wholes.



8 Action research	7 Phenomeno-logical research	6 Case studies	5 Surveys (opinion research)	4 Field experiment	3 Laboratory experiment	2 Mathematical modelling	1 Conceptual study
Scientist is part of the research. Reality is understood by linking theory to practice.	Focuses on understanding the essence of experience (Boland, 1985). Focuses on the context of research.	Examination of phenomena with no clear boundaries at the outset.	Sampling dependent upon judgement or convenience	Data collected on the behaviour of the independent variable. Dependent variables measured.	Manipulate independent variables. All 'noise' controlled.	All variables known. Therefore analysis reduced to a set of equations.	Armchair research

29

Figure 4.1 Research methods continuum

Source: Adapted from Wood-Harper 1989 and Douglas 1976, and building on Galliers 1985

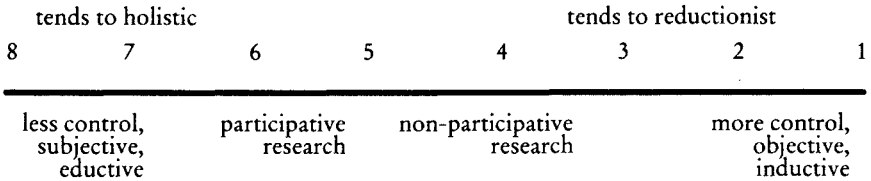


Figure 4.2 The basics of the continuum

A continuum of research approaches

Other authors (e.g. Douglas 1976, and Galliers 1985 and 1992) have attempted to include the two broad schools of approach to research in a single model. Figure 4.1 is a representation of this unified view or continuum. The continuum depicts eight points. The points may be differently labelled and there are other types of research approach which could be added:[1] however, the eight shown here should be sufficient to explain the argument which follows.

Although there are always exceptions to generalised rules, to the left the social-sciences-based approaches to research tend to predominate. Similarly, the natural-science approaches would tend to cluster to the right. All eight of the approaches shown here have salient features which make them different from all the others. Each has its own assumptions or worldview. This is an important point. The major salient features of the continuum are set out in Figure 4.2.

The assumptions of the methods to the right (numbers 1 to 4) of the continuum are broadly reductionist, being derived from natural sciences, and are focused (though not exclusively) on a controlled and controllable universe in which objective processes can lead to knowledge of all that it is needful to know. In contrast the assumptions of the approaches on the left (5 to 8) are based upon human nature, assume that there are very few fixed points upon which the researcher can depend, and often assume that nothing can be absolutely known. It should be noted as an exception to this rule that functionalist interpretations of the

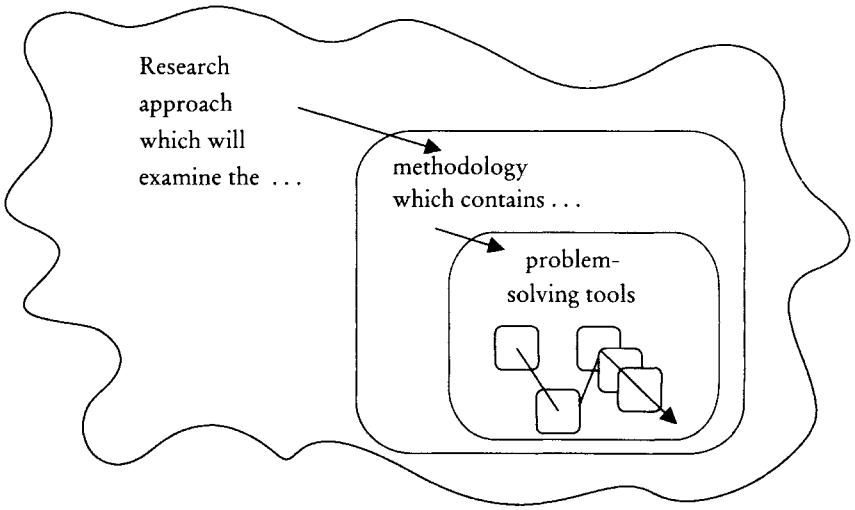


Figure 4.3 Research approach, methodology and problem-solving tools

social sciences would reject this point, and authors such as Kirk and Miller (1986, pp. 72–73) argue that reliability and validity can still be achieved by a process of invention, discovery, interpretation and explanation.

As applied here research requires the adoption of an overall framework or *approach* for the application of a *methodology* which in turn contains the *tools* which comprise the methodology (see Figure 4.3). Methodology ('the science of method or arrangement', Kirk and Miller 1986) should provide the logical and sequential structure for the application of tools in order to arrive at an understanding of the problem.

The selected research approach

In assessing research approaches it is useful to relate the positive aspects of the various approaches to the needs of the work in hand. The research approach adopted here is intended to be applicable in testing the research question set out in Chapter 3. From what has been seen in Chapters 1 and 2 the situation in developing countries is prone to a large number of vagaries and risks (in particular with regard to Table 1.2: Factors inhibiting information-technology transfer). This in turn means that the research approach needs to be flexible and able to cope with social as well as technical problems, and with unknown as well as known variables. To assess the variety of approaches, two separate but linked lines of analysis have been adopted. Wood-Harper (1989) in developing Multiview discussed the strengths and weaknesses of the eight research approaches set out in Figure 4.1 (Wood-Harper 1989, pp. 119–134). The work of Galliers (1985 and 1992) has many similarities to that of Wood-Harper and incorporates a review of the positive and negative features of different approaches. Table 4.1 presents the gist of the two reviews. The first observation to make is that all the approaches have strengths and weaknesses. The first four appear to be reductionist in tendency. Therefore they would offer objectivity where variables can be controlled. From the discussion relating to developing countries and systems analysis and design in Chapters 1 and 2 this would not seem to be a realistic expectation from this research. This point is noted in column 3 of the table and effectively rules out the first four approaches from further consideration.

The second four approaches demonstrate a certain amount of similarity, which indicates possible communality and homogeneity of techniques. Wood-Harper (1989) indicates links between action research and case studies, the former of which are seen by some as an element of the latter (Benbasat *et al*. 1987). With regard to phenomenology Wood-Harper argues that 'Its application may not be so much as an independent method but an approach to use in conjunction with other methods for example action research or case study' (Wood-Harper 1989, pp. 128–129). Concerning the less objective approaches to research, Galliers argues that 'the survey, descriptive/interpretive and action research approaches appear to have the widest applicability in information systems research' (Galliers 1992, pp. 160–161).

In 1989 Wood-Harper, building on the work of Galliers and Land (1987), argued that 'only action research fulfils the research requirements to understand the Multiview methodology in a practical situation' (Wood-Harper 1989, p. 133).

To further support this statement he later argued that action research was distinctive in being context-based and non-quantifiable; the researcher is actively involved in the context, goals are negotiated with the client group and insights drawn from research are context-dependent (Wood-Harper 1990).

Table 4.1 Research approaches: strengths, weaknesses and developing country context

Research approach	*Strengths*	*Weaknesses*	*Issues for research into systems analysis in developing countries*
1 Conceptual study	Repeatable process.	No on-site experimentation carried out. No measurement or observation.	Lack of clarity as to the rigours and uncertainties of the research site in question.
2 Mathematical modelling	Objectivity is high.	All independent and dependent variables must be known. No context is relevant to the results.	The risk and uncertainty of the context make it very hard to be sure of the variables, therefore objectivity might be a problem.
3 Laboratory experiment	Objectivity is high if the environment is effectively controlled. A small number of variables for intensive study.	Requires a controlled environment in which the impact of independent variables is measured on dependent variables.	As indicated in Chapter 1 and noted for mathematical modelling, risk and uncertainty make the issue of control problematic.
4 Field experiments	Interaction of subjective and objective elements less 'artificial/ sanitised than laboratory' (Galliers 1992, p. 150).	Potential bias in statistical inference because subjects are not randomly assigned to be tested.	The lack of homogeneity in the developing countries makes it difficult to draw statistical parallels between experiments.
5 Surveys	Easier to make generalisations. More variables can be studied. Low cost of questionnaire survey method.	No guarantee that respondents are those from whom a response is required. Non-response may bias results.	Difficulty in identifying likely stakeholders of a system without prior personal contact, therefore the need for approaches such as 6, 7 or 8.

Research Approach	*Strengths*	*Weaknesses*	*Issues for research into systems analysis in developing countries*
6 Case studies	Iterative approach to the fitting of research question to the situation being studied. Study can be undertaken in natural settings. Complexity of process can be studied.	Control of independent variables is weak. Interpretations highly subjective. Difficult to generalise between studies. High cost, low control.	There is a danger of subjectivity being expressed by the researcher but the researcher is not part of the research context. This is not such an issue for 8.
7 Phenomenology/ Hermeneutics	Subjective and objective are seen as two aspects of one whole. Concerned with the structure of meaning.	Subjective interpretation of prejudices. Difficult to make objective comparisons.	Possibly a problem will arise if there is little time for the researcher and the stakeholders in the context to arrive at shared meaning, see 8.
8 Action Research	Research part of the context. Links theory and practice.	Requires mutually acceptable ethical framework.	As with 7, a potential problem if time is not available in arriving at a shared ethical framework.

The basis of the approach is that it is context bound, and analysis and design also shows a high degree of contextual sensitivity (understanding context has been shown in Chapters 1 and 2 to be a critical factor in comprehending all forms of intervention in developing countries). A problem associated with action research is that it produces narrow learning that is appropriate only to specific context and non-generalisable. Wood-Harper (1989) argues that generalisable learning is possible, but that it must be carefully derived from context. Such learning can then be the basis for further development of the methodology. Given this proviso it could be argued that action research is appropriate for the development of information-systems methodology in developing countries because it has 'the characteristics of being problem centred, based on long-term involvement with clients and centred on the needs of those clients involved with following through and monitoring changes in the organisations in which they are working' (Warmington 1980, p. 24).

Figure 4.4 demonstrates the major components of an action-research approach as set against the situation which can prevail if the approach is wrongly applied or not applied. The Figure is based on the continuum in Figure 4.1.

The upper, action-research approach shows several important and useful themes:

- The analyst and the client for whom the system is being designed work together as a team—an important point if clients are remote from 'expert' guidance after implementation.
- Strategy is jointly agreed.
- Final policy is jointly undertaken.

Whilst it should not be inferred that any other approach would be fatally flawed, the non-action research model shows some of the range of problems which can arise if less emphasis is paid to the client than to a predetermined model of the problem (chiefly the imposition of assumed 'solutions' to problems).

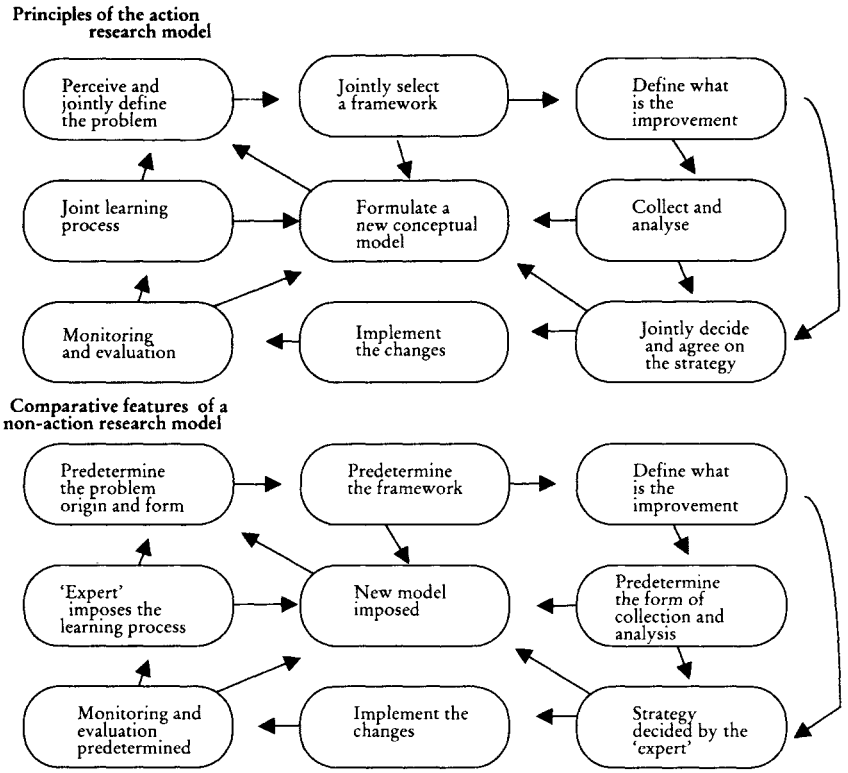


Figure 4.4 Action-research principles and non-action research

Source: Adapted form Warmington 1980, p. 27

The action-research approach has a number of positive aspects for fieldwork in developing countries. It allows the analyst to become involved with the stakeholders in the study organisations, a point of considerable importance if the information system is to be relevant to the local context. This reduces the possibility of alienating these stakeholders and/or missing vital organisational constraints which lie outside the narrow confines of the proposed information system. Action research is intended to provide 'a means by which people learn with and from each other by attempting to identify, and then implement, solutions to their problems/issues/opportunities' (Weil and McGill 1989, p. 117).

The intention of the approach is to encourage participation and experiential learning: 'Through participation, individuals can be actively involved in thinking, feeling and acting in relation to specific problems' (Keregero 1989, p. 196).

The action-research approach reflects some of the issues which have arisen in the development and information systems perspectives discussed in Chapters 1 and 2. In particular it provides for the degree of participation seen as being desirable in the Chambers approach (pp. 48–50). The problem of generalising results from action research will be discussed later, in particular in the description of three separate pieces of action-research fieldwork.

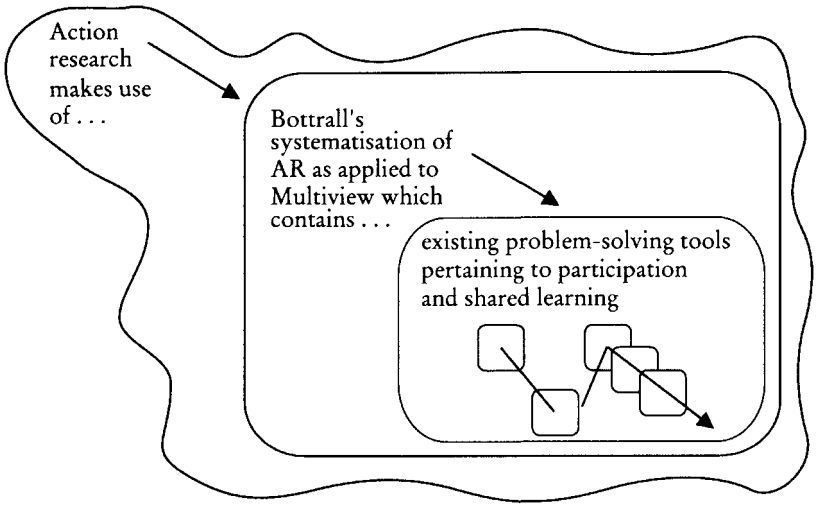


Figure 4.5 Research approach, methodology and problem-solving tools as applied

METHODOLOGY AND RESEARCH APPROACH

The purpose of the fieldwork was to investigate the use of the Multiview methodology in developing countries. The methodology by which Multiview is to be applied and examined conforms to Bottrall's (1982) systematisation of action research.[2] For Bottrall action research has five distinct phases:

1 *Diagnosis.* Research team to conduct independent, objective appraisal of client organisation's existing structure and management performance; subsequent joint discussion of findings between client and research team and agreement on definition of principal problems.
2 *Action planning.* Joint consideration of alternative courses of remedial action. Joint agreement on course of action to be followed.
3 *Action taking.* Client organisation to take agreed action; research team to stand back from action, monitoring client's decision making processes and their effects.
4 *Evaluation.* Research team to present evaluation of action programme to client for joint discussion.
5 *Specifying learning.* Client to extract lessons from evaluation of particular concern to itself (which may be fed back into further cycles of action planning, action taking and evaluation). Research team to extract lessons for general theory and for its application in action research programmes elsewhere.

(Bottrall 1982, pp.2–3)

This, as shown in Figure 4.5, is the framework used in the fieldwork. Occasions when divergence from it occurs are discussed as they arise.

The Multiview methodology

In Chapter 1 the Multiview methodology was introduced, initially under the heading of eclectic approaches (see pp. 27–29). In Chapter 2 hard and soft approaches were discussed and linked to existing experience of systems planning operations in the area of agricultural research in developing countries (pp. 45–48). Again

the Multiview approach was examined and links were made to experience in Rapid Rural Appraisal (see pp. 48–50). Chapter 3 presented the various aspects of the research question which pointed to Multiview as an appropriate analysis and design methodology for use in developing countries. The Multiview methodology will be examined within the overall action research approach set out by Bottrall. It should be noted, however, that Multiview itself is not an unchanging intellectual construction. Since the early work of Antill and Wood-Harper (1985) through to the more recent work of Avison and Wood-Harper (1990) Multiview has changed, so it is important to set out explicitly the form of Multiview adopted initially in this research fieldwork.

The proposed form of Multiview for the research

The version of Multiview adopted for the initial 1988 research work in the first study was that as set out primarily in Antill and Wood-Harper (1985) and Wood-Harper, Antill and Avison (1985). Essentially this is the form which is given in Chapter 2, but it should be recognised that at the time of the research the monitoring element was not developed beyond a narrow definition pertaining to the interior workings of a technical solution. In addition, the approach had not been investigated for application in environments outside the United Kingdom.

Given the wide range of views of systems and views of development as set out in Chapters 1 and 2, it was thought that the approach needed to be as flexible as possible without losing an essential logical structure. Part of the purpose of applying any method is to supply a tried and tested framework within which findings can be assessed in an objective manner. Without this there is a danger that research could ‘lose many of the practical benefits that a methodology is supposed to provide, such as common methods and improved control’ (Avison and Fitzgerald 1988, p. 305). It was anticipated that Multiview would be able to accommodate change and adaptation in the light of experience in whatever research context. An essential part of the research was therefore the development, adaptation and adoption of new elements in the Multiview methodology, without affecting its capacity as a framework for sound analysis and design.

Adaptations to Multiview

Chapters 5 and 6 will provide numerous examples of minor and major changes to the Multiview approach. This section identifies the areas which were thought to be most likely to require such adaptation, and introduces adaptations which were set up before the field research began. Four related areas for adaptation were identified:

1 The completeness of Multiview as a useful systems planning and development tool in developing countries
2 The analyst’s preferences
3 Experiential learning
4 Self ana lysis.

The completeness of Multiview

This refers to the use of Multiview as a systems-development as well as a systems-analysis and design tool. The question which confronted the researcher was will the role of the analyst be expected to stop with the design of a system? Given the lack of awareness of the problems of analysis and design revealed in the Overseas Development Administration meeting described in Chapter 1 (pp. 15–17) it is reasonable to expect that the methodology needs to be extended not only to design but also to implementation and post-implementation issues (e.g. monitoring and evaluation).

The analyst: subjective preference and self-analysis

Chapter 1 (pp. 7–11 and 22–25) went into some detail about the variety of perceptions which can arise in the mind of an individual working on analysis and design specifically in the developing-country context. Chapter 2 (pp. 34–44) developed the theme of these perceptions in relation to hard, soft and eclectic approaches. The analyst is a key issue in this research. Individual preference can have a considerable impact upon how development is perceived and upon methodology selection. Galliers (1985) argues that, from a hermeneutic perspective, researchers always undertake their research from a standpoint or bias of some kind: 'One's analysis must therefore contain an element of introspectivity' (Galliers 1985, p. 287). The application of Multiview in the fieldwork is therefore monitored at the level of the development of the analyst in order to indicate the manner in which both analysis and design and the analyst develop in the context of the fieldwork. In Chapter 8 this is shown to be the basis for a more fundamental appraisal of the way in which analyst and methodology are integrated in terms of a problem context. At this stage it is important to note that the issue of the subjectivity of the analyst is important but that (as with the core issue of analysis and design in the development context), the available literature is minimal.

To test the literature more fully on the issue of the analyst and self analysis, an on-line search was undertaken in 1991 using the DIALOG system and reviewing a large number of databases. Only four items were found, of which those by Sondak and Hatch (1982), Ferratt and Starke (1989) and Dimino (1984) were central to the research focus. These papers concentrated on issues of self-evaluation for students (Sondak and Hatch 1982), self-analysis in terms of systems analysts career transition (Ferratt and Starke 1989) and developing self-awareness in order to understand better the effect of the rigours of new consultancy (Dimino 1984). None was focused on what is the core issue here: that of developing empathy between the analyst and the subject of his or her analysis; and none was specifically concerned with experiential learning or user participation.

Systems analysis and experiential learning

One of the major features which has arisen from the review of methodological approaches is the importance and value of understanding what users want. This is particularly stressed in the participative, soft approaches and in Multiview. Participative approaches require that the results of experience be distributed to the group of stakeholders involved with the system. Weil and McGill (1989) argue that the range of interests encompassed by this technique are many:

> Experiential Learning includes the development of understanding of how emotions, fears anxieties, defences, values and attitudes influence behaviour…. Approaches identified with this [perspective] tend to operate largely on the assumption that social change will result from increased opportunities

> for people to become more self-aware, more genuine, more understanding of others' perspectives and experiences, and more attuned to factors influencing group and interpersonal effectiveness.
>
> (Weil and McGill 1989, p. 19)

Information systems, intimately linked to many elements of the social, technical, political and cultural aspects of users' lives, are also very complex. What is not accommodated by hard analysis and design methodologies in general is that these factors too are part of the overall context within which the analyst will work.

The recognition of the analyst's place in the problem context and the implicit need to understand what the analyst is bringing into that context (the need for self analysis) has been recognised by others, for example Checkland 1981 and Davis 1982.

Davis argues that the selection of strategy and methods within strategy in terms of the evaluation of a problem context could be set out as a logical process. The process involves making a subjective analysis of the levels of uncertainty in the situation. Davis attempts to simplify the context into four characteristics: system, information system, user and analyst. In relation to these he postulates three process uncertainties:

- Do usable requirements exist?
- Are users able to specify requirements?
- Can analysts elicit requirements?

Dependent upon these three will be the degree of overall uncertainty. If a set of usable requirements for the system exists then uncertainty is low and asking will provide methods. On the other hand, if the usable requirements for the system are not evident, users cannot specify requirements and the analyst has difficulty in eliciting requirements, then uncertainty is high and experimentation will be required to derive usable methods.

This approach has been criticised by Episkopou and Wood-Harper (1986) as not being easy to apply, primarily because of the intangibility of many of the variables and the fact that the measure of uncertainty in the selection process is itself subjective.

Setting the analysis in a broader context, this approach is limited in its capacity to assess the impact of the environment upon the analyst, and also appears to assume that variables can be known and assessed in advance. Whilst this may be partly true, it might be better to separate out evident problems which can be dealt with by contingency planning (risks), and invisible problems for which provision cannot be made (uncertainties). The method appears to be linear and surprisingly non-self-reflective (e.g. making use of feedback loops) for an introspective tool. Checkland (1981) argued that the analyst-was within the problem context and was therefore an integral component of that context. Episkopou and Wood-Harper (1986) defined the process of arriving at a 'problem-solving system' as being 'an approach-choosing and matching system'. The details of the matching system are set out in Figure 4.6.

The theme of self-appraisal within the problem context of the approach is consistent with the concerns of this research. Chapter 2 has already set out methodological procedures ranging from the hard to the soft. It has also been shown that each approach has potentially useful aspects in the context of developing countries. Applying Episkopou and Wood-Harper's model to the current research, the 'problem owner' and the 'problem context' refer to users in developing countries and to the environment in the country itself.

Table 1.2 (as discussed in Chapter 1) shows that the user and the environment are full of risk and uncertainty from the point of view of the analyst. The analyst focuses on the need to get the right mix of problem-solving tools derived from the methodology.

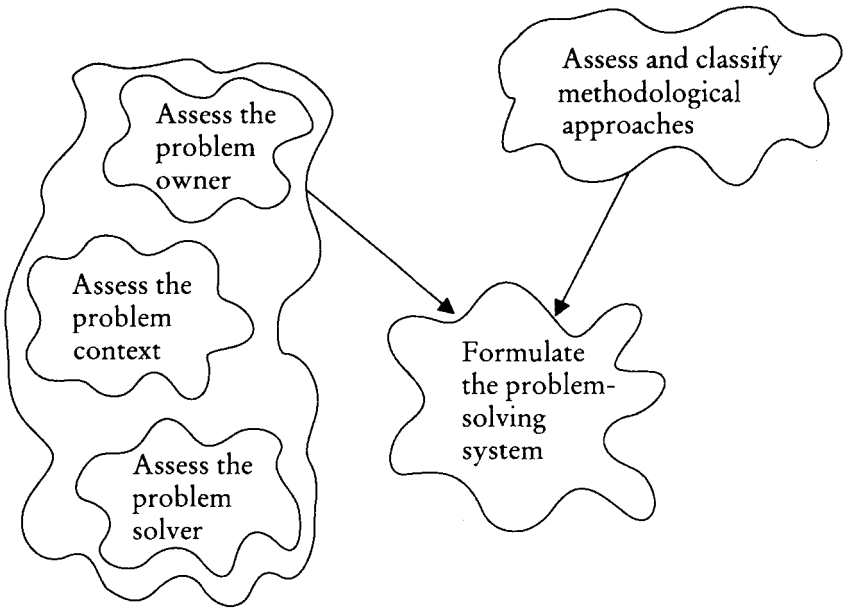


Figure 4.6 An approach-choosing and matching system

Source: Adapted from Episkopou and Wood-Harper 1986, p. 224, building on Checkland 1981, p. 239

Analysis and design requires that the analyst should be within the research context and that he or she will influence what occurs in the context. Personal preferences will have an impact upon planning, and the analyst may, consciously or unconsciously, attempt to influence stakeholders towards preset ideas about what is 'right'. This may be unavoidable and therefore is best declared at the outset.

A self-analysis tool

The self-analysis tool used throughout the research is based upon the work of Episkopou and Wood-Harper (1986) and Bell and Wood-Harper (1990) which in turn was derived from the outline for the 'organised use of rational thought' as set out by Checkland (1985). It is intended as a stage-by-stage (or frame-by-frame) monitor of the current intellectual framework, methodology (in general terms) and area of application of the analyst. Table 4.2 shows the three frames of experience of the analyst prior to the first of the three pieces of action-research fieldwork.

Table 4.2 A simple self-analysis tool

1	*2 The intellectual framework*	*3 The methodology in use*	*4 The area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
Frame 1 (1985)	Development-studies literature based on the planning tradition (making things happen).	DataPro (a software selection tool adapted to system planning).	East Africa. Many imponderables. Critical issues of data requirements of the system.	Technical resources, functionalist, consensus regulation.

1	*2 The intellectual framework*	*3 The methodology in use*	*4 The area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
	Some geographic information-systems literature.			
Frame 2 (1985)	Focus on harder systems approaches due to the need for quantitative details of incoming systems.	Adapted DataPro. Adaptations focusing on rigour in specifying the requirements (in data terms) of systems.	West Africa. Again data blind spots but linked to hidden agendas on the part of donors and recipients.	Functionalist, conservative, consensus regulation.
Frame 3 (1986)	Critical of the hard tradition. Recognition of the Lindblom (1980) view 'muddling along'. Some interest in softer methodology.	Second amended and adapted DataPro. This time with more emphasis on political and social considerations.	West Africa. Very disorganised views of systems by both donor and recipient. Methodology again too inflexible.	Social forces, interpretative, consensus regulation.

Table 4.2 provides three snapshots of my own development as an analyst. There is evidence of movement from non-specific systems approaches to hard approaches and then from hard to softer tools, each movement being made in the light of experience. The table also shows the way in which intellectual background leads to methodology selection and this in turn feeds into the experiences in the fieldwork. The fieldwork can then be seen as developing the intellectual framework of the next frame, and so on.

Column 5, the analyst, is of major importance. In this column key descriptive words are drawn from both Table 2.1, which gave an interpretation of the approaches to development and information systems development in Chapter 1 and from the Burrell and Morgan (1979) model in Figure 2.3. It can be shown that certain approaches on the part of the analyst arise from the interaction of intellectual framework, the selected methodology and the area of application.

This tool is used throughout the fieldwork. Its purpose is to make the concerns over perception set out in Chapters 1 and 2 explicit in all three pieces of fieldwork (and so to ensure that subjective evaluations of methodology will be seen for what they are). This approach is developed:

- in the account of the fieldwork (Chapters 5, 6 and 7); and
- in the analysis and development of it in Chapter 8.

The next section introduces the action-research fieldwork.

INTRODUCING THE ACTION-RESEARCH FIELDWORK APPROACH

As already mentioned, in order to test Multiview in such a way that would produce generalisable results, three applications were undertaken and compared in Asia and Africa. The action-research fieldwork studies were undertaken between 1988 and 1991. They offer various views of several aspects of the systems analysis and design process. They are not directly comparable in all aspects (e.g. type of institution worked

in, duration of research), and to some extent they overlap in time, the writing up of one piece of fieldwork taking place at the same time as the preliminary feasibility study of another. The Asian example was a short research effort, lasting six months from start to finish (including five weeks in the country). The two African examples extend over two and three years respectively with several visits to various sites.

The research attempts to demonstrate the manner in which methodology and tools are applied and can be developed in the light of experience. Sometimes the cases had a direct bearing upon each other, as one would prove to be the testing ground for ideas expressed and refined later on in another. All three led to further intellectual and methodological development of the researcher. In all cases the action-research, participative approach was applied, and in all cases situation analysis (prior to research) and self-analysis were andertaken in order to discover the degree of compatibility between the analyst and the context.

The nature of the fieldwork

This research is primarily concerned with the rigours of actual experience and not with artificially contrived research situations which bear little resembance to real-world situations. Because of this it was considered appropriate :hat it should be carried out within the context of consultancy. The research would then be able to reflect upon:

- the realities of real terms of reference
- real constraints of time and resources
- the responses of recipients to consultancy.

All these factors should add to the relevance of the research findings to studies in the future.

An evolutionary approach

It was evident that the Multiview methodology should be tested in a number of contexts and in a number of manners in order to gain a clear view of its strengths and weaknesses. Obviously this type of analysis could not be carried out all at the same time: fieldwork would have to follow fieldwork. In this sense each study would build upon the experience of the one before; Lessons would be learnt and then reflected in the adaptations made to the overall approach. The self-analysis tool would provide a measure against which change in the structure of Multiview could be evaluated. The research shows an evolutionary tendency in the sense that the methodology was adapted and developed over the three-year period of field research.

The structure of the fieldwork

The fieldwork as set out here can be regarded from three different points of view: chronological, logical and comparative.

Chronological structure 1988–91

Chronologically, as indicated above, the fieldwork began in 1988 with a consultancy for a Department of Roads. The two further studies followed on rom this work, although there had been some prior contact with the Staff college. The earlier contact had related to initial work, specifically with the development of management information systems. It should be noted that Multiview was not applied there in any of its

guises until the Department of Roads work had been completed. The fieldwork for the Board for Technical Education was taking place during and after the Staff College study. To some extent both of these studies were building upon each other, although it will be shown in Chapters 6 and 7 that the Staff College study was focused primarily on the development of the user participation in Multiview, whereas at the Board for Technical Education the focus was more on development and implementation and in particular on monitoring and evaluation tools.

Logical structure

Each of the field studies, as indicated above, offers a different view of Multiview and suggests different interpretations and adaptations. A linking feature between the three studies is that, in each, computer technology was a fairly new idea: each was a 'green field' site. The logical manner in which the fieldwork studies build upon each other is as follows:

- Department of Roads. This provided the overview for the entire Multiview approach, focusing on time constraints in practice. This study provided a review of the total methodology, highlighting strengths and weaknesses in a situation where analysis and design was not a familiar practice. There was no clear agreed focus for automation, and time was in short supply.
- The Staff College. Arising from the first fieldwork study, changes were made to Multiview; these were further tested at the college. A key focus at this stage is that of recipient ownership, not only of the system under discussion but also of the means whereby this system was put in place and developed over time.
- The Board for Technical Education. Again the existing changes to Multiview were looked at in different circumstances. Aspects of the methodology were used, attempting to maintain a unified approach to analysis and design whilst focusing on the aspects thought to be of greatest value, i.e. the development of post-design tools within the Multiview framework, specifically those relating to implementation and monitoring and evaluation.

Comparative structure

As will have become apparent from the two preceding sections, the three pieces of fieldwork are not directly comparable. In the Department of Roads the study was undertaken in one month whereas both the other studies were undertaken over a period of three years. The approach is evolutionary, and therefore it is not possible to compare studies with one another in terms of the application of a fixed approach (as already noted with regard to action research on pages 67–71). In any case the replication of research in order to gain a quantitative analysis of variation over time and space is the approach usually reserved for reductionist, controlled research. It has already been argued (pp. 72–73) that the approach of this work will be action research using systemic techniques to work with recipient communities towards a joint understanding of the techniques involved. Such an approach does not allow for rigid comparisons which depend on the expectation that variables will be known and controlled. Nevertheless, comparisons can be made in terms of the success and appreciation of the type of tools which Multiview contains. Therefore during each study problems and possibilities arising were noted; they are compared in the analysis in Chapter 8.

SUMMARY

Chapter 4 has presented:

- the overall research approach and a justification for it
- the methodology for the application of Multiview within an action research context
- the integration of the key concern (expressed in Chapters 1 and 2) of the subjective views and preferences of the analyst in the form of a simple self-analysis tool
- a brief introduction to the chronological, logical and comparative structure of the three pieces of fieldwork.

The next chapter will review what happened in the fieldwork.

Part III

ACTION-RESEARCH LEARNING

5
LEARNING CYCLE 1: A DEPARTMENT OF ROADS

The process of analysis and design as discussed throughout this book is integrally linked to the observation (first discussed in Chapter 1, pp. 15–17) that much development work undertaken in the developing countries is sponsored by grant and loan money from the richer countries via government development agencies (e.g. the UK Overseas Development Administration) and internationally funded organisations such as the agencies of the United Nations (e.g. the Food and Agriculture Organisation) and the World Bank. The observation made in Chapter 1 on the interventionist nature of development recognises that much intervention is sponsored by aid. The basis for the following case studies is consultancy funded by aid money in one form or another. This factor will not just have implications for the analyst undertaking the research (e.g. the potential, due to external funding, to be 'remote' and unsympathetic to the recipient community), it will also affect the recipient's reaction to what is being planned in the systems analysis and design process (e.g. the rejection explicitly or implicitly of the 'foreign expert'). An observation arising from the work of Biggs and Farrington (1990) is that much aid-funded research is looking for rapid, researcher-led change. The following case studies were undertaken recognising that this approach is problematic. In the words of Georgiades and Phillimore (1980) it is based in part upon the myth of the 'hero innovator':

> This then is the myth of the hero-innovator: the idea that you can produce, by training, a knight in shining armour who, loins girded with new technology and beliefs, will assault his organisational fortress and institute changes both in himself and others at a stroke. Such a view is ingenuous. The fact of the matter is that organisations such as schools and hospitals will, like dragons, eat hero innovators for breakfast.
>
> (Georgiades and Phillimore 1980, p. 315)

In the following case studies the action-research approach was adopted in order to include the researcher as one actor amongst many in the problem context and to avoid an overly self-important, heroic role for the researcher. The research is intended to analyse vigorously the role of analyst, context and methodology through the phases of action research: diagnosis, action planning, action taking, evaluation and specifying learning.

The first piece of fieldwork was undertaken at a Department of Roads (DoR). Prior to the research the self-analysis framework discussed in Chapter 4 (pp. 77–78) was applied to the researcher, and this indicated the tendencies set out in Table 5.1.

Table 5.1 Self-analysis prior to research at the Department of Roads

1	*2 The present intellectual framework*	*3 The present methodology in use*	*4 The present area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
Frame 4 (mid-year 1988)	Movement towards softer tools for the greater understanding of complexity, e.g. Web modelling (Kling 1987), soft systems methodology and Multiview	The Antill and Wood-Harper version of Multiview specifically set out in the 1985 publication	Department of Roads	Interpretative. An essentially social-action approach. An attempt was made to reserve judgement on the type of approach required by the situation.

The table shows Frame 4, a frame on from Table 4.2, and the inclination towards softer approaches, linked to interpretative and liberal attitudes. The impact of these attitudes upon the research process will be commented on in the fieldwork conclusion. The pre-research assessment of their impact in the department was to assume that research would be focused on a wide range of issues (possibly concentrating on the social but ranging to the technical). This in turn indicates that prior to the specific fieldwork an attempt was made to provide a sound basis to undertake the range of activities included in the Multiview methodology.

The starting point for the review of the application of Multiview is the use of Bottrall's (1982) five-point action research structure as set out in Chapter 4:

1 diagnosis of principal problems
2 action planning of alternative courses of remedial action
3 action taking by the client (and researcher in this case, as is explained shortly)
4 evaluation
5 specifying learning.

In the event all five stages were completed partially or fully, so that it was possible to appraise the Multiview methodology.

DIAGNOSIS

In this section brief details are provided on the country itself, the client department, and the basic requirements of the consultancy as set out and agreed with the donor agency. The following outline of the case is drawn from field notes taken at the time.

The country

The country is among the poorest countries in the world. It has a rapidly growing population, the majority of which is based in the often remote rural areas though a growing percentage is in the capital city. It is land-locked and is located in a position of political sensitivity with larger neighbours.

One of the main problems facing the country is the lack of infrastructure for national development. Among the key issues with regard to infrastructure is the matter of communications, and in particular roads.

It has been suggested on various sides that the development of roads in the country will have a potentially dangerous impact, in that it will lead to unequal trade relations between different areas and between the country and her larger neighbours (e.g. cheap products from urban areas swamping rural markets and putting local manufacturing out of business). Nevertheless, the provision of roads in this country is still a development focus for many aid agencies, and the research described here is expected to contribute to the efficiency of the operation of the department.

The specific situation

Discussions with senior members of the department elicited the following details. The Department of Roads operates under the Ministry of Transport. It is specifically involved in the provision and maintenance of roads throughout the country. It is based in the capital city and employs several thousand people. There is also an elaborate nationwide organisation of regional and project offices which administer and manage specific work that is undertaken. Furthermore, the department has numerous links with a range of donor agencies with whom it co-operates in roads provision (donor liaison is an important element of the work of the department). The department has to operate within the infrastructural constraints of the country, and these impinge upon a number of operations. Specific issues arising from preliminary discussion with members of the department are set out in Table 5.2, which seeks to demonstrate how the general developing country factors indicated in Eres's Table (Table 1.2) are relevant. Specific key features relating to the environment were:

- the large number of unskilled workers in the department
- the highly centralised nature of decision making
- the poor communications infrastructure
- the inefficiency of existing data handling and storage which meant that information on projects (past and present) was often not available
- the high cost of imports (including computers).

These features indicated that the situation was one of some risk for a planned computer-based information system (e.g. power supply, lack of trained staff) and uncertainty (e.g. the future political development of the country, the integration of a computer-based system into existing work practice).

In the light of fieldwork experience, to test the context sensitivity of Multiview, Table 5.2 will be reviewed again at the end of this chapter.

ACTION PLANNING

The jointly agreed action planning for the consultancy was set out by the authorities of the country and the donor representatives. Central to it was the need to outline possible improvements to the information processing within the department. This process was to be undertaken by a research team comprising the analyst and members of the Computer Policy Advisory Group (CPAG), of whom more will be said shortly.

The objectives of the consultancy

The purpose of the consultancy from the joint donor and recipient perspective was to:

- survey the needs and uses to which IT could be put in the department (with a preliminary focus on issues relating to management information systems (MIS)
- undertake an analysis of the capacities of the department to make effective use of computer-based technology
- indicate the type of technology which could be supplied.

A period of one month was set aside for the consultancy. It was assumed by the project managers (but left open at this stage) that there would be a need later on for further development to the system and inputs in the form of training and support. It was presumed by the analyst/researcher that the department would require internal staff capable of taking up the initial design and developing new systems. The analyst envisaged that the members of the CPAG would develop some of the views of the department following this first visit and produce further enhancements to the initial design.

Prior to the main research there were two periods of contact with the department. First, a one week pre-project visit was made by the researcher. The purpose of this was to gain a preliminary view of the department's

Table 5.2 Risk and uncertainty factors

General factors	*Conditions in the country*	*Observations*
1 Economic	Labour-intensive society Low availability of capital Inability to absorb recurring costs	The DoR has a large, unskilled clerical workforce involved in a variety of filing operations. The conditions of the head office (including broken machinery and non-functioning lights, etc.) indicate that there are problems in absorbing running costs for the department.
2 Manpower	Lack of available trained personnel	At the time of the consultancy there appeared to be one or two individuals in the department with some understanding of computer operations (a small system was producing occasional statistics and a payroll system was being planned). There was no evidence of SA&D skills. There was some pre-project training in SA&D for the three members of the Computer Policy Advisory Group. Existing information storage operations were poorly planned.
3 Physical	Limited resources Geographic isolation	The country is physically isolated in terms of trade. It depends upon imports for most commodities. The power supply in the country is erratic.
4 Cultural, demographic and social	Large percentage of unskilled workers	The large clerical workforce employed by the DoR provides some evidence of this. Preliminary discussions with several members of

General factors	*Conditions in the country*	*Observations*
		senior staff indicated that there was a general lack of computer awareness amongst officers. This was linked to a degree of computer animosity among some staff members.
5 Political	Need for tight security Constantly changing priorities Centralisation of decision making	At the time of the visit there was considerable political instability. The accompanying sense of a need for change seemed to infiltrate most aspects of the department. Decision making was highly centralised.
6 Existing information infrastructure	Poor quality of telephone services Inadequate postal services Tight customs control	As well as the observed problems with imports of commodities (including computers), national communication was managed by a mixture of difficult radio links (prone to breakdown due to climatic disturbance) and lengthy road journeys.

Source: Adapted from Eres 1981, p. 101

operations and to select three members of staff for training in the United Kingdom in systems and computer-related issues. These three members of the department's staff would then act as the CPAG to the chief of the department and would act as counterparts[1] to the researcher during the fieldwork.

Second, these three members of the department's staff came to the United Kingdom for a ten-week training course in the use of computers and related subjects. By this means all three were introduced in a brief manner to the Multiview methodology. During their time in the United Kingdom they were trained in the use of standard software packages (word-processing, databases and spreadsheets), studied MIS theory and took part in a critical review of the 1985 version of Multiview (including some sessions with the joint author of Multiview, A.T. Wood-Harper). The review included wide questioning of the scope of analysis and design and its expected results.

The funding agency considered that the two pre-project components would provide the analyst with enough scope, in terms of awareness of major constraints in the department and of staff perceptions, to undertake the analysis in the four-week period.

ACTION TAKEN

This section covers details arising from the action-research approach (as discussed in Chapter 4) to the application of Multiview.

The application of Multiview

Two issues with implications for the success of the fieldwork arose prior to the independent appraisal of the department's existing structure and management performance:

- understanding of the methodology by the recipient community
- tools for applying the methodology.

So far as understanding of methodology is concerned, for action research to be effective (in Bottrall's (1982) terms) and for a computer system to work effectively, it is important that the recipient community participate in the development of that system (see Mumford 1979,1981a, 1981b, and Mumford *et al*. 1985). The issue of user involvement in systems analysis and design has been discussed in Chapters 1 and 2. Mumford (1979, pp. 4–7) has defined participation on the part of users as operating at three levels:

- Consultative: which 'leaves the design tasks to the systems analyst' (Avison and Fitzgerald 1988, p. 37). This form of participation is restricted to consulting stakeholders concerning the details of the new system.
- Representative: in this form, user-group representatives of the organisation and the analyst combine so that the user has more say over the final design.
- Consensus: in this form the users as a whole drive the analysis. This form is time-consuming but seeks to ensure that all user views are built in to the final design.

The action-research approach is intended to operate at the consensus level, but this requires that the recipients 'own' the methodology (that is, are totally familiar with it at a practitioner level). The training of the members of the CPAG in the United Kingdom had not, in the opinion of the researcher, made the group familiar enough with its workings and confident enough in their knowledge to be able to drive the analysis. Therefore the level of participation was an amalgam from consultative to representative, and this in turn meant that the researcher had a lead role in driving the use and adaptation of the methodology during the action-taking stage. This did not mean that the action-research approach was abandoned but it did require the researcher to be careful in:

- explaining stages as they arose
- being rapidly adaptive in making tools understandable
- being prepared to modify the approach in the light of recipient comment.

The issue of user involvement and participation was identified as a problem and is returned to in the next fieldwork example.

The second issue was that of tools for applying the methodology. Multiview in the 1985 form was an unsophisticated instrument, in terms of the procedure and method of application in organisations. There was little material about the difficulties and complexities of gaining information from large organisations (such as government ministries) or of drawing out information in the early stages for the development of the primary diagnosis tool, the rich picture (as discussed in Chapter 2). For all the concern expressed in eclectic analysis and design development, Multiview was still remarkably vague as to the nature of organisations and their complexity. Argyris (1960) argues that organisations are 'grand strategies' designed by people to achieve objectives, and that the formal structure of the organisation (chain of command, unity of direction, span of control and task specialisation) is constantly being modified by the informal activity of the people who make it up. For Argyris it is the total organisation expressed in the union of formal organisation and informal behaviour which is of most interest. From the discussion set out in Chapters 1 and 2 (pp. 21–24, 30–34 and 51–54) it can be argued that systems analysis tends to be interested in formal organisation. Even the early Multiview-based text produced by Antill and Wood-Harper (1985) argues, when discussing the

development of a rich picture of an organisation, that: 'We also have to remove people, although not their roles, from the picture, because we do not want to create a system around particular personalities' (Antill and Wood-Harper 1985, p. 25). This may be an ideal in terms of 'clean' analysis and design, yet the personalities of an organisation are often central to understanding many of the informal aspects of that organisation which make studies meaningful. It can be argued that this is specifically so in the area of systems analysis and design where, in the experience of this researcher, for good reason or bad, projects very often appear to be orientated towards one or two trained individuals upon whom the following system is then dependent (as potentially with the CPAG in this case).

In order to draw out the concerns and requirements of both formal and informal aspects of the department's structures and personalities, the application of Multiview in this case was tempered by the addition of methodology application tools appropriate for dealing with complex organisations. Some of these tools were attitudinal, for example:

- sensitivity to and awareness of the possibility of hidden agendas
- awareness of the likely variance in perceptions of the various stakeholders

Others related to practical issues of research methods (such as those set out by Casley and Kumar, 1988), for example:

- the need for a structure of regular, documented meetings
- attention to regular reporting
- attention to positive initial contact, e.g. dress and manner
- sequence in interview (interview technique)
- level and format of questions, e.g. avoiding confusing jargon
- understanding the need for caution when questioning in sensitive areas
- basic observations of the site (e.g. absence of care and attention to decoration, dress of officers, etc.).

The original Multiview methodology provided little or no guidance in any of these areas. This in turn indicated a weakness in Multiview at a practitioner's level. Much of the material produced on the methodology was academic in form and content. One of the objectives of this research was in fact the development of a more practical systems-analysis and design methodology.

Stage 1: the human-activity system

The diagnosis stage of the action-research approach was assisted by the use of the first aspect of Multiview: the analysis of the human activity system derived from the soft systems methodology of Checkland (1981). The Multiview review of the human-activity system varied from the approach set out in Checkland's original work in that it focused on the rich picture, the transformation element of the root definition and a systems view of a conceptual model. Checkland's original work had focused on an overview of human activity (not specifically a rich picture), root definition (which included the idea of transformation as well as various other components) and an activity-based conceptual model.

The rich-picture stage of the analysis was undertaken in order to become more familiar with the workings of the department, as well as to gain a greater understanding of problems and issues (including the uncertainty and risk) within it which could be the key to a new automated system. Understanding the problems and

issues was essential to successful development of a new automated system. The results from this phase would then be fed into a consultative process leading to agreement on the way forward to the next stage of the analysis.

The creation of the rich picture involved various problems which will be discussed on pages 115–117. Nevertheless, a rich picture of the organisation was produced and circulated for discussion with a number of staff in the department and the project managers. The process of undertaking the rich-picture exercise was as useful as the picture itself, because in the process of investigating the department many aspects of the organisation were clarified (e.g. interdepartmental co-operation, archiving practice, etc.). In all, the rich picture provided:

- a focus on both hard and soft features of the environment
- a requirement for the analyst to integrate these features into one model and then use this as the basis for further discussion
- agreement from the various actors for the next step.

The rich-picture stage had been successful in identifying a range of issues, both technical (e.g. power supply, skilled operators and planners, access to data) and soft (e.g. interdepartmental rivalry, inefficiencies, bureaucratic bottlenecks, factionalism). Following this, the root-definition stage was applied to set out an agreed agenda for action.

The joint consideration of alternative courses of remedial action was effectively contained in the root-definition aspect of stage 1 of Multiview. The root definition as described in Multiview was not in fact presented as a tool for arriving at a participative view of an improved situation. Rather it was given as a means to identify one view of transformation. Although this was not explicitly stated, as given, it could easily be adopted as the analyst or expert view of the way forward. In this instance, however, to encourage a broad view of the research, the root definition was constructed by the analyst as the perceptions of client, actor, transformation, worldview, problem owner and problem context or environment (CATWOE) derived from the perspectives of the analyst, the donor representative and the chief of the department.[2] These three perspectives were then compared by the researcher and a consensus CATWOE produced for discussion among the various parties. The consensus CATWOE was constrained by the terms of reference of the consultancy (e.g. the size and cost of the transformation). However, discussion led to the generation of an agreed[3] form of transformation which focused on the key aspect of MIS development for central administrative and management functions (e.g. payroll, personnel, roads register, mechanical register). The agreed transformation was then to be taken forward as the basis of the system to be modelled as a management information system, in the third phase of the human-activity system stage. The importance of linking together the various views of the root definition was to provide an outline transformation which could be broadly agreed to by all parties.

The third element of the analysis, following the rich picture and the root definition, required the construction of a conceptual model of the proposed transformation derived during the identification of the CATWOE. As already indicated, the authors of Multiview and of Soft Systems Methodology vary in their view of the exact procedure for constructing a conceptual model. The purpose of this stage of the fieldwork was to produce an outline system which would provide non-specialists in the department with an understandable model of the system under discussion. This model could then be developed in the ensuing data-orientated phases of the methodology. The result of conceptual modelling was a diagram representing a series of systems (e.g. administration, design, mechanical) and their relationship within an overall information system. At this stage, details of information movement and data quantity were not required. The

main aim was to develop the view of the system and thus demonstrate some of the implications of management information systems, in particular the interconnection between previously separate departments (e.g. personnel and administration, mechanical and projects), and so to help towards understanding a key idea behind management information systems, namely the 'transparency' of information (i.e. information which is verified and validated, available on demand and known to be accurate) which the system should give. If this idea could be grasped, it would make a basis for discussing the issue of sharing between different departments what had previously been discrete and separate information sources.

This in turn demonstrates one of the social aspects of information-systems work. Management information systems require information sharing and often result in the production of comparative performance indicators (PIs). Many public-sector bureaucracies are reluctant to share this type of information because of concerns about departmental hegemony over discrete areas of work and/or anxiety about issues such as unfavourable comparison and internal mistakes and errors becoming public knowledge. They do not welcome the implications of an information system based upon computers (as argued by Avgerou and Land 1992). Therefore the conceptual modelling stage is useful not just in its recognised role as a model to compare against present activity in an organisation as set out in the rich picture. It can also be used as the basis for far-reaching discussion within the organisation and as a means to develop internal awareness of what the current project entails. Thus conceptual modelling can be used as another tool for developing participation in design and for increasing awareness of issues in the organisation concerning the implications of systems changes. It was so used in this research.

The end of the first stage of the Multiview methodology according to Avison and Wood-Harper (1990) may be an improved human activity system, in which case no further stages need to be undertaken. However, it is usually assumed that an information problem of some magnitude has been indicated and that the second phase of the methodology is necessary. This brings in something which is both a critical strength and a weakness of Multiview (the two are the same thing in this case). In order to deal with reality, Multiview uses a range of approaches (or 'views') to gain a greater understanding of potential problems than any single view would give. However, to benefit from these views it is essential to integrate them into one overview. Figure 5.1 demonstrates the nature of this problem.

The 1990 version of Multiview indicates that a conceptual model is 'carried on' to the next stage. Little guidance is provided on how this is to be managed. Figure 5.1 indicates that there is little provision for integration between the views (described here in terms of weak and strong links). This is an issue which will be returned to in the second and third pieces of fieldwork. At this stage it has to be noted that a further change was made to the methodology.

In the original Multiview the conceptual model in stage 1 (the human activity stage) moved on to the functional decomposition (understanding and modelling the functions within an organisation) within the information-modelling stage 2. The view of conceptual models as models of interactive systems (rather than activity models as Checkland had them) was maintained in this fieldwork, but the progression from this was changed from functional decomposition to entity models (models of the things about which information is to be kept). There were two main reasons for this:

- Improving linkage between the various views. In the Department of Roads example, systems indicated in the conceptual model consisted mainly of items such as design system, administration system, accounts system. These, in the view of the researcher, translated readily into entities such as roads register, employee database, preliminary budget listing.

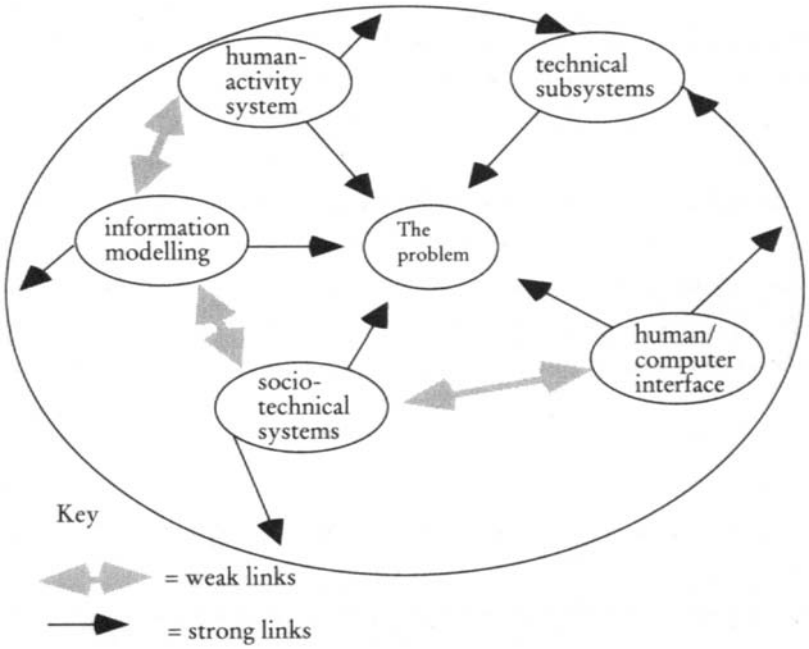


Figure 5.1 Multiview: weak and strong links

- Understanding on the part of the people for whom the system was being developed. The recipients (including the members of the CPAG) found it more logical to move from systems to entities rather than to functions. One member of the CPAG explained this, using the metaphor of language, as follows:

  It is a movement from one view of a noun to another (the movement from system to entity). If we go from conceptual models to functions it is like moving from one view of a noun to a different view of a verb; there is little obvious linkage.

  (Member of the Department of Roads, 1988)

The human-activity stage of Multiview was completed in one week and produced general agreement among major stakeholders on a way forward for the proposed system. The focus of the conceptual model/ conceptual system and transformation as set out in the root definition was to be an automated management information system. The second stage of the methodology was used to develop the information model.

Stage 2: information modelling

The second stage of Multiview required a data view of the department, that is, a view which demonstrated the major data sources and information requirements of the organisation. Focusing on linking the stages of Multiview into one whole, the basis for this view was, first, the consensus transformation derived from the root definition and, second, the systems derived from the conceptual model of the improved situation. From this basis, it was possible for the researcher, working with members of the department, to focus the initial

information system on a number of key data areas: programme planning, personnel records, roads register and equipment inventory. Within these four, thirteen specific entities were identified (e.g. employee records, preliminary budgets, accounts, etc.).

This stage of the analysis had to be completed in no more than five days. This time constraint meant that only an outline information model could be constructed, which would need elaboration and development at a later stage by members of the department. A complicating factor was the current disorganisation of information storage. All major data stores in the department were visited and reviewed in terms of current data storage facilities and techniques and reporting procedures. In several cases there appeared to be no storage techniques in evidence and information requested could not be located, even given more than a day to do so. Further, the workings of the internal bureaucracy did not appear to be standardised around agreed procedures. The diversity of procedures (e.g. where and when to refer an issue to the Chief) led to congestion of data at certain points, although in some cases the CPAG could provide advice and help to explain what was happening and why, at times, procedures seemed to be a mystery. The existing manual practices seemed to be only semi-structured in some cases. This raised another issue: the advisability and suitability of automation rather than improved manual practice in aid projects. This issue is related to the requirement for aid projects to provide *sustainable* change (i.e. sustainable after the project has finished).

As indicated in Chapter 1 (pp. 15–17), there appeared to be little structure and planning in the activity of the aid agencies in information-technology and information-systems projects at the time. Computers tend to be planned for only after the information technology has been agreed in principle, as in the present fieldwork, a case of retrospective planning after agreement on the technology-transfer event. During the information-modelling stage of Multiview, it became apparent that the department did not have an effective manual information system at many levels (e.g. register/library of road projects). It also became apparent that the department lacked an 'information culture'. An information culture requires the implicit understanding that to process data and to be informed is a beneficial condition. The development of management information systems presumes the existence of an information culture (for a discussion of the need for this as a prerequisite see Vernon 1991). An issue carried forward to later fieldwork, and developed in Chapter 9, is the need for potential IT sites to be effectively previewed before systems analysis and design to ascertain capacity and willingness to adopt the social implications (e.g. 'transparency' in internal procedures) and requirements of technology.

The problems which entity modelling revealed were noted and discussed with the CPAG. The view of the members of the CPAG at the time was that, just as the analysis had highlighted data-handling problems, the computerised system would enforce rational changes in the way in which procedures operated. Another issue identified at this point was the existence of different views of the proposed system. The analyst recognised that information systems as perceived by the donor and by computer systems planners required organisational and management change in terms of transparency, altered work practice, etc. It became apparent that some members of the department's staff perceived computerisation as the acquisition of prestigious machinery with little impact on work. Some senior staff did realise the implications of automation, but they appeared to be in a minority. This difference of view (a difference of culture, as Lind (1991) might argue) was expressed to the researcher many times during the consultancy; it suggested the need to monitor such changes in perception—a point discussed more fully on pages 115–121 and in Chapters 6 and 7.

Following entity modelling, the second aspect of information modelling was that of attribute mapping. The original version of Multiview did not make use of normalisation[4] (as discussed, for example by Bowers 1988) as a means to develop an accurate picture of entities and attributes. The time constraint of the consultancy provided only for a brief listing of major attributes for each entity. To achieve this and to

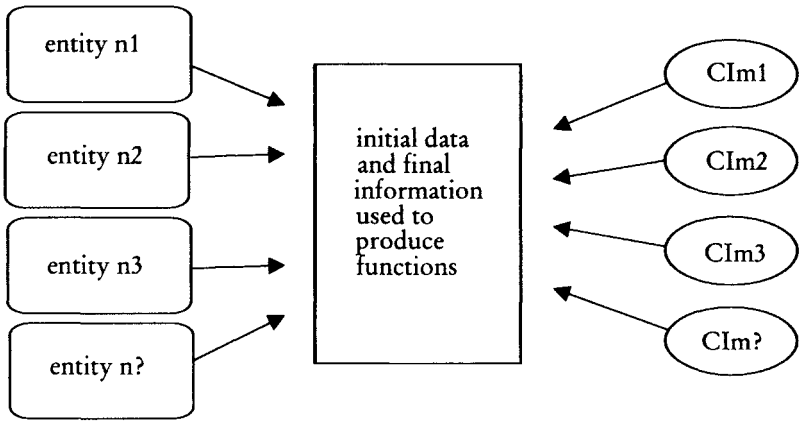


Figure 5.2 Entity- and CI-driven functional decomposition

reduce the possibility of duplication of attributes between entities, an entity/attribute matrix was used to cross-check the selection. The attribute stage was again discussed with the CPAG. The researcher observed that the group's comprehension of the new proposed system was improved if entities and attributes were initially described respectively as database tables and fields in the database (a step usually reserved for stage 5 of Multiview).

The third aspect of information modelling in the format adopted in this fieldwork is the development of a functional decomposition for the information system. As with the entity map, this procedure was integrally tied to the consensus transformation and conceptual model derived from the human-activity system. However, within Multiview the linkages within information modelling are implicit rather than explicit. Wood-Harper (1989) suggests that entities and functions can be cross-checked with an entity/function matrix. However, MIS work provides the idea of 'critical indicators' as a means to link functions to entities. Central to a management information system, as perceived by this project and by a number of project management agencies (e.g. the British Council), is the generation of a series of critical (or performance) indicators (CIs or PIs). The generation of CIs is the basis of the system. These provide the performance-related information necessary for managers to judge the efficiency of their activities. Given this CI output and the entity and attribute input, one view of the purpose of functional decomposition is that it provides the routines that will result in the appropriate indicators (see Figure 5.2). This approach is discussed and developed further in the third piece of fieldwork. In the present case there was not sufficient time (during the specific consultancy) for a dialogue with the department to develop the CIs required from the system. In this case the entity/function matrix was applied by the researcher to double-check the top-level functional decomposition produced.

During the research period, functional decomposition was undertaken by the researcher for the element of the information system which dealt with the road projects aspect (these are the road-building projects which are undertaken by the department). Some elements of the decomposition were found to be ambiguous. For example, in the production of final programme proposals dealing with expenditure on new roads or on existing roads maintenance, the procedure was for an internal evaluation of the proposals followed by a report from the evaluating officer. In practice proposals were often late in arriving at head office owing to communications problems (either radio or transport) and there was little time for such evaluation or reporting. The result was that proposals would go into the procedure for approval without prior vetting.

Ultimately the management information system would be concerned with such problems, seeking inefficiencies and providing suggestions for improvements.

The final element of this second stage is that of event mapping. Multiview advocates the use of data-flow diagrams in order to display triggers (events) which initiate the action of the functions already known. This worked well in practice with the limited decomposition available. One of the benefits of this approach was that it linked events neatly into functions in much the same way as attributes were linked into entities.

The final function of the information-modelling stage is to provide data elements which can be incorporated into the technical specification of the system to be set out in stage 5. Wood-Harper (1989), in introducing stage 2 of Multiview, develops entities and attributes separately from functions and events, putting them together into a 'verify models' phase at the end. In practice it was found to be difficult to do this, as entities were central to the generation of the CIs at the core of the information system (see pp. 116–121, the subsection dealing with problems in the application of the methodology). Further, Multiview provides little help in linking the results of this hard stage to the following soft, socio-technical stage (the same weak link as that noted between stage 1 and stage 2).

Stage 3: socio-technical systems

The third stage of Multiview is intended to 'produce a good fit design taking into account people's needs and the working environment on the one hand, and the organisation structure, information technology and necessary tasks on the other (Wood-Harper 1989, p. 102).

As with the link from stage 1 to stage 2, there was no definite structure to the link between stages 2 and 3. In the event, the analyst and the CPAG carried forward from stage 2:

- The organisational scope of the information model (i.e. the requirement for the system to bring together in one place the databases for and information outputs from a number of existing departments).
- The data and CIs for the information model (i.e. during stage 2 the prospective size and volatility of data and information was made evident. This would have implications for the size and specification of the system.)

From stage 1 the carry-forward was the transformation of the root definition and the implications of the system integration set out in the conceptual model. The transformation (derived from the root definition CATWOE) had been arrived at from the analysis of several different views and therefore, in attempting to harmonise these views, the root definition offered a 'consensus' view of the transformation. Keeping in mind the Rapid Rural Appraisal approach to rural development and the need for this stage of the fieldwork to be completed in approximately three days, it was evident that it would require some amendments to make it usable. In his thesis of 1989, Wood-Harper sets out an eight-fold approach to socio-technical systems design. Figure 5.3 shows this structure.

Essentially this structure was maintained in the analysis, but some amendments were required because of:

- limited time for analysis which limited the capacity of the analysis to go into depth in some areas
- the view of some members of the department and of the donor that the analysis should focus on delivering a practical computer-based system and not involve itself in political matters (e.g. staff job satisfaction–a key issue in Mumford's (1983) work).

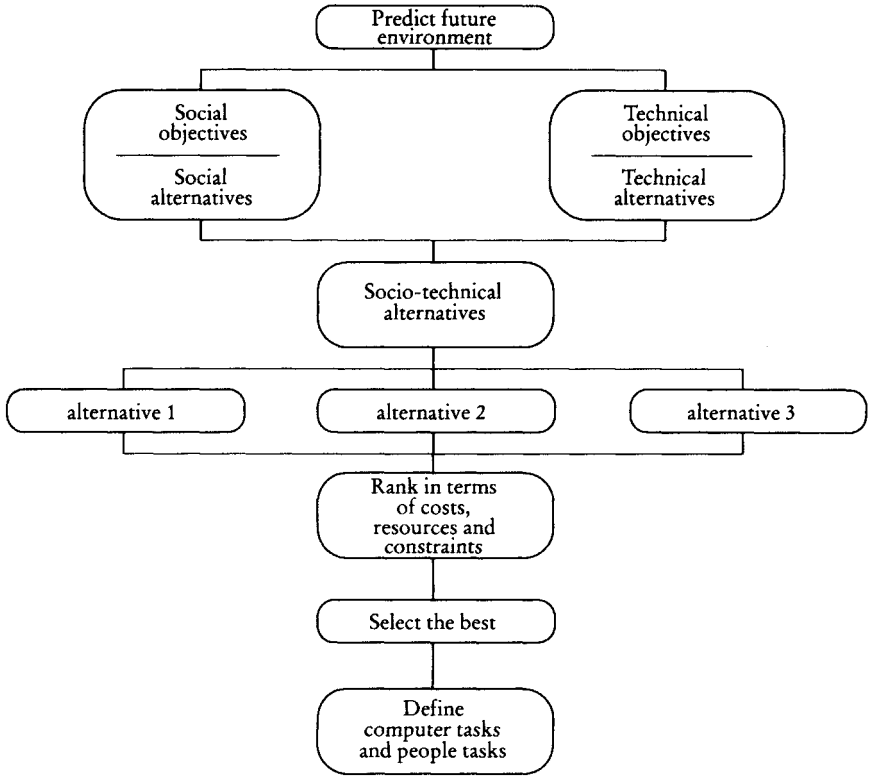


Figure 5.3 Socio-technical systems design

Source: Adapted from Avison and Wood-Harper 1990, p. 135

To modify stage 3 as required by recipient and donor, the scope of the analysis was altered by:

- Keeping the social objectives of the analysis as wide as interviewees indicated but honing down the resulting social alternatives to issues of staff expertise and training requirements, rather than including wider and more general issues of job satisfaction and quality of working life; these issues would be reviewed in stage 4.
- Focusing on appropriate levels of technology. The aim was to link technical objectives and alternatives with social objectives and alternatives. In the 1985 version of Multiview the social and technical aspects of the system could be designed in isolation from each other, leading to possible fragmentation and difficulty in making a good 'fit' in socio-technical alternatives. The key issue identified in interviews with recipients and donors was the potential size of the planned system (in terms of processing power and cost); this was reflected in the design of the socio-technical objectives.

Thus stage 3 would not indicate wider roles for individuals or draw attention to potential weaknesses in work practice. In one sense this did not represent a great loss since much of the information which would have been produced by this stage was already available from the rich picture set out in stage 1.

The result of the first elements of stage 3 (setting out social and technical objectives and alternatives) was to produce on the social side a mix of staffing requirements, involving either training existing staff or employing new skilled staff. Technically, three different levels of computer-based system were suggested, ranging from stand-alone microcomputers to a minicomputer.

The next stage was to bring together the various combinations and assess them for costs, constraints and benefits. Again, Multiview did not provide a technique for making this assessment. In the absence of guidance, two methods were reviewed: cost-benefit analysis of each combination, and a simple grading system for each combination. The time constraint ruled out the first possibility and therefore the second was developed. The combinations of social and technical alternatives were assessed on a simple scale ranging from 1 to 9, very poor to very good with average at 5. Each combination was assessed and scored by the analyst with suggestions from department staff. For example, two extreme combinations are set out and scored in Table 5.3.

Table 5.3 Exam mple of so ocial and tec chnical alte ernatives

Alternative	*Social costs*	*Technical costs*	*Social resources*	*Technical resources*	*Social constraint*	*Technical constraint*	*Total*
Training of in-house staff plus a micro computer network	4	4	3	3	1	1	16
Trained new staff brought in plus a minicomputer	8	8	7	8	6	9	46

The ranking of the various alternatives was a subjective process. For example, to one individual a minicomputer might be seen as having a high social cost requiring substantial training for staff and rigorous control of the work environment (see Table 5.2), but to a more technically enthusiastic member of staff these costs might all be wiped out because of perceived social benefits (e.g. rapid report delivery and data processing). Ideally the production of a full table comparing all the various alternatives (in the case of the Department of Roads there were four social alternatives and three technical) should cover all key staff who would be involved in changes. In the case of this fieldwork, the members of the CPAG were involved when they were available. This raises another issue.

The members of the CPAG and other interested members of staff were involved in the analysis and design but their involvement was restricted by their existing responsibilities, from which they did not receive leave. This meant that some parts of the methodology were applied by the analyst in isolation, with final reporting and discussion periods at the end of the process. This had implications for the effectiveness of participation in this type of consultancy, where the analyst is expected to deliver a system design. On several occasions the analyst was confronted with the attitude ‘why bother to ask me, just set out the system which you think is best and we will agree with it’. This raised doubts about the importance and value of participation within systems design. It became apparent that, as the consultancy continued, the system was expected to be largely consultant-designed. The time limit on the consultancy tended to reinforce this view. Even with the training that the members of the CPAG received concerning analysis and design techniques there seemed little enthusiasm on their part to become involved in the intricacies of planning and

development. This was a problem for the case and for Multiview, and is reviewed again in the second piece of fieldwork.

Keeping in mind these considerations, donor representative and staff members combined in agreement on the selection of one alternative, in this case that of internally trained staff and a microcomputer network.

The final aspect of stage 3 was to set out the human and computer tasks. Again Multiview was vague in this area. The analyst devised a checklist of items which needed to be known and which built on the results of stages 1 and 2, seeking to make use of the eclecticism of Multiview. Figure 5.4 demonstrates this checklist and integration of the Multiview stages. It also indicates the logical input from stage 3 to stage 4 of the methodology. More will be said about this in the next section.

The integration of human and computer tasks required each planned element of the computer facility to be supported by human actions on the one hand and data availability on the other.

The specification of human and computer tasks concludes the socio-technical systems stage of Multiview. The next stage is that of the human/ computer interface. Again, Multiview specified no formal link from stage 3 to stage 4.

Stage 4: the human/computer interface

The fourth stage of the analysis and design evolved as a tool which could be used in a preliminary fashion at this point but was intended to be used in more detail by members of the CPAG as they built on the original results of the consultancy. Because of the limitations of the methodology, the analyst/ researcher was required to make the link from stage 3 to stage 4 and to provide some structure as to the nature of stage 4. Wood-Harper in his thesis (1989) discusses the human/computer interface (HCI) mainly as a matter of dialogue styles (e.g. menus, forms), dialogue analysis (e.g. linking dialogue type to user type), error prevention and response time. To develop the model set out in stage 3 the analyst dealt with the HCI under the headings of social interface and technical interface. A third factor which arose was that of security. This was seen as being relevant in part because of the risks and uncertainties prevalent in the department's situation (as set out in Table 5.2) and in part because of the fragility of microcomputer networks at the time of the study.

The social interface was concerned with the work impact of the proposed system. Work impact refers to job loss or gain and changing work practices. This dealt with the work element of automation which was dropped from stage 3 of the analysis. Wilcocks and Mason (1987) note that automation often leads to downgrading of skill levels in the workforce. They refer to the increasing prevalence of the 'flexible craftsman' created by the impact of computers on two grades of worker. On the one hand those involved in 'routine jobs' such as data-entry clerks could become more 'flexible' by undertaking this task for a range of different data sources. On the other 'specialist work' such as design and accountancy could be transformed and simplified by appropriate software into low-skill tasks. Wilcocks and Mason were noting negative social impacts of the HCI at a more significant level than man/machine dialogue types. The requirement of this stage of the analysis was to note potential problems in the impact of automation on work practice. Subsequent action would depend upon the considered opinion of the organisation's management.

The other major development in the social interface was that of training. Throughout the consultancy it had been made plain to the analyst that many members of the staff of the department considered that the training allocation for the MIS project, consisting solely of the three members of the CPAG trained in the United Kingdom, was insufficient. To identify training needs and training gaps a simple quadrant tool was devised. This is shown in Figure 5.5.

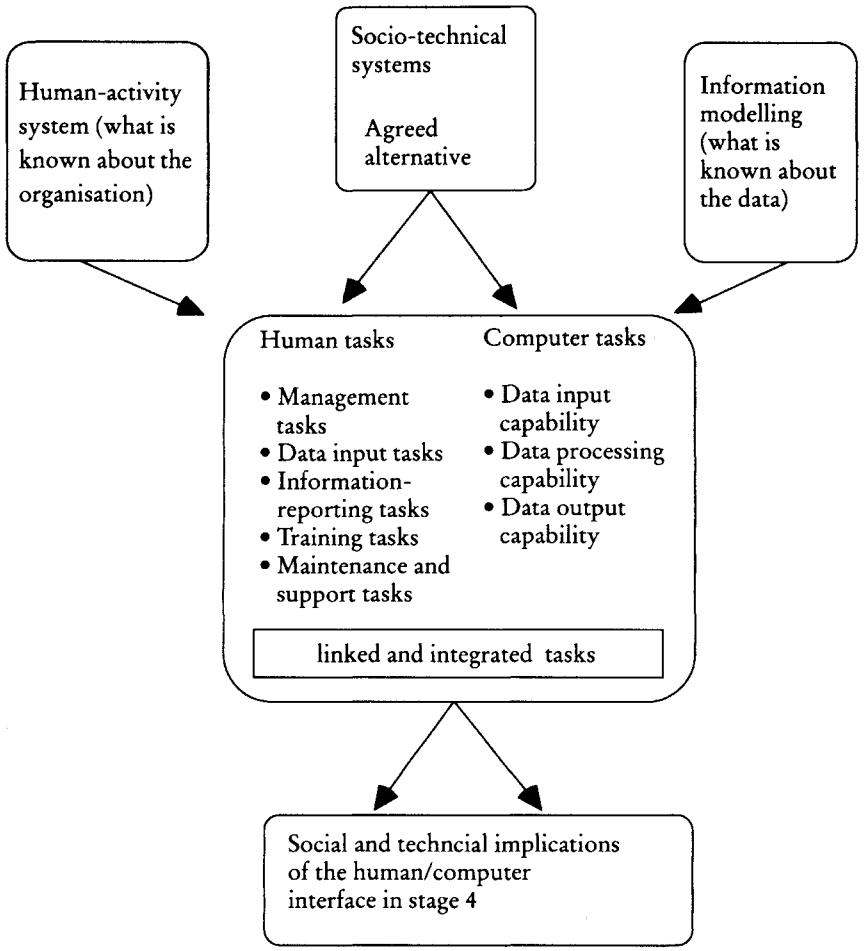


Figure 5.4 Socio-technical systems checklist

The model requires the analyst to specify for any specific group of workers the existing relevant skill levels for the work which they undertake and the need for training in the changed situation which technology will provide. The technical interface relates directly to the data and information side of the proposed system set out in stage 3, computer tasks. It also focuses more on the types of issue originally discussed by Wood-Harper (1989) and mentioned in the introduction to this sub-section (computer-screen dialogues, etc.). An initial issue in the country was language. Although all senior staff in the department spoke English, many junior staff did not. During a visit to the National Computer Centre in the capital the analyst was shown Macintosh microcomputers running word-processing packages using the local script. The possibility existed that the planned system could be designed around an interface in the language of the country rather than English. Following further consideration and discussion with staff in the department this idea was not developed because:

- All information systems staff were expected to use English.

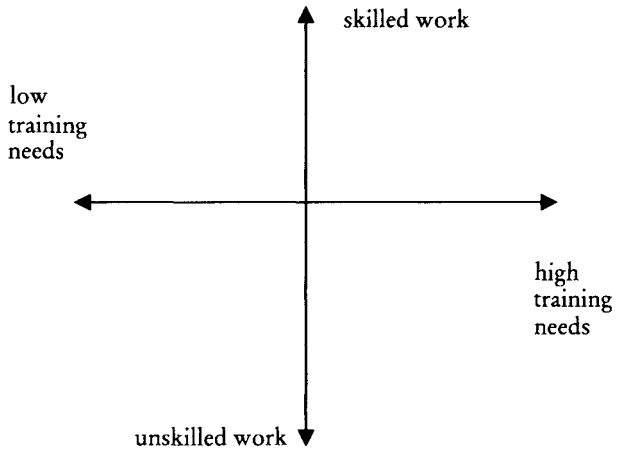


Figure 5.5 Training requirements selection

- Interfaces in the language of the country were restricted to simple word-processing and data entry. The investment for a system based on the language of the country was thought to be beyond the capacity of the project funds.
- Characters in the local script were available only on Macintosh computers. This was thought to be too restricting for the proposed system. Initial views from the CPAG indicated a preference for MS-DOS or UNIX-based systems.

Wilcocks and Mason (1987) deal with the issue of interface from the dialogue perspective; Table 5.4 presents the major features of the dialogue types which they consider to be most important. The requirement of the consultancy at the Department of Roads was to select appropriate dialogues for the appropriate users within the confines of the possibilities of the system and cost.

Table 5.4 Appropriate technical interfaces for the Department of Roads

Dialogue type	*Characteristics*	*DoR users*
Form filling	Form displayed, blanks to be filled by staff	Clerks
Menu list	Set of options displayed, user to select as appropriate	Clerks and managers
Question and answer	Display of a range of options	This type of interface is common in critical indicator (CI) display and may therefore be used by managers.
Function keys	Options linked to function keys	Probably appropriate for some functions for all users
Command language	Well-defined and limited set of commands	Computer support staff
Query language	User request expressed in specified language	Available for experienced management users

Source: Adapted from Wilcocks and Mason 1987, p. 126

Table 5.4 also shows the dialogue forms thought by the research team to be most appropriate for the various users of the information system.

The selection of dialogue types is seen to relate both to the users' needs and capacities and to the type of system specified in stage 3. The third element of the HCI is the security interface.

The problem for any security system is to provide access for users whilst providing a safe environment for the system. Security can relate to the system itself (e.g. passwords and user 'pin' numbers) or to the environment in which the system is set up (e.g. room security such as locks, etc., building security). This is often a paradoxical situation, in that, as security is increased so access can become more difficult (e.g. having to remember passwords, access only to parts of the system). Conversely, as access is made easier so security can become more fragile (e.g. the ability for unauthorised persons to gain access to confidential information). Each location and case has to be judged on its merits.

As the department's building already had security guards and the networked system was to be located in specific user offices which could be locked, the assessment of the CPAG and the analyst was that a simple password entry software tool would suffice.

This concluded the fourth stage of the methodology. In contrast to previous stages, Multiview did provide links from stage 4 to stage 5 and links to stage 5 from the other three stages.

Stage 5: technical aspects

Figure 2.8 shows the aspects of this fifth stage of Multiview and indicates the linkages of ideas and analysis and design considerations from previous sections. Although Multiview did develop linkage between stage 5 and the preceding stages the detail relating to each of the aspects was brief, leaving a great deal of room for interpretation on the part of the analyst.As with the earlier stages, the field work was used as an opportunity to develop a 'rapid' approach to the stage. Table 5.5 shows the various subsystems or aspects and their major elements with regard to the department.

The key aspects which were adapted in the analysis process were management, maintenance and monitoring. In the original Multiview all three were focused inwards on the database and related computer elements of the system. This did not seem to be appropriate in the present case, given the complexity of the social environment in which the system was operating and the stated eclecticism of the methodology.

This is how the researcher developed these aspects:

Management This was redirected outwards from concerns relating to the technology, to deal with environment and users as well as the workings (e.g. control and recovery) of the computer system itself.

Table 5.5 Tech nical aspects of stage 5

Aspects	*Characteristics*	*Department characteristics*
Application	Transactions in the computer, the major software tool	For example the roads register element of the information system would contain applications such as present cost status of roads, amount of road usage, environmental impact. The applications could be argued to be critical-indicator (CI) generating.
Database	Core data structures of the database	The entities and attributes set out in stage 2 (e.g. roads register)

Aspects	*Characteristics*	*Department characteristics*
Information retrieval	The output from the system	The view of almost all those contacted on this stage was to work from the existing report-form structures used by the department.
Control and recovery (management)	This deals with the overall information system process.	This element was thought to be named in an unnecessarily obscure fashion. The subsystem was renamed management. Simple guidelines were set out to deal with controlling the system, with the operating system, job priority control, security and user support.
Maintenance	In the original Multiview this related to database maintenance issues (e.g. records maintenance).	The maintenance thought vital in the department related to the system not the database level. Guidelines were set out for corrective and preventative maintenance procedures. These were tied in to maintenance-staff identification and training specification.
Monitoring	The general review of the system for its smooth running	This was very lightly dealt with in the literature. In this case it was covered in some detail and at a number of different levels.

Maintenance This was focused entirely on the maintenance of the system as a whole. The original Multiview applied maintenance as a database function. Table 5.2 indicates a wide range of potential risk features and uncertainties in the environment. Maintenance was taken as a vital line of defence against these problems. Preliminary discussions were held with members of the department concerning preventative and corrective maintenance measures. The preventative side of maintenance should act as a shell protecting the incoming system from environmental factors (e.g. heat, dust, humidity) whilst corrective maintenance ensures that systems are regularly assessed for their operational efficiency and problems are dealt with as they arise. The majority of discussions focused on maintenance staff and the development of maintenance logs.

Monitoring This needed substantial development. Initially the aspect was upgraded from monitoring (the assessment of the implementation of the project) to monitoring *and evaluation* (M&E, where E is the evaluation of the final product of the project). The work of Coleman (1987) was used to establish the value and importance of monitoring and evaluation. Figure 5.6 sets out his view of the procedure for projects. The diagram also builds in the stages of analysis and design as appropriate.

Figure 5.6 shows that monitoring and evaluation needs to be in place from an early stage in order to monitor the process of systems implementation and to feed back lessons learned to earlier stages as part of the process of reflection. This point has already been made in relation to the need to integrate the various stages of Multiview. Monitoring and evaluation in this wider sense of the term is valuable to analysis and design in that it:

- helps to ensure that lessons are learned, and

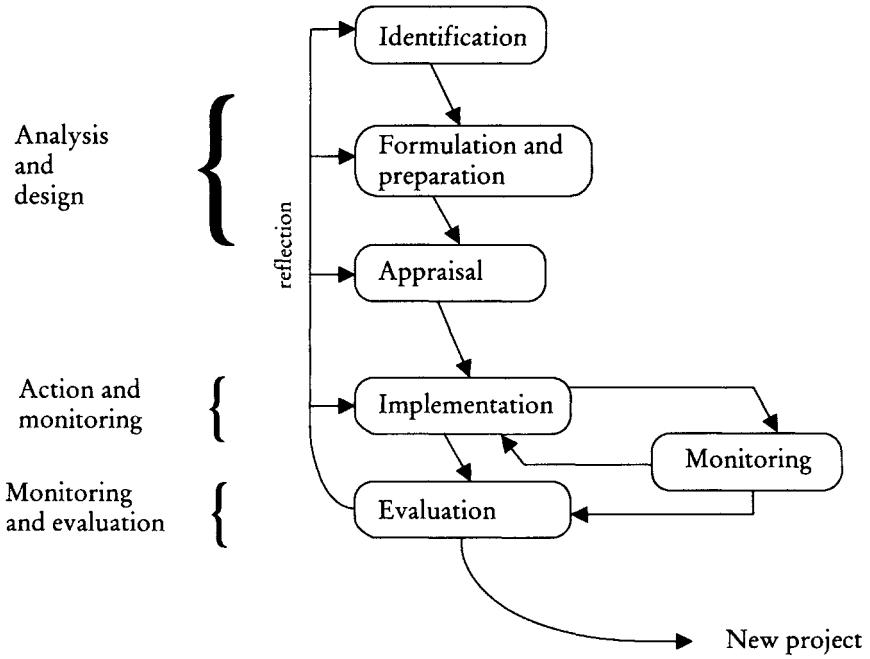


Figure 5.6 Monitoring and evaluation and systems analysis

Source: Adapted from Coleman 1987

- integrates the stages of the methodology.

The cost to the analyst/designer is that it extends the use of the methodology (and therefore the time required to undertake it) beyond the specification of a technical solution to systems implementation. This will shortly be shown to be an effective sixth stage to the methodology.

In an attempt to develop the monitoring and evaluation tool as a means to integrate further the features of Multiview, the researcher applied the stages of the methodology to the development of a systematic tool shown in Table 5.6.

Table 5.6 A monitoring and evaluation Multiview tool for the Department of Roads

Multiview stage	*Stage element*	*Indicators to be used in monitoring and to feed into project evaluation*
Human-activity system	Soft structure	Interdepartmental rivalry
	Soft process	Linkage to donor agencies
	Hard structure	Changes in departmental structure
	Hard process	New departmental links
Information modelling	Entities	New entities arising
	Attributes	Switching of attributes between entities
	Functions	Changes in the way functions are broken down
	Events	Changes in dates of key events

Multiview stage	*Stage element*	*Indicators to be used in monitoring and to feed into project evaluation*
Socio-technical systems	Human tasks	Changes in responsibilities
	Computer tasks	Economic performance of technology
HCI	Technical	Developments in dialogue (e.g. graphic interfaces)
	Social	New training requirements
	Security	Requirement for greater physical security
Technical aspects	Retrieval	New information products required
	Management	Changes in the systems performance
	Maintenance	Levels of breakdown

The indicators set out in the third column are not intended to be definitive but to provide a series of monitoring points for the analysis as a whole. The results of monitoring would be noted and lessons learnt would be fed back into daily operation in implementation and into the final project evaluation. This would assist the overall methodology because of:

- Multiview's existing weakness in this area
- the weakness of donor agencies in this area (as set out in Chapter 1, pp. 16–17).

The requirements of the department and the catalytic action of the tool required that Multiview be extended beyond the specification of the technical aspects of the system to systems implementation. This will be discussed next.

Stage 6: training, hardware and software selection and implementation strategy

To complete the analysis and design, the activities of training, software and hardware selection and implementation strategy were added to the methodology. The primary reason for this was to ensure that the results of the analysis and design were fed into the systems-development processes, so ensuring that designs were transferred effectively into the final system. In the case of the Department of Roads, if the methodology had not been extended to encompass these areas they would have been specified in an *ad hoc* manner either by non-specialists in the donor agency or (more likely) by vendor agencies in the capital. In neither case could continuity from analysis to implementation be guaranteed, and this could in turn lead to duplication of effort in some areas and earlier lessons being ignored. The inclusion of this sixth stage was thought to add to the holistic approach which is implicit in the eclecticism of Multiview.

It was not the purpose of the consultancy to produce definitive systems-development and implementation techniques and tools for Multiview; the intention was to set out broad themes which could be developed in subsequent stages by the same systems-analysis and design team. The major elements of software and hardware purchase, training and implementation strategy are set out in Table 5.7.

Table 5.7 Training, software and hardware selection and implementation strategy

Hardware selection
(adapted from Datapro 1980)

• System evaluation, including such stages as:

– gather information

– identify vendors
– identify if hardware will adapt to the user environment
– generate product short list

• Installation evaluation, including:
– what local factors will affect installation?
– How easy will the system be to use?
• Discussion of systems with an existing user
• Benchmarking the system
• Negotiation of the contract (including issues of update and support)

Table 5.7 Continued

Software selection

The specification of software includes:

• What size? How large are datasets to be?
• Volatility. The regularity with which old data is removed and new data added.
• Response time. At what speed (or at what events) is data required?
• Types of software, e.g:
– packages
– tailored packages or custom built.

Specific questions developed by Kozar (1989) at this point include:

– Which software does the job set out in the technical specification (stage 5)?
– Does software fit the hardware?
– How well do performance times of software relate to each other?
– Will the type of HCI set out in stage 4 be possible on selected packages?
– How adaptable to upgrade and development is the software?
– What is the comparative cost of software?

• Negotiate the suppliers' contract (including updates and support)

Training strategy

Specific features outlined included:

• the transfer of skills
• the repetition of skills outside the training situation.

Training would need to be discussed at all levels from senior managers to junior clerks, focusing on key areas in the various stages of implementation.

Implementation strategy

Using Kozar's (1989) model there are at least four types of potential strategy:

• Parallel approach: where the new system is run for a trial period at the same time as the old.
• Phased approach: aspects of the new system added on a function-by-function basis.
• Pilot approach: One aspect used as a pilot to test out the new system. If successful pilot procedures are applied to the organisation as a whole.
• Cut-over approach: Abrupt change of total system on a given date.

Kozar has suggested that these four approaches need to be assessed in terms of their implications for:

– stress
– cost
– duration
– human resource management.

Most of these issues have already been discussed in the earlier stages of the methodology.

The table indicates that for each of the four areas readily applicable ‘rules’ can be set out which build from the methodology as already applied. The approaches are not intended to be exhaustive in their scope but rather to suggest areas where planning is needed. As with many of the other adaptations suggested for Multiview in this fieldwork, the approach has more in common with that of Rapid Rural Appraisal as described on pages 48–51 than with the Structured Systems Analysis and Design Method mentioned on pages 22–24 and 34–37.

The action-taking stage of the action-research fieldwork ended with the proposal of the four elements of stage 6 . Multiview had been applied and examined in the context of the Department of Roads. The next stage of the study was to evaluate its performance.

EVALUATION

The evaluation of the use of Multiview was undertaken under two headings: the positive aspects arising and the problems. Both positive aspects and problems relate to two views of the fieldwork:

- the manner in which Multiview performed in the developing-country context
- the possibilities of adaptations to Multiview in the light of the developing-country context and the problems involved.

Positive aspects of the application

The following section notes the positive aspects observed in the various stages of Multiview in the fieldwork context.

1 The revised rich-picturing exercise did help analyst, donor and recipient to reach agreement on the areas of key concern to the project as a whole. The analysis of both hard and soft features was shown to be necessary for understanding the full implications of information-systems development.

2 The first stage of Multiview provided much of the information required for subsequent stages. For example, the visits to the sections of the department gave a first indication of problems in the handling of personnel records and the roads register library. These two data-collection and distribution points were identified as being central to a new information system and hence as entities in the information model designed in outline in the second stage.

3 The revised root definition, integrating CATWOE views from a number of perspectives, was considered by the researcher to be a useful tool for integrating a number of views, held by different people with different expectations and levels of involvement in the system, of one transformation and then developing a consensus and agreement on the way forward.

4 In all, the first element of the human-activity stage of Multiview was useful in providing information about which risk and uncertainty factors (from among those set out in Table 5.2) were likely to be

encountered. The soft approach provides the analyst with the necessary tools to cross-check for variations in view as to the requirements of the consultancy, as well as to maintain a broad perspective on problems. A narrower analysis and design might well not be concerned with power supply, operator skill levels, interdepartmental rivalries and concerns over factionalism in the organisation.

5 The information-modelling stage of the analysis produced a series of data-handling problems. As originally set out, this stage of the methodology was intended to be largely descriptive of an improved information system (in terms of functions, events, entities and attributes). In the event it was valuable in being more widely descriptive of further types of problem in the organisation (developing the themes set out in stage 1) which would need to be addressed if an improved information system was to be devised.

6 The socio-technical systems design stage, as simplified, provided a readily understandable tool for comparing the merits of potential systems.

7 The HCI stage as adapted linked closely into stage 3 and contributed to the development of the social and technical details of the system, thus enhancing the eclecticism of the approach.

8 The technical aspects were more directly derived from the previous four stages, linkage being seen as a critical point of this application. The amendments helped to focus this component on immediate issues pertaining to risk factors in the environment (e.g. power supply, theft), rather than on the data on which the original Multiview concentrated. This change can be seen as positive for this application. It also demonstrates the flexibility of the methodology under certain circumstances. The flexibility of methodology, and its implications, is dealt with in greater detail in Chapters 6, 7 and 8.

Problems with the application

Various problems arose with the stages of Multiview. They are presented in context here.

1 An overall complaint from the researcher about the Multiview approach was its inconclusiveness as a practitioner's guide. Many of the tools and techniques discussed in the Multiview literature required considerable additional detail to be of value in practice.

2 As Avgerou and Land (1992) have noted, centralised government bureaucracies can be suspicious of the value and credibility of the soft-systems approach. The researcher picked up concern from a number of senior sources as to the value of the soft first stage of the methodology. Even though the CPAG had some familiarity with the approach there was evidence that acceptance of soft procedures was far from wholehearted. This is not only a problem of Multiview as such; it is a general issue for bureaucracies in accepting critical evaluation. As such, it is an item of concern for all management studies.

3 The limitation of the research period to four weeks meant that no more than one week could be spent on stage 1 of Multiview. This limited the analyst's capacity to gain an in-depth understanding of the department and the possibility for discussion of the results of the stage.

4 All staff were fully employed, if not over-employed, on current projects. It was very hard to get officers together for briefing and fact finding.

5 Many junior staff had a very poor grasp of English. The researcher did not speak any local languages. Most interviews were aimed at senior staff and this meant that the view of the department and its problems was derived primarily from one source. The language barrier was noted as another aspect of concern in the design of any incoming computer systems.

6 The senior managers of the department were generally available only very briefly for discussion.

7 Experience indicates that expatriate researchers can be subject to several limiting factors when working in developing countries. These issues include:

- reticence on the part of the recipient in communicating fully because of the short time available to get to know each other
- user anxiety over divulging departmental secrets to outsiders, leading to apparent lack of co-operation at times.

8 The rich-picture exercise required greater structuring than that provided by the Multiview texts. Leaving the drawing of rich pictures as a relatively subjective process did nothing to improve the recipients' distrust of the soft method and tended to confirm their belief that its primary concern is with chaotically assessing items unconnected to information processing and more focused on political subjects. However, providing a structure did help to make the stage more understandable and useful. Measures applied included:

- listing formal (hard) structures in the organisation
- listing informal (soft) structures
- relating hard processes to hard structures
- relating soft processes to soft structures
- producing a rich picture from the above but using an agreed glossary of diagram notations.

This process provided a picture which could then be assessed in terms of the resulting tasks and issues facing the organisation.

9 The value of the rich picture in itself was problematic. The 'cartoon-like' form was not understood by many of the stakeholders in the system, and other presentational tools were discussed. This point received some further discussion and development in the second piece of fieldwork.

10 The use of root definitions was also problematic, in that the time constraint imposed on this analysis and design exercise required that only a few perceptions of the required transformation could be accommodated. It would have been of value to carry out a wider sampling of views. These would have provided a greater indication of the problems which the system might run into, from various staff factions and user groups (e.g. the CPAG, clerks, senior officers). For the purpose of this fieldwork, however, this might have resulted in two difficulties:

- Not enough time to assess the balance of a larger sample. All views of a system are subjective. Views once expressed need to be balanced against each other.
- Not enough time to undertake an integration, and potential reconciliation, of views.

11 The conceptual model, like the rich picture, although very valuable in itself for drawing out improvements in systems terms to organisational problems, caused difficulties when used as a tool for briefing participants in the analysis and design, whether donor or recipient. These arose because of the form of the model and the need for the people being briefed to understand something of the systems process which underpinned its construction. This raises the issue of participation again. If recipients are to be engaged in the analysis and design process, the tools used to convey ideas have to be 'user friendly'. The results of the first piece of fieldwork indicated that, for the human-activity system aspect, the existing tools required amendment at the point of presentation. Either ideas would need to be expressed in a formal report or more time would be needed to convey the forms and process of the methodology to recipients.

12 Linkage between stages of Multiview was weak in the literature. It was evident that some amendments would be needed to transform the results of the five 'views' into a single picture. The strengthening of the

link between stages 1 and 2 involved logical connections between the conceptual models in stage 1 and entity models in stage 2.

13 The information-modelling stage in itself was not unified in its scope, in that the entity and function aspects did not link together in a formal process. The stage was divided into two modelling components: entities and attributes on the one hand, functions and events on the other. In this fieldwork this issue was not resolved, but it was thought that for management information systems the identification of critical indicators (CIs) would help to focus the development of functions from the entity base and to create the information necessary for producing CIs. This theme will be returned to in the third piece of fieldwork.

14 The stage 2 to stage 3 link was hardly mentioned in the Multiview literature. The overall model of Multiview indicated that functions would be carried forward to socio-technical systems design but this was not explained in the text. 'Views' are either separate and non-connected or they are part of an eclectic view of the organisation which is gradually built up. As it stood the views were separate, leaving the practitioner to make what links were possible and feasible. The problems with this are first that the entire analysis could degenerate into a series of atomised views of the organisation which do not take each other into account and therefore do not develop as a learning process, and second that the views do not build a model which can deal with the complex reality which is an organisation. This was precisely one of the benefits expected from the eclectic view in the first place. This discussion will be developed in the section on analyst issues below.

15 The need for feedback between stages arises from the previous point. During information modelling the data-related issues diagnosed were fed back to enrich further the rich picture and to ensure that they would be taken into account in achieving the transformation set out in the root definition. Multiview as set out in Figure 2.7 displays no recognition of the value of this process. Again, for the eclectic nature of Multiview to bring real benefits it was thought that stages should support and build upon each other. Otherwise, when a stage is completed its conclusions may be accepted and then the results forgotten. However, if feedback occurs and stages are continually reworked in the light of later experience, the organisation continues to be represented as multidimensional, the analysis continues to develop on all fronts, and possibilities arise for the development of continuous monitoring and evaluation (M&E) tools. This point is developed in the third piece of fieldwork.

16 Multiview set out no linkage between stages 3 and 4. The comments made above concerning the potential atomisation of the methodology apply here also.

17 Stages 4 and 5 both needed amendment in terms of orienting the system towards social and environmental issues and away from a preoccupation with data concerns. Without these amendments the approach seemed to become too concerned with the technology aspect of the system—a tendency which seemed at variance with the eclecticism of the overall methodology.

18 Participation. As the fieldwork developed it became apparent that the system was being largely developed by the analyst, although there were meetings for briefing on progress. The reasons cited by department staff for this lack of interaction included:

- not knowing the methodology well enough
- not knowing the technology well enough
- 'It is not our job, that's what you are here for!'

Despite considerable efforts to encourage recipient empowerment in systems analysis and design, this remained a problem throughout. It was subsequently addressed in the second piece of fieldwork.

SPECIFYING LEARNING

The final element of the action-research approach to the fieldwork is to specify learning.

The fieldwork was rich in experiential learning. The key lessons will be considered under the headings of the analyst, the context and the methodology.

Analyst issues

The researcher began the fieldwork with a self-analysis in order to set out explicitly what he was bringing to the problem situation in terms of beliefs and approach. The value of this process within the study was:

- To act as a point of reference against which to measure the analyst's changing role. For example, from stage 3 of the methodology onwards it was noted that the analyst had to be more proactive in driving the analysis and design. This required that certain liberal attitudes towards participation had to be exchanged for an 'expert-driven' approach consistent with less participatory attitudes. This in turn has implications for the development of the methodology and the issue of participation in the fieldwork set out in Chapters 6 and 7.
- To act as a point of reference to measure recipient and donor attitude. It became apparent in the process of analysis and design that both the recipient and the donor had different views of the analyst's role from that held by the analyst. This in turn led to questions about the manner in which donor, recipient and analyst work with each other and what they expect from each other (e.g. roles and responsibilities). This issue of the perceptions of problem contexts and roles of participating agencies is one which first appeared here; it arose again in both the other pieces of fieldwork and is dealt with in more detail in Chapters 6 and 7. It also feeds directly into the context issues which will be discussed next.

Context issues

The issues arising from the context are presented first in the form of observations arising from the risk and uncertainty factors set out originally in Table 5.2 and represented here in Table 5.8.

The main items of interest arising from the review of context included:

- The sustainability of any new system. The analysis clearly demonstrated that economic conditions within the context would not support capital-intensive developments.
- In relation to the point concerning perception made in the section on analyst issues above, not only were there different perceptions of the analyst's role; there were also differences in how the system was perceived, and they affected the way in which the context was considered. They were most significantly addressed in the derivation of a root definition and in the production of the hierarchical information system set out in the conceptual model.

A fundamental observation arising from the research was that Multiview was not focused specifically on the practicalities of systems development. This issue is further developed in the next section.

Table 5.8 Context and the value of methodology: the Department of Roads

General factors	*Pre-analysis observations*	*Methodology responses*
1 Economic	The DoR has a large, unskilled clerical workforce involved in a variety of filing operations. The conditions of the head office (including broken machinery and non-functioning lights, etc.) indicate that there are problems in absorbing running costs for the department.	The analysis was concerned with the capacity of systems to be sustainable in context. This in turn meant that systems had to be able to respond effectively to difficult economic conditions. In the event this meant that hardware and software recommendations had to provide for minimum finance for maintenance.
2 Manpower	At the time of the consultancy there appeared to be one or two individuals in the department with some understanding of computer operations (a small system was producing occasional statistics and a payroll system was being planned). There was no evidence of SA&D skills. There was some pre-project training in SA&D for the three members of the Computer Policy Advisory Group. Existing information storage operations were poorly planned.	The methodology was specifically focused on the various groups within the DoR which would need to make use of the final system. Of major interest was the level of skills of the various groups and their linguistic requirements.
3 Physical	The country is physically isolated in terms of trade. It depends upon imports for most commodities. The power supply in the country is erratic.	It was noted that the systems to be provided would require uninterruptible power supplies in order to deal with the power fluctuations.

Table 5.8 Continued

General factors	*Pre-analysis observations*	*Methodology responses*
4 Cultural, demographic and social	The large clerical workforce employed by the DoR provides some evidence of being unskilled. Preliminary discussions with several members of senior staff indicated that there was a general lack of computer awareness amongst officers. This was linked to a degree of computer animosity among some staff members.	The first stage of Multiview was successful in indicating areas of staff animosity to new systems. Furthermore the lack of computer awareness, already noted in item 2 above, was recognised at an early stage, and action to focus training on key areas was suggested in stage 3.
5 Political	At the time of the visit there was considerable political instability. The accompanying sense of a need for change seemed to infiltrate most aspects of the department. Decision making was highly centralised.	Information systems need to reflect realities in the context. The country's political system was reflected in the department in a highly hierarchical structure. It was noted during the root-definition element of stage 1 of the analysis that views varied considerably about the value and purpose of the analysis and design exercise among different staff.

General factors	*Pre-analysis observations*	*Methodology responses*
		Adaptations to this element allowed these variations to be reconciled.
6 Existing information infrastructure	As well as the observed problems with imports of commodities (including computers), national communication was managed by a mixture of difficult radio links (prone to breakdown owing to climatic disturbance) and lengthy road journeys.	The analysis and design was critically concerned with the national 'mission' of the DoR whilst recognising that most of the initial interest in technology was to be focused on the internal workings of the main office in the capital.

Methodology issues

So far as the development and extension of methodology is concerned, three areas for learning can be defined:

- Multiview as it stands has internal problems of linking stages together (as discussed in the section on Stage 1 and shown in Figure 5.1). If the analysis and design methodology is to deal adequately with the complexity of organisations, there should be integration and cross references between the constituent parts; otherwise the question arises as to why the analyst/ researcher should use an eclectic methodology. During the fieldwork a number of attempts were made to develop the links between stages. Most promising of these is the development of the monitoring and evaluation tool, but this in turn raises another issue:
- As it stands Multiview ends with the technical aspects stage. This leaves development and implementation outside the scope of the methodology. M&E as set out in the fieldwork assumes that subsequent training, software and hardware procurement and systems implementation strategy are to be included in the total systems-analysis and design project.
- Finally, the most important methodological lesson from the consultancy was that the fieldwork was centrally concerned in producing a practitioner's tool in the spirit of Rapid Rural Appraisal rather than an academic's theory in the spirit of pure design. Much of the Multiview literature was seen to be deficient in understanding the realities of the practitioner's role (e.g. gaining participation, providing stakeholders with the capacity to set out an implementable system). Many of the amendments and changes made arose directly because the methodology as it stood was incomplete or aimed at inappropriate levels of systems (e.g. data issues rather than organisation issues).

Table 5.9 shows the changes made to the methodology as compared with the original.

CONCLUSIONS

Multiview was used and successfully helped in the production of an outline management information system. The system was 'successful' in that the results of the analysis and design were accepted by both donor and recipient. From the preceding section it can be seen that Multiview needed modification and amendment so that it could be appropriately adopted in the context of the Department of Roads. An outstanding issue to be carried forward to the next piece of fieldwork was participation as a means towards improving the recipient's ownership of methodology.

Table 5.9 Multiview methodology: a comparison before and after the first piece of fieldwork

Stage and link	*Original Multiview*	*Multiview after fieldwork 1*
Pre-analysis and analysis preparation	No detail	Self -analysis of the analyst and preparatory tools specifically relating to interview techniques
Stage 1 : the human activity-system	Rich pictures, root definitions and conceptual models	As original, plus standardised glossary of diagram tools for rich picture, multiple uses of root definitions to cross-check results, conceptual models
Link stage 1 to 2	Conceptual model to functional decomposition but no clear link	Conceptual model plus transformation from root definition to entity model Explicit link
Stage 2: information modelling	Functions, entities, attributes and events	Re-ordering of four elements, plus greater emphasis on integrating them together into a single model
Link stage 2 to 3	Functional model but no explicit guidance	Details of the organisational change and data requirements from stages 1 and 2
Stage 3: socio-technical systems	Options, alternatives, comparison, selection, human tasks, computer tasks	As in original, plus greater focus on computer-based alternatives and a simple comparison tool
Link stage 3 to 4	Role set and people tasks	Carry forward social and technical aspects of stage 3 to social and technical interfaces
Stage 4: HCI	Dialogue types	Social interface, technical interface and security interface
Link stage 4 to 5	Links from all previous	As in original stages
Stage 5: technical aspects	Application, database, maintenance, retrieval, control, recovery, monitoring all data-oriented	Application, database, total systems maintenance, retrieval, management, M&E total-system oriented
Further stages	No provision	Software and hardware selection guidelines, training guidelines, implementation guidelines

6
LEARNING CYCLE 2: AN ADMINISTRATIVE STAFF COLLEGE

The first piece of fieldwork was based on an examination of the potential of Multiview in a situation where analysis and design had to be completed in a very short period of time. Although there were other factors at work in the situation, some of the problems associated with this timescale were:

- the need to abridge the methodology in places (e.g. stages 1 and 2)
- the need to adapt the methodology to simplify it in places (e.g. the selection of socio-technical alternatives)
- the need to adopt other elements into the methodology (e.g. tools relating to how to undertake analysis, structuring the human/computer interface, software and hardware selection criteria, implementation issues).

The second piece of fieldwork was based at an Administrative Staff College first introduced in Chapter 4. It arose from the changes mapped out in the first fieldwork and developed some of the themes set out there. As with the first fieldwork, the tool used to assess the situation at the beginning of the study was the self-analysis tool shown in Table 5.1. Table 6.1 shows the situation at Frame 5, just prior to the present study.

It can be seen from Table 6.1 that there has been some intellectual, methodological and personal movement since the previous frame was reviewed in Table 5.1. At the time of the fieldwork the analyst is still orientated towards an interpretative approach but the liberal attitude of the first piece of fieldwork has been replaced by a more conservative view. This movement away from a liberal approach results largely from the client's expectations of what the analyst is intended to do. In the first fieldwork the recipient of the technology, specifically senior members of the department, had a view that the analyst was the 'expert' and should be less interested in encouraging stakeholders to express their own views and more proactive in ascertaining the direction of the research. Whilst not wishing to reduce the user involvement in the analysis and design process, in fact wishing to increase it, the analyst thought that a more formally expressed attitude towards both recipient and donor would lead to greater confidence by both groups in the outcome of the study.

Table 6.1 Self- analysis prior to research at the Administrative Staff College

1	*2 The intellectual framework*	*3 The methodology in use*	*4 The area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
Frame 5 (mid-year 1989)	Following application of Multiview,	The basis of the research was still Multiview,	An Administrative Staff College	Still interpretative. The fieldwork in the first study indicated some

1	*2 The intellectual framework*	*3 The methodology in use*	*4 The area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
	increased interest in participative approaches and in the value of eductive techniques.	specifically the Wood-Harper, Antill and Avison version set out in the 1985 publication, but overlaid with the considerations set out in the first field study.		problems with clients if too liberal an attitude is taken; therefore slightly more conservative whilst emphasising participation in the design of the system.

Another departure from Table 5.1 is the development of methodology. Multiview is now overlaid with the adaptations and adoptions which are noted in Table 5.9 and discussed throughout the first field study. The issue of methodology development will be discussed in greater detail in Chapter 8.

As with the first field study, the structure for the research was as that given by Bottrall as set out in Chapter 4.

DIAGNOSIS

The diagnosis is concerned with the context, the evolving methodology and the analyst which came together to produce the research. Material for the diagnosis is drawn chiefly from the field research and notes and exercises produced by college staff while training in the United Kingdom and in the country.

The country

The country for the second research study is populous (a recent census indicates a population of several tens of millions). In order to understand the context of the college and the attitude within the country to information systems it is necessary to understand some details of recent history.

The country splits along tribal lines. There are several major tribal groups as well as several dozen smaller groupings. From conversations with nationals, it is apparent that tribal identity is still important and that it is to some extent seen as being more important than national identity.

The other major division in the country is religious. Islam and Christianity are the major religions. The picture is further complicated by the existence of over a hundred tribal religions. The religious differentiation should not be superimposed on the tribal breakdown. All major tribes have both Islamic and Christian elements. The relationship between the two major religions has always been stormy, and religious riots, with the burning of churches and mosques, have been regular events over recent years.

The other element of background required in understanding the situation is economic. The country is rich in many minerals, including oil, but this wealth has not been evenly distributed in the past. As a result of internal turbulence and corruption mineral wealth has not been translated into high living standards. In order to gain needed foreign currency for imports via access to loans, the country instigated a World Bank Structural Adjustment Programme. Key elements of the programme are the control of public finance and the continued rigid maintenance of austerity.

This is the national context in which the college has been operating since its founding.

The specific situation

Since its establishment the college has been involved in the training of mid-to high-ranking civil servants. The college occupies a site some distance from the capital and employs over 2,000 staff, approximately 200 of whom are professional training or administrative staff, the remainder being support staff. Since the mid-1980s, the college has also had a smaller site where some training programmes are also run. The college is constantly changing and adapting its core of basic courses but essentially offers training in the areas of general management studies, financial management, public sector ethics, administration and accounting. As well as running the core training programmes, staff are also involved in consultancy services for other governments in the region.

In the 1990s the college suffers from its remoteness owing to the difficulty of road transport; for example:

- Often the college's vehicles are out of commission and not immediately repairable because of lack of spare parts.
- All travel has to be completed before nightfall on account of bandits.

The remoteness is further exacerbated by erratic telephone communication with the capital and unpredictable internal postal services.

These factors can be better assessed if compared with the full range of risk and uncertainty factors as set out in Table 6.2. The table indicates that the college suffers from a wide range of these factors. Included here, and to some

Table 6.2 Risk and uncertainty factors

General factors	*Conditions in the college*	*Observations*
1 Economic	Labour-intensive society Low availability of capital Inability to absorb recurring costs	The college had little access to funds for the purchase of capital goods. At the time of the first visit in 1986, the college had been attempting to purchase a single microcomputer for some time but could not clear the expenditure. Generally capital equipment was in a poor state of repair with little evidence of funds being available for maintenance of existing resources.
2 Manpower	Lack of available trained personnel	The college had no trained IT staff in 1986. Prior to this fieldwork some staff (one group of five and another group of two) had received training in basic microcomputer applications in the UK. Many staff had received some microcomputer awareness training.
3 Physical	Limited resources Geographic isolation	As has already been noted, the college was quite isolated. This situation was compounded when the mains electricity supply was

General factors	*Conditions in the college*	*Observations*
		inoperative and both internal generators were also out of commission, a fairly regular occurrence.
4 Cultural, demographic and social	Large percentage of unskilled workers Factions	The college had a support staff to professional staff ratio of 20:1. Most support staff received only brief on-site training in highly specific areas. The training ethos of the college did mean that the principle of training in computer awareness for junior staff received wide support from senior staff. The college contains a number of factions along the lines discussed on p. 125. It proved to be difficult to assess the implications of this factionalism.
5 Political	Need for tight security Constantly changing priorities Centralisation or decision making	The site had been made reasonably secure at the time of construction. A perimeter wall had been erected and a staff of security officers employed. All staff and vehicles are searched on leaving the compound. The college has to reflect the political priorities of the Government. The changing economic climate has led to changing priorities. Decision making is centralised in the hands of the Senior Director.
6 Existing information infrastructure	Poor quality of telephone services Inadequate postal services Tight customs control	Telephone services are erratic, as are postal services (although international mail seemed to be relatively trouble-free). The import of capital goods is rendered more difficult because of import duty and corruption.

Source: Adapted from Eres 1981, p. 101

extent invisible to the outsider, is the issue of factionalism. During preliminary investigation, members of college staff explained to the researcher that, like all large organisations, it contains a number of different factions, both tribal and religious. Linked to this internal conflict were the relationships between the senior staff and the project managers.

Throughout the three-year period of the study the analyst was aware that at times internal and external factional interests were impinging on the process of analysis and design. However, it should be noted that the description and analysis of such interests is a subjective matter depending upon the role and standpoint of the observer. The researcher often received contradictory information as to the nature of current thinking and the predispositions of senior staff to the project from different sources within the college.

Elements of the methodology (e.g. stage 1 and the social side of stage 3) focused on these issues in so far as they impinged upon the successful running of the project. By this means it was possible to make some

assessment of the importance and effect of the context. Given the short amount of time actually spent at the college, however, it was difficult to gain a full understanding of the complexities of this element of context.

Key points arising from the diagnosis are:

- The relatively poor condition of the college's finances. This was most notably evident in the inability of the college to maintain capital goods, such as power generators.
- Its relative isolation in terms of both a continuous power supply and access to the maintenance and supply skills offered by a large metropolis such as the capital.
- Although by 1988 many of the staff had access to computer-awareness training, the general level of computer familiarity was very low. At the time of the study it was not evident if this was because the computer laboratory, known as the computer unit, was so tightly guarded as to make access difficult, or if there was generally a lack of enthusiasm for the facility among staff.
- There was evidence of conflicts between internal factions in the college and also of conflicts of interest between the donors, project managers and senior college staff.

These features indicate that there was a wide range of factors which might impact negatively upon the further development of information technology and information systems within the college. In short, the development of information systems was set to take place under conditions of physical, economic and social risk. The methodology would need to be evaluated in terms of its capability to cater for these conditions as the project advanced.

ACTION PLANNING

The action planning stage of the research was based upon the existing IT development context. In 1986 the college had hosted the first consultancy visit which resulted in the receipt of a laboratory of IBM XT computers plus uninterruptible power supplies, printers, software and general training for a small number of staff both in the UK and in the country. Staff training had focused on the development of a cadre of IT professionals—a manager, trainers and maintenance officers—and in general awareness raising among senior training staff in the college. The laboratory had not been planned with Multiview. A hardware/software procurement technique had been applied and systems analysis was not included in the training of the IT staff. The laboratory was intended to be used by staff as a training resource for the Civil Service but three of the systems provided were expected to be developed in the college as management information systems (MIS) units for the library, the stores, and accounting—specifically the payroll.

The fundamental aspects of the consultancy were set out by the funding agency, the project managers, the Civil Service and the senior director and senior staff of the college itself. One major feature of the consultancy was that the success of this project was seen as being essential for a second, and possibly larger, project to be initiated in 1992. In order for this to materialise the college had to be assessed as achieving some degree of proficiency with the first set of equipment.

The objectives of the consultancy

Target objectives for the project were originally devised by the donor and the college in co-operation with the Government. In the first instance, it was not known how many computer-related inputs there would be in relation to the rest of the project, or how long they would take, although approximately two two-week visits

were envisaged annually. Decisions on the duration and type of contributions to be made by the analyst/researcher would result from the donor's and analyst/researcher's agreed perception of the rate of development of the college towards the agreed objectives. These objectives are set out below.

1 For the computer laboratory to be operational in offering a range of basic computer courses for the staff at the college and more generally for the country's Civil Service. Courses at this stage were envisaged as being in the area of computer awareness and the provision of basic software skills.

2 For the MIS units in the library, stores and accounts to be in place and functional. This objective did not specify that MIS activity had to be fully developed. At this stage the generation of a range of simple database and spreadsheet applications would be sufficient. Automated information system applications would need to be duplicated in the first instance by manual practices.

3 This, the most critical objective, was for the college's computer staff to undertake a range of fieldwork, thus demonstrating their capacity to undertake computer-related research work, such as systems analysis. The fieldwork was intended to cover the specific areas of interest to the college, such as:

- To arrive at a picture of the computer needs of the various departments in the college and, related to this, the computer awareness and skills of the staff in the departments. This fieldwork would indicate present capability and link it to present perception of need. To some extent the fieldwork was expected to act as a priming activity, generating interest in and awareness of the current facility.
- To review the training needs of the Civil Service. As noted earlier, the college's prime function was to act as a training resource for the Civil Service. The need for training, and the type of training required, were unknown at the time of the fieldwork. The review of training needs study was part of the effort to understand the magnitude of demand in the public sector.
- To carry out detailed systems analysis of the college with a view to establishing a schedule for the future, and a provisional recipient view of the major requirements for a second project. This study was of major importance. The fieldwork was primarily focused on this element, as it was the vehicle for local staff to demonstrate their facility with the Multiview methodology and their capacity to use analysis and design in the context of the country. The setting out of analysis would provide the evidence that staff in the college were fully capable of participating in the analysis process.

The donor agency was concerned with achieving sustainable development, requiring the college to demonstrate a capacity to absorb and maintain the various information-technology aspects of the project. Therefore, a major requirement for the achievement of all of the above objectives was that the college be demonstrably self-supporting in its computer training, analysis and design and maintenance. For this to be achieved, participation was a prerequisite for the project as a whole so that the indigenous facility could be properly assessed. In order to assess the degree of participation achieved, the results of the college's various efforts would be compared with the criteria which Hirschheim had produced in 1989, i.e.

- Users possess positive feelings towards participative design, indicating that there is a commonly expressed appreciation of the value of such participation in terms of the appropriateness of the final system.
- Participation appears applicable for most systems development or technology introduction.
- Participation does mean that users are involved with the systems development process but this does not necessarily lead to fewer requests for systems modification at a later date.
- Participation is not problem-free—for example Hirschheim discovered that problems included:

- Participants still required the proactive input of a consultant to keep the design process running.
- Some participants felt that they did not have enough time to dedicate to the process.
- The group involved in the design process has to be the right size (an issue which varies between specific projects) otherwise it is non-representative or unwieldy.
- Systems boundaries. Hirschheim notes that participants were unclear about the extent of the systems on which they were working and therefore the degree of responsibility they had for design outside their own specific location.
- When to begin the participation.
- Seniority of participatory staff. In the Hirschheim survey it was found that senior staff have more willingness and greater ability to participate. Junior staff do not have the same confidence to express their ownership of the system.

(Adapted from Hirschheim 1989, p. 194).

The experience of the college fieldwork would be compared against the general results of the Hirschheim study in order to assess if the experience of the college was comparable to more general findings. The comparison would be expected to provide meaningful observations concerning the college's capacity to participate in analysis and design, and also to indicate if problems with participation experienced in the United Kingdom were also experienced in this study. This in turn would cast light on the issue of participation as experienced throughout this research as a whole.

Participation was discussed in the first piece of fieldwork as being either consultative, representative or consensual (Mumford 1979). In the college context, two levels of participation were required from two groups of the staff. The first group, the IT specialists both in the computer laboratory and the MIS units, would be required to participate at the level of consensus, driving the analysis itself. These individuals would need to be familiar with the methodology. Participation for this group would be achieved primarily through the training of key staff members in the use of the methodology. The second group of staff to be involved were the potential users within the college. As already mentioned, at the time of this continuation of the project in 1989, some college staff had received awareness training in the use of computers, but analysis and design had not been included in the training outline. The intention from this point was to develop computer awareness in order to improve the internal development of such technology in the college as a whole. The level of participation of the second group would be consultative, feeding in concerns and observations to the specialists.

In 1989 the project suffered from a lack of computer-trained staff. The training undertaken at this time was short term and based on the acquisition of skills; more substantial academic training (e.g. at Masters level) was not available in the project as originally agreed. Further, some staff who had been trained had not, in the opinion of the analyst/researcher, made full use of their skills; they had been switched to other sections of the college through either personal preference or the interest of their superiors. Because of this, the entire college computer facility was dependent upon the skills of two individuals, the computer unit manager and the computer unit maintenance officer. Another aim of the project was therefore to broaden the base of officers competent in the use and development of computer facilities. This training was seen as being important in both the computer unit and the MIS units.

ACTION TAKEN

The fieldwork was developed from the experiences of the first study. It was therefore necessary here to develop a more participative approach to systems development, and this was reflected in the outline terms

of reference set out above. Participation was to be encouraged by broad training in the use of Multiview and by helping staff to develop new potential lines of systems development, as set out in the terms of reference for a report on internal analysis and design.

The application of Multiview

The application of Multiview was based both on the Wood-Harper, Antill and Avison book (1985) and on the adaptations arising from the first piece of fieldwork. The methodology was taught to computer unit staff, and to staff from each of the three MIS units. The training itself spanned three years and was undertaken both in twelve-week training courses in the United Kingdom and in workshops at the college. In participation with the analyst/researcher, college staff involved themselves in outlining their current situation and the developments they wanted to see for the future.

Stage 1 of Multiview: the human-activity system

The work on the human-activity system can be broken down into that which was carried out by the MIS units and that produced by computer unit staff.

The MIS units

Two members of each of the three units were introduced to the Multiview methodology and encouraged to outline, first in terms of a rich picture, then as root definitions and conceptual models, the manner in which their units worked and the potential improvements which the computer software already supplied (databases and spreadsheets) could provide. A number of models were produced and the rich-picture work in particular was of value in providing the analyst/researcher with insights into the workings of the various departments and the personalities and conflicts within them (including complex observations concerning factionalism).

Generally the root-definition and conceptual-modelling stages were less revealing. The root definition in particular was often seen by staff as being a ‘rubber stamp’ for the system as already devised in the procurements set out in 1986. Each MIS unit was to receive one computer with uninterruptible power supply and printer; two members of staff were to be trained in the development of an appropriate application. In the light of this reality the transformation expected from the system was often stated in highly generalised terms, such as: ‘to improve the information processing function of the unit’ (comment made by an MIS unit member of staff).

Attempts were made by the analyst to encourage staff to be more imaginative or more specific in the changes expected from the system (e.g. discussing new areas within the context of the units or specifying directly those existing areas and the levels of change expected and required). While guidance was offered, care was taken that the analyst/researcher did not take over the stage and thus reduce the participants’ sense of ownership over the systems design. The researcher observed in this stage of the fieldwork that staff were highly conservative and unwilling to adopt policies which might be seen by senior colleagues as being beyond the boundary of their concerns (a point noted in the Hirschheim study).

The conceptual models produced were usually re-expressions of the workings of aspects of the department. Efforts were made by the analyst/ researcher to encourage staff to produce models focused on information-processing flows and activities within the three units, and this met with some success, most notably in the library unit. It became apparent at this stage that the systems to be designed and operated in

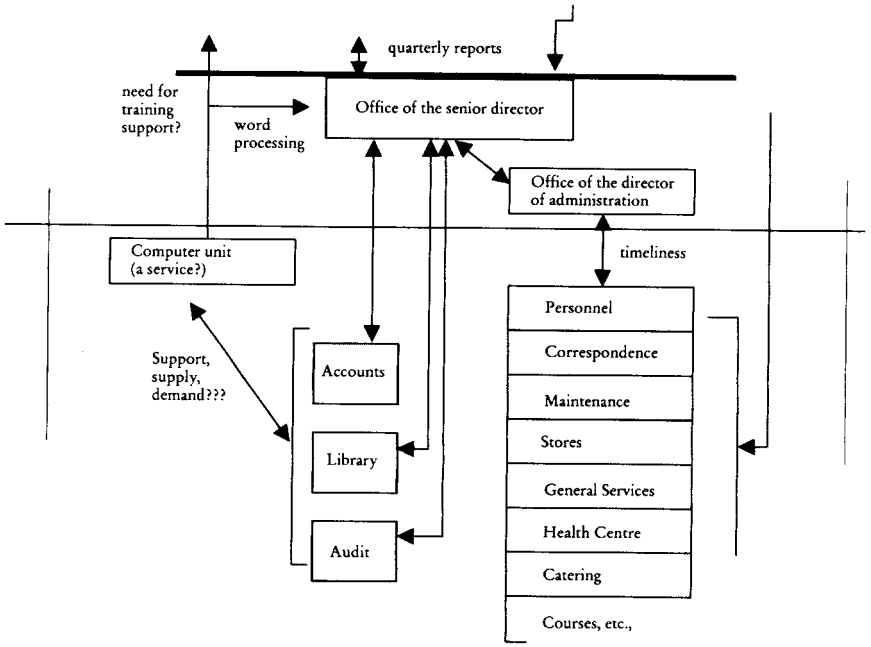


Figure 6.1 Element of the college rich picture

each unit would in the first instance be electronic databases of information rather than information systems producing critical indicators. However, it was noted by the participants that the resulting databases were the first stage of the new systems development, the move from database to management information system being a second evolutionary step in the overall systems development. The alternative to this approach would have been for the analyst/researcher to be more proactive and to generate the system with less emphasis on a consensus approach, adopting a more consultative basis. But that would raise questions (as set out in Chapter 1, the section on technology transfer) of how suitable the resulting system would be. For example, would it be inappropriate and soon redundant? Would it be liable to break down and not maintainable locally? And might the analyst's intervention result in staff not being brought into the planning process and thus being unable to manage the new facility? It has already been argued that the systems being designed must, from the overall project perspective, be locally designed and managed. The consultant for the most part is several thousand miles away.

The computer unit

Here the response to the analysis and design exercise was more innovative. Staff plainly had difficulty with the diagrammatic and 'cartoon' type skills required for the clear production of rich pictures. And reservations about the informal structure of the diagrams caused concern over their value as informative tools for providing management with a clear analysis of current practice. Because of this problem, the participants were encouraged to produce, with the assistance of the analyst/researcher, their own kind of rich pictures. Figure 6.1 is one such picture.

The picture has a number of features which make it different from the rich picture as usually produced:

- In diagrammatic terms it appears more like a circuit diagram, indicating the communication between different units.
- Unlike the usual form of rich picture, all conflict and interdepartmental rivalry is removed. The concession made to areas of uncertainty is to place a question mark near them.
- In its focus on departments and their relationships the diagram is more like an organisational chart.
- The above come together to provide a view of the organisation which is conservative and non-confrontational, but also unrevealing of the real difficulties and problems that reside in the organisation.

These observations are particularly interesting when compared to the informal views of the operations and procedures of the college set out in Table 6.2. This issue was seen as relating to the staff's unwillingness to appear to be critical of the organisation and therefore of the leaders of that organisation, an interesting element of the context.

A number of features which arose from reporting sessions with the unit staff do not appear in Figure 6.1:

- the need for high-level political support for the unit in order to ensure stability and continuity, specifically with regard to the development of a recurrent budget
- the need for a stable power supply for the unit to protect it against the power fluctuations experienced by the college
- the requirement for extensive further training and staffing in order to be able to cope with the perceived growth in demand that would be placed upon the unit.

These observations did not appear in the rich picture, presumably because they were thought to be political or beyond the scope of the unit. The other element of the human-activity system which was developed by the computer unit was the conceptual model. This varied considerably from Checkland's original (see Checkland 1981, pp. 169–180) and was therefore renamed in this exercise as the 'outlining model'. As with the rich picture the conceptual model idea was adapted by staff, the primary focus being on the development of a diagram which could be readily understood by other staff. They decided that the model should reflect the organisational structure of the college rather than activities or systems. The researcher/analyst recognised that such an approach would tend to re-emphasise the status quo, but this seemed to be unavoidable (from the perspective of the members of staff) if the analysis was to be accepted. The model is still conceptual in that it outlines how the computer unit would integrate into further aspects of the work of the organisation. Of less importance intellectually but of greater importance presentationally, it was decided to use straight lines and boxes rather than the usual bubbles and curved lines. The model shown in Figure 6.2 shows various organisational areas, in terms of departments, and their expected interrelation with the computer unit.

The production of the conceptual model by the computer unit staff completed the analysis of the human-activity system. When the system for the college had been planned in 1986 the outlining of the computer laboratory and the three MIS units had been completed entirely by outside consultants (under the terms of the project document at that time). The model produced in the college did not deviate from the original work but did show the following positive developments:

- the recognition that there are flows of information which link the entire organisation
- the integration of the computer function as a key facilitating element to that flow.

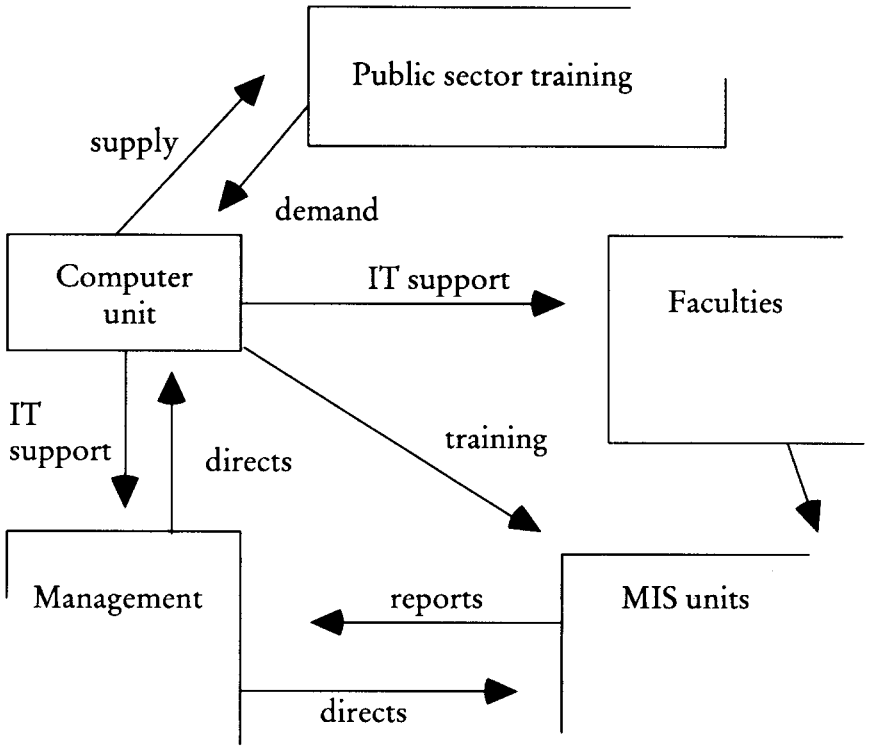


Figure 6.2 Element of an outlining model/conceptual model

The diagram was produced by college IT staff and was intended for local consideration by colleagues. These two factors need to be kept in mind in assessing the value of the exercise.

Stage 2: information modelling

The MIS units For these units the development from stage 1 of the analysis varied in each case depending upon the conditions and requirements of each.

The *library* had been selected in the first place for MIS unit status because there was a functioning manual data base system based on card catalogues. The analyst considered that the library also possessed the staff necessary to manipulate data and to consider their information and data-processing requirements in terms of entities and attributes. Two staff from this unit undertook training in the United Kingdom, where they were encouraged to apply design and database skills to the development of simple systems on the basis of the conceptual models which they produced.

As has been noted, the technology and staffing for the units was given in the original project document. This factor, combined with the need to enable the participants to become rapidly familiar with the actual outcome of analysis and design, led to the view that it would be valuable to encourage staff to produce the databases which they saw as being central to the eventual system. One of the two staff produced several

important database files for use in the library. These were linked together by some simple programs which were produced in collaboration with another trainee from a separate project.

Unfortunately the *stores* unit was without a unit head for much of the duration of the project because of internal problems in the college. As a result, only one member of staff from stores received computer training, and he was moved on to other duties shortly after his return to the country. However, major entities and attributes were drawn out during training, and some simple databases were produced.

Two members of the *accounts* section received training and were encouraged to develop models of the various accounting operations in the college. The area was large and complex and the staff involved in training were quite junior, lacking authority to take decisions on major information system issues (e.g. performance of cost centres such as catering and maintenance, or the relative profitability of different courses). Initially it was decided that the focus of their work would be on payroll. This was an area where considerable improvements could be made merely on the basis of the existing calculation errors produced by manual practices that involved large numbers of clerks. Because of the complexity of the country's tax system (e.g. a large number of tax bands), UK-based packages were not appropriate. In participation with the analyst/researcher and other trainers in the United Kingdom, two simple, semi-manual systems were derived from basic entity modelling.

The computer unit The conceptual model produced in the first stage of Multiview had indicated the position of the unit in the college, in terms of its relation to existing information flows as a whole, but had not explicitly indicated the information processing which the unit would be required to provide for the college. The outlining conceptual model indicated only that the unit would provide 'training' and 'support' to other departments.

The information-modelling exercise undertaken by staff provided an outline of how the various sections of the college were organised and linked together. This provided valuable information about how the college worked, and indicated areas in which training and support could usefully be provided. It did not, however, provide any information on likely computer-based improvement to operations.

Stage 3: socio-technical systems

The MIS units Stage 3 and the further stages of the analysis were not completed in any detail or depth by the staff on the training programmes. As already noted, the computer tasks for the various units were set out in the original 1986 specification which included details of hardware and software, and the related human tasks of providing a structure for the database and maintenance. Staff did recognise and report on the need for the college to be self-supporting in IT and training because of its physical isolation.

The computer unit Stage 3 resolved itself into a detailed listing of the staffing and systems which would be needed if the unit were to provide necessary support for college staff and the public sector at large. The computer unit, like the MIS units, recognised the key importance of maintaining the college's IT capacity in terms of management and maintenance.

Stage 4: the human/computer interface

The MIS units Although some time was spent in discussing likely screen interfaces and the need for training of junior staff (technical and social interface areas as set out in the first piece of fieldwork), the majority of time was spent on the security interface. This was seen by the local staff as being the primary

issue as the units could not receive their computers until security was established. The main emphasis of the security review was on providing adequate protection against theft. For example, a room was set aside, bars were put on the windows and locks on the door, and a short list of authorised staff was created. The environment was also catered for: air conditioning and uninterruptible power supplies were provided.

The computer unit When the unit was first set up it was provided with security and management. The only issue to arise from this stage of the analysis was the need for an uninterruptible power supply for the room as a whole.

Stage 5: technical aspects

The MIS units Application, retrieval and database functions had been set out during the information-modelling stage of the analysis. Management and maintenance were provided in part by the computer unit. Monitoring and evaluation remained an issue difficult to develop beyond the area of physical maintenance of the hardware and software, partly because the form and structure of monitoring and evaluation for this context was still unclear to the analyst/researcher, and partly because the local staff considered that the narrow view of this function was adequate.

The computer unit The analysis and design exercise by the computer unit had largely resolved itself into a review of present and future computer capacity for dealing with training and support needs, concentrating specifically on the requirement for the college to be self-sufficient in computer expertise and maintenance because of its physical isolation. The technical aspects were already largely accounted for in the existing unit structure. One further question of preventative maintenance arose: computer viruses. On several occasions over the three-year period of the fieldwork viruses had appeared in the college, on one occasion actually causing closure of the unit. Anti-virus software was seen by local staff and the analyst/researcher as a priority for the immediate future.

Stage 6: training, hardware and software selection and implementation strategy

As indicated in the previous section, aspects of software provision, training in monitoring and evaluation techniques, and further analysis and design skills had been identified as necessary. The lessons learnt from the first piece of fieldwork were carried into this work, and some general specifications were given for training, software, further hardware and means of implementation.

EVALUATION

The evaluation of the system, as in the first piece of fieldwork, reflects on both positive and negative or problematic aspects of the Multiview approach. It also compares the results of the present case with those achieved by Hirschheim (1989).

Positive aspects of the application

Staff were generally keen in principle to learn more about the system-planning aspects of their work. Most perceived it as a means to improve their own work status and increase their responsibilities. Some of the staff of the MIS units did express concern over their ability and competence to produce the designs for

workable systems, a point related to competence and confidence, but there was a general willingness to 'have a go'.

1 Many rich pictures were produced which were both instructive and revealing of the way in which the college worked, though those produced for public consumption were highly uncritical (see the section on problems below). There was, however, a positive side to the organogram-style rich pictures produced. This relates to the adaptability of analysis and design tools to local conditions—what might be described as tailoring the design process. This introduces the important idea that the appearance and working of a methodology is a critical factor for the understanding of the individuals who have to work with it. The experience of this fieldwork was that understanding and ease of use were facilitated by adapting the methodology, often reducing those critical (current practices) and informal aspects (e.g. rich pictures) which seemed at variance with the college's bureaucratic structures and procedures. Participants in the process of analysis and design wanted to be able to recognise what they were getting from the analysis in a form which was readily apparent and non-confrontational (an observation arising from training). To the researcher/analyst, some of the work produced by the college in both analysis and design seemed imperfect and even erroneous in terms of the original ideas as set out in Multiview, for example, both the rich picture and the outlining/conceptual model were at variance with what is usually produced. However, taking into account the importance of local empowerment and understanding of the analysis and design procedure, these matters could be argued to be of secondary importance in the first instance. Over the longer term it would be expected that skill in the use of the various tools and techniques would increase and that the use of the methodology would come closer to the original. A significant proviso here would be that college staff would overcome their unwillingness to be critical.

2 The outlining/conceptual model produced demonstrated that the computer unit staff did have the confidence to express their views over the integration of the function of their department into the organisation as a whole and, as with the rich picture, to adapt the methodology as considered to be appropriate.

3 The first stage of Multiview as produced by the three MIS units and the computer unit demonstrated that the computer facilities in the college were gradually being accepted as part of the organisation, particularly by the staff involved in their planning. Most importantly, the computer unit conceptual model demonstrated that the people who created it understood the manner in which information-systems functions can integrate units such as theirs into other areas of the organisation.

4 The entity-modelling stage of the methodology provided staff in the three units with a simple tool which could readily be translated into database structures for basic stores of information. The staff involved in the exercise expressed confidence that this type of structure would provide them with manageable and workable information systems which could later be developed so as to provide a more detailed information system, as the necessary skills to produce it were developed in the college.

Problems with the application

As with the fieldwork described in Chapter 5, rather more problems than positive points were identified with the participative application of Multiview.

1 The researcher observed that all staff seemed to have large conceptual problems in adopting and making use of the Multiview approach. These problems became the more apparent the further the staff went in their work. During the development of the human-activity system a number of issues arose and were anecdotally commented on, for example:

- There was disbelief that the rich-picture exercise was a serious tool. Few of those trained had come across diagrammatic techniques in any type of analysis, and they felt either embarrassed to attempt the work or incredulous that anything positive could arise from the effort.
- Ironically, this lack of faith in the tools was accompanied by reservations that the rich picture in particular, if applied as set out in the training, would require staff to be explicit in their view of the relative merits of the work of colleagues and the relative value of their leadership. In short, some participants showed an unwillingness to be seen to be critical.

To what extent the reservations over explicit criticism of the management of the college encouraged criticism of the methodology tools which could provide such criticism was unclear, but a causal link could not be discounted.

2 Related to this point was the observation drawn from Hirschheim's (1989) work, indicating that junior staff are less willing to participate than senior officers. The most senior member of staff involved in the participative design process was the head of the computer unit. All other staff were mid-to junior-ranking. It was noted in conversation that the junior staff felt that at times they could not express their full opinions in case they conflicted with those of their senior officers, or they led to changes of which senior staff did not approve.

3 The information-modelling aspect or stage was seen by the computer unit to be largely redundant because no specific data-processing requirement was envisaged at this time. The MIS units, in contrast, made use of this stage both in generating databases from the entity model and in producing some simple program code from the functional decomposition.

4 Stages 3, 4 and 5 of the methodology were not applied in any depth by any of the units. This was in part because they were not required for the immediate work in hand (e.g. technical aspects for the computer unit), or because elements of them had been completed in the past (e.g. the databases for the library unit) or were reserved to be undertaken at some point in the future (e.g. HCI for the payroll unit).

SPECIFYING LEARNING

The emphasis of the second piece of action-research fieldwork was user participation in information-systems planning and development. Table 6.3 compares the results of the fieldwork with the factors identified by Hirschheim, set out on pages 129–130.

What was learned from the situation is set out in the next section.

Analyst issues

Over the three-year period of the research the analyst made four visits of approximately two weeks each and several one-day visits (time allocated on this project whilst working in the country on other business). Seven members of staff received three months training in the United Kingdom. In contrast to the first piece of fieldwork, the majority of the systems under discussion had to be designed by the eventual users and almost all of the systems development would be undertaken by college staff.

In the first fieldwork the self-analysis tool was noted as being of value in two contexts. First, it was used as a benchmark against which to assess the changing role of the analyst in the problem context; second, it was applied as a means to measure the variable attitudes of donor and recipient. This process was continued in the college fieldwork and provided a number of insights.

The value of participation and the need for systems planning and development has already been discussed both in Chapter 1 and in the first action-research fieldwork. However, neither the donor nor the recipient was as concerned with the development of participative analysis and design as the analyst/researcher; their view related much more to the traditional perception of analyst as expert. The donor appeared to be traditional in its views of the analyst/researcher as the catalyst of change and the main agency of innovation. The recipient appeared more concerned with getting technology than dealing with effective planning (as assessed by the analyst/ researcher in the activity of the various staff members representing the units). From the fieldwork both the donor and the senior management of the recipient tended towards technical and functional views of systems development.

Out of a growing awareness of the importance of understanding the variable views of all actors involved in the analysis and design process, the analyst began to develop a more explicit process of monitoring the views and values of donor and recipient. This was reflected in the third piece of fieldwork and is further discussed in Chapters 8 and 9.

Table 6.3 A comparison of the Hirschheim factors and the college context

Hirschheim's factors	*Staff College context*
Users possess positive feelings towards participation	Certainly the college wanted to own the incoming system and to indicate its competence to plan further developments.
Participation appropriate to most systems development	This was the case for the four units under view.
Participation does not lead to fewer requests for systems modification	The systems were only partially implemented during the research period; however, in both the computer unit and the accounts unit modification to existing practices continued throughout the research.
Participation problem 1 Hands-on activity of consultant required	This was an ambiguous area. It was often felt that the consultant's input was resented but at other times it appeared nothing would happen until there was an input.
Participation problem 2 Not enough time for participants to dedicate to the process	True in the case of the three MIS units. With the computer unit this had been the case but after some internal struggles staff were relieved of other duties to concentrate on computing and related information systems.
Participation problem 3 Right size of group for the design process	This related to problem 2. Those who were involved did not have enough time but also there not enough staff involved in the process; for example the instances when staff felt too junior to offer ideas on new systems could have been alleviated if more senior staff had also been involved, even if only at a consultative level.
Participation problem 4 System boundaries	This was fairly clear for the MIS units (although there was some confusion initially with the accounts unit). The computer unit gradually gained confidence in looking at the college's needs as a whole.
Participation problem 5 When to begin the participation	Some anecdotal evidence was produced during the first stage of the methodology that the case would have been more successful if formal participation had been planned for and included from the outset in 1986.
Participation problem 6 Seniority of staff	A very potent factor. Unless senior staff are involved at the outset, junior staff are very reluctant to become involved in wide-scale planning. Related to problem 3.

Hirschheim's factors	*Staff College context*
	Possibly a strategy of involving senior staff at a consultative level to work with junior staff at a consensus level could be investigated.

Contextual issues

As with the first piece of fieldwork, the context is first assessed by comparing the operation of the Multiview methodology against the risk and uncertainty factors identified at the outset. This comparison is set out in Table 6.4.

Key issues arising related to:

- hardware and software being locally supportable
- the need for wide-scale training and awareness raising
- sustainable systems in remote locations
- the unwillingness of staff to provide information on soft issues such as factionalism and the possible impact on systems development
- the need for computer units to be effectively politically supported in the college.

Furthermore, throughout the analysis the recipient's use of the analysis and design methodology indicated that there was a need to involve explicitly the recipient organisation's staff in:

- assessing the boundaries of the systems in question
- assessing the type and number of staff to be involved in the analysis and design
- indicating when participation should begin, and at what level.

On the other hand the analyst working within the context needs to be able to assess the recipient context prior to intervention. This would assist in integrating the analyst's approach with the recipient organisation's capacities and requirements.

Methodology issues

In the second action-research fieldwork, while the issue of methodology was of less importance and concern than that of participation by the user community, it did lead to a revised approach to a number of questions. The most important was the problem of gaining acceptance for using soft-systems techniques and concepts in the identification of problems in the organisation. Although the analyst/researcher did receive informal soft briefings, noted on pages 131–134, so long as the content of these is not effectively applied and developed in the formal analysis there will be a question mark over their value. Greater contact with both recipient and donor before analysis might give an opportunity to introduce the soft techniques and explain their value. This needs further testing. One further and more serious issue relates to the concern of Avgerou and Land (1992) that soft techniques may not be acceptable to unwieldy bureaucracies in developing countries. The evidence from this fieldwork indicated that soft techniques are informally useful but rarely formally reportable. This was further tested in the third fieldwork study.

Table 6.4 Context and the value of methodology: the Administrative Staff College

General factors	*Observations pre-analysis*	*Methodology responses*
1 Economic	The college had little access to funds for the purchase of capital goods. At the time of the first visit in 1986, the college had been attempting to purchase a single microcomputer for some time but could not clear the expenditure. Generally capital equipment was in a poor state of repair with little evidence of funds being available for maintenance of existing resources.	The first stage of the analysis was able to identify these issues with some clarity. The systems as specified in 1986 had been microcomputers which are relatively easy to maintain and support (as compared to larger systems). The developing systems as set out by the MIS units, and the computer unit also recognised the need to focus on affordable, maintainable hardware.
2 Manpower	The college had no trained computer staff in 1986. Prior to the fieldwork some staff (one group of five and another group of two) had received training in basic microcomputer applications in the United Kingdom. Many staff had received some microcomputer awareness training.	The evidence, particularly of the computer unit's analysis, was to result in the specification of wide-scale computer appreciation and training throughout the college.
3 Physical	As has already been noted, the college was quite isolated. The situation was compounded when the mains electricity supply was inoperative and both internal generators were also out of commission, a fairly regular occurrence.	Part of the computer unit's analysis had been for the provision of a large uninterruptible power supply to support the laboratory. This was a result of stage 1 of the analysis.
4 Cultural, demographic and social	The college had a support staff to professional staff ratio of 20:1. Most support staff received only brief on-site training in highly specific areas. The training ethos of the college did mean that the principle of training in computer awareness for junior staff received wide-scale support from senior staff. Anecdotally the college contains a number of factions along the lines discussed on p. 125. It proved to be difficult to assess the implications of this factionalism.	The first stage of the analysis was inconclusive in terms of being able to work with this type of issue. The unwillingness of staff to produce clear and unambiguous views of the soft and hard features in the college context (particularly soft) was accompanied by informal briefings given to the analyst by staff members on political and factional issues prevalent in the college.
5 Political	The site had been made reasonably secure at the time of construction. A twelve-foot perimeter wall had been erected and a staff of security offices employed. All staff and vehicles are searched on leaving the compound. The college has to reflect the	The MIS units as originally devised included a degree of decentralisation of both computer capacity and decision making. The developed analysis produced by the staff conformed to this model and this in turn seemed acceptable to senior

		political priorities of the Government. Decision making is centralised in the hands of the senior director.	staff. The computer unit's position was politically ambiguous initially; however, during the analysis and design process, and in part as a result of the discussions which it produced, the unit came under the direct control of one senior director within the college.
6	Existing information infrastructure	Telephone services are erratic, as are postal services (although international mail seemed to be relatively trouble-free). The import of capital goods is rendered more difficult because of import duty and corruption.	The use of the analysis and design approach explicitly recognised that the college should be developed as a self-sustaining IT site capable of both support and maintenance of facilities and staff. Both the MIS units and the computer unit recognised this requirement during stages 3 and 6 of the methodology.

Overall, the Multiview methodology as adapted in this fieldwork did provide the recipient community with a range of tools for systems analysis, some of which were adopted successfully. A new issue, as seen in the case of the MIS units, is the capacity for elements of the methodology to be applied on their own ('self-standing'). This is another item which will be developed in the third piece of fieldwork. Table 6.5 presents the significant queries and adaptations made to the methodology as compared with the first fieldwork.

CONCLUSIONS

In conclusion, the fieldwork yielded three important factors to carry forward:

- Participation can be fostered, through training, and this in turn can help in developing the recipient's ownership of the final system. However, gaining greater participation is still a major issue if recipient communities are to 'own' the systems which are provided.
- Recipients can feel uncomfortable with the implications of the tools used (specifically soft tools), for example in terms of expressing criticism of the wider organisational context. Some effort can be made to moderate the critical content of the results of using such tools; this, however, may reduce their value from the point of view of the methodology as a whole though not from that of the recipient.
- Related to the first two factors is the need for the analyst to know more about the values and assumptions of both donor and recipient, so as to be able to make the approach appropriate to recipient needs whilst maintaining the integrity of the methodology. This will be returned to in the next fieldwork study and in Chapters 8 and 9.

Finally, it is important to note that at the end of the research the donor employed an outside consultant to evaluate the project, including the information systems. Although the results of all such evaluations are confidential, one element of public knowledge resulting from the study was a recommendation (duly agreed to by the donor) to set up a second project in the college.

Table 6.5 Multiview methodology: a comparison before and after the second piece of fieldwork

Stage and link	*Multiview after fieldwork 1*	*Multiview after fieldwork 2*
Pre-analysis and analysis preparation	Self-analysis of the analyst and preparatory tools specifically relating to interview techniques	Indication of the need to develop p re-project analysis of both recipient and donor
Stage 1 : the human activity-system	As in original, plus standardised glossary of diagram tools for rich picture, multiple uses of root definitions to cross-check results, conceptual models	As previous but some freedom given to recipients to adapt tools
Link stage 1 to 2	Conceptual model plus transformation from root definition to entity model. Explicit link	As previous
Stage 2: information modelling	Re-ordering of four elements, plus greater emphasis on integrating them together into one model	Greater freedom in allowing recipients to develop entities directly as databases when this is appropriate for the development of simple database systems (link to stage 5)
Link stage 2 to 3	Details of the organisational change and data requirements from stages 1 and 2	As previous
Stage 3: socio-technical systems	As in original, plus greater focus on computer-Based alternatives and a simple comparison tool	Relaxation on this stage as recipients use it as a means to specify necessary hardware and software (link to stage 6)
Link stage 3 to 4	Carry forward social and technical aspects of stage 3 to social and technical interfaces	As previous
Stage 4: HCI	Social interface, technical interface and security interface	Specific focus on security interface
Link stage 4 to 5	Links from all previous stages	As previous
Stage 5: technical aspects	Application, database, total systems maintenance, retrieval, management, M&E total system orientated	As previous with greater interest in the issues of software maintenance, specifically virus control
Further stages	Software and hardware selection guidelines, training guidelines, implementation guidelines	As previous

7
LEARNING CYCLE 3: A BOARD FOR TECHNICAL EDUCATION

The third piece of fieldwork was undertaken at a Board for Technical Education (hereafter the board). As with the previous two cases the analysis started with self-analysis. This is set out in Table 7.1.

Table 7.1 Self-analysis prior to research at the Board for Technical Education

1	*2 The intellectual framework*	*3 The methodology in use*	*4 The area of application*	*5 The analyst (from Table 2.1 and Figure 2.3)*
Frame 6 (late 1989)	Again increased interest in participative approaches and in the value of eductive techniques. Also some focus on the basis of understanding and education (Winograd and Flores 1986, Well and McGill 1989).	The basis of the research was still Multiview as adapted in case studies 1 and 2. Some questioning of the value of a fixed methodology (e.g. the 'against method' views of Feyerabend 1988).	The Board for Technical Education	Still interpretative and emphasising participation in the systems design. The second piece of fieldwork has shown that both recipient and analyst have preconceptions relating to the purpose of methodology and consultancy.

Two elements from the table require some explanation. In the methodology column the work of Feyerabend (1988) is noted. Experience from the first two case studies has indicated that methodology, if used in participation, can be subject to changes in context. Feyerabend provides some legitimation for the adaptation of methodology. In his book he argues, with regard to scientific method, that 'The only principle which does not inhibit progress is: anything goes' (Feyerabend 1988, p. 5). In part the justification for this is the observation that any new hypothesis which works from and agrees with existing accepted theories tends to preserve the older theory and therefore does not promulgate change. Feyerabend argues for 'theoretical anarchism' in order to arrive at a humane approach to science. In a detailed critique of modern philosophy and science he concludes that:

> It is conceited to assume that one has solutions for people whose lives one does not share and whose problems one does not know. It is foolish to assume that such an exercise in distant humanism will have effects which are pleasing to the people concerned. From the very beginning of Western Rationalism intellectuals have regarded themselves as teachers, the world as a school and 'people' as

> obedient pupils. In Plato this is very clear. The same phenomenon occurs among Christians, Rationalists, Fascists, Marxists.
>
> (Feyerabend 1988, p. 287)

Feyerabend argues that scientific method is restricted (be it critical rationalism or logical empiricism) because of its limited vision and its restricted capacity to offer meaningful ideas of change. The fieldwork undertaken so far has also shown that if method (in this case systems analysis and design method) is brought in without due regard to context and the related requirements then the methodology can be regarded by recipient or donor as at best irrelevant or at worst unwanted.

The intention in the third piece of action-research fieldwork was to focus more on the context and the needs of the various actors and less on the potential straitjacket of the methodology. To be meaningful the methodology has to be relevant to the actors. This is a theme which was first indicated in the question by Georgiades and Phillimore (1980) about hero innovators at the beginning of Chapter 5, but which will now be systematically applied.

In the previous fieldwork the conflict between the need for participation and the problems of participation in analysis and design has been indicated. On the one hand systems need to be owned and supported by local populations; the consultant has neither the time nor the resources to undertake all analysis and design and undertake management and maintenance. On the other hand, problems of participation abound. Table 6.3 sets out the context-specific problems of participation in the staff college situation. At the outset this research was primarily concerned with testing a methodology for appropriateness in two developing countries. Gradually the focus changed from methodology development to context analysis in terms of the values and assumptions of recipient and donor (both actors in the situation). In understanding the context in which eclectic methodology is used and participation takes place, a more holistic approach might emerge, with the analyst, recipient and donor all working to a common agenda of action. This theme will be developed during the following description of the fieldwork.

DIAGNOSIS

The diagnosis was undertaken during lengthy conversations with both donor and recipient.

The specific situation

The board is working under similar national conditions as set out for the college in the previous fieldwork (see pp. 124–126). As with the college, the board contains, in microcosm, all the factions and interests of the country in question as a whole. Often the precise form and action of these larger, national factors within the situation were not apparent to the consultant, but there is evidence of in-fighting in the organisation and of a number of different views as to where the project is being directed.

The board is the co-ordinating institution for higher education in the country and deals with, over forty polytechnics. It controls course accreditation, syllabus development and general management. It has the national responsibility for producing statistics on student numbers, success rates, staff employment and financial management.

The risk and uncertainty factors set out in Table 7.2 are quite similar to those of the college. Major features identified from the context by the analyst/researcher included:

- the lack of any staff familiar with computer technology

- the need for the board to have access to communications systems (point 6 in Table 7.2) in order to be able to function effectively
- factionalism.

At this stage of the enquiry it was recognised that information concerning issues of risk and uncertainty, in Eres's terms, are of value to the subsequent analysis but (as noted in Chapter 4) it would also be useful to have more information concerning the recipient and donor. In particular, building upon the framework used throughout the case studies, it would be of value to know:

- their views of the context (in which analysis and design is to occur)
- their viewpoint relating to the value of potential information systems
- their understanding of the needs and rigours of analysis and design itself.

This information was not available at this time but was included for analysis in the first stage of Multiview.

ACTION PLANNING

The action planning for this fieldwork was undertaken at a number of levels: the programme and projects directors of the board, the executive secretary of the board, the local office of the donor (the project manager), the Ministry of Education, and the representatives of the donor. Beyond this wide mix of

table 7.2 Risk and uncertainty factors

General factors	*Conditions in the board*	*Observations*
1 Economic	Labour-intensive society Low availability of capital Inability to absorb recurring costs	At the beginning of the project the board was moving into a new prestigious office in a provincial capital. However, resources had run out before all aspects of the building were completed (e.g. the installation of lifts) and there was some evidence that, as with the college in the previous study, finance was very tight.
2 Manpower	Lack of available trained personnel	At the time of the first visit to the board (in 1988) the organisation did not have any staff with computer awareness.
3 Physical	Limited resources Geographic isolation	The board is not isolated from resources and support. However, most government agencies are based in other major cities so the board was isolated in terms of its relationship with central government. The board monitors the work of the country's polytechnics. The task of keeping in touch with these institutions was a major logistic problem for the board.

General factors	*Conditions in the board*	*Observations*
4 Cultural, demographic and social	Large percentage of unskilled workers Factions	The issue of factionalism is again an unquantifiable factor for the analysis. Like the college and the Department of Roads, the board employs a large number of unskilled clerical officers.
5 Political	Need for tight security Constantly changing priorities Centralisation of decision making	The office site is monitored by security staff. The board has to reflect the changing political priorities of the Government.
6 Existing information infrastructure	Poor quality of telephone services Inadequate postal services Tight customs control	Telephone services are erratic, as are postal services (although international mail seemed to be relatively trouble-free). The import of capital goods is rendered more difficult because of import duty and corruption.

Source : Adapted from Eres 1981, p. 101

potential views and values, often not represented to the analyst/researcher directly, the consultants working on the project had a degree of autonomy in their action, and this and their influence on the work in hand expanded still further the range of values which could impinge upon the projects direction. The specific fieldwork discussed here was a small part of a much larger project for a number of departments within the board. Consultancy inputs were provided at a number of levels: level 1 project management; level 2 management information system (MIS) management; level 3 computer provision. Level 3 was the level at which analysis and design was undertaken, and therefore it was influenced by the dispositions and requirements of the two levels above it. In all, the large number of agencies involved with the project and the comparatively minor position of the computer-technology element meant that goals and objectives were often partially shared among the project team and there were often occasions when conflicts between perceptions of the project surfaced.

In all, the third piece of fieldwork was to prove the most ‘fuzzy’ of the three in terms of objectives and of applying the methodology.

The objectives of the consultancy

In 1988, without any prior analysis and design, the board had received a consignment of IBM XT microcomputers. The purpose of the computers was to provide some form of background processing power for a national management information system. The information system was to be designed to produce a number of critical indicators (CIs) relating to student and staff records; the exact nature of the information required was to be decided by the recipients. The macro view of the computer element of the project is set out in Figure 7.1.

The project was organised initially as a pilot, for a management information system in four of the country’s polytechnics. The board was to co-ordinate the operation of the project in-country. Each of the participating colleges, known as zonal centres, was expected to pass on information to the polytechnics in their catchment area, between five and nine for each of the four. The analysis and design was intended to supply

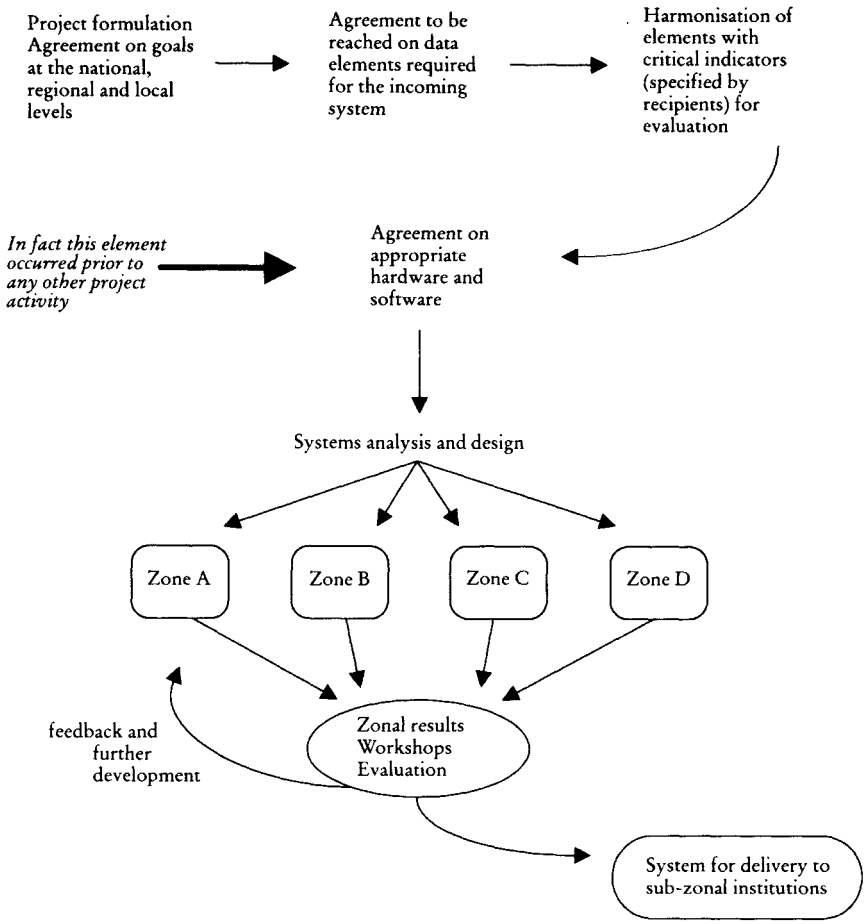


Figure 7.1 The management information system project plan

Source: Derived from an early strategy plan from the board

the outline of a computerisable system which would be implemented, in part or in total, on the hardware provided.

From the information-system perspective, there were two phases which dealt generally with pre-implementation and implementation of the management information system, and which involved the analyst/researcher.

Phase I:
The pre-implementation stage of the management information system

As with the college project, hardware and software were prescribed before the data elements or critical indicators were agreed rather than being decided on after the process of analysis and design (a point at variance with the project plan set out in Figure 7.1). Almost the first activity within the project was the

arrival of computers which were to be distributed following collective, national training of board and zonal staff members. Partly because of the absence of any detailed planning and as a result of the wording of the original project document, the training consisted of a two-week short course in the use of the disk operating system, a word processor and a database. In the view of the analyst/researcher this was an inadequate basis upon which to build a system, and further details for training were provided (a point agreed to by representatives of the institutions on the course).

A primary task was the identification by the board of a core of staff to handle the project (i.e. MIS chairpersons, managers, maintenance officers, operators). Further, the project managers worked with the board on the identification of key national committees and the related development of terms of reference, composition and frequency of meetings.

Second, there was to be further training of the board and zonal centre core staff in computer use, together with introductions to some aspects of MIS theory. This training was to take place in the United Kingdom on twelve-week short courses.

This practice was to be repeated for the zonal centres. At this stage, according to the project plan, each of the project zonal centres was to begin informing the institutions within the zone (the sub-zonal centres) of the progress being made on MIS development. Following from this there would be preliminary zonal committees, regular information-sharing workshops, newsletters, etc.

The board, in co-operation with the analyst and other members of the research team, was to organise a national convention of heads of colleges to agree on the details of the information system, that is the 'data elements' and the identification of information outputs (in this case these were to be known as the 'performance indicators' (PIs)).

Identification of a system which was workable at a manual as well as an automated level became a controversial area, included in the project terms of reference but accepted by only some members of the project team, chiefly at the second level (MIS consultants). The observation of the analyst was that from the perspective of these consultants the original intent of the project was for information-systems awareness and development first and computerisation second. For this reason the project terms of reference specified firstly aiming at sound information-handling practice, and secondly (if time and resources allowed) computerising that system. It will be seen that this aspect of the project threw up a range of problems of perspective which are highlighted in the first stage of the analysis and design.

Phase II: Implementation

This phase covered various activities by a number of agencies, both consultants from the United Kingdom and local staff. Primary activities of this phase were:

- Monitoring progress, in particular providing support for weak institutions which were seen to be having problems in supplying resources for the development of the management information system.
- The development of a manual information system and the subsequent transfer of this system to computer if time and resources allowed. The analysis and design was intended to provide a sustainable basis upon which to design some form of information system derived from a database constructed in the dBaseIII software.
- Streamlining of national committees and workshops and the further development of zonal committees and workshops.

It was envisaged that there would be an opportunity to provide an early prototype national system, based upon sound manual practices and supported by the software developed for the pilots.

From the outset the analyst/researcher was working directly with one key member of the board staff who had been designated as the 'MIS manager'. This individual undertook two three-month training courses in the United Kingdom, covering most aspects of microcomputing, Multiview training and principles of management information systems. He was joined on his first visit (summer 1989) by the chairpersons from the board and the zonal centres. The following year the computer managers received training in the United Kingdom.

ACTION TAKEN

As with the previous fieldwork, the action taken was shared between the analyst/researcher and the local staff. In this case staff were involved from the five institutions in the preliminary pilot system. As indicated earlier, this group did not have sole responsibility for the project and therefore the views of the various agencies and other consultancies also impinged upon the action as directed.

The application of Multiview

The various stages of Multiview were undertaken with members of the board in the zonal centres, at the board headquarters and in the United Kingdom from 1989 onwards. The project involved two levels of participation, using Mumford's (1979) categories: the consultative, with policy makers (e.g. the polytechnic rectors, the project managers and other consultants) and with largely political appointees (e.g. the chairpersons); and the consensus, with the managers as contact time allowed. In an effort to reduce conflict between the methodology and the capacities and perceptions of the recipient and donor including other consultants, methodology was often kept in the background and not made explicit with participants at a consultative level. Instead, methodology was applied by the analyst and consensus-level participants who took part whilst other participants applied themselves to discovering problems and identifying solutions. The managers, as consensus-level participants, were involved with the application of the methodology most specifically when they were undergoing training and in contact time with the analyst/researcher in the country. By this means the consultative actors were not involved with learning a methodology and coming to terms with its form of analysis and means of reporting (a problem noted with both of the previous pieces of fieldwork).

Stage 1: the human-activity system

Keeping in mind that the primary focus for the computer element of the project was to provide a sound basis for the development of management information systems, issues arising from the rich-picture exercise included:

1 Confusion over the type of information system being planned: manual or technology-based. In interviews the local participants strongly expressed their view that the system should be computer based. It was a widely held belief that the planning of manual systems was patronising. As noted before, this was not a view shared by other participants—most specifically the second-level MIS consultants. The lack of clarity on this issue had resulted in what many recipients perceived as being a 'gesture' of the provision of a set of

computers (prior to analysis and design) which would self-evidently be unable to provide the basis for a final system (one IBM XT to each of the five institutions).

2 The problems of long-distance communication and information sharing between zones and the board and between each zone and its sub-zones.

3 Uneven development between and within zones in terms of capacity to provide staff and resources for the project. The researcher observed that some zones were much better provided with resources, human and financial, and with the political will to participate fully in the project.

4 Training. As already noted, this had in the past been of short duration and poorly focused in relation to need, a situation which arose in part because some training had taken place prior to the analysis and design and therefore before the delineation of the system to be trained for.

As with the second piece of fieldwork the tendency had been for projects to focus all their efforts on one individual in each institution, in this case the managers. These individuals were then considered by colleagues to be local 'experts', although in fact their training had been quite brief. The managers were rarely released from other duties and had little internal support. Poor initial training and geographic isolation from assistance meant that the issue of long-term training support to improve the sustainability of the IT systems was a major concern for the managers.

5 Computer viruses. In visits to the four zonal centre polytechnics it was found that viruses were common on computers in use throughout the institutions. This indicated to the researcher:

- poor management
- lack of provision of funds for software support
- lack of control over users.

In visits to the zonal computer centres, local staff confirmed to the researcher that viruses had already led to the temporary interruption of work, the closing of one centre, unnecessary hardware replacement, slow processing and project failures.

6 Finally, the researcher observed that all polytechnics involved at the zonal level had staff familiar with computers and therefore able to assist in the development of automated information systems. On the other hand the board had no such staff. At an early stage, it was recommended that a long-term posting, one to three years, of a consultant might be needed at the board's headquarters in order to assist with the implementation of the system and to develop an effective 'counterpart' in the institution capable of dealing with the evolving system.

Having identified the complexity of the project situation, as set out in the rich-picture exercise (one output of which is shown in Figure 7.2), the analyst/researcher, working closely with the board MIS manager, set about developing the project's root definition. In the dialogue which developed it was found and agreed that there were at least three different views of the activity involved: those of the board, the MIS consultants and the donor. Figure 7.2 shows this diversity.

The three views were markedly different and provided enough variation to produce confusion and unreconciled differences for the duration of the fieldwork. The essential difference was that the board wanted a fully developed, computerised system. Neither of the other groups focused on this. The MIS consultants (second-level consultants as originally defined on page 152, controlling the activity of the computer consultants) did not think that computerised practices were appropriate in the present situation for the administration and management of further education in the country because, in part at least, of the absence of sound manual practice to build upon. The donors were insistent on the pilot nature of the project and therefore were only interested in providing a sound basis from which a national system might be

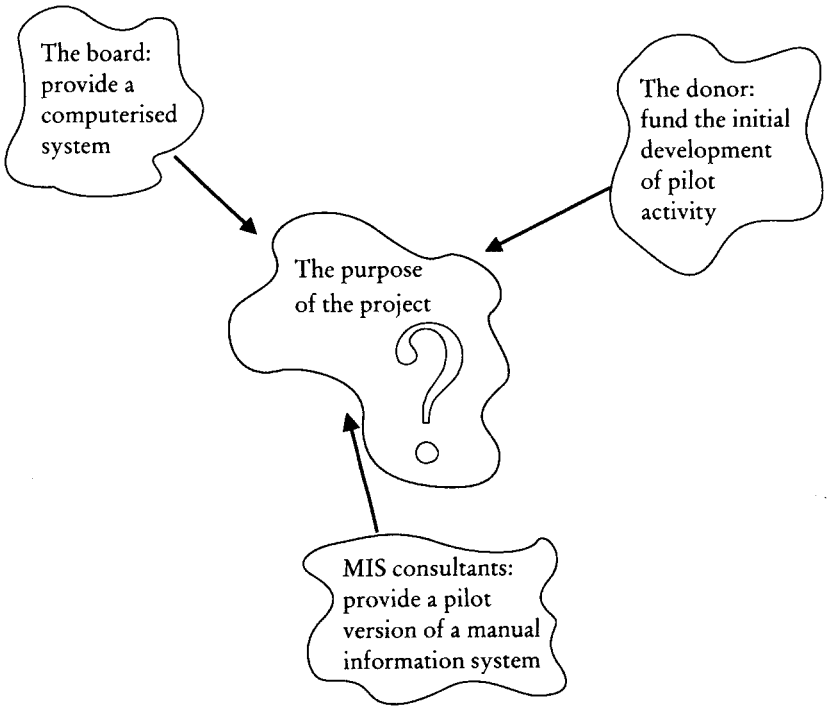


Figure 7.2 Three views of the project

developed at a later date. The rich-picturing exercise, undertaken by the analyst and described briefly above, indicated to the analyst that these three views were rarely discussed among the various actors and that as a consequence three different agendas of action existed at any one time.

From discussions with all groups the analyst concluded that the major restriction on the board in supporting their definition of the aim was the small number and lack of power of the computers provided under the project. The major obstacle to the MIS consultants was that while the board and polytechnic staff were willing to co-operate in the design of MIS procedures, they were constantly focused on computerising them. The problem for the donor and project managers was keeping all eyes fixed on the pilot nature of the project and attempting to focus attention on this and not on the larger national system which might follow and which was beyond the remit of the project in hand. This meant that the donors and project managers were taking a shorter-term view of activity, whereas the board and zonal centres were more concerned with long-term continuity.

The root-definition activity gave the analyst/researcher the basis for the terms of reference for the analysis and design. They were:

> To provide the foundation for a system outline, based on manual practices, which would provide a full range of performance indicators (PIs) for a pilot system on very limited computer facilities (as possible and feasible).

The basis for the analysis and design work was the range of perceptions which made up the reality of the situation; i.e. computers had been provided for a pilot system which was seen by some of the major actors as being primarily a manual system.

All these factors provided background on the context for the new systems design. The conceptual model was produced in much the same manner as the rich picture and the root definition, i.e. by encouraging participation in terms of broad comments concerning the nature of the system and the requirements for improvement. The analyst and the managers then translated this into the form required by the methodology. The resulting model produced by the analyst/researcher indicated that the information system would be initially limited to the production of a small number of PIs (e.g. staff/student ratio, full-time-equivalent student numbers, full-time-equivalent staff, staff-utilisation ratio, etc.). The PIs were produced as the outcome of a meeting in the capital of the rectors of all the polytechnics. The donor and the MIS consultants took the view that this group would have the requisite political authority to get changes agreed. The problem, identified at the time by the analyst/researcher and confirmed in subsequent work, was that the resulting PIs might not be obtainable. This point raises wider issues and in turn reveals that the fieldwork should be looked at from two perspectives:

- the analysis of Multiview: the primary concern of the fieldwork
- the analysis of the project: the secondary concern of the fieldwork.

In the first place there are many positive aspects of the fieldwork which indicate that the methodology was discovering important problems and needs in the project as a whole, for example the diversity of views over the definition of the project as a whole. In terms of the project, there were occasions when features arising from the analysis and design were overlooked or ignored by the wider project team, as were, for example, many elements of the first stage of the analysis such as the divergence of views over the project goal. This raises another issue of concern. Chapter 1 demonstrated that funding agencies have not in the past given much consideration to either the planning or the evaluation issues related to computer adoption in developing countries. This observation was confirmed at the level of the project; the analyst/researcher observed that neither project managers nor other consultants were much concerned with the results of the analysis and design except in so far as they were related to narrow technical matters.

The results of the analysis of the human-activity system yielded two separate, major outputs:

- On the one hand, there was an agreed outline for a system design for MIS implementation on microcomputers, supporting manual processes. This was the issue concentrated on thereafter by the project managers.
- On the other hand, a complex and varied range of perceptions of issues relating to the information systems context in the country was identified. These might well interfere with the subsequent design of the management information system, for example the emphasis, which the recipients, in contrast to the MIS consultants, placed on MIS managers being provided with training and hardware/software. There remained a divergence between recipient and consultants over whether the system should be largely computer based or manual.

The result of the first stage of Multiview was to arrive at a working basis for systems development at the information-modelling stage, but many problems had also been identified, and they had not been effectively dealt with. Their impact on the project was yet to be measured.

Stage 2: information modelling

The information-modelling stage was essentially based upon the results of the technical side of the analysis and design. Knowing the PIs to be produced (as derived from the meeting of the rectors of polytechnics) made the selection of entities, or databases to provide the information for them, relatively straightforward (as already indicated in the lessons learned from the use of CIs in the first piece of fieldwork). As with the second piece of fieldwork, entities were directly translated into databases. Eight key entities, with their related attributes, were produced by the analyst/researcher (in co-operation with managers from the board and the polytechnics).

Using the lessons learned in the Department of Roads fieldwork, the functional decomposition stage of the analysis was closely related to program design, the analysis being focused on the *function*ality of the program code. Both the analyst/researcher and the board MIS manager for the fieldwork felt concerned that MIS managers in remote zones, possibly unable to attend and participate in all analysis and design sessions and planning periods because of communications difficulties, would have difficulty in relating the MIS systems analysis and design to the final software produced. By tying analysis and design into the software production process the manager would be in a better position to link abstract and theoretic concerns to the final product. The functional decomposition process started with the sixteen PIs as the final product and the entities as the primary source, and then produced a decomposition of function (both machine and human) to produce the PIs from the entities.

Event modelling provided the necessary background information which indicated when PIs would be required.

The information-modelling stage provided a direct link between the terms of reference for the analysis and design contribution in the information-systems development to the design of the details of the software product. It could not resolve the problems which had been identified in stage 1 and was not designed to do so.

Stage 3: socio-technical systems

The socio-technical systems design stage of Multiview was applied in line with the considerations set out in the first two fieldwork studies, simplifying the selection of alternatives and focusing on the hardware and software requirements. The analyst/researcher noted that only one microcomputer system was allocated to each institution and that this posed a problem for the project. The primary result of this stage was the presentation to the donor of a sound case for further hardware units. These were subsequently supplied. This stage provided the argument for the use of a database package, specifically dBaseIII, as the software for the management information system. Data transfers between the various zones and the board would be a matter of sending floppy disk by road. Vernon's experience (Vernon 1991) indicated that such a strategy could work in a developing country context.

Stage 4: the human/computer interface

As in the previous case studies, the social, technical and security interfaces were dealt with. The issues which commanded particular interest were as follows.

1 The need for wide-scale training, focusing not just on the computer-use element but also on related subjects such as monitoring and maintenance. There was a general understanding, both in the board and the polytechnics, that computers should be thoroughly introduced as a part of the 'information culture' requisite for the successful application of information systems.

2 The technical interface, in which dialogue was a key issue. The work of the MIS managers and the analyst indicated three levels of user: computer staff, PI users and clerical officers. It was assumed that computer staff would not require interfaces but would deal with software at the command-language level. Clerical officers would be provided with simple menu selections for entering data, and with limited means for editing. The needs of the users of the PIs provided the greatest scope for debate. PI production was linked to management needs for a narrow band of specific performance-related statistics; this suggested to the analyst/researcher the need for users to be able to get to specific PIs via menus. It was also recognised by both researcher and members of the board that managers might be dissatisfied with the simple representation of PIs (giving views of the organisation's performance on key topics, or 'How is?' descriptive analysis of institutions) and might require modelling tools, particularly the ability to change assumptions and undertake 'What if?' analysis. Eventually the analyst/researcher, in consultation with the MIS managers, decided that the essential core software required for the initial pilot should calculate only the PIs. Potential links into a spreadsheet for 'What if?' analysis and further modelling were postponed for a later stage.

3 In relation to security for the system, detailed instructions were set out by the analyst/researcher for all managers and chairpersons. These covered the basics of security in terms of the system, environmental considerations, the user and the potential abuser.

Stage 5: technical aspects

This stage was undertaken in much the same manner as in the Department of Roads fieldwork. The information-modelling stage had provided background for the details of the database and for application and retrieval aspects. Management and maintenance had been structured in the socio-technical stage. The major additional development of the project fieldwork was the enhancement of the monitoring and evaluation element, both to maintain cohesion between the geographically remote co-operating institutions and also to provide a holistic framework to link the various aspects of the methodology.

In the Department of Roads the monitoring and evaluation tools had been developed from the monitoring idea set out in the original Multiview. Although the developed tool set out in Table 5.6 was aimed at deriving critical indicators according to the elements of the methodology, it was directed at elements of the original analysis and design, not at the developing project during and after implementation. One widely used tool for monitoring and evaluation in development projects is the Logical Framework, specifically that developed by Practical Concepts Incorporated (1979) and Coleman (1987). Logical Frameworks, or Logframes, are designed much in the spirit of Rapid Rural Appraisal, in that they have both quantitative and qualitative aspects and can be set up in a short space of time. Table 7.3 provides the details of the framework as adapted by the analyst/researcher for the board.

The structure of a logical framework is a four by four matrix of cells, working from top to bottom. These relate to the goal of a project, the purpose, the outputs and the inputs or activities. The columns of the framework, from left to right, provide a narrative summary of goal, purpose, activities and outputs, verifiable indicators to measure each of the four, means to verify the verifiable indicators and assumptions about each of the levels.

The matrix indicates the integration of the principal stages of Multiview into an experimental project design, for example the use of material from the first stage of Multiview in the definition of project goal and purpose.

The analyst's visits for monitoring purposes to the various zonal centres had to be completed in half a day, travel arrangements being restricted by the amount of time in-country. A common monitoring, interview form was drawn up covering a wide range of issues concerning, for example, data, technology, human factors, and method. This information was then incorporated into the overall framework for national assessment of the development of the project.

As the project continued two features were identified:

- The MIS units gained confidence and ability with hardware and software. Staff developed new databases and systems were generally maintained and managed efficiently.
- The prototype software required programming skills beyond the ability of most staff and was not developed locally. As an intermediate step in the development of a more structured management information system, simple spreadsheet applications were developed which were in keeping with local computer knowledge.

Table 7.3 Experimental Logframe

Narrative Summary	*Verifiable indicators*	*Means of verification*	*Assumptions*
Goal			
1 Improved polytechnic management efficiency, derived from stage 1 of methodology	1 Course provision, staff/student ratio, etc.	1 National register	1 MIS remains politically favoured in further education by the Ministry
Purpose			
1 Management informed locally of polytechnics' capabilities and performance (stage 1) 2 Board informed of national performance (stage 1)	1 Polytechnics, basic statistics 2 National statistics	1 Local statistics register (produced annually) 2 National statistics register (produced annually)	1 Register made available for external assessment 2 Polytechnics and board continue to agree on purpose
Outputs			
1 16 performance indicators (stage 2) 2 Trained MIS staff (stage 3) 3 Management staff aware of MIS potential (stages 3 and 5)	1 PI programming 2 MIS staff performance 3 Management making use of PIs	1 Programming produces PIs correctly and on time 2 Management techniques 3 PI access register	1 Hardware secure from viruses 2 MIS management has time and resources to manage 3 PI awareness training effective
Activities			
1 Provision of hardware, software and	1 Hardware and software delivery	1 Quantity, quality and time	1 Delivery and installation without breakage

Narrative Summary	*Verifiable indicators*	*Means of verification*	*Assumptions*
training as set out in stage 3 2 Development of MIS programme from outline set out in stages 2, 4 and 5 3 Data collected, validated and verified	1.1 Training design and delivery 2 Programming 3 Series of specific assessment areas, e.g. comparison of student records with computerised records	1.1 Assessment of training provision as compared to UK standards 2 Assessment of programming by an expert witness 3 Series of assessment areas – random checks	1.1 Staff available and capable of taking training 1.2 Training correctly directed for staff 2 Programs produced in a straightforward manner, designed for adaptation in the country 3 External auditor available to check records

Note : 'Stage' refers to the stages of Multiview which provide the necessary information

Stage 6:
training, hardware and software selection and implementation strategy

The fieldwork in this study, as with the Department of Roads and the Staff College, required some provision of software, hardware, training and implementation guidance. In this case, these aspects of the project had been supplied before the analysis and design described here (see pp. 152–155). Throughout the analysis and design, further provision was made with regard to software (the specific software for the management information system), training (use of and design and programming skills for this system) and hardware (further computer units).

EVALUATION

The overall evaluation, like the discussion above, needs to be considered primarily in terms of the working of Multiview. As with the previous fieldwork, the evaluation begins with positive aspects of the application of Multiview.

Positive aspects of the application

In terms of the capacity of Multiview to meet the requirements of the situation, the fieldwork had many positive aspects.

1 The human-activity-system stage of the analysis, made less formal for the benefit of participants but still undertaken by the analyst/researcher in co-operation with some participants, produced a wide range of issues and views of tasks. The rich-picturing element provided information that had a bearing on the causality of the project as a whole. The observations on the variety of views as to the project purpose were relayed to the donor and thence to the other consultants and recipients. Unfortunately they had no discernible impact on the project development, apparently because the results of computer systems analysis and design were not broadly disseminated and discussed among the various donor and consultant groups. Nonetheless, the techniques of soft systems methodology produced, from the perspective of the analyst/researcher, particularly powerful observations about the project.

2 In subsequent training it was found that the information-modelling stage of the analysis enabled the local participants to understand how software is derived from analysis and design. This was a primary requirement for the project: that the staff on site in each of the co-operating institutions should be able to apply and adapt the design process and improve upon the software produced for the prototype. This would be essential if the prototype software produced for the pilot project were to become a national information system.

3 Stages 3 and 4 functioned satisfactorily given the limited room for change that the project provided.

4 With the managers' participation the monitoring and evaluation tool was developed in stage 5 of the methodology. Specific issues which were thought to need monitoring included:

- the MIS prototype software which produced some problems when released for appraisal by local staff
- the initial problems in the variety of perceptions of the objectives of the project
- the identified issues of risk and uncertainty set out in Table 7.2.

These items underlined the need for comprehensive monitoring of the project as a whole.

5 The Logical Framework linked to Multiview was applied each time a visit was made to the zonal centres. This supplied an increasing appreciation of their specific problems, and of the unevenness of development across the country in terms of the level of development of the systems and their integration into management processes.

Problems with the application

1 Because the methodology was used implicitly[1] rather than explicitly, participation was made easier, removing a learning requirement for consultative participants. However, this could lead to problems in future, primarily in terms of providing staff who could adequately develop the system, for example undertaking analysis and design which would lead to developing new PIs and incorporating new modules into the software.

2 The information-modelling stage of the analysis provided a good link for participants between the design stage and the production of software. However, it proved difficult in the time available to train staff in programming skills and confidence which should allow them to begin the process of applying the prototype software adequately and making amendments. The later development of spreadsheet models as an interim measure did have some advantages over MIS software in the production of PIs:

- Spreadsheets are relatively easy to learn to use.
- They are correspondingly easy to build.
- Spreadsheets can rapidly provide 'what if ?' analysis (a desired requirement specified during stage 1 of the analysis).

3 The major problem for the application of the methodology was its operation within the project as a whole. The main indicator of this was the difficulty experienced in getting views arising from the analysis and design accepted by other consultants in other areas (e.g. the MIS consultants and the overall project consultants) and by the donor's project managers. Although findings were reported, the perceptions and biases of the various actors restricted the resulting action. Often it seemed to the analyst/researcher that the analysis and design approach was the only structured modelling technique being applied (a review of other consultants' reports on visits would seem to confirm this observation), no other project-planning techniques

(for example) being evident. The major problem for the analysis and design was in gaining the acceptance of all the actors that a number of different perceptions and sets of assumptions were operating and that these should be brought together and discussed.

SPECIFYING LEARNING

The researcher began with some questioning of the value of methodology (as set out by Feyerabend 1988) and with stating the importance of understanding the nature of the context in which activity takes place. The researcher was also interested in developing participation in systems design, if necessary by making use of the methodology explicitly for consensus participation and implicitly for those providing consultative participation. The results of the participation exercise are set out in Table 7.4.

The table indicates that participation was less difficult than in the context of the Staff College. However, participation is seldom problem free. A richer view of the context is gained and this in turn means that the analysis and design has to cope with a wide range of problems as seen from a wide range of views.

Analyst issues

The analyst's perspective of the analysis and design was revealing in respect of a number of issues:

- The analyst as part of a consultancy team. The analyst/researcher was working in this case in a wider project context than that provided by the technology alone. This meant that the results of the analysis and design could be used to develop the thinking about the entire project. This proved to be problematic; often the more sensitive findings of the softer aspects of the methodology were apparently ignored by both donor and fellow consultants, for example the range of definitions of the computer element of the project. How far this was specific to this field work and/or indicates wider tendencies is unclear.
- The analyst as a fellow-participant with recipient actors. In this case the methodology was taught to MIS managers but the use was largely implicit. This meant that the analyst was always, to some extent, leading and directing the course of the analysis.
- Analysis of the other actors in the situation. As noted in the college context, the importance of the perceptions and value systems of the other actors in the situation was significant in understanding the manner in which the

Table 7.4 A comparison of the Hirschheim factors and the context

Hirschheim's factors	*Board context*
Users possess positive feelings towards participation	As with the previous research project, participation was needed and the system was to be the result of the work of the board and polytechnic staff. There was a recognition on the part of MIS managers that the analyst's help was required and therefore that participation should involve both local and consultancy staff.
Participation appropriate to most systems development	This did seem to be the case; local staff in both the board and the polytechnics wished to be involved in how the system developed.
Participation does not lead to fewer requests for systems modification	As above, this was the case. The prototype software was constantly being adapted in the light of

Hirschheim's factors	*Board context*
	comments from all actors (both recipient and donor).
Participation problem 1: Hands-on activity of consultant required	As noted above, the consultant was required to be hands-on throughout most of the SA&D process. This was especially evident in that the methodology was not used explicitly by most of the participants.
Participation problem 2: Not enough time for participants to dedicate to the process	Board staff were fully occupied with their existing workload.
Participation problem 3: Right size of group for the design process	The number of staff available to give meaningful participation was small.
Participation problem 4: System boundaries	This was not such a problem, mainly because the PIs, the output of the system, were defined by senior executives of the polytechnic system and agreed at a national meeting.
Participation problem 5: When to begin the participation	Unfortunately this was after the initial computer systems were purchased.
Participation problem 6: Seniority of staff	The MIS managers, the major participants in the systems design, varied in seniority and authority in each institution. This variation undoubtedly exacerbated the problems of uneven developments between institutions.

project functioned. In the third fieldwork study, special attention was paid to these factors. The result was instructive, indicating a wide range of perceptions of the problems in question. This in turn provided the analyst with a means to bring the various views together in one set of terms of reference (as indicated in the root-definition stage).

The issue of developing greater awareness of the assumptions and world views of actors in problem contexts is further developed in Chapter 8.

Contextual issues

The need for emphasis on contextual issues evolved in the first two pieces of fieldwork, and, supported by Feyerabend's argument, was evident in the use of stage 1 of the methodology. The college fieldwork had indicated a number of problems in defining systems boundaries, the limits of the context, and the nature and number of participants. In this fieldwork, the boundaries were more firmly delineated by the development of the PIs. More general views of the manner in which methodology was applied in the light of context are set out in Table 7.5.

The major issues defined here are:

- Stage 1 of the methodology is valuable in providing further confirmation of the pre-analysis view of risks in the environment.
- Microcomputers are the most sustainable form of technology for such projects.
- Counterpart training is valuable as a means to reduce risk.

- Monitoring and evaluation by means of the logical framework approach is one means to improve project cohesion.
- Working on the basis of consultative and consensus participation increases the range of participants involved in decision making.
- A wide range of potentially conflicting views was picked up by stage 1 of the analysis.
- Communication between zones and the board is indicated as a key problem area.

Context is a multidimensional issue, in which the major features vary depending upon the view of the spectator (e.g. the view of the MIS consultants that the context would not support a computerised information system, in contrast to the view of the board). The development of a single view of the context is set out in Chapter 8.

Methodology issues

Multiview had already been adapted under the influence of Rapid Rural Appraisal and holism, with the explicit aim of, for example, making tools quicker to use and linking the stages together more explicitly. In this

Table 7.5 Context and the value of methodology: the Board for Technical Education

General factors	*Observations pre-analysis*	*Methodology responses*
1 Economic	At the beginning of the project the board was moving into a new prestigious office in a provincial capital. However, resources had run out before all aspects of the building were completed (e.g. the installation of lifts) and there was some evidence that, as with the previous fieldwork, finance was very tight.	The first stage of the methodology applied in this case seemed to reflect these issues adequately and produce agreement on the type of system (microcomputer based) as being the most locally sustainable.
2 Manpower	At the time of the first visit to the board (in 1988) the organisation did not have any staff with computer awareness.	The SA&D had taken particular note of the training problem in stages 1 and 3. Issues including the provision of adequate 'counterpart' development had been suggested.
3 Physical	The board is not isolated from resources and support. However, most government agencies are based in other major cities so the board was isolated in terms of its relationship with central government. The board monitors the work of the country's polytechnics. The task of keeping in touch with these institutions was a major logistic problem for the board.	The isolation of the various agencies within the project was a fixed and unavoidable issue. The development of the M&E tool in stage 5 was seen by the analyst as one means to attempt to manage and effectively improve the cohesion of the project.
4 Cultural, demographic and social	The issue of factionalism is again an unquantifiable factor for the analysis. Like the college and the	The use of both consultative and consensus participation in this fieldwork was an attempt to bring in

General factors	*Observations pre-analysis*	*Methodology responses*
	Department of Roads, the board employs a large number of unskilled clerical officers.	the views of a variety of interested groups and factions.
5 Political	The office site is monitored by security staff. The board has to reflect the changing political priorities of the Government.	The MIS as devised is modest and will require evolution in-country, probably through the contribution of the MIS managers and according to the views of the board and rectors. Also noted are the range of views of various agencies within the project.
6 Existing information infrastructure	Telephone services are erratic, as are postal services (although international mail seemed to be relatively trouble-free). The import of capital goods is rendered more difficult because of import duty and corruption.	Communications remain a problem for any national information system. In the first instance data transfers between the zones and the board were planned on the basis of sending floppy disks by road.

Table 7.6 Multiview methodology: a comparison before and after the third piece of fieldwork

Stage and Link	*Multiview after fieldwork 1*	*Multiview after fieldwork 2*	*Multiview after fieldwork 3*
Pre-analysis and analysis preparation	Self-analysis of the analyst and preparatory tools specifically relating to interview techniques	Indication of the need to develop pre-project analysis of both recipient and donor	Further evidence for the need for pre-project analysis of all actors. Information from stage 1
Stage 1: the human-activity system	As in original plus standardised glossary of diagram tools for rich picture, multiple uses of root definitions to cross-check results, conceptual models	As in first fieldwork 1 but some freedom given to recipients to adapt the use of tools	Valuable insights gained from the use of the soft tools. Specifically relating to the different perceptions of the project focus by the various actors
Link stage 1 to 2	Conceptual model plus transformation from root definition to entity model. Explicit link	As previous	As previous
Stage 2: information modelling	Re-ordering of four elements, plus greater emphasis on integrating them together into one model	Greater freedom in allowing recipients to develop entities directly as databases when this is appropriate for the development of simple database systems (link to stage 5)	Further encouragement for actors to use information modelling as a logical stepping stone to software design by making the link from entity to database (for example) more explicit
Link stage 2 to 3	Details of the organisational change and data requirements from stages 1 and 2	As previous	As previous

Stage 3: socio-technical systems	As in original, plus greater focus on computer-based alternatives and a simple comparison tool	Relaxation on this stage as recipients use it as a means to specify necessary hardware and software (link to stage 6)	As previous
Link stage 3 to 4	Carry forward social and technical aspects of stage 3 to social and technical interfaces	As previous	As previous
Stage 4: HCI	Social interface, technical interface and security interface	Specific focus on security interface	As previous
Link stage 4 to 5	Links from all previous stages	As previous	As previous
Stage 5: technical aspects	Application, database, total systems maintenance, retrieval, management, M&E total system orientated	As previous, with greater interest in the issues of software maintenance, specifically virus control	Specific attention to the monitoring and evaluation component and producing this in a log frame form
Further stages	Software and hardware selection, training guidelines, implementation guidelines	As previous	As previous

fieldwork, the challenge was to maintain the logic and structure of the method whilst allowing the context to be fully represented in such a manner as to make the tools and techniques relevant and understandable to participants (as in the adaptations made to stage 1 of the methodology in the college fieldwork). The adapted Multiview methodology was seen to produce a number of very positive results in the board work:

- Stage 1 provided detailed information on the perceptions of the various actors in the situation and attempted to link them in one root definition of the project content.
- Information modelling provided a relatively quick-to-learn tool for demonstrating the manner in which an analysis and design procedure can lead to a software application.
- An improved monitoring and evaluation tool was developed.

Table 7.6 lists the changes. The table shows that changes did occur, but the frequency of the term ‘as previous’ indicates that the tools as refined from the first two pieces of fieldwork were adequate for this context.

CONCLUSIONS

The board fieldwork provided three key observations:

- Participation can be improved at a consultative level if methodology is kept in the background. The danger of applying this approach is the possibility that the methodology will not be transferable to all participants.
- It is important to understand the context in which analysis and design will take place. In this case it was not possible to gain such pre-project information, but the results of stage 1 of the methodology, if known

sooner, might have led to some detailed questioning of the project, in terms of objectives and focus, and of its major actors.
- It is important to develop other tools within Multiview. Too rigid an adherence to one set of tools and techniques may be limiting. In this case the Logical Framework monitoring and evaluation tool was one such example of evolution in methodology.

SUMMARY

The three pieces of fieldwork provide a chronological map of the changes made to Multiview over a three-year period. Major points to be carried forward into the analysis are:

- the development of the eclectic methodology, Multiview, as a rapid-use tool
- Multiview as a participative tool
- Multiview as a practitioner's tool.

Two further elements which have arisen are:

- The importance of subjective perception on the part of the analyst or other major actors in the problem context. This issue arises specifically as an element of pre-project analysis.
- The predominance of the context as the driving force behind methodological evolution.

These issues are developed in Chapter 8.

Part IV

OVERVIEW AND CONCLUSIONS

8
AN OVERVIEW OF THE LEARNING PROCESS

Chapter 1 introduced the major fields in the study of the application of analysis and design tools in developing countries. The two core areas discussed were development and systems approaches. In relation to development, the topics discussed were: perceptions of the developing countries and the development process; technology transfer; and the policy issues involved in the interaction between donor agencies such as the Overseas Development Administration (ODA) and the recipient in developing countries. With regard to systems, the range of perceptions of systems, from machine-like and functional to soft, was briefly introduced; systems analysis and design was defined and considered as a systems planning and development tool. Eclectic methodologies were introduced as one means of combining the strengths of the soft and hard approaches to systems analysis and design.

Chapter 2 focused on delineating differences between the two generalised methods of systems work, soft and hard; it reviewed issues arising from previous development experience in developing countries, specifically in relation to agricultural research and rapid rural development planning. Finally it reviewed the available literature on the interaction between computers and information systems and the development process. The purpose of the chapter was to refine the area of interest, specifically focusing on eclectic systems development and the potential for linking it to the current development practice of Rapid Rural Appraisal.

Chapter 3 took points made in Chapter 1 and 2 and set out the research question:

> Is a flexible, eclectic systems analysis and design tool such as Multiview an appropriate planning and development methodology for introducing information systems into developing countries?

Chapter 4 discussed various appropriate research methods and presented an argument for the use of the action-research approach for the fieldwork. The fieldwork was briefly introduced. The section on the structure of the fieldwork (pp. 79–81) described the manner in which the three pieces of fieldwork related to each other—chronologically, logically and comparatively.

Chapters 5, 6 and 7 were devoted to testing the use of Multiview in three separate contexts. They demonstrated that each piece of fieldwork related to and affected the next, with lessons being carried forward from one to be put into practice in the next. The application of Multiview in each case was unique, being derived from lessons already learned. Table 7.6 illustrates how some stages of the adapted methodology remained in the same form for the duration while others changed a great deal.

The present chapter covers four topics:

1 By reviewing the overall experience gained from the fieldwork, the original research question is assessed in terms of how well Multiview, in its original form, dealt with developing-country conditions.
2 The major adaptations which were made to the five initial stages of Multiview are explored.
3 The adoption of new stages into Multiview is discussed in relation to the implications for the integrity of the methodology, and to the purpose which the methodology is intended to fulfil.
4 The issues of pre-project analysis and self-analysis are developed. Throughout the fieldwork consideration of these issues progressively illuminated the application of the methodology (for example in demonstrating that what we are affects what we do). One means of incorporating this type of analysis as an essential part of systems analysis and design is introduced for further examination in Chapter 9.

RESEARCH QUESTION AND FIELDWORK: THE GROUNDS FOR COMPARISON

The research question asked if Multiview was a valid form of systems analysis and design for developing countries. This research question was based upon a number of observations:

- the observed weaknesses implicit in both hard and soft analysis techniques
- the variety of influences, specifically risk and uncertainty, operating upon analysis and design in the developing countries
- the experience of other planning approaches in developing countries, specifically Rapid Rural Appraisal
- the experience of other scientific professionals operating in developing countries.

These observations had led to a number of specifications for analysis and design:

- In order to deal with the complex situations in developing countries (in terms of general context and specific risk and uncertainty), hard and soft techniques needed to be blended in an eclectic mix.
- Any analysis and design approach had to be capable of being applied relatively quickly in order to fit in with the time available for the practice in-country, as set out by major donors and as argued by Chambers (1981) in the Rapid Rural Appraisal approach.
- Analysis and design needs to be participative, and those practising it need to be aware of the number of channels (formal and informal) through which innovation and ideas can flow (in line with Biggs's (1989a) observations).

The research question assumes that these observations can be accommodated within Multiview. In the following section the outcome of the three pieces of fieldwork is examined in relation to the original five stages of Multiview.

ADAPTING MULTIVIEW

In the first piece of fieldwork Multiview was applied as originally set out in Antill and Wood-Harper (1985) and Wood-Harper, Antill and Avison (1985). By the end of the second piece of fieldwork, Wood-Harper's thesis was available for study (Wood-Harper 1989) and this supplied more of the theoretical basis for Multiview. The third piece of fieldwork was completed before the more practitioner-based Avison and

Wood-Harper (1990) version had been published. Nevertheless, the problems identified in all the fieldwork were evident in the 1990 version, therefore the following critique can be regarded as applying to all the available versions of Multiview to date.

Stage 1: the human-activity system

The human-activity system stage of the analysis was directly comparable to soft systems methodology as developed by Checkland (1981). Differences, particularly in the Antill and Wood-Harper (1985) version, related chiefly to building conceptual models and root definitions. In each of the pieces of fieldwork the human-activity stage was applied; in the first two pieces it was adapted as outlined below.

Fieldwork 1: Department of Roads The rich-picture stage was found to be too unstructured for the participating members of the Department of Roads. The major problem related to the 'free form' of the tool, no precise skills or techniques for which other than the ability to produce cartoon-like drawings were required, and its resultant lack of formality and structure. Structure was introduced by specifying that both soft and hard processes and structures should be individually educed from the context and then mapped together into a picture making use of a restricted glossary of diagrammatic tools.

Fieldwork 2: Staff College In this fieldwork the method of producing the rich picture was still problematic for the participant, partly because of the frankness of view which it encouraged. This was not seen as being acceptable to senior managers in the college. In this case participants were encouraged to produce their own rich pictures in order to provide a descriptive tool which was acceptable to senior staff whilst at the same time being generally informative. The result succeeded in the first objective but failed, in the eyes of the analyst/researcher, to achieve the second because it lacked critical detail, though the staff who undertook the analysis seemed to be content with their endeavours.

Fieldwork 3: Board for Technical Education In the third piece of fieldwork participation was encouraged by using the methodology implicitly rather than explicitly for the wide range of consultative participants. The participants provided background information, and contributed towards the rich picture of the organisation and its relationships with other aspects of the project, including donors and consultants. The result was revealing of the variety of views and agendas operative. It also highlighted some problems for the longer term.

Conclusion The first stage of Multiview, when adapted, was considered to be successful by the analyst and also, with the noted reservations, by the other actors, in terms of identification of tasks and issues. The imposition of deadlines for the analysis (omitted as a stated requirement of the original Multiview), most specifically in the Department of Roads, meant that the stage was completed rapidly.

The structuring of the tool and its implicit rather than explicit adoption in the third piece of fieldwork facilitated consultative participation. With the adaptations, the stage as a whole was useful at a practitioner level in drawing out problems, informing stakeholders and sharing perceptions of the context.

In conclusion this stage of Multiview as originally specified was weak in respect of:

- the lack of detail concerning structuring and integration of elements
- the open-ended description of the methodology, which imposed no time deadline
- the lack of detail about the encouragement of participation.

On the other hand, the soft first stage provided the overall methodology with the capacity to map out and plan ways for taking into account non-technical issues (political, social, etc.).

Stage 2: information modelling

Elements of information modelling are common to almost all analysis and design techniques. Their inclusion within Multiview was a means of producing an information model corresponding to the needs identified in the human activity system.

Fieldwork 1: Department of Roads Participants in the department considered that the sequence of the four elements of the stage was not the most appropriate for their circumstances. They considered that entities should be the first to be planned for. This theme will be discussed later in relation to improving the links between the stages within Multiview (p. 185). The second item arising was improvement of the internal cohesion between the elements of the second stage. As presented in the Multiview literature, entities and attributes, and functions and events, were developed without explicit correlation. Fieldwork 1 began the process of their greater integration.

Fieldwork 2 and 3: Staff College and Board for Technical Education In both these pieces of fieldwork the four elements of the stage were more closely correlated in software terms as set out in Table 8.1.

Table 8.1 Information modelling and software development

Information modelling element	*Software counterpart*
Entities	Directly related to database, e.g. stores inventories at the college
Attributes	Directly related to fields
Functions	Correlated to programs, e.g. the MIS software for the board
Events	These were provided as triggers for action, the basis of the PIs, and the cause of program code.

Although such direct correlation is discouraged in the Multiview literature as it can invite confusion, in practice it was found to be a valuable way of helping participants to visualise the link between analysis and design on the one hand and the development of a computerised system on the other.

Conclusion The information-modelling stage required development in order to:

- improve the internal linkages between the entity and function elements
- improve the explicit linkage of modelling to software and therefore translation to computer-based systems.

Stage 3: socio-technical systems

Stage 3 of Multiview in effect is based on the socio-technical systems approach, and is a complete systems analysis and design methodology in itself. It does not presuppose either technical or social situations but, within the problem context, provides a range of alternative social and technical strategies for arriving at a system specification. A constraint arose in the application of this stage in fieldwork 2 and 3 since the technical aspect of the system had already been determined by the donor agencies. However, even in these cases the stage was still of value, as indicated below.

Fieldwork 1: Department of Roads The socio-technical systems stage of the 1985 version of Multiview was not specific as to which elements of technology and organisation should be the key issue of this stage. Although each context will give rise to a different set of alternatives depending upon local factors, it was

thought that the methodology would be improved if some general guidelines could be provided. This case was centrally concerned with different levels of technology (computers) and the staffing that such technology would require. Therefore the first adaptation was to restrict the alternatives to issues of staff and computer sophistication. On the technical side this meant that the analysis related to types and complexities of systems from stand-alone microcomputers to a minicomputer. On the social side, the alternatives were primarily concerned with staffing requirements. This in turn meant that the range of alternatives was focused on training and the employment of new staff. The second major adaptation to stage 3 was in formalising the stage devoted to the comparison of alternatives. The grading of alternatives according to a scale of 0 to 9 proved to be a success from the participants' point of view, providing them with a formal yet simple means to rank their preferences.

Fieldwork 2 and 3: the college and the board Both were constrained in terms of the technology and training available. In the college the stage was useful in building a logical case for system expansion if and when a second project was agreed. At the board the stage provided justification for further inputs of technology and staff training. Both these studies reflect the value of the stage, not only as a means to make a logical case for systems development but also as the basis for a valid argument, from the donor perspective, for further expenditure.

Conclusions From the point of view of the analyst/researcher, recipient and donor, stage 3 was the most readily understandable and useful. Multiview in its adapted form, for the contexts specified, provided a means to develop a logical outline of a systems specification and to demonstrate rapidly by means of comparison the best alternative solution.

Stage 4: the human/computer interface

The first three stages of Multiview all have strong correlations with distinct types of systems analysis and design,[1] but this is not the case for stage 4. The human/computer interface was designed to follow from the specification of human and computer tasks set out in stage 3 and to reflect the need to design an understandable dialogue between these two aspects of the information system. In the fieldwork this approach was expanded upon.

Fieldwork 1: Department of Roads Three separate aspects of the interface between human being and machine were developed in fieldwork 1: the technical (relating to dialogue types), the social (specifically aimed at the impact of computers in the workplace) and security.[2] These three areas were considered to be of critical importance by staff in the department. Underlying the adaptations made to the HCI stage is the observation that the original form of the stage was too inward looking and reflected upon narrow technical concerns. Throughout this book, I have attempted to express the diversity of factors and problems which beset developing countries. Technical dialogue types are important to consider, and in the research a more systematic appraisal was made of the various interfaces available than had been set out in the original version. Would-be recipients of technology (such as senior staff consulted) were, however, concerned about other interface issues. The Wilcocks and Mason (1987) material on computerising work was seen by the analyst to be applicable in terms of the perceived negative and positive impacts of computers on working procedures. This element of interface therefore needed to be formally encompassed and discussed within the context of analysis and design. Security was of such critical importance that it was designated as a separate substage. Security is both a technical and a social matter. Dialogue types need to have security devices built in to them, for example passwords and selective entry. The social appreciation of computers can also lead to security issues, for example computers seen as downgrading skills or leading to redundancies and therefore

being the object of vandalism. As a link factor between the technical and social issues, and yet having distinct requirements of its own, security was seen as requiring a structured approach in its own right.

Fieldwork 2 and 3: the college and the board The adaptations made to the HCI in the first piece of fieldwork were carried forward to the next two and were broadly seen as being of equal importance. In fieldwork 2 the security issue was seen as being of great importance.

Conclusions At this stage the need for Multiview to be more broadly focused in relation to technical issues was demonstrated (a theme which had arisen in stage 2 and would be repeated in stage 5). The adaptations made reflected the concerns of recipients involved in the fieldwork for a more structured approach (e.g. the Wilcocks and Mason (1987) dialogue classification), but one set out over a broader base, including technical, social and security issues. This made the stage more relevant in the eyes of the recipient and more applicable to developing-country contexts.

Stage 5: technical aspects

Of this stage Wood-Harper says: 'In this stage, therefore, a technical view can be taken so that the analyst can concentrate on efficient design and the production of information systems specification' (Wood-Harper 1989, p. 111). As with stages 2 and 4, the narrow technical view of the system specification was adapted in line with the concerns and needs of the contexts in which the three pieces of fieldwork took place.

Fieldwork 1: Department of Roads Wood-Harper argues that the process of technical design should 'cover everything that has to be taken into account by the computer systems and the people operating it' (Wood-Harper 1989, p. 111). In the first piece of fieldwork the focus of the technical subsystems was seen as being too narrow within the context. Three areas were specifically adapted to take into account wider concerns: management, maintenance, and monitoring and evaluation.

Management replaced the narrower terms 'control and recovery' used in the original because they were seen as being narrowly focused on issues of data entry, program errors and machine malfunction. Management was taken to include user issues, such as access, control and support, the planning of maintenance, and monitoring and evaluation aspects, as well as job-priority control and overall system management and control.

Maintenance was similarly expressed as a process extending beyond database maintenance. The maintenance of systems as a whole is of critical importance in the developing-country context, where numerous factors can combine to make information-technology installations and support extremely risky. The planning of total-system maintenance, both preventative and corrective, was required by recipients, and an outline structure for it was set out.

Monitoring was of major importance, though it was not set out as a procedure in early versions of Multiview. In the first case the monitoring theme was seen as being not only a means of keeping effective control over systems and providing early warning of likely breakdown, but also a potential tool for making eclectic methodology itself more holistic. To this end a monitoring structure, based upon the stages of Multiview, was set out and experimented with. Evaluation was also lacking in Multiview. This is the means whereby the results of monitoring are fed back into future development to ensure that analysis and design is an iterative, evolving process, learning from mistakes. The inclusion of evaluation will be dealt with in the section on adding to Multiview (pp. 187–191).

Fieldwork 2 and 3: the college and the board This fieldwork used the adaptations made to stage 5 and also focused on the importance of systems maintenance, particularly because of the growing concern over computer viruses, and on the further development of the monitoring and evaluation aspect. In the board

work the earlier form of monitoring and evaluation was further adapted by developing it in line with the existing logical framework tool (see Coleman 1987).

Conclusions The fifth stage of the methodology was adapted (as were stages 2 and 4) in line with the wider concerns expressed by the recipients. The changes made in the Department of Roads fieldwork were of critical importance to both the following studies.

Links between stages

The original methodology as applied and examined in the action-research fieldwork does provide some tacit links between stages, most clearly stated in the development of stage 5 from the previous four stages (see Avison and Wood-Harper 1990). However, for the actors in the fieldwork the links were neither obvious nor structured. This was also a point of concern to Jackson (1992), as noted in Chapter 2. He questioned the capacity of Multiview to integrate successfully both soft, hermeneutic, stages and hard, structured, intervention. Therefore an attempt was made throughout the fieldwork to make the outflow from one stage become an obvious and key element of inflow for the following stage. By this means it was envisaged that the five stages would hold together better and would provide the methodology with a more integrated and holistic character. The links between the various stages are set out in Table 8.2. The table shows that only one of the links (between stage 5 and the previous 4) was well developed in the original version of the methodology. The other links were developed during the fieldwork.

The issue of critical importance in the development of links is tying together the hard and soft aspects of the methodology. As argued in Chapters 1 and 2, hard and soft can be seen as being opposing aspects of systems work. Yet the basis of eclectic methods is to bring together the strengths of the two approaches into one unified, complementary view. The links were seen as being central to this requirement. By formally deriving one stage's input from the output of the previous stage, it could be demonstrated that Multiview was not merely a collection of disparate tools brought together to meet the changing eventualities of differing contexts but was in fact a cohesive assemblage of mutually supporting views of organisational complexity.

Conclusions

The adaptations made to Multiview indicate that in its original form it did not fully meet the requirements of the fieldwork. In relation to the development of methodology in the light of experience, Wood-Harper, describing the development of Multiview, says:

Table 8.2 Multiview: links between stages

Link stages	*Detail of link*	*Observations*
Stages 1 and 2	Transformation from the CATWOE and linking conceptual model systems to entities.	A system is seen as containing entities. These were readily appreciated as being features of systems.
Stages 2 and 3	Systems and data aspects feed into socio-technical systems.	Systems-based conceptual model demonstrates organisational change, and the data requirements of information modelling indicate technical needs. Together they form the basis for the socio-technical stage.

Link stages	*Detail of link*	*Observations*
Stages 3 and 4	Socio-technical aspects feed into social, technical and security interfaces.	The human and computer tasks form the basis of the three interfaces.
Stages 4 and 5	Each of the aspects requires input from the four previous stages.	These links were well developed in the original Multiview.

> It is hoped that the generalised findings from this research will result in other researchers and practitioners applying the Multiview theory in practice and will take into consideration the learning that emerges in the complex process of defining Information Systems.
>
> (Wood-Harper 1989, p. 134)

Multiview in its original form was seen to be deficient in three key areas:

- As a practitioner's tool. The original models of the methodology set out by the authors were largely academic in appearance. Part of the intention of the work described in this book has been to set out guidelines for analysis and design which is to be undertaken in complex situations.
- As a participative tool. Participation was encouraged but few means were provided to encourage participative development of new information systems.
- As a holistic tool. Eclectic tools can be argued to encourage a holistic approach in so far as they explicitly require the practitioner to link together the various views of complex organisations into one unified plan. The original form of the methodology was weak in this area for the developing-country context.

The adaptations made to the structure of the five stages of Multiview were one element of the process of improving the methodology's capability. The second involved the addition of new stages and tools.

ADDING TO MULTIVIEW: NEW TOOLS

In Chapters 1 and 2 the importance of personal perception was stressed in terms of the interpretations that arise in the mind of the analyst/researcher concerning complex situations. It was shown that professionals in development studies and in information systems hold very different views concerning their subject areas. Development studies can be viewed from a number of different positions, including planning, political and historical. Information systems can be seen as organisational and social, technical, or functional. The background and assumptions of the analyst will have a major bearing upon the resulting perception of the situation in question. This was the starting point in appending new elements to the Multiview methodology.

Self-analysis/pre-project analysis

Developing countries have in the past, as described in Chapter 2, caused problems for those who sought to apply standard planning and research techniques (Chambers 1981, Biggs and Farrington 1990). The views of experts in both the planning and the agricultural research fields have had to change and adapt as original assumptions about the value of innovation or planning have been challenged by developing-country conditions. With this in mind it was decided at the outset to make explicit the analyst's current intellectual framework, the present methodology in use, the area of application and, in sum, the overall view of the

analyst/researcher. This self-analysis structure was derived from adapting Checkland's (1985) model of the organised use of rational thought. The Checkland model was supplemented by Burrell and Morgan's (1979) work on sociological paradigms (see Chapter 2 pp. 33–34. The information which arose from the application of the self-analysis structure was then assessed in terms of the likely assumptions held by the analyst/researcher. The key theme for the self-analysis tool was to interpret the nature of the relationship between analyst, methodology and context. In the course of the fieldwork the analyst/researcher's development was found to evolve as situations demanded (demonstrated first in Chapter 4). Table 8.3 demonstrates the analyst/researcher's development over the course of the fieldwork.

The table shows that the interpretative approach adopted at the outset did not change. Approaches to methodology ranged from the liberal to the conservative, but the underlying significance of the observations is the growing awareness of the importance of understanding and building into the modelling exercise the perceptions and assumptions of the other actors/ participants in the systems analysis and design process. In the third frame this was attempted by making the methodology less obvious to some of the actors and allowing them to respond to questions and situations in their own terms rather than those imposed on them by methodology.

Table 8.3 The development of the analyst/researcher

Fieldwork frame	*Observations*	*Resulting changes in approach to methodology*
Prior to the Department of Roads fieldwork	The theme of an interpretative approach was set out in this frame and maintained throughout. Originally the approach to SA&D was liberal, being prepared to adapt and adopt methodology as circumstance required.	Initially there was a strong inclination towards allowing the methodology to develop and change as the situation required. In the case of the DoR this resulted in making Multiview more outward looking, as noted above, and simplifying the tools. The stages of Multiview were adapted so as to improve internal cohesion and ease of use for participants.
Prior to the Staff College fieldwork	Too liberal an approach endangered the SA&D by providing too little guidance on the overall application of the analysis. The approach was still interpretative but with a slightly more conservative view of the systems approach.	In the college fieldwork the approach of the analyst/researcher was more 'hands on' in terms of directing the application of the adapted methodology. An attempt was made to make the methodology more participative by providing the participants with some freedom in interpreting the form of the various stages. The focus was on the practitioner aspect of the methodology presentation.
Prior to the Board for Technical Education fieldwork	By this stage it was recognised that the interpretation of the value and product of SA&D held by recipients and donors was an additional important element. If participation was to succeed, their assumptions would have to be made manifest.	The methodology was implicit for most of the actors in this fieldwork. Previous experience indicated that too much focus on the tools and techniques involved in Multiview served to confuse and distract participants. By holding the adapted methodology in the background and

Fieldwork frame	*Observations*	*Resulting changes in approach to methodology*
		working on responses to questions and exercises, valuable insights were gained.

The self-analysis process was therefore useful in interpreting the views of the analyst/researcher and relating them to the developments and changes made to the methodology. The regular use of self-analysis produced a frame-by-frame picture of the evolution of the analyst over time and between contexts. This provided a valuable indicator of the generalised lessons which could be shared between all aspects of the action-research fieldwork (e.g. concern over holism, participation and the development of a practitioner's tool).

One recurring concern was the potential for integration of the various views and assumptions of major actors (researcher/analyst, recipients and donors) in one overall frame. This issue is explored further in Chapter 9.

Tools for applying the methodology

As noted in the Department of Roads fieldwork, Multiview as presented in the 1985 literature was, from a practitioner's point of view, an unsophisticated tool which gave little attention to the means by which it was to be put into practice. Numerous books have been produced on the subject of intervention by consultants in host organisations (for example in the field of Third World development see Murphy and Sprey 1982, or Poate and Daplyn 1993). To provide a measure of continuity in the development context, the application tools (e.g. in interview techniques and other forms of organisational study and data abstraction) of Casley and Kumar (1988) were used.

Monitoring and evaluation

As noted in the section on stage 5 (pp. 184–185), in Multiview the monitoring tool was not developed in terms of the wider project, being chiefly concerned with user log-in times and access to disk space. The present research was more concerned with the range of complex sources of disruption which can impact upon information systems in developing countries. As explained above, the monitoring tool was applied to the various elements of the methodology, thus linking them more closely together in a single approach and providing a wider range of monitoring information, ranging from the changes made to entities to political turmoil in management areas. The M&E tool evolved into the Logframe adaptation made in the Board for Technical Education fieldwork. Evaluation requires that the monitoring be carried out along lines which provide some measure of the success or failure of certain activities and actions within the analysis and design process. In this case the use of Logframe provided 'objectively verifiable indicators' and 'means of verification' as part of the logic of its structure. Linking the Multiview aspects into the Logframe structure provided an improved, flexible and 'Multiview' monitoring and evaluation tool.

Software and hardware selection

As used in Multiview, analysis and design is not specifically concerned with the development of systems once designed. The experience of the fieldwork indicated, however, that the analyst/researcher was often required to go beyond analysis and design and to specify systems. While Multiview was not equipped with such tools, standard procedures for such specification do exist (e.g. DataPro 1980), and the Multiview methodology already provided the analyst/researcher with the opportunity to:

- set out basic rules for hardware and software selection, based upon the human and computer tasks set out in stage 3 of the methodology
- encourage and enhance the participation of actors in the specification process, through the participation already established, thus reducing the risk of inappropriate technology being prescribed by third parties.

The resulting selection procedures, based upon the earlier analysis and design, became stage 6 of the methodology as initially discussed in Chapter 5 (pp. 111–113).

Training and implementation issues

Like software and hardware selection, the development of training regimes for staff, and the process of implementation, with the associated risks, are not usually considered to be within the remit of analysis and design. In the cases discussed in this book, and as with software and hardware selection, the analyst/researcher was usually the only skilled professional available to provide such information. Therefore, to ensure that procedures were based upon the knowledge gained from the analysis and design, and not imposed by a third party without this understanding, basic training guidelines and implementation scenarios (based on the work of Kozar (1989) and set out in Table 5.7) were built into stage 6 of the adapted methodology (see Chapter 5, pp. 111–113).

Conclusions

The additions to Multiview had three major implications for the method:

1 The original methodology was improved on during its application in the developing-country context in terms of its increased sensitivity, expressed both in the explicit appraisal of the analyst's assumptions, and in the development of tools that were responsive to local conditions.
2 The development of the monitoring and evaluation tool through the use of Logical Frameworks meant that the results of monitoring could be objectively assessed. This provided the methodology with the means for a more holistic assessment of the total method, and so with a better self-learning tool, a feature noted in the literature on rapid appraisal techniques.
3 The addition of stage 6 provided Multiview with the capacity to ensure that the results of analysis and design were taken forward into development and implementation.

In all, the additions were intended to provide Multiview with a greater capacity to produce relevant systems and to ensure that those systems were effectively monitored, evaluated and implemented following participative analysis and design.

ASSESSMENT OF THE RESEARCH QUESTION

Table 8.4 summarises the adaptation and additions which Multiview underwent in the course of the fieldwork. The various changes can now be explored by means of an evaluation of the use of Multiview and the original research question.

The research question: positive and negative comparisons

The research question was centrally concerned with Multiview's appropriateness as an analysis and design methodology for use in developing countries. Four major issues of concern in the use of Multiview were set out in the second section of Chapter 3.

1 The ability of the analyst to cope with the range of hard and soft tools within Multiview: do eclectic approaches work?

Experience from the fieldwork indicated that, given the willingness of the analyst/researcher to be undogmatic in the interpretation of stages, the hard and soft tools could be effectively linked together. In part this flexibility was present in Multiview, in part it was developed.

2 The capacity of Multiview to be participative and involve users in the planning process

Multiview did not contain inherently participative tools. Participation was encouraged by training users in the use of the methodology, allowing users to develop and change the tools in minor ways, and at times keeping the methodology in the background and thus encouraging participation in planning free from the explicit Multiview structures.

3 The adaptability of the components of Multiview in the face of time constraints: could a rapid approach in the spirit of RRA be used?

The fieldwork in the Department of Roads and the college made comparatively more use of stages 1 and 3, whereas the board fieldwork was devoted

Table 8.4 Multiview: the methodology following the fieldwork

Multiview stage	*Adaptations and additions*
Pre-project stage: Self-analysis and meth-odology application tools	Multiview did not contain guidance in either of these areas in terms of tools for a practitioner. Self-analysis was included to improve understanding of the manner in which methodology is selected and adapted in practice; application tools were included to improve professionalism in the use of Muitiview.
Stage 1: human-activity system	Some restructuring of rich-picture creation plus multiple uses of root definitions to cross-check and come to a consensus transformation
Link stage 1 to stage 2	Conceptual models to entity models (system to entity)
Stage 2: information modelling	Integration of four elements into one information model. Focus on transfer of the model to software production.

Multiview stage	*Adaptations and additions*
Link stage 2 to stage 3	Organisational changes and data requirements taken from stages 1 and 2
Stage 3: socio-technical systems	Focus on staff requirements and system needs. The use of a simple comparison tool for evaluating the range of alternative systems.
Link stage 3 to stage 4	Social and technical aspects carried forward
Stage 4: HCI	Social, technical and security interfaces
Link stage 4 to stage 5	Reworking of management, maintenance, and monitoring and evaluation aspects
Stage 5: technical aspects	Focus on and inclusion of monitoring and evaluation aspects and the concentration on the environment in which systems operate, not just the technical details of the internal workings of the system
Link stage 5 to stage 6	Previous stages have provided outlines of software and hardware (stage 2) and implementation and training (stage 3) concerns. These are carried forward.
Stage 6	Software and hardware selection, training and implementation issues

to stages 2 and 5, the monitoring and evaluation aspect. Although the complete Multiview methodology was useful for all three studies it was evident that aspects could be emphasised as needs demanded.

4 The ability of Multiview to produce sound analysis and design

This was potentially the most difficult question to answer with any degree of objectivity. In all three pieces of fieldwork, the various stages of Multiview produced results which were agreed by the participants to be of value. In each, the analysis and design practised was the first which the organisations had experienced. This in turn meant that the local practitioner's professionalism and expertise was in its infancy, providing many opportunities for poor interpretation and analytical error. However, this is a criticism not so much of Multiview but of the context in which local practitioners had to operate, and of the provision made within projects for their effective training in the rigours of systems analysis and design.

Each of the three pieces of fieldwork gives examples of the effectiveness and value of various stages. Each also demonstrates occasions where stages were changed or where problems in the interpretation of stages arose. A major issue impacting upon the value of Multiview is the variety of perceptions held by analyst, recipient and donor as to the purpose, role and value of analysis and design. These outside forces were seen to have important implications for effective analysis and design, specifically in the board fieldwork where more time was devoted to drawing out the issues.

Multiview and the Rapid Rural Appraisal tradition

All conclusions drawn from this research have to be seen in terms of the specific contexts in which the methodology was applied. However, in relation to these specific contexts, Multiview can be argued to have important positive aspects for the analyst/researcher working in developing countries in that it is eclectic and fits in with many of the requirements of Rapid Rural Appraisal (RRA):

- It provides the analyst/researcher with a range of stages which can be variously applied in terms of the needs of the context (related to the 'optimise trade offs' aspect of RRA).
- The stages are both hard and soft, offering a number of views of the organisation (related to the 'triangulation' aspect of RRA).
- The various stages can be seen as combining, through the link stages and monitoring and evaluation, to provide a detailed view of organisational complexity.

These positive aspects have to be seen in relation to:

- Multiview was extensively adapted as contexts demanded.
- Other elements and stages were added to Multiview to improve the scope of the methodology.

Critical to the research was the finding that Multiview did lend itself to adaptation and addition in the light of experience. The form of the methodology allowed the analyst/researcher to make adaptations as needs demanded; in this the approach reflected two further aspects of the RRA approach— 'learning with people' and 'learning progressively'.

SUMMARY

In summary, Multiview can be seen as being an appropriate analysis and design tool for use in the developing countries because:

- The eclectic nature of the approach proved to be effective.
- This eclecticism made it possible to relate the methodology, in principle, to an existing effective development approach, Rapid Rural Appraisal.

The link to RRA is of considerable importance in that it brings information-systems planning in developing countries into a mainstream debate in development studies itself.

Related to the above, and an outcome of the research, was the observation of the manner in which methodology could be changed as context demands. This 'context-driven' aspect of the application of the methodology was an important consideration. As the fieldwork developed it was noted that the context was of primary importance, and this included the value judgements of all major stakeholders in the problem context. The self-analysis tool, applied before each piece of fieldwork, provided the analyst with the necessary knowledge to assess personal value judgements in terms of methodology application. The human-activity stage of the methodology provided a tool for reflecting the pressures and assumptions implicit in the situation. What was not available was a means to cross-check the assumptions of all the various stakeholders prior to detailed analysis and design stages. In the board fieldwork these assumptions were seen as being at variance on major issues. In Chapter 9 this issue is discussed further, and a pre-project analysis tool is also discussed.

9
THE NEXT STEPS

The preceding chapters have been primarily concerned with testing an analysis and design methodology in the context of developing countries. In three separate pieces of fieldwork the methodology has been assessed in terms of its capacity to reflect adequately the needs and constraints of the environment in which computers and related information systems are planned. In Chapter 8 it was argued that Multiview, with certain adaptations and additions to its structure, had been partially successful in meeting the requirements of this context. Two major observations can be made on the fieldwork:

1 That the methodology had to be flexible in adapting to changing needs
2 That the views of all actors in the problem context (analyst/researcher, recipient and donor) need to be taken into account when planning intervention.

In all the fieldwork the assumptions and background of the analyst/ researcher were made explicit at the outset. The result of the exploration of the analyst/researcher's intellectual background and selected methodology for the area of study was used as an informal means of gauging both the manner in which methodology was applied, and the effects of previous applications of methodology on the current situation. The research described in this book was concerned with making methodology suitable and appropriate to the problem context. One means to achieve this is to improve the synergy between background, methodology and situation, and to use it as a means to arrive at a project plan for the application of analysis and design. In the following section, on further developments, this idea is explored, and the results of the self-analysis are systematically integrated into a single model which provides an action plan for the application of methodology. It is a further purpose of this chapter to provide a mechanism for integrating the views of analyst/researcher, donor and recipient in a unified pre-project analysis. The Board for Technical Education fieldwork in particular indicated that the assumptions of some of the agents working for the donor (in this case some consultants) and those of the recipient were not identical and that the different assumptions could cause problems in the development of the project's direction and content. One method for obtaining pre-project information about the assumptions of actors including the analyst/ researcher is discussed in the latter part of the section on further developments.

Concerning the first observation (the need for methodology to be flexible), the self-analysis before the third piece of fieldwork indicated a growing concern on the part of the analyst/researcher over the place of methodology in the analysis and design process. The board fieldwork itself made less explicit use of Multiview, tending instead to focus on the observations of actors as directed by the analyst/researcher. Although this meant that the participants were less involved with methodology, they were still critically involved with the development of the management information system at the centre of the project. The

value of explicit methodology (certainly in the form of methodologies such as Multiview) is discussed on pages 204–206.

Finally, on pages 206–207, further lines of research enquiry are suggested, based upon the original premises of Multiview, the findings of this research and the perceived needs of the developing countries.

FURTHER DEVELOPMENTS IN SELF- AND PRE-PROJECT ANALYSIS

This section develops the self-analysis tool first discussed in Chapter 2 in relation to the Open University Systems Group's (1987) use of analyst, context and method, and later returned to in Chapter 4 (pp. 74–76), against the background of Checkland's (1985) 'organised use of rational thought'. This section is concerned with developing action plans based upon the three elements shared by both Checkland and the Systems Group: analyst, methodology and context. Each element is discussed in terms of assessing the implications of current views and the requirements of the context.

Assessment of the analyst's intellectual background

In Chapter 2 the three elements of the analysis and design situation were first analysed. The demarcation between them was set out according to the Open University Systems Group's (1987) labelling of context, method and analyst. The primary means for assessing the analyst/researcher (and thus their intellectual background) was the Burrell and Morgan framework, as shown in Figure 9.1.

The fieldwork discussed in this book has been primarily concerned with the horizontal axis, between the interpretative (subjective) and the functionalist (objective) quadrants. The features of the vertical axis were not so apparent, the participative approach adopted throughout being aimed at maintaining consensus in all

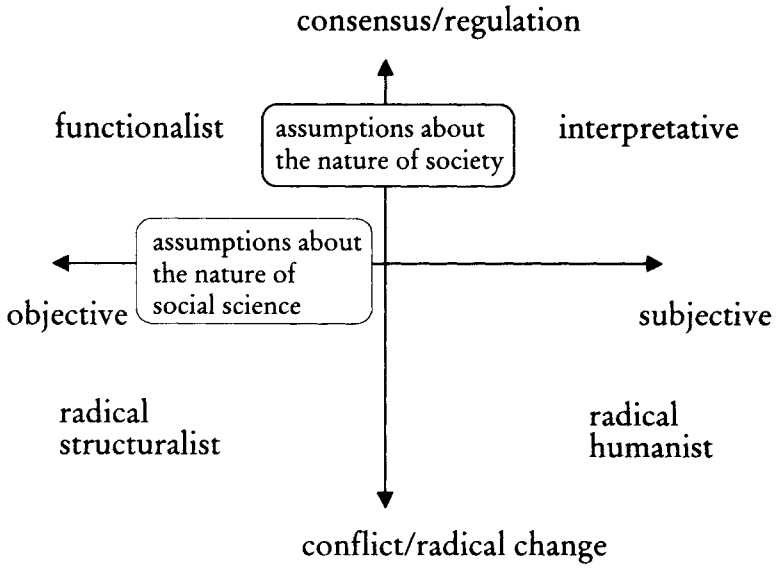


Figure 9.1 The Burrell and Morgan framework

Source: Adapted from Bell and Wood-Harper 1992, p. 27, building on Burrell and Morgan 1979

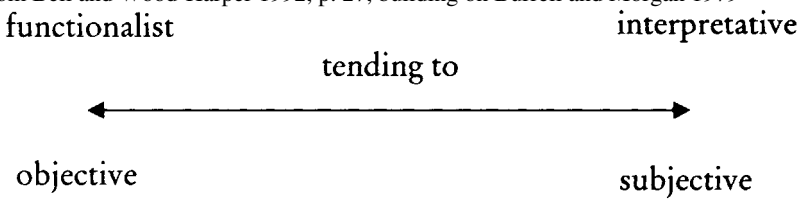


Figure 9.2 Self-analysis of the analyst

analysis and design. In the following exercise the horizontal axis will be adopted as a simple means to indicate the view of the assumptions of the analyst/researcher.[1] Thus the analysis of the intellectual background of the analyst will be self-assessed between two points as set out in Figure 9.2.

Assessment of the analyst's methodology preferences

The second critical area in which to establish the pre-project preference of the analyst is that of methodology. In Chapters 1 and 2 the key hard/soft variable was discussed in terms of defining systems approaches. It was noted that some methodologies tended towards the soft perspective (e.g. Soft Systems Methodology, General Systems Theory and Socio-Technical Systems Design (Wood-Harper 1989) whilst others are harder (e.g. Technical Specification, Structured Systems Analysis and Data Analysis (ibid.)).

The basis for the tool used to assess methodology preference in relation to the hard/soft variable is taken from the Douglas (1976) continuum of research approaches as adapted by Wood-Harper (1989). The scale is shown in Figure 9.3.

The critical question is where does the methodological preference come on the scale? Not all practitioners of analysis and design use a single approach. For example, some practitioners of the Structured Systems Analysis and Design Method (SSADM) may use Soft Systems Methodology (SSM) as a front end

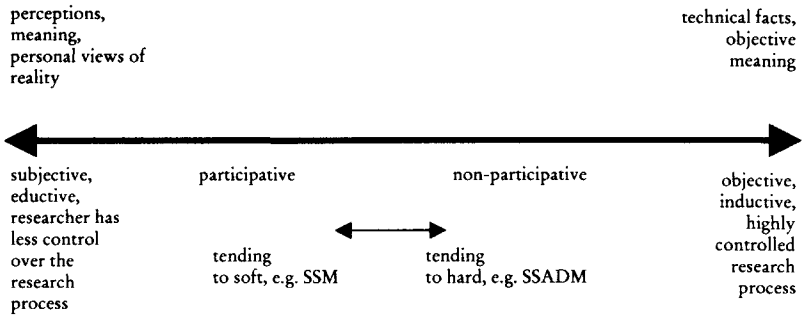


Figure 9.3 The analyst's methodological preferences

for their analysis. Practitioners of SSM may follow their analysis with information modelling and normalisation. Some analysts use eclectic methodologies such as Multiview. Two observations can be made:

1 Adapting techniques and tools proved helpful in the research described, and therefore any analysis and design which follows this approach may have a good chance of success in developing countries.
2 On the other hand, an analyst who is unsure of the methodology required could attempt the following analysis set out in this chapter, first adopting a hard approach and then assuming a soft approach. The emphasis of this approach is always upon the analyst making sense of his or her own experiences.

Assessment of context

Chapter 1 set out in table form (Table 1.2) factors affecting the uptake of information systems in developing countries. This table was further adapted in the context of the fieldwork in Chapter 5. The environment in which the analyst is to work can be assessed by using the six points in the table. Table 9.1 demonstrates the six required assessments, along with some examples taken from Eres (1981) of areas of risk.

The six points could be assessed mechanically, for example giving each a value on a scale running from 1 to 10 and providing a total between 0 and 60.

Table 9.1 Risk and uncertainty factors

Eres Factor	*Low-risk assessment*	*High-risk assessment*
1 Economic	Capital available Ability to absorb recurring costs	Low availability of capital Inability to absorb recurring costs
2 Manpower	Trained personnel available Additional trained labour available Sophisticated training and education systems available	Low availability of trained personnel Poor further and higher education systems
3 Physioecological	Geographic proximity to resources	Geographic isolation
4 Cultural	Low percentage unskilled labour Familiarity with modern technology Accurate expectations of technology	High percentage unskilled labour Fear of modern technology Inaccurate expectations of technology
5 Political	Stable governments Secure environments Fixed priorities	Unstable government Insecure environments Changing priorities

Eres Factor	*Low-risk assessment*	*High-risk assessment*
	Decentralised decision making	Centralised decision making
6 Information infrastructure	Good telecoms and postal services	Poor telecoms and postal services

Source: Adapted from Eres 1981, p. 101

Scores over 30 would be assumed to indicate high risk and uncertainty, those below 30 low risk and uncertainty. Alternatively the six pointers could be used with much greater flexibility. For example, work undertaken in Ethiopia in 1985 (Bell and Abel 1985) would have indicated low risk and uncertainty (localised to the establishment where the work was undertaken) in terms of items 1, 2, 3, 4 and 6. The political factors of item 5 would, however, indicate a high degree of risk; this, in the context, would be seen to override the others in importance and thus the assessment would be one of high risk and uncertainty. This latter type of approach (balancing the relative weights of the indicators rather than applying the tool mechanically) would be more in keeping with the spirit of the present analysis.

Linking the three indicators

The original concept behind the present work was to provide greater synergy among the three indicators of analyst, methodology and context and then to derive action plans according to the scenarios perceived. One means to achieve this is to set out the three factors on a three-dimensional graph (see Figure 9.4) which produce a range of boxes indicating scenarios.

Figure 9.4 indicates the possible relationships between the three factors, and this can in turn be used to develop action plans for analysis and design. Table 9.2 sets out the composition of the matrix; Figure 9.4 provides a graphic view of the information contained in the Table, and this will in turn assist in the identification of coincidence between the three factors.

Table 9.2 Matrix features

Box	*Methodology*	*Context*	*Analyst*
1	Hard	High R&U	Functionalist
2	Hard	High R&U	Interpretative
3	Hard	Low R&U	Functionalist
4	Hard	Low R&U	Interpretative
5	Soft	High R&U	Functionalist
6	Soft	High R&U	Interpretative
7	Soft	Low R&U	Functionalist
8	Soft	Low R&U	Interpretative

Drawing conclusions from the matrix

Coincidence in this sense indicates a good fit among the three factors. A good fit would result in a positive diagnosis with possibilities outweighing problems. Poor coincidence would result in a negative diagnosis indicating that problems are likely to occur. Table 9.3 provides an overall analysis.

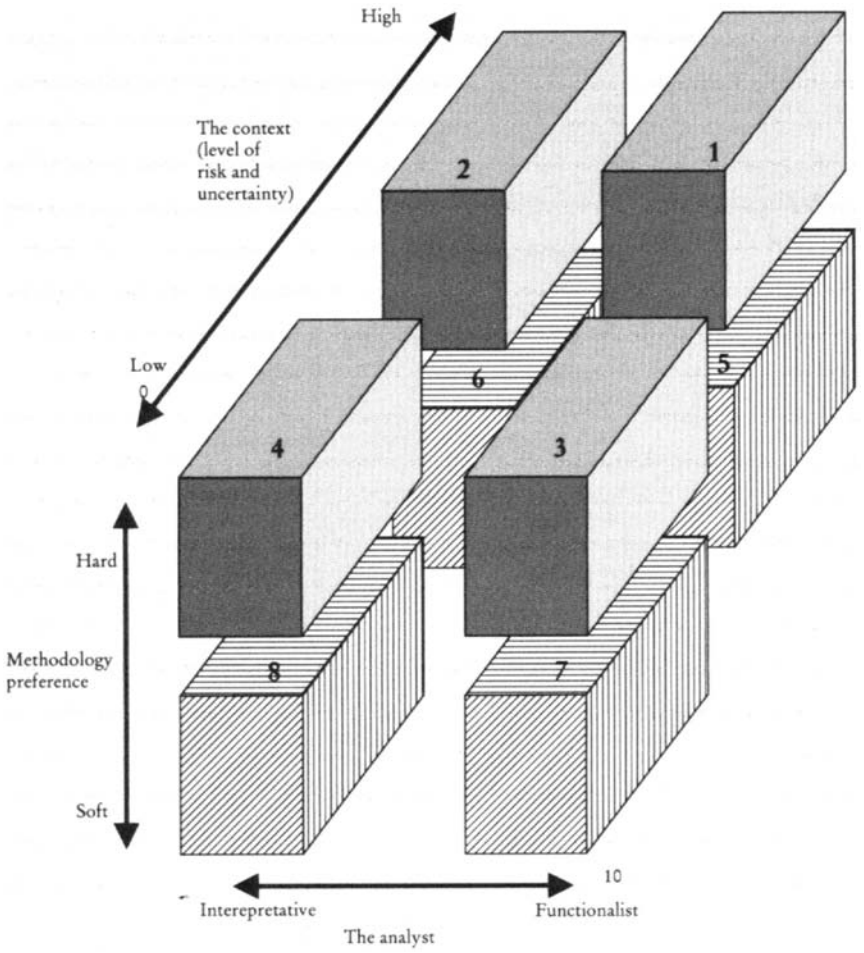


Figure 9.4 The three indicators in a three-dimensional matrix

Each of the octants provides a different scenario which includes positive aspects and problems. The best mixes of aspects produce the most positive diagnosis. Generally speaking there are two extreme positive positions:

- The first extreme relates to the use of hard methods: a functionalist attitude and low risk and uncertainty (octant 3). This combination provides an appropriate base for analysis and design in situations where objectives are unambiguous and resources are available. The focus for this octant would be the achievement of unambiguous technical solutions.
- The second extreme relates to the combination of soft methods, an interpretative attitude and high risk and uncertainty (octant 6). This combination would be appropriate for identifying issues in problematic situations. The likely outcome is enhanced understanding of a wide range of problems which could endanger systems development.

Between these two extremes are the other six octants which contain positive and negative elements. The next stage is to set out action plans to indicate areas where change will be appropriate in terms of the analyst or the methodology (the context is seen as fixed).

Action planning

The different combinations of positive and negative properties which arise from the different combinations of factors can be assessed in terms of their potential, and action plans for intervention can be derived. Table 9.4 provides one such set of plans.

Table 9.3 Coincidence, problems and possibilities

Octant	*Coincidence*	*Possibilities*	*Problems*	*Diagnosis of the three indicators*
1 (Hard, high R&U, functionalist)	Very poor	The selection provides the opportunity to narrow down SA&D to a very specific, technical matter.	The hard, functionalist approach may miss many of the high risk features of DC environments.	Negative; problems outweigh possibilities.
2 (Hard, high R&U, interpretative)	Poor	There is greater possibility for diagnosing R&U features.	The hard methodology may still create problems in terms of adapting to high R&U.	Mainly negative; much depends upon the analyst's adaptability.
3 (Hard, low R&U, functionalist)	Very good	The coincidence of hard, functionalist and low R&U would indicate strong synergy between factors.	Problems might arise if any R&U factors pertain to elements outside the scope of hard approaches.	Positive, but a possible problem if the R&U is non-technical.
4 (Hard, low R&U, interpretative)	Good	Again, low R&U and hard methods provide a strong correlation.	The interpretative approach may result in identification of aspects beyond the ability of the hard method to cope with.	Mainly positive; in this case the analyst may need to adapt to the methodology.
5 (Soft, high R&U, functionalist)	Poor	High R&U should be identifiable under the soft approach.	The functionalist approach may result in too formal an application of the soft methods.	Mainly negative; the analyst will need to adapt.
6 (Soft, high R&U, interpretative)	Very good	The coincidence of soft, interpretative and high R&U suggests an appropriate balance for problem identification.	Problems might arise if technocratic solutions were required as a result of problem identification.	Positive, but further problems may arise after initial problem identification.
7 (Soft, low R&U, functionalist)	Poor	A functionalist approach linked to low R&U could lead to identification of a range of technical issues.	The soft methodology may well be unable to produce technical solutions.	Mainly negative; the methodology is inappropriate.

Octant	*Coincidence*	*Possibilities*	*Problems*	*Diagnosis of the three indicators*
8 (Soft, low R&U, interpretative)	Good	Soft methods and an interpretative attitude mean that the limited R&U in the context can be adequately catered for.	Problems may arise if the SA&D is seen as being too problem orientated when a simple, technical solution is required.	Mainly positive, but lack of technical orientation may cause problems.

Table 9.4 Action plans

Octant	*Action plan*
1	The major danger of this octant is that attitude and methodology may miss critical risk and uncertainty features in the environment. The action plan would involve the inclusion of soft methodology. At a more fundamental level, however, the attitude and assumptions of the analyst may mean that this is not a viable combination for a project.
2	Inclusion of soft methodology elements to provide an adequate analysis of the context.
3	A positive combination. Some soft analysis may be appropriate to gain a wider view of the R&U features in the environment.
4	The mismatch here is between attitude and methodology. The interpretative approach may, however, result in identification of soft areas of concern so the combination might prove capable of dealing with the situation with the addition of soft tools.
5	The dichotomy in this octant is between attitude and methodology; in this case the attitude may needlessly curtail the use of soft methods. This might in turn lead to an unsuccessful project.
6	A positive combination. Inclusion of some hard techniques may be indicated by the analysis and design.
7	Similar dichotomy to that observed in octant 5. The low R&U means that the attitude may not be such a problem. Hard tools may be required.
8	The action plan in this case may indicate the need for a harder, more technical approach if the initial SA&D indicates that this is appropriate.

The outline action plans set out in Table 9.4 indicate changes (where appropriate) to methodology, or problems and potentialities of the analyst's attitude in terms of the impact upon context and methodology. The purpose is to foresee problems before they arise and to plan accordingly. In the fieldwork described in Chapters 5, 6 and 7 this type of approach was informally adopted; here it is more systematically structured. The result of the action planning would be the selection of an appropriate methodology for the context whilst attempting to accommodate the preferences of the analyst/researcher. Therefore action planning could be seen as the primary tool for indicating methodology adaptation or the addition of new tools (as has been seen throughout the fieldwork in Chapters 5, 6 and 7).

To improve further the synergy between elements in terms not only of the analyst/researcher's attitude but also of the wider dynamics of the project as a whole, it is important to consider the other actors in the participative analysis and design.

Action planning for all participants

As noted in the board fieldwork, there are occasions when the perceptions and assumptions of the major actors in the problem context do not converge, and this can lead to problems related to the scope and

direction of the analysis and design. In such an eventuality the pre-project self-analysis tool set out above could be applied at a number of levels: for example in the board case to the analyst/researcher, MIS consultants, donor representative and recipient representative. Were the tool to be applied too widely, the term 'actor' would replace 'analyst' in the self-analysis. These views could then be brought together at the level of the matrix and compared for consensus and conflict. A structure for the resulting analysis and design is shown in Figure 9.5.

Convergence among the views of the actors/stakeholders would indicate that the perception of the analysis and design task in hand had a high degree of internal cohesion, and that the analysis would have a good chance of being undertaken in a spirit of consensus. A negative feedback (in terms of lack of convergence) from the comparison of pre-project views would provide valuable information for project handlers about the different assumptions and expectations of the various stakeholders.

Another advantage of the pre-project analysis is that the users of methodology are encouraged to become more flexible. One of the key reasons for the selection of Multiview was the eclectic and flexible range of tools which it provided. In the scenario set out above pre-project analysis becomes a means to produce methodology as context demands, adding and adapting tools in the light of the needs of the environment. In this case fixed methodology of any sort is brought into question. Does the pre-project analysis tool mean that methodology is constructed in context? Does it mean that fixed methodology is irrelevant? The next section briefly develops this theme for future research.

CONCLUSIONS AND THE NEED FOR METHODOLOGY

Part of the background to the third fieldwork study was the work of Feyerabend (1988). His book, *Against Method,* provided part of the justification for allowing participants to move and mould methodology as need demanded. Feyerabend's work could be seen as being part of the current movement in which 'scientific' approaches to problem solving are being widely questioned (see for example Kolakowski 1990 and Bell 1994) because of the perceived limits to their scope. A major reason for the adoption of methodology in Avison and Fitzgerald's terms is to provide control and common methods (Avison and Fitzgerald 1988). The fieldwork gives rise to the key observation that context (in this case the context of developing countries) reflects upon and encourages fresh thinking in the application of methodology. This process is recognised in Checkland's (1985) 'organised use of rational thought' as methodology impacts upon intellectual background and areas of application to provide new ideas within the scope of methodology.

The observation arising from this research is not that methodology is valueless or that analysis and design tools and techniques are redundant. Rather it is that there is a delicate interplay between analyst, context and methodology. For example, the choice of application of methodology is largely dependent upon the perceptions of the various actors and the needs of the context. This in turn feeds back into the specification of the methodological requirements for the context—soft or hard, and the approach of the analyst—interpretative or functionalist.

The model provided for pre-project analysis is not intended to be perceived as final or definitive. It encompasses the work of various authorities and was applied in an evolutionary manner in the fieldwork. Other criteria might be applied to it. For example, if the major element of the context is not seen to be risk and uncertainty, then another major aspect could be applied to that axis (e.g. level of sophistication of technology) and a different range of action plans derived. The fundamental issue is that analysis and design should reflect the wider concerns which impact upon the analyst, methodology and context, and that these concerns can then be reflected in the evolution, development and subsequent use of methodology.

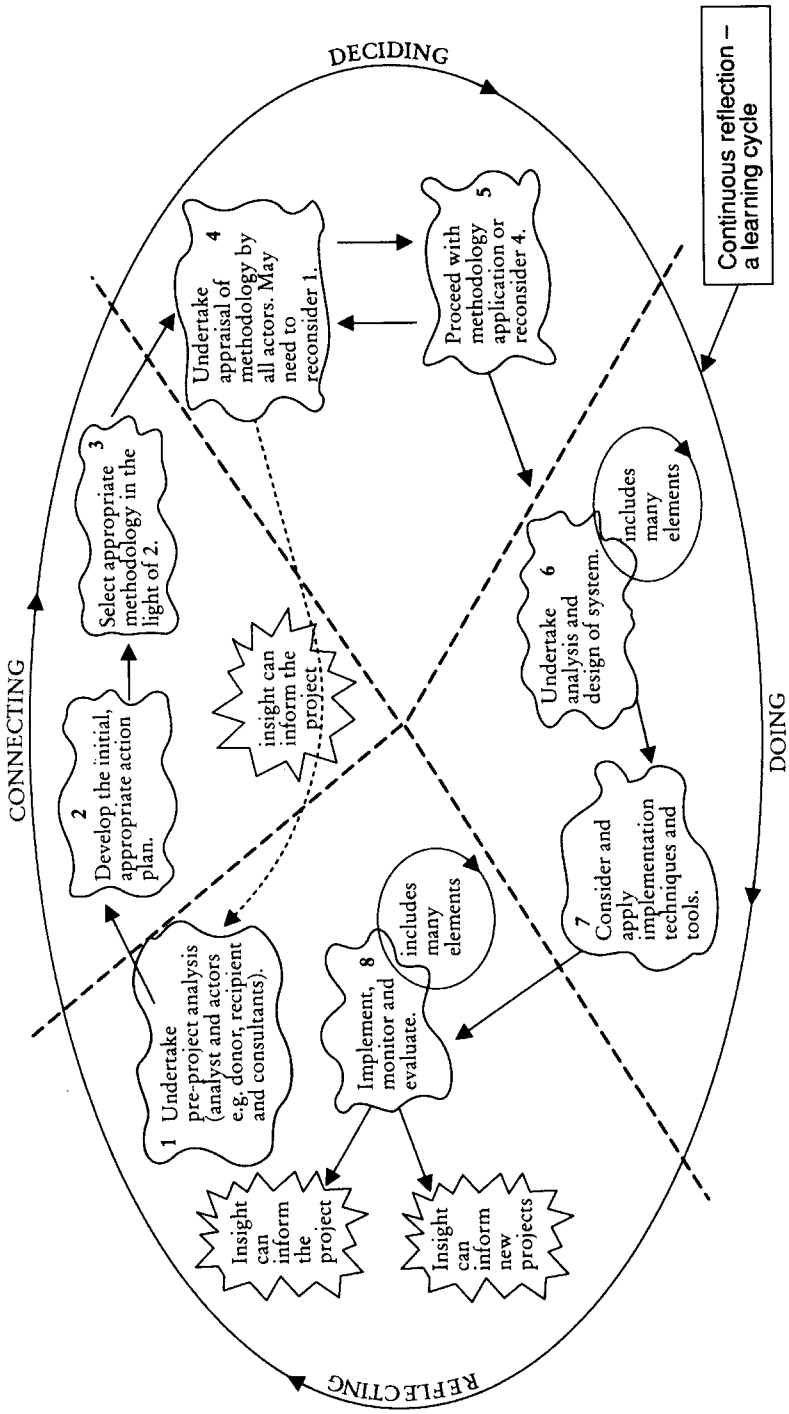


Figure 9.5 Analysis and design following the learning process (building on Kolb, 1984)

FURTHER RESEARCH, FURTHER LEARNING

The foregoing analysis has attempted to indicate a way forward in improving the integration between the analyst and participating actors, the methodology, and the context in which the analysis and design is taking place. The suggestions made in this chapter are preliminary, and in order to further test and extend their adequacy the following research areas are suggested.

Research area 1 The use of the pre-project approach needs to be tested in-country in several developing-country contexts. This would require several different analysts to make use of the tool. A central point of such research would be to provide some quantitative data for the assessment of the analysis and design procedures. This is a point which is further discussed below.

Research area 2 The results of the research indicated in area 1 should be fed into an overall appraisal or review, giving some generalised findings on the impact of pre-project analysis. This would need to focus on the adaptability of the approach to different analysts and contexts whilst still maintaining the capacity for the analyst to apply control and to use common methods.

Research area 3 As the ideas set out in this book were forming and being expressed to various audiences, the major comment made was: 'Surely these ideas are as relevant to the United Kingdom and Europe as to the developing world?'. A future area of research would be to test out some of these ideas in these contexts.

Research area 4 Related to area 1 is the question 'How much systems analysis and design is undertaken in developing countries and how well is it done?' At present there is very little information on this, either quantitative or qualitative. Such information would assist researchers in ascertaining the value of eclectic methods.

Research area 5 Ideas from other disciplines (agricultural research, rural appraisal) made a major contribution to the research described in this book. Further research might be focused on discovering other lessons that could be learnt from apparently unrelated disciplines (e.g. soil science) concerning the integration of new technologies into developing countries.

IN SUMMARY

In summary, this research began as an examination of the adequacy of one methodology in the developing-country context. Through three pieces of fieldwork various lessons have been indicated:

- the need for methodology to be eclectic, offering a range of tools
- the need for methodology to be participatively applied
- the need for methodology to be orientated towards the practitioner
- the need for methodology to be contextually specific and to be adaptable.

These observations do not mean that methodology is negated or that common standards are ignored. They do, however, recognise the need for context-specific work, and for that work to be undertaken with a degree of introspection and humility.

NOTES

1
INTRODUCTION AND BACKGROUND

1 It is recognised that this is a problematic term to categorise. Recently Booth (1994) has set out some of the varied lines of thinking which can be seen as constituting the changing face of development theory.
2 It has also been argued that many that do receive planning fail anyway (see De Marco 1982). The problems ascribed to hard planning approaches will be returned to on pages 20–23 and in Chapter 2.
3 A term used to describe the senior adviser or consultant in a team of consultants.
4 Total not holistic. Eres does not attempt to show the relationships between factors.
5 Whether this is possible to achieve in practice will be discussed further in Chapters 2, 5, 6 and 7.
6 For example, the 'information' produced by the statistician, in the form of indicators, is often the base 'data' from which politicians draw out their own 'information'.
7 Soft does not have one definition but is widely interpreted as meaning qualitative and focused on social and non-technical issues.
8 Both structured and machine-like approaches as set out here are part of the 'hard' systems tradition which in contrast to soft, is taken to mean quantitative and focused on technical issues
9 'Holons'. Checkland and Scholes argue that 'holon' is a better term than 'system' for describing abstract models of the world. Systems exist in reality but the models artificially produced by man are always at least one step away from that reality.
10 The confusion among practitioners as to what constitutes 'correct thinking' is extensive; for example see Checkland and Scholes 1990b, and Mingers 1990.
11 Evidence for these assertions arises from a review of standard texts on SSADM (e.g. Ashworth and Goodland 1990) and also from discussions with practitioners in local government.

2
INFORMATION SYSTEMS AND PLANNING IN DEVELOPING COUNTRIES

1 The Burrell and Morgan approach has been adopted by a number of information-systems thinkers, for example Checkland (1981), Wood-Harper (1989) and Hirschheim and Klein (1989).
2 Taken from a coversation with A.T. Wood-Harper, May 1993.

4
SELECTING THE RESEARCH APPROACH

1 See also, for example, the reference in the acknowledgements to the University of Western Sydney group. See also Galliers 1985, 1990 and 1992.
2 Based in turn upon Susman and Evered 1978.

5
A DEPARTMENT OF ROADS

1 A term used in consultancy to refer to indigenous officers trained to undertake the analyst's roles and responsibilities.
2 Client: the perceived client for the system under discussion; actor: the primary mover in the changing systems situation; transformation: the change which we wish to bring about; worldview: the assumptions within which the situation occurs; owner: the problem owner; and environment: the environment and related constraints within which the transformation is to occur.
3 It should be noted that agreement was gained from a cross section of DoR staff and from a local representative of the donor.
4 A procedure for avoiding repeating or duplicating information items.

7
A BOARD FOR TECHNICAL EDUCATION

1 I.e. not using the various tools directly in co-operation with the various actors but directing work using the various stages, and then translating the results of joint work into the Multiview format.

8
AN OVERVIEW OF THE LEARNING PROCESS

1 Soft systems methodology, structured systems analysis and ETHICS respectively.
2 It was recognised at the time of the study that security has ramifications beyond the level of the user interface (e.g. interorganisation relations, data integrity, etc.) but this is the level dealt with in this research.

9
THE NEXT STEPS

1 This does not preclude the consensus/conflict axis being applied in a reworking of the model. Rather, from this research, it would seem less relevant.

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