THE EVALUATION OF INFORMATION SYSTEMS IN THE ORGANISATIONAL CONTEXT OF THE NATIONAL HEALTH SERVICE

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This thesis describes a project which has investigated the evaluation of information systems. The work took place in, and is related to, a specific organisational context, that of the National Health Service (NHS). It aims to increase understanding of the evaluation which takes place in the service and the way in which this is affected by the NHS environment. It also investigates the issues which surround some important types of evaluation and their use in this context.

The first stage of the project was a postal survey in which respondents were asked to describe the evaluation which took place in their authorities and to give their opinions about it. This was used to give an overview of the practice of IS evaluation in the NHS and to identify its uses and the problems experienced. Three important types of evaluation were then examined in more detail by means of action research studies. One of these dealt with the selection and purchase of a large hospital information system. The study took the form of an evaluation of the procurement process, and examined the methods used and the influence of organisational factors. The other studies are concerned with post-implementation evaluation, and examine the choice of an evaluation approach as well as its application. One was an evaluation of a community health system which had been operational for some time but was of doubtful value and suffered from a number of problems. The situation was explored by means of a study of the costs and benefits of the system. The remaining study was the initial review of a system which was used in the administration of a Breast Screening Service. The service itself was also newly operational and the relationship between the service and the system was of interest.

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List of Abbreviations.

BITGAS   "Buying IT Goods and Services" (a publication of IMG).

BRP   Benefits Realisation Programme.

BSS   Breast Screening System.

CBA   Cost-Benefit Analysis

CSF   Critical Success Factors

DCF   Discounted Cash Flow.

DH   Department of Health, formerly DHSS.

DHSS   Department of Health and Social Security.

EC   European Community.

FPC   Family Practitioner Committee (now known as Family Health Services Authority).

GATT   General Agreement on Trade and Tariffs.

GP   General Practitioner.

HA   Health Authority.

HISS   Hospital Information Support System.

IMG   NHS Information Management Group.

IS   Information System(s)

IT   Information Technology.

ITT   Invitation to Tender.

MIS   Management Information System

MOS   Memorandum of Specification.

NHS   National Health Service.

NPV	Net Present Value.
OR	Operational Requirement.
QALY	Quality Adjusted Life Year.
RHA	Regional Health Authority.
w.t.e.	Whole time equivalent.

Chapter 1.

Introduction.

1.1. Introduction to the research area.

The introduction of information systems (IS) to any organisation requires a series of decisions. Where these involve choices between alternative courses of action, projects, designs, software packages etc. they are supported by an explicit or implicit assessment of the alternatives. In other words, an evaluation is required. These decisions are the occasions for the more usual types of IS evaluation, feasibility decisions being the most common example. In contrast, post-implementation evaluation, which is the assessment of operational systems, has been described as "Probably the most neglected activity along the system life cycle" (Ahituv et al., 1986).

There is no particular reason why an information system should involve a computer, and many do not, but this project confines its attention to computer-based systems. These can be regarded as human activity systems (Checkland, 1981) in which the technology is only one element. During its development, the system will be represented in various ways. The definition of evaluation used in this thesis may thus include the evaluation of an operational system or of a model, a project proposal or a description of software. The subject will, however, represent a system or sub-system and will be considered in broader terms than the correctness of software: the project is not concerned with the testing of programs. Nor, at the other end of the spectrum, does it extend to the evaluation of the entire IS function within an organisation.

Post-implementation studies are often confined to monitoring costs and performance (Blackler & Brown, 1988), and feasibility decisions can be based on a cost-justification, though it has been suggested that this is often not carried out rigorously (Ginzberg, 1979). The scope of evaluation, that is, the range of aspects of a system which are studied, can be much wider than this. Concentration on the economic and technical aspects of a system may cause important organisational and social factors to be overlooked, yet these can have a significant impact on the effectiveness of a system. Possible areas for study include functionality, the relevance of the information produced, operational factors, the structure of the organisation, the infrastructure which supports the system, ergonomic considerations and social factors such as job satisfaction and the use of skills.

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Evaluation may allow problems of various types to be identified, and can provide input to long and short-term planning. Opportunities to expand the use of the system, or to gain further advantages through extending the facilities provided, may be identified. Other possible beneficial effects of evaluation are an improved understanding of the system, and better communication between users and developers. Process evaluation, that is, analysis of the process by which a system was developed or acquired and implemented, can enable the organisation to learn valuable lessons for the future (Blackler & Brown, 1988). It may be concluded that the full potential benefits of evaluation are not being achieved, as the factors which are neglected are those which can lead to better systems and prevent problems which can affect the use and effectiveness of the system.

This thesis describes a project which has investigated the evaluation of information systems. The work took place in, and is related to, a specific organisational context, that of the National Health Service (NHS). It aims to increase understanding of the evaluation which takes place in the service and the way in which this is affected by the NHS environment. It also investigates the issues which surround some important types of evaluation and their use in this context.

1.2. Outline of the project and the thesis.

The remainder of this chapter gives a further introduction to the research area and describes the aims of the project. It also introduces some of the issues which will be important to the research. Topics which are necessary to a general understanding of the area are covered here, but subjects which are relevant to the action research studies are given a more detailed treatment in the appropriate chapters. These include procurement methods (Chapter 3), cost-benefit analysis (Chapter 4) and post-implementation review (Chapter 5).

Section 1.3 places the project in context by describing the type of research which has taken place in IS evaluation. Section 1.4 outlines the stages in the life of a system at which evaluation can take place. A number of analyses of current evaluation approaches are discussed in Section 1.5; Section 1.6 describes the approaches themselves. The relationship between information systems, the organisation and its members, and IS evaluation is discussed in Section 1.7. Section 1.8 describes how the objectives of the project developed and sets out the aims which were eventually adopted. The choice of research methodology is explained in Section 1.9.

The first stage of the project was intended to give an overview of the practice of IS evaluation in the NHS and to identify any needs or problems experienced or other important issues. This was a postal survey in which respondents were asked to describe the evaluation which took place in their authorities and to give their opinions about it. The survey is described and a summary of the results given in Chapter 2; this chapter also gives an introduction to NHS computing and the environment in which it takes place.

Three important types of evaluation and the issues related to them were examined in more detail by means of three action research studies. These dealt with the selection and purchase of a system, a review immediately after implementation and an investigation of an established system and the problems which surrounded it. A detailed review of these three action research studies forms the main body of the thesis.

The project described in Chapter 3 was concerned with the procurement of a large hospital information system. The study took the form of an evaluation of the procurement process, and examined the methods used and the conduct of the project. Influences on the project are discussed.

Chapter 4 is concerned with the planning and execution of an evaluation of a community health system. This had been operational for almost two years when the study began but was of doubtful value and very unpopular with its users. In order to explore ways in which evaluation techniques could be helpful in this situation, a planning exercise was carried out. The chosen approach was an impact analysis, framed as a study of the costs and benefits of the system. The study explored the choice of approaches to post-implementation evaluation and issues related to the measurement of the costs and benefits of MIS in this context.

The remaining study (Chapter 5) was also concerned with the planning of post-implementation evaluation and the factors which affect its conduct. In this case the system, which was used in the administration of a Breast Screening Service, was newly installed: this was therefore an initial review. The service itself was also newly operational and the distinction between service and system was of interest.

Chapter 6 discusses the main themes of the research, presents the conclusions of the project and suggests further work. It also contains a discussion of the chosen research approach and an assessment of the studies as action research.

1.3. Research in information systems evaluation.

There is now a considerable literature concerning the evaluation of information systems and other related fields. This section gives a brief outline of the scope of research in IS evaluation.

IS evaluation can bring together techniques drawn from financial management, psychology and the social sciences, statistics and operational research (OR), as well as computer science and the information systems discipline. Much of what has been written about the nature of evaluation in the social sciences is also applicable to the evaluation of IS. The general information systems and management literature is also relevant to an understanding of systems, organisations, and the effect of each on the other. Some work concentrates on the evaluation of particular types of system, such as decision support, expert systems, office systems or specific application areas.

An important reference discipline is evaluation research. Evaluation is important to both research and practice in the social sciences, and evaluation research often combines the evaluation of social programmes or organisational change with more theoretical learning about the subject of study. A considerable literature about the practice of evaluation and the related issues has now appeared. Many writers and practitioners in this field place an emphasis on experimental or quasi-experimental design and quantitative methods (Weiss (1972) gives a good introduction to this approach), but there is also an active interest in qualitative methods, e.g. Patton (1990). Evans & Riha (1989) apply the methods of evaluation research to the evaluation of decision support systems, with the intention of providing a rigorous approach, and Blackler & Brown (1988) have shown how the problems of evaluation research described by Legge (1984) are also relevant to the evaluation of information systems. These relate to the methods used, the acceptability of evaluation findings and their utilisation.

Research into IS evaluation has addressed a number of areas. Important aims of research have included:

Providing a theoretical basis for evaluation. Hirschheim & Smithson (1988) have related evaluation approaches to the underlying assumptions, showing that most of the common approaches reflect the paradigm of positivist science, but suggest that in view of the social and human aspects of IS, an interpretivist perspective is more appropriate as it allows the subjective nature of social systems to be taken into account. In the field of evaluation research, Legge (1984) relates the design of evaluation to the underlying

philosophical position, showing that the positivistic and interpretive perspectives require different evaluation designs. Symons (1991) considers various perspectives on the impact of information systems, concluding that an approach which emphasises the interaction of the technical and organisational aspects of systems will give the best foundation for their implementation and evaluation.

There has also been an emphasis on the *definition of concepts* which can be measured and used as evaluation criteria. Terms such as "success" and "effectiveness" have been defined (Bruwer, 1984; Miller & Doyle, 1984) and where they are not measurable, surrogate measures have been found. These include users' satisfaction with the system or the information which it produces, and the level of use of the system where its use is not compulsory (Ives et al., 1983; Srinivasan, 1985).

The *development of approaches and methods* is needed to make measurable concepts operational in evaluation and in order to introduce both new approaches and techniques and those which have been developed for other areas. *Assessment of methods* is also needed. There is a considerable amount of such work: examples include Strassman's value added approach (Strassman, 1985), and the work of Sassone & Schwartz (1986) on cost justification.

In conjunction with the development of concepts and methods has been a certain amount of *development of tools*. These include survey instruments and software packages used to support complex techniques, such as the work of Pearson & Bailey (1979) and Raymond (1983).

Analysis and classification of approaches and methods has focused on a few underlying concepts: some of these are discussed in the next section.

Studies of the practice of evaluation include a number of surveys which ask questions such as how widespread different types of evaluation are, what techniques are used and how effective they are considered. This work is considered further in Section 2.3.

An interest in *understanding the evaluation process* has led to case studies such as those of Pettigrew (1973), Etzerodt & Madsen (1988), and Symons (1990). These focussed on social and organisational issues and internal politics rather than questions of method and procedure.

In addition to the research literature, there is also a considerable amount of prescriptive writing which makes recommendations about the evaluation which should be carried out and how it should be done. This can be found in articles in practitioner and academic

journals, books for students and professionals, training literature, procedure manuals etc. However, the development methodologies in common use give limited advice on evaluation. Some give support for the decision to undertake a project and for decisions between possible solutions, although decisions about the purchase of hardware and software tend to be neglected. Few give any structure to post-implementation evaluation, or to its planning or preparation.

The current project combines a study of the practice of evaluation in the chosen sector with investigations which aim to increase understanding of the evaluation process, especially the planning of post-implementation evaluation and the factors which influence the conduct of evaluations in the NHS environment. In addition, two approaches are considered in detail: these are a procedure for IS procurement and an approach to post-implementation evaluation based on the identification of costs and benefits.

1.4. Evaluation and the life of a system.

This section expands the definition of evaluation given in Section 1.1.

The idea that evaluation supports the decisions made during design is extended by Iivari (1988), who considers that the whole of IS design is a process of evaluation. He writes:

> "It is clear that IS development always includes the explicit or implicit consideration and selection of alternative information systems.... The consideration and "rational" choice of alternative information systems requires a certain IS assessment, i.e. evaluation of the consequences and characteristics of information systems relevant to the interest groups involved and affected by IS development. Conversely it is clear that IS assessment, without any opportunity to change the system on the basis of the assessment reached, is a quite futile exercise."

Iivari's remarks must be qualified by the suggestions that the understanding gained from an evaluation may itself be useful, and that changes to a system must be taken to include decisions about its future use.

This gives a conception of evaluation as an activity which occurs throughout the life cycle as an integral part of the life of the system, producing results which are used in the development or, after implementation, the improvement of the system. As installed systems may become less useful or suitable when requirements or the environment change, it is also suggested that post-implementation should not be an isolated event, but should take place at intervals or when a particular need is perceived.

The structure of the life-cycle and the stages at which it is supported by evaluation depend to some extent on the methodology used, and on whether software is to be bought or written. The remainder of this section describes the stages at which evaluation may occur.

Planning for information systems aims to ensure that the IS provision supports the objectives and needs of the business. This can involve an assessment of current systems and selection of the areas where systems will be provided. Such planning takes a business-wide perspective.

Feasibility studies, in contrast, assess the needs of a single application area and propose alternative solutions. One of the feasible options is recommended. The study considers whether proposed solutions are technically feasible, financially possible and worth undertaking. This can include an attempt to cost-justify the system.

Option selection during the development process can involve decisions between alternative designs or choices about the parts of an operation which are to be computerised, the type of technical solution, the organisation of work, etc. The nature of such decisions depends to some extent on the approach used.

Purchasing decisions involve the assessment of software packages or proposals against each other and against the organisation's requirements. The purchasing process may be as simple as a visit to the local PC dealer or as complicated as a full open tender procurement.

Many development and project management approaches include *end-of-stage reviews* which provide quality assurance for each stage of a project, or *user sign-off* points which secure approval of the work done and consent for the next phase. These can be considered as IS evaluation when they go beyond the technical correctness and conformance to standards of methodology products, and consider the suitability or impacts of the proposed system.

The *assessment of prototype systems* may form part of the development process. Within a life-cycle approach to development, prototypes may be constructed as an aid to requirements definition or as a means of testing a design. Evolutionary prototyping is an alternative approach to systems development which has an intentionally iterative structure as opposed to the *de facto* iterations of more conventional approaches. The assessment of each new version is crucial to development. Prototypes are successively refined until a final acceptable version is reached (Mayhew & Dearnley, 1987).

Acceptance testing takes place when a new system is delivered. It is the users' opportunity to confirm that the developers or suppliers have produced a system which meets its specification or requirements. This usually leads to a focus on software testing and system performance which does not accord with the broader view of evaluation taken in this project. It is normally carried out before the handover to the new system is complete, and pilot trials or parallel runs may be involved.

Post-implementation review often refers to the evaluation of a recently installed system. Although there are a variety of recommendations for the conduct of this type of evaluation, a focus on the satisfaction of system objectives, performance, and comparison of actual costs and benefits with their predicted values seems common. The post-implementation review need not be an isolated event: further reviews may be held at intervals. The benefits which have been suggested from regular reviews include better understanding of systems by their users, more of the maintenance effort devoted to enhancements rather than corrections, greater use of the information provided, and more favourable user opinions. These are discussed further in Section 2.3. *Post-implementation audit* is sometimes used as a synonym for post-implementation review, but may imply a focus on the control of the system, especially aspects such as security, data control, accounting controls within the system, and the system budget.

Ad hoc evaluations can serve a variety of purposes. Possible reasons for undertaking such evaluations include the investigation of problems, the need to provide a baseline for planning or the development of an IS strategy, and the need to decide whether to extend the system or to implement it at other sites.

Process evaluation can form part of a post-implementation review but is sometimes undertaken as a separate exercise. This is the assessment of the development and implementation project, and may assess the procedures used, the way in which they were applied, timescales and other project management issues. It does not normally contribute to the current project, but is part of the organisation's learning process as the lessons of one project may be applied to others.

The action research studies in this project are concerned with a procurement and the related process evaluation, a review of a newly installed system, and an evaluation which investigated an established system and its problems. The survey investigated post-implementation evaluation and evaluation to support the decisions taken when acquiring new systems.

1.5. Analyses of evaluation approaches.

A number of writers have suggested classifications of the various approaches to evaluation, and different criteria for classification have been used. This section describes some of these categories: the approaches themselves are described in more detail in Section 1.4.3.

Blackler & Brown (1988) consider the subject of the evaluation, and suggest that there are four basic approaches. These are:

- Cost substitution, that is, a comparison of the financial costs of old and new systems.
- The value-added approach, which involves quantitative and qualitative comparisons of the effects of the system on various aspects of the organisation's performance.
- Organisational evaluation, which is concerned with the impact on the structure of the organisation and on user attitudes.
- Evaluation of the process by which systems are produced.

Hirschheim & Smithson (1988) present the literature relating to post-implementation evaluation in a scheme which includes not only different evaluation approaches but also work on understanding the nature of evaluation. This is seen as a continuum which represents the assumptions on which the work is based, ranging from objective and rational to subjective and political. The evaluation approaches are seen as measuring the efficiency of systems, where efficiency is concerned with the quality and performance of a system, or effectiveness, which is concerned with how well the system achieves some end external to itself. The efficiency factors are largely technical and non-controversial, whereas effectiveness is a concept which requires definition and for which many measures have been suggested. These measures include the level of usage, where this is voluntary, cost-benefit analyses, the fulfilment of objectives, various aspects of user satisfaction, and assessments of utility (value to the assessor). Some of these are likely to result in different assessments by different parties.

Ginzberg & Zmud (1988) distinguish between the assessment techniques and the assessment situation in which they are used. They suggest three characteristics by which assessment techniques can be categorised. One is the domain, or area of assessment. Three domains are suggested: technical, operational and economic. The operational domain includes organisational factors. The second category is the time-frame, i.e. whether the evaluation refers to the past, present or future. A useful development of this idea would be to consider the object of the assessment, i.e. whether the evaluation considers an operational system, a design, a proposal, an implementation process etc.

The final dimension is the nature of the assessment, defined as whether it is *summative* or *formative*. This is a useful concept, related but not identical to the purpose of the evaluation. A summative evaluation is one which aims to produce a conclusion or a judgement, or an assessment on which a decision can be based, whereas formative assessment is more diagnostic and provides the information needed to make incremental improvements. According to Hamilton & Chervany (1981a), summative evaluation determines whether goals have been achieved and is concerned with the outcome of a process. Formative evaluation is concerned with the process or means by which objectives are sought, and aims to improve this. This distinction is found in evaluation research, where, according to Patton (1990),

> "Summative evaluations serve the purpose of rendering an overall judgement about the appropriateness of a [social] program, policy or product for the purpose of saying that *the idea itself* is or is not effective and therefore has the potential of being generalizable to other situations. ... Formative evaluation, on the other hand, is limited entirely to a focus on a specific context. Formative evaluation serves the purpose of improving a specific program, policy, group of staff (in a personnel evaluation) or product. Formative evaluations aim at 'forming' the thing being studied."

Ginzberg & Zmud (1988) also categorise the situations in which assessments take place. This is done in terms of the rôle of the IS, the stakeholders in the system and the purpose which the evaluation is to serve. Three common purposes are identified: these are considered the most important though there can be others. They are resource allocation, system tuning, and opportunity surfacing (seeking new ways to benefit from an IS). Resource allocation is seen as the most common of these, and the purpose of system tuning is to prevent problems in the future. Small changes in these three dimensions can cause a different evaluation approach to be required. Hawgood & Land (1988) also identify a number of purposes which evaluation may serve: they suggest a control function, use in planning, diagnostic functions, and the reduction of uncertainty associated with planned action. Neither list is intended to be fully comprehensive, but an important purpose not mentioned in either is that of learning from the experiences of the project. This is important in post-implementation assessments and process evaluation. The uses of post-implementation evaluation in health authorities are investigated in Chapter 2.

Hamilton & Chervany (1981a) identify a number of approaches to the measurement of effectiveness, and categorise these according to whether they are summative or formative, and objective or subjective. The objectives of information systems are seen as efficiency oriented or effectiveness oriented, and it is suggested that a problem with common

evaluation approaches is that they use efficiency-oriented objectives and measures whilst ignoring the measurement of effectiveness objectives.

Acts of evaluation are a normal feature of personal and institutional life. Legge (1984) writes:

> "We all evaluate, that is assess, against implicit or explicit criteria, the value or worth of individuals, objects, situations and outcomes, informally and often unconsciously every day of our lives."

Evaluations, then, include the informal personal judgements made by individuals as well as officially sanctioned formal evaluation exercises (Legge, 1984; Hirschheim & Smithson, 1988). There is also a sense in which the degree of formality is linked to the methods used. For example, the state of a system may be discussed by a user group in order to decide whether any action is needed: this is a very informal type of evaluation, yet still a recognised part of a decision-making process.

1.6. Evaluation approaches.

This section describes a range of approaches to evaluation and aspects of systems which may be subject to assessment. There is a degree of overlap between the approaches, as individual techniques and approaches can be relevant to more than one type of evaluation. For example, cost-benefit analysis and the measurement of the extent to which the objectives of a system have been fulfilled have been suggested as a method of impact analysis and a measure of effectiveness. In some cases a number of approaches are relevant to the measurement of a concept such as success or effectiveness. Some are particularly relevant to certain stages in the life of a system, others can be used in various ways at a number of stages.

Impact analysis.

The impacts of an information system are of many types, and can include effects on the operation of the organisation, its finances, and its staff. Carlson (1974) describes a number of methods for the evaluation of the impact of a system on the organisation. As impact analysis is concerned with measuring the effects of an organisational change, some of the approaches, such as event logging, attitude surveys, or measurements of the performance of the target system, are most helpful if used with periodic measurements or before/after comparisons. This suggests that post-implementation evaluation needs to be planned before the system is implemented. Other suggested approaches are cost-benefit

analysis, rating and weighting, and, interestingly, system analysis. Analysis techniques can be used to describe organisational processes, and comparative material is provided by the analysis which was carried out before the introduction of the system. Kaplan and Duchon (1988) suggest that an individual's perception of the impact of a system upon his work will be affected by his perception of his own rôle and the aspects of his work which he finds important.

Measures of effectiveness.

Discussion of effectiveness implies that a system is expected to have some desired end outside itself. Hawgood and Land (1988) point out that effectiveness is "a subjective concept, seen differently by different people". By this they mean that not only assessments of a system but also expectations will vary. System effectiveness is not a directly measurable quantity. Substitute measures have included economic effectiveness, usually in the form of cost-benefit analysis; satisfaction of system objectives; the extent of system use, on the assumption that a better system will be used more; and the opinions of system or information users.

Economic approaches.

Probably the best-known and most common evaluation approach is cost-benefit analysis, which is used in project selection, feasibility studies and post-implementation evaluation. A system is considered to be justified if avoided or reduced costs and any other financial benefits from the system outweigh the expenditure on the system during its lifetime. Analysis techniques can allow alternative uses of resources to be compared. This approach is used in a large number of fields: the difficulties which arise from its application to information systems are discussed in more detail in Chapter 5.

As a major difficulty in assessing the financial contribution of information systems is that of linking the system to the output of the organisation, Strassman's value added approach has attracted interest (Strassman, 1985). This is based on a measure of management productivity: the ratio of management's contribution to revenue to the cost of management. The basic assumption is that when the organisation's costs, including labour costs, and the contribution of capital, are subtracted from its revenues, what remains represents the contribution of management. This allows the contribution of information technology to be treated as a change in the level of management productivity and assessed on the evidence of financial results, thus avoiding the need to identify the effects of the system directly. However, other factors which may affect financial results must also be taken into account. The approach is applied in the context of a database

containing detailed performance figures for a number of companies, allowing comparisons to be made. The method and its assumptions have been challenged (Symons & Walsham, 1988) on the grounds that it is not possible to separate the contribution of IS to management productivity from effects on labour productivity, and that financial results cannot be related to specific parts of an organisation. Strassman suggests that the approach can be applied in the public sector if a valuation of the services provided can be agreed.

Information Economics (Parker et al., 1988) is a comprehensive attempt to overcome the difficulties of cost-benefit analysis when applied to project selection. The traditional cost-benefit approach is supplemented by a range of other techniques. These can assess the effects of a system on other parts of the organisation, the ability to achieve benefits more quickly, the transfer of effort to tasks of greater value, and the risks and value of innovation. The techniques used are chosen to match the rôle of the system within the organisation. It should be noted that a fair degree of managerial judgement is needed in the valuations. These results are combined with the results of traditional cost-benefit analysis to become the input to a return on investment (ROI) calculation. The ROI is combined with qualitative assessments of other factors in the business and technology domains. These include risks and uncertainty, competitive advantage, the potential to meet information needs and the match with corporate strategy. A scoring approach is used. The result is not a financial prediction but an index which can be used in ranking proposed projects.

Objectives.

Assessment of the extent to which a system satisfies its objectives has been widely accepted as a means of measuring system effectiveness, and is the basis of several suggested approaches to evaluation both during development and after implementation (Land, 1976; Hamilton & Chervany, 1981a). The setting of detailed objectives and attainment targets for a wide range of aspects of system quality is central to Gilb's Design by Objectives methodology (Gilb, 1988) and to a method of assessing the impact of new office technology recommended for use in the Civil Service (HM Treasury, 1984).

However, the approach can present practical difficulties. Dawes (1986) found that if an evaluation based on system objectives is not planned in advance of implementation, the necessary predefined objectives may not have been established. Land (1976) notes that the various stakeholder groups within an organisation will have different objectives. As objectives can relate to many aspects of a system, a range of appropriate measuring techniques will be needed.

User satisfaction.

User assessments of information systems have been a popular surrogate measure of system effectiveness. Ives et al. (1983) see user information satisfaction as a reasonable substitute for measuring changes in organisational effectiveness and the usefulness of information in decision making, as these are unmeasurable. Sanders (1984) also suggests that general user satisfaction and users' assessments of the support provided for decision making give an indirect measure of the impact of the system on organisational effectiveness, as the achievement of organisational goals is affected by the decisions made. One model of user satisfaction suggests that it derives from a match between the perceived importance of the factors assessed and the system's performance on these factors (Miller & Doyle, 1987; Remenyi & Money, 1991).

A number of survey instruments for measuring user satisfaction have been proposed. These have recently been reviewed by Kim (1990). The assessments cover a variety of subjects, ranging from opinions of individual output documents to satisfaction with supporting services and direct perceptions of system effectiveness and value. Several of these instruments are based on that of Pearson & Bailey (1979), which has a strong emphasis on the service provided by the IS department rather than concentrating on features of the system.

The work of Neumann and Segev (1980) raises a possible question about the reliability of opinions as a measure of effectiveness. They found that when managers' assessments of information were correlated with assessments of the performance of the managers themselves, there were significant differences between the assessments of highly rated managers and those of the whole sample.

Usage.

The measurement of usage as a surrogate for system effectiveness rests on the assumption that users will make greater use of a system which is effective. Davis (1989) questions the accuracy of self-reports of usage, but automated recording is not difficult. The approach has limitations, as it requires use of the system to be optional, must make allowance for fluctuations in demand, and takes no account of the importance of the function served by the system. As effectiveness cannot be measured directly, a number of researchers have investigated the relationship between the level of system use and user opinions of the system, which are another measure of effectiveness. This work,

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reviewed by Sanders (1984) and Srinivasan (1985), has produced contradictory results, and the relationship must be regarded as not proven.

Utility Approaches.

The concept of utility is taken from decision theory, where it represents subjective assessments of worth to a decision-maker. There are a number of possible techniques. Some approaches used in IS evaluation have used hierarchies of weighted criteria which produce an overall utility score by summing the results (Land, 1976; Mumford et al., 1978). This technique is somewhat limited in that it cannot take into account the value of different combinations of criteria. An approach to decision-making proposed by Efstathiou et al. (1986) overcomes this problem by allowing the decision-maker to consider the utility value of each option, making any trade-offs between criteria. Hawgood & Land (1988) have applied the approach to IS evaluation both before and after implementation. Stakeholders assess the relative utility of systems in comparison with a reference policy, which is the continuation of the previous system. The assessments of each stakeholder group are treated as co-ordinates in a multidimensional space in which each option is represented by a point defined by the combination of utility values. This enables a joint assessment to be made.

Comparison with standards.

Hamilton & Chervany (1981a) describe a view of system effectiveness, the systems-resource view, which is based on the achievement of satisfactory standards as opposed to the attainment of objectives. However, comparison with standards is not a single evaluation approach, but a part of several, and occurs at many stages in the life of a system. The purpose of standards is to ensure quality. The standard may be a statement of requirements against which software packages or designs are compared or an installed system is assessed; it may refer to standards set by an organisation, such as defined procedures which must be followed; it may be imposed by legislation or relate to more informal ideas of "good practice"; it may involve comparisons with other organisations. The method by which assessments are made will frequently require some type of measurement or observation, but quite informal evaluation procedures may be involved.

Usability.

System usability is an important area for assessment both during design and after implementation, as deficiencies will affect users' opinions of the usefulness of the system (Davis, 1989) and their decisions about whether to use it, if this is optional. Physical aspects of the system and its environment are important, and recommendations for the standards to be followed are easily available (Grandjean, 1987). Eason (1988) proposes a comprehensive model of usability which is based on the correspondence between users' needs and expectations and the characteristics of the system. The areas covered include physical requirements: the system should have appropriate methods of input and output, which should use existing skills, and the user should have control over his interaction with the system. Another main area is the match between the system and users' concepts of the task to be done and the way in which systems behave. The provision of support facilities and an appropriate learning environment is also covered. Eason suggests that usability assessments should be based on users' ratings of the various aspects of the systems in comparison with their requirements.

Technical factors.

Computer system performance is important to efficient operation and, especially where interactive systems are involved, can affect the usability of the system and the attitudes of its users. System availability and reliable error-free operation are also important. An introduction to the techniques of performance measurement is provided by Kobayashi (1978). Relevant measures include response times, database or file access times, CPU utilisation and measures of throughput. These techniques are used not only to assess the service currently provided, but also in planning for future systems or workloads, where simulations and modelling tools are now often used.

Process evaluation.

Study of the implementation process can provide knowledge which will be useful in future implementations. Blackler & Brown (1988) suggest that it should focus on project management issues, participation and the quality of end user support and development. Peccei & Guest (1984) also suggest that evaluation of technological change should include aspects of the change process: the nature and quality of the decision-making process involved in implementing the change; the efficiency of the change process, including its cost in time and resources; the extent to which the scheme was implemented; and the technical success of the project.

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1.7. Evaluation, organisations and people.

Evaluation can be viewed as a social and political process, both in itself (Symons, 1990), and as part of the development and introduction of an information system. This section considers aspects of the relationships between information systems, the development process, and the organisation and its members. These relationships have implications for the practice of evaluation.

Any assessment is influenced by the values of those who make it. These values are determined by some combination of personality, cultural influences and the aims and interests of the individuals or groups concerned, and may be conflicting. Lyytinen & Hirschheim (1987) suggest that values are made operational in IS development by their influence on the objectives of the system.

Robey & Markus (1984) see system development as a political process in which the stages of the life cycle are used to serve the interests of participants as well as for their overt purposes. There may be conflicts of interest between users and developers, or other groups or individuals. The processes involved provide a demonstration of rationality, regardless of whether the outcome has in fact been arrived at by rational means. Robey et al. (1988) propose that areas of conflict can be identified and this knowledge used constructively to produce better designs.

Markus (1983) shows how the implementation of a system can be used to transfer power between groups within an organisation. The potentially strong position of analysts with respect to users is discussed by Newman & Rosenberg (1985), and Robey and Markus (1984) note the influence of those who carry out feasibility studies. Capper (1988) examined a number of implementations and noted the difference between their stated and unstated goals: the reason why a project is required may not be that which appears in the feasibility report, and individuals or departments may be working towards their own objectives rather than the official ones.

At the post-implementation stage, Blackler & Brown (1988) suggest that the evaluation which is carried out is largely determined by organisational and political factors, and give examples of cases where the possibility of an unfavourable assessment prevented evaluation from taking place. Although an overtly rational process, evaluation within organisations may have covert objectives, as individuals may have a personal interest in a particular outcome (Legge, 1984).

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The search for an objective viewpoint may lead an organisation to employ an outsider to carry out an evaluation study: it must be realised that this objectivity is threatened at the point where the evaluator's own values and interests support or come into direct conflict with those of some party within the organisation. A particular risk is that the evaluator may assimilate the views of those who commissioned the study: the desire that evaluation results should be accepted and used can contribute to this (Legge, 1984).

Capper (1988) suggests that post-implementation evaluation, should be carried out at three levels: operational and technical, usability, and organisational and political. In the planning of systems, adequate consideration of the usability and organisational dimensions can be shown to affect system success, and may therefore be considered desirable by management, but it is harder to envisage an officially sanctioned investigation of the effects on personal goals and power distribution. Capper, however, suggests that data processing managers frequently make informal assessments of these factors and attempt to satisfy both organisational and political requirements.

Many groups and individuals can be affected by a system, and the effect may not be the same for all staff groups. Perceptions of the system, for example of costs and benefits, may vary between staff groups or between staff and their managers. Further, individuals and groups may have different opinions, objectives and values, and the results of evaluation may favour some interests more than others. It is therefore seen as important to include the views of all relevant parties in evaluation studies. These individuals and groups, known as stakeholders, may include parties external to the organisation as well as staff and managers. They could include people whose interest in the system is indirect, or personal and unofficial. Stakeholders in NHS systems, who may consequently have an interest in any evaluation which is carried out, could include health care professionals, patients, managers, clerical staff, the general public (as potential patients and taxpayers), IT staff, suppliers, other health authorities and the Department of Health.

As the stakeholders in a system may have widely differing viewpoints, it is necessary to ask whether the broad criteria for evaluation and the techniques to be used should be prescribed by a methodology or by organisational standards, or decided by developers, managers and/or other users. (Detailed criteria will be case-specific.) The case for evaluation according to the users' quality criteria is argued by Elam (1979), who suggests that this will lead to greater understanding and acceptance of the system. The possibility that conflicts of interest will result in conflicting evaluation criteria must be considered: it

may be difficult to arrive at a consensus about what constitutes a desirable system (Iivari, 1988).

Kling & Scacchi (1982) show that an IS and its infrastructure interact to form a complex social organisation. Systems are seen as

> "complex social objects constrained by their context, infrastructure and history".

Factors which affect organisations or people at work can have an impact on the effectiveness of information systems. The design of the jobs of those who operate and use a system is important to its success and to the organisation as a whole. Eason (1984) suggests that the reactions to jobs which include a high proportion of VDU work may range from sickness, absenteeism and high staff turnover to resistance to change amongst staff and a loss of flexibility in the organisation. However, the introduction of some types of computing can add interest to clerical jobs (Yaverbaum, 1988).

Deficiencies in the infrastructure, that is, in the facilities which support the system, can prevent it from functioning smoothly, reduce its resilience or affect the quality of the information produced. For example, in a study which preceded the current project (Avison et al, 1989b) the over-dependence of a system on a single operator was found to cause operational problems and the quality of information was threatened by the inability of a hospital department to provide accurate clocks.

Other social and organisational factors such as the flow of work and the relationship between users and support staff may also have an impact on the effectiveness of the system and the organisation which uses it. These factors need to be considered during the planning and selection of the system and are appropriate subjects for post-implementation evaluation.

It can be seen that the effects of a system may be widespread; they will also be varied in nature. Some will be difficult to measure, such as the value of information to a department whose manager uses it in decision-making. They can also be difficult to compare. The value of information can be hard to weigh against the cost of the system, and is certainly not directly comparable with social impacts, such as the effect on individuals of stress or late working. Different types of measurement or investigation will be needed. This issue is discussed further in Chapter 4.

1.8. Aims of the project.

1.8.1. Assumptions about evaluation.

The above discussion can be summarised as a number of basic assumptions about the practice of evaluation:

- That evaluation should occur throughout the life cycle and should be seen as a normal part of the life of an installed system.
- That evaluation is useful in developing better systems, and can be formative, i.e. used in improving the system, or summative, i.e. providing an assessment for use in decision-making.
- That evaluation should include a broad range of factors, including social and organisational factors, rather than concentrating on financial and technical areas.
- That the opinions and interests of all concerned parties should be represented.
- That different situations will require different approaches.
- That the impacts of an information system will require to be measured in varying ways and will not all be directly comparable.
- That post-implementation evaluation should be considered before the system is introduced.

These ideas contributed to the planning of the research project.

1.8.2. Development of the research objectives.

The objectives of the research project developed over a period of time: it cannot be claimed that they were fully formulated at the start of the research and all subsequent work directed towards them.

The starting point for the project was the desire of one of the sponsoring health authorities to evaluate some of its information systems. This was not a normal activity for the authority, and it was thought that the project might serve the dual purpose of carrying out some evaluations and suggesting how such assessments might best be made. For this reason, early formulations of the objectives for the research project were cast in terms of finding appropriate methods by which health authorities could evaluate their systems. The action research studies were seen as an essential part of the project as they would allow experimentation with proposed approaches and techniques; it was intended that they would examine evaluation at various stages in the life-cycle.

It has been suggested that the practice of evaluation in the United Kingdom is poorly developed (Blackler & Brown, 1988). An aim of the early part of the project was to establish the state of practice in the target sector. If recommendations about methods were to be made, it would be useful to know what evaluation was done by other authorities, how helpful this was and what difficulties were encountered. Accordingly, the survey of health authorities was initiated as the first stage of the project in order to find out the current state of practice, and the opinions of the responsible managers about the approaches they used. Meanwhile, suitable applications were sought for the action research studies.

The ideas summarised in 1.4.1 suggested that no single evaluation approach would be suitable in all circumstances. Questions of interest would therefore be concerned with the way in which the NHS environment would affect the choice of approach and the conduct of evaluation, as well as with the suitability of various techniques, and post-implementation studies would need to have an emphasis on the planning of evaluation. The specific evaluation approaches which would be examined in detail, and therefore the questions which would be explored in individual studies, were thus dependent on the cases chosen. These in turn were constrained by the systems which the sponsoring health authorities were prepared to make available. It soon became clear that if the studies were to cover different stages in the life-cycle, there was little if any choice of applications. The initial planning of each study needed to ensure that relevant questions for research could be considered whilst meeting the needs of the authority concerned for evaluation. It had originally been envisaged that a possible direction for the later part of the work would be the integration of post-implementation evaluation and the necessary planning and preparation for this with a development methodology. This proved impracticable as no suitable development project was available in which to test a proposed approach.

1.8.3. Research questions.

A number of directions for the research were considered in the early stages of the project. The areas selected for detailed attention were chosen on the basis of relevance and practicality, as described above. These areas are:
- The state of practice of IS evaluation in the NHS (survey).
- The effect of the local and wider NHS environment on the conduct of evaluation (survey and action research studies).
- Procedures for IS procurement and the evaluation involved; procurement as a social process (HISS study).

- The planning of post-implementation evaluation and the factors which must be taken into account (Comcare and BSS studies).
- Identification and measurement of the costs and benefits of health information systems (HISS and Comcare studies).
- Post-implementation review in the context of a new organisation (BSS study).

1.9. Research approach.

Possible research approaches for information systems research have been listed by Jenkins (1985) and Galliers (1985; 1990) among others: there is no definitive list and the various authors have chosen different categorisations of the approaches. The list which follows describes a number of these methods.

- Philosophical research uses reproducible thought processes to explore ideas.
- Subjective or argumentative research attempts to produce creative thought by means of speculation or opinion. The approach can include reviews of existing material.
- Laboratory experiments follow the scientific method by manipulating chosen variables, using human subjects in a controlled situation.
- Field experiments also use experimental methods but attempt to introduce greater realism by using a natural setting, i.e. a real organisation.
- Field studies involve the systematic measurement of dependent variables, but without manipulation of independent variables.
- Survey research gathers data about facts or opinions from a number of subjects. Methods include questionnaires and structured interviews, supported by statistical analysis.
- Case studies make detailed observations of a single situation, or a small number of similar situations, in order to produce rich data leading to understanding. Several methods of data collection may be used.
- Archival research is concerned with the use of documents as a source of evidence.
- Simulation attempts to reproduce the behaviour of a system by means of mathematical or statistical models, and is useful for exploring situations which cannot be examined in the real world.
- Game and rôle playing are amongst the forms of simulation which use human participants.
- Action research is similar to the case approach, except that there is a recognition that the researcher will inevitably affect the situation being researched. Its distinguishing feature is the active involvement of the researcher in the process which is studied.

A number of these approaches have been used in research in the field of IS evaluation.

Jenkins (1985) stresses that a clear definition of the research objective is necessary if an appropriate methodology is to be chosen. A combination of methods may be advantageous as credibility is added to the findings if similar results are gained by different approaches, and insights of different types can be provided (Kaplan & Duchon, 1988). The research objective incorporates not only the subject of the research but its stage in theory development (Benbasat et al., 1987; Galliers, 1990).

This research project aimed to combine a broad view of the practice and problems of IS evaluation with a more detailed study of the use of evaluation in specific situations. For the wider view, survey research was clearly indicated and a questionnaire adopted as the method of choice. This is described in more detail in Chapter 2. The survey was the first practical activity in the project as its results were expected to be an input to the planning of the later stages.

The in-depth studies required a research approach which would allow the researcher to propose evaluation approaches and would also give a good understanding of the events of the evaluation and the environment in which it occurred. An action research strategy was chosen. The researcher would conduct or participate in evaluation studies of information systems in the sponsoring health authorities. This was seen as a benefit of the research to its sponsors.

The subject matter would include subjective and qualitative factors. The approach must be consistent with the position that social systems are subject to multiple interpretations, and that the research itself will affect the situation being studied. Action research, by means of the close involvement between researchers and subjects, allows an interchange of views and permits the direction of the research and the ideas brought by the researcher to be affected by the real world situation and its participants. The researcher's influence is made explicit.

The view of evaluation taken in the project regards it as a part of the development process. The inclusion of evaluation in a development methodology was seen as a possible direction for the project; action research has been successfully used in the development of IS methodologies (Wood-Harper, 1985; Avison & Catchpole, 1987). Finally, a methodology which would allow exploration of the research area and initial development of theory was required, rather than an approach for testing or extending a theory which was already firmly defined. Action research is an appropriate approach for this stage of research (Galliers, 1990).

The project adopted a simple model of action research which is shown in Figure 1.1. This draws on the descriptions of the research process given by Checkland (1981), and Antill (1985). Knowledge about a real world problem area gives rise to theory from which suggestions for practice can be made. The suggestions for practice will be appropriate to particular situations, and will be tested and developed through application in those situations. The learning which arises may lead to changes in the suggestions for practice or in the ideas from which they arose.

In this case the problem area concerned health authorities' need to evaluate their information systems and the perceived lack of appropriate methods. The relevant knowledge consisted of existing knowledge about IS evaluation, together with the information about its practice in the NHS and the opinions of IS managers which was derived from the survey.
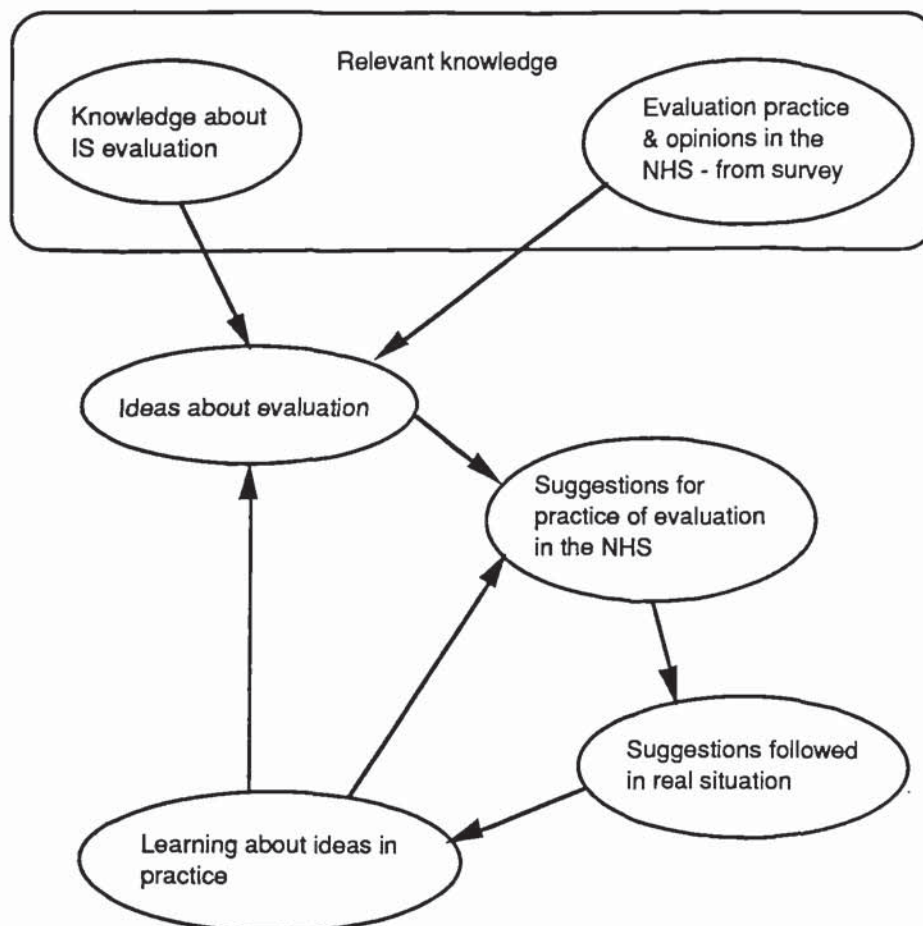
Figure 1.1. Action research in IS evaluation.

Checkland (1981), whose soft systems methodology was developed by means of action research, warns that this approach can lead to unpredictable results.

> "When the phenomena under study are social interactions the researcher will find it almost impossible to stay outside them. If he accepts wholeheartedly that he cannot remain aloof - which is what he does in the intervention in purposeful systems which is action research - then he may express his research aims as hopes but cannot with certainty design them into his 'experiments'. He has to be prepared to react to whatever happens in the research situation; he has to follow wherever the situation leads him or stop the research."

In this project, an example of this unpredictability was that the type of evaluation to be carried out in the two post-implementation studies could not be determined in advance, as it depended on the results of the initial investigations.

Chapter 2.

A survey of information systems evaluation in the NHS.

2.1. Introduction.

This chapter is concerned with the practice of information systems evaluation..It presents a survey of IS evaluation in health authorities which was carried out as the first stage of the research project. Section 2.2 describes some important events in the development of health service management and computing; these provide an introduction to the environment in which NHS computing takes place. Much of the material discussed in Chapter 1 was concerned with understanding evaluation and with how it can or should be conducted. Section 2.3 examines the evaluation which is actually carried out by organisations, and its benefits. The final section (2.4) describes the survey and presents its main findings; more detailed results are given in Appendix B.

2.2. The NHS environment.

During the period of the project, 1988-1991, and the preceding years, considerable changes took place in the management of the NHS and in both its information requirements and its methods of meeting them.

A significant step in the development of NHS information management was the series of reports produced by a committee chaired by Edith Körner. The Körner reports specified the minimum data sets which should be maintained by health authorities in most of their areas of activity. These data sets were put into place during the 1980s, together with the required annual statistical returns to the Department of Health. This process involved considerable developments in information systems.

The Griffiths (1983) report introduced a change in the style of NHS management. The appointment of general managers at regional, district and unit level was an attempt to produce greater efficiency and accountability, and involved a movement away from the consensus style of management which had been prevalent. However, the significant rôle of clinicians, and especially consultants, in decision making in hospitals cannot be overlooked, and continues to be extremely important. The Resource Management Initiative aimed to involve clinicians in the planning of expenditure and was the starting

point for further development of information systems. These changes, and their effects on IT in the NHS, are discussed more fully by Willcocks and Mark (1989).

The publication of the White Paper "Working for Patients" (Department of Health, 1989) coincided with the start of the first of the three evaluation studies in this project, and the subsequent discussion and implementation of its policies *continued throughout the* practical work. The proposed changes, like many NHS matters, became an important issue in national politics. The possibility of self-governing trust status for units provoked much debate and controversy. More relevant to the current project was the introduction of an internal market, in which purchasing authorities would enter into contracts with the providers of health care. This change came into force in April 1991 and brought with it considerable reorganisation within authorities and a new set of information requirements (Department of Health, 1990a; 1990b).

The 1980s saw considerable growth in the use of information systems in the NHS. Early systems were based on mainframe computers and were developed and maintained by the regional computing services, except in a few large teaching hospitals and districts with their own IT resources, but this period saw the beginning of a move towards computing at district level. More districts acquired their own IT personnel. The growth in microcomputing and the increasing availability of applications from non-NHS sources were also significant features of this period. The possible applications of IT became much more sophisticated, and computing technology began to appear in wards as well as laboratories and offices.

2.3. Surveys of evaluation practice.

Whilst there is much literature prescribing the evaluation which should be carried out, it is frequently stated that evaluation is in practice mainly concerned with the cost-justification of proposals or with machine performance and that the systematic evaluation of operational systems is rare. See, for example, Hamilton & Chervany (1981a), Hopwood (1983), Ahituv et al. (1986), Blackler & Brown (1988), Ginzberg & Zmud (1988). However, few surveys of evaluation practice exist and many of these are quite old. There has been a certain amount of recent work: most of this has concentrated on the areas of feasibility and justification of proposals. More comprehensive information about the evaluation approaches which are in use in organisations would be useful. This section reviews survey work covering post-implementation evaluation as well as project

justification. Some studies are concerned purely with what is done, others investigate the benefits which are gained from evaluating systems.

Section 1.5 noted the identification by Blackler & Brown (1988) of four approaches to the evaluation of information systems: cost substitution, the value-added approach, organisational evaluation and process evaluation. The results of their attempts to identify actual examples of these approaches are revealing. They found that the cost-justification of proposed purchases was popular; a cost-substitution approach was normally adopted and there was a tendency to concentrate on cost reduction in the short term. However, other approaches were less common. Some attempts were made to justify systems on the basis of organisational benefits or by a value-added approach. These seemed to be used where a conventional cost-substitution approach did not provide an adequate justification.

Cost-benefit analysis is the most generally accepted evaluation approach, but even this is not universally applied and its use may not be systematic or comprehensive. Early studies carried out in co-operation by the National Computing Centre (NCC) and the British Institute of Management (BIM) suggested that whilst most organisations carried out some sort of justification of proposed projects, fewer reviewed the actual costs and benefits after implementation. The NCC study (National Computing Centre, 1971) found that 77% of sites evaluated new applications as they arose, whilst some sites also justified the complete computer installation. After implementation, 65% reviewed costs and 60% reviewed the benefits achieved. In addition, some sites reviewed the completion (53%) and efficiency (48%) of the project. A parallel study of installations with inventory management applications found that the actual costs of systems were rarely calculated, and reported a tendency for costs occurring outside the data processing department to be overlooked (National Computing Centre, 1971). The BIM survey (Johannsen & Birch, 1971), which investigated a number of aspects of IT management, also found that the majority of sites evaluated all (66%) or some (30%) proposals, but a smaller proportion reviewed costs (34%) or benefits (49%) after implementation. The proportions reviewing completion and efficiency of the projects were also smaller: 10% reviewed completion and 38% efficiency. Johannsen & Birch suggest that the difference between the two surveys may be explained by the greater computing experience of the sites in the NCC sample.

Slightly more recently, Ginzberg (1979) studied the analyses contained in 71 proposals produced by a single organisation in the United States. This company was thought to be typical of large organisations using modern development methods. Although attempts were made to justify the systems and to state costs, only 35.2% of the proposals

attempted to quantify any of the expected benefits, and in a small number of proposals (10.1%) no benefits were mentioned at all. A study of proposal justification in a US government organisation (Jameson, 1981), came to similar conclusions: the cases for projects were poorly documented and the prescribed procedures were frequently disregarded.

Although most of these surveys are now quite old, there is little evidence to suggest that either the techniques in use or the way in which they are applied have changed greatly. However, as the focus of systems development has moved from the automation of clerical functions to the provision of management information, justification of proposed systems on the basis of cost savings has become more difficult. Silk's studies of the IT-related issues which are seen as important by managers give some indication that the justification of investment in IT is of increasing concern (Silk, 1989; 1990a). Preliminary results from a survey of the method used to justify projects suggest that financial justification is not universally practised (Silk, 1990b). Respondents were asked to indicate which of seven types of justification were in use in their organisations; they could specify more than one type, as organisations may use more than one approach. Only about half indicated that the type of justification which included a financial valuation of benefits was used: the significance of this is that the other half presumably never used it. Of the other categories of justification, one, described as "Must-Do", represented those systems which have to be developed because of external mandates or which are seen as necessary to the organisation's survival. (This has been an important type of motivation for systems development in the NHS.) Half the organisations had justified projects in this way. The remaining categories represented increasingly thorough non-financial analyses of the benefits from a proposed system. Hochstrasser & Griffiths (1990) found that only 16% of managers regarded a rigorous assessment of benefits as the main reason for their IT investments: more common reasons included the sense that IT helped to give a competitive edge (30%), or that the business could not be conducted without IT (21%). 18% reported that individual departments were left to made their own investment decisions: these again appeared not to include a thorough benefits assessment.

No work on the practice of evaluation in the NHS was found, but Zinn & DiGiulio (1988), working in the US health care sector, examined the decisions about IT purchase made by hospital managers. They found that 53% based their purchasing decisions on quantitative and qualitative benefits equally, 24% primarily on quantitative benefits and 22% primarily on qualitative benefits. The importance of qualitative benefits appeared to be slightly greater in larger hospitals.

Lester & Willcocks (1990) carried out a survey of evaluation in 50 organisations in a variety of industry sectors. The main focus of the study was on feasibility decisions. Cost-benefit analysis was the most common criterion, used by 96% of respondents and the first priority of 62%; other important factors were competitive edge, service to the public and the quality of the product. A high level of satisfaction with evaluation at all stages of the life-cycle was reported. The authors suggest that this confidence was misplaced in some cases as very few of the organisations based their feasibility decisions on more than four criteria. The authors consider that a range of criteria should be used. An interesting point concerned the choice of approach to the decision; 44% of sites changed their method according to the project, but only 16% of the others, which used the same approach for all projects, reviewed the method to ensure that it remained satisfactory.

These studies suggest that whilst some sort of assessment of costs and benefits is very widespread at the feasibility stage, the approach to justification and especially to determining benefits can vary widely and that a financial approach is not always taken. Whilst in the past, this has been condemned as lack of rigour (e.g. Ginzberg, 1979), it is now widely accepted that factors other than the quantifiable return on investment may be of greater importance, and that there are some systems which it is not appropriate to assess in financial terms (Parker et al., 1988; Silk, 1990b).

There is less literature about the practice of post-implementation evaluation, and various views about its content. Blackler & Brown (1988) found few attempts to carry out any sort of systematic post-implementation evaluation. As with the justification of proposals, the cost-substitution approach was the most common: no examples of process evaluation were identified and cases of the other approaches were rare. Other work on post-implementation evaluation gives a more confused picture of how widespread it is, though there is some evidence that it is considered beneficial.

Using the results of a survey of 487 data processing organisations in the U.S.A. and Canada, Lientz and Swanson (1980) attempted to identify the effects of various methods of controlling the maintenance workload on the problems encountered by the organisations. Of the control measures studied, only the practice of holding regular reviews of operational systems seemed to have a significant effect. This was associated with a reduction in problems associated with product quality and users' understanding of their systems and with a higher proportion of the maintenance workload devoted to user-requested enhancements rather than to the correction of faults. However, only about a third (32.4%) of the sites surveyed carried out these reviews on a regular basis. The

other measures which were examined included logging of requests for program changes, a formal test procedure for amended software, charging of costs to the users and documentation of program changes. Lientz and Swanson recommend that regular audits should take place throughout the life of a system, including the development phase.

Cerullo (1979), on the basis of a survey of 60 leading companies in the USA, also asserts significant benefits from the regular conduct of post-implementation audits. These include greater use of the information provided, including use by senior management; more sophisticated applications; higher perceptions of indirect benefits; and a higher opinion of the information provided. Unfortunately, the author does not present the figures which support these assertions, nor does he examine how the benefits are produced. He proposes that evaluation should cover the systems staff, the information and reports produced by the system, the effectiveness of control systems and the involvement of management with the MIS, as well as the benefits received. Intangible as well as tangible benefits should be included. 76% of the companies gave responsibility for these audits to a committee of user, financial and data processing (DP) managers: this is the author's preferred approach. The implication is that a high proportion of the organisations were carrying out audits.

Using a five-stage model of the life of a project, Lester & Willcocks (1990) discovered that all the organisations in their sample carried out feasibility studies and over 80% conducted evaluations at each of the other 4 stages: during development, during implementation, post-implementation and during normal operation. 66% carried out evaluation at all five of these stages. The scope of evaluation as they describe it in the later stages is largely concerned with financial and project management issues, and with system availability during routine operation. Post-implementation evaluation is expected to involve comparisons with earlier projections. Evaluation during implementation will assess the ease with which the user department is adapting to the system and the handling of predicted problems.

Peters (1990) found that fewer than 10% of the organisations in his survey carried out reviews to assess whether the expectations of a system in the original investment appraisal had been achieved. He suggests that this was frequently because the justification had been made on the basis of factors which were intangible or improvements in performance where the effect of the system was difficult to gauge, but also notes that

> "Some companies never bothered with regular post investment appraisals because it didn't suit their culture."

Conrath and Mignen (1990) investigated the extent to which user satisfaction is assessed in practice. They were interested in users' opinions of the DP function as a whole, rather than in satisfaction with individual systems. Of the 163 Canadian companies which responded to their initial request for information, 26% had a formal procedure for assessing user satisfaction. These were sent a more detailed questionnaire. On the basis of the 23 responses to this, the authors investigated a number of questions, including the factors which were considered important, the methods of measurement which were in use, and the benefits from the assessment procedures.

The factors which the respondents to this survey considered most important were the general quality of the services given, the match between the actual services given and the users' expectations, the degree of co-operation between the DP department and the users, the general level of satisfaction among users with DP products and services, and the timeliness of the services provided. The level of system usage ranked very low in importance. This is of interest in view of the debate about the validity of usage as a surrogate measure for effectiveness or user satisfaction (summarised by Robey (1979), Sanders (1984), and Srinivasan (1985)), though the measure is perhaps more relevant to the effectiveness of single systems than to the assessment of the DP function as a whole. Eleven of the 23 sites did monitor usage, but all used this in conjunction with other methods of measurement. The most common method was to seek feedback from departmental managers, though most sites used more than one approach. Thirteen out of nineteen sites consulted end users as well as their managers. The main reasons for measuring user satisfaction were to improve the quality of the services provided and to increase the degree of co-operation between the DP department and users. The respondents, who were DP staff, had found that the assessments improved their understanding of the users' problems and produced some improvement in relationships between user departments and DP staff, the level of co-operation, and the quality of the service given.

The work reviewed in this section has given a rather confused picture of the evaluation which is carried out, and there appear to be some contradictions in the findings. In particular, it is not at all clear whether post-implementation evaluation is commonly practised, though the evidence suggests that it can be considered beneficial. Project justification is frequently attempted, though there is considerable variation in the extent to which the expected benefits from a proposed system are assessed and quantified.

At the time of the commencement of this project, there appeared to be little recent survey work examining the practice of IS evaluation. Some of the work discussed above is quite

old; some was published after the survey described in the following section was carried out. Much of the work is principally concerned with feasibility studies. There was a need to investigate the practice of evaluation at other stages in the life-cycle. Furthermore, the NHS is a public sector organisation whose requirements and practices could well be different from those of commercial companies. A survey to investigate the evaluation carried out in the target sector was considered useful in itself and a necessary foundation for the project.

2.4. A survey of IS evaluation in Health Authorities.

2.4.1. Purpose and conduct of the survey.

The lack of recent information about the practice of evaluation has already been noted. The first part of this research project took the form of a survey of evaluation in health authorities, which was carried out in 1989. This had two main aims. The first was purely factual: it was intended to discover what aspects of information systems were evaluated by health authorities and what approaches were used. Evaluation which took place during development or procurement and after implementation was covered. The second aim was to discover the attitudes of NHS information systems practitioners to evaluation. Knowledge of the problems and deficiencies which managers have found in their current practices was expected to be useful when making recommendations. Managers were also asked to suggest types of evaluation which would be useful in addition to those which are currently performed. The survey was intended to provide the necessary background information for the second phase of the project.

The survey took the form of a questionnaire which was sent to the managers responsible for information systems in each of the 14 Regional and 200 District Health Authorities in England and Wales. A draft questionnaire was discussed with information managers in three authorities and their comments were incorporated in the final version. The questionnaires were sent out in April 1989. Non-responders were sent a second letter and questionnaire after two months. Eventually, 73 responses were received, although seven of these were too incomplete to be used, giving a usable response rate of 30.8%. Of these, four were from Regional Health Authorities (RHA's). It should be noted that the majority of those whose responses were not included, as well as several whose partial responses were used, indicated that they could not reply because they had no formal procedures for evaluation, and / or because such activities were the responsibility of their

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RHA. There is therefore a possibility that the sample may include an unrepresentative proportion of the authorities which do have evaluation procedures.

The questionnaire was divided into three sections. The first asked for background information about the scale of the IS operation within the authority and the methods of acquiring application systems. The second part asked respondents to outline the types of evaluation practised in their authorities, and the third asked for their opinions on these procedures, what changes they would like to introduce and what problems had been experienced. Both closed and open-ended questions were included. Appendix A contains a copy of the questionnaire; full details of the results are given in Appendix B.

Although a reasonable response rate was achieved in terms of the number of questionnaires returned, the quality of the responses was disappointing. It appears that the questionnaire was too long and contained too many open-ended questions to be completed easily, as a proportion of the respondents did not complete Section 3 or gave very limited answers. Far more detail than had been expected was given in response to questions 1.2 and 1.3, which asked about current systems and planned future developments. These should have been in a closed format as they were intended only to indicate the extent of the use of information systems within the authority. Confusion in the responses suggests that some questions should have been worded differently. Follow-up interviews would have been useful in order to validate the survey findings, but were not considered practicable because of the time involved and the need to proceed with the action research studies.

The number of the responses to the open-ended questions, especially those in section 3, which dealt with the respondents' opinions of their evaluation practices, was too low to allow a numerical analysis of the contents. However, it was considered worthwhile to identify the categories of response even though in most cases their respective importance could not be ascertained. These categories, with the number of examples of each, will be found in Appendix B; a summary of the most important points is presented in this chapter. A few questions produced responses which were too varied in content to be treated in this way.

2.4.2. Background information.

In order to ascertain the extent to which information systems were used by the authorities in the sample, the survey asked what systems existed in the main application areas and whether further development was planned. Nearly all authorities had patient administration systems and one or more departmental systems in their hospitals, financial

applications, and at least one system in the community health area. Manpower or personnel systems were also common; other important applications were supplies and works management. There was a wide range of other application areas including operational systems such as ambulance scheduling and catering, and management information systems covering various areas of activity. Some systems used by districts were operated for them by their Regional Health Authority. Almost all sites were undertaking or considering extensions to their systems; in many cases these were expected to involve a number of application areas.

Whilst some District Health Authorities had large information and computing departments, a significant number had very few staff in this area. Many districts were very dependent on their regions and on commercial suppliers as sources of software. Whereas 60 respondents (89.6% of the 67 usable responses) used commercially produced packages and 55 (82.1%) had systems which were operated for them by another authority (usually their RHA), only 36 (53.7%) had any software which had been developed in-house. It should be noted that until recently, few districts took responsibility for their own information systems. It is therefore not surprising that when asked which methods of systems analysis and design were in use in their authorities, about half replied that they were not using any. Most of the remainder, 26 authorities (32.9%), were using traditional methods for some or all of their systems, including the approach proposed by the National Computer Centre, and the NCC design documentation (Daniels & Yeates, 1971). The government-recommended methodology SSADM (National Computing Centre, 1986) was in use in 14 sites (19.2%), including the four RHA's. A number of respondents appeared to be using the project management method PROMPT (L.B.M.S., 1987) to guide their systems projects, although as this information was not specifically requested, it was not possible to estimate how widespread the use of the method is.

All Health Authorities had been instructed by the Department of Health to formulate an information strategy by April 1989. As this would prescribe directions for the future development of information systems, it was likely to be of relevance in assessing proposals and making feasibility decisions. It was also recommended that it should include criteria by which proposals would be assessed and procedures for the selection of systems and for the assessment of completed applications (NHS Information Management Group, 1987b). The survey asked whether the authority had an information strategy. Figure 2.1 shows that many authorities' strategies were still being prepared.
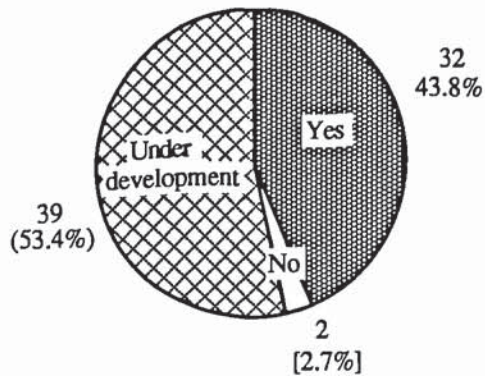
Figure 2.1. Information strategies.

The questionnaire asked whether the strategy contained, or was expected to contain, the suggested guidance on evaluation. Table 2.1 gives the results. Some authorities were not yet in a position to answer this question, as their strategies were not sufficiently well developed.

	No. of authorities	%
Criteria for assessment of proposals	24	55.8
Procedures for system selection	28	65.1
Procedures for assessment of systems	15	34.9

43 responses.

Table 2.1. Guidance in information strategies.

2.4.3. Evaluation procedures.

The first part of Section 2 dealt with decisions to undertake or discontinue a project and the selection of systems. The responses received were almost all concerned with the purchase of systems rather than their development. The type of procedures described varied considerably, but though a few respondents mentioned large procurements following an open tender procedure, in many cases projects were less formal, and presumably fairly small.

The responses were too varied to categorise other than very loosely, but a few different kinds of response did become apparent. One point of interest was whether projects were

identified as part of an information strategy or some other formal planning process, or the result of one-off feasibility studies as needs arose. Decisions to proceed with or discontinue a project could occur at various stages, and the number of these decision points varied from a project with several stages, perhaps managed under PROMPT, in which decisions to continue were taken at the end of each stage, to a process with only one formal decision point, which might occur after a feasibility study or when the available packages had been assessed. Some authorities had very informal procedures, or none; a number accepted systems selected by their RHA and were therefore not responsible for assessing the possibilities. The type of procedure could vary according to the size of the system, but many district authorities would not have conducted large procurements themselves. One authority employed consultants to manage larger projects.

Guidance from central NHS sources recommends that an option appraisal based on cost-benefit analysis should be made if an information system is to be acquired (NHS Information Management Group, 1988b). Cost-benefit analysis, however, was an area of difficulty. The survey asked which costs and benefits would be taken into account when selecting systems, and how these would be assessed. Part of this information is summarised in Table 2.2. The figures represent the number and percentage of authorities which would include each factor and which would make a financial valuation. It should be noted that some items, e.g. cost of buildings, are not relevant to all authorities. It can be seen that whilst a few authorities attempt to assign a value even to intangible benefits, in general benefit assessment is qualitative, and a few authorities did not make a financial assessment of some costs which would be easy to quantify. More authorities include staff time saved by a system in their assessments than include the time required to operate the system and collect data: the reasons for this would be of interest.

Respondents were also asked what factors other than costs and benefits were taken into account when assessing projects or possible solutions. The main responses are summarised in Table 2.3. The factors in the "other" category, which were suggested by respondents, included compliance with communications standards, the potential for tailoring packages to local requirements, other supplier-related issues, and the views of users.

Costs	Included in assessment		Financial assessment	
	No. of sites	(%)	No. of sites	(%)
Buildings	46	(74.2)	39	(62.9)
Hardware	60	(96.8)	59	(95.2)
Software (developed externally)	57	(91.9)	55	(88.7)
Consultancy	43	(69.3)	38	(61.3)
Training - external	53	(85.5)	45	(72.6)
Systems staff - development or procurement	24	(38.7)	14	(22.6)
Systems staff - implementation and training	32	(51.6)	21	(33.9)
User staff - development or procurement	23	(37.1)	10	(16.1)
User staff - implementation	33	(53.2)	14	(22.6)
User staff - training	36	(58.1)	18	(29.0)
Stationery	48	(77.4)	47	(75.8)
Other consumables	50	(80.6)	48	(77.4)
Hardware maintenance	59	(95.2)	58	(93.5)
Communications	57	(91.9)	55	(88.7)
Software support	57	(91.9)	54	(87.1)
Staff time - system operation	42	(67.7)	25	(40.3)
Staff time - data collection	44	(71.0)	25	(40.3)
Staff time - support	41	(66.1)	24	(38.7)
Risk of system failure	33	(53.2)	6	(9.7)
Disruption caused by introduction of system	34	(54.8)	4	(6.4)
Effect on job satisfaction	28	(45.2)	2	(3.2)
Benefits				
Meeting statutory / central requirements	60	(96.8)	10	(16.1)
Reduced or avoided costs				
- Stationery etc.	43	(69.3)	42	(67.7)
- Equipment	49	(79.0)	46	(74.2)
Time savings:				
- Clinicians	52	(83.9)	12	(19.3)
- Managers	55	(88.7)	14	(22.6)
- Nursing & paramedical staff	54	(87.1)	18	(29.0)
- Laboratory staff	54	(87.1)	18	(29.0)
- Clerical staff	56	(90.3)	26	(41.9)
- Others	41	(66.1)	13	(21.0)
Availability of staff for additional tasks	47	(75.8)	13	(21.0)
Improved management information:				
- New information	60	(96.8)	7	(11.3)
- More timely information	60	(96.8)	8	(12.9)
- More appropriate information	59	(95.2)	7	(11.3)
- More accurate information	59	(95.2)	5	(8.1)
- Easier access to information	60	(96.8)	5	(8.1)
Improved service to patients	57	(91.9)	10	(16.1)
Other operational improvements	46	(74.2)	17	(27.4)
Improved decision-making	54	(87.1)	8	(12.9)
Better management control	58	(93.5)	10	(16.1)
Better use of resources	56	(90.3)	26	(41.9)
Improved ability to respond to change	43	(69.3)	5	(8.1)
Improvements in job satisfaction	37	(59.7)	4	(6.4)
Better security against loss of data	36	(58.1)	9	(14.5)
Greater confidentiality	37	(59.7)	4	(6.4)

Table 2.2. Costs and benefits assessed in system selection.

	No. of authorities	%
Type of finance required	45	70.3
Other potential uses for available resources	46	71.9
Compliance with Information Strategy	52	81.3
Use of preferred hardware	49	76.6
Opinions of reference sites	51	79.7
Availability of software support	56	87.5
Potential for integration	61	95.3
Usability	53	82.8
Size or reputation of supplier	51	79.7
Other	14	21.9

Table 2.3. Other factors in system selection.

The type of cost-benefit analysis used was of interest, though it was suspected that the majority of authorities would do little more than ascertain the capital and revenue costs of the system. The most recently published advice on investment appraisal from the NHS Information Management Group (1988b) had recommended the use of the Equivalent Annual Cost method, as this allows the values of projects with different lifespans to be compared. Respondents were asked which methods they used to calculate and compare the values and costs of systems. The results are summarised in Table 2.4. It appears that the proportion using the more sophisticated methods is low.

	No. of authorities	%
Statement of capital & revenue costs	57	90.5
Payback period	28	44.4
Net Present Value	10	15.9
Internal Rate of Return	2	3.2
Equivalent Annual Cost	15	23.8
Replacement costs	1	1.6
None of these	3	4.8
Don't know	2	3.2

Table 2.4. Methods of cost-benefit analysis.

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A number of sites used the post-implementation review to assess the actual costs and/or benefits of a system: further details are given below. However, there were also other control measures, ranging from separate benefits studies to informal monitoring by a manager or user group. Some respondents saw cost control as part of the project management process, and a number relied on their normal budgetary control procedures. Several authorities apparently undertook no monitoring of either benefits or costs.

On the basis of the work described in Section 2.3, it was expected that the survey would reveal little post-implementation evaluation. However, three-quarters of the authorities in this survey carried out post-implementation reviews of at least some of their systems. In answer to the question "Does any formal review of a system take place once it has been implemented?" the responses were as follows:
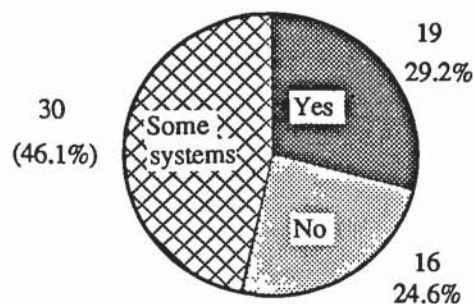
Figure 2.2. Practice of post-implementation review.

Some respondents questioned the use of the word "formal" in this question, indicating that they took an informal approach to reviews. The largest category, those which reviewed some but not all systems, used a variety of criteria for deciding which systems should be assessed. The most important appeared to be the cost, size or importance of the system, the existence of problems, and the availability of staff to carry out the review. Several factors could be included in the decision. The timing of the initial review could be from one to eighteen months after implementation, though from six to twelve months seemed the most usual period. Some authorities carried out further reviews at intervals.

About 90% of the authorities which conducted post-implementation reviews investigated the performance and reliability of the system and the users' opinions. The achievement of non-financial benefits was also included by a high proportion (82%), as were costs (76%) and the amount of use made of the system (80%). Realisation of financial benefits was included less frequently (66%), but not all NHS systems are intended to produce benefits of this kind. Other factors, including the impact on the organisation and effects on the users, were also less common, though of the topics suggested, only ergonomic

factors were included by fewer than half the respondents. (The survey did not ask how detailed the various investigations were.)

The regular practice of post-implementation review was not the only reason for evaluating installed systems or for carrying out other types of investigation. The development of district policies had prompted reviews in a number of authorities; these could involve more than one system. Several authorities had undertaken ad hoc reviews when problems were experienced, and two respondents mentioned that systems had been replaced as a result. There was not enough evidence to show whether or not the regular practice of post-implementation review would reduce the need for ad hoc reviews when problems occurred.

Some authorities had carried out process evaluation, i.e. assessment of the process of development, procurement or implementation, but the quality of responses to the question about this did not allow any conclusions to be drawn about its prevalence (see Appendix B). However, there is a contrast here with the findings of Blackler & Brown (1988), whose slightly smaller sample included no cases of process evaluation. Learning from the project in order to improve the implementation process was seen as a benefit of post-implementation review.

2.4.4. Opinions and problems.

The final section of the questionnaire asked the managers to give their opinions of their evaluation procedures, and to describe any problems which they had experienced or any changes which they would like to make. The majority of respondents found their evaluation procedures fairly effective, both for selecting systems and for post-implementation evaluation where this was carried out.

Respondents were asked to suggest improvements to their project selection and procurement procedures. The most frequently mentioned were the provision of a strategic framework; improved cost-benefit analysis, including various additional costs and benefits which should be taken into account; a more structured approach; provision of more resources; and greater involvement of users. Other suggestions related to the improvement of specific points, and a number were not specifically improvements to procedures but related to the environment in which systems were acquired: conflicts between districts and regions, management attitudes and the resources available for system purchase. A few respondents felt that no changes were required.

Few changes to post-implementation evaluation were suggested: most of these were concerned with the inclusion of additional topics.

A number of benefits from carrying out post-implementation review were mentioned. The most common was the ability to learn from a project in order to improve the organisation's capabilities and procedures for the future. Identifying and solving problems was also important. Most of the responses were similar, in that they were concerned either with learning from experience or with tuning and improving various aspects of the system. A few were more summative in nature, for example, "confirmation of decisions made". Some were concerned with less direct functions of evaluation: public relations, improving user confidence, and motivating those involved in system selection. The full list is given in Table 2.5.

Ability to learn from mistakes and improve planning / implementation procedures	6
Problem identification and resolution	5
Identification of enhancements	5
Confirms objectives have been achieved	4
Ensures benefits achieved	2
Confirms original decisions	2
Helps improve system use	2
Planning	2
Gives feedback from users	2
Used in decisions to replace an existing system	1
Can abort unsuccessful projects	1
Increases user confidence	1
Prospect of review improves selection process	1
Confirms reliability of system functions	1
Helpful when considering extension to other sites	1
Confirms control procedures followed	1
Identifies training requirements	1
Ensures support is satisfactory	1
Public relations	1
"Makes users and support staff stop and think"	1

26 responses.

Table 2.5. Benefits of post-implementation evaluation.

Respondents were asked whether they had experienced any problems in evaluating systems. The problems most commonly reported in system selection were the difficulty of measuring benefits and a lack of resources, especially staff with the necessary skills. Another problem was the lack of an overall strategy for information systems and standards for technological developments. Although many authorities had not met the target date for the production of an information strategy, planning was nevertheless in progress, and this problem could be expected to become less severe as a result. Lack of resources and the difficulties of cost-benefit analysis were also the most commonly reported problems in post-implementation evaluation. All these factors are listed in Appendix B.

Of the problems mentioned by respondents, only those relating to cost-benefit analysis were primarily methodological. Whilst it is possible that lack of experience was compounding this difficulty, as several managers mentioned a lack of the required skills, the problems of applying cost-benefit analysis to information systems have been extensively discussed in the literature (see Section 4.2). The problem is therefore not unique to the NHS, but a situation of increasing financial stringency in which many economies have already been made, and where many systems are not intended to produce cash-releasing benefits, makes it particularly relevant.

Several respondents, at various points in the questionnaire, mentioned the problems caused for districts because systems were chosen or imposed by the RHA. This suggests that the authorities concerned had different criteria for selecting the systems. The nature of these criteria would be an interesting question for further study; any such investigation would need to take account of political factors as well as the more overt criteria. One respondent gave a region's view, mentioning the need for "Justification for local solutions when central solutions would be more cost effective". Other problems, and reasons why the suggested changes to evaluation procedures could not be implemented, were also concerned with the environment in which evaluation took place: lack of resources, policy changes, attitudes to information systems etc. These are listed in Appendix B.

2.4.5. Conclusions.

The survey showed a situation in which the use of information systems was expanding. Authorities were interested in evaluation, and especially in cost-benefit analysis. It appeared that changes were taking place in the way that systems were planned and provided. The introduction of information strategies was expected to be of assistance in selecting and guiding projects. It would be interesting to discover whether the benefits which were expected from strategic planning are now being achieved.

Post-implementation evaluation was seen as beneficial, not only because it helped in improving the current system, but also because it allowed lessons from one project to be applied to others. The timing and contents of post-implementation reviews varied considerably. The tendency to review some but not all systems, and to select those which represent the largest investment or where there are problems, is consistent with a situation where resources are scarce and where the benefits from a review are not necessarily seen as immediate. There was some overlap between the benefits described by respondents and the results of carrying out evaluation identified in the surveys which were described in Section 2.3.

The results of the survey contributed to the rest of the project by suggesting subjects for evaluation which could be of interest in post-implementation review and by highlighting problems which were likely to be encountered: lack of suitable staff; the difficulty of assessing benefits; a situation in which many authorities had their IT resources fully committed to new developments; and the possibility of conflicts of interest between districts and their regions or other bodies, making assessments of systems a political issue.

The problems and desirable changes described by respondents suggest that factors in the organisational environment have an effect on the conduct of evaluation. However, despite the concerns which they mentioned, the majority were fairly satisfied with the effectiveness of their evaluations, suggesting that the effects are not severe. There appears to be a contradiction here. Evaluation in the NHS environment is explored further in the action research studies.

Chapter 3.

Procurement and the HISS project.

3.1. Introduction.

This chapter describes an action research study which investigated the acquisition of a Hospital Information Support System (HISS) by Darlington Health Authority. Section 2.4 noted the importance of software purchase to health authorities. However, little guidance about the conduct of procurements is available from standard IS methodologies.

Gronlund (1991) describes HISS as follows:

> "The objective of HISS is to provide support in the operational activities of a hospital; in the day-to-day work of nurses, clinicians, and other hospital staff; and in providing an improved service to patients. This philosophy finds integration the approach of choice, comprising a patient-based system as the cornerstone - the functional area central to delivering operational benefits being the communications infrastructure, often implemented in the form of an order entry / results reporting system (also known as order communication)."

In other words, a HISS is an integrated system in which a central patient record can be accessed and updated by those involved in treating the patient or in administering his or her stay or visit. The system is used to communicate requests for the services of hospital departments and to make the results of tests etc. available to clinicians on the wards. Clinical and non-clinical departments can be included. Data which is collected for clinical or operational purposes also provides management information. HISS is therefore able to provide the information needed for resource management. The system at Darlington will be very comprehensive; other sites may choose to include fewer departments.

This study was planned as an evaluation of the procurement process. Process evaluation can enable the organisation to improve its performance by drawing out the practical lessons to be learned from the execution of a project, allowing them to be applied to the next. It can also be used to review the appropriateness of the procedures used. This second function was of considerable importance here. Darlington's HISS project was part of a national initiative, for which Darlington was one of three pilot sites. Learning about the methods of selecting and implementing systems was therefore an objective for the project. There was little experience of such purchases within the NHS; the system was large and complex and some application areas were new to NHS hospitals. Although some guidance on IT procurement was available within the service, procedures

were being defined during the project, and it was essential that they should be effective. The process evaluation was to comment on the procedures used as the project progressed, as well as submitting formal reports on the main phases of the procurement.

Areas of particular interest in this study were:
- Procurement procedures, and the suitability of the methods used.
- The effects of the local and wider NHS environment, especially as the situation had a clear political dimension.
- System benefits, their identification and achievement.
- The study as a process evaluation.

This chapter, therefore, deals with two linked evaluations: that contained in the procurement itself, and the process evaluation. Section 3.2 discusses procurement and the achievement of benefits. Procurement is seen as having three important aspects: procedural, decision-making, and the organisational and social dimension. In Section 3.2.1, NHS and other procurement procedures are discussed and compared. Section 3.2.2 treats procurement as a decision-making exercise and gives an overview of relevant techniques. Much of the interest of this study was in the view of procurement as an organisational, social and political process. These aspects of procurement are the subject of Section 3.2.3. Section 3.2.4. discusses the identification and achievement of benefits, as a benefits study took place in parallel with the procurement. The process evaluation is outlined briefly in Section 3.3 and discussed more fully in Section 3.7. The events of the procurement are described in Section 3.4, and the benefits study is discussed in Section 3.5. Section 3.6. discusses influences on the procurement and the procedural and other questions which arose.

3.2. Procurement and benefits realisation.

3.2.1. Procurement procedures.

At the beginning of the HISS project, the main source of guidance for health authorities involved in the procurement of information systems and computer equipment was a publication of the NHS Information Management Group (1987a), entitled "Buying Information Technology Goods and Services" (BITGAS). This was supplemented by a "Guide to the Preparation of an Operational Requirement" (NHS Information Management Group, 1988a), which gives a standard format for this important document.

```
              ┌─────────────────────┐
              │ Agree procurement   │
              │ procedure           │
              └─────────────────────┘

┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Agree evaluation │  │ Write operational│  │ Advertise        │
│ criteria         │  │ requirement      │  │ procurement      │
└──────────────────┘  └──────────────────┘  └──────────────────┘

              ┌─────────────────────┐
              │ Issue operational   │
              │ requirement         │
              └─────────────────────┘

              ┌─────────────────────┐
              │ Receive proposals   │
              └─────────────────────┘

              ┌─────────────────────┐
              │ Select shortlist    │
              └─────────────────────┘

┌──────────────────┐          ┌──────────────────────┐
│ Discussions with │          │ Draw up memoranda of │
│ shortlisted      │          │ specification        │
│ suppliers        │          └──────────────────────┘
└──────────────────┘

              ┌─────────────────────┐
              │ Invite suppliers to │
              │ tender              │
              └─────────────────────┘

              ┌─────────────────────┐
              │ Receive tenders     │
              └─────────────────────┘

              ┌─────────────────────┐
              │ Evaluate tenders    │
              └─────────────────────┘

              ┌─────────────────────┐
              │ Award contract      │
              └─────────────────────┘
```
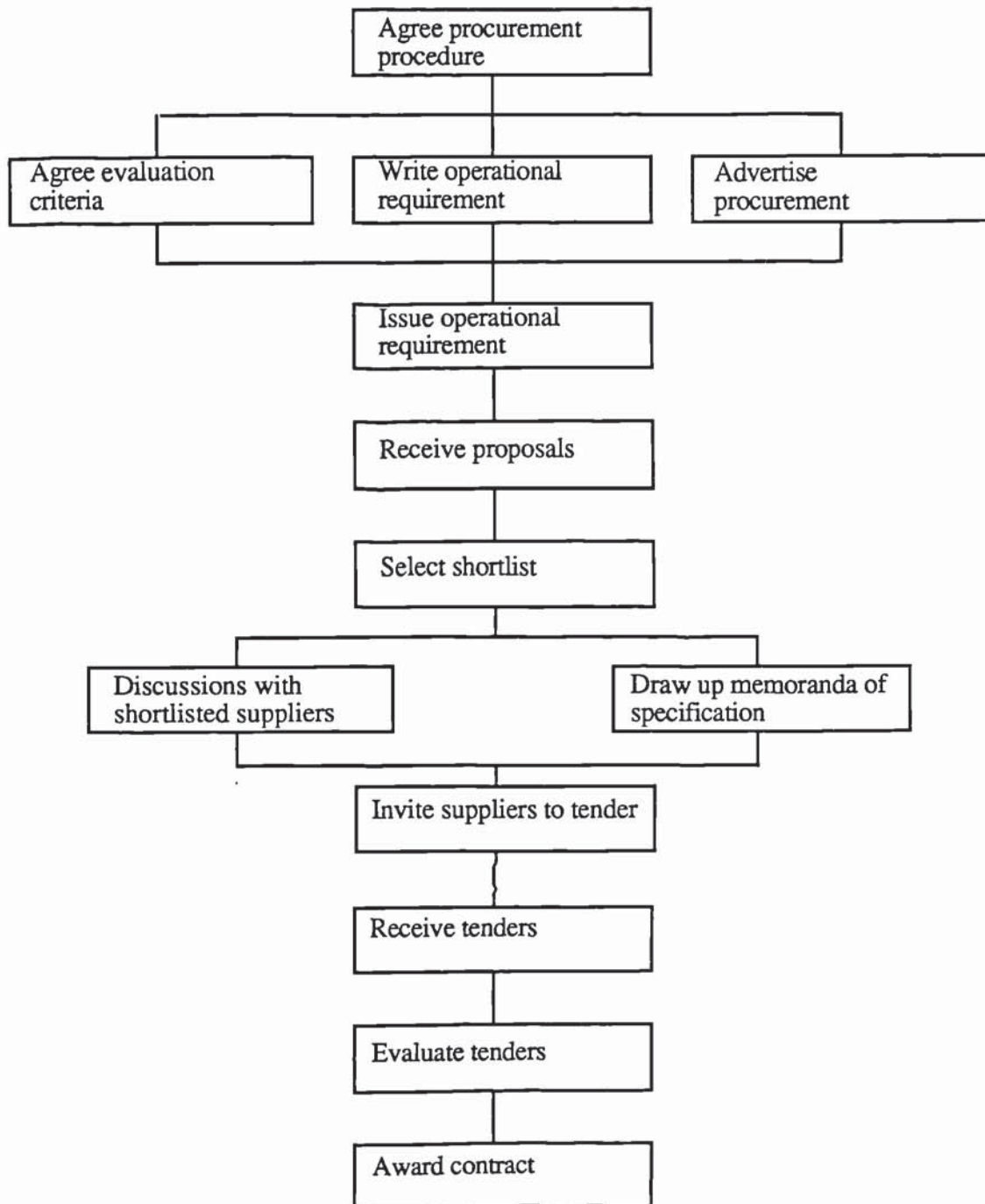
Figure 3.1. Main stages of BITGAS procurement procedure.

As the HISS procurement was originally expected to follow the procedure recommended by these publications, their approach was the starting point for the study. It is therefore described in some detail in this section.

The importance of following a defined procedure is stressed throughout the BITGAS recommendations. The account which follows is mainly concerned with large

procurements, as the HISS project was in this category. Smaller projects will have shorter timescales and a simplified procedure. The main stages in the full procedure are shown in Figure 3.1.

The operational requirement (OR) sets the proposed system into the context of the Authority's strategic plans, and describes application, technical and support requirements. The results of any data analysis are given, or failing this, other information about the data which must be held. It also describes the procurement procedure and gives the required format for proposals. It should give enough information about the authority to enable the supplier to interpret the requirement correctly.

The OR should describe requirements rather than solutions unless it is essential for a requirement to be met in a specific way. If specific facilities are stipulated, rather than objectives, proposals which meet an objective in a different way will be excluded. Requirements are categorised as either mandatory or desirable, and failure to meet a mandatory requirement results in exclusion from the procurement. BITGAS recommends that there should be as few mandatory requirements as possible and that those which are stipulated should relate to general issues such as the ability to meet timescales.

The criteria for shortlisting and for the evaluation of tenders are developed early in the BITGAS procurement procedure, at the time of the preparation of the OR. This is to ensure that the information needed for evaluation can be requested, and in order to avoid bias. Evaluation criteria are not made known to the suppliers, as it is thought that this will lead to unbalanced proposals which concentrate on the known criteria. Methods of gaining the agreement of interested parties to the criteria and of giving formal approval are not within the scope of BITGAS.

During the shortlisting process, any supplier which cannot meet all the mandatory requirements is eliminated. The remaining proposals are assessed and ranked according to the shortlisting criteria. The shortlist is chosen on the basis of this ranking.

Once the shortlist has been selected, discussions with the shortlisted suppliers begin. These lead to the production of a Memorandum of Specification (MOS) for each supplier. The MOS defines the goods and services to be supplied and forms the basis of the eventual contract. A detailed comparison of the proposals with the requirements takes place at this stage, and if suppliers have suggested alternative products or methods of meeting requirements, these must be compared against each other in order to select the most suitable. The discussions can include demonstrations, visits to existing users of hardware and software, and also perhaps performance trials.

The suppliers are invited to submit a tender for the goods and services defined in the MOS. Suppliers unable to meet any mandatory requirement will have been excluded from the procurement by this stage. The tenders are handled in accordance with the authority's normal procedures for any type of procurement.

The evaluation which takes place after tenders have been submitted is in two parts, technical and financial. It is an evaluation of the MOS and tender, not of the initial proposal, and must only consider information which has been formally submitted in the initial proposal or any supplementary submissions requested during the discussions.

It is intended that the technical evaluation should be qualitative, allowing scope for professional judgement. However it is recognised that authorities may wish to use a scoring method to support the assessment. In this case, it is suggested that the scoring system should be kept as simple as possible. The recommended scheme is:

0 - Requirement not satisfied.
1 - Requirement partly satisfied.
3 - Requirement fully satisfied.

This embodies the belief that it is considerably more valuable to have a requirement fully satisfied than partly satisfied. The assessment is based on criteria at two levels: the higher level criteria are assigned weights to reflect their relative importance. Other scoring models allow a hierarchy of criteria to be constructed with weights at each level.

Costs are presented as comparative tables, without comments, and in summaries of the projected expenditure for each month or quarter. A discounted cash flow may also be given, but is not obligatory. BITGAS does not give a method of weighing costs against the facilities provided. This is a problem of comparing qualitative assessments against figures, and requires the use of professional judgement if there are significant differences between proposals.

BITGAS does not lay down a specific rule for the tender decision, which will be made according to the authority's general financial instructions. However, a common principle is that the lowest tender will be accepted unless there are good reasons for accepting a higher-priced proposal. This makes it necessary to be able to demonstrate the differences between proposals and the advantages and disadvantages of each. BITGAS relies on qualitative assessment at this point: even if the option to use a scoring model has been chosen, no scoring system can be regarded as entirely objective and rigorous.

A weakness in this procedure is its inherent assumption that the new applications will be developed specifically for the health authority. The assessment of packaged software is not well supported.

Another more recent approach to procurement in the public sector is that recommended for universities which are seeking to replace the computer equipment used for teaching (Central Computer and Telecommunications Agency, 1989). This replacement is done on a regular cycle, and involves the purchase of hardware and systems software. Applications software is not normally included. There are a number of differences between this procedure and that of BITGAS: two areas are noted here as they represent a difference in approach which became important in the HISS procurement.

In the universities' procedure, the OR contains requirements in three categories: minimum, highly desirable and desirable. Minimum requirements are similar to BITGAS mandatory requirements in that they must be satisfied, but there is the important difference that they give a comprehensive description of the minimum required system, so that a proposal which satisfies the minimum requirements within the cash limit for the procurement is deemed to be acceptable.

Discussions with the shortlisted suppliers lead to the drawing up of a Memorandum of Agreement for each. Investigation of the extent to which highly desirable and desirable requirements are fulfilled also takes place at this time. When tenders are received, the evaluation which takes place is basically financial, and where possible the cost of meeting the requirements in each area to an acceptable standard is calculated. Qualitative assessments are only made when a financial assessment is not possible. These are included in the evaluation report where there are significant differences between proposals. Each factor is given a rating on a ten-point scale, supported by comments, but the ratings are not combined into an overall score. The qualitative criteria are used to decide between proposals with similar costs. If one tender is significantly lower than the others, it will normally be chosen; any other decision will need to be thoroughly justified.

3.2.2. Decision-making in procurement.

At the centre of a procurement are the implicit final decision to proceed with the purchase and in most cases an explicit decision between possible solutions. This section concentrates on the second of these decisions. Formal evaluation procedures aim to promote an objective approach, to ensure that the decision is based on the criteria which are important to the organisation, and to enable it to be justified to management and

perhaps other parties. Where there are uncertainties or subjective elements, it is important that they should be understood. Various approaches have been suggested. Klein and Beck (1987) give an introduction to some of these, and a further survey follows.

The type of decision to be made may vary: for example, there is more than one approach to a tender decision. The lowest priced acceptable system is not necessarily the same as the system offering the best value for money, or the best system available within some limit on spending. The universities' procedure, described in the previous section (Central Computer and Telecommunications Agency, 1989), would tend to produce the first of these results, whereas other approaches would be consistent with any of the three.

Procurement is an example of the class of decisions which are based on multiple criteria. Most non-routine decisions made by managers are in this category. There has been a considerable amount of work on techniques to assist in making these decisions. The evaluation of proposals for Research and Development projects, within the discipline of Operational Research, has been a productive source of suitable techniques, especially in the area of scoring and other models for evaluation, although other models are now preferred for this task (Souder & Markovic, 1986). However, project selection typically involves fewer criteria than procurement decisions, and some of the methods become unmanageable if the number of criteria is too large. Other related areas are information systems project selection and the establishment of criteria for post-implementation evaluation.

The most popular type of model to support the evaluation of proposals is the weighted scoring model, in which proposals are scored according to a number of evaluation criteria, each of which is assigned a weight reflecting its importance. Weights are usually expressed as percentages or decimal fractions, totalling 100% or 1. When scoring is complete, the weights are applied and a total of the weighted scores is calculated for each proposal. These totals can then be used to rank the proposals. The evaluation criteria may be expressed as a hierarchy, in which case weightings are applied at each level, so that the weights of each group of sub-criteria total 100%. Additive scoring models have the advantages of ease of use and conceptual simplicity, and can easily be supported with an automated tool such as a spreadsheet. They are also very flexible: a wide variety of criteria can be included and the results are less sensitive to the structure of the model than is the case with other scoring approaches. A hierarchy of criteria can be set up, and the accumulated scores are meaningful at all levels.

The main components of a hierarchical additive scoring model are the weights, scales and system of scoring. The actual criteria for evaluation will be specific to the procurement.

Procurements can involve large hierarchies of criteria, so that a detailed assessment is made and marks assigned to many separate factors, most of which, as long as they are basically satisfactory, will have little effect on the result.

The assignment of weights is a subjective process. It is made more complicated by the need to gain agreement between the parties involved, who may have widely differing views on the relative importance of the criteria. This may be done by arithmetic methods, in which individual preferences are combined to produce an average result which is taken to be the opinion of the group (Eckenrode, 1965; Moore & Baker, 1969a), or through group processes such as discussion, voting, or the Delphi method. (Scheibe et al., 1975).

The marking scheme must be carefully chosen as different schemes favour proposals with different distributions of strengths and weaknesses. For example, the scale used by BITGAS (NHS Information Management Group, 1987a) gives preference to proposals which satisfy requirements completely rather than partially, so that if two equally weighted criteria are considered, a proposal which completely satisfies one and does not address the other at all will outrank one which partially satisfies both (see Section 2.2.1). The length of the scale will affect the ease of marking: it appears that in order for there to be maximum discrimination, rating scales should have as many points as possible, but it is difficult to work with more than 9 points (Moore and Baker, 1969a; 1969b).

The above discussion assumes that the scoring will be an essentially qualitative process of comparing proposals to the stated requirements. It may be appropriate to use more objectively based scales for some criteria, such as cost, manpower requirements, timescales, capacity or performance measures. Where these scales are used, it is necessary to determine the range of values to be covered and the points to which scores are to be attached. One approach is the use of value functions. Keeney & Raiffa (1976) describe a general method of developing these and Klein and Beck (1987) describe their use to assess the value of additional disk capacity in a microcomputer. The principle behind these functions is that the value to the organisation of some measurable attribute does not necessarily increase linearly with the measurement of that attribute. The function maps the measurement onto the value to the organisation. It will normally be derived from the perceptions of managers, as suitable rules are unlikely to exist in advance.

It is essential when considering the results of scoring models to be aware of their limitations. They do not, and cannot, provide a totally objective assessment of a proposal. There are subjective decisions at many stages: in selecting the criteria, in assigning weights, and in the scoring of factors which may not be quantified in any way. It is not possible to be sure that the difference in importance to the organisation between

successive points on the scale is similar for all intervals, i.e. the marks should be regarded as ordinal, not interval, data. However, the model treats the marks as if they were interval quantities. The weight assigned to any criterion is not related to the score. However, it is possible for the importance of a factor to depend on the service level provided, particularly when some minimum service level is required. Any interaction between the criteria is not represented. The total score should be treated with caution as it gives only an overall assessment of the quality of the proposal. There is a need to know which are the strong and weak areas of each proposal, as the model will average out high and low marks if the weightings are equivalent, so that a proposal receiving consistently average scores may have a very similar total score to one with more extreme results. Where proposals have already been examined to ensure that a comprehensive range of mandatory requirements have been satisfied, these problems are considerably lessened.

A type of scoring model in which the weighted scores are not added together but multiplied is found in other applications of scoring techniques (Moore & Baker, 1969b; Melone & Wharton, 1984), but its use in procurement cannot be recommended as it is more complicated in use than the additive model and has been shown to give less consistent results.

An approach which has been applied to computer selection in small businesses is described by Raymond (1983). The ELECTRE method uses weighted criteria, and proposals are scored according to each criterion. The method differs from the usual scoring model in that the proposals are then compared in pairs. Thresholds are specified which determine whether one proposal can be considered superior to the other: these consist of a minimum amount by which a proposal must be superior and a maximum amount by which the score of the inferior proposal may exceed that of the superior on any criterion. Any proposal which can be shown to be outranked by another according to the specified criteria is eliminated. Although there may not be one proposal which is clearly superior, the preferences which are expressed are probably more reliable than those derived from scoring model totals alone, as the method has more built-in safeguards. Additional screening could be used to ensure a minimum standard.

Another method which involves paired comparisons is proposed by Klein and Beck (1987), but in this case the features found in proposals are compared directly. Their example applies the method to hardware selection. As the comparisons between various features are made, options which differ only on one feature are eliminated if they have the less favoured characteristic. Although many criteria can be included, the method, which is supported by an interactive computer program, will be of most assistance where the set

of options for each criterion is fairly limited, so that the same values will occur in several proposals. This method is unlikely to be feasible for large IS procurements because of the lack of common features and the number of comparisons to be made.

Other possible approaches to procurement decisions include utility assessment (Hawgood & Land, 1988), which enables different views about a number of criteria to be considered, and the Analytic Hierarchy Process, which has been applied to the selection of hardware and software (Seidmann & Arbel, 1984; Zahedi, 1985).

In public procurements, value for money is an extremely important factor in the purchasing decision. At some point in the evaluation, the cost of the proposals must be taken into consideration, but an objective assessment of their value for money would require a complete analysis of the costs and benefits of each. This would involve a considerable amount of effort, and raises the question of assigning values to intangible benefits, for which there is no satisfactory solution. If the costs are similar, the assessment of benefits is unlikely to be sufficiently detailed to allow proposals to be compared in this way. Various alternative approaches have been suggested.

If a scoring model is used, one possibility is to include cost as a criterion in the evaluation, i.e. to give it a weight and include it in the scoring model. There are a number of possible difficulties with this approach. The scale used may allow insufficient differentiation to reflect the range of costs. The importance of the cost to the eventual decision may vary with both the amount involved and the quality of the proposal. If there is a need to follow a formal tendering procedure with a bias towards the lowest priced proposal, it is probably more appropriate to compare, rather than to combine, the cost figures with the assessment of other aspects of the proposal.

A simple approach to measuring value for money involves the calculation of a price/performance ratio, using the score derived from an additive scoring model as the index of performance, i.e.

<div align="center">

Cost of proposal (preferably lifetime cost)
Score from model

</div>

The resultant figure must be treated with caution as it gives a measure of value for money but does not take into account the suitability of the proposal, with the result that a poor but relatively cheap proposal would appear to give better value than one which was far more suitable but relatively more expensive.

A variant on the above, suggested by Welsby (1985), attempts to overcome this limitation. In his approach, two ratios are calculated.

$$\text{Ideal ratio} = \frac{\text{5 year cost of proposal}}{\text{maximum possible score}}$$

$$\text{Score ratio} = \frac{\text{5 year cost of proposal}}{\text{actual score}}$$

The score ratio is the price/performance ratio mentioned above. The deviation of the score ratio from the ideal ratio is then calculated, i.e. the percentage of the ideal ratio by which the score ratio exceeds it. The most attractive proposal is that with the lowest percentage deviation. Although these ratios may be used for comparison, the figures themselves have little meaning.

An early attempt to develop an objective assessment method and give an estimate of value for money was Joslin's cost/value method (Joslin, 1968). In this approach, desirable features are listed in two groups: essential requirements, which all proposals must provide; and useful additional features, for which the organisation is willing to pay more. A value is assigned to each item in the latter group. When proposals are received, the notional value of features in the additional category is deducted from the cost of each proposal. The sum that remains is taken as the cost of providing the basic system. This method has the advantage that it provides a value for money comparison which takes into account the extent of the facilities provided. However, the pricing of the features may be difficult, especially where they involve intangible benefits. Joslin suggests that the technique should be extended to take into account the quality of the features provided. The method does not appear to have been widely adopted.

Shoval & Lugasi (1988) propose a graphical cost-benefit approach to inform value-for-money decisions. This uses scales representing the level of benefit, a normalised cost, and the relative importance of the levels of cost and benefit to the decision-maker. For any point on the scale of relative importance, the graph will show which alternative is preferable. The results have been shown to differ from those produced by a simple cost-benefit ratio. The method allows a decision-maker to choose an acceptable trade-off between benefit and cost, and different decision-making styles can be accommodated.

Risk factors can be included in the evaluation in a number of ways. The risk to the success of the project presented by poor performance on each criterion can be reflected in the weightings, and mandatory requirements can be used to exclude proposals which

have a high risk of failure. The risk that the system or the supplier will not perform as expected can be a question of the accuracy of the assessment, and the confidence which can be placed in it, but in some cases it is the accuracy of suppliers' predictions and estimates which is in doubt. A second weighting factor reflecting the level of confidence in each assessment can be applied to the scores, either initially or as part of sensitivity analysis. Another possibility is to include in the model the factors which lead to confidence in a proposal, such as the opinions of reference sites, existing customer base, and the results of trials. Alternatively, an estimate of the probability of success could be one of the evaluation criteria. Any assessment of risks or confidence levels supplied by evaluators is likely to be highly subjective. However, a popular approach is the inclusion of risk factors in a financial model, treating them as part of the cost of ownership. The basis of this type of risk analysis is the valuation of each risk as:

Probability of event occurring x Cost if event occurs.

Sensitivity analysis can be used to test the validity of the evaluation results. This is a process of recalculating the scores after slight variations have been made in the model, to discover whether the results are highly dependent on any specific assumptions. Likely subjects for investigation in a scoring model would be the weights and the scores of highly weighted single criteria. This process can increase confidence in the model, or show any areas where low confidence casts doubt on the validity of the results.

3.2.3. Organisational aspects.

A procurement is part of the implementation of an information system, which was described in Section 1.7 as a social and political process. That discussion is now extended to the specific area of procurement. The implementation involves the introduction of an organisational change and may take social and organisational factors into consideration. It takes place within a specific organisational context. Features of the local or wider environment may affect the formal structure of the procurement, the way in which it is managed and what actually occurs.

It has been shown that IS failures can arise from rejection of the system by its users as well as from technical or functional inadequacy. Resistance to a system can occur throughout the life cycle, not only when the system is operational, though it is frequently manifested at this stage (Hirschheim & Newman, 1988). An obvious response to this is the view that the development method or procurement procedure should be applied in a way which will help to gain commitment and to promote user acceptance. This presupposes that the "rational" assessment made by managers is more accurate or has a

greater right to be accepted than the more subjective and personal assessments of users. An alternative response would be the development of a common assessment. Deficiencies such as lack of skills, poor communication and poor understanding of the organisation can also threaten the success of a project. These issues are partly in the domain of project management.

The case for user participation in development projects is of interest, as this has been proposed both as a method of gaining acceptance and a means of ensuring that the interests of users are protected. Definition of the requirements will involve the users to a greater or lesser degree. If evaluation is to be carried out on user-specified criteria, these must be elicited and agreed, and user involvement in the assessment process is possible. According to Land (1982), participative design can reduce the problems of communication between data processing specialists and users. The system can be based on a more accurate model of reality, as the perspectives of all parties are considered. The increased understanding of the changes which are to take place will lessen the users' uncertainty about the future and the possibility of opposition to the implementation. Unrealistic expectations can also be reduced. These are another possible contribution to the failure of projects (Ginzberg, 1981).

These arguments cán be applied to the purchase of systems as well as to in-house development. However, there may be practical difficulties in organising a project with many user participants (Hirschheim, 1985). Eason (1982) suggests that if users are not familiar with the design process, they will not be able to make a significant contribution as they will still be learning when most of the important decisions are made. He recommends evolutionary development as a solution to the problem, so that experience will be gained through trials and experiments, but this solution is not compatible with the purchase of large packaged applications.

Social and organisational factors need to be considered during the planning and selection of the system. The relevance to procurement may be direct or indirect. Some factors need to be assessed directly, either against defined requirements or in comparisons between proposals, as required by the method. These could include ergonomic factors, ease of use, ease of learning and perhaps supporting services. Appropriate methods of assessment will be needed. Other aspects will need to be considered in order to determine the system requirements, so that suppliers can be asked to propose appropriate facilities. These will include issues of procedure and job design. The implication for the procurement process and its place in the IS project is that organisational issues should be considered before the OR (or equivalent) is written.

This raises the question of the relationship between procurement procedures and IS methodologies, and the type of methodology which is most suitable. Most work on IS implementation and most methodologies assume that software will be developed. However, a similar process is required if software is to be purchased, though the emphasis will be on the specification of requirements rather than the detailed technical design of solutions. There is a need for methodologies to make greater allowance for the possibility of software purchase (Avison & Fitzgerald, 1988). This question is beyond the scope of the current project.

If procurement is seen as part of IS implementation, then factors which affect the selection of a methodology should be relevant. It has been proposed that the choice of an IS methodology should be contingent on various factors. Suggestions include:

- The uncertainty involved in the system and the organisation, the number of users and their skills, and the experience of the analysts (Davis & Olson, 1985).
- The personality, cognitive style and abilities of the problem owner(s) and problem solver(s), together with factors such as the size and culture of the organisation and the resources available (Episkopou & Wood-Harper, 1986).
- The interaction between the system and its environment, and the degree to which each is affected by the other (Land & Somogyi, 1986).

Chapter 2 has described the environment in which NHS computing takes place and some of the changes which have occurred in recent years. These provide part of the broader NHS environment whose effects on the HISS procurement will be discussed. The Audit Commission (1990) has noted that when rapid change produces pressure to implement IT systems, control and thoroughness in procurement can be lost. Willcocks & Mark (1989) describe the effects on IT implementation in the NHS of funding policies and the need for authorities to respond to a series of initiatives rather than allowing their systems to develop naturally.

Another aspect of the wider environment is the existence of regulations and policy relating to procurement, which may affect the structure of the procurement and the type of solution which is required. Public policy is important to NHS procurement because:

- it imposes procedural requirements which must be followed by the authority;
- it sets the general objectives which the authority will aim to meet by its procurement procedures, e.g. by providing definitions of "value for money";
- it contributes to the environment and organisational culture in which the procurement takes place.

Sources of policy and regulations on public purchasing include the Treasury, the European Commission, and the General Agreement on Trade and Tariffs (GATT), an international agreement to which all EC countries are signatories. Specific regulations which affect NHS purchases of information systems relate to the use of a single tender procedure, advertising the procurement, and compliance with European or international standards.

According to the 1984 report on government purchasing (Cabinet Office, 1984), the two aims of public procurements are to provide the end users with "what they need, when they need it, at the lowest cost" and to achieve value for the taxpayers' money. These aims can be achieved in both direct and indirect ways: directly, by good practice in individual procurements; and indirectly, by encouraging competition, developing the base of potential suppliers, and considering methods of improving procurement practice and the organisation of public purchasing. Value for money is defined in terms of quality as well of cost, and purchases should be justified by an investment appraisal covering the whole life of the project.

The local situation can also have its effects on the project. The idea that there is an interaction between a development methodology, those who use it and the situation in which it is used (Avison & Wood-Harper, 1990) is applicable here. The use of methods or techniques can be affected by the skills and attitudes of those involved. The possibility of conflicts of interest has already been mentioned. The process may also be affected by management style and the flexibility or otherwise of the organisation, which may restrict the degree of innovation which is acceptable. The survey of health authorities suggested that in the NHS context, relevant factors might include lack of time, staff and other resources; a lack of confidence in existing methods; conflict between district and regional interests; and attitudes towards IT and its providers. The factors operating in the HISS study are discussed in Section 3.6.2.

Subjective factors can be important in decision-making and the interaction between formal and informal assessments is therefore of interest. The attempts of sales organisations to develop favourable subjective impressions of their companies are well known. Pettigrew's study of computer acquisition within an organisation indicates that social contact between those involved in the purchasing decision and those making proposals may affect the assessments which are made (Pettigrew, 1973). Individuals in the purchasing organisation may have preferences between suppliers, arising from previous experience or a variety of subjective considerations, and in the absence of formal procurement procedures these may determine the decision or be a cause of disagreement.

3.2.4. Benefits realisation.

A Benefits Realisation Programme (BRP) is a management process which sets targets for the progressive achievement of benefits throughout the implementation of a new information system and monitors the benefits achieved (Anderson, 1983; Avison et al., 1989). The objective is to ensure that the potential benefits are achieved in practice. Smith (1990), who suggests a similar approach for the implementation of office systems, notes that some benefits are easily obtained because they are advantageous to individuals, who are motivated to achieve them. Others, such as reductions in staffing levels, are unlikely to occur unless someone is made responsible for them. There is some variation in precisely how the programme is carried out, but an essential early stage is a study of the potential benefits from the proposed new system. For an effective realisation programme to be planned, detailed estimates of benefits are required. However, the initial study is often carried out at an early stage, in order that it may contribute to the justification of the purchase. At this stage, it relates to a generic system and will need to make assumptions about the nature of the system which is to be installed. If greater accuracy is required, it must be refined.

The idea of a BRP was developed to aid the achievement of benefits from hospital systems in the U.S.A. This was not a well understood process in the NHS at the beginning of the project, but an IMG publication concerning investment appraisal, which described techniques for assessing the benefits from a proposed system, had recently appeared. This described two pilot studies (NHS Information Management Group, 1988b). BRP's in the United States often have system justification and cost reduction as their major objectives, whereas the emphasis at Darlington was on achieving a range of qualitative and quantitative benefits. Although most proponents of benefits realisation claim to do this, there often appears to be a heavy emphasis on the quantitative side (see, for example, Anderson, 1983; Parker, 1988).

The essential elements of benefits realisation are detailed prediction of the expected benefits and targets for their achievement; a detailed plan for the management action needed to attain these targets; methods of measuring each benefit; a method of instituting corrective action; and an organisational structure to support the program which includes wide user involvement and clear assignment of responsibility.

Benefit identification usually involves a detailed examination of activity levels, as the major tangible benefit from hospital systems is often expected to be the release of staff time. Questionnaires or activity logging are used to establish the time spent on various

tasks. It is necessary to be realistic about the amount of time which can be re-allocated, and to ensure that this happens in practice. However, other types of benefits should also be identified and their levels estimated as far as possible. These projected benefits become the objectives for the realisation programme. The organisational changes needed to achieve them are agreed in advance and take place as the implementation progresses. The implementation can be planned so that the most significant benefits are achieved as soon as possible.

The realisation tactics must be started as soon as implementation of the system commences. Measurements will be taken to ensure that the predicted benefits are actually achieved. This is likely to involve repeating the activity logging which took place at the identification stage, and comparing the results with the objectives. Measurement of the intangible benefits might involve attitude surveys of staff and patients, recording the demands on patients' time, logging errors and the resulting delays in treatment etc. Corrective action can be taken if the targets are not being reached.

The stages of the BRP must relate appropriately to the procurement cycle. An important question is that of when the expected benefits can be predicted in detail. Objective setting and implementation planning are dependent on this detailed study. Anderson (1983) suggests that targets for benefit achievement should be agreed before the system is chosen. An alternative view is that this would be unrealistic if the proposed systems differed significantly in their design or method of operation. In this case, either it would not be possible to complete this stage until after the procurement decision had been made, or a set of estimates would be needed for each proposal.

The assignment of responsibility for achieving benefits is a potentially difficult area. A high level of accountability is sometimes proposed, with individual managers undertaking to deliver the projected benefits in their areas (Blask et al., 1985). This approach is not natural to the NHS and might be thought to detract from co-operation and the sense of ownership. A shared commitment to the achievement of benefits within each working group would seem more appropriate.

There are a number of possible methods of estimating the time savings resulting from the introduction of operational systems, and giving a value to these. It is necessary to identify the tasks which will be affected by the new system and to measure or estimate the frequency with which they occur and the time taken to perform each task. The tasks required by the new system or alternative possible systems are identified and similar estimates are made for each alternative. Where a specific software package is being considered, it may be possible to obtain precise activity timings from other sites.

In the "Time Savings Times Salary" approach, the time saved by each new system is calculated and costed in terms of the salary and on-costs of the staff concerned. At its simplest, this takes no account of the way in which the saved time might be used. It also assumes that the value of a person's time is equal to its cost.

The hedonic wage model (Sassone & Schwartz, 1986) is more complicated but has the advantage that it takes into account the value of using time more effectively, such as cases where professional staff can be relieved of clerical tasks and spend more time on work requiring their specialised knowledge. Existing activities are divided into broad categories according to their value and the proportion of their time spent on each category of work by each level of staff is ascertained. Next, the average cost of each level of work is calculated. The resulting values are used to calculate the value of the work done by each category of staff. Profiles of work under the new system are defined: this requires the way in which freed time will be used to be specified. The changed value of the work of each category of staff can then be calculated. Any increase in the amount of work carried out is included, as this is equivalent to freed time.

These two approaches have been the subject of case studies in the NHS and are documented in its guide to investment appraisal (NHS Information Management Group, 1988b). Value restructuring (Parker et al., 1988) is similar to the hedonic wage model, but uses agreed values for each level of work rather than deriving values from actual salaries. A number of others approaches exist (Sassone & Schwartz, 1986).

Post-implementation evaluation can be carried out by repeating the measurements and calculations, then comparing the results with the predictions. The effort involved in this type of assessment should not be underestimated.

3.3. Outline of the study.

This section describes the process evaluation and other work involved in the action research study. The conduct of the procurement is outlined in Section 3.4.

The procurement lasted for nineteen months from approval of the project to the announcement of the final decision. As the research project had already been set up when Darlington heard that it had been selected as a HISS pilot site, it was possible for the work to begin at a very early stage. The main part of the study was an evaluation of the procurement process. The author was also involved in the project in a limited capacity by

providing background information about relevant areas and commenting on the methods to be used. Two interim reports discussed the advice on IT procurement produced by the NHS Information Management Group (1987a; 1988a), made comparisons between this and other methods of system selection, and discussed relevant decision making techniques. A short report on benefit realisation was also produced, giving background information and commenting on the proposals which had been received from consultancy firms. The procedures defined by the project team and others were discussed in a series of meetings between the author and the project manager: the intention of these discussions was to give to the project team the benefit of the researcher's perspective and experience as well as to inform the author of the progress of the project. Ad hoc discussions on matters of concern also took place on occasion.

The process evaluation derived its information from interviews and from documents used in the procurement. The documents included sample forms, reports, project schedules, instructions to participants and proposals for consultancy work. The author also attended various project meetings. The main contact within the authority, and the sponsor of the study, was the project manager, who was also the IS manager for the district.

The study was introduced to participants in the procurement by the project manager, at the project launch meeting. This gave it a high profile and public support at an early stage. There were two main series of interviews. The first took place after the shortlist was agreed, the second a few weeks after the decision was announced. A report was produced after each of the two stages of the study.

The first set of interviews were with selected participants. At this stage, the individual application areas were considered as groups of related areas, and a representative of each group was chosen. There were interviews with six user group convenors and a meeting with the project manager. The areas and staff groups represented were consultants, hospital management, laboratories, medical records, finance and paramedical staff. This selection was thought to be representative, except that none of the nursing participants was available for interview. It was not considered feasible to interview more participants at this stage, as the procurement was still in progress and participants were actively involved in preparing for the product demonstrations.

In preparing the second round of interviews, all the more active participants were identified. These included user group convenors, members of management groups, the senior managers who had been involved, and a few other user group members. This list contained about forty names, but the total number of participants was larger than this as many staff had attended the product demonstrations. Interviews were arranged with as

many of those who were available as could be seen in a two-week programme. Twenty-seven meetings took place. All application areas were represented as well as senior management and the IT staff.

The final meeting of the study was a discussion with members of the HISS Central Team. This meeting was requested as the team had played a central part in the procurement and it was considered important to the process evaluation that their views should be included.

The study was concerned with the procedures used and with project management issues such as communication and timescales. Confidence in the outcome was also of interest. It was considered important that Darlington should be able to learn from its experience as a pilot site, and this was soon reinforced by a perception that the purchase of a HISS was beyond current experience and that existing NHS procurement procedures would not be adequate.

In the second series of interviews, it rapidly became apparent that the benefit identification exercise which had taken place alongside the procurement was causing concern. This was raised by participants in the early interviews. Although the benefits study was not originally within the remit of the process evaluation, the interview plan was altered to include it as it was clearly affecting participants' perceptions of the project, which were being considered in this phase.

Each interview covered the stages of the procurement in which the person had been involved and more general areas such as communication, participation and the sense of ownership. The second series also asked for participants' opinions of the decision which had been made, and explored the factors which participants would regard as indicative of the success of the project once the system was operational.

The approach to interviewing in all three studies was the same. The interviews were based on a prepared plan. The sessions were not recorded, but notes were taken by hand and transcribed as soon as possible. After the first few visits, a portable microcomputer was used to speed this process. The interviews were scheduled to be an hour in length; this was adequate in most cases. Inevitably, there were some cancellations and rearrangements, and a few sessions had to be curtailed due to other pressures, but in general the study was given the priority it needed.

The reports from the study contained material which is considered commercially sensitive by the health authority. Material in this thesis therefore does not identify the suppliers or

allow the details of the assessments made to be associated with particular companies. All comments made by individuals are intended to be unattributable.

3.4. The procurement.

This section gives an overview of the events of the HISS procurement. The benefits study is described in Section 3.5 and the important procedural questions and other issues which arose are discussed in Section 3.6.

Capital and initial revenue costs at the pilot sites were to be fully funded by the Department of Health. A central organisation had been set up by the Department to support the project nationally. This was the HISS Central Team, based at Winchester. The NHS Computer Procurement Centre provided expertise in negotiation and contractual areas.

The stages of the procurement were based on those of the BITGAS procedure. However, the recommended timescales rapidly proved inadequate both for Darlington and for the suppliers, and were extended. The published guidance on the method was found to be insufficient, and clarification was sought from the Central Team. This became a process of defining procedures in conjunction with the Central Team and the other pilot sites. A project management structure was established, following the PROMPT methodology (L.B.M.S., 1987). The project team consisted of Darlington's own IT specialists, supplemented by additional technical personnel made available by Northern RHA; further staff were brought in from consultancy firms. User groups were set up, each with a convenor, and an IT specialist was assigned to each user group. The project manager was assisted by a support group which contained another technical specialist and a number of consultants and managers. The members of this group were, in their individual rôles, key participants in the project.

Production of the OR commenced immediately. The document was written by the IT specialists on the basis of the users' requirements. At this stage there was little knowledge of HISS systems within the hospital and most professional staff knew little about IT. Darlington had not yet produced an information strategy, and there was not time to carry out a full data analysis. The OR was completed after extensive revisions at the quality assurance stage. Much of the revision concerned the classification of requirements as mandatory or desirable, as both the approaches to mandatory requirements described in Section 3.2.1 had been taken by different analysts. The more

recent approach of defining an acceptable system by means of the mandatory requirements was adopted, and a consistent style was imposed.

The procedure for shortlisting was agreed between the pilot sites and the Central Team, with the aid of management consultants, and planned in detail locally. It was expected that a preliminary scan of the proposals would be carried out in order to reduce them to a reasonable number, but in the event this was not necessary as only six proposals were received. All mandatory requirements were checked by a team of IT staff; quality assurance was provided by a second team checking in parallel. The final stage was a detailed assessment of the application, technical and business aspects of the proposals, which used a simple scoring model. Technical aspects and the 26 application areas were weighted. Each application area was divided into subsidiary areas by the user group, on the basis of the functional decomposition contained in the OR, and these sub-areas were weighted. A score on a scale of 0-4 was required for each area, but user groups were free to decide how this was to be produced from their sub-criteria.

An initial attempt at assigning weights to the application areas by the Project Management Support Group did not produce a consensus, although it allowed some of the issues to be debated. A method which would allow agreement to be reached was provided by the consultancy firm. Paired comparisons were made between the 26 areas. This was done by consensus in two meetings which lasted $9^1/_2$ hours in total. A spreadsheet was used to record the comparisons and to derive a ranking. In order to produce weightings, a ratio was agreed between the weights of the most important and least important areas. The spreadsheet allowed the effects of various ratios to be explored: eventually a factor of 5:1 was agreed. Intermediate weights were produced by applying a scaling formula to the rank ordering. This procedure was found helpful, and produced a result which all were able to support.

The first phase of the procurement produced a shortlist of three suppliers. These were invited to spend a week demonstrating their products. The demonstrations were planned in detail by Darlington: scripts which the suppliers were expected to follow were prepared for each application area, though in the event, the demonstrations did not all conform to the scripts. Some scripts consisted of lists of facilities to be demonstrated, based on the OR. Others incorporated the facilities into a life-like scenario, following the progress of a patient through the hospital. In particular, the session which was devoted to the integration of the proposed facilities was planned in this way. The demonstrations were marked using a simple scoring scheme and an assessment report was produced for each area. These sessions were valuable: several interview participants had gained a much

clearer idea of the systems and how they related to the requirements from the demonstrations than from reading the proposals.

Visits to reference sites were carried out: these necessitated travel to Australia, Canada and the USA as none of the suppliers had the complete range of applications in use in UK hospitals. The intention was to see the systems in use and to speak with users. The visits were considered worthwhile, and were found useful for giving an understanding of the companies as well as for what they revealed about the systems. Participants returned with an awareness of the differences in culture between the hospital systems in which the proposed software had originated and the NHS. One company was asked to withdraw after the visits.

It had by now become apparent that considerable development would be required as neither of the remaining proposals met Darlington's requirements in every area. This led to the need for an additional stage to be added to the procurement. In order to give confidence in their development capabilities, the suppliers were asked to develop functional specifications for representative application areas. This took place in parallel with the technical discussions but nevertheless caused the project schedule to be delayed. Three application areas in which the proposals were weak were selected for each supplier.

The purpose of the exercise was not to produce the specification, but to test the supplier's ability to deliver a solution and to ensure that Darlington felt confident about working with the company. This was felt to be a new problem and outside the scope of standard procurement procedures. The project did not stipulate a method for producing the specifications, and different approaches were used. The product in each area was a high-level design which showed how the system would achieve the requirements: detailed design work would be necessary for the specification to be implemented. In some cases prototype systems were also produced. Quality assurance was carried out in formal walkthroughs before the specifications were agreed. The specifications were also tested against a scoring scheme; this was similar to the scoring of the software demonstrations.

A memorandum of specification (MOS) was agreed with each supplier and the two companies were invited to tender. A financial model was produced, using a spreadsheet, for analysis of the tendered and attributable costs throughout the life of the project.

The method of making the final decision was the subject of considerable debate between Darlington and the Central Team. The recommendation given was that the decision should be made on the basis of lifetime costs: unquantifiable factors should be taken into account only if their value to the Authority was more significant than the difference in the

Net Present Value (NPV) of the proposals. It was considered possible that this might apply in the event of a difference of up to 3%, though a firm boundary was not set. Darlington, however, proposed that unquantifiable factors should be considered in the case of a much larger difference in cost, e.g. up to 10%. These approaches are discussed further in Section 3.6.1.

An assessment of qualitative factors was carried out by a small group of mainly technical staff on the basis of the user groups' assessments. This was to be used if the lifetime costs were sufficiently close. The areas covered included possible risks, the supplier's organisation, the available support, the development environment, commitment to OSI and the approach to project management. However, when it became clear that Darlington was unlikely to be able to use the assessment, in order to be able to include at least some of these factors in the final decision, those which were identified as risks became the subject of a risk analysis. The results of this were included in the financial evaluation. The risks which were taken into account included machine capacity; any inadequacies in the quality, customisation or integration of software; and possible delays to the implementation. It was suspected that the capacity of the hardware proposed by one of the suppliers was inadequate. The team's original intention was to assign a high probability to this risk and to value it at the cost of upgrading, but eventually the company was requested, after the MOS had been agreed, to quote for a larger configuration. These discussions delayed the issue of invitations to tender.

In the event, the final decision was made entirely on the basis of the financial model. As there was a substantial difference in cost, there was no question of taking the qualitative factors into account. The announcement of the decision was delayed by discussions between Darlington and the Department of Health about funding for the long-term revenue cost of the system. The delay, which took place at a stage when only a small number of people knew the results of the procurement, led to suspicions that there was insufficient money to fund the full project and that its scope would be reduced, and to a loss of confidence.

3.5. The benefits study.

The benefits study was not strictly part of the procurement process, as it did not affect the choice of system, but it was relevant to the funding of the project and to the attitudes of those involved. It is given attention at this point as it illustrates problems in the application of the approach and also shows possible sources of conflict.

An exercise to investigate the potential benefits from the HISS system was carried out by management consultants during the early part of the procurement. It predicted a large negative Net Present Value (NPV) over a 7 year period. An initial estimate of the level of cash-releasing benefits was subsequently reduced, but there does not appear to have been a great degree of confidence in the final figure. The project team did not give its approval to the report which was sent to the Treasury as a result of this work, as it had a number of reservations about the methods used.

In order to make these estimates, staff in the clinical areas were asked to complete timesheets on which they recorded their activities. These were consolidated by their managers and passed to the consultants for analysis. The results were discussed with the manager of each department and an estimate of the level of realisable benefits was produced. The methods used involved detailed calculations of the time which would be saved on individual tasks, using a "time savings times salary" approach, and more general assumptions about, for example, reductions in length of stay. The assumptions on which these calculations were made were based on experience in the USA.

It was decided to refine this work and to make plans for incorporating benefits realisation into the implementation. The purpose was to ensure that all possible benefits could be achieved rather than to cost-justify the system. By this time, the likely costs were known and the need to ensure funding of the revenue cost had become important. Darlington was interested in the project because of its clinical benefits, but now felt under pressure to explain why the expected benefits were largely not cash-releasing.

A group was set up to study the benefits exercise and detailed discussions were held in the ten user areas where the largest benefits were expected. The initial estimates of time savings were revised to the point where only those savings which were realistic and could be made cash-releasing (i.e. staff could actually be reduced) were still included. There was some disagreement with the results of this process in the user departments.

It was clear from the interviews that there was little confidence in the benefits study and that ill-feeling and suspicion had been caused. Most interviewees had reservations about

the methods used and a number of concerns and queries were raised. Some of these were genuine problems with the method or its application, others suggested a lack of information about the methods used. Senior managers suspected that an expectation of large cost savings was the reason for the whole HISS programme.

Interviewees felt that their ways of working were not understood and that the timesheets were not able to capture the complex working patterns of hospital staff. Considerable concern was expressed that nursing time which appeared to be freed by the system would not in fact be available for re-allocation. Attempts had been made to translate the small amounts of time saved by a large number of people, such as the reduced time spent on telephone calls by nurses, into a staff saving in terms of whole time equivalent. These were considered invalid. Some time savings are reductions in activities which take a nurse away from what he or she is meant to be doing, so that the full time or attention can be given to the task in hand. This leads to an improvement in the quality of care rather than to freed time. These cases will not be appreciated without a good understanding of the way in which *hospital staff work, as opposed to a knowledge of what work is done.*

The initial estimates of savings used assumptions which were based on experience in the USA. However, there are differences in culture and especially in staffing patterns which cast doubt on the validity of these figures. U.S. hospitals are generally less fully occupied and have clerical staff based on the wards who are available for data entry. The site visits raised awareness of these differences.

The timesheets were completed retrospectively, at the end of the day, and managers had little confidence in their accuracy. The guidance given on completion of the timesheets was considered poor and staff had difficulty in completing them. There was no quality control. Tasks were divided into categories, but the allocation of the work done to these categories may not have been done consistently. Staff did not agree with the classification of some activities. There was some suspicion that double-counting may have taken place and that the effects of staff reductions on other figures may not have been taken into account. The length of a patient's stay in hospital can be reduced by these systems, for example by reducing the time taken for test results to become available. Benefits from shortened length of stay were valued using an average daily cost, whereas the days which are released are those when the patient requires the least nursing care.

Managers questioned whether the time required for system use had been taken into account when calculating benefits, and whether non-staff benefits, such as reduced stock levels, had been included. The project team was concerned about the use of the test discount rate (newly raised to 6%) in NPV calculations. NPV calculations are very

sensitive to the choice of discount rate, but the use of the test discount rate is standard practice in public sector appraisals, and the rate is set by the Treasury.

User representatives were told very little about the purpose of the studies. The general impression at the time it took place seems to have been that the initial exercise was intended to identify the clinical and practical benefits to their departments, especially the amount of time which would be freed for other work. This was reasonable as an investment appraisal is (or should be) concerned with the value of benefits of all types, although one of the points on which Darlington disagreed with the results was that those benefits which were not quantifiable were not included in the final report. When the second phase began, user representatives were informed that it was intended to clarify the assumptions on which the figures were based and to confirm the viability of the project. The emphasis was intended to be on identifying those benefits which could be made cash-releasing, i.e. the potential for reductions in staff, rather than, for example, time which could be used in improving the quality of service. This is a narrower focus than that of the initial investment appraisal. This change in emphasis seems not to have been appreciated in all departments. User representatives saw this process as a substantial revision of the figures, rather than the identification of a specific part, and it does appear that some of the estimates of time saved were reduced.

Some interviewees saw both phases of the study as a single process and felt that they had not known the real purpose of the investment appraisal when the timesheets were completed. The apparent lack of understanding of the work of a hospital seems to have led to a loss of confidence in the results amongst managers, though the worst of the problems were resolved. One manager related that assent was not given to the final figures for the department, although the management consultants treated them as agreed.

In some areas, the possibility of staff reductions was not realised until the second part of the study, when the interest in cash-releasing benefits became apparent. As, in most cases, uses for any freed time could easily be found, this was not perceived as a benefit. Some shock and ill-feeling resulted.

Neither the procedures nor the purpose of the exercise appear to have been satisfactorily explained to departmental managers. There appeared to be no common definition of realisable benefits and no appreciation of the value of those benefits which will be realised in the form of improved quality or work which would not otherwise have been done rather than reduced expenditure. These also need to be included in a benefits realisation programme as they have a value and their achievement requires management action, but the need to fund the revenue cost of the system could have contributed to their neglect.

Benefits realisation is a complex subject and is new to most NHS hospitals. Experience of the actual savings gained during the initial HISS implementations and at other sites which have experimented with these techniques will remove the need to base assumptions on the experience of foreign hospitals.

3.6. Issues from the procurement.

3.6.1. Procedural issues.

This section discusses the main procedural issues which arose from the procurement, and 3.6.2 is concerned with project management issues. Section 3.6.3 examines the fitness for purpose of the procurement procedure, and the influences which shaped the project are discussed in 3.6.4.

The main procedural issues were:
- The classification of requirements as mandatory or desirable, and its relationship to the later stages of the procurement.
- The basis on which the final decision was to be made.
- The use of the specification exercise to assess development capability.

Section 3.2 noted that the original NHS procurement recommendations, the BITGAS procedure (NHS Information Management Group, 1987a), suggested that there should be few mandatory requirements and that they should deal with general aspects of the proposals. Another approach was the specification of a set of mandatory requirements which defined a minimum acceptable system. Both the approaches have dangers. In the first case, proposals may be received which are far from the required system, and a greater effort may be required to eliminate these. With the second approach, it may be necessary to amend the requirement in order to allow the procurement to continue, and there is a risk that higher development costs will be incurred, with the associated risks, if requirements cannot be waived. Stipulating that the required facilities are mandatory will eliminate suppliers who are unwilling to tailor or extend their packaged software. The effects of not having the specific facility should be considered when deciding whether a requirement is mandatory, as it is possible that an otherwise suitable proposal may be rejected because a single mandatory requirement is not fulfilled.

The relationship between the two policies and the later stages of the procurement is also of interest. The policy of specifying few mandatory requirements is associated in

BITGAS with a relatively subjective assessment of the cost of the proposals against their merits, though the usual decision rule, that the proposal with the lowest lifetime cost will be accepted unless other factors strongly suggest another choice, is not actually specified in the procedure. The other approach is associated in the universities' procedure, which was outlined in Section 3.2.1, with the assumption that there will be little to choose between the proposals: the assessment is primarily financial (Central Computer and Telecommunications Agency, 1989). It should be noted that all three procedures require proposals which are not acceptable to have been eliminated by this stage.

The basis on which the tender decision was to be made became the subject of a serious difference of opinion between Darlington and the Central Team, and it is not clear that either viewpoint was fully appreciated by the other party. The approach proposed by the Central Team was that the proposal with the lower lifetime cost would be accepted, unless the costs were so similar that uncertainty in the assessments or the value of unquantifiable factors could be greater than the difference in cost. No rigid limit was defined for the region of uncertainty, but it was suggested that it might apply if the costs fell within 3% of each other. This was interpreted at Darlington as "Unquantifiable factors can only be considered if the costs are within 3% of each other", and this limit was perceived as too narrow. Understood in this way, the method expresses as many of the decision criteria as possible in terms of one, the financial criterion. Factors which cannot be expressed in this way are effectively given a lower weighting, even though no assessment of their importance has been made. This could be seen as arbitrary.

The project team was concerned that some of the unquantifiable factors were in fact quite important, and began to argue, unsuccessfully, for a wider limit of perhaps 10%, but in fact an approach based on a price-performance ratio would have been preferred. Subsequent events, including the use of risk analysis in order to include some of the factors in the model, have been described in Section 3.4. The approach used requires a clear definition of what constitutes an acceptable system and is therefore facilitated by the "minimum system" approach to mandatory requirements. This defines an acceptable system in advance, rather than making a decision about each proposal during the technical discussion phase, and thus sets a boundary for the area of uncertainty.

There seem to be a number of underlying questions here. Much of the discussion revolved around definitions of value for money. The suggested procedure seemed to imply an assumption that the acceptable system at the lowest cost would provide the best value. Darlington's contention was that additional facilities or differences in

unquantifiable factors above the minimum acceptable level might be worth greater expenditure. This proposition was quite unacceptable to the Central Team.

It can be argued that if the factors which are of concern to the organisation are included in the model, then the model will produce the required result more accurately than if a subjective decision had been made. This is reasonable if all the relevant factors can be included. Darlington's extension of the model to include a risk analysis was a step in this direction. However, some aspects of the proposals were still not quantified in financial terms. Desirable requirements were not explicitly assessed: these are presumably desirable on account of some benefit or reduced risk. A completely satisfactory application of this approach would require all risks and benefits of each proposal to be calculated separately. The area of uncertainty can be reduced by including as much as possible in the financial model, but it can never be eliminated and the subjective elements in the individual valuations which make up the model should not be overlooked.

Another aspect of this issue concerns the degree of control which the alternative procedures leave to the participants. The procedure used incorporated a number of subjective judgements into the financial model, but did not leave a final subjective decision to be made. This has a possible psychological disadvantage in that the organisation has not made a conscious choice between systems: the choice is reduced to the more limited question of whether the difference in unquantifiable factors and the possible uncertainty is greater than the difference in cost. If not, the result produced by the model is accepted. This reduces the possibility of unconscious or intentional bias. However, a decision of this type could have an adverse effect on confidence and ownership if it were interpreted by the user community as "buying the cheapest", and considerable confidence in the model is needed if autonomy is to be surrendered. In Darlington's case, this confidence did not exist, as it was considered that unquantifiable factors were not given sufficient importance. The method of making the final decision was not publicised, though this was not a matter of policy, and many interview participants who had not been closely involved in the final stages assumed that the selected system had been chosen because it was in some way better than its rival.

The requirement in some application areas had innovative features, which no supplier would be able to offer, and when proposals were received it became clear that the necessary development would be more extensive than had been expected: any of the shortlisted proposals would require substantial development work in a number of areas. This led to the need to assess the ability of the suppliers to develop these applications, which was addressed by the functional specification exercise. The usual approach to this

question is to consult reference sites for whom the suppliers have carried out similar work. In this case there were no suitable NHS sites for one company, and only sites with limited experience of further development for the other. This exercise required significant effort from both the suppliers and the authority. A reasonable level of confidence was gained, especially in the successful company. Unsatisfactory results would have been difficult to interpret and deal with, especially as the elimination of either supplier would have led to a single tender situation. As these systems become more common, it is to be expected that the need for significant development will be reduced and that there will be a greater availability of suitable reference sites.

3.6.2. Conduct of the project.

In a large project such as this, good project management is essential. Darlington's first experience with the PROMPT project management method was considered a success and participants appreciated the attempts to provide structure for both the project as a whole and the individual activities. However, there were a few areas of difficulty in the conduct of the project.

The introduction of a HISS is a significant organisational change; it cannot be treated as if it were purely a matter of hardware and software. A weakness of the project was the failure to consider organisational and personnel issues at an early enough stage. In particular, no decision had been reached about which staff would enter data and how this would be done, even when the contract was awarded. This was a significant lapse, as there could have been implications for the cost of ownership, the level of benefits or even the system requirements. Personnel matters such as the expectation of rewards for using IT skills could also affect the cost of the system. Lack of time to consider the implications of the system seems to have been partly responsible.

The pressure on participants was a cause for concern. People were willing to rise to the occasion, but there was a sense that the limits were being reached. The existence of a high priority project such as HISS does not reduce the amount of clinical work which needs to be done, or the effort involved in running a department, and there may be a clash of priorities between the project and participants' other work. A few participants felt that there was a lack of sensitivity to their other responsibilities. It may not be possible for hospital staff to give as much attention to the project as they, or the project team, would like. The involvement of clinicians and other users is essential for the specification and assessment of such specialist applications, and also helps to build commitment. However, it needs to be facilitated as well as encouraged. Freeing people may require resources.

Opinions on the timescales varied. Some felt that the deadlines were reasonable and necessary to ensure that tasks were completed within a reasonable time. Others found that an unacceptable amount of pressure and diversion from their normal activities was involved. The consultants who were interviewed noted that their schedule is already full and there is a limit to how much can be done without a reduction in the amount of clinical work undertaken. It can be concluded that the effort required of participants in the project was approaching the limit of what can reasonably be expected.

Managers noted that the HISS project appeared to have become the highest priority activity throughout the hospital, and felt that other work suffered as a result. This has occurred when other initiatives have taken place, and managers seem to expect it, though with various degrees of acceptance. Clinical work had been given high priority, but routine or non-urgent managerial tasks had suffered. Some managers from clinical departments felt that the project team did not appreciate the demands of their normal work. Meetings called at very short notice had been a problem in some cases. Late nights and increased workloads were frequently mentioned in the interviews, but people had been willing to make the necessary additional effort, despite some personal cost. The finance department was involved in a number of initiatives at the same time as the procurement and found its resources over-stretched as a result.

Throughout the project, work in the user departments tended to occur in high-pressure bursts interspersed with quiet periods. Considerable effort was required from participants in the early part of the procurement, until the end of the supplier demonstrations. The demonstration weeks themselves were considered hard work by most participants. After that point, however, many user representatives had no further involvement in the project. Only a few managers and clinicians were involved in the site visits and the development of functional specifications, and the subsequent work was done by the project team. The end of their personal involvement was accompanied by the ending of communication about the progress of the project, and managers found that commitment and the sense of ownership were hard to maintain. Continued regular information about the progress of the project would have been welcomed as an aid to maintaining interest and commitment amongst staff. Lack of communication at this stage also seems to have made these departments (or their representatives) feel under-valued. In departments where functional specifications were developed, interest was maintained, but there was still a perception that communication had ceased once the specification was complete and that the sense of ownership could be lost before implementation.

Communication during the project did not have a planned structure, but took place as required. It tended to concentrate on the next task to be done rather than giving information on the progress of the project, though three more general meetings for all convenors and consultants were held at the start of the project and at the end of the two major stages. Brief updates on the project were given at some of the hospital's regular monthly management meetings. Opinions about the level of communication ranged from satisfaction to "Authoritarian, top-down and on a need-to-know basis."

Communication within the departments was the responsibility of convenors and seems to have produced variable results, depending on the action taken by the managers concerned and the interest shown by the staff. Little informal communication between user representatives and the project team took place: that which did occur seems to have been initiated largely by the users. Better communication at all levels would have been helpful.

A circular was issued to departments when the tender was awarded. Despite this, two convenors mentioned that the press knew of the decision before hospital staff; one of these had read of it in a local newspaper before the circular was received. The basis on which the decision was made was not generally known in the hospital even after the result of the procurement was announced, though it was clear from the computer press that cost was the major factor (Computing, 1990b).

Within departments, user group convenors were responsible for drawing in other staff. The number of people in the various application areas varied considerably: in some smaller staff groups it was possible to involve anybody who was interested, whereas in others representatives were chosen. In some areas the opinions of all levels of staff were sought; in others, involvement was confined to higher grades. A participant who supervised a number of clerical staff said that they felt that their opinions were not considered important, although they would be the actual users of the system in that department: for example, the demonstrations appeared to have been aimed at clinicians and managers.

There was a need to motivate people and to develop a sense of ownership in preparation for the implementation. This involves communication and consultation to ensure that people at all levels feel that their views have been considered. Darlington was aware of these needs though not completely successful at meeting them. The participative structure of the project was helpful, but communication could have been better: people will feel used and undervalued if they are only told what is happening when something is required

of them, and it was clear at the end of the procurement that more work would be needed with those who had not yet been involved.

Concern was expressed that the delay before implementation would lead to a loss of the sense of ownership which had been developed during the procurement. In some departments it was felt that this had already happened. Some participants also felt that, as this was to be a hospital-wide system, effort was needed to build a common vision between departments, but they had been told little about the work done in other areas.

Those consultants who were interviewed suggested that any consultant who wished to be involved and had the time to do so could have participated in the project, but time factors and clinical commitments were a severe limitation on their involvement. Clinical work was not allowed to suffer. There was probably as much involvement as could have been arranged. Nevertheless, more would have been better. Colleagues who were not involved in the project would know little about it and many would not want the system. A consultant from one department felt that non-medical staff had dominated the user group and that it had not been possible for consultants to contribute their requirements.

The project affected sensitive areas, such as staffing levels and people's image of themselves as professionals. Some managers said that their staff were apprehensive at the prospect of change. These included professional groups who feared that the use of terminals would affect their status or slow down their work. In other areas, feelings were mixed. However, in many staff groups, some or all were very positive about the system and saw it as beneficial. A few groups were concerned about the possibility of staff reductions. People who had been involved in the project were generally enthusiastic, but in some areas, those who had not been involved were thought to know little about it.

It was a requirement for the procurement procedure that it should give confidence in the chosen system. The interviews revealed that the preferences of user representatives between the two systems were evenly divided. Most participants whose preferred system had not been chosen were quite prepared to accept that the system which was best for their department might not be best for the hospital as a whole, though most also assumed that "the best" system had been chosen.

3.6.3. Requirements for the procurement process.

Part of the rôle of Darlington as a pilot site was to investigate the fitness for purpose of the methods chosen, and this was one of the main reasons for the current study. A number of requirements for the procurement process were identified from the procurement literature and in discussions within the current project.

- It must conform to the regulations governing public sector procurement.
- It must allow the authority's needs to be reflected in the specified requirements.
- It must ensure that the selected proposal is suitable and that unsuitable proposals can be eliminated.
- It must give value for money.
- It must lead to a decision which is defensible and demonstrably fair.
- It must encourage the submission of suitable proposals, in order to provide a good choice and to encourage competitive tenders.
- It must allow packaged software to be assessed.
- It must allow assessment of the capability and willingness of the supplier to develop applications to the authority's specifications.
- It must allow for the assessment of a range of factors relating to the proposals, including technical aspects, reliability of the supplier and other unquantifiable factors.
- It must give confidence in the system which is chosen.
- It will ideally allow a sense of ownership to be developed throughout the organisation.
- It must be possible to carry out the procedures within the limits of the available resources, including time, money and skills.
- It must ensure that the project remains under the control of the authority.

The regulations which are applicable in this case are those designed to promote fair competition within the European Community. The procurement was the subject of an advertisement in the Official Journal, as required.

The necessity for the specified requirements to reflect the authority's needs affects not only the conduct of the actual procurement, but also the activity which supports the specification process. In this case there was little analysis before the OR was written, and important organisational issues were not considered until a late stage. This deficiency was largely caused by the haste in which the project was initiated. It is suggested that there is a need for procurement to be seen as part of a complete implementation process, and that support from an IS methodology would allow it to be integrated with the required planning and analysis. It is necessary that those who define requirements should have knowledge not only of the application area but also of the possibilities given by the use of

IT. There was very little knowledge of IT or information systems in some areas, and though an effort was made to allow management to learn about HISS systems at an early stage, some of the user groups felt unprepared to specify their requirements.

Elimination of unsuitable proposals was possible at the shortlisting stage, when three proposals were rejected. The use of a set of mandatory requirements which defines completely a minimum acceptable system ensures that any proposal meets an agreed standard of functionality. Another company was excluded after the site visits. However, this left only two suppliers. Had either of these proved unsatisfactory, their exclusion would have caused difficulties. This situation was most likely to have arisen after the functional specification exercise. An unacceptable performance by either supplier would have given the authority a choice between allowing a single tender, which would have been likely to result in a higher price, or running the risk of having to select a company which was not thought capable of developing the required systems. Good risk analysis would be critical in this situation. There is a conflict here between the suppliers' need not to waste money on unsuccessful bids and the authority's need to have at least two suitable proposals at the tender stage in order to promote competition. It must be possible to eliminate those which are unsuitable, even at a late stage, but it is preferable that proposals which pass the shortlisting stage should be satisfactory solutions.

The definition of value for money was the subject of considerable debate between Darlington and the Central Team. In this case it was clear once tenders were received that one supplier offered considerably better value than the other, as there was little to choose between the proposals and the costs were significantly different. If the price had been very close, or the proposals substantially different in qualitative factors or desirable requirements, there would have been a need for wider ownership of the assessments of these areas if they were to have been used in the decision. The procedure does not rule out their use, but there is a need for methods of incorporating the differences between proposals into the decision model if this approach is to be used to the best advantage.

The requirement for a defensible and demonstrably fair decision was satisfied. The use of a comprehensive financial model makes the facts on which the decision was based explicit. The assessment of unquantifiable factors and the valuation of risks are more difficult areas, in which it is necessary that the facts supporting each assessment should be carefully documented, and wide agreement on the evaluation is advisable. In this case, a risk analysis was included in the financial model and an assessment of qualitative factors was made but not used. The only point at which even-handed treatment of the suppliers might have been called into question was during the demonstrations and the

preparation for these, when one supplier had the demonstration scripts for a shorter time than the others. This was the result of shortage of time to prepare the scripts, rather than the consequence of the methods used, and could be avoided in future procurements.

The shortage of suitable proposals threatened the success of the project. A number of factors contributed to this. Few suitable systems are available in this country. However, another pilot site received proposals which required much less development in response to a similar OR. These procurements require a high degree of effort from suppliers: it is difficult to support more than one and failed bids are costly. Darlington's location may also have been a factor.

The assessment of software took considerable effort at various stages: shortlisting and validation of mandatory requirements, demonstrations, discussions with suppliers, and to some extent during the site visits. Much of this effort went into assessing the functionality of individual modules and ensuring that the basic requirements were met. The assessment of application areas was satisfactory given the practicalities of the situation. There was little opportunity for user groups to consider quality or the user interface. Most of the work was done by groups working in individual application areas. As integration was handled by a separate group, those working in specific areas had little feeling for the system as a whole. These were large applications. Demonstrations could only give a limited view of the systems and several user groups were left without a clear picture of how the system would work in practice. Nevertheless, the demonstrations were thought to give a better understanding of the systems than had been gained by reading the proposals. In some cases, the need for development meant that applications could not be fully demonstrated.

Assessment of the development capabilities of the suppliers proved more important than was originally expected. Darlington added an extra phase to the procurement in order to aid this and to build confidence. This exercise required significant effort from both the suppliers and the authority. A reasonable level of confidence was gained, especially in the successful company. Unsatisfactory results would have been difficult to interpret and deal with. In an ideal situation, this amount of development would not be necessary, and the suppliers involved would be better known to the NHS.

The assessment of a range of factors was possible within the structure of the project. Assessment of technical aspects of the proposals does not seem to have been a problem, with the exception of sizing. A more detailed study was thought necessary here. The site visits were helpful in giving a good picture of the companies themselves: this aspect of the visits was carefully planned, and was found very valuable. Attempts were made to

test the strength of the relationship between companies which had made a joint proposal, though this was difficult to assess.

The Authority should be able to have confidence in the selected system. The major risks have been assessed or controlled. There seems to be a good degree of trust in the decision process amongst participants, though in some cases this was based on a misconception of how the final decision was made.

A relatively good sense of ownership was generated amongst those who took part in the procurement through the participative structure of the project, though there was some concern that it might subsequently be lost. Better communication at all levels would have been helpful and there was a need to motivate staff who were not involved in the procurement.

The project required a high level of resources and would have been beyond the capacity of Darlington's own IT service without outside assistance. Other small districts would be in a similar position. Considerable manpower was required and there were a number of areas where specialist expertise was needed. However, it was possible to draw on Regional staff, IT consultants and members of central organisations. This gave access to expertise in such areas as communications, capacity planning and contractual issues. Darlington's knowledge of hospital systems, procurement procedures and project management has been considerably increased as a result of this project. Prior knowledge of HISS systems and the latest techniques for procurement and benefits realisation could not have been expected. The project depended on the involvement of many participants from within the hospital. These people were under considerable stress at times. Some external funding was available for the conduct of the project. The level of resources which suppliers need to devote to a bid is also important, both for securing their participation and for ensuring cooperation in the assessment procedures. This area is currently the subject of discussion between the NHS and the suppliers and it is expected that simplified procedures will be agreed.

A struggle for control occurred during the demonstrations when the suppliers were reluctant to conform to the scripts. As the approach was helpful in ensuring that all relevant areas were examined, future sites would do well to stress that scripts should be followed, to ensure that suppliers have them well in advance of the demonstrations, and to maintain control over the demonstration sessions.

3.6.4. Influences on the procurement.

This section discusses the factors which determined the requirements for the procurement procedure and affected the way in which it was carried out. The main areas are:

- Known objectives and requirements of the procurement process.
- The size of the project.
- The level of knowledge about HISS and about procurement.
- Factors affecting suppliers.
- The continuous definition of methods during the project.
- The need to involve consultants, and factors which affected this involvement.
- The national scope of the HISS programme, and the influence of other NHS bodies.
- Availability of staff and other resources.
- Priorities.
- Timescales.
- The opinions and attitudes of participants in the project.
- The quality of the proposals.
- The broader NHS environment and the effect of recent changes in the service on attitudes.

Any public procurement procedure is obliged to follow the regulations which govern public purchasing (see Section 3.2.3). The procurement was the subject of an advertisement in the Official Journal, as required. In addition, there is a need to avoid any appearance of bias, as the result may be legal action by unsuccessful suppliers. It will be easier to demonstrate the reasons for the decision which has been made if the subjective element is limited and there is a clear difference in value for money. Other dangers which must be avoided are influence on the procedure by suppliers, resulting in loss of control by the authority, the normal project management concerns of mushrooming work and timescales and the inability to carry out a meaningful assessment because of insufficient or inappropriate information. A strong project management structure was put in place.

The demonstration scripts were introduced in order to maintain control over the product demonstrations and to allow the proposals to be marked. However, the suppliers were reluctant to conform. This was the only point at which there was a serious attempt by suppliers not to conform with Darlington's requested procedure, though there were occasions during the site visits when negotiation was necessary to ensure that Darlington's agenda was fulfilled, and some of the reference sites were less comparable with the hospital at Darlington than other establishments in the vicinity.

The system was large, affecting most departments of the hospital, and was to be highly integrated. This suggested that there was a need to consider the system as a whole, as concentration on individual areas would overlook essential requirements. As integration was handled by a separate user group, and there was little communication between groups, those working in specific areas had little grasp of the system as a whole. The assessment of application areas was satisfactory given the pressure under which it was done and the size of the system, but it concentrated on the functional requirements: there was little opportunity for user groups to consider quality or the user interface. System-wide features such as the user interface were also the province of a separate group. The size of the applications and the need for development left several user groups after the demonstrations without a clear picture of how the system would work in practice.

The project needed to allow staff to be represented as changes in working patterns and the possible impact on staffing levels could have caused concern, and it was important to develop a sense of ownership in the many staff groups which would be affected and among all levels of staff. These factors, with the need for professional knowledge and the size of the undertaking, led to a participative project structure, in which the groups of users in each area were assisted by an IT specialist. Participants ranged from consultants and senior managers to clerical officers and secretaries. However, there was some feeling amongst the staff on lower grades that their views were not given enough weight.

Darlington as a pilot site had to climb a steep learning curve: there was little appreciation of the scope and potential of a HISS when the project was launched, as these systems are new to Britain. At a very early stage in the project a small number of senior managers joined a visit to the United States which had been arranged by another pilot site, in order to gain a better understanding of the type of system. The newness of the application areas contributed to the need for development, as all the shortlisted systems had originated abroad and only one had a significant part of the proposed software installed in sites in this country. HISS in the USA have developed from the need to record all activities for the purpose of billing and thus have a different focus from a British HISS (Gronlund, 1991). Although American companies were offering software in these application areas, parts of Darlington's requirement were thought to extend beyond any available software. The lack of knowledge of similar systems, or in some departments the lack of any knowledge of IS or IT, was thought by some interviewees to have affected their definition of their requirements.

The authority had not previously undertaken an IS procurement on this scale, though some staff had been involved in smaller purchases of systems or equipment. Comments

about the sales techniques used and the differences between their expectations of the demonstrations and the reality showed this lack of experience. In the early stages of the project, there was uncertainty about the procedure, the products, and, in some cases, the requirements. Interviewees suggested that their lack of knowledge of the products had affected their view of the procedures which would be needed, as they expected that the demonstrations would show applications which were largely complete and did not expect to have to assess the suppliers' development methods.

The need for extensive development and the resultant need for the specification exercise has already been noted. The first pilot site to award its contract had much less need for software development, as the proposals received there were a closer match to the requirements. This was a larger hospital than Darlington, and situated in London. Darlington's location may have made it a less popular target for suppliers. Suppliers have found procurements of this type costly and are unwilling to compete for all the available contracts (Computing, 1990a); considerable time and money can be invested in an unsuccessful bid. This has led to a process of consultation between the NHS and supplier groups, which is intended to produce revised procurement recommendations.

Darlington attempted to ensure that the methods used were rigorously defined and that the necessary guidance was available to participants. This involved considerable work, and the shortage of time was not helpful. The project team appeared increasingly conscious as the project progressed that they were defining their methods as they needed them, rather than following an established procedure. Later HISS sites will have the benefit of the experience of the pilot sites and of the guidance which has been prepared. It is important to the fostering of ownership and enthusiasm that people should understand what is being done; the benefits study was not well handled from this point of view.

Darlington was originally expecting to follow the BITGAS procedure, as this was the current recommendation. Definition of the OR began with the aid of the "Guide to the Preparation of an Operational Requirement" (NHS Information Management Group, 1988a). However, this was soon found to be insufficiently detailed. Requests for clarification led to the definition of procedures by the Central Team, sometimes in consultation with all the pilot sites. Signs of a change in direction were apparent when the OR was subjected to quality assurance. It appeared that some parts had been written in accordance with the BITGAS suggestion that there should be few mandatory requirements, while others had many more. During the quality assurance phase, which was carried out under the direction of the Central Team, large sections of the OR were re-written in accordance with the newer approach, so that the mandatory requirements would

define a complete system. This was done in a timescale which allowed little consultation with the users.

The need to define the procedures as the procurement progressed resulted in some difficulty in the demonstrations, as the approach to these was not defined in time for scripts to be completed in advance. The first supplier thus had very little notice of the final content of the scripts, although draft versions were made available. Detailed guidance was later prepared for the conduct of the site visits. Awareness of a need to confirm the ability of the suppliers to develop applications to Darlington's requirements caused a new activity to be added to the investigations. This was the preparation of the functional specifications, and there was a clear belief here that the situation was one which existing procedures did not cover.

Consultants are a powerful and important group within a hospital. Their acceptance of the project was vital, and as it involved clinical application areas, their requirements and knowledge were also needed. Their involvement was seen as essential to the success of the project, but could not be enforced. A few consultants were closely involved in the procurement, as convenors, support group members and members of user groups. The approach taken to seeking their involvement was that those who were closely involved would communicate with their colleagues and draw in those who wished to take part. Most of the consultants interviewed felt that those who wished to take part could have done so, though clinical commitments had proved a restraining factor and some of their colleagues had not participated due to lack of interest.

The context of the HISS procurement was that of a national initiative, and the capital cost and part of the revenue cost was to be met by the Department of Health. Darlington was therefore not in complete control of its project: external forces were important in determining timescales, funding, and to some extent the scope of the system. Some decisions about methods were taken in conjunction with the other sites. For example, workshops involving Greenwich and the Central Team were held to discuss the shortlisting procedure. The Central Team controlled the funding for the conduct of the procurement and also provided various specific resources such as expertise in sizing and benefits realisation. The project team at Darlington would have appreciated greater clarification in advance of what these resources would be. Although the Central Team was not managing the project at Darlington, it was able to exert a significant degree of control and could determine the methods used in the procurement.

A meeting was held with two members of the Central Team as part of this study. Some differences between Central Team and Darlington in their perceptions of the procurement

process became apparent during this discussion. Disputes between the project team and the Central Team did not aid co-operation and clearer definition of rôles would have been useful. There appeared at times to be a struggle for control of the project between the Darlington project team and the Central Team. It was clear from the interviews and discussions throughout the project that the relationship between the two teams was not ideal, and in time a degree of hostility became apparent, though individual members of the Central Team were highly regarded at Darlington. Darlington liaised with the other two sites on matters of policy where it was considered desirable to present a common opinion. Mutual regard was not high: the use of staff from consultancy firms to supplement the permanent staff gave the appearance that the personnel from Central Team lacked continuity and some appeared to hospital staff to have little understanding of hospitals or HISS. The Central Team had very little confidence in Darlington's project, and at one stage thought it would not be viable because of the poor fit between the requirements and the proposals received.

Timescales were short throughout the project and this caused considerable pressure on participants. More notice of the start of the project would have been preferable and would also have allowed better analysis of requirements. A completion date for the procurement was set by the Department of Health: this was always considered unrealistic at Darlington, and political motivation was suspected, though the first schedule for the project was said by the Central Team to be derived from the timescales given in BITGAS. There was some slippage: the tender was placed six months later than originally planned. Part of the delay was at the request of the suppliers, who needed more time to produce their proposals and tenders. Part occurred because of the need for additional activities: the production of functional specifications and the negotiations about funding.

The project had to work within the available time and other resources. Darlington was fortunate in that external funding and specialist personnel were available, but a heavy commitment was also needed from user staff. As existing high priority activities, especially in clinical work, must be respected, interview participants suggested that people would not be free to participate in a project of this type unless positive steps were taken. This might involve delegation of managerial work, overtime payments to allow staff to attend training sessions during implementation, or increasing the medical establishment to ensure consistent representation of consultants.

Lack of time may have contributed to the neglect of organisational issues, though it was interesting that in the first round of interviews, only one person seemed to have noticed this omission. This was a manager who had experience of administrative computer

systems and the staffing issues which can be raised, but whose position gave little influence over the project as a whole. By the end of the second round of interviews, more senior people were aware of the situation, though it had not changed.

The large number of different staff groups involved created the possibility of conflicts of interest within the hospital. In fact there was very little overt disagreement, even though the proposals had different strengths and weaknesses and opinions of which was the most suitable system were fairly evenly divided. The weighting of application areas before shortlisting was a point at which serious differences of opinion might have appeared, but the members of the group which carried out this task appeared to be open-minded. Nevertheless, it was not possible to gain consensus through discussion alone and the structured procedure described in Section 3.4 was adopted. The reasons on which participants' suggested orderings were based included:

- The need for some areas to function correctly in order to provide a basis for the rest of the system.
- An emphasis on areas which support patient care, as HISS was intended to be a clinically based system.
- The amount of revenue involved in the various areas, which caused systems to support nurse management to be favoured by some members.
- An emphasis on the case-mix system, which provides information for resource management.
- The potential for savings offered by new office systems.

The group decided that the ranking should not be public knowledge, in order not to discourage the lower-ranked departments. The need for communication may also conflict with the need for confidentiality with regard to suppliers, who are not allowed to know about other proposals or the criteria on which they will be assessed.

As many managers have come from operational departments, there is not a distinct division between those with a "professional" or "clinical" viewpoint and those whose primary interest is management. The managers of clinical departments are engaged in the management of patient-related work. Consultants, however, do appear to see themselves as a distinct group. Darlington is not a teaching hospital: there are therefore relatively few junior medical staff.

The proposals themselves were a factor: had the suppliers and their applications been established in the UK, suitable reference sites would have been available, reducing the need for foreign site visits and for the the functional specification exercise. Had the applications been closer to Darlington's requirements and tailored for use in Britain, the

need for development would have been less. In the event, the procurement was not only a purchase of hardware and software, nor only the selection of a software developer, but required a procedure which was capable of achieving both.

There was some discussion during the procurement about the purpose of the system, and comments made by various participants showed suspicions that the system was intended to further aims other than the ostensible ones. These covert objectives were attributed to various parties: hospital management, factions within the Department of Health, or even the government. Management policy was that the system was intended to produce clinical benefits, but there was some suspicion amongst clinicians that the intended use of information from the system to support resource management was the primary aim. The benefits study led to suspicion in some user departments that the system was being introduced in order to cut staff, whereas comments from other parties suggested that the reverse was closer to the truth. A chance reference to "an opting-out environment" (i.e. one in which units could apply for NHS Trust status) at an early briefing meeting provoked considerable reaction from consultants. These suspicions were no doubt intensified by the fact that the project was launched at about the time of the White Paper "Working for Patients" which introduced NHS trusts and the internal market (Department of Health, 1989). The HISS programme had a high profile within the NHS and was reported in the national and trade press.

3.7. Discussion of the process evaluation

The process evaluation was also affected by events and by environmental constraints.

The points in the procurement at which the two sets of interviews would take place were decided at the start of the process evaluation. They were chosen because each marked the end of a distinct phase of the project and because the pressure on participants would be lower at these times. However, the procurement eventually had a longer timescale than intended, and it was noticeable in the second round of interviews that the events discussed had taken place up to a year previously. A full set of interviews would not have been feasible when the procurement was in progress, but the interviews revealed that some participants were not involved in the last few months of the project, and these people might have been available for an interim discussion. More input during the procurement from participants other than the project manager would have given a broader view, and an earlier discussion with the Central Team, had this proved acceptable, might have given a better appreciation of that viewpoint.

The pressure under which the project team was working made communication difficult at times. The project manager, who was the main sponsor of the study, had an extremely busy schedule. The provision of the promised documentation was a little unreliable, and not all those items needed for the study were available when required. The pressure of work to which the interview participants were subject also caused practical difficulties: inevitably a few people were unavailable and meetings had to be changed at short notice. One interview was interrupted when the manager concerned was summoned to another meeting which had been called without warning. The pressures on clinicians are also severe. A surgeon interrupted a theatre session which had over-run in order to attend his interview, which was severely curtailed in order to allow him to return to the theatre, and another clinician spent the entire session signing forms. The interview schedule did not allow either of these sessions to be rearranged.

The study was given the necessary priority and publicity within the hospital, and there was no difficulty in securing the co-operation of interview participants. Darlington's status as a pilot site and the general sense that new ground was being broken were helpful here: participants were aware that the hospital was able to learn from the experience and were willing to participate in the study, though it was also true that anything connected with HISS was given priority, willingly or otherwise.

Although supported by the authority and already known to some members of the project team from a previous study, the researcher was in the position of an outsider with relevant experience: this was probably ideal as it gave confidence and enabled confidentiality to be assured. A good degree of openness was obtained, though some issues appeared to be sensitive and a number of participants requested that their comments should be unattributable. Once confidentiality was assured, there was no reluctance to participate. This was a successful project, despite a few difficulties, and appears to have been achieved without serious internal conflict. Much of the blame for the problems which did occur could be attached to external agencies or to the general pressure of work, except perhaps in the case of the communication problems.

The extension of the scope of the interview programme to include the benefits exercise was a decision which had to be made without consultation as the subject was raised during the course of interviews. The benefits study was not originally included in the process evaluation as it was not actually part of the procurement, but it proved to be an important part of the social aspect of the project because of its effect on attitudes to the system. Separation of the project into a procurement and an investment appraisal was an artificial division from this perspective.

The process evaluation was largely interview-based, which brings the problems of establishing precisely what happened: memory can be unreliable. It was noticeable that there were varying perceptions; these were not only differences in the accounts of what happened, but also different opinions of the effectiveness of aspects of the project. Where a number of groups are represented, different accounts of events can indicate that techniques were applied in different ways. There is a need to distinguish between accounts of the outcome of the various stages and opinions about their effectiveness, and not to accept the views of informants uncritically when drawing the conclusions of the study. The project documentation which was made available was helpful in establishing the advice and instructions given, especially regarding details such as scoring systems or where it appeared that there had been some misunderstanding.

The views of a satisfactory proportion of the participants in the project were included. Every application area was represented by at least one person, and some by more than one. Some participants had worked in more than one area. Several of the technical team were also included. However, it should be noted that these were all people who had been involved in the project in some formal capacity. A full investigation of the communication and public relations aspects of the project or staff attitudes to the new system would have needed to ascertain the views of those who were less involved, for example, people whose only contact with the project had been attending a demonstration, or receiving whatever information the convenor in that department had circulated. As it was, only the views of those who were responsible for communicating with other staff were obtained.

The choice of methods needs to take into account the pressure under which almost all staff operate. Interviews were the preferred approach because of the rich data which they provide, but there was a need to control their duration and to be flexible in planning the interview programme. They also gave more control to the interviewer than a less direct method such as a questionnaire would have done: under such circumstances a low response rate would have been expected. For ascertaining the views of the wider hospital community, i.e. those who were not directly involved in the project, a simple survey would have been an appropriate approach; again, it would have been necessary to reduce the effort needed to complete it as far as possible, though space for respondents to make comments or express concerns would have been worthwhile. The advantage to the study of undertaking such a survey would probably not have been worth the effort involved for staff, as their managers' accounts of their views were known.

It was not possible to obtain detailed feedback about the study from Darlington, but the findings were accepted by the project manager in a written response (Appendix C). He indicated that the project had not been able to communicate the lessons learned to the service as a whole, and proposed to make the results of this study available to the Central Team so that wider dissemination could be considered. A decision about this had not been made at the time of writing. To supplement the general comments, it would have been useful to obtain the views of user representatives about the process evaluation.

3.8. Summary.

The final section of each of the three chapters relating to the evaluation studies will give a brief summary of the chapter. This chapter has illustrated the three aspects of procurement described in Section 3.2: procedures; decision-making; and organisational and social factors.

The procurement was basically successful in that a system was selected and a good level of confidence in it achieved. In outline, the procedure used resembled the BITGAS procedure (NHS Information Management Group, 1987a), though there was an additional activity, the functional specification exercise, during the technical discussion phase, and other differences have also been noted. A process of procedure definition was taking place throughout the project. The main procedural questions concerned the definition of requirements as desirable or mandatory, the use of the functional specification exercise to assess and raise confidence in the suppliers' ability to develop the required applications, and the method by which the final decision was made.

The final decision was based on a financial model which included a risk analysis. This approach assesses a number of criteria in financial terms, combining assessments which reflect the quality of the proposals with the lifetime cost. The method of making the decision was controversial, as it was thought by the project team to give insufficient weight to factors which could not be assessed in this way. The implications of the approach have been discussed.

Although organisational issues were neglected in the definition of requirements, the project demonstrated social, organisational and political aspects of procurement and implementation. These included:

- The importance of confidence in those who give advice - in this case, an understanding of the NHS and hospital work was a pre-requisite.
- The participative structure of the project, and the need to represent staff at all levels.
- The attention given to developing a sense of ownership.
- The importance of a hospital's consultants.
- The clash of priorities between the project and other work.
- Suspicions about the motivation behind the HISS programme and the project at Darlington.
- Differences of opinion about the method, in circumstances where the outcome of the procurement might be affected.

The main influences on the procurement were:
- External influences - externally imposed timescales and an external influence on the methods used.
- Lack of experience of procurement and HISS - little knowledge of available products and at first, limited understanding of the requirements.
- Internal pressure, especially that of clinical work - some conflict was caused here.
- Uncertainty in the methods used - defining methods at each stage rather than following or designing a complete process.

The benefits study suffered from a number of problems in the methods used and there is potential to improve the approach by learning from the experience. There was an apparent lack of understanding of the way in which hospital staff work, and the study was poorly handled from the point of view of communication and explanation. Concern was caused in the user departments as a result. An exercise of this type could cause significant difficulties at the implementation stage if it were mismanaged or if unrealistic results were accepted. The possible effects on staffing and other resources make the study particularly sensitive and important to departments.

The process evaluation was largely interview based and attempted to include a wide range of opinions. Interviews were used as they were the most suitable method of gathering the rich data required. Darlington's pilot status provided a good reason for the study, and a high degree of co-operation was received from participants in the procurement. The process evaluation was affected by slipping timescales in the procurement, the pressures of participants' normal work, and the sensitivity of some issues, which led to a need for confidentiality. The results of the evaluation were accepted at Darlington, and wider dissemination within the service was under consideration at the time of writing.

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Chapter 4.

Costs and Benefits of a Community Health System.

4.1. Introduction.

4.1.1. Outline of the chapter.

This chapter describes the evaluation of an established system. This was a management information system intended to support the managers of community health and paramedical staff at Darlington HA, and to provide the information required for its statistical returns to the Department of Health. The evaluation had two distinct phases: a planning exercise which was used to decide the most appropriate approach; and the main evaluation, which was a study of the costs and benefits of the system.

The remainder of this section gives a brief description of the system and the work which it supports. The scope and possible uses of post-implementation evaluation are discussed in Section 4.2, which also introduces the important question of the choice of an evaluation approach. Section 4.3 introduces the approach which was eventually chosen: cost-benefit analysis. Although cost-benefit analysis is a widely accepted form of IS evaluation, a number of criticisms of the approach have been made. These are outlined in 4.3.1. The types of cost and benefit which may arise from health care systems are described in 4.3.2.

The practical and research objectives of the study are outlined in Section 4.4. The planning process and its outcome are described in Section 4.5, and Section 4.6 gives an account of the main cost-benefit study. Section 4.7 gives a summary of the results of the evaluation. The full results were presented in an evaluation report which is contained in Appendix F. Section 4.8 describes the use made of the study at Darlington and assesses it as an evaluation exercise.

Section 4.9 considers factors which were taken into account in the planning of the study or affected its conduct, and also notes other points which were of use in understanding the situation. The study raised and illustrated a number of issues relating to cost-benefit analysis of information systems in the NHS environment. These are discussed in Section 4.10, which also considers factors which affected the achievement of the potential benefits from the system. The final section (4.11) gives a brief summary of the study.

4.1.2. Background to the study.

Community health and paramedical services involve a number of professions with very varied types of work. Health visitors and community nurses care for the very young, the elderly, and others requiring nursing care in their homes. Midwives provide maternity services in the community and in hospital. Other specialist nurses work with people with mental handicaps and mental illness. Paramedical staff include physiotherapists, occupational therapists, chiropodists and dieticians: these groups can work with in-patients of the District's general hospital, in specialist units, and in the community. At the time of the study, Darlington HA was managed as three units: Acute (the general hospital), Community and Mental Handicap. Many of the staff groups involved worked in more than one of the units, and some staff worked in multi-disciplinary teams. Individuals may work in several locations.

Darlington HA uses an information system to collect the Körner data for these areas and to meet the information requirements of its own managers. At the time of the main part of this study thirteen staff groups were using the system, as well as a small number of senior managers who received information from it, but a number of other groups were expected to use it in the future or had done so in the past.

The use of computers in Community Health at Darlington began with the development of a pilot system. This was part of a research project which investigated development methodologies for use in this application area (Avison & Catchpole, 1987). The system was favourably received by the two staff groups which tested it. However, it was not extended to the other staff groups at the end of the trial. Instead, an externally produced system was acquired. This decision was not based on a local evaluation of alternatives: regional policy seems to have been the deciding factor. The chosen system was Comcare, which had arisen from a centrally funded management information project but was developed and supported by a commercial company. The system is in use in a number of authorities and there is a national user group.

The basic structure of the system is very simple. Each patient is registered in the system. Staff record the activities which they carry out with individual patients or groups, and also their non-patient-related activities. The time spent on each activity is also recorded. This data is captured using daily activity sheets or hand-held computers (Psion Organisers). Monthly summaries of the information are produced. Darlington has extended the system so that ad hoc information requests can also be met.

Implementation of Comcare commenced early in 1988. In October of that year, the transfer of responsibility for the system from the IT team to the Community Unit prompted a review. It was clear that there were serious problems, as the monthly reports were several months in arrears and the system was causing considerable inconvenience with no apparent benefit. Measures were taken to clear the backlog of daily activity data awaiting input, through the provision of additional temporary data entry staff and an accelerated programme of implementing Psion Organisers. As the information provided was not meeting the needs of the users, new reports were required. The RHA provided software which enabled data to be extracted from the system and transferred to a PC, where it could be analysed and presented using database, spreadsheet and graphics packages. The accuracy of data was a problem, and this was thought to arise from a lack of motivation. Attempts were made to increase the commitment of management and staff towards the system, which was by now extremely unpopular, by promoting its use in resource management and other initiatives in the Community Unit.

It was shortly after this that the opportunity arose for further evaluation to be undertaken as part of the current research project. The original request by the District's IT unit was that a study of the use of hand-held computers for data entry should be carried out. However, initial discussions with the information manager in the Community Unit, who became the internal sponsor of the study, showed that the issues involved were broader than this. The situation presented a good opportunity to investigate the usefulness of an evaluation approach in a complex and problem-laden situation.

4.2.   Post-implementation evaluation.

4.2.1. The purpose of post-implementation evaluation.

Post-implementation evaluation may serve a number of purposes, and the term can refer to various assessment situations, as outlined in Chapter 1. In the context of this discussion, the most important distinctions are between the initial post-implementation review, subsequent regular reviews, and ad hoc evaluations for specific purposes.

A number of uses for post-implementation evaluation can be identified. Ginzberg & Zmud (1988) suggest that most information systems assessment is for the purpose of resource allocation, opportunity surfacing or system tuning. Peccei & Guest (1984) suggest that evaluation serves the following purposes:

- Feedback to aid decisions about future practice, e.g. why a system did or did not succeed.
- Feedback during the introduction of new technology, in the form of regular progress reviews.
- To provide information to influence or complement the subjective judgements which will inevitably be made.

The benefits which can arise from evaluation were discussed in Chapter 2. Lientz & Swanson (1980) found that regular reviews were associated with a better understanding of the system, fewer problems with system quality and the ability to devote more of the maintenance effort to providing enhancements. Cerullo (1979) suggests that in organisations which evaluate their systems, managers make more use of the information provided and opinions of systems are more favourable. Conrath & Mignen (1990) found that in sites which measured user satisfaction with the IS function, relationships between users and support staff were improved and support staff had a better appreciation of users' problems.

Etzerodt & Madsen (1988) see evaluation as a learning process which can increase knowledge of the system and the organisation. Their study was user-led, and attempted to uncover alternative viewpoints and explanations for the problems which were investigated. The increased understanding which resulted was expected to lead to a greater ability to identify and solve problems. Where a study is carried out by IT staff or external evaluators, users may seek to use an evaluation not only to make their views known, but also to ask questions. This occurred in a previous study in which the author participated (Avison et al., 1989), though it was not one of the intended purposes of the review.

The study described in this chapter was an ad hoc review which was motivated largely by the problems which were being experienced. The survey of health authorities (Chapter 2) suggested that the need to investigate problems is a common reason for reviews, though in some cases, ad hoc assessments were undertaken to support specific decisions or planning exercises. The survey also elicited some perceptions of the benefits of post-implementation evaluation. These were listed in Chapter 2. The most important uses appeared to be learning from experience for the benefit of future projects, finding and solving problems, identifying enhancements and confirming that objectives have been achieved. However, the suggested benefits included some which were not direct applications of the evaluation results, such as public relations and increased user confidence.

The suggested purposes and benefits of post-implementation evaluation can be summarised as follows:

- Control of the system, that is, confirming or monitoring that objectives or requirements in a variety of areas have been met.
- Identification of areas where corrective action is needed. This is closely linked with the idea of control and can be seen as a process of feedback and correction, or quality assurance.
- Input to long and short term planning for the system and organisation, including support for decisions about the future of the system.
- Investigation of problems.
- Identification of possible improvements and enhancements.
- Identification of opportunities to derive further benefits from the system (opportunity surfacing).
- Improved knowledge and understanding of the system, the organisation, or systems in general.
- Learning how to improve the implementation process or future systems.
- Improved communication & working relationships between users and support staff.
- Improved confidence in the system, greater acceptance.
- Motivation of those involved in system development, support or use.

Benefits which do not involve specific uses of the evaluation results may be side-effects rather than objectives of the evaluation, or could represent the more covert, political purposes of an evaluation which ostensibly has different aims.

4.2.2. Planning post-implementation evaluation.

Chapter 1 described a variety of possible approaches to evaluation. There is a need to consider whether there is a single best approach to post-implementation evaluation, or whether a choice needs to be made to suit specific systems and organisations.

Ahituv et al. (1986) suggest that evaluation studies should begin with a planning phase in which the approach is decided, until experience of several studies enables an appropriate approach to be determined. This implies that the same method will be satisfactory for all systems within an organisation.

This project has adopted the assumption that the evaluation approach should be chosen or adapted to fit the specific circumstances. The selection of an approach will cause emphasis to be placed on certain aspects of the system. In some cases, the use of a more

restricted approach could affect the overall judgement of the system. For example, an assessment which concentrated on the quality of the information provided might find that this was excellent, but fail to notice the high running cost of the system. However, a fully comprehensive and detailed examination may not be feasible in practice, or may not be considered relevant. Limited resources may necessitate a more restricted assessment.

When planning any type of post-implementation evaluation, a number of points must be decided or assumed. These will include the objectives of the evaluation and the way in which its results are to be used; the approach to be taken and the methods and techniques which will be used; the parts of the system and of the organisation which are to be included; the timing of the study; the level of resources which will be provided; who is to conduct the evaluation; and, if relevant to the approach, the views which will be represented in it.

These decisions will be made on the basis of various factors within the organisation and characteristics of the system. Some of the points may not be explicitly considered: for example, in both the post-implementation investigations described in this thesis, there was an assumption that the evaluation would be carried out by the researcher. There may be a policy within the organisation about the timing and content of post-implementation reviews.

Authors in the fields of evaluation research and IS evaluation have suggested that evaluation approaches should be matched to the purpose of the assessments (Patton, 1990; Legge, 1984; Dawes, 1987; Ginzberg & Zmud, 1988). In an ad hoc evaluation, such as the one described in this chapter, it is clear that the reason for the review will be an important determining factor in the approach. There have been many suggestions concerning the subjects to be investigated in a post-implementation review: some of these are presented in Chapter 5, which is concerned with a review of a newly installed system. However, it can still be argued that the intended use of the information may not always be the same and that characteristics of the system and the organisation will affect the relative importance of aspects of the system.

Practical considerations such as whether the evaluation is planned before implementation and the availability of data for comparison can affect the design of an evaluation (Legge, 1984). The availability of resources may be a constraint, but it is suggested that the scale of the evaluation exercise may also be influenced by the priority given to it and the benefits expected from it. The factors which should be considered were investigated in the current study and the Breast Screening System evaluation, and are discussed in Section 6.3. The survey responses in Chapter 2 mentioned a number of constraints on

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the evaluation which was considered feasible in health authorities. Legge (1984) notes that evaluations can be planned and the aspects to be studied chosen with the aim of achieving political objectives such as the concealment of unfavourable aspects of a change programme.

A possible development from the idea that various factors will affect the choice of evaluation approach is the question of a contingency approach to the planning of evaluation. This would require the points which require decision and the factors which make one approach more suitable than another in a given situation to be identified: analysis of the situation on the basis of these factors would then suggest the most appropriate approach. Ginzberg & Zmud (1988) propose a framework for matching approaches to IS assessment to the purpose of the evaluation and to the rôle of the system and the stakeholders whose interests are to be considered.

This approach has been also been applied to other types of evaluation. Davis & Hamann (1988) suggest that the criteria for assessment of the IS function within an organisation should be chosen according to the characteristics of the organisation and of the competitive environment in which it operates, and the type of information which is required by the organisation. Gregory (1991) proposes a contingency framework for choosing an approach to organisational evaluation which is based on the characteristics of the evaluation group. She suggests that the group's capabilities and its orientation towards a qualitative or quantitative evaluation are relevant to the choice of approach.

Dawes (1987) proposes that the matching of evaluation techniques to the evaluation situation may be based on one or more of four approaches: the provision of a comprehensive set of objectives for the system; an organisational view, identifying critical success factors; an approach in which the various interest groups identify the areas which are most important to them; and a soft systems approach, identifying issues which are relevant to the situation and proposing an evaluation based on these. The first of these implies an objective-based evaluation approach, but leaves the areas which will be examined to be decided. The critical success factor approach allows the subjects for evaluation to be determined on the basis of their importance to the organisation. The other two methods are more open-ended.

The extent to which stakeholder interests are represented in the planning process could vary from a situation in which the purpose and subject of the evaluation are decided by those who commission it, usually management, to a fully participative approach in which all interested parties are involved. A consultative style of participation is also possible: this would involve establishing the preferences of interested parties before deciding the

evaluation approach. This was the method used in the current study, as the views of a number of system users were incorporated in the planning process, but the evaluation approach was chosen by the evaluator in consultation with the manager responsible for the system.

4.3. Costs and benefits of information systems.

4.3.1. Cost-benefit analysis of information systems.

Cost-benefit analysis (CBA) is a common approach in many fields. Its best known use is probably its application in the planning process, where it can be used to assess all types of commercial and public projects. In the IS arena, its principal uses are in feasibility studies, project selection decisions and option appraisal. However, it can also be used in the evaluation of live systems as a tool for management control, by comparing the original estimates with the actual benefits and costs; as a measure of effectiveness; or, as here, as a method of impact analysis.

The weaknesses of the cost-benefit approach when applied to information systems are now well documented (King & Schrems, 1978; Carlson, 1974; Lincoln & Shorrock, 1990). The main difficulties are:

Identification of all costs and benefits. Costs in particular may be hidden if they occur in parts of the organisation which are not directly involved with the system, or may be overlooked because of the complexity of the situation.

Attribution of effects to the system. Changes observed after the introduction of a system may not be wholly attributable to it. Other factors in the environment need to be considered when benefits are claimed. Organisational changes may have accompanied the implementation and the effects of these and other factors may have combined to produce the observed changes (Lincoln & Shorrock, 1990).

Measurement of qualitative benefits is difficult, although in some cases it can be attempted by observing the quality of the service provided, by means of surveys, or by choosing a related quantifiable factor as a surrogate measure. It may be possible to do no more than note the existence of intangible factors.

Closely allied to this problem is that of *comparing diverse benefits and costs*, where these have been measured in different units or assessed without quantification. Attempts

are sometimes made to convert everything to a financial scale. This can involve giving a monetary value to factors which are not naturally assessed in this way, and is likely to be subjective.

Subjective assessments may be hard to make or justify and can even involve ethical questions, especially in a field such as health care where decisions about the allocation of resources can affect the lives of patients.

The *choice of analysis techniques* may affect the outcome of the analysis. In project selection decisions, different techniques can give preference to different projects. When discounted cash flow techniques are used, the results are sensitive to the choice of discount rate, which can thus make a project seem more or less attractive. There are a number of theories about the best approach to setting this rate, which represents the expected return on capital (Sassone & Schaffer, 1978).

The normal *accounting problems* of this type of analysis are applicable: avoidance of double counting, deciding what is an effect of the system and what is so indirect an effect as to be omitted, and allocation of an appropriate share of the organisation's overheads.

Viewpoints. The costs and benefits of a system may appear different from different perspectives. This will apply especially to indirect and intangible effects. *For example,* increased control over the operation of a department may equate with closer supervision or reduced autonomy in the minds of staff, or, as in the case of Comcare, *better* information for managers may require others to spend longer on collecting data for which they have no personal use.

Estimation errors. It is commonly held that there is a tendency to underestimate costs and overestimate benefits when predicting the future, though Couger (1982) has reported the opposite tendency in his observations.

Defining a baseline for comparisons can present problems. The policy of comparing a new system with its predecessor can be unrealistic, as in practice even manual systems are not held static. If the system has been introduced to meet some pressing need, continuation of the old system is not a viable alternative and this must be taken into account in the assessment.

Analyses may be carried out under *political pressure* to produce a desired result, and may be ignored if this result is not produced. Other types of evaluation are also subject to this difficulty: its manifestation in cost-benefit studies is likely to be in the values given to intangibles (Lincoln & Shorrock, 1990) and the amount of emphasis placed on them.

A thorough cost-benefit study may require considerable *effort*. The study itself may not be cost-effective.

There is a need for a method of approach which will enable all types of effects to be considered systematically without having to reduce them all to financial values.

Benefits arising from better information are particularly complicated. Improved information may contribute to better decisions by managers, but measurement of the outcome of decision-making is problematic. The information provided by the system is unlikely to be the only factor which affects the decision-maker. If the results of decisions are examined, the observed effects may not be entirely due to the decision made if changes in the environment have occurred. Decisions may preserve the status quo, or it may not be possible to decide what would have happened without the information.

The justification for a system which aims to support management decision-making can include both unique and regular decisions. If regular decisions are improved by the new information, this benefit will continue to occur, but improvements to ad hoc decisions cannot be predicted in the same way. If the situation is stable, the number of one-off decisions may be small. Even if the initial cost of a system appears to be justified by improved decisions made early in its life as a result of the information provided, if such decisions are no longer being made the continued existence of the system may not be justified. However, the element of risk must also be considered: a system may be needed, not because it is being used for important decisions, but because the decisions which it supports, though rare, are vital. It seems more feasible to investigate the extent to which the system is meeting the need for information to support the types of decision which occur than to seek for actual benefits from these decisions.

A final criticism which could be levelled at the approach is that of irrelevance to many systems. It can be argued that the approach of CBA is bottom-up, aggregating individual effects on the assumption that the overall result will be meaningful. This is valid where systems are aimed at cost-reduction or avoidance, or operational improvements, as the impacts are felt at this level, but where a decision support system or management information system (MIS) is involved, the ultimate impacts on productivity, profitability or other organisation-level measures are of interest. This has led to an interest in linking the IS to organisational performance or productivity measures such as those described in Chapter 1.

In the public sector there are specific problems because the product of the organisation is a service and not naturally measurable in financial terms (King & Schrems, 1978). Beneficiaries may be diverse, hard to identify, or not individuals at all but the community as a whole. The use of resources in the NHS does not normally produce a financial return, as this is not the objective of the organisation. The performance of units and health authorities is normally measured in terms of a range of performance indicators rather than than by any single measure. Most of these indicators assess aspects of the delivery of health care rather than their outcome (Birch & Maynard, 1988), and they do not allow assessments of total performance to be made.

4.3.2. Costs and benefits of health care systems.

A number of categorisations of the costs and benefits of information systems have been produced (King & Schrems, 1978; Knutsen & Nolan, 1974; Ginzberg, 1979). None of these seemed appropriate as a general description of the benefits and costs of systems in an organisation which does not make a profit but whose main aim is to provide a service, although the taxonomies suggested by Parker et al. (1988) include a list of suggested benefits from IS in a hospital. Ginzberg (1979) has some interesting ideas. He sees three major types of benefit: improved efficiency, improved effectiveness, and mandated changes, which are those changes in information processing which an organisation is obliged to make. In his framework, benefits operate at three levels, as changes in information provision lead to changes in the operational processes. The highest level consists of the ultimate business outcomes: changes in sales revenue, profitability, customer satisfaction etc. Valuation of mandated changes is considered unnecessary, but other benefits will be valued at the level of operational processes.

For the purposes of this study it was necessary to identify the impacts of the system, and a simple framework was developed in the initial stages to help in this process. The effects of the system were categorised as either "costs and undesirable impacts" or benefits. Costs were either direct costs, i.e. the initial and recurring direct expenditure, or indirect costs and effects on the organisation's functioning, such as the demands on staff time, effects on the service provided, effects on staff or any operational problems. Benefits would include reductions in expenditure, improvements in service, benefits to staff in their working lives, operational improvements, changes resulting from the use of information, and the ability to satisfy mandatory requirements such as the information requirements of the Department of Health. Table 4.1 shows examples of the various categories.

Costs and undesirable impacts

Direct Costs

- Initial
  - Equipment, buildings, software, installation, training.
- Recurring
  - Supplies, staff time, maintenance, overheads.

Indirect Costs and Impacts

- Effects on service provided to patients
  - Time taken from patient care, intrusive data collection, threats to confidentiality.
- Effects of problems
  - Practical - effects of errors, usability problems;
  - Organisational - staff attitudes, morale, dependence on system, disruption.
- Effects on staff as individuals
  - Uninteresting work, physical problems

Benefits

Direct cost savings

- Reduced expenditure on information processing, operational tasks.

Improved service to patients,

- Direct
  - Less waiting, faster test results, reduced length of stay.
- Indirect
  - Better level of service provision through management use of information

Other operational improvements

- Direct efficiency improvements from the system
  - Automation of clerical tasks, faster operation, fewer errors.
- Indirect improvements through use of information
  - Better work allocation reduces travelling, work done by appropriate grade of staff.

Management benefits from information

- Better information leading to improved quality of management
  - Better decisions, control,
- Improved organisational capabilities
  - Flexibility, communications.

Mandated benefits

- Requirements imposed on the authority
  - Statutory returns, minimum data sets
- Facilities needed to continue operation
  - Contract monitoring, processing not possible without computer system

Benefits to staff as individuals

- Improved quality of working life

Table 4.1. Initial cost-benefit framework, with examples.

The aspects of costs and benefits which need to be considered include not only the nature of the benefit or cost but also its timing and by whom it is incurred. Not only can opinions of benefits and costs vary between different groups and individuals, but the tangible impacts of a system may be different in different parts of an organisation. The beneficiaries of health information systems were considered in three main categories: the organisation and its members in their work rôles; patients; and the staff as individuals with personal needs and aims. Service to patients is clearly an important objective. The staff as individuals should be considered both for humanitarian reasons and because failure to do so is thought to increase the risk of a failed system (Bostrom & Heinen, 1977). A fourth category might include external bodies to whom the system is relevant: perhaps other health authorities, government departments or education authorities.

Benefits to the organisation may appear at various levels (authority, unit, department, individual performance etc.) and can be of several types. The effects of a new system may appear beyond the specific departments or wards in which the computer system operates. Financial savings and increases in efficiency benefit the organisation by freeing resources. These savings can arise in various ways: two important categories are the automation of time-consuming tasks, such as drawing up rosters or manual collection of statistics; and reduced wastage, for example by reducing the number of incorrectly ordered meals or repeated tests. There can also be improvements in efficiency and effectiveness as a result of the use of information.

Improvements in organisational capabilities help the organisation to fulfil its objectives and to become more effective. These might include practical changes, such as the ability to communicate between departments more easily, or capabilities resulting from better information, such as the ability to respond to changing demand for services or to predict training requirements. In some cases an organisation will require information or the use of technology in order to continue to operate, or be obliged to fulfil externally imposed requirements, such as the Körner requirements for community health (Steering Group on Health Services Information, 1985) or the proposed data sets for monitoring contracts (Department of Health, 1990a) in the current study. These are the type of benefit described by Ginzberg (1979) as "mandated".

The benefits to patients will depend on the type of system. Examples suggested for large hospital information systems are sometimes impressive: reduced waiting at reception desks, faster test results, staff with more time for personal contact, fewer errors in medication, reduced length of stay etc. In the community health system, the expected benefits to the community were less direct: knowledge of the workload and better

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resource utilisation were expected to contribute to the provision of a range of services which matched the demand. The methods of monitoring improvements in service will depend on the outcomes which are expected, but might include surveys, observation, or statistics about workload and timings derived from the system itself. Such monitoring may already be part of service management.

Discussion of the impacts of systems on staff as individuals tends to focus on the area of job satisfaction. The introduction of an information system may allow jobs to be redesigned in order to give greater interest or autonomy. Individuals may also find their career prospects altered, new opportunities available or new skills learned. The effects, however, may not be beneficial: perhaps the new tasks are repetitive or uninteresting, or the individual is de-skilled. In some cases the use of technology brings changes in the work or the working environment which, if poorly designed, can lead to physical problems for system users.

4.4 Objectives of the study.

4.4.1. Planning phase.

The first requirement for any evaluation of Comcare was the formulation of an approach suitable for the circumstances and purpose of the assessment. However, the purpose of the assessment was as yet not clearly defined. There was a perceived need to improve the current situation, and it was thought that evaluation could provide information or judgements which would be useful in decision-making, planning or changing the system. The first stage of the study was therefore a planning process. This aimed to give a clearer understanding of the current state of the system, to identify aspects of the system which should figure in an evaluation and the type of assessment which would be most helpful, and to define how the evaluation would be relevant to the current situation.

The need to define the objectives of the evaluation at this stage may need explanation. Several of the purposes of post-implementation evaluation which were discussed in Section 4.2.1 might be relevant. For example, an evaluation study in this situation could aim to identify operational problems, to provide information which would support a decision to continue or discontinue use of the system, or to stimulate ideas for improving the use of information (opportunity surfacing). It was also possible that a further evaluation exercise was not in fact the best approach to the current problems, though the

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nature of the research project made it likely that an evaluation study would be carried out and the initial planning worked from this assumption.

The planning phase was important to the research project as well as to the conduct of the evaluation. The chosen evaluation approach would be implemented, its relevance considered and its problems examined as appropriate, but the issues which could be explored in the second part of the study were partly dependent on the choice of approach.

The planning exercise itself might allow factors which determined the choice of an approach to be identified: it would certainly allow an approach to the planning of post-implementation evaluation to be tested. The method used was based on the idea that stakeholders' understanding of the system and the current situation, and their particular concerns and responsibilities, were likely to affect their views of what evaluation would be useful and relevant. If these could be ascertained and a majority view identified or agreement reached, this would appear to be a relevant approach to evaluation. This strategy required users to have some appreciation of the possible uses of post-implementation evaluation and the choice of approaches, but this could not be assumed. A means of informing participants about the possibilities would be required as well as a way of ascertaining their views. The planning phase was intended to be open-ended: there was no preconceived idea about the most appropriate evaluation approach.

The effects of the local and wider NHS environment on the conduct of the evaluation would be considered, both in the planning phase and in the application of the chosen approach.

4.4.2. Cost-benefit study.

The cost-benefit study aimed to identify tangible and intangible effects of the system. Its objectives were to provide a more concrete basis for planning the future of the system and to explore further the current problems, especially the issues surrounding the motivation of staff. As well as current benefits, those expected in the future were to be ascertained. The study would allow identification of any departments where costs or benefits were particularly high or low, or the system particularly troublesome. The reasons could then be considered. Such understanding would allow improvements to be made or be of assistance in avoiding the same difficulties if the system were replaced. The results of the study were to be widely disseminated.

The study would consider the usefulness and limitations of the cost-benefit approach for these purposes and its ability to provide the type of information required. The approach

was thought to be flexible in its application. It would also allow an exploration of the issues relating to the measurement of costs and benefits in this organisational context.

Considering the immediate and longer term action to be taken would require not only an understanding of the costs and benefits, but also of their origins. The use of a cost-benefit framework for what was essentially an impact analysis was intended to provide a tool for understanding and a language for discussion. It was expected that this formulation would be readily understood and would allow at least some comparative assessments to be made, though a comprehensive assessment in financial terms was not expected to be possible.

4.5. Planning the Comcare study.

4.5.1. Planning Interviews.

This section describes the planning process and the choice of an evaluation approach.

It was thought desirable to incorporate a number of stakeholder views into the planning process, rather than to rely on the perspective of the manager responsible for the system. A number of individuals and groups had direct contact with the system or its outputs:

- Unit level managers.
- Managers of the individual staff groups.
- The staff of those groups.
- The information team and its manager.
- Clerical staff of a number of departments, who entered some of the data.
- Support personnel at District and Region.

Other less direct stakeholders would include the patients whose personal data is stored in the system and whose services might be affected, and more remotely, the public at large, who are potential patients and whose taxes are the source of funding.

Personal contact appeared necessary in order to explain the objectives of the study and to clarify the issues involved. Interviews would allow better familiarisation with the application area than a group approach, and would permit individual services to be differentiated. However, the range of direct stakeholders was too large for all to be interviewed. A selection of interested parties was made. These included two senior managers in the Community Unit, the system operator, the information manger, and the

managers of two paramedical departments and a multi-disciplinary team of community nurses. This list was thought to give a representative range of views. In the event, the opportunity arose to include another senior manager responsible for the seven paramedical services. This manager had not been included in the initial list because an appointment to the post was about to be made. With this addition, almost all the staff groups involved were represented.

An initial series of interviews was conducted. These were based on a standard interview plan which covered the following topics:

- The position and responsibilities of the interviewee.
- Contact of the interviewee and his/her staff with the system, and the use made of it.
- Critical aspects of the system: those parts seen as most important for the functioning of the department.
- Current problems.
- Deficiencies in the service provided.
- Weaknesses of the system, or areas of risk.
- Useful subjects for evaluation.

The interviews enabled participants to identify parts of the system which were seen as especially significant and to give an overview of the problems which were being experienced. They provided valuable background information and enabled the important issues to be identified. Discussion of risks was not particularly fruitful as many actual problems already existed. The author also attended, as an observer, a system review meeting in the Audiology department, and found that similar views were expressed to those given in the interviews with managers of other services.

The interviews used, as an aid to discussion, a version of the document which is found in Appendix D. This planning aid is in two parts. The first section was used at the start of the interviews to introduce the concept of IS evaluation and the purposes which it could serve. The second part contains a list of aspects of an information system which might be the subject of an evaluation study. These are presented in six groups, each of which has a common theme. The list is not intended to be exhaustive and there is some overlap between the groups. Its purpose was to aid communication about an unfamiliar subject by illustrating the possible scope of evaluation. It appeared to serve this purpose. The interviewer was also equipped with a list of application-specific examples of the areas. The document which is contained in the Appendix is actually a later version, as it was revised slightly after this study for use in the review which is described in Chapter 5.

4.5.2. Choosing the approach.

The initial interviews revealed a situation in which there was a general awareness of serious problems. These were in a variety of areas: technical difficulties causing errors; a suggestion of incipient performance problems; a severe lack of motivation amongst staff involved in data collection, which appeared to reduce the effort put into data capture and the accuracy of data; inappropriate output which did not meet the needs of its users, etc. The question of the justification of the system was also raised and different perceptions of this appeared to exist. The system was seen as essential by the highest level of management, but it appeared not to be cost-justified and might not be justified on any criteria. A number of the problems could be attributed in part to historical factors which were difficult to undo, notably the lack of initial analysis and a number of software problems. The system had not been selected on the basis of the district's requirements, and the problems appeared so fundamental that replacement might be a reasonable option. However, it was also apparent that a considerable amount of effort had been invested in the system and that senior management was committed to it.

It could already be seen that expectations of the system had changed since its introduction. From an initial focus on the Körner requirements and the needs of local managers, an emphasis on resource management had developed. The areas seen as critical by managers were mainly concerned with the information needed for resource management and staff allocation, but the requirements of the White Paper "Working for Patients" (Department of Health, 1989) were also being assimilated within the unit. As the study progressed, the idea that Comcare would provide the information needed in agreeing the cost of the new contracts between health care providers and the purchasing authority became increasingly important. The implementation of HISS, the new hospital system described in Chapter 3, was also expected to have some effect on the system, though the full impact of this had not been determined by the time the current study ended.

The concerns and suggested subjects for evaluation were extracted from the interview notes and areas of consensus about these were identified. There was in fact a wide spread of opinion about both questions. No more than two people expressed interest in any particular focus of evaluation; those which were suggested by two people were the justification issue, and an investigation of data capture and its relationship with working patterns. A senior manager was interested to know whether the decision to invest further resources and development effort in this system had been correct; this was interpreted as similar to the question of justification. The justification of the system was also of concern

to the manager of the District's IT unit, who had ultimate responsibility for all information systems within the District. Other suggestions were the satisfaction of system objectives, and studies of motivation, various specific requirements, and the quality of user support and training.

There was more consensus about the areas of concern. Support and training were one of the major areas; the others were the reliability and accuracy of data, the motivation of staff, and the advent of HISS in the Acute Unit. Input methods were also a concern, as were the costs of the system, various specific requirements, and the way in which the system was implemented, though these were mentioned by fewer people. Some technical problems were raised by the system operator, who was the only interviewee directly involved in these aspects of the system. This appeared to be a wide range of subjects, but in fact the apparent relationship between input methods, the cost of the system and motivation meant that some of the areas mentioned were very closely connected, and all the managers interviewed had focused on some part of this central problem area.

As a problem-centred situation seemed to exist, and the problems appeared to be largely inter-connected, the information manager (now cast in the rôle of problem-owner) requested that a detailed representation of the issues involved should be produced. The main elements of this are shown in Figure 4.1. Figure 4.2 is the full diagram which was used in planning the evaluation.
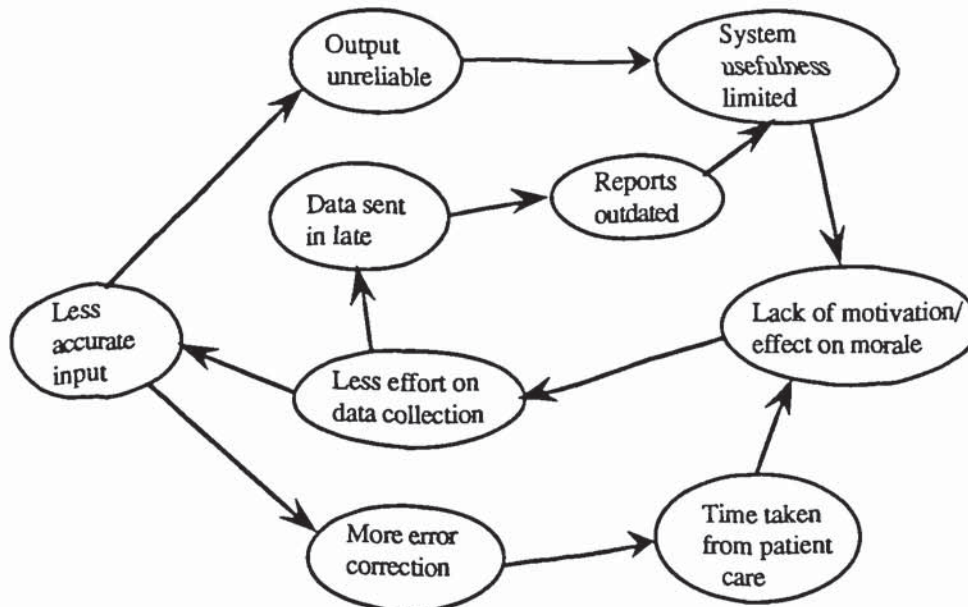

Figure 4.1. Main elements of Comcare problems.

The problem situation appeared to be self-reinforcing, as the high time requirement for data capture and the lack of useful output was thought to contribute to a lack of motivation and a resulting lack of attention to the quality and timeliness of input. This reduced further the usefulness of the reports, which was at first also seriously affected by their late arrival, and also increased to some extent the amount of time spent on error correction. A similar cycle of motivation affecting quality is described by Yap (1991), who uses a tool called an influence diagram to illustrate the situation. This would also have been a suitable tool for this stage of the planning process: its conventions allow the direction of the effect of one factor upon another to be shown and also permit loops such as this to be explicitly identified.

The complete problem chart is shown in Figure 4.2. It was produced with some hesitation, as despite its complexity it is an over-simplification. To state that one factor causes another is to ignore the range of unobserved contributory factors and the personal viewpoints and interpretations from which the representation is derived. Most of the elements of the situation are therefore designated "contributory factors" rather than "causes"; only a small number of elements whose importance was quite clear are marked as major causes. The representation is only partial; in particular, some historical and environmental factors have been omitted. *It was necessary to take some factors as given in order to set a boundary on the area under discussion:* these are the bubbles marked with small black triangles. Similarly, the large white arrows represent effects on the organisation which have not been charted. Some corrective action had already been taken: this is indicated by the "action bubbles" in heavier print.

Using this chart, possible approaches to various elements of the problem situation were suggested by the researcher. (The elements involved are indicated on the chart by small white arrows.) A more participative approach would have been to generate these suggestions in a group discussion. At the same time, possible ways of achieving other potential benefits from post-implementation evaluation were listed. These two sets of suggestions were combined and consolidated into a list of possible approaches to the situation, taking into account the preferences and areas of concern expressed in the interviews. Many of the items on the list were not evaluation activities; they included suggestions such as strengthening of the data control procedures and provision of additional training. The complete list of suggestions was discussed with the manager responsible for the system.

A problem-solving focus for the evaluation seemed indicated, but the initial impression was that solving the problems which had been expressed in the interviews could require
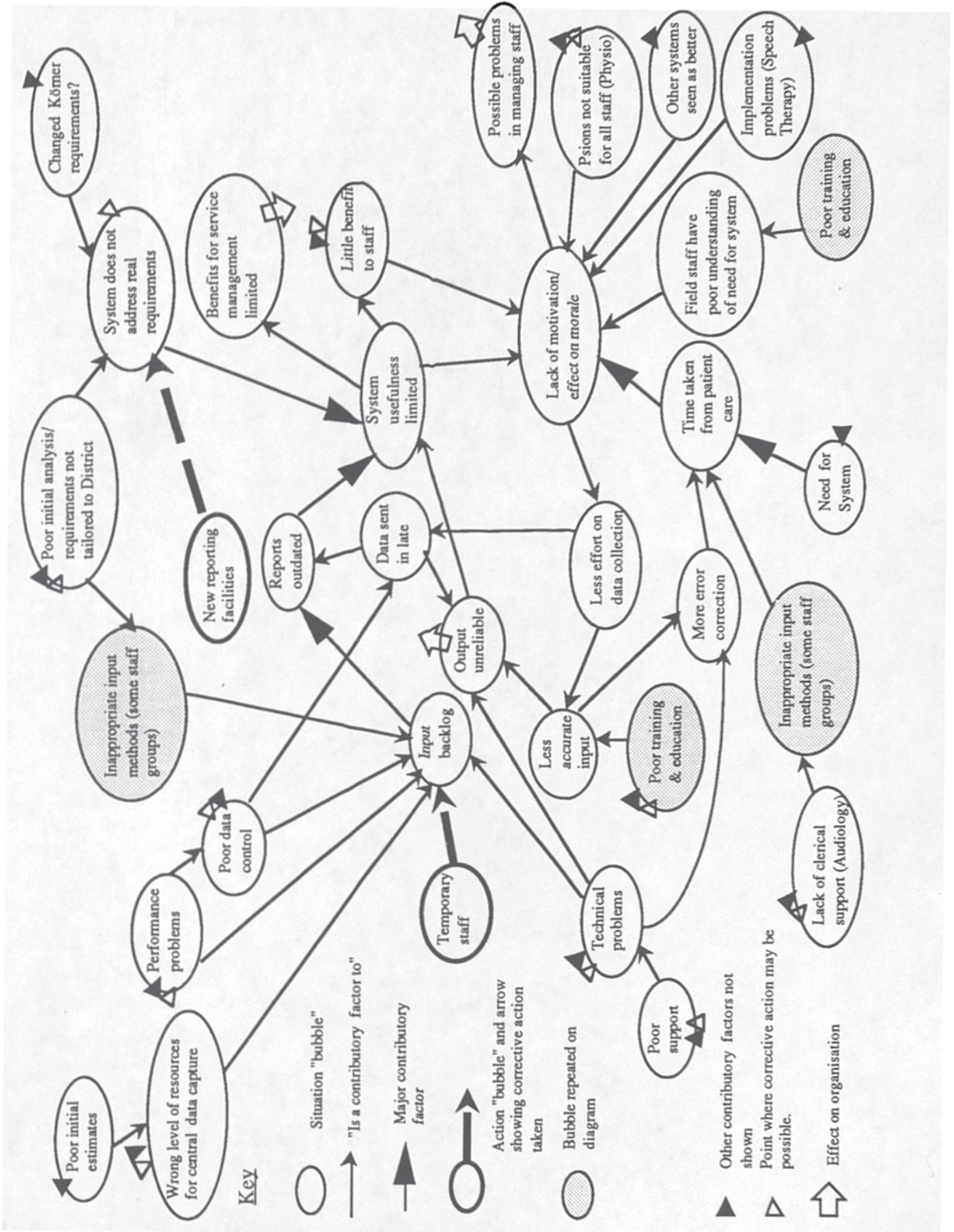
Figure 4.2. Comcare problem chart.

fairly radical action. Planning on this scale was beyond the scope of the current project, but a better understanding of the state of the Comcare system under consideration would certainly be needed if a decision about the future direction of IS in the Community Unit and paramedical departments were to be taken. The future information requirements of managers and the effects of the introduction of HISS would also need to be considered.

4.5.3. Outcome of the planning exercise.

The need to plan for the further development of information systems within the application area was by now clear. In discussing the list of possible approaches with the information manager, it became apparent that the manager's own thoughts and activities were on similar lines. An evaluation study would be needed to assess the current state of the system in greater detail than had hitherto been possible, in order to allow a decision about its future. The most important areas of work were identified from the list of suggestions, using the interests and concerns of interviewees as an indication of their significance.

A plan was produced which was thought to comprise a short-term strategy and the work was allocated between the internal support team and the external evaluator. The evaluation study would be part of a range of activities, one of which was already in hand. Five areas of work covered the main concerns and areas of interest which had been raised in the interviews.

- The evaluation would be an assessment of the costs and benefits of the system. This would allow the effects of the system to be identified and provide the information needed for planning.
- As data entry was clearly a problem, the programmer within the Unit's information team would select departments where this was thought to be particularly troublesome, and apply a structured analysis approach to their procedures in order to ascertain whether other methods of input would be more suitable.
- A separate investigation of the information needs of the unit was already in progress. This was based on a Critical Success Factors (CSF) approach (Rockart, 1979).
- A further assessment of performance, sizing, reliability and the likelihood of receiving satisfactory support would also be needed when considering a development strategy, but this was not of immediate concern and could take place at a later stage if necessary.
- The relationship between Comcare and the new HISS system was not yet clear. This would be an issue for a number of departments, as many staff groups worked in more than one unit and patients could be transferred between units. The interface between the systems should have been defined in the HISS OR: this would be verified.

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The reasons for selecting a cost-benefit framework for the evaluation study arose from the inter-connections between the various aspects of the problem area. The justification of the system was one of the suggested areas for investigation, and the main problems appeared to be connected with the high cost of the system in terms of time required to collect the data, and individuals' assessments of the worth of the system. A study of costs and benefits would allow many of the problems to be investigated in more detail and would provide a framework within which they could be considered and compared. The study was to use costs and benefits as a way of describing a broad range of system impacts, but, as discussed in Section 4.3.1, a full financial analysis was unlikely to be possible.

4.5.4. Non-evaluation activities.

The cost-benefit study is described fully in Section 4.6, but the outcome of the other activities will now be summarised.

The CSF exercise was completed, and showed that managers had some difficulty in identifying their objectives and information requirements. The implications of this will be discussed in Section 4.9.3. The information team was able to address the suitability of the method of data capture in one department which appeared to have a particular problem in this area, but a change of staff and the pressure of other work prevented any further analyses from taking place. The results of the investigation were helpful, however, as it transpired that the reported problem was the result of the way in which patients were referred, rather than a consequence of the method of data capture, and this could be rectified.

The interface with HISS was not in fact well defined: this remained the case for some time and was the cause of considerable concern in user departments. The eventual discussions about the future of the system, to which the evaluation study contributed, focused around this interface. Technical investigations relating to the current hardware and software were by this stage a secondary issue, and were not carried out.

At the time of the planning exercise and over the subsequent months, the problem situation was changing rapidly as more Psion Organisers were purchased and implemented, the data entry backlog was overcome, new reports were produced by Darlington to replace the standard listings from the system, and in the Unit as a whole, resource management and then contracting became the focus of management's attention.

4.6. The cost-benefit study.

4.6.1. Outline of the study.

The cost-benefit study was timed to allow the effects of other work on the system to be seen: thus it took place during the summer of 1990 as it was expected that there would be some demonstrable benefits by this stage. Thirteen staff groups in the community and paramedical services were using the system at this time.

It was considered important to inform system users about the study and its results. A seminar was held to report on the findings of the planning phase and the other activities relating to Comcare which had been taking place, and to introduce the main part of the study. It was well attended by the managers of the services which use Comcare and a number of other information users. An outline of the next phase of the study was given, and a framework for considering costs and benefits was introduced.

The main components of the study were an assessment of direct financial costs, interviews which mainly concentrated on the benefits of the system and the less quantifiable costs, attempts to quantify and cost the time spent on data capture, and an investigation of attitudes to the system and the effects on staff as individuals. Participants in the interviews were the managers of the individual services which were using the system at this time, and three more senior managers.

It was necessary first to identify the costs and benefits which had been experienced or which might be expected for the future. The interviews were used to ascertain what the effects were in each staff group and how they could be measured if this was possible and appropriate. A further information gathering stage then collected the required data from staff. Finally, the results were assimilated and presented.

Information about direct expenditure on the system was derived from the Community Unit's records, but the time requirements and the effects on staff as individuals were investigated by means of a user survey. This took the form of a questionnaire which was sent to all system users. The survey had two parts: one aimed to establish the amount of time spent on the system, the other was concerned with users' attitudes to the system and its effect on their working lives. A copy of the questionnaire is included in the evaluation report (Appendix F).

4.6.2. Interviews.

A simple checklist was drawn up and circulated to the proposed interview participants, who were asked to complete and return it before the interview. This took only a few minutes in most cases. The checklist contained a list of those costs and benefits which were known or thought likely either to have occurred already or to be expected in the future. It was based on a preliminary identification of the costs and benefits of the system, which used the results of the previous interviews, knowledge of managers' information requirements and their intended uses of the information, and other knowledge of the possible benefits and costs of this type of system including the framework shown in Table 4.1. One section asked about some specific ways in which information was expected to have been used, another was concerned with more general benefits from better information, but it also seemed prudent to include a section which ascertained whether improved information was in fact being received. Participants were asked to indicate the categories of cost which they had encountered and the types of benefits which they were receiving now from the system and which they expected to receive in the future.

The completed checklist was used to steer the discussions: this allowed the various impacts to be identified and defined more exactly. It has been suggested (Section 4.3.1) that it is difficult to identify the effects of better information. However, in order to give an understanding of the type and scale of the benefits, it seemed reasonable to attempt to identify how the information was used and specific decisions which had depended on it. This was possible because there had been little use of the information as yet. The benefits of this system and the effort involved were compared with previous methods of collecting information. The interviews were also used to secure agreement to the user survey and to extracting from the system the activity data relating to system use.

Most of the interview participants were the managers responsible for staff groups which used the system, and these discussions focussed on individual departments. The three more senior managers were able to give a more general perspective on the situation and, more importantly, on future trends in information needs.

4.6.3. Timings.

A major cost, and the most controversial and generally felt, was the time spent on data capture and related tasks by the professional staff. The original intention was to use the system itself to collect information about this time requirement. Staff record their non-

patient-related activities in the system, and system tasks are recorded as a specific type of work. However, in discussion with the service heads it became clear that this data was not necessarily reliable, as staff who entered data after each activity tended not to record the time spent, or to enter only an estimate, and in some staff groups administrative tasks were not recorded at all or only on a sample basis. The available data was in fact extracted, and comparison with both the managers' estimates of the time spent and the results of the timing survey which was eventually carried out, supported the suggestion that the time was under-recorded.

In order to collect the necessary information, questions on the time spent on the system formed the first part of the user survey. Devising a suitable questionnaire proved difficult, as it had to encourage staff who work in a variety of ways to recall and estimate accurately the time they spend. The system users include hospital and community-based staff in a number of disciplines, and the type of work, the number of patients seen, and the method of using the system all vary considerably, even within departments. Staff see patients individually and in groups, in the home, in clinics, and as in-patients, and it is possible for an individual member of staff to work in several or all of these ways. The terminology used by staff had to be understood in order to make the questionnaire unambiguous. For example, the administrative activities mentioned above are universally known as "other" activities, and items relating to these required careful wording.

In order to encourage accuracy and to enable analysis of the time taken by the various types of system activity, the questionnaire asked staff to identify the time spent on recording individual activities, where they recorded each activity as it occurred, or to give the time spent in each period of system-related activity. The number of activities of each type (registrations, contacts, groups sessions and non-contact activities) was requested, and error correction and any other activities were also included.

4.6.4. Costs and benefits to individuals.

Although various stakeholder groups had been identified, it was noted that in the main, the known costs and benefits of the system related to the interests of the organisation and to stakeholders' ability to fulfil their rôles within it. The interests of the system users as individuals had not yet been considered in any detail. The second part of the user survey therefore examined the effects of using the system on the staff involved in data collection. The main emphasis of this section was the effect on job satisfaction; however, this included questions which allowed users to express their opinions of the system.

The survey instrument was based on Mumford's (1972) model of job satisfaction. According to this, job satisfaction is achieved when an employee's needs and expectations are satisfied. Five areas of expectation are proposed. Elements in these areas which might be affected by use of the Comcare system were identified and appropriate questionnaire items devised. The range of elements covered was thought to be broader than those actually affected, on the basis of the discussions with service managers. Positively and negatively phrased items were used. The five areas, and the rationale for selecting the aspects to be included, are as follows:

Knowledge. The employee wishes his or her skills and knowledge to be used and developed. The system requires limited computer skills for Psion data entry. Very few staff already had these skills. Data entry was thought likely to be seen as a lower grade, clerical activity by health care professionals. However, some managers had reported that staff had found use of Psions a challenge and enjoyed meeting it.

Psychological. The employee seeks to further interests personal to himself, such as achievement, responsibility, status, recognition etc. In one department, information from the system had been used to give greater individual responsibility, but most people were thought to regard actual use of the system merely as a duty. Some groups were reported to regard the existence of information about their activities as a threat to their security. Some managers had reported that staff were initially apprehensive about the use of the hand-held computers, but that some had gained a sense of achievement from mastering the machines. Managers had experience problems in motivating staff to provide accurate data: an item was included which aimed to ascertain whether data collection was seen as a responsible task.

Efficiency. The employee seeks a fair reward for his or her work and wishes controls, including supervision, to be acceptable. The system could be seen as a control mechanism. The support available to users of the system was thought to be relevant to this area.

Ethical. The employer's values should not conflict with those of the employee. NHS staff have a strong sense of responsibility to their patients, which makes good use of their time an important issue. If the system were not seen as worthwhile, the time spent would appear wasted. A number of items which related to the usefulness of the system for various purposes were seen as part of this aspect of job satisfaction, as well as providing feedback about users' opinions of the system.

Task structure. The job should be of interest and provide sufficient variety, targets, feedback, task identity, autonomy etc. Data collection is different from the other activities of staff and might provide variety. However, it might be seen as less interesting or professionally challenging than other tasks. Output from the system was intended to provide feedback to staff about their work, although it was thought that few had taken advantage of this. No managers had used the information for setting targets, so no item about this possibility was included. An item about task identity (13) was included with some caution, as an improvement in this factor could be provided by the restructuring of work by management as well as by the use of the feedback provided to individuals.

The questionnaire consisted of a number of statements, with which respondents were asked to agree or disagree. These are listed in Table 4.2. 7-point Likert-type scales were used to indicate the extent of their agreement or disagreement. Respondents were also given the opportunity to make comments about the system. A small number of the items were aimed at discovering attitudes to specific issues, such as the use of hand-held computers rather than forms. Staff who used hand-held computers (the majority) were asked to complete three additional items (24 - 26).

Data collection is only a small part of the work of these staff, and outside the main focus of their activities. An attempt was made to relate the attitudes discovered to their general level of job satisfaction. The survey instrument was therefore expected to show how significant an effect the system had on overall job satisfaction, whether this effect was positive or negative, and what aspects of job satisfaction, if any, were affected.

4.6.5. Conduct of the user survey.

A trial of the questionnaire was arranged. A small number of staff from each of two groups were asked to complete the questionnaire, and timed as they did so to ensure that the time requirement was reasonable. The average time requirement appeared to be about twenty minutes. In discussions afterwards, the participants were asked to identify any difficulties or ambiguities, and questions were asked about points which had caused concern during the drafting of the document. A few small changes were made as a result. This pilot trial was less effective than had been hoped, as fewer staff were provided than had been requested (four, rather than six). It had been intended that the participants should be a mixture of community and acute unit staff, but the paramedical department concerned had provided staff whose work was in the community.

Strongly agree	Agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Disagree	Strongly disagree

1. Comcare provides me with useful feedback about my work.
2. I resent others knowing how I spend my time.
3. I try hard to ensure that the data I submit to Comcare is accurate.
4. I do not find data collection interesting.
5. On balance, I think the system is worth the effort we put into it.
6. Data collection prevents me from spending my time more usefully.
7. We need Comcare to collect our Körner data.
8. I appreciate the variety which data collection adds to my job.
9. Information from the system helps my department or team to give a better service.
10. I am afraid that the information might be used against the interests of my department or service.
11. Providing good information is a responsible task.
12. We do not receive enough support for our use of the system.
13. Comcare has given me a better sense of what my job comprises.
14. I use my professional knowledge in recording my activities.
15. Recording my activities adds stress to my job.
16. Using Comcare has enabled me to develop new skills.
17. Information from Comcare helps me to plan my work.
18. The information we provide is necessary if our service is to be well managed.
19. I enjoy my job less because of Comcare.
20. This type of information will be essential once the White Paper comes into force.
21. I would rather use a Psion than forms.
22. Taking the job as a whole, I get a lot of satisfaction from my work.

23. How important is Comcare in determining how happy you are in your job?

Not a factor	A very small factor	A small factor	A fairly important factor	An important factor	A very important factor	The most important factor

Psion users only:

24. I was initially apprehensive about using a Psion.
25 Being able to use my Psion gives me a sense of achievement.
26 I feel confident about using my Psion.

Table 4.2. Attitude survey items.

102 usable questionnaires were returned, a response rate of 50.2%. This was considered reasonable, but was probably adversely affected by the timing of the survey, which was circulated during the holiday period. There was also a degree of administrative confusion, as another questionnaire, which required to be completed in the week selected for the user survey, was received unexpectedly from the Department of Health, causing the Comcare survey to be delayed in a number of groups. The questionnaire was anonymous, but respondents were asked to identify the staff group and unit in which they worked.

Analysis of the survey results was carried out with the aid of a microcomputer, using a spreadsheet to hold the responses and calculate the time requirements and costs, and statistics packages for analysis of the attitude survey results. The results of this analysis are contained in the full evaluation report (Appendix F) and discussed in Section 4.8.

The calculation of time requirements involved some assumptions and also required careful scrutiny of the data. Despite the clarifications made after the pilot trial, there were clearly some misunderstandings. A number of staff did not give any timings or gave incomplete accounts of the time spent: responses were not used if significant items were missing. Several questionnaires asked how long an activity would normally take: in some cases a range of times was given and the mid-point was used in calculations. This could be a source of inaccuracy, especially where the timings related to the entry of single activities. Total time requirements and the average time for each staff member were calculated for each staff group. Where possible the calculations were based on full time staff only, though some departments were too small to allow this. The cost of this time was estimated using figures supplied by the finance department which represented a standard salary and on-costs for each group of staff. The standard practice is to use the mid-point of the salary scale for this purpose, though discussions with service heads suggested that for some groups staff turnover is low and a higher point on the scale would be more representative.

The time requirements produced from the survey data were compared with managers' estimates and data stored in the system, if either of these were available. In general, the survey results gave a figure which was comparable with the manager's estimate, but higher than the totals provided by the system. It should be noted that several managers suspected under-recording of this activity in the system.

The attitude survey results were analysed by staff group and for all users. A tabulation was sent to the manager of each department showing the responses to each question for

that department and for all departments. Using the responses to the attitude survey items, measures of workload, and time taken on all data entry tasks and for specific tasks, Pearson correlation coefficients were calculated between each pair of items in order to investigate the relationships between them.

4.6.6. Other information.

Direct financial costs were obtained from a number of sources. The expenditure on equipment, software and support was extracted from purchase requisitions held by the IT Unit and the Community Unit, as the computerised accounting systems did not allow purchases to be identified. A certain amount of work was needed to resolve apparent discrepancies and to avoid double-counting. The cost of building work was also identified. Supplies such as stationery and batteries were represented by budget estimates in most cases. Staff costs for the Community Unit's IT team were supplied by the Finance Department. Telephone calls related to the system were logged for a sample period, and a figure for calls made by the Community Unit was estimated on the basis of the log, but calls made by users were not included. As the Unit has not in the past assigned its overhead costs between teams and departments, it was not possible to include a share of the overhead in the analysis.

The time spent on training was estimated from the number of staff who had become system users and Psion users, and a value calculated, though as with the time spent on data capture, this is not a direct financial cost.

The amount of effort expended on installing and tailoring the system, training etc. by the District's IT team was not recorded, and even projected workloads were available for only part of the implementation and immediate post-implementation period. This cost could therefore not be satisfactorily estimated. The district had in the past regarded the cost of providing its IT section as an overhead and not attempted to allocate it between systems or services, though at the time of the study, a project control system which would provide this type of information had recently been proposed.

4.7. Results of the study.

4.7.1. Presentation of the results.

As the full results of the cost-benefit study are presented in the evaluation report which is contained in Appendix F, only a summary is given here. The main part of the evaluation report is concerned with the costs and benefits within each group of system users, i.e. each department and the small number of senior managers who receive output from the system. Each departmental sub-section describes staff views, management use of the information, operational and organisational impacts and any known effects on the service provided to patients. Comparison shows that the perceived usefulness of the system and the difficulties experienced vary between staff groups: this assessment by service is therefore important for understanding and improving the current situation. However, the individual sections do not allow comparisons to be made easily, and they should be read in conjunction with the overall summary and with the appendices to the report, which give figures representing the time requirements for the system in each group and the notional cost of this time, as well as full details of the survey results.

The remainder of this section gives a brief account of the costs and benefits of the system. After a short summary, these are presented under the headings described in Section 4.2.2: costs and benefits to patients, to the organisation, and to staff as individuals. The effects within the organisation are sub-divided according to where the costs and benefits were experienced. An appropriate division for this application seemed to be between the information processing operation, staff in their operational work, management of staff groups and the more senior managers. These correspond to the categorisation used by Ginzberg and Zmud (1988), However, the differences between departments were also important and the evaluation report describes management use of the system and the effects on staff within each staff group. It should be noted that individuals may fall into more than one of these categories: some senior managers are also service heads, and many of the service managers have their own case-load.

4.7.2. General conclusions.

At the time of the study, attempts to remedy the problems of the Comcare system were beginning to produce results and confidence in the system had increased, although a number of problems remained. The main cost of the system was that of the time spent on data collection by user staff. It appeared that the improvements made to the system had been helpful and good foundations were being laid for its extension to other staff groups.

There had been little practical benefit from the system as yet, but managers were in most cases optimistic about the future usefulness of the system. However, one department predicted little need for the information and another, whose patterns of working were difficult to record, still had considerable problems with the use of the system. Information requirements had changed since the system had been implemented, and the need to operate within the proposed internal market and the mandate to maintain a minimum data set made the question of justifying the system much less relevant.

Users' opinions of the system were very mixed: in general a small majority appeared to think that the effort made was not worthwhile, though the need for the information was appreciated. Few staff received any individual benefit from the system, but it had little effect on job satisfaction.

4.7.3. Benefits and costs to the organisation

Information processing operation.

The costs associated with the information processing operation were presented in financial terms and form the main part of the direct cost of the system. They included the purchase and maintenance costs of hardware and software, part of the cost of the information team, supplies and communications costs. Table 4.3 gives a summary of these costs.

Unit level management.

The more senior managers who took part in the interviews were interested in summary information relating to the services under their control, but this type of report had not yet been provided and additional data items would be needed. Ad hoc reports had been of use where the information was of sufficient quality. These managers were responsible for ensuring that future information requirements such as those of the internal market would be met. They tended to take a longer term view than the service heads and the interviews discussed a wider range of types of information, such as outcome measures and geographic data. The system was expected to meet the Department of Health requirement to maintain a computer system holding a revised minimum data set which would be needed in order to operate in the internal market. The ability to cost services and measure workloads was seen as essential for negotiating contracts with the purchasing authority, which would be necessary for the continued functioning of the unit: Comcare was expected to provide an important part of the information needed for this.

Non-Recurrent Costs	£
Hardware & Software	
DRS installation	28,482
Microcomputers	34,025
Psions and accessories	48,901
Works	11,000
Total non-recurrent:	122,408
Recurrent Costs	
Support staff	42,583
Hardware maintenance	2,905
System support / User Group	3,805
Supplies	1,807
Communications	412
Capital charges	692
Total recurrent:	52,204
Projected From 1992-3	
Replacement of Psion Organisers	2450

Notes:
Non-recurrent costs relate to the period November 1987 - April 1991. Further purchases of Psion Organisers were envisaged.
Recurrent costs are based on the financial year 1990-91.
All prices include VAT.

Table 4.3. Summary of information processing costs.

Service management.

The interviews with managers attempted to identify both current uses of the information and those expected in the future. Measurement of the benefits in financial terms was not expected to be practicable, as the expected benefits were largely those of improved management information. Assigning a monetary value to these presents severe difficulties. Effects on the quality of decisions made and other aspects of management, or specific consequences of having certain information at a particular time, would be difficult to identify and value.

A number of specific ways in which it was expected that information would be used were discussed. These were:

Providing information for the annual Körner returns. This was the original purpose of the system. All but one department had been able to derive the previous year's return from the system, although in one case extrapolation from data for part of the year had been necessary.

Business Planning. Eleven of the thirteen service managers expected that information from Comcare would be useful for planning the development of their services. Managers were beginning to make use of the information or to become aware of its potential. Most of the practical uses of information described by managers seemed to relate to the short and medium term, rather than to long range planning.

SWOT analysis. An analysis of strengths, weaknesses, opportunities and threats had recently been carried out in many departments. Although most managers expected that the system would in future be able to assist with this type of exercise, it had not been widely used on this occasion.

Allocation of staff and workloads. Only three departments had used system-produced information for this purpose as yet, though all but two service managers expected to do so in the future. One department had undertaken a fairly extensive reorganisation with the aid of the system, in order to introduce greater specialisation. The manager of one of the smaller departments was able to use other sources of information and saw no need for Comcare in the future.

Costing of services, especially in relation to contracting. Reports on the costs of each service were being developed at the time of the review, so this was in general an expected rather than an actual use. Although the service which acted as pilot for the costing reports

was not yet completely satisfied with them, it had begun to make use of the information and had been able to decide the most cost-effective way of carrying out a particular type of minor surgery on this basis. This type of information was seen as essential for contracting.

Other uses of the information were discussed and specific examples identified, in order to show where possible the types of benefit which could be expected and to ensure that the information had actually been usable and useful. A small number of managers had made no practical use of the information, other than to make their Körner return. Most could cite a few occasions in which the information had contributed to decisions. Often, information from other sources was also used, or the Comcare information served to confirm the decision which had been made, though there had been a few unexpected discoveries. Some examples of the decisions made and other uses were:

- A decision that a vacancy could be filled by someone of a lower grade
- To predict the increased number of referrals which would result from the appointment of an additional consultant.
- To show the effects of removing a post from the establishment (2 cases).
- A decision to appoint a nurse to specialise in a particular aspect of a department's work.
- To reject a proposal to appoint lower grade staff to carry out basic treatment, as this was rarely the only type of care given in an appointment.
- To re-allocate work as part of the restructuring of a department.
- Student research projects.

Managers in all but one department were expecting the system to be of considerable use in planning and managing their services in the future, though some felt that their need for this type of information was more limited. Almost all expected that the information would allow them to make better decisions, make better use of resources, and detect and respond to changes in demand. Better use of resources was expected to allow them to offer a better range of services. However, about half the service managers felt that their ability to make use of the information was currently limited by inaccuracy, inconsistent use of codes by staff, coding structures which despite revision did not adequately reflect the patterns of work, and/or the need to record additional items of information specific to their services.

Most of these benefits, including those expected in the future, are concerned with improvements in the organisation's capabilities. These include the ability to calculate accurately the staff cost of providing each package of care; the ability to provide the

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required mix of skills in each situation; the ability to predict the effects of proposed changes to departments; and the ability to detect changes in the demand for services and to respond to them, including the ability to predict that demand for a service is likely to exceed the contracted level. Managers discussed "control" in general terms: better information is seen as helpful in increasing their ability to be aware of what is happening in their departments. Some of these benefits are related to the avoidance of risk. There is also a political element in that information can be used in promoting a service, i.e. ensuring its continued or increased support and resource provision.

In most departments, Comcare replaced or co-existed with other methods of collecting information. In many cases, activity timings were the main additional type of information provided by the system. Where these were inaccurate, there was little if any advantage over manual methods which could produce the basic information with little effort. The recently introduced graphical outputs were generally approved and considered easy to use. Comcare was thought to be more flexible than previous systems and to give better access to information now that it was possible to produce ad hoc reports. However, one manager noted that she was no longer able to ask her staff to collect other data for ad hoc exercises because of the pressure caused by Comcare.

A small number of managers had been relieved of the need to spend time on other data collection methods. Displaced costs in the use of information, as where a manager can reduce the time spent on planning or decision making because the system can produce exactly relevant information for the task, were not found to be significant.

The attitudes of staff in some departments had led to some difficulty in managing them. A small number of managers described severe problems, particularly in cases where individuals had reacted adversely to the introduction of the system.

Operational level.

The time spent by professional staff on data capture was expected to be the major recurrent cost and was also thought to be one of the main factors affecting motivation. The time spent on training was also estimated and costed.

The time requirement was presented as an average time spent by each person in a week; as an annual cost and as the number of whole time equivalent staff: this is particularly meaningful where services are over-stretched or being obliged to contract. In some departments, part of this time would previously have been spent on other methods of data collection, but in other cases, manual systems are still used.

The total cost of staff time in user departments was calculated as more than £186,000 for 1990-91. This represents 11.8 whole time equivalent staff in an establishment of 203. Cost figures such as this must be treated with extreme caution as they can be both sensitive and misleading. It is essential to realise that the figure does not represent additional expenditure on the system: it is a surrogate measure for a number of different impacts. Some additional time had been required, of which some was overtime which is paid at a different rate. In some cases, especially where staff enter data after each contact and work in appointments of fixed length, data collection had been absorbed into the existing schedule. The effect would then be seen in an increase in the intensity of work. Some staff, especially community nurses, enter their data at the end of the day, or take it home, and so work in their own time. A few departments were aware that the number of patients seen had been reduced. The necessary information to define these costs precisely was not readily available.

All staff groups had experienced a degree of disruption to their normal operation when the system was introduced. Whilst some disturbance would be expected, this was severe in many cases. Changes to coding systems, input methods and the data items to be collected had caused further problems, although the severity of these again varied between groups. A number of managers had noticed that the morale of their staff was affected: in most cases the situation had been worst immediately after implementation and was now improving.

The Physiotherapy department in the Acute Unit has a particular problem in that the system seems unsuited to their methods of working and cannot record the complexity of their patterns of work. Physiotherapists in this department also have large workloads and work under high pressure, and motivation had been a problem, although the actual time spent on data entry in this department is not the highest. The system was producing no information which was considered sufficiently reliable to be used.

There were a small number of cases where staff had previously spent time on collecting, collating or interpreting data using manual systems which had been completely replaced. This could be regarded a benefit to be offset against the time requirements for Comcare, but only rough estimates of the time involved were available. These were not included in the financial tabulations, which in effect compare the current situation with the situation if the system were removed, rather than with the previous situation.

The way in which information is disseminated to staff varies between disciplines, but most saw their own printouts (showing numbers and types of activity and the time spent)

and the summary for the department. The user survey showed that opinions of the feedback given to individuals varied even within departments, and this seemed to be related to the respondent's overall assessment of the value of the system. Staff were in general aware of a need for the system, though fewer than half found that it gave actual benefits to themselves or thought that it improved the service given by their departments.

4.7.4. Benefits and costs to patients

Whilst there was concern in a number of departments that using the system reduced the amount of time available for patient related activities, it was not possible to measure the impact of this on the patients themselves. This will vary between departments. The greatest concern was expressed in two departments which were already very stretched, in one case because of staff shortages and in the other because of the high level of demand. One of these carried out most of its work in appointments of fixed length and had initially reduced the number of appointments made with each staff member by two each day, though changes to the input method had now reduced this time requirement. This would impact on waiting times. In the second case, the existing workload could not be covered, and treatment could not be offered to all who would have benefited from it: the additional time requirement aggravated the situation. In this case there would also be an impact on the well-being of these patients.

The benefits to patients expected from Comcare were indirect: better information was expected to lead to a better use of resources and the provision of a better and more appropriate range of services. These benefits were expected in the future by the managers of most staff groups, but as yet there had been little use of a type which would bring such benefits. The system had contributed to some decisions whose result could be directly beneficial to patients, such as the assignment of work to more specialist staff, who would be expected to be more skilled in the specific area.

The treatment of personal data is relevant to the interests of data subjects, who have a right to expect confidentiality and accuracy. Managers' opinions about the effects of keeping this data in the system varied: this variation is likely to reflect their past experience of the system as well as the degree of protection actually offered to personal data. In a small number of departments, Comcare replaced less orderly methods of keeping personal data, and confidentiality and security were thought to have increased. In other cases personal data had not previously been held. The accuracy of data had in the past been affected by system errors.

4.7.5. Benefits and costs to staff as individuals.

Almost all the survey respondents found their jobs very rewarding and few indicated that the system had more than a slight effect on their overall job satisfaction. This is reassuring as data collection is only a minor part of their work. The use of Psion Organisers had caused initial apprehension, but most seemed to have overcome this and some found that mastering the technology had given them a sense of achievement. The two departments whose staff held the most consistently unfavourable opinions of the system had received very little benefit from it and had experienced considerable problems in the past because of the time taken for data entry, including an impact on the number of patients seen. Attitudes were more varied in the other staff groups.

A majority of staff found that data collection required the use of their professional knowledge, but fewer than half felt that new skills had been acquired through using the system. Providing information was considered a responsible task by almost all respondents. Some managers had mentioned a concern amongst staff about the way in which information from the system might be used, and this appeared to be linked to the belief that only a member of the profession concerned could interpret accurately the data about any staff group. Responses to the questionnaire item relating to this concern ("I am afraid that the information might be used against the interests of my department or service") were mixed, even within some departments, and a significant proportion of respondents did not agree or disagree, though of those who did express an opinion, a majority agreed with the statement. The two largest paramedical departments seemed particularly concerned. However, very few respondents resented their own use of time being known by others.

A majority of survey respondents found that data collection added stress to their jobs: user comments indicated that frustration with the inadequacies of the system was one factor in this, and these responses were strongly correlated with the effect on job satisfaction and with the view that the time taken by the system could be better spent. Service managers are subject to the pressure of dealing with demoralised or angry staff, and some recalled a degree of stress as a result of this. Opinions of the support provided to system users were evenly divided.

Responses about the value of the system in relation to the effort put into it and whether the time could be better spent showed that a small majority doubted the value of the system, though the responses to items about specific uses of information suggested that most staff appeared to see a need for the information for management purposes. There

were significant correlations between general items about the value of the effort made (5 and 6) and the general assessment of the effect of the system on job satisfaction (19), but the relationship with items about use of the information seemed weaker. Although a number of the written comments also appreciated the need for management information, a degree of frustration with the limitations of this system was evident in several of them. Few staff used the system output in planning their own work, though a larger minority found the feedback received useful. Most system users found data collection uninteresting and did not welcome any variety added to their jobs.

It appeared that some staff carried out data capture in their own time. Their attitude to this and the effects on their personal life were not investigated. Some also worked overtime, which is paid at an enhanced rate.

4.8. Assessment.

4.8.1. Feedback and utilisation.

The results of the study have been widely circulated. A full report was produced for unit management. A summary of the results was distributed to the departmental and unit managers who participated in the study, together with the section of the main report which related to each manager's department, a summary of the results of the attitude survey and the full results for that department. Comments and survey results relating to individual departments were only made available to the department concerned and to senior management in the full report. However, owing to the reorganisation within the District which accompanied the introduction of the internal market, Community Health had lost most of its senior management by the time this information became available.

All the user departments were invited to send representatives to a seminar at which the results of the study were presented and discussed. Attendance was low and representation of staff groups was uneven; interestingly, the group with the strongest representation was one which had started to use the system after the study took place. Nevertheless, a lively discussion about the progress of the system took place. The information manager used the summary paper as the basis for a further seminar at which the future of Comcare and the new HISS system were discussed. The author was not present at this second meeting. Participants appeared to find that the results were credible and that they reflected their experience. One of the information manager's intended uses for the work was to stimulate debate about the costs and benefits of systems, and this

seems to have been achieved. Discussion of the costs of HISS was generated, especially in view of the amount of data which the system will need, and the way in which systems for these areas should operate was also discussed. It was felt that information should be a by-product of clinical work rather than the product of a specific information gathering exercise. This is in line with the philosophy of HISS, which is primarily intended to be a clinical system.

Discussion of the work in progress with staff from other authorities confirmed the impression that the experience at Darlington was not unique. The information manager made a presentation about the study to the national Comcare user group and copies of the summary paper were made available to members. Several Districts seem to have used it as background information for their own consideration of these systems. Newer community health systems which aim to give direct benefits to nurses are becoming available, though a recent comparison of a clinically-based system with a more traditional system shows that the perceived usefulness of the more recent approach was not as great as might have been expected (Garber & Fitter, 1991).

The cost-benefit study itself was directly relevant to the strategy which had been adopted for the development of the system and its structure provided a framework for further assessment and planning.

An evaluation exercise can serve purposes beyond the strict definition of the study. A number of factors were examined which are not strictly benefits or costs, but contribute to them, and recommendations were made, both informally *during the study and in the report*. Practical suggestions from end users were gathered during the user survey and passed (anonymously) to the Information Team for consideration and action, as they showed issues which still need to be addressed. The survey answered some specific questions, as it demonstrated that the need for the system was appreciated, and showed where attention to the costs and benefits to individuals was needed within staff groups.

4.8.2. Assessment of the study.

The planning exercise was considered worthwhile as it allowed an independent view to be taken of a problematic situation and enabled clarification of the issues involved. An appropriate evaluation approach was decided and implemented as a result of the exercise.

The method of choosing the approach was an extension of that originally envisaged. This was because of the need to gain a clear understanding of the problem situation and to consider the possibility of other types of action. It is a hazard of action research that

preconceived ideas about the methods which are to be applied and researched may have to be adapted to take account of the needs of the real life situation, but this is also a strength of the research strategy, as the limitations and applicability of the methods under investigation are explored.

The final stages of the planning process involved discussions between the researcher and the information team. A more participative approach would have involved the interview participants in generating solutions to the problems and perhaps also in choosing the approach on the basis of their preferences in a joint decision-making process. However, wider involvement would have been more difficult to secure.

The approach used synthesised a number of different views of the situation. It was necessary to determine which areas were generally relevant and which were more limited, and the problem chart indicates sources of difficulty which are applicable to single staff groups. There was in fact a considerable degree of consensus amongst the interviewees about the nature of the problems, but in the event of differences, a greater degree of interaction between participants would have been preferable in order to resolve them. The problem chart was a helpful tool, and was used at Darlington for discussing the system outside the context of this study. However, the full chart was too complex for use in meetings, and a simplified version which concentrated on the current situation was produced.

The cost-benefit study was planned to take place at a point when new reports would be in use. In fact, some departments had not had the opportunity to make much use of them and one manager had not yet received them. As further changes were already underway, it was not likely that a point at which the system was stable would be found.

As this was entirely a post-implementation study, and the system had been installed for some time, comparison with previous systems was not likely to be helpful or accurate. Information relating to the installation and early use of the system and to direct expenditure on equipment etc. was difficult to find and some costs required data which was not normally recorded. Some of the direct costs have been estimated and it is appreciated that some figures are given to a much greater degree of accuracy than others.

The cost-benefit approach provided a helpful and flexible framework for the study as it was readily understood and covered a wide range of system impacts. It allowed factors which prevent the achievement of benefits or contribute to costs to be identified and discussed: this followed naturally from the attempt to define the effects of the system.

The study did not succeed in making an assessment of the overall value of the system, though it was clear that until very recently there had been scarcely any benefits to offset against its costs. Both current and expected future benefits were of a type which cannot readily be valued. This was understood at the beginning of the study, and any attempt to justify the system would have had to be in qualitative terms. However, the introduction of the internal market, an important change in NHS management which had not been envisaged when the system was implemented, had effectively made the system essential in the short term. More relevant questions now concerned practical solutions to the problems of the system in the immediate future, and in the longer term, a direction for future development.

The analysis by staff group was essential, as the situation varied considerably between departments and between staff of the same profession working in different units. It also provided a natural way of presenting the results and allowed the requirement for confidentiality to be met, as each manager could be given results which related only to his or her department and an overall summary.

A more extensive pilot of the user survey involving staff with a wider range of working patterns would have been helpful, although given the limited user community, it would not have been possible for a large enough trial to test its statistical validity. The paramedical participants were not from the Acute Unit, as had been requested: it was not clear how this confusion arose. Some problems in completing the questionnaire were not detected in the trial.

It would have been preferable to include in the part of the user survey which related to time requirements more detailed instructions about answering the questions. In particular, respondents should have been asked to enter typical values for the time taken to carry out single activities, as the need to take an average value where a range of times was specified introduced a source of error into the calculations. It would have been helpful if part-time staff had been asked to specify their working week in terms of whole time equivalent, though the number of days worked would still have been needed. A larger response would have produced more reliable results, and a better understanding of the distribution of system tasks between department members would also have been helpful in some cases.

Responses to the attitude survey did not indicate any major difficulty in understanding the items, though a preliminary scan of the input data suggested that in a very few cases a negatively worded item could have been mis-read as positive, as the response was

inconsistent with other items. It appeared from written comments that item 23 ("How important is Comcare in determining how happy you are in your job?") was taken by at least one respondent to imply that using the system should increase the user's happiness, whereas in fact any effect on the level of job satisfaction was meant. The purpose of this item was to give a better indication of the importance of any effects on job satisfaction, but it was not in the event very useful.

Attention was given to restricting the time requirement from system users and their managers. Although those involved are busy, this study did not at any point suffer from the difficulties in making and keeping interview appointments which were a problem in the other two studies. In general, managers were interested and helpful. They were also willing to allow their staff to participate in the user survey, and although there were some difficulties when the questionnaire was actually issued, a good response was received. The time and effort involved in cost-benefit studies was one of the difficulties noted in Section 4.3.1; the requirements for this study were documented in the evaluation report (Appendix F).

The interviews with managers achieved their objectives in the allotted time. The use of the checklist was very helpful in steering the discussions as it allowed specific points which needed attention to be identified in advance and also provided a structure. The checklist took only a few minutes to complete in most cases and does not seem to have caused much difficulty, except that a few interview participants had apparently not noticed the existence of the section on costs, and had entered these in the sections on benefits, which were placed first. *The positioning of the instructions for completion was probably* responsible for this and as the document was intended for use in discussion, no problems arose as a result.

It was necessary to ask managers to recall events which had taken place up to two years previously. This may have led to omissions. It appears that most actual uses of the information in departments have been identified, but this would not have been practicable if more departments had made significant use of the information. Under these circumstances, a log of information requests would have been helpful. An earlier review would have been better placed to investigate the immediate effects of the implementation and to compare the impacts of this system with the previous situation.

A degree of sensitivity and detachment was needed in dealing with managers in one department where there were particular problems with the system and some conflict appeared to have arisen.

A good working relationship was established between the researcher and the information team. Although the evaluation study was the work of the researcher, it was discussed at every stage and valuable suggestions and opinions of proposed ideas were received. The researcher facilitated some of the other activities suggested in the planning phase, e.g. by investigating the progress of HISS and by providing advice on analysis techniques. Informal feedback took place as the research progressed: for example, a problem was identified in one department which could be remedied immediately by the provision of an additional piece of documentation.

4.9. Organisational factors.

4.9.1. Factors in the choice of evaluation approach.

It was proposed in Section 4.2.2 that various factors will affect the choice of an evaluation approach. The process by which the evaluation was planned was described in Section 4.5; this section highlights the factors which were considered. Chapter 6 will compare these with the factors used in the other post-implementation study (Chapter 5).

It is important to distinguish between the data and criteria on which the choice of approaches is based, and factors which have a more subjective influence on the planning process. Subjective elements in decisions and motives which are not openly discussed are difficult to trace and assess. The planning process considered the concerns expressed by users and the subjects for evaluation which were of interest to them. The focus on concerns, as opposed to other questions considered in the interviews, arose because of the importance and severity of the problems which were being experienced. The cost-benefit study was intended to investigate these areas of difficulty. The concerns and interests of system users would themselves have been largely dependent on the work situation.

The purpose of the evaluation has been suggested as an important factor in the choice of approach. The purpose of this study was not pre-defined, but an emphasis on providing input to the planning process developed in the course of discussions. This was the purpose of the cost-benefit study, which aimed to give an understanding of the current situation and the future usefulness of the system. Other suggested activities also looked to future developments, though the proposed investigation of input methods was aimed at problem-solving.

The fact that this was a purely post-implementation study limited the choice of approach. There was no comparative data from before the implementation, and it was not clear that the fairly informal process which had led to the decision to install Comcare had defined any objectives for the system which would be of use in evaluation.

Practical requirements had little effect on the choice of approach in this case, as no serious difficulties were envisaged. The necessary manpower and skills appeared to be available. It would be necessary to limit the time commitment required from system users and their managers; it was therefore useful that the planning exercise had given the opportunity for familiarisation with the system and the community and paramedical services. The timing of the cost-benefit study was determined by the development activities which were underway, as it seemed appropriate to allow new reports to be put into use.

Respondents to the survey of health authorities had seen the difficulty of measuring the costs and benefits of health systems as a limitation on the evaluation which could be carried out. In this case, it was understood that the costs and benefits would not be fully comparable: this was not considered a problem and the areas of difficulty were expected to be of interest for the research aspects of the project.

The design and conduct of the planning process were also affected to some extent by aspects of the organisational environment. The wide range of staff groups involved with the system was reflected in the choice of interview participants. The cost-benefit approach was chosen on the basis of a range of stakeholder interests. There was no conscious attempt to consider the weight to be given to the views of individuals, though it should be noted that the members of the organisation who were most closely involved in the action research study and who took part in the planning of the evaluation were members of the team responsible for providing information systems within the unit.

The position of the study's sponsor, an information manager, allowed other activities related to the further development of the system to be suggested, including those requiring IS skills. The need to meet new information requirements and the existence of the HISS project suggested some of these other activities.

It was perhaps an unusual feature of the situation that the purpose of the evaluation had not been defined at the beginning of the study. The existence of the research project had in fact prompted the evaluation, and the purpose for which it was originally requested by the District IT manager, to investigate the use of hand-held computers, was no longer seen as relevant by the time the initial planning meeting was held, as a policy decision on

this matter had been taken. This gave a very open situation which could have led to a variety of outcomes, and necessitated discussion of the purpose of evaluation as part of the planning process.

A feature of the situation throughout the study was the constant change in the wider NHS environment and its effect on information requirements in the Community Unit. This, combined with the fact that the system had been in operation for some time, made an approach which would be independent of change desirable. For example, comparison of the system with its original objectives would not have been particularly useful: concentration on the current situation and its requirements was more appropriate. An objective-based evaluation in these circumstances would need to begin by considering the changes which had taken place and defining appropriate current objectives.

4.9.2. Influences on the cost-benefit evaluation.

The main purpose of Comcare is to provide information for managers. This type of benefit is difficult to quantify and not susceptible to measurement. In the NHS environment there are no financial outcome measures, either for IS or for the more direct health care applications with which demands for resources to provide information must compete. A qualitative assessment was needed, and interviews with the managers concerned were chosen as the method of investigation.

The number and wide geographical distribution of user staff made a written survey the most practical means of including their views in the study. The variety of working patterns greatly increased the complexity of the timing survey. The survey aimed to build up a picture of how time was used as well as to give an accurate estimate of how it was spent: this was considered preferable to simply asking staff to estimate the weekly or monthly time requirement. Items were phrased so that they would be appropriate to staff working in different situations. However, as these were all professional health care staff, it was not expected that there would be significant differences in their ability to complete the survey or in the values which they brought to it.

It was noticeable that managers' concerns and the purposes for which they required information were changing during the study, especially at more senior levels. This was the result of expected changes in the management of the NHS. At the beginning of the study, the main concerns were providing the Körner returns and information needed for operational management, but the emphasis within the service on resource management was also being absorbed. By the end, providing the costing and workload information needed in order to negotiate contracts was becoming increasingly important.

These changes affected the possible uses of evaluation results and the questions which appeared relevant. The need for departments to be able to make and monitor contracts and to hold a prescribed set of data made the question of the justification of the system almost irrelevant, as for most departments there was no practical alternative in the short term, given that significant changes were expected as a result of the HISS project. Increasing awareness of the implications of HISS affected the planning horizon for the system and information from the study was used in considering the interfaces with HISS.

The practical effects of features of the organisational environment on the conduct of this study were fairly limited. The pressures of other work were respected by restricting and monitoring the time required from participants, but less difficulty was caused by this pressure than in the other studies. One service manager was concerned about the time required by her staff to complete the user survey, and the restricted participation in the survey pilot may also have been the result of pressure of work, but in general participation in the study was not seriously affected.

Accounting and charging practices restricted the availability of some necessary information, and the use of the standard practice of using the mid-point of the salary scale for costing staff time may have affected the accuracy of the estimates in some staff groups.

The implementation process continued throughout the study, bringing new staff groups onto the system and adding to the range of information available to users. There was no stable point at which to conduct the study, with the effect that the situation had changed and there were new groups of users who had not been included in the study even by the time the results were reported.

This system was selected after a regional assessment but without local investigations and there seems to have been little consideration of the extent to which it would meet local requirements. There was therefore no pre-defined set of expected benefits against which to assess the system.

The effects of the organisational context on the attitudes of staff and managers were of interest. The NHS has been subject to constant change in recent years. Some managers reported that their staff felt insecure and were more likely to regard the information system as a threat because of this. The study took place in the year before the introduction of the internal market, so that a significant change was expected. In addition, pressure to reduce services by cutting staff and closing wards was being felt in

this Authority for the first time. There were fears that the quality of the service would be disregarded in the pressure to increase the number of patients treated. There was also a concern that information could be misinterpreted by higher management, though a belief that the work of a department could only be fully understood by a member of that profession also contributed to this.

Such concerns are likely to affect users' assessments of a system, which are made within the context of the organisation, and their acceptance or rejection of it. These factors lay behind the inclusion of two items in the user survey: "I resent other people knowing how I spend my time" and "I am afraid that the information may be used against the interests of my department or service." The survey also incorporated an item on the need for the system in the White Paper environment, in order to see whether the implications of this were appreciated.

Staff are highly motivated with regard to their clinical work, and derive considerable satisfaction from their jobs. This needs to be considered when assessing the effects of an information system on their working lives or motivation. As using the information system is a small part of their work, the survey was attempting to identify effects which were also likely to be small unless severe difficulties had been experienced. Impacts on clinical work are likely to be a significant factor in individual assessments of the worth of the system.

Many staff are willing to make an additional effort to ensure that record keeping tasks are completed and their clinical work unaffected. A better assessment of the actual effect of the time requirements of the system would have needed to ascertain the amount of paid overtime, entitlement to time off in lieu, work done without pay and any actual increase in staffing. Increased pressure of work would need to be explored more fully and more detail of the reductions in clinical work and their effects would be required.

4.9.3. Other points of interest.

Discussion of the effects of a system on the organisation should not be taken to imply that these impacts are simple: the organisation also affects the system. The study noted a number of points which were not themselves costs or benefits, but which were of use in understanding the situation or how benefits or costs were produced. Some of these points are noted here.

The organisational factors which contributed to the extent to which benefits were being achieved included both practical points and user attitudes. For example, interdisciplinary

team structures, combined, apparently, with the view that information could only be interpreted by a member of the profession concerned, hindered the feedback of information about their own work to individuals. This in turn was a factor which appeared to contribute to the overall assessment of the system. The existence of clerical systems for gathering similar information reduced the advantage of having Comcare without reducing its cost. Mileage claims could not be produced from the system because of schedules operating in another part of the Authority. Factors of this type need to be considered when implementing a system.

The study worked on the assumption that improved information is not of itself a benefit, but should give benefits when it is used. For this reason the interviews with managers established that the information received was considered better than the previous provision, then investigated how it was used and what advantages it gave. In a few cases, very little use of the information was expected, and it appeared that a small number of managers were unprepared to use the information which was available, or saw no need for it. This supported the findings of a recent investigation of information requirements by the Comcare team (see Section 4.5), which used a Critical Success Factors approach (Rockart, 1979). These discussions had shown that managers had some difficulty in identifying their objectives and information requirements, and that most were mainly concerned with the day-to-day running of their departments. Information requirements had now been defined for each staff group. Some future needs were not yet being addressed, though management was aware of them. It seems that if benefits are to be achieved from management information, there is a need for the information provision to converge with an actual need which is perceived by the user, and a readiness to take advantage of the information provided.

A number of staff groups had attempted to reduce the effort involved in data entry. Methods included the adoption of more limited data sets for registering patients, the use of redesigned activity sheets, containing data for a week, and simplified coding systems. In some departments, individual staff had made their own decisions about the information to be recorded, and the professional association of one staff group had advised against the recording of activity timings. Such measures limit the negative effects of the system, but also restrict the information which can be derived from it and so affect its usefulness. Attempts in one department to preserve a high degree of confidentiality by not differentiating between patients had a similar effect.

The question of whether a lack of motivation affects the accuracy of input data was not resolved by the study. Almost all survey respondents claimed to make an effort to

provide accurate data, which was perhaps predictable, but it was not possible to investigate respondents' perceptions of the required degree of accuracy. A number of staff received no personal benefit from the system, and some managers were aware that staff were cutting corners when entering data. However, there were a number of problems and pressures, including the volume of clinical work and the deficiencies (and frequent changes) of input methods and coding systems, which could also have affected accuracy. Some of these were inherent in the software and so not susceptible to management action. Whilst the quality of the information appeared to have improved, problems with accuracy still remain in some departments and there is certainly more than one contributory factor.

Few staff groups were uniformly favourable or hostile towards the system, in most cases there was a fair degree of variety in the responses to survey items. Managers' views also varied from very positive to very negative: one regarded the system as one of the strengths of her service and had produced a culture of information use amongst her staff, a few saw little if any benefit. The accuracy of the information and the availability of other sources of data contributed to their assessments: where no information had previously been available, managers generally found the system useful, whereas opinions were less favourable where there was less incremental benefit, especially if previous systems were still in use. The departments which had least benefit from the change were two where pressures of work were high and similar data was available from clerical systems. There were generally low opinions of Comcare amongst staff in these departments, and written comments suggested that feelings ran high.

4.10. Cost-benefit issues in the health environment.

4.10.1. Measuring costs and benefits.

This section considers the problems of measuring costs and benefits in the Comcare study and in the more general NHS context. The difficulties of cost-benefit assessment of IS were introduced in Section 4.3.1, and were amply illustrated by this study.

The difficulty of determining the value of management information has already been noted, and most of the benefits from Comcare were of this type. It was possible to ascertain the types of decision-making and other uses of the information which had been made possible or aided by the system. These findings demonstrated the difficulties involved: other information sources also contribute to decisions; the information may be

used directly or to confirm information from other sources, in which case the benefit is one of increased confidence in the decision; if decisions to preserve the status quo are taken there is no demonstrable outcome; and the type of decision for which this information is used tends to be one-off rather than a regular use providing a repeatable benefit.

Most of the benefits, including those expected in the future, are concerned with improvements in the organisation's capabilities. These include the ability to calculate accurately the staff cost of providing each package of care; the ability to provide the required mix of skills in each situation; the ability to predict the effects of proposed changes to departments; and the ability to detect changes in the demand for services and to respond to them, including the ability to predict that demand for a service is likely to exceed the contracted level. Separation of the information system from the management process which it supports is thus difficult. Managers discussed "control" in general terms: better information is seen as helpful in increasing their ability to be aware of what is happening in their departments. Some of these benefits are related to the avoidance of risk. There is also a political element in that information can be used in promoting a service, that is, ensuring its continued resource provision. Although the community health services appear to have a common purpose, ultimately there is the possibility of competition between them.

As expected, the evaluation produced assessments of benefits and costs measured or expressed in different ways: monetary values, time, survey results, descriptions of actual and expected uses of information, accounts of operational disruption and management problems etc. Although it appeared that most actual uses of data from the system in decision-making within departments had been identified during the study, as expected it was not possible to quantify the benefits from the use of the information, and had there been more actual use even identifying the applications would not have been possible. Reducing such diverse results to a financial scale was clearly not possible, and had not been intended.

The origins of system impacts can be complex. Some are the effects of interactions of factors of which the system is only one. For example, in the Physiotherapy department the time required for data entry combined with the suitability of the system for the working patterns of the department and the high pressure of work to produce a perception of serious effects on clinical work.

It has already been noted (Section 4.8.3.) that the stated cost of staff time was not an actual change in expenditure, but reflected a range of system impacts including not only

salary costs but also a personal cost to staff and reductions in the service to patients. The use of time or the cost of time as a measure is justified on the basis that it represents the resources which would be needed to restore the level of service, but it cannot be taken to represent the actual impact, even the financial impact. Clinical outcomes are particularly difficult to predict. The condition of patients who are not treated because of a reduction in service may deteriorate, requiring more extensive treatment at greater financial as well as human cost, though the patient may also improve without treatment, or move away.

4.10.2. IS assessment and resource allocation.

The purposes of the current exercise were to provide information for use in planning for the future development of the system and to increase understanding of the factors involved, especially those relating to motivation. The study has produced a considerable amount of detailed information but has not overcome the difficulties of comparison which prevent an overall assessment in financial terms from being made. However, the need to have either this system or one with similar capabilities makes the detailed findings, and perhaps comparisons with other possible methods of providing management information, more relevant than valuations of a single system or decisions about whether the information should be collected.

The identification and measurement of costs and benefits may be used for various purposes: investment appraisal, decisions about the future of a system, problem identification, ensuring achievement of benefits and control of costs, etc. These possible uses of information from a cost benefit study suggest a need for two types of information: a summative assessment for use in resource allocation, and the detailed information needed to increase understanding, solve problems and plan for future development. The approach used in the study proved helpful in providing information at the detailed level, suitable for formative assessment, but some additional or alternative approach is needed for comparisons with other possible systems or other uses of resources.

Information systems are only one possible use of resources, a fact which has been made more apparent by the increasing responsibility of units and districts for their own IS. Decisions about expenditure on IS may involve comparison with other possible uses which including more direct health care applications. During the planning stage of the study a senior manager questioned whether allowing a lower level of management control and allocating more resources to direct health care activities might not produce a better level of service. However, such comparisons are problematic: an assessment of the likely improvements as a result of allocating the resources to the type of care concerned would be needed as well as an awareness of the likely contribution of the system. This is the

type of information which the system in question is expected to provide. To optimise the use of resources would require management to assess the effects of various possible uses on the service given. There appears to be a need to compare the effects of changes as varied as staffing increases, new treatments, purchase of clinical equipment, research projects, management programmes and the information systems to support them. Resource allocation decisions are made more complex by the need to satisfy a range of demands rather than to optimise a single output, and value judgements concerning relative priorities are inevitable.

Not only is the output of the NHS not quantifiable in financial terms, but there is no single measure of the activity or productivity of a unit or authority. The relative priorities of various activities are a matter for debate; there is also the question of service quality. There is no simple way to relate effort or resource consumption to the amount of care delivered or the improvement of health attained. This lack of a measure of overall achievement or productivity renders difficult any approach to evaluation which considers the effects of a system on the performance of the organisation, though a comprehensive outcome measure for a unit or department would raise the possibility of an equivalent to the value-added approach (Strassman, 1985) which was discussed in Section 1.4.3.

Ideally such a measure would be in terms of health care outcomes, as this would reflect changes in effectiveness as well as in the amount of service given. However, activities of many kinds are carried out and although all are aimed, directly or indirectly, at promoting and improving health, some have no clearly defined outcome measure. Measures such as the quality adjusted life year (QALY), which considers the extent and duration of improvements in the quality of life (Gudex, 1986), have been used to measure and compare the improvements in health which result from different treatments, and there are also a number of approaches to the economic assessment of health care programmes (Drummond, 1989). Whilst a comparison of cost per QALY is considered a useful measure of the effectiveness of direct health care interventions, it is normally applied in trials and projects, rather than to measuring the actual outcomes of the work of a unit or department as a whole, which would require a prohibitive degree of effort. Such a ratio would normally vary according to the types of treatment given, and so would not be useful for inter-departmental comparisons. The effects of information systems and other organisational changes are much less direct, less well understood, and can have more widespread effects than the type of project which can be assessed in this way. This is therefore not a practical approach to the problem of resource allocation at this level.

Decisions to acquire IS, therefore, are part of a much larger problem of resource allocation which is itself highly complex. In the absence of a direct or indirect method of measuring the value to the organisation of various uses of resources, resource allocation decisions will involve a subjective element, and efforts have been made to identify methods of reaching a consensus on priorities (Health Service Journal, 1992). However, the general resource allocation problem in the NHS is beyond the scope of the current project except insofar as it affects possible methods of assessing IS.

A further complication arises if there is any compulsion to have the system or to carry out its functions. This can be the result of externally imposed information requirements, but a similar situation arises if the organisation considers that its survival depends on the information produced. In this case, instructions from the Department of Health (1990) made obligatory the collection of a minimum data set for contract monitoring, which must be held in a computer system. In addition, the ability to bid successfully for contracts and to fulfil them will be essential if departments are to continue to operate in the internal market. As it was expected that Comcare would be able to meet these requirements, there was a strong compulsion to keep it or to provide a similar system.

This affected the type of questions about the system which would be of interest: decisions about whether the information should be collected were no longer appropriate, though the detailed findings of the current study would be of use in short-term tuning of the system, and in considering the action to be taken in the future and ensuring that current problems were not repeated in any replacement system. Comparisons between methods of meeting the Authority's needs would also be relevant in planning for the future. Another possible line of enquiry would be the identification of the minimum system needed to fulfil the requirements, though it seemed likely that in this case almost all the information currently collected would be required. This would allow the additional benefits and costs of added functionality to be assessed separately.

4.10.3. Stakeholder issues.

The importance of considering different stakeholder viewpoints in evaluation has been discussed by a number of authors. Land (1976) identified five major interest groups whose objectives will differ: the organisation and its management, customers, employees, those with a financial interest in the organisation, and the community interest. Peccei & Guest (1984) suggest that assessments of programmes of technological change should consider the costs and benefits to interested groups within the organisation.

The current study attempted to identify impacts in three main areas: the organisation at its various levels, including individuals in the performance of their work; staff as individuals; and patients, who correspond to customers in Land's outline (Land, 1976). However, the measurement phase concentrated on the organisational and staff groups, using staff time as a surrogate measure which included the effects on patients.

There was a considerable difference in the impacts of the system between staff groups and even between members of the same profession working in different situations. The type of contact with the system and its usefulness varied between field staff and their managers. Personal costs and benefits varied even between members of the same staff groups, and the stress felt by managers as a result of having to deal with discontented staff was caused in a different way to that experienced by the staff themselves. It is clear that the evaluation process must allow and account for variations in views and impacts if it is to have formative value, and differences in the work situation as well as the level within the organisation need to be considered.

The question of users' assessments of systems whose benefits are to others is of interest. Sandström (1988) studied a group of professional staff within a hospital which used a system whose main benefits were to the administration, and found that their opinions of it were generally low and that they were reluctant to use or to trust it. The Comcare study noted that within the organisational category, benefits were not generally experienced where the main (time) costs were incurred. Fewer than half the respondents to the user survey said that they received useful feedback themselves, but most accepted that the information was needed for at least some of the suggested purposes, i.e. needed by management. Written comments also suggested that users appreciated that the information was needed elsewhere. Although feedback to individuals was strongly correlated with their assessment of whether the system was worth the effort, there were also significant correlations between this general assessment and items concerning use by management. However, not all those who thought the information necessary for good management also considered the system worthwhile or thought that it helped their department to give a better service.

This stakeholder cost-benefit approach seems a useful avenue for identifying costs and benefits and also appears to have some explanatory value. Garber & Fitter (1991) used a similar approach in a study of community systems which was contemporaneous with the current evaluation. They suggest that identification of stakeholder interests in the information to be collected, at the development stage, will allow problem areas to be

identified in advance, and the problems which they envisage are similar to those experienced in the Comcare implementation.

Evaluation by stakeholder groups raises a number of questions. One is that of whom to include, or where the boundary of the evaluation should be set. Cost-benefit analysis within organisations is not like that carried out in public projects, where the total value to society is assessed (Mishan, 1975). Organisations must decide whose interests they wish to promote. Stakeholders in the Comcare system could include patients, community health professionals, clerical staff, Unit information staff, Unit management, managers of individual services, support staff at District and Region, and indirectly even the Department of Health. Where there is an organisational hierarchy, e.g. Unit, District, Region, or both the purchasing authority and provider units may be affected, to confine the study to one organisation may be too simplistic. In a public body such as the NHS, however, the organisation exists to serve community interests, and the study of organisational impacts is necessary because the linkage to the benefits or otherwise to society as a whole is insufficiently direct.

Another problem is the need to deal with contradictory interests. For example, what management sees as increased productivity may be the staff's increased effort and stress, and reduced job satisfaction. Whether personal costs and benefits are included will depend on whether the organisation regards staff welfare as an important goal. It would be difficult to defend the inclusion of considerations of personal power in a study, though they may have been motivating factors in decisions about the system, but at the group level it is possible that commitment to an individual service, though itself desirable, may conflict with the need to resource all departments.

Individuals operate in various rôles simultaneously, and may experience impacts on themselves as individuals as well as in their professional capacity. These rôles may reinforce each other if they have personal goals which coincide with work goals, such as the desire to provide a high standard of care, but they may also conflict. Some of the overlaps in stakeholder rôles are shown in Figure 4.3. Almost all members of the community also have a financial interest: if they or their families are not taxpayers then they are likely to be recipients of other publicly funded benefits. If the interests of external bodies were considered suitable subjects for inclusion in a study, this would be because of the community benefit or their financial interest.
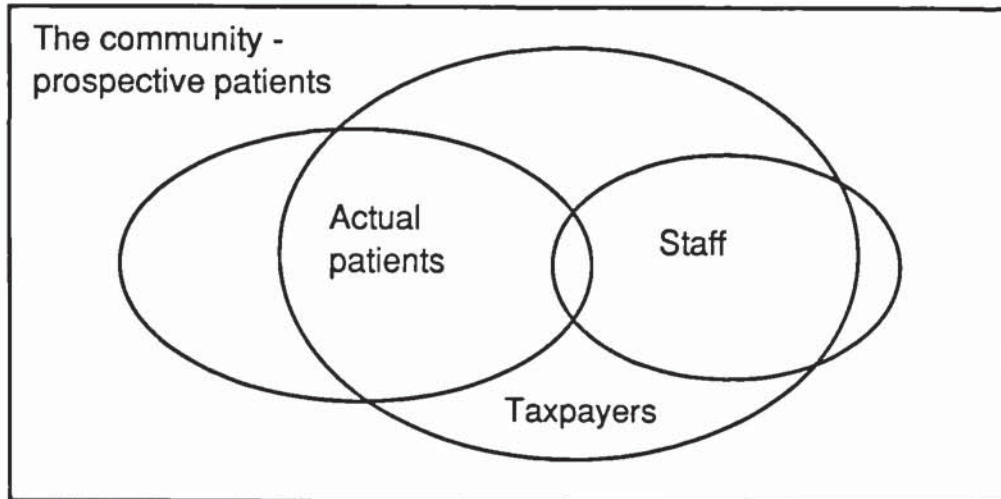
Figure 4.3. Stakeholder rôles.

Indirect effects can be complex, and in some cases benefits or costs to stakeholders outside the organisational group may have secondary consequences for the organisation. For example, a benefit which is sometimes claimed for hospital information systems is that improvements in job satisfaction, a benefit to staff as individuals, may benefit the hospital by reducing staff turnover.

Questions such as the survey item which asked whether the system was worth the effort required are asking the user to evaluate subjectively the very question which the more formal approach of the study has not answered. The trade-offs made in such subjective assessments, which will in any case be made by users because of the human tendency to make informal assessments (Legge, 1984), would be an interesting avenue for investigation. The factors valued by stakeholders will depend on their role in the organisation, their perceptions of the work situation and perhaps also their personal interests. In the current case, for example, a manager might well conclude that the system takes the equivalent of a whole team member to support it, but weigh this against the use of information from the system to request an additional member of staff, or absorb the loss of a post, or reorganise the workload.

In order to gain understanding of a situation, indirect effects and the interaction with other factors within the organisation are very important and whilst impacts should not be over-emphasised by the use of more than one measure, there is a need to include alternative viewpoints. Different measures could be relevant to different interest groups or at more than one level of analysis. This is to be distinguished from double-counting in summative assessments, which is to be avoided.

4.11. Summary.

The action research study described in this chapter began with a planning process which was carried out in order to explore a highly problematic situation and to select an appropriate evaluation approach. A good understanding of the problem situation was gained. It became clear that evaluation was only one of the activities which would be necessary if a development strategy for the system was to be formulated. The final stage of the planning process therefore made use of the knowledge which had been gained to suggest other relevant activities, using a representation of the problem situation as a tool. The evaluation approach was identified on the basis of the preferences and concerns of system users. The planning study can itself be seen as an evaluation exercise as it established the state of the system, albeit in a restricted and informal way.

The chosen evaluation approach was a study of the costs and benefits of the system. The results of the study were quantified as much as possible, but the benefits were almost all unquantifiable. At the time of the study, the costs clearly outweighed the benefits, though benefits were only beginning to be achieved and there was an obligation for the authority to have this or a similar system. The main part of the findings consisted of a detailed presentation of the unquantifiable impacts in each department. This allowed individual situations to be presented, thus giving the information and understanding necessary to consider the action to be taken in the short term. A full understanding required analysis by level within the organisation as well as by discipline and work situation.

The evaluation promised to be useful as a foundation for the future development of the system, though management changes affected its utilisation. The problems of cost-benefit assessment of IS, described in Section 4.3.1, were illustrated by the study, and the use of the approach in the health context has been discussed. Cost-benefit analysis is generally used in summative evaluation, to provide an assessment of the total value or impact of the system. Such assessment of IS presents severe difficulties. However, the Comcare study used the cost-benefit framework as a tool for analysis at the detailed level, where it proved useful as a means of identifying problem areas and strengths, and as a means of structuring an investigation which allowed understanding of the situation to be gained.

Chapter 5.

Breast Screening System: A Post-Implementation Review.

5.1. Background.

This chapter describes an initial post-implementation review of the information system which supports the Breast Screening Service in North Tees Health Authority.

In 1986, a national working group chaired by Sir Patrick Forrest recommended that a programme of breast screening should be started in order to promote the early detection of breast cancer in the most vulnerable age group (Forrest, 1986). Early detection gives a much greater chance of recovery. Women in the age range 50 - 64 were to be called for screening at intervals of three years. A target date of April 1990 was set for the commencement of this service in all parts of the country, although some screening units already existed. The screening service at North Tees came into operation at this time.

North Tees HA provides the screening service for its own area and that of four other authorities. There is a static screening unit and assessment centre at North Tees General Hospital, and two mobile screening units which cover the wider area, remaining at each location for a number of weeks.

The screening service at North Tees uses a computer system to support its operation. This is the Breast Screening System (BSS) written by Oxford Regional Health Authority (Oxford RHA, 1990). At the time of this study, it was in use at about 50 screening centres throughout the country and was being extended by Oxford to provide additional facilities. There is a support network at regional and national level as well as a national user group. The software is in use in all the screening centres in Northern Region.

The system relies on the Family Practitioner Committee (FPC) to identify the women who are to be screened. At North Tees, the screening service uses a three-year rota of the General Practitioners (GPs) and practices whose patients are to be called. The names and addresses of the selected women are provided by the FPC's computer system and transferred to the screening office system using an electronic link. Printed lists are submitted to the GP, who informs the FPC of any corrections to the data and also indicates any women who should not be called for screening. After a corrected list has been transmitted to the screening office, the screening system prints an invitation for each woman. The appointment may be rearranged if the suggested date and time are not

convenient. With the invitation, the women are sent a letter endorsing the service, signed by their GP, and a leaflet about breast screening. It is important that this material should give all the necessary information and encourage women to attend.

When each client arrives, the receptionist (or a radiographer on the mobile units) checks her registration details and takes a history of any previous mammograms (breast X-rays) or breast disease, using a form produced by the system. The form is passed to the radiographer, who uses a second page to enter details of the films taken. The films from each screening session are "read" by a radiologist, who records his or her opinion and proposed action on each client's form. The forms are later entered into the computer system by the office staff. The most common results of screening are:

- Routine recall - the films are normal and the woman will be recalled after three years if she is still in the age group. Letters are sent to her and to her GP confirming this.
- Technical recall (from mobile units only) - a film is faulty and cannot be read. The woman is sent a letter explaining this and asking her to attend for a repeat screening. This will take place at the assessment centre, where the films can be developed and checked immediately.
- Review in clinic - the films show features which require further investigation. The client is asked to attend for assessment and given an appointment.

All assessment takes place at the Assessment Centre at North Tees General Hospital. The woman is examined and further mammograms may be taken. These are developed immediately and examined by the radiologist, who will discuss the result with the client and inform her of any further investigations which are needed. In most cases, assessment does not lead to a diagnosis of breast cancer. Assessment results are notified to the GP and FPC.

The system holds administrative details and clinical information about each client. The clinical information includes aspects of her previous medical history which may be relevant, and details of each screening episode. An episode consists of initial screening and, if necessary, assessment and primary treatment (such as a biopsy).

The basic ethos of the screening team is one of service to its clients. These are "well women", and are never regarded as "patients" unless treatment is required. However, the process of being screened to detect cancer can be worrying and the service aims to provide information and support in order to reduce this natural anxiety. The design of all printed material, including system-produced letters, is undertaken with this in mind. The effectiveness of the unit depends on the rate of uptake of the service which it provides. A

high standard of service is required in clinical matters, personal contacts, and administration. An uptake rate of 75% has been achieved.

5.2. Points of interest in the BSS review.

A number of approaches to the conduct of post-implementation reviews have been suggested. Some of these concentrate on a small number of aspects of the system, or the use of a particular model or technique. Others are more broadly based. A brief tabulation of the recommendations given in a selection of the papers and texts which refer to this subject demonstrates the range of possibilities (Table 5.1). The number of possible subjects for inclusion in the review was large, and a method of choosing appropriate areas was needed. The study commenced with a planning exercise similar to that in the Comcare study, and the factors which influenced the choice of approach are discussed in this chapter. The effects of the local or broader NHS environment on the conduct of the evaluation and the results obtained are also considered.

Particular features of the system and its environment were of special interest. The BSS review was slightly unusual in that not only was the system newly installed, but the service which it supported had not previously been offered. The installation of the system was part of the institution of the new screening service. This was therefore not an evaluation of change within an organisation, and any review carried out within the unit would not involve an impact analysis. Furthermore, the evaluation was to be considered as part of a broader evaluation process covering all aspects of the service. The implications of these factors were considered during the study.

The underlying assumptions stated in Section 1.8.1. were reviewed in the light of the study (see Section 6.4). In particular, the assumption that post-implementation review should be planned before implementation was open to question. There was no previous manual or computerised system with which to make comparisons, i.e. no "before/after" comparisons were possible because there was no "before" situation. The learning curve to be followed by staff would include all aspects of the work, not only the new system. The timing of both phases of the study is considered in Section 5.6.3.

Ahituv et al. (1986)	May include resource consumption, reliability, data quality, flexibility, ease of use, procedure quality, quality of programming, development procedures (whether followed and whether appropriate).
H.M. Treasury (1984)	For office systems. Assess on predefined objectives selected from: value of main benefits & their relationship to costs; project management; the system and its usage; staff attitudes; impact on office work and on the organisation and its procedures.
Cerullo (1979)	Systems personnel, extent of top management involvement in project, information and reports, comparison of direct and indirect benefits with expectations, effectiveness of control systems.
Elam (1979)	Assess on user-defined quality criteria: goals relating to technical and operational aspects, meeting deadlines, availability.
Kendall & Kendall (1988)	Utilities of information: possession by appropriate people; format and content; timeliness; delivered to the right place; able to be introduced and used; helps organisation to achieve its goals.
King & Rodriguez (1978)	Comparisons before and after implementation of attitudes, perceptions of the value of the system, decision performance and the way in which information is used.
Perry & Fitzgerald (1977)	That system operating as expected; that documentation complete - but other factors should be assessed during development. Mainly concerned with the possibility of audit.
Senn (1985)	Whether the system has met its objectives. Mainly concerned with impact on the organisation's costs and methods; organisational changes such as centralisation and changed interactions between members of the organisation; user attitudes. Also quality of output, usability, safeguards against error, user confidence. Audit tests to explore controls and security. Comparison of costs with estimates.
West (1984)	Performance; reliability; quality of procedures; adherence to procedures; comparison of actual with planned costs and benefits; comparison of system with requirements.

Table 5.1. Recommendations for post-implementation review.

5.3. Planning the BSS evaluation.

A preliminary discussion with the screening service manager served to give background information and to secure agreement for the study. The next task was to decide the objectives of the review and the approach to be taken.

The first decision to be made was whether to allow the team members to suggest the nature and subjects of the evaluation, or whether to decide these on the basis of professional judgement and good practice. It seemed preferable to involve the team members in order to use their insights in planning the review, and on the assumptions that the opinions and interests of all concerned parties should be represented and that the most appropriate subjects for evaluation will be dependent on the organisational situation (see Section 1.7).

The timing of the planning phase was open to question. It was scheduled for a point after installation of the system had commenced but before operational use started. Both practical constraints and research interests were involved in this decision. The lack of a previous system challenged the assumption that planning should take place before implementation in order for comparative measurements to be taken. There was in principle still the possibility of using logging techniques in the early stages of the life of the system. The accuracy of people's expectations, and the validity of their concerns, were of interest in considering the planning of reviews. At a practical level, the screening service team was small and most key staff were expected to be in post by this time. The interviews were able to take place at a time when there were no operational pressures associated with the screening service, though staff still had other responsibilities, and the review itself could take place soon after implementation. The validity of this decision is considered in Section 5.6.3.

The planning phase involved interviews with representatives of all available disciplines. The alternative of a group discussion was rejected on the grounds that it would require more time from each participant and be more difficult to arrange: interviews can be more flexible, though more time-consuming for the interviewer. The exchange of views and explicit consensus which could have been gained from a group session was thus lost. Interviews can give the opportunity to explore specific topics in detail, but in this case the screening service requested that they should be of short duration.

The planning interviews took place in November 1989 and January 1990, finishing $2^1/_2$ months before the commencement of screening. Input to the system began in the period between the two groups of interviews. The intended interviewees were the consultant

radiologist, surgeon and pathologist, the service manager, the superintendent radiographer, the nurse counsellor, and the District Health Promotion Officer. These were all the team members so far appointed, with the exception of a clerical officer who had had no involvement with the system when the interviews were planned. It was expected that the superintendent radiographer would represent the views of her profession, and that at this stage the screening office manager would represent the interests of the office staff. Contact was made with the support team at Northern RHA, and the person responsible for supporting the system at North Tees was also included in the interviews.

The planning interviews were intended to be conducted in the same way as those for the Comcare study, using a similar interview outline which ascertained what contact interviewees or their staff would have with the system, what aspects of the system were considered most important, and what areas of concern had been noted. The same planning aid was used, after slight revision, though examples relevant to this application were identified for use in the discussion. In practice there were some divergences from this plan. One team member had been in post for insufficient time to become familiar with the functioning of the service. A second interview was arranged for a later date, but the planning aid was explained and left with the interviewee so that she could consider her responses in the interim. Another participant preferred to keep the planning aid and write with his suggestions: a detailed letter containing areas of interest and concern was received. The consultant surgeon was unavailable for interview, but the purpose of the interviews was explained by letter so that he would be informed about the project.

A number of factors seemed relevant to the planning process:
- The system been installed very recently; its use commenced in the period during which the planning interviews took place.
- Most of the staff were recently transferred or appointed, though the service manager and the consultants had been involved in planning the new service for some time. When the evaluation was planned, most people had little knowledge of the system and had not been involved in its implementation. There had been no development process within the organisation.
- The system would at first be largely operational in function as the parts which would provide statistics and information for management had not yet been developed. It was known that other modules of the system were likely to be revised as a result of the experiences of earlier sites.
- Other evaluation was likely to take place within the service.

- The software was a package; not only had it been developed elsewhere, but technical support was provided by the RHA, so that the scope for changes to the software was limited, and some aspects of monitoring were already the responsibility of other bodies.
- A new release of the software with many additional facilities was expected shortly after screening commenced.

The key areas, concerns and suggestions were identified from the interview notes and ranked, as in the Comcare study. A plan for the evaluation was proposed by the researcher on the basis of the suggestions made and the interests and concerns expressed, rather than in a joint process with system users.

The planning phase for this study had a slightly different focus from that which preceded the Comcare study, and the interviews varied in usefulness. Whilst it was possible to discover concerns about the system, some of the team members found it harder to discuss the aspects which were most important for them, or to envisage an IS evaluation and to decide which aspects of the system would be of most interest to them if evaluated. The plan which was formed may therefore have a bias towards the ideas of those who had definite views. There was more emphasis on identifying areas of importance. There seemed to be a tendency to assume that as the interviewer had a knowledge of information systems, she was in the best position to decide what would be worthwhile.

The main reason for this was lack of familiarity with the system and the future operation of the service: concerns related directly to the system were those which had been gained from discussions with colleagues in other centres. Although training was in progress, staff were not familiar with the way in which their work would be organised, or with the system. It would have been preferable, from this point of view at least, to leave the planning until the implementation had progressed further, when a greater degree of knowledge would have been gained.

Planning the review involved consideration of the other evaluation work which was to take place. The service was part of a national initiative and considerable emphasis was placed on quality. Evaluation of all areas of the service was planned. A network of quality assurance groups relating to the professional disciplines involved (Radiology, Surgery, Pathology, Health Education and IT) had been set up at regional and national levels. North Tees was well represented on these groups. It was possible that some of their activities, and some of the monitoring carried out by the support team, would overlap with topics which would be natural subjects for a post-implementation review. This study was seen as part of a broader evaluation process and its boundaries were

determined accordingly. The alternative would have been to seek agreement to duplicate (and thereby implicitly assess) other work.

Clients of the screening service receive computer-generated letters; they see the receptionist using the system and are aware that their medical details are held on the computer. Factors which influence the attitude of women to the service can have an effect on their decision to attend, either for the first time or when recalled. They can therefore affect the uptake of the service and its effectiveness in detecting disease. It would seem reasonable to regard the clients as stakeholders in the system and to treat their attitudes as a valid subject for inclusion in a post-implementation review. The wording of the invitations and other letters produced by the system had been extensively discussed. Their effects were of interest to most members of the team. Investigating the reactions of clients to the system outputs would have been an interesting evaluation exercise. However, it would have been relevant not only to consideration of the information system, but to client satisfaction in general and perhaps also to reasons for non-attendance. As discussions continued, it became likely that Regional funding would become available for an evaluation of the health promotion aspects of the service, which would include these areas. The letters were therefore not included in the IS evaluation.

The cost of the system was not included in the review, as only initial costs could be covered and service costs were already the subject of regular monitoring by the finance department.

Whilst there were service objectives for the service as a whole, there were none which related specifically to the information system. This was not surprising as the system was seen as an integral part of the service rather than as a discrete entity, but would have made difficult an objective-based approach to evaluation.

After a final discussion with the service manager, a proposal was produced and presented to the group responsible for service evaluation. This group had been a significant factor in the institution of the service as it had been responsible for co-ordination and planning. It had now changed its rôle to one of monitoring and evaluation. All disciplines involved in the service were represented, as well as management and finance. The group's agreement to the review was secured.

Most parts of the system became operational at the commencement of screening, though data capture started several weeks earlier. The suggested date of the review was four or five months after screening started. The survey of evaluation in health authorities showed a wide variation in the timing of the initial post-implementation review (Section 2.4).

This was a relatively early review, and the full workload had not yet been reached. This time was chosen partly for practical reasons, and partly in order that recommendations would be able to be adopted at an early stage, before problems became entrenched. It was expected to allow enough time for most problems to become apparent and for familiarity with the system and procedures to be gained. A new release of the software which involved important changes was due to be installed by the chosen date. It was emphasised that only a preliminary review could be performed at this stage. The effects of this timing are discussed in Section 5.2.3.

Contact with other sites had raised concern about the usability of the software, and especially about the suitability of the appointments module for use in a busy office. The information provided by the system was another area of general concern, as it was known that deficiencies existed. Work on the software was taking place and the next release was expected to improve the situation. Although there was no possibility of change to the software as a direct result of the review, it would have been possible to pass comments to the developers through the regional representative on the user group. It was considered worthwhile to investigate this area as part of the review.

The review was to include topics from the "usage/usefulness", "system impacts", "organisational concerns" and "user-related" groups in the planning aid (Appendix E), though discussion of "impacts" was not particularly appropriate. It seems to have been seen internally as a review by an independent IS professional for the purpose of quality assurance, with the possibility of making improvements as a result of the recommendations made. Its main emphases were on quality and the identification of problems.

The areas to be covered were:
- The computer system itself, including usability and any problems experienced.
- The collection of data.
- Operational procedures.
- The provision made for the information requirements of team members.
- Confidentiality and security of data.
- The equipment and physical environment.
- Supporting facilities.

The methods used were to be kept simple: interviews, informal observation of the screening office at work, demonstrations of the system and access to relevant documentation. As preparation, the office staff were asked to log any problems which

occurred. The small number of staff involved made survey techniques inappropriate. The amount of time required from staff was to be as small as possible.

5.4. The review.

The main part of this review took place in the last week of August 1990, when the service had been in operation for five months. Peak workloads had not yet been reached as only one of the two mobile units was in use. The review was based on demonstrations of the system, relevant documentation, and discussions with those members of the team who had contact with the system or its inputs or outputs or who had relevant information requirements. By this stage, the team was almost complete: radiographers, clerical staff and a second consultant radiologist had been appointed. The superintendent radiographer was again the sole representative of her discipline, as it would have been disruptive to interview her staff, whose work is closely scheduled. It would nevertheless have been preferable to include one or more radiographers, as those staff present in the static unit at the time of the review were keen to make known their opinions and to ask questions about the system. The second radiologist felt that he could add little to his colleague's opinions, so did not participate.

There were now four office staff. However, because of changes within the hospital, two of these posts could not be filled permanently and a succession of temporary staff on two month contracts had been appointed. The current post holders were recent arrivals and were receiving training: rather than holding full interviews with these staff, less formal discussions were held and the interviewer took the opportunity to attend a training session. The two permanent office staff demonstrated the system and gave information about office procedures, security, and supporting facilities. They were also asked to describe any problems which had been encountered and to give their opinions about their working patterns, the office environment, the equipment, ease of use and ease of learning of the system, and the training they had received.

The other interviews were planned individually, but all covered:
- The individual's contact with the system.
- Opinion of documents and parts of the system used.
- Any problems encountered.
- Information requirements and the extent to which these were met.
- Any specific points raised in the preliminary interviews.

A number of difficulties were experienced in carrying out the study. The researcher requested that the interviews and other activities should take place in a period of about eight days in two consecutive weeks, and that a location in the office should be found for the researcher. This would allow exposure to the work of the office and informal contact with staff. However, the amount of work to be done in the screening office is predictable but irregular and it was preferred that the visit should be scheduled for a period which was expected to be relatively slack. This resulted in an interview programme which was condensed into four days. The screening office had insufficient space for its own staff and equipment: accommodating extra personnel for the purpose of observation was not feasible and there was in any case insufficient time for this. It was possible to examine the office and equipment from the point of usability.

The requested logging of problems did not take place: apparently there had been no problems other than those caused by unfamiliarity with the system, which had been easily solved by a telephone call to the support team. The interviews and demonstrations suggested that this report was not entirely accurate, as a number of system problems were outstanding, though none of these had caused major disruption. A telephone discussion with the support team served to clarify queries about the software and the future development of the system. The expected new release of the software had not yet been installed; this was regrettable as the usefulness of parts of the evaluation was reduced.

The interviews which took place achieved their objectives and there was no difficulty in covering the material. As with previous studies, some participants treated the interviews as a chance to ask questions about the system. However, the consultant surgeon was again unavailable due to the pressure of his clinical work. It proved impossible to make an alternative appointment: the study was therefore unable to take into account any requirements of the system relating to surgery or the viewpoint of this member of the team. This was in fact one of the most complicated areas of the system.

Relevant documents such as system manuals, forms and policy statements were made available. These provided useful background information, and the usability of forms and manuals was considered. This part of the study took place as planned once confusion about what documentation actually existed had been resolved.

The main findings of the review are summarised in the remainder of this section. A report for management was produced: this will be found in Appendix G.

The review produced few recommendations for change. The service was well managed with an impressive level of attention to detail, and appeared to be operating smoothly. Efforts were being made to provide a good working environment and satisfying job structures for the staff. The few problems which existed were in the main minor or beyond the control of the service. Teething troubles had arisen because of lack of familiarity with the system and because of differences between the office procedures at North Tees and those envisaged by the systems designers. Lack of time was beginning to be a problem although the full workload had not yet been reached. This was not aided by a reorganisation of the hospital which had necessitated the appointment of a series of temporary clerical staff, requiring a considerable effort in the training of newcomers.

Some problems with the usability of the software were noted. System manuals were confusing in their presentation and lacked detail in parts. Ergonomic aspects of the equipment and its surroundings, whilst not always completely in line with the latest recommendations, were quite reasonable, with the exception of the receptionist's position which was unsuitable for the regular use of a terminal. The main problem was one of space: this had been obvious for some time but it was unlikely that anything could be done about it. The situation had arisen because the planning of the office space had not taken into account two large machines. Recommendations were made about a few points, including good working practices for terminal users.

System performance was not investigated, as this was the responsibility of the support team at Northern RHA, and the intention was to complement other work rather than to repeat it. However, a subjective impression that response time was poor for such an early stage in the implementation was noted and continued monitoring advised: response has in fact deteriorated as use of the system and the amount of data held have increased.

Deficiencies in the information provided for service management were a problem. Although a few statistical reports were produced, these were difficult to interpret and did not contain the information required for monitoring the workload and uptake rate. Additional facilities had been promised, but in the meantime the clinical departments had made other arrangements: one consultant was using his own personal computer to monitor the assessment workload. The needs of the Health Education department were not met by the system-produced reports, and although most of the relevant data could be collected, it was not being recorded. The Health Education department, which is responsible for promoting uptake of the service, had not been involved in this decision and its information requirements had never been discussed.

5.5. Follow-up visit and feedback.

A follow-up visit in which the report and subsequent events were discussed with the service manager took place eleven months after the review. This section gives the substance of that discussion. The timing of the visit allowed the service to develop, so that it was possible to see whether expected changes had taken place.

The evaluation report was circulated within the screening team. Although it did not recommend significant changes, it was found quite useful as it confirmed that the system was operating on the right lines. Recommendations were being followed where they were in areas over which the service had any control. (Some of the suggestions concerned additional information requirements; these would require further development of the system.) Comments which confirmed that current practices should be continued were considered worthwhile as they encouraged attention to areas such as security and good working practices for terminal users. Software problems were being recorded and reported to the support team, as recommended in the study.

Some recommendations had not been followed: for example, it had been found totally impracticable to allow staff more time for familiarisation, and, as expected, no additional office space had become available.

Many of the software problems which were causing concern at the time of the review had been overcome as familiarity with the system increased: in some cases, solutions had been found even before the report was received. However, some of the problems had arisen from differences between the ways of working envisaged by the software designers and those in use at North Tees, and the solutions had involved changing working practices to accommodate the system.

Some of the recommendations were about ways of easing the introduction of the system, such as aids to form completion. These became less important as staff became familiar with the system. This type of comment is useful for learning about systems and how to implement them, but was found less relevant to the continued use of the system at the review site. The training of new staff was not considered a problem by this stage.

The follow-up interview suggested that the timing of the review was not ideal from the point of view of the service, because the system was new and because changes to the software were expected. The team was not yet familiar enough with the system for the review to be fully effective. Everybody was new to the service, and information requirements were not understood. Concerns were raised which would not have existed a

few months later. The review would have been more valuable at a later stage when everybody was fully trained, perhaps at about the time of the follow-up interview, as it would then have been more likely to detect deviations from good practice. However, the value of an early review was in setting up good practices: this could be seen as its prime objective. The subjects which were covered were as required, with the exception of aspects related to primary treatment, which had to be omitted because of the pressure of the consultant surgeon's clinical work.

The survey which was expected to be carried out by Health Promotion, which would have included the quality of system produced letters, had not taken place, but a member of staff had been appointed at Region to carry out this type of work and an investigation was expected. A good uptake rate had shown that this area was not a problem, making both the survey and the lack of information provided by the system for health promotion of less importance.

The five national quality assurance groups continued to function and had been valuable in their own fields, developing guidelines at national level. The local evaluation group continued to meet every two months so that problems in any area of the service could be reported. The meetings were brief as the service was running smoothly. Lack of space was a continuing problem and the workload had proved too great for the number of staff, but only one additional person had been appointed as there was no more room available.

It appeared from the discussion that the review had been of more interest to the screening office than to other departments, and that the experience had given a degree of confidence in the evaluation process. A subsequent review would be considered if the opportunity arose. It was considered important that the time required of team members was not great, and that the investigator came from outside the organisation. An unfavourable report would have been considered sensitive.

5.6. Assessment.

5.6.1. Conduct of the evaluation.

A few comments may be made about the conduct of the evaluation at a practical level. The study was considerably shaped by circumstances. It would have benefited from more detailed discussion and more explicit agreement about the methods to be used and the contribution of the screening service to the study.

The review achieved its objectives of assessing and suggesting improvements to the system to some extent, as assessments and suggestions were produced and some of the recommendations were followed. However, a closer investigation would have been preferable. The time constraints made it impossible to give more than superficial consideration to the office procedures, information requirements and other aspects of the study. Under these circumstances, it is difficult to give an independent assessment of the problems and views reported in the interviews. More time to become familiar with the software and office procedures before starting the main interview series would have been very useful.

The choice of interview participants allowed all the departments which have contact with the screening service to be represented. However, greater involvement of the radiographers and involvement of the clerical staff in other departments who have contact with the system documents would have been preferable.

As with the other studies, flexibility was needed to accommodate the schedules of busy clinicians. The demands of clinical work are not always predictable. Interviews were carefully planned and lasted no more than an hour, except in the cases of the service manager and the office staff who also demonstrated the system and described procedures in detail. However, the amount of time spent with the service did not allow sufficient flexibility to ensure that interviews could be rearranged if necessary. The practical difficulties of visiting the site, which is not easily accessible, reduced the flexibility which was possible in the interview schedule.

When planning the review, the opportunity to speak to the evaluation group, which consisted largely of the consultants and managers whose services would be involved in the review, served to gain the agreement of system users to the approach and the content of the evaluation, although there was little debate. This was preferable to the situation in the Comcare evaluation where plans for the proposed study were presented to the intended participants at a slightly later stage.

This evaluation had a fairly low profile in the organisation, and it seemed that there was an inevitable conflict between the needs of the review and the pressures of clinical work and the operation of the service, which will necessarily have a higher priority. The screening service did not have sufficient slack resources to allow much effort to be devoted to a study of this kind.

5.6.2. Content.

This section considers the areas chosen for evaluation in terms of whether an assessment which produced learning was possible and whether there was scope to apply the knowledge gained.

The computer system itself was the most difficult subject of assessment, as it was not possible to become sufficiently familiar with it. The physical aspects of usability could be demonstrated, though the screening service was dependent on the software suppliers for any changes to the system. The match between the system and the users' conception of their work (Eason, 1988) seemed a less appropriate concept in a situation where the structure of the work was initially determined to a large extent by the structure of the system, and was not assessed. The match between the system and the preferred methods of working in the screening office was a more valid subject: this was approached by asking where difficulties had occurred.

The time constraints and lack of familiarity with the service made consideration of software problems, whether actual errors or mismatches with requirements and procedures, both difficult and somewhat superficial, and the value of the attempt can be questioned. Little if any new understanding of these areas was produced, as the software was seen largely through the eyes of the system users, supplemented by demonstrations and rather inadequate system documentation. The evaluator spent part of the time on site learning about the system, despite preparation by reading the manuals, and felt that any independent identification of software problems would have been highly unlikely as the system was not well enough understood. The only apparent design flaw which appeared to have been discovered by the review did not in fact exist in the software: incorrect documentation was at fault. Time spent with an expert on the system would have been more likely to provide users with explanations of these difficulties than time spent discussing them with an outside evaluator. However, it appeared that the study could be used to communicate the difficulties experienced by individuals.

Assessment of data entry procedures and forms was possible, though again, examination of the screens in the computer system could not be very detailed. There was some potential for tailoring screens within the system, but the format of system produced documents was fixed. Comments about these were made, but only recommendations about the way in which documents were used could be followed. The assessment of operational procedures was limited by the time constraints, as described in Section 5.6.1. Checking conformance to procedures was not possible without monitoring over a longer period, though quality assurance checks on a sampling basis were in fact regular practice at this stage. Deciding whether the procedures themselves were appropriate was a matter for judgement, but again required familiarity with the operation of the service.

The provision made for the information requirements of members of the screening team was lacking in important respects, and alternative measures had been taken. However, little attention was given to this area in the review as the expected arrival of new facilities made it irrelevant in some disciplines.

The measures taken to protect the confidentiality and security of data seemed satisfactory, and only general advice was given in this area, though attention over a longer period would be needed to ensure that security procedures were in fact followed. The equipment and physical environment could easily be examined, though it was too late to make more than minor changes here. Assessment of some supporting facilities, such as the support organisation at Region, was dependent on the opinions of system users. The system documentation was made available, but changes to this were beyond the control of North Tees although comments were made and in one case a supplementary aid was suggested.

It is suggested that a review can generate useful knowledge not only by the use of expertise in IS and evaluation to identify hitherto unknown problems and to produce new assessments, but also by bringing into the open problems which are known only to individuals and assessments based on the viewpoints of particular individuals or stakeholder groups. Similarly, if a study is to make recommendations or suggest solutions to problems, these may arise from the application of the evaluator's knowledge or from the insights of system users.

Utilisation of the evaluation in areas where no change was possible would be limited to the learning which took place within the screening team, unless it was decided to pass on comments to the software providers. This was left to the discretion of the team and was not done.

It appeared that the type of review required by the service was a brief study by a disinterested party with the relevant professional knowledge, concentrating on the assessment of working practices and the installation against good standards of practice. The areas included in the review were chosen with this in mind, but it seems reasonable to assume that different interests on the part of those commissioning the study would have made other areas seem relevant. For example, the service manager was concerned to ensure a high quality of working life for her staff, and questions about this were included in the interviews with the office staff.

There seems to be enough evidence to suggest that a post-implementation review can help to improve aspects of the system which require attention (see Section 2.4.4), and it is suggested that a broadly based review is appropriate for this purpose. In the BSS study, a number of areas were covered at a high level. Some topics were omitted specifically because they were the subject of other review and monitoring, and other aspects of the service were also the subject of evaluation. Other topics, such as the implementation process, were not of interest to the service.

5.6.3. Timing.

This section discusses the timing of both the planning phase of the study and the main review.

The planning phase spanned the implementation of the system, as initial data entry began between the two periods in which the interviews took place. Training had commenced for some staff, but full operational use had not yet started. It has already been noted that this led to a lack of familiarity with the system at the time of the planning interviews.

When the concerns which existed at the planning stage were compared with the problems which actually arose, it was found that some points had arisen because interviewees were not familiar with the system, but the general impressions gained from other sites were fairly accurate. The outline of the office procedures was determined at an early stage, but the details of manual and computerised procedures were refined once system use started. An early concern in the Radiology Department about the need to use a second, completely separate system for this aspect of their work did not last.

As there was no need to record data relating to a previous system, it appears that there was less need for this study to be planned at an early stage. The interviews could even have been held once the service was operational, and indeed the meeting of the evaluation group which agreed the scope of the review took place a few weeks after screening

commenced. However, this would have been less convenient for the screening team. Any evaluation subjects which required data to be recorded from the start of operation would need to be planned in advance. Such recording might include support and other costs, or event logs related to the implementation process.

The survey (Chapter 2) noted that most reviews took place 6-12 months after implementation. This was therefore a relatively early review, and as noted in Section 5.5, the timing was not considered ideal.

There are arguments in favour of both early and later post-implementation reviews. A review shortly after implementation should allow problems to be corrected and undesirable trends identified at an early stage, so that action can be taken before serious consequences have arisen. A later review allows troubles which are caused entirely by unfamiliarity with the system to pass. One suggestion which seems sensible is that the system should be reviewed when all procedures and parts of the system have been used. The problem here is that parts of the system which are used on a long cycle, such as year-end procedures and annual statistics, may not be tested until the system has been in action for some considerable time. Where the review is concerned with the achievement of objectives or benefits, or with recording costs, some of these may also require a longer time-frame.

The BSS evaluation illustrated the problems of an early review. A process of finding and resolving difficulties was in progress. Staff were still becoming familiar with the software and with other aspects of the work of the screening service. Procedural questions were still being considered, and the assumptions of the software designers could determine how the service would operate.

The review gave a picture of the situation at a particular point, as almost all the difficulties noted in the report were already known. A later study, when the situation was more stable, would have spent less time on problems which arose from lack of knowledge and which time and the normal support arrangements would soon overcome: any problems raised would have been more likely to be of lasting concern. However, even at the stage of the follow-up visit, there did not appear to be any serious problems with the system. Naturally, this was known only with hindsight.

The experience of this study, which is of course only one example, suggests that whilst an early high-level review was potentially useful, a later study would have been more appropriate for detailed evaluation or for an evaluation with a more summative purpose.

The time at which aspects of a system can in practice be evaluated will vary. For example, post-evaluation of the physical environment did not require the system to be well-established, or even operational, but merely that the equipment and furniture should have been installed.

A phased evaluation, considering aspects of the system at times appropriate to each, is a possible strategy, and a few of the authorities which responded to the survey (Section 2.4) carried out several reviews in the first year of system life. This would have the additional benefit of spreading the evaluation workload and any disruption caused to the service. The earlier part of the study could then be at an overview level unless areas requiring immediate attention in detail were discovered. Regular reviews throughout the life of the system also appear useful (Lientz & Swanson, 1980).

However, some of the problems discovered could not be remedied at any stage after implementation, notably the shortage of accommodation for staff and equipment. This suggests a need for validation during the planning of the system. Other aspects of a system such as *software usability would also benefit from evaluation during* development.

Many of the problems encountered in the review were the result of unfamiliarity with the system. The review found that staff had not been given sufficient time for familiarisation before the system became operational. *Better familiarisation and practice on the training* system might well have revealed some of the difficulties and especially areas where the main problem was lack of knowledge. This would have reduced the difficulty of separating genuine problems from those which arose from unfamiliarity.

5.7. Discussion.

Section 5.3 gave a full account of the planning of the review. The factors which were taken into consideration can be summarised as follows:

- The purpose of the review was seen as ensuring the quality of the system and improving it where necessary.
- The areas for evaluation were chosen on the basis of the planning interviews. These identified the areas which were seen as most important, and perceived risks and deficiencies which were known from other sites.
- The main function of the system was the routine operation of the screening service: this led to an emphasis in the review on data collection and operational procedures.

- Management was interested in good working practices, accordingly, a number of user-related factors were also included.
- The desire to identify and overcome any problems or poor practice led to an early timing for the review.
- The close integration of the service with the system it supported was a significant factor (see below).
- A low time commitment from team members was requested by the service. This reflects the demands of clinical work and the operation of the service.
- The existence of other evaluation initiatives affected the choice of subject areas, as this work was not duplicated.
- The fact that the service itself was new limited the choice of evaluation approach (see below).
- Planned developments in the system were also a factor in the choice of timing, as the intention was to carry out the review once the new facilities were available, but in the end the new software was not available when expected and the scope of the evaluation was limited as a result.

An interesting aspect of this review, especially relevant in the planning stages, was the lack of a clear distinction between the information system and the administration of the service which it supported. This was made apparent by the obvious dependence of the service on the IS, the wide distribution of system produced documents, the lack of service objectives specific to the system, and the influence of aspects of the system on parts of the service as diverse as appointment scheduling and health promotion. It would have been difficult to define a boundary for the system for the purposes of the review.

This lack of differentiation was not only a result of the service itself being new; if another system were introduced at some stage this would also be closely integrated. However, it was made more apparent by the fact that the introduction of the system was not a change within the service.

The evaluation was seen as part of a more general process of evaluation covering all aspects of the service, and integrating the current review with other evaluation activities was an important part of the planning process. Most of the operational procedures of the screening office were based around the information system, and to try to distinguish between system procedures and others would have been artificial, restrictive and unhelpful. Had a review of the operation of the service been commissioned, there would have been a considerable overlap with this study. The situation demonstrated the difficulty of considering an information system in isolation from its environment (Kling &

Scacchi, 1982) and in effect, the entire screening office operation was treated as the unit of analysis.

There was no question of studying the effects of introducing the system in this situation, though the impact of the service would be a valid concept. This could involve both clinical outcomes and the effects on the workload and operational procedures of the related departments (Pathology, Surgery and Radiology). The only question raised during the study which appeared to be a question of the impact of the system was the situation in the Radiology department, where staff were at first concerned at the prospect of using two separate computer systems.

Aspects of the organisational environment also affected the conduct of the review. The climate within the organisation was favourable towards evaluation. This reflected the nature of the screening programme nationally, in that there was an emphasis on monitoring and quality assurance. Evaluation in a number of areas was being undertaken by authorities in co-operation: the proposed study in the Health Promotion area was an example of this.

The experience in this study reinforced the need, when planning or conducting evaluations, to reach an accommodation with other priorities. The screening office was already beginning to experience pressure, although the full workload had not yet been reached. Clinical workloads can be high and unpredictable. This led to a conflict of interests between the needs of the service, which needed the evaluation to require as little time from team members as possible, and the needs of the review for detailed information and familiarity with the system. Clinical pressures combined with other practical constraints on the review to prevent an important area of the service, surgery, from being included in either phase of the study. It appears that this conflict is inevitable: an activity such as an IS evaluation cannot take precedence over the demands of clinical work or the day-to-day provision of a service.

There was no IT support within the district at all, so no possibility of an internally conducted review. However, an external reviewer was also the preference of the service manager, because such a person was perceived as unbiased. An unfavourable review would have been considered sensitive.

The fact that the review of the IS was not an evaluation of change within an organisation gave an emphasis to the interviews which was rather different from those in the Comcare study. There was no previous situation to act as a reference point for the discussions, and the assessments made by individuals could not be based on comparisons.

The physical environment could have imposed a constraint on the methods which were used during the review. The use of observation techniques was considered at one point, though not in the end attempted. However, lack of space in the screening office would have made this impossible: there was nowhere that an observer could have been stationed without causing considerable inconvenience to staff.

The usefulness and perceived importance of the evaluation results were affected by various factors. The changes in the software implementation programme made comments about information provision less useful and restricted the scope of this part of the investigation as those parts where new software was expected imminently were not included. However, the satisfactory uptake rate reduced the importance of the lack of information for health promotion purposes, and the availability of a consultant with a PC and the necessary skills reduced the impact of the poor information provided for service management. Interestingly, this solution, which was regarded as a temporary substitute for suitable facilities in the system at the time of the review, had become accepted and accommodated within the radiology department by the time of the follow-up visit.

As the office staff were not yet entirely familiar with the system, and there was no internal support, the researcher's familiarisation process was made more difficult as questions could not always be answered.

A few comments may be made about the utilisation of the evaluation results and recommendations.

The review was intended to be formative: the intention was not to assess how far targets or objectives had been met, but to suggest how the system and its operation could be improved. The study suggests that a formative evaluation need not only be concerned with recommending change. The approval given to some aspects of the service and the encouragement to give continued attention to good practice was seen as part of the shaping of the service and was considered worthwhile by management.

Learning for future implementations was seen as an important benefit of post-implementation evaluation by survey respondents (Section 2.4.4). However, it appeared not to be of great interest in this evaluation, perhaps because introducing new systems was not a normal activity of the screening team. Comments which were mainly relevant to the early part of the implementation, i.e. those which related to training or aids for system users, were not seen as useful: these were not current problems. Comments of this sort could have been helpful if the organisation was interested in applying them to

future implementations, and in this case might have been relevant to the installation of the next release of the software, which introduced significant changes. However, suggestions which related to the need to gain greater familiarity with the system were not considered feasible.

5.8. Summary.

This section gives a brief summary of the main points of the chapter.

The evaluation described in this chapter was a post-implementation review. Its subject was a newly installed system which supported the operation of a screening programme which was itself new. This was a formative study which covered a number of areas, not including cost or performance, in a fairly informal way. The main emphasis was on data collection and operational procedures, though user-related areas and information provision were also included.

The planning phase of this review took place before staff had experienced the system for themselves. The impressions which they had gained from other sites were fairly accurate at a general level, but less precise about points of detail. Some knowledge of the system is necessary for a planning exercise of this type and the planning phase could usefully have been left until later, as in this situation there was no need to collect data relating to a previous system

There was not a clear boundary between the system and the service of which it was a part, and much of the operation of the service fell within the scope of the review. The areas chosen for the study were selected on the basis of their importance to system users and the concerns expressed in the planning interviews, but the existence of other evaluation activities within the service was also a factor.

The review was considered useful by the service manager. Some of the recommendations were followed, especially those concerned with ensuring good working practices. However, the system was not yet entirely stable at the time of the review, and procedures were still being defined. A number of apparent problems were found, but most of these were the result of unfamiliarity. This affected the usefulness of the evaluation.

The study was constrained by operational necessities, and especially by the lack of available time for participation in an evaluation, which restricted both the coverage of the

study and its depth. The availability of time is seen as reflecting the priority given to the activity. As even important managerial activities will not willingly be allowed to take precedence over actually providing the service in this environment, *an evaluation study needs to be able to give useful results in the time which can be committed to it.*

Chapter 6.

Discussion and Conclusions.

6.1. Summary.

The research project described in this thesis aimed to investigate the state of practice of IS evaluation in the NHS, and to explore the effect of the local and wider NHS environment on the conduct of evaluation. The approaches used in three evaluation studies relating to different parts of the life-cycle were considered, and the factors to be taken into account when planning post-implementation evaluation were of particular interest.

The survey of health authorities explored the extent to which evaluation is practised in the NHS and the aspects of systems which are investigated during system selection and after implementation. Of considerable interest were the opinions of IS managers about the advantages gained from post-implementation evaluation, perceived deficiencies in their own practice of evaluation, the problems which they had experienced and the constraints which prevented changes and improvements to their evaluation procedures. The responses allowed a number of factors in the NHS environment which affected the practice of evaluation to be identified, principally a lack of staff and other resources, management attitudes, and changes in the local and national NHS environment. Similar factors were observed during the action research studies, which observed the effects of organisational and environmental influences on the conduct of three specific evaluation exercises. The project was thus able to investigate these factors by a combination of methods.

The action research studies also considered issues related to the specific types of evaluation undertaken in each. The HISS study was concerned with the requirements for a procurement procedure, and viewed procurement as a process with organisational and political dimensions as well as a decision-making exercise. The main focus of the Comcare study was the measurement of costs and benefits; the difficulties of cost-benefit assessment of IS were examined, and in particular the difficulty of making an assessment of the total impact or value of the system. The Breast Screening System review considered the timing and content of a review shortly after implementation. The planning of post-implementation evaluation was also an important consideration: a procedure for defining a relevant approach was used and assessed, and the factors considered in planning decisions were examined.

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This chapter extends the discussion in previous chapters by addressing subjects which are of concern in more than one of the four pieces of practical work, i.e. the three action research studies and the survey, and presents the conclusions of the project.

The effect of the organisational environment on the process of evaluation has been of interest in the survey and all three evaluation studies. This is discussed in Section 6.2. Section 6.3 considers the planning of post-implementation evaluation and the factors which need to be taken into account. The conclusions of the project about three other areas are presented in Section 6.4: these are the practice of IS evaluation (6.5.1), procurement (6.5.2), and the measurement of costs and benefits (6.5.3). The assumptions about evaluation which were derived from the discussion in Chapter 1 and summarised in 1.5.1 are reviewed in Section 6.5, and discussed in the light of the work done in the project. Section 6.6 considers in retrospect the choice of an action research approach. A number of characteristics of good action research are identified from the literature, and the three evaluation studies are compared with these. This leads to a discussion of the suitability of IS evaluation as a subject for action research. The final section (6.7) proposes directions for further research in the area of IS evaluation which were suggested by the project.

6.2. Evaluation and the NHS environment.

6.2.1. Organisational factors in evaluation.

The survey results and the action research studies have indicated a number of social and organisational factors which were thought to affect aspects of the conduct of evaluation and the utilisation of evaluation results. These are brought together in this section. Section 6.2.2 discusses the assessments which individuals make of their systems and the attitudes towards evaluation which were encountered, while Section 6.2.3 considers the implications of these factors for the rôle of the evaluator. Factors which influenced the choice of evaluation approach in the post-implementation studies are discussed more fully in Section 6.3. These include constraints on the evaluation which can be undertaken, such as lack of resources, problems with the evaluation techniques themselves, management attitudes and practical limitations. Some of these constraints could be relevant at any stage in the life of a system.

From the survey results reported in Chapter 2, we find that health authorities can be constrained in the evaluation which they undertake by a lack of resources, by management

and user attitudes, and by an environment where staff changes and changes of policy cause practical limitations on what can be done. Other problems mentioned were those associated with the available methods, especially with cost-benefit techniques, which could limit the evaluation which authorities are willing to undertake; the lack of an information strategy, and the consequent lack of criteria against which the effectiveness of a system could be judged; and the inability to make any necessary changes which might be identified by an evaluation, which reduces its usefulness. (The full list is given in Appendix B.) *The action research studies also encountered some of these difficulties,* though it was not to be expected that three studies would demonstrate the full range.

Lack of resources has been a recurrent theme throughout the project. The resources which are of interest in this context include user and IS staff as well as finance. A number of survey respondents noted that there were insufficient IS staff to carry out evaluation, and/or that the necessary skills were not available. This problem also affected the ability to carry out changes to systems and was thus relevant to the utilisation of evaluation results; one respondent appeared not to carry out evaluation because any suggested changes could not be resourced. Many authorities employ very few IS staff. For example, the authority concerned in the BSS evaluation had none at the time of the study. *Changes in policy were mentioned as a reason why changes in evaluation practice could not be implemented: this seems to reflect the strain on resources caused by constantly changing requirements.*

Practical restrictions were important in all three studies. In some instances it appeared that the difficulties reflected a lack of control or arose from the method of financing the organisation. The availability of information in the Comcare study was affected by a number of case-specific details such as standard project control and accounting practices, and the information available from accounting systems. These practices were beginning to change as the new management structure brought the need to account and charge for service functions. In the HISS study, some of the documentary evidence about the benefits exercise could not be obtained as it was in the hands of the management consultants who had carried out the study. Foreknowledge of the evaluation and its information requirements might have allowed suitable sample documents to be kept. There was some difficulty in discovering what documentation of the Breast Screening System was available as relevant manuals were newly released.

From the three evaluation studies it was apparent that the restricted availability of staff, especially clinical staff, to participate in evaluation exercises of any type can be a difficulty which needs to be accommodated. However, in all three studies only one individual

declined to participate in the interviews, and some made a considerable effort in order to attend, though in other cases appointments were cancelled or curtailed for various reasons, and a number of staff did not complete the Comcare user survey. The need to limit the time required from participants and to maintain flexible schedules is the practical consequence of this. However, in the BSS review it appeared that the attempt to limit the time required from participants was probably taken too far to allow the subject matter to be covered sufficiently, and more time with the office staff would have been very useful. This was the study in which a low time requirement was requested most explicitly, and it appeared that any further effort would not have been forthcoming, though the system manager agreed that the time requirement had been acceptable.

The time scheduling of health care professionals appears to balance a range of conflicting demands, with the needs of patients given very high priority. These conflicts were made most evident in the HISS procurement, where the project was seen as the latest of a series of management initiatives which had caused existing priorities to be revised whilst ensuring that clinical work did not suffer.

The project took as one of its underlying assumptions the need for stakeholder views to be represented in evaluation. This could be achieved by a user-led evaluation project with an IS specialist as' facilitator, as proposed by Etzerodt & Madsen (1988), or by consultation with the affected individuals and groups. However, it follows from the above discussion that a participative approach to any IS or evaluation project is likely to meet with little enthusiasm unless there is a strong incentive to be involved. The highly participative HISS procurement had a clear and desirable outcome: that of selecting and designing the required system. There was a strong justification for wishing clinical views to be represented, and the consultants who took part saw their involvement as important, though many others did not wish to participate and took little interest in the project. In the case of post-implementation evaluation where there is no clear system product, a consultative style of participation is likely to be more acceptable, as in the planning of the two post-implementation studies of this project. (The situation might be different if recommendations for significant change were expected.) In any case, it is suggested that the reason for the evaluation should be clearly explained and the effort involved justifiable. Where a new system is to be reviewed, this can be seen as the final stage in the implementation process rather than an additional task, and if the review is planned in consultation with the users, the effort involved will not be unexpected.

Management support was useful in all three cases, but the greater degree of interaction with the Unit's IS staff in the planning and execution of the Comcare study seemed

particularly effective, and there was a greater interest in the utilisation of the results of this study.

The commitment and participation of consultants was important in the HISS procurement, both because of their specialist knowledge and because of the importance of their acceptance of the system. As a group they have considerable influence, and they also have the freedom to act independently in clinical and related matters. Their position is an important feature of the social structure of hospitals.

The effects of organisational change can be significant in evaluation in a number of ways. The drain on resources has already been noted. Changes in the organisation or in its environment can lead to changes in the requirements for information systems. This is well-known as a difficulty of conventional IS development approaches, and methods of overcoming it have been proposed (Land, 1982; Fitzgerald, 1990). It affects evaluation in that the agreed criteria may no longer be relevant, and the longer the time that has elapsed since the criteria were set, the more likely this is to be the case. System changes may make comparisons invalid over time and remove the possibility of before-after or longitudinal comparisons. Post-implementation evaluation, therefore, if using an approach which involves criteria or objectives which have been agreed before implementation, needs to allow these to be reviewed in the light of any change which has taken place.

The Comcare study lasted for several months as it was decided during the planning phase that the main evaluation would take place at a particular point in the development of the system. Not only had the purpose of the system changed since its implementation, but further change occurred during the period of the study. Although no pre-set criteria were involved, the changes which took place affected the evaluation questions which were relevant.

The evaluator will naturally feel that evaluation results should be used (Legge, 1984), but if this is left to the HA there is little that can be done to guarantee it. The action researcher may be in a stronger position if dissemination of the results and monitoring their utilisation is part of the scope of the project. An authority will wish to reject conclusions which it considers ill-founded, but there is also the possibility of political motivation in the acceptance or rejection of evaluation results (Legge, 1984), and other possible factors are noted below.

The use of evaluation results may either be direct, such as the adoption of recommendations or the consideration of evaluation findings in decisions about the

system, or indirect, in the form of organisational learning which can be applied in other situations.

The survey of health authorities suggested that learning was an important reason for evaluation, though it did not ask how such learning was assimilated. Willcocks (1992) investigated this point and found that few organisations had formal means of ensuring that it took place. The HISS study had learning about the procurement process as its primary aim, but the dissemination of lessons from the project was not undertaken by the authority until a considerable time after the procurement was completed, apparently because of the pressure of other work which included the implementation of the system (see Appendix C). Whilst much of the dissemination of the results of the Comcare evaluation was seen as part of the action research study, the BSS report was circulated within the screening team over a period of several months, and such recommendations as were considered feasible were implemented without any intervention by the researcher.

The studies attempted to present their results in a way which would be relevant to their intended use. The HISS and Comcare reports both attempted to present the lessons to be learned about the evaluation process and about information systems in an explicit way, and the BSS report included advice about good practice where this seemed appropriate. The Comcare and BSS studies were also intended to produce results which could be used more directly, and both included direct recommendations about the system. However, the main part of the Comcare findings consisted of the detailed information which would allow changes to be made.

Organisational change can affect the utilisation of evaluation results. In the Comcare study, the purpose for which the results would be used was affected by changes in the wider NHS management structure. These brought about changes in information requirements and limited the possible courses of action with regard to Comcare and information requirements for community health.

Other factors can also have an effect, and evaluation needs to be planned with utilisation in mind. When expected changes in the Breast Screening System did not occur at the expected time, the part of the planned evaluation which related to those parts of the software seemed pointless, and was therefore not carried out. The continuing process of problem solving and familiarisation which was taking place rendered some of the findings of the review irrelevant almost immediately. A lack of resources to implement the changes suggested by a post-implementation review was mentioned in the survey of health authorities, and in the BSS study some recommendations were not followed

because they were not considered practicable within current constraints on the service. This is consistent with the general pressure on resources.

6.2.2. Individual assessments.

The assessments of systems made by individuals are made in the context of their views about their work, the service etc. The extent to which these views affect assessments of IS is of interest. This question was not directly addressed in the current project, but a few points were noted. It has been suggested that the climate of change and uncertainty in the NHS increased users' fears about the use of information from Comcare. NHS staff are generally dedicated to their work, and find it satisfying. Comcare, despite its problems, did not appear to have a serious effect on its users' job satisfaction, but users clearly resented encroachments into clinical time whilst accepting the need for a system. The operational BSS did not suffer from this disadvantage as it contributed directly to the management of patients. In some staff groups which would use HISS, the new types of work which would be involved touched on the sensitive area of people's image of themselves as professionals.

Survey respondents noted differences of opinion about the choice of systems between districts and their regions or, in one case, the Department of Health. One respondent from a region mentioned a desire to justify local solutions when the regional alternative was more cost-effective, and several districts had found the systems selected by their regions unsatisfactory. This suggests the possibility of different criteria in selecting systems. The different criteria preferred by Darlington and the HISS Central Team for assessing the HISS tenders also suggested that different types of outcome were preferred by the parties.

A possible source of differences of this type is that the responsibilities of those involved in the different authorities are not the same. In the case of HISS, funding for the capital cost of the system came from the Department of Health and was only available to Darlington if used for this purpose. A purely local view in these circumstances would seek to maximise the quality within the available funding, whereas a service-wide view would attempt to balance quality and expenditure as resources could be used elsewhere. Where a RHA provides systems for a number of authorities, the districts concerned are likely to have different working patterns; this brings a pressure to change established ways of working which are considered satisfactory, or even necessary because of local characteristics. The Region, however, is concerned to meet the needs of all the districts in a cost-effective way. Such tensions seem understandable; whether they are constructive as a means of achieving the best compromise is a question beyond the scope of this

project, but the possibility of such differences in objectives emphasises the need to include all relevant viewpoints in development and evaluation.

Although the attitudes towards evaluation expressed by survey respondents varied to some extent, very few appeared to find it unhelpful in principle. It should be noted that the respondents were managers with responsibility for IS, rather than user managers. Resistance to the idea of evaluation (Blackler & Brown, 1988) was not encountered in any of the action research studies, which would presumably not have taken place had it existed. The Breast Screening Service had a culture which was favourable towards quality assurance and evaluation, and the review was part of the wider monitoring of the service, though in the end the evaluation which could be undertaken was constrained by the staff time which could be made available and by other factors. Both the other studies had a clear motivation: in one case, the problems of the Comcare system and the need to plan for change, and in the other, the pilot status of the HISS project and the responsibility to assess the methods used.

6.2.3. The rôle of the evaluator.

The evaluator's external status appeared to be advantageous in the HISS and BSS studies, as there was a desire for an independent viewpoint. This did not seem to be a requirement in the Comcare study, where there was a closer working relationship with the local IT staff, perhaps because the IT team was highly regarded by users. However, the attitude of participants in the HISS procurement towards suppliers' staff and those members of the project team and the HISS Central Team who came from consultancy firms showed that an understanding of the NHS and its work is expected if outsiders are to be trusted. (Fortunately, the researcher's experience in NHS computing appeared to give the necessary credibility.)

This knowledge also helps to give a good understanding of the system concerned and related organisational issues. The wide range of possible topics for evaluation suggests a need for a variety of skills, and some types of evaluation require a technical knowledge of the hardware and software, or skill in specialist disciplines such as capacity planning. A comprehensive evaluation study may need to draw on several sources of expertise.

Each of the studies had some scope for use of a more political nature. The HISS process evaluation might have been useful to defend Darlington against possible criticism from an apparently hostile central organisation, though in the event the reports from the study were not entirely favourable to the project team. The BSS review demonstrated that the Screening Service had taken steps to ensure the quality of its computer operations. Even

a balanced assessment such as the Comcare study could provide those responsible for the system with ammunition to use in any attempt to change the system or to defend the investment in it, or to encourage confidence in the developments which have taken place.

These organisational and social concerns can present difficulties for those undertaking an evaluation study. There is a need to remain separate from internal conflicts, despite attempts to enlist support, if the evaluator is to remain credible with all parties. This was a difficulty in the HISS study where the meeting with members of the Central Team appeared to engender considerable suspicion, which was presumed to be because the process evaluation had been commissioned by Darlington.

Interviewees in the HISS study often requested that their comments should be unattributable, and this was adopted as standard policy, though it caused problems in presenting evidence in an anonymous form. The identity of the different disciplines involved was relevant to the findings of the other two evaluations, and could not be concealed, though there appeared to be no sensitivity about comments in the BSS review, and another approach to confidentiality, that of restricting access to the results, was adopted in the Comcare evaluation. It was not unknown for participants to wish to make comments "off the record", which is of very little use, and where this occurred efforts were made to agree a form of words which could be used.

Information may flow in more than one direction during evaluation interviews: some users seem to see a "computer expert" as a source of knowledge about the system. However, this is not necessarily appropriate. Even if the evaluator would normally support openness, he or she may not have the necessary depth of knowledge of the system or the situation, or, as in the case of the HISS study, questions asked by interviewees may relate to areas which the project management regards as confidential.

Maintaining objectivity in an evaluation which aims to establish users' opinions involves making an independent assessment rather than accepting uncritically the views of system users whose assessments may be coloured by other factors.

When defining the scope of the evaluation, there is a need to set the evaluator's judgement of what evaluation is necessary and how it can best be carried out against the resource constraints. A study may have been launched with little idea of the effort involved on the part of the organisation, and experience in these studies suggests that agreement in advance about this is advisable.

The difficulties of securing participation in the studies have been discussed at length, and included problems in arranging and keeping interview appointments and cases where promised actions were simply not carried out. In one study, continued lack of support eventually necessitated a confrontation with the internal sponsor of the evaluation, who was able to ensure that the situation improved. If co-operation is failing to materialise or promised information does not appear, the evaluator may be in a weak position, especially if the organisation's representatives are not convinced of the value of the project, or if there are hidden agendas. A degree of confidence and skill in handling working relationships is advantageous.

6.3.   Planning post-implementation evaluation.

6.3.1. Purpose of this section.

This section considers the choice of an evaluation approach and other factors of importance in post-implementation evaluation. Both the post-implementation studies in this project commenced with an initial planning exercise which aimed to decide an appropriate evaluation approach and agree other details of the evaluation to be carried out. These planning exercises are assessed in Section 6.3.2. Section 6.3.3 discusses what the project has shown about factors which need to be considered when planning the evaluation of existing systems. During the planning studies there was little guidance available about the question of choosing the best evaluation approach for use in specific circumstances. A method of matching the situation with evaluation approaches has been identified from the literature and is considered in Section 6.3.4 in the light of the experience gained in this project.

6.3.2. Planning the Comcare and BSS studies.

The significant characteristics of the method used to plan the two post-implementation studies are that it asks a range of questions which are thought to provide an appropriate basis for selecting the evaluation approach and defining the scope of the study, and that it incorporates the views of a range of stakeholders rather than accepting the viewpoint of the managers who commissioned the evaluation. The second of these characteristics is intended to allow the most important issues to be identified; it also addresses the problem that evaluators can adopt the values of those who commission the study (Legge, 1984) .

The actual questions asked in these studies were not following a pre-defined contingency framework, i.e. they were not concerned with pre-determined factors in the organisational and evaluation situation which were thought to make one approach more suitable than another, though given a framework such as that of Ginzberg & Zmud (1988), this would be a possibility. Instead, they attempted to find users' priorities for the approach and aspects of the system to be studied, and criteria on which alternatives could be ranked. Questions were asked about the participants' interaction with the system, those parts of the system which were considered most important for the work of the individual or department, and areas where there were problems, deficiencies or risks, as well as about the types and subjects of evaluation which would be of interest.

In both cases an approach was chosen and the views of a range of users were considered in the choice. Important aspects of the situation were identified: the problems of accuracy and time commitment in the Comcare study, and the need for a high-quality error free standard of service in the Breast Screening Service. The planning approach in the Comcare study was combined with a fuller investigation of the problem area which allowed problem-solving activities other than the evaluation to be suggested. In the BSS case, the planning exercise was more useful in focusing on the areas to receive attention than in selecting the actual evaluation approach.

In neither case did the suggested evaluation approaches show clear agreement on a single approach. The planning exercise in the BSS study was less productive of suggested approaches than that in the Comcare evaluation, though it was clear from the interviews that a high quality of service was a key area, and a formative review which focussed on the quality of the system and its operation seemed the most appropriate approach as a result. The fact that staff had little knowledge of the system and of IS in general at the time of the planning interviews was a handicap in this case.

The evaluation approach to be used in the Comcare study was decided largely on the basis of the interest in the justification of the system as a subject for evaluation and the concern expressed about the central problem situation. The cost-benefit approach was expected to provide a framework for investigating the problems and give the information needed for making necessary decisions about the future of the system. Techniques to identify the costs and benefits involved were decided, but there was little difficulty in selecting these and the main constraint was the need to restrict the time required of field staff. The planning process was extended to include detailed consideration of the problem situation, and a number of relevant non-evaluation activities were suggested.

In the BSS study, the interviews identified areas which were of importance to team members, and the evaluation approach was chosen largely on this basis, as despite the explanations given there seemed to be less appreciation of how evaluation might be useful than in the Comcare study. The result was a formative review which seemed quite appropriate for the stage in the life of the system at which it took place. The interviews and subsequent discussions also showed that other evaluation was planned which might overlap with this study. The need to fit in with other work was one of the main constraints on the design of the study, others were the request that the time required of staff should be kept low and the state of development of the system itself, though the impact of the last of these was not fully predicted.

In neither study was it appropriate to use an evaluation approach which depended on measurements taken or objectives set before implementation: in the Comcare study, no such measurements or objectives existed, and in the BSS case, the fact that the service itself was new prevented before-after comparisons and produced a situation in which the system was not distinguished from the rest of the service for this purpose.

Other questions which are needed in planning the detail of a review were also addressed, though in both cases the question of who should carry out the investigations was not considered as it was assumed that the researcher would do this. Both studies were timed to suit the requirements of the situation. In general the detailed planning was done in consultation with the sponsor of the study rather than a wider range of HA staff, though agreement was sought from the relevant people when proposals had been formulated.

The purpose for which the evaluation is required or the questions which it is to answer can suggest the type of information which is needed and the most useful way in which to present it. For example, a formative post-implementation review such as the BSS review requires detailed assessments and recommendations for action. The findings of the Comcare study were presented largely by department, along with an overall summary, because assessments of widely differing situations were needed, and the detailed level of information was required for planning the action to be taken and predicting the future situation in these different areas.

The interviews in the planning phase were also used to introduce the idea of evaluation to the staff and to enable the evaluator to gain the necessary knowledge of the system. The experience in the action research studies suggests that it is helpful if staff have a reasonable knowledge of both the system and the possible uses of evaluation. As the

second of these could not be expected, the interviews allowed time to discuss the possibilities with participants.

It was noticed that whereas users of Comcare, which is an established system, had a range of ideas about the types of investigations which would be of interest, and were well aware of the problems of the system, the most fruitful line of discussion with prospective BSS users was concerned with the parts of the system which would be most important and where difficulties would entail most risk Only a few problem areas were known. However, it is quite conceivable that prospective users of a system may have specific concerns about it, especially if they have a greater degree of familiarity with it or if specific questions have arisen during development, and it seems preferable that the questions raised at this stage should be open enough to allow the situation to be explored thoroughly. If it were decided that any additional factors, such as aspects of organisational culture, could affect the choice of approach, these would need to be incorporated into the discussions.

A possible weakness of the approach is that in neither case was a full range of users involved in the final choice of approach: this was agreed between the evaluator and the manager responsible for the system in the case of Comcare, and proposed by the evaluator and finalised and agreed in discussion with the committee responsible for service evaluation in the BSS study. This was probably more appropriate than a participative approach in the case of BSS, as there were in fact few strong views on the part of team members but there was a need to co-ordinate the study with other evaluation of the service.

6.3.3. Relevant factors.

It can be seen that the planning process requires not only knowledge of the factors which are to be considered in determining a suitable approach but also familiarity with those constraints which might limit either the use of otherwise suitable approaches or the scope of the evaluation. Where constraints cause the scope of evaluation to be limited, some means of deciding which aspects are the most important will be needed: hence the emphasis in the planning interviews on establishing the areas of priority. It is also possible that the content of evaluation will be affected by hidden factors such as political motivation or opinions of particular methods, and it might be advantageous for some of these to be made explicit during the planning process. This section considers some of the factors which need to be taken into account.

The uses of post-implementation evaluation suggested by survey respondents fell into the main categories of correcting and improving the system; confirming the success or otherwise of the implementation or, in extreme circumstances, aborting the project; learning from the implementation for the benefit of future projects; and supporting specific enquiries or decisions, such as whether the time has come to replace an old system, whether to implement a system in further sites, providing a baseline for strategic planning, investigating problems, or comparing existing systems with new standards. Various more political purposes were also mentioned, such as reassuring users and public relations: these may be quite legitimate from the point of view of an IT department whose responsibility is to ensure that systems are used to the best advantage.

It can be seen that a single study, especially the post-implementation review of a new system, could serve more than one of these purposes. The Comcare evaluation had the dual purpose of investigating a problem situation and providing the information needed for planning the future of the system, though the BSS review was almost exclusively aimed at system tuning. Learning for the benefit of future implementations suggests that an element of process evaluation is involved. This learning element could be combined with other evaluation requirements, though it should be noted that it was the only benefit mentioned by some survey respondents. If a combination of objectives is desired, this needs to be considered in selecting an evaluation approach: a combination of methods may be required.

When defining the scope of an evaluation, it may appear that there is no clear boundary to be drawn between the system and its organisational environment. This was the case in the Breast Screening Service, where almost every aspect of service administration was highly dependent on the system, and as the service had never operated without it, there was no possibility of assessing the changes which had taken place. Lincoln & Shorrock (1990) describe a case in which a system could not be distinguished from its environment for the purpose of cost-benefit analysis. A related difficulty was found in the Comcare study, where even though the information processing functions could be delineated, the benefits of the system were inextricably linked to both the information produced and the decision-making and other management processes in which it is used, and any attempt to identify benefits from the system alone would be meaningless.

The constraints on evaluation reported by survey respondents (Chapter 2) are relevant here. The most important of these seemed to be lack of resources, management and user attitudes, and changes within the organisation. The attitudes of managers and system users towards IS will affect the aspects of the system which they see as important in

evaluation. Change, both within the unit or department concerned and in the wider organisation, can not only place pressure on the available manpower and financial resources, but also lead to new requirements and expectations which must be taken into account.

Lack of resources seems to be a widespread problem in NHS computing and was encountered in these studies in the form of limited availability of staff to participate in evaluation. The perceived importance of the evaluation is likely to affect the resources which can be allocated to it. If it is seen as sufficiently important or beneficial to merit the necessary commitment, problems such as the shortage of staff time or the necessary skills can be overcome.

This discussion has assumed that the review of a new system has not been planned as part of the development or implementation process. If the system is new, planning the review before implementation enables evaluation to be carried out early in the life of the system, and if appropriate would allow comparative measurements of a previous system to be made. It is suggested that making the preparation for evaluation part of the implementation project would reduce the likelihood that evaluation would be neglected. This could be integrated with a development methodology, and some of the necessary information, such as objectives or critical factors, could well be collected as part of the development process. This possibility is discussed further in Section 6.7.

6.3.4. Selecting the approach.

The planning process described above carried out the necessary information gathering to enable choices about the evaluation approach and the scope of the assessment to be made. It did not, however, provide any guidance about the selection of an approach suitable for the organisational situation and the requirements for evaluation. This was done on the basis of the evaluator's judgement. The possibility of a contingency framework to assist in selecting evaluation approaches has already been mentioned. Producing such a framework would be a substantial undertaking requiring analysis of a wide range of situations, and was not attempted in the current project. However, there has been some work in this area, and the discussion which follows takes as its basis the framework of evaluation situations proposed by Ginzberg & Zmud (1988), as this is the most comprehensive which was encountered in the literature. The experience in the current project suggests comments on their proposals and factors which are relevant to the choice of approach.

The Ginzberg & Zmud framework of evaluation situations was described in Section 1.5, but some points should be noted here. Firstly, although the framework exists, the matching with suitable approaches is far from complete as suitable techniques for most of the possible situations do not exist. Even if an appropriate evaluation approach has been selected, other organisational factors can act as constraints on the evaluation which can be undertaken. The techniques are described at quite a general level, so that the framework, even if fully populated with suitable approaches, aims to allow only the broad outline of an approach to be selected. Choices about the details of the approach, its scope and the assessment and measurement techniques to be used, would still need to be made. This project has therefore tended to work at a lower level of detail.

The main dimensions of this framework are the stakeholders for whom the evaluation is to be undertaken, the rôle of the IS within the organisation, and the purpose of the evaluation. As the first two of these dimensions have subsidiary scales, and each scale has several possible values, there are a considerable number of possible combinations of values. In addition, as in the example given by the authors, real evaluation situations can fall into more than one category in each dimension. For example, in terms of this framework, the Breast Screening System was intended to support communication and transaction targets at the operations level and decision targets at the management and institutional levels, impacting on work quality. Comcare, if used to the full, would support decision targets at the operations, management and institutional levels, also impacting on work quality.

Ginzberg & Zmud use as a dimension of the evaluation situation the stakeholders from whose viewpoint the evaluation is conducted. This project has attempted to represent the views of a wide range of stakeholders in planning the evaluations. The Comcare study in particular demonstrated that stakeholders may be interested in different questions and different types of evaluation.

This leads to the possibility of investigations with more than one purpose. However, the general constraint on resources brings the need to prioritise the various types of evaluation which could be carried out and the aspects of systems which could be investigated. The planning phases of the studies allowed this, though it was less important in the BSS review where other constraints also limited the scope of the evaluation.

Organisational rôle in this framework has three sub-dimensions which cover the functions of the system, the organisational level at which it operates and the type of impact which it is intended to produce. The last of these has three categories: work quality, quality of

working life, and work-related politics. It is quite possible that a system whose intention is to improve work quality will have an impact on the other two areas, and these may be of considerable interest to the affected stakeholders, even (or perhaps especially) if the effects are not intentional.

It seems worth giving attention to the possibility that characteristics of the organisation and its culture may affect the evaluation approaches which are considered useful and acceptable. For example, financial assessments may be considered less relevant in a public body whose product is a service, such as the NHS, or interest may be limited to control of costs rather than a full cost-benefit analysis. There is also the possibility of individual preferences between techniques, which might imply that the abilities of the evaluation group and their preference for qualitative or quantitative assessments should be considered, as suggested by Gregory (1991). Neither of these areas is included in the framework under consideration.

The purposes of post-implementation evaluation noted by survey respondents, which were summarised above, almost all fell into two of the three categories in the framework: system tuning and resource allocation. No examples of opportunity surfacing were found. The exception was the opportunity to learn from the implementation. If, as it seems, this is considered important in some installations, it should be explicitly considered in designing evaluation studies.

Although these uses of evaluation could be broadly categorised in the way suggested by the framework, in fact there were considerable differences between some which would fall into the same category. For example, a review of the current IS provision to aid strategic planning and a review to confirm the success of a newly installed system would both have resource allocation as a purpose, but might use very different methods and would relate in one case to future needs and in the other to current objectives or costs and benefits. This suggests that the purpose of the evaluation needs to be defined more precisely.

Practical constraints may also be important. For example, some approaches will be unsuitable because they require information which is not available. Especially where an established system is to be evaluated, any approach which involves comparison with targets or objectives will need to include consideration of the effects of any organisational or environmental change which has taken place, as discussed in Section 6.2.1. The stage in the life of the system is thus relevant, and would be even more important if evaluation at other stages in the life-cycle were to be considered, as the object of the evaluation would then not be an operational system.

The framework includes a wide range of characteristics of the IS and allows a number of important points to be considered, but it seems that an even greater degree of complexity is needed. Given the limitations of existing techniques and the many possible combinations of IS characteristics, some degree of compromise is likely to be needed in many evaluation situations, and an attempt to identify an approach which is appropriate to the most important objectives and features of the situation is likely to be more helpful than a rigid structure. The approach taken in the action research studies provided the necessary degree of flexibility, but Ginzberg & Zmud are certainly correct in their assertions that a greater degree of knowledge is needed about the approaches which are appropriate in various situations, and that the commonly used techniques do not have wide enough applicability.

To summarise the above discussion, it appears that the choice and implementation of an evaluation approach require a wide range of factors to be considered. The planning process used in the studies allowed a number of viewpoints to be taken into consideration. This ensured that the choice of approach was based on a good understanding of the situation and allowed important issues to be identified. Discussion of the proposed approaches allows any constraints to be taken into account. The ability to prioritise possible evaluation topics is useful in this context, as resources are limited.

6.4. Assumptions about evaluation reviewed.

The underlying assumptions stated in Section 1.8.1. were reviewed in the light of the project.

That evaluation should occur throughout the life cycle and should be seen as a normal part of the life of an installed system.

This is clearly only the correct policy if evaluation is thought to be beneficial. Section 1.4 has outlined the points at which evaluation is likely to take place during the development process. The importance of including organisational and user-related considerations and ensuring that the system will meet the organisation's needs must be stressed.

In the period immediately after implementation, new working patterns become established and problems begin to appear. The benefits realisation approach regards this stage as crucial in turning predictions into achieved benefits, and the approach could be extended: monitoring and control of other aspects of system use would be helpful. This could

detect the appearance of problems and allow early action to be taken, as well as ensuring that systems and information are being used, though the BSS review illustrated the need to distinguish genuine difficulties from those which arise from inexperience.

Survey respondents suggested a range of uses for post-implementation review, of which the most important appeared to be problem-solving, learning from the experience gained from the system, and the identification of enhancements. Only one of the post-implementation studies (BSS) was a scheduled review, the other (Comcare) was commissioned because of specific circumstances and was in fact the second ad hoc review of the system. The BSS review was considered helpful in confirming that good practices had been adopted and encouraging their continuance, and further recommendations were made. If monitoring after implementation and post-implementation review are regarded as a normal activity they can be planned and treated as part of the implementation process. Later regular reviews were not covered in the studies but are likely to be more limited in extent than an initial post-implementation review: they will be likely to include elements of monitoring and quality assurance as well as discussions of perceived problems, opportunities and needs for change.

That evaluation is useful in developing better systems, and can be formative, i.e. used in improving the system, or summative, i.e. providing an assessment for use in decision-making.

The two post-implementation studies produced information which was suited to a formative use, although cost-benefit assessment, the approach used in the Comcare study, is more normally associated with summative evaluation. The Comcare study attempted to provide information which could be used to planning the future of the system and to elucidate some of its problems. Some suggestions for action were also made, but this was not the main purpose. The BSS study was aimed at system tuning and a number of recommendations for practice were made.

The influence of a procurement process on the system which is implemented is clear, and the HISS procurement included activities aimed at ensuring that acceptable standards would be achieved, though the element of comparison between the proposals on the grounds of quality had little place in the final system selection. There was little evaluation of the application requirements themselves, other than the detailed quality assurance of the Operational Requirement. The process evaluation was not relevant to this assumption except insofar as it had the potential to produce a more effective procurement process in the future.

That evaluation should include a broad range of factors, including social and organisational factors, rather than concentrating on financial and technical areas.

The range of factors considered in the BSS study was limited by the scope of other evaluation work, but the areas of interest were largely concerned with organisational and user-related issues. In the case of Comcare, motivation and people's perceptions of their work were found to be relevant. The views held in departments of their need for information were important in understanding the actual and expected benefits. A purely financial analysis would have given little understanding of the reasons for the current situation. The HISS implementation would bring a considerable change in the working lives of some users and the need to treat the project as an organisational change was stressed in the findings of the process evaluation.

This also applies to evaluation during development. Some of the problems of Comcare user departments could have been avoided if their working patterns had been considered in relation to the system and although the situation was much less serious and difficulties had been accommodated in a way which was considered acceptable, similar mismatches had occurred in the BSS implementation.

That the opinions and interests of all concerned parties should be represented.

All three action research studies supported this, but in two main ways. The HISS and BSS studies were both situations in which different individuals and groups were concerned with different parts of the system, and would use it in different ways or for different purposes. Clearly a wide coverage is needed in this situation. It was noticeable in the HISS procurement that opinions about which system would be preferable were fairly evenly divided, and that some users were aware that the system which they found best for their department might not be best for the hospital as a whole. The Comcare review showed a situation where the user departments were attempting to operate the system in similar ways, and managers were expected to use information for similar purposes. However, different circumstances within the departments, including working patterns and the pressure of work as well as the perceived need for information and the availability of other information sources, affected the difficulty of using the system and the quality and usefulness of the information, with the effect that there was considerable variation between departments.

That different situations will require different approaches.

The three studies were very different and different approaches were to be expected. A number of factors which will affect the choice of evaluation approach have been suggested (see Section 6.3), including the purpose of the evaluation, the stage of system life and the form in which the system is to be evaluated, and organisational factors such as the available resources, the relevance or otherwise of particular methods of assessment in the organisational context, and the perceived importance of the exercise. Further work would be needed to produce a comprehensive matching of situations with suitable approaches. The scope of the evaluation will also need to be decided: this was done in the action research studies on the basis of user preferences and priorities, and practical constraints.

That the impacts of an information system will require to be measured in varying ways and will not all be directly comparable.

This assumption is derived from an extensive literature and was fully supported by the Comcare study, in which a range of impacts were described or measured in various ways. These have been fully described in Chapter 4 and Appendix F. The benefits of the system were not quantifiable, and a direct comparison of costs and benefits with the aim of producing an assessment of the current "value" of the system was not made. Such a comparison would have been largely subjective. System impacts were not a relevant concept in the BSS study. However, the HISS procurement included an attempt to predict benefits which concentrated largely on the cash-releasing variety, a fact which reduced its credibility with users who felt that other possibilities were overlooked.

That post-implementation evaluation should be considered before the system is introduced.

This applies to the review of a new system rather than to an ad hoc review some time after implementation. Reasons for this pre-planning include ensuring that information about a previous system is available for use in comparisons, ensuring that objectives, expected benefits or other initial success criteria have been documented and agreed so that they can be of use for evaluation, and ensuring that monitoring can be started immediately if this is required.

The Comcare evaluation was not particularly relevant here as it took place a considerable time after implementation, though some of the information which was not available might well have been kept had a post-implementation review been expected. However, the BSS

study caused some questioning of the assumption. This was partly planned before implementation, or at least before full operational running, as some data collection began during the period of the planning interviews. In this case, a lack of knowledge of the system amongst its future users was a problem, and there was no possibility of needing comparative data from a previous system, as the screening operation was entirely new. The circumstances of this system appear to make it a special case: user staff in an existing operation would have had a clearer idea of the work and of their concerns about proposed changes, even if unfamiliar with the proposed system. One activity which was requested, problem logging, might have begun immediately after implementation, had this been requested, but in fact the detailed plan was not finalised until the system was operational and the log was in any case not kept. Service objectives for the system would have been useful, and ensuring that these are defined in advance might appear more objective than reconstructing them with the benefit of hindsight.

In cases where a system is introduced into an existing organisation, there seems no reason to challenge the assumption, though the studies have not addressed this case. However, it is possible that organisational changes will affect system objectives, as in the case of Comcare, or that once experience of the system has been gained, the areas which seem important will not be those which appeared *significant or where problems were expected* before implementation, as in the BSS study. Evaluation criteria or targets set before implementation may need to be revised in the light of changes which have taken place during development. When a system has been in operation for some time, changes in the environment or in requirements may have occurred which mean that comparison with the pre-implementation situation is no longer relevant.

6.5. Further Conclusions.

6.5.1. Conclusions from the survey of health authorities.

The user survey attempted to show the state of practice of IS evaluation in the NHS at the beginning of the project. Some of the survey results have been used in conjunction with the action research studies to give an understanding of factors which affect the conduct of evaluation. Other conclusions are summarised here.

Questions about the general computing environment showed that the use of information systems was increasing. Almost all the authorities now had systems in place in the core areas, and most were undertaking extensions to their systems. The number of IS staff

varied considerably between districts, and not all of these were classed as computing personnel: a number of districts had no computer staff. A very high proportion of authorities used commercially produced software, though over half had some applications which had been produced in-house and the local RHA was also an important source of software. Most sites which undertook development used traditional analysis and design methods.

The survey showed the types of cost and benefit which are taken into account when assessing future systems. The time required from user staff was assessed in most cases but costed in fewer than half the sites. Time savings were more likely to be included in the assessment than additional time requirements, but were less likely to be assessed financially unless they related to clerical staff. This may reflect the difficulty of quantifying changes in the working patterns of health care professionals, though the value of time saved by managers was also rarely estimated. The other benefits suggested by the survey were mainly not of an easily quantified type, though some sites assigned financial values to factors such as improved security, better management control, better use of resources and even improved job satisfaction. The type of cost-benefit analysis used was usually fairly basic.

The procedures used in project and system selection varied considerably, and a number of improvements to these procedures were suggested. The most important were the provision of a strategic framework, improved cost-benefit analysis, a more structured approach, provision of more resources and greater involvement of users. Factors in the organisational environment could cause difficulties; these have been discussed in Section 6.2. In general respondents were fairly satisfied with their evaluation procedures, both before and after implementation. Few improvements to post-implementation evaluation were suggested.

Blackler & Brown (1988) suggested that post-implementation evaluation is rarely carried out. This survey did not support their assertion, at least in the target sector, as over three-quarters of the authorities assessed at least some of their installed systems. (Other survey material is also not unanimous about this point, as discussed in Section 2.3.) However, only about 30% of sites assessed all their new systems, and it appeared that where only some systems were reviewed, there was not necessarily a policy such as the evaluation of all systems of a particular size or type. Some of the reviews described arose because of problems with installed systems or the need to take particular decisions.

Most sites seemed to include a wide range of factors in post-implementation reviews; user opinions, performance and reliability were the most common topics. Three-quarters of

the sites assessed costs, and non-financial benefits were more likely to be included than financial benefits. Respondents mentioned a number of benefits from post-implementation evaluation, of which the most important seemed to be the ability to learn from the implementation for the benefit of future projects, and the opportunity to identify problems and improve various aspects of the system.

There were a few examples of process evaluation, though the question about this was not satisfactory and it was not possible to tell how frequently this is carried out. It seems that it may form part of post-implementation review in some cases. This also contrasts with the investigation by Blackler & Brown (1988), which found no examples of process evaluation, perhaps because a smaller sample was used.

6.5.2. IS procurement.

The survey of health authorities demonstrated the importance of software purchase to health authorities and the HISS project provided an example of a large procurement. Chapter 3 treated procurement as a process with procedural and decision-making aspects and an organisational and political dimension, and highlighted the aspects of the HISS procurement which were relevant to these areas. The effects of organisational characteristics on the project were considered, and this discussion was extended in Section 6.2. This section concentrates on important aspects of the procurement procedure itself and its underlying requirements.

The introduction of an information system can involve significant organisational change. Procurement is a part of this process. It is important that organisational factors and the implications for staffing should be considered at an earlier stage than they were in the HISS project, as the omissions here were potentially serious. The failure to consider the new working patterns until late in the procurement could have led to inaccurate estimates of benefits and costs and even to late changes in the system requirements.

The discussion which took place about the method of making the tender decision illustrated the fact that more than one approach is possible and that these can have different outcomes. As it appeared that aspects of the proposals which were not included in the financial model could only be considered if the costs were very close, the method appeared to choose the least expensive system which satisfied the mandatory requirements, even if there were significant differences in unquantifiable factors or in desirable facilities. Darlington wished to be free to compare the differences between the functionality and quality of the proposals with the differences in cost, and to decide whether any additional cost was worthwhile. It appeared that the approaches which were

discussed rested on different definitions of value for money, which is an important concept in public sector purchasing. In fact, the situation was confused by different interpretations of the proposed method, and a strict implementation of the original written guidance would have allowed the type of comparison which Darlington desired. Nevertheless, the discussions illustrated the possible effects of different methods of making this type of decision, and organisations need to understand the implications of the methods which they adopt.

The project showed the possibility that a system will satisfy the requirements of some departments better than others. However, the use of mandatory requirements means that a minimum level of service can be ensured for all users, and it would appear that the more complete the minimum requirement is, the less likely are significant conflicts of interest. Participants were aware that the interests of the hospital as a whole might not coincide with those of their department, and there was little conflict of any type within the organisation.

Section 3.6.3 set out the requirements for the procurement procedure in this situation and assessed the project against them. Some of these requirements were particularly relevant to the public sector, others could apply to any project. One requirement which was specific to the project was the need to assess both existing software and the capability of the supplier as a developer of new applications. Existing procedures did not cover this situation. The type of assessments which would be required were not finalised until the proposals had been received and understood: a stage was added to the procurement when the extent of the new development which would be needed was realised. Prior knowledge of the products which were likely to be proposed could have enabled this to be predicted, but this knowledge was not available.

The requirements for the procurement procedure suggest that there are also underlying needs. One of these is the knowledge needed by participants in the project. In the case of HISS, staff needed to become familiar with the possible uses of computerised information systems in application areas which had previously had no computer support; to define their requirements in an unfamiliar way; and to understand written proposals and product demonstrations. The guidance of IT specialists was essential, as many participants had no experience of any of these activities. As these advanced hospital systems were relatively new to the NHS, there was little knowledge of such systems, even at senior level, at the beginning of the project. Demonstrations seemed to be more helpful than the proposals in allowing prospective users to understand the applications. Projects must allow the necessary learning to take place.

The close connection between the requirements definition process, procurement and the identification and achievement of benefits from the system suggests that a framework to support the whole implementation is needed. Good analysis and requirements definition are necessary. The flexibility to cater for a situation where some of the activities can depend on the nature of the requirements and the available software is also required. However, the increasing trend towards the purchase rather than development of software and the possibility that applications will include both new and packaged software have not been fully accommodated by methodology developers (Avison & Fitzgerald, 1988). Survey respondents acquired their applications from other health authorities as well as by development or purchase from commercial suppliers, and can face choices between Regional initiatives and local solutions. There is a need for IS methodologies to give greater support not only for procurement, but also for the assessment of options which include systems from different types of source.

6.4.3. Achievement of benefits.

The idea of a benefit realisation programme was introduced in Section 3.2.4. The main elements of the approach are a detailed prediction of the benefits expected from a new system, a detailed implementation plan which prescribes how the benefits will be achieved, commitment to achieving a prescribed level of benefit from the responsible individuals, monitoring during and after the implementation process, and a feedback mechanism to make any necessary changes. The benefit realisation literature has an emphasis on the timing of activities. However, benefits of all types are expected to be included.

Chapter 3 described how the first stage of the approach, a study of the expected benefits, was carried out during the HISS procurement. The identification of benefits turned out to be a particularly sensitive area, and strong reactions were expressed in the interviews. It required a good understanding of working patterns within the hospital. This is a complex area of which there was no prior knowledge in the organisation, and communication about the exercise was poor. The managers concerned had little confidence in the methods used or in the results; they also considered that some of the assumptions upon which early estimates were made were inapplicable in the NHS context as they were based on experience in foreign hospitals which have different workloads and working practices. There seems to be a need for guidance specific to the NHS.

In the HISS benefits study, the expected time savings were valued using salary and on-costs. The costing of time was also important in the Comcare study, where the time

required by the system was valued in the same way. The assumption underlying this is that staff time to replace any which is spent on the system can be bought at the same rate. In the Comcare study, the monetary cost of the time spent on the system was used to reflect other costs such as the impact on patient care which resulted from the use of this time for other purposes.

Reactions to the idea that the staff time freed by HISS would be realised in the form of staff reductions rather than available for re-allocation to other work were not favourable, suggesting that this type of valuation may be open to debate from the viewpoint of departmental managers: the additional staff time at their disposal would be worth more, in their subjective judgement, than the released resources which would be offset against the revenue cost of the system. Distrust of the predicted level of benefits and other concerns about the benefits study, such as the suspicion that costs had not been taken into account, may have contributed to this reaction. Nevertheless, the possibility that the value of something as apparently quantifiable as time may be subject to different perceptions is an interesting one.

The later stages of benefit realisation were not included in any of the studies. (The Comcare evaluation investigated system benefits, but not as part of a realisation programme.) However, it seems worth considering whether the approach could have been of use in either of the other studies, in what circumstances it could be applied, and whether the structure which it provides could have any further applications.

The application of a benefit realisation programme to management information systems, where the benefits would be assessed in a more qualitative way than in operationally-oriented applications, would be a possible development. Chapter 4 discussed the problems of measuring benefits in the Comcare study, where the expected benefits were from the use of management information. However, it was also true that very few benefits had been achieved. The reasons for this were a combination of severe problems with the quality and relevance of the information produced, and a lack of use of the information which was available. Although it would be extremely difficult to assess the value of information use, it would be quite simple to check that the information was in fact being received by those who were intended to use it and used by them for the expected purposes. This situation was so severe as to be apparent at an early stage, but in less extreme circumstances, early detection of low levels of benefit and excessive levels of effort (i.e. cost) could allow corrective action to be taken. A further extension would be the prediction and monitoring of costs as part of the programme, as benefit measurement

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naturally has to include some elements of cost if the net benefit is to be calculated. This is discussed further in Section 6.7.1.

Are there, then, any situations in which a BRP would not be relevant or appropriate? The Breast Screening System seems to be an example, although as an operational system carrying out automated clerical tasks, it would appear to be well suited to the approach. The relevant factors are those which were of interest in planning the evaluation: that the system is effectively mandated as the service could not operate without it, and therefore the level of benefit is not an issue; that the system is almost inseparable from the service which it supports, and any benefits arise from the entire operation; and that the system and service were both new, so that no changes in benefit, impact etc. could be observed. Detailed targets for system performance, as opposed to service performance, did not exist and would not have been particularly meaningful as a separate entity, though some targets for the level of service had been set and were regularly monitored by the evaluation group. The only part of the system which could perhaps have been considered in isolation was the information provided for service management, but the fact that this was quite inadequate and there was little to assess was known in advance from the specifications. In this case, then, a monitoring approach concentrated on the information system seems inappropriate.

6.6. Action research.

6.6.1. Characteristics of action research

As the studies progressed, and especially once the HISS study was defined, the question "Is this action research?" began to appear significant. The researcher's involvement in the HISS procurement was very small, though she conducted the associated process evaluation. It became clear that the research would be concerned with two separate types of evaluation: the process evaluation and the procurement. However, it was not the intention that there should be two distinct but simultaneous studies, as the learning function was part of Darlington's rôle as a pilot site and feedback from the process evaluation was intended to influence the procurement, even if in retrospect this influence appears very slight. The process evaluation is therefore regarded as part of the "action", and as such is also a valid subject for learning. Questions were also raised by the other studies as action research is usually concerned with change processes, but the two post-implementation evaluations appeared not to involve actual change, unless action were to be taken by the health authorities as a result of the studies.

This section considers the research methodology chosen for the studies, first by examining in more detail the characteristics of a "good" action research project on the basis of a number of descriptions of the approach; then by considering the three studies in relation to these characteristics. Finally, the related question of whether evaluation is an appropriate subject for action research is discussed.

Warmington (1980) outlines the development of action research, noting that it has now evolved to the point where its characteristics can be defined. The approach has been developed in the social sciences, especially in the area of organisational behaviour, and has tended to focus on the implementation of change. In information systems, action research has been used in methodology development (Wood-Harper, 1985); this work has followed in the tradition of Checkland (1981) and the development of soft systems methodology. A proportion of action researchers, especially those in Scandinavia, have regarded an emancipatory interest as essential, but this is not universal.

A commonly cited definition of action research is that of Rapoport (1970):

> "Action research is a type of applied social research differing from other varieties in the immediacy of the researcher's involvement in the action process. .... Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework."

Rapoport found the emphasis of other writers on a problem solving process too limiting, but Foster (1972) adds the following to his definition:

> "....and the intention of the parties, although in different rôles, to be involved in a change process of the system itself."

Another description is that of Hult & Lennung (1980):

> "Action research simultaneously assists in practical problem-solving and expands scientific knowledge, as well as enhances the competencies of the respective actors, being performed collaboratively in an immediate situation using data feedback in a cyclical process aiming at an increased understanding of a given social situation, primarily applicable for the understanding of change processes in social systems and undertaken within a mutually acceptable ethical framework."

Warmington's description of the action research process is also based on the application of change in order to improve a problem situation (Warmington, 1980). He specifies that there should be an ethical framework for the work, and that this should be agreed between

the researcher and the subjects. The researcher should also bring an appropriate conceptual framework to the work.

A distinction must be made between action research and consultancy, as both address practical concerns. It is important that action research studies should have the potential to contribute to knowledge about the field. Wilson (1990) stresses the importance of distinguishing between the real world and the intellectual constructs which are used to understand it.

> "[Action research] can only be successful if both the 'action' and the 'research' take place. The action without the research could be seen as no more than consultancy where 'what is learned' can be described as experience. For the research to be present it is necessary to know *what has been learned* from the experience. Such learning requires intellectual reflection on the experience and that in turn requires the establishment of concepts so that 'what has been learned' can be known and made explicit. Without this the knowledge gained cannot be made transferable."

It can be seen that the main elements of these definitions are:
- Researcher involvement,
- Participation by the "subjects" of the research,
- A problem situation,
- A change process,
- An ethical framework,
- Contributions both to the situation and to research.

Warmington (1980) adds to this
- An appropriate conceptual framework brought by the researcher

and Hult & Lennung (1980) also include
- Learning by the respective actors,
- Data feedback in a cyclical process.

6.6.2. Assessment of the project as action research.

Is this project action research, or is it simply consultancy combined with an attempt to learn from experience? In this section, the studies are considered in the light of the characteristics of action research which were listed above. These are not treated as a rigorous definition, in the sense that only work which conforms to all of them can be classed as action research, as researchers appear not to be in complete agreement about all the elements. Rather, they are regarded as a standard of practice.

Researcher involvement

The researcher was the main actor in both the post-implementation evaluations, and in the process evaluation component of the HISS study. A more active involvement in the HISS procurement had originally been planned, but had not proved feasible; the researcher participated to a very limited extent by providing information about possible techniques and by making suggestions and discussing proposed approaches with the project manager.

Participation by the "subjects" of the research,

The two post-implementation studies used the views of a number of members of the organisations in the planning process, though the actual decisions about the nature of the evaluation involved only the study's sponsor in the case of the Comcare study, and the service manager and the supervising committee in the Breast Screening System (BSS) case. At the evaluation stage, a large number of system users contributed their views and experiences in all three studies, but again, only the three internal sponsors had any input to the conduct of the evaluations, and one of these expressed a preference that the "expert" evaluator should decide what needed to be done. In this case (the BSS study) a greater emphasis should have been given in the initial discussions to the desire for participation.

The small number of health authority staff who were closely involved is not necessarily a problem: Wilson (1990) describes projects undertaken by teams of two researchers and one member of the organisation. However, the quality of their involvement is crucial. Wider discussion of the ideas behind the projects would have been useful: the HISS study achieved most in this respect, as the subject of the evaluation coincided directly with one of the subjects of research. The process of procurement was a subject of wide concern and a number of views were gained in the course of the interviews.

Assessing the evaluation work and specifying learning are weak points. Feedback from the authorities was difficult to obtain: in the HISS and Breast Screening studies, only the comments of the internal sponsor of the study were secured. More attention was given to feedback in the Comcare study, and discussion with the manager concerned throughout the project was very useful. Predictably, presentation of the work to system users elicited more views and questions about the system than about the evaluation. Providing feedback, though of importance to the research project, was of no direct benefit to the organisation, and it would have been prudent to secure an explicit prior commitment to the later stages of the studies. Specifying learning was solely the activity of the researcher.

In all three studies to some extent, and in the Breast Screening study in particular, the independence of the evaluator was considered an advantage by the host organisations. Participation during the execution of the evaluation could have affected its perceived objectivity, in view of the preference for an outside evaluator. Where this view holds, there is a conflict with the principle that action research should be collaborative. As the effect of the environment on the practice of evaluation was of interest it was considered appropriate to comply with the preferences of the organisation. However, there is also the possibility of producing acceptable results through consensus rather than by relying on perceived independence.

A problem situation.

This was clearly the case in the Comcare study, which explicitly identified and applied an evaluation approach which would be relevant in an extremely problematic situation. Neither the BSS study nor the HISS process evaluation was intended as problem-solving activity, although the IS projects which they supported could be viewed in this way. It could be argued that the HISS process evaluation addressed the organisation's lack of knowledge of suitable procurement methods: this was certainly one objective, but a more generally applicable aim for process evaluation would be to learn from the experience of a given project in order to increase the organisation's capacity to carry out others. The identification of problems was an aim of the BSS study: this was seen as a means of management control which would allow any necessary action to be taken rather than arising from the perception that problems did in fact exist.

A change process.

In each case the evaluation can be seen as part of a change process. This is clearly so in the case of the HISS procurement, and also in the Comcare case where the evaluation was expected to contribute to action. A post-implementation review, such as the BSS evaluation, has been seen in this study as part of the implementation of a system, although in this case the organisational change involved was the introduction of the entire service. In addition, any evaluation which leads to change is part of a change process. In this project, however, the change resulting from the two post-implementation studies and the influence of the process evaluation (to date) has been slight, and investigative activity alone does not constitute change, other than the learning which results. This learning may be seen as an objective of evaluation (Etzerodt & Madsen, 1988), and was part of the rationale for the HISS and Comcare studies but less important in the case of BSS.

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An ethical framework.

Questions of values in the research were not formally discussed with the host organisations at any point. The researcher's purely subjective perception was that, as her NHS background was well known, she was assumed to share the value system of the NHS staff with whom she had contact. This was probably a reasonable assumption at the beginning of the project, though later there appeared to be some differences in values between those, mainly practitioners, who gave the highest priority to their own clinical work and those who were concerned with or could appreciate the problems of resource allocation and cross-discipline issues. It seems likely that the changes in NHS management which were taking place at the time made these differences more obvious, though presumably management had been concerned with these issues for some time.

Contributions both to the situation and to research.

An appropriate evaluation activity was carried out in each case. The contributions to research presented in this thesis are derived from all three studies.

An appropriate conceptual framework brought by the researcher.

The concepts and information brought to the action research studies include the conception of evaluation given in Chapter 1 and knowledge about the practice of evaluation and possible constraints upon it derived from the survey (Chapter 2). These ideas, and especially the notion of evaluation as having many potential uses, these being contingent on the precise situation, gave rise to the idea of a specific planning phase for post-implementation evaluation which was used in the Comcare and BSS studies. The Comcare study used the language of costs and benefits in order to explore the current effects of the system; these were identified using a simple framework of possible benefits and costs. The standards used in the BSS study can be characterised as "good practice" for IS management. The HISS process evaluation and the BSS study employed no additional theoretical concepts, though attention was given to the methods used. The HISS study drew on knowledge of procurement and the project manager's perceptions of the current situation to determine the requirements for a procurement procedure which would be fit for its purpose.

Learning by the respective actors.

Learning in the HISS study was made explicit; a total of three reports about relevant methods for procurement and benefits realisation were produced. Both researcher and practitioners learned from these. In the Comcare study, a very good working relationship allowed a less structured exchange of ideas, with the researcher learning a considerable amount about the current state of the NHS, and providing material about analysis techniques, systems methodology and other more or less relevant areas to an interested team. The Breast Screening study gave the researcher access to an application area with which she had little familiarity; the screening team was unfamiliar with computer systems in general at the start of the project, but learned rapidly from experience, and it is not clear what if any learning occurred as a result of the study.

Data feedback in a cyclical process.

A degree of feedback was built into each of the studies. The reporting structure of the HISS study was agreed in advance, and there were also regular progress meetings with the project manager. The post-implementation studies each had a feedback point at the end of the planning phase, and a final report was produced for each. Apart from this, both involved a series of meetings with the managers concerned, but the duration of the active part of the BSS study was quite short and there was little discussion during the actual evaluation period. The Comcare study, in contrast, was designed to take place over a longer period and there was a considerable amount of informal communication about progress which contributed to the further development of the evaluation. This study also included efforts to communicate the results of the study to staff, managers, and other Comcare sites.

It can be concluded that these studies have many, but not all, of the characteristics required in action research. The existence of a change process and a problem situation is open to interpretation, and more emphasis should have been given to discussing the values assumed by the work, and to securing feedback about the work done. A greater degree of participation would have been inappropriate in much of the evaluation work. This does not invalidate the learning which occurred, but the differences raise a further question of whether evaluation is a suitable subject for action research, or whether there is inevitably a mismatch with the characteristics of the approach.

6.6.3. Evaluation as a subject for action research.

The points in the description of action research given above which appear to raise most difficulty are the related items of a problem situation and a change process, and the involvement of members of the organisation.

Legge (1984) describes the close relationship between evaluation and organisational change. However, whilst evaluation is part of planned change, and evaluation and its resultant action constitute a change process, it does not of itself produce change unless the learning involved is the desired objective, and such learning may be limited. There may also be no conscious change as the result of an evaluation: its findings may be ignored or rejected, and no action taken. The cited definitions therefore lead to a questioning of the suitability of evaluation as a subject for action research. Foster (1972) suggests that much social research is diagnostic, but does not become action research because no change is implemented.

Similarly, evaluation does not necessarily take place in a problem situation. (This term is defined by Wilson (1990) as "a situation in which there are perceived to be problems".) As noted in the survey of health authorities, the existence of problems can prompt an evaluation study. However, where evaluation is part of the development process, as in procurement, the assessment of alternative solutions, or where post-implementation review is a standard practice, it is not a response to difficulties but a normal activity. In a wider sense, the introduction of the system is likely to be a response to a perceived need; in this sense it could be argued that a problem situation exists, but evaluation itself does not necessarily constitute the problem-solving activity implied by the definition.

It appears that not all types of evaluation are appropriate subjects for action research if the approach is limited to the definition given here. However, the experience of this project suggests that the main characteristics of action research are present: contributions to research and useful action in a real situation. It seems reasonable to extend the range of allowable research situations to include activities which are largely investigative, if research into this type of activity is required. Action research studies in this area include the work of Davis & Hamann (1988) and Simonse & Dijkstra (1988).

However, there are good reasons to suggest that studies which are confined purely to evaluation are not ideal. Research into evaluation which forms part of the development process would require to be done in the context of a development if its effectiveness and the fit with the other development activities are to be considered. The quality of the

results of an evaluation is important, and the utilisation of evaluation results is an important issue.

It is suggested that action research projects in the area of evaluation should include in their scope the utilisation of the evaluation results. Monitoring any action taken would allow some assessment of the evaluation results or recommendations. Practically, this will need to be defined when agreeing the scope of the study with the host organisation, both in view of the well documented tendency in other fields of evaluation to ignore the results, which Legge (1984) describes as a 'crisis of utilisation', and also because the same principles of shared learning and allowing multiple viewpoints need to be observed as in the other stages of the project. The current studies could have given more attention to this area.

The involvement of members of the organisation in an evaluation may also be a problem as it is incompatible with an independent opinion. Two of the studies in the current project involved system users in the process of defining the evaluation which would be carried out, and all three benefited from the involvement of an internal sponsor, but whilst user opinions were well represented in the actual evaluation, any assessment was done by the researcher. This division of work seemed to provide an appropriate solution for the studies concerned.

6.7. Further work.

6.7.1. Questions raised by the project.

Various possibilities were raised in the project which could not be pursued at the time, but might be included in any further studies if appropriate to the situation. One of these possibilities would be the planning of evaluation by consensus in a user group, rather than the consultative approach taken in the two post-implementation studies in this project. This might be particularly appropriate in a study where evaluation was expected to lead to considerable change, as it could be the first stage of user involvement in a subsequent development project.

The HISS study noted that at least two possible criteria for making tender decisions were considered during the procurement. Others may also exist and there is a need to understand the possibilities and their implications for the type of system selected.

The question of accuracy in data capture was raised by the Comcare study, and it was thought possible that staff perceptions of the level of accuracy required might vary. It was suggested that lack of motivation was probably not the only factor involved in that situation, but a full investigation of the relationship between motivation, other relevant factors and the perceived and actual accuracy of input data was not possible. An investigation of this area, as part of a suitable evaluation study, would need to consider a range of factors including the effort involved, ergonomic and other characteristics of the data entry process, and motivating factors such as the benefit to the individual.

As evaluation studies can involve considerable contact with users, their attitudes to the process are of interest, especially whether it is seen as useful and worth their participation, whether it is seen as a threat, and, if so, by whom. Attitudes to benefit assessment and realisation would be of particular interest, as the HISS study showed that this can be a sensitive area.

The small number of studies in the project were only able to consider a very limited range of organisational characteristics and types of evaluation. In order to understand the effects of organisational and social factors on the practice of evaluation more fully it would be necessary to consider a wider range of organisations, including organisations in other sectors, and to examine evaluation at other stages in the life cycle. Similarly, the identification of factors which should be taken into account in planning post-implementation evaluation is necessarily incomplete, and there is a wide range of evaluation approaches whose suitability for use in various circumstances could be explored.

The survey of health authorities gave a picture of the state of practice of evaluation at the start of the project. As some time has now elapsed, it would be useful in the fairly near future to undertake further survey work to ascertain the current situation, and to examine in more detail points raised by the original work. There would probably be less need for information about general questions the range of applications in use, and with the aid of the first survey to show the type of responses which could be expected, it should be possible to reduce the number of open-ended questions.

A number of specific points could be investigated. The original survey failed to discover how frequently process evaluation is carried out. The way in which post-implementation reviews are conducted would be of interest, as would the circumstances in which they occur, as it appeared that whilst many authorities undertook some reviews, these might be fairly informal and were often a response to specific situations rather than normal policy.

Respondents mentioned that learning from the implementation was a benefit of post-implementation evaluation and it would be useful to find out how such learning is assimilated.

It would be useful to discover the extent to which the various problems identified by the first survey are now experienced. Although a number of problems with the evaluation which could be carried out were noted, most respondents found their evaluation procedures fairly effective, and it would be possible to examine the effects of the difficulties which were mentioned. Various recommendations for the practice of evaluation and for benefits realisation have been released in the service in recent years, and it would be of interest to discover whether these are used and to solicit reactions. Several survey respondents expected their evaluation practices to improve when an information strategy containing evaluation criteria for new systems became available; it should now be possible to find out whether such criteria are in fact used.

The Comcare study noted serious difficulties in assessing both the costs and benefits of IS and the total impact of an IS on the performance of a health authority or unit. Solutions to these do not seem to be forthcoming in the short term and alternative approaches are needed. However, within the limitations of the cost-benefit approach, short-term goals might include gaining a greater understanding of the trade-offs made in subjective assessments of health care systems, and refinement of the simple cost-benefit framework used in the study to provide a more structured guide for identifying system impacts.

The HISS study suggested that there were problems with the techniques used for estimating benefits, and further experimentation with these is needed. This should be done in consultation with professional staff, allowing those with a knowledge of their working patterns to agree how changes in effort could be accurately assessed and how and where the impact of such changes would be felt. The accuracy with which benefits of all types can be predicted is important, especially in view of the connection proposed by Ginzberg (1981) between users' expectations and the success or failure of a system. The work should include the implementation and monitoring processes as well as the identification phase. Guidelines for estimating the impact of hospital systems on patient throughput which are applicable to the NHS are also needed. (The HISS Central Team is expected to carry out further work in the area of benefits realisation.)

It would appear to be a small extension to the basic idea of a BRP to include cost monitoring and control in the implementation plan. This could help to prevent situations such as that which arose in the Comcare implementation from reaching such severe levels

by detecting problems at an early stage. The same feedback mechanism could be used to agree corrective action. Costs of various types could be covered, including those of personal concern to users if anticipated during development. Despite the terminology of benefit realisation, the measurement of some types of benefit will also detect costs, especially where problems have occurred and made worse some aspect of an organisation which should have been improved. Activity timing will in any case need to include the time spent in carrying out tasks which use the system. However, direct financial costs and other pure costs such as the staff time required to collect data for the Comcare system may be independent and need separate assessment.

A comprehensive and staged programme such as this would be an alternative to many aspects of the traditional single post-implementation review, but unanticipated side-effects would not be covered. A more open-ended element of review would still be needed to cover these and to deal with quality and other issues, and could be combined with suitable parts of the monitoring. Such a scheme would be one possible approach to post-implementation evaluation, but no approach will be the best in all circumstances. Research would be required to find whether this is a useful and efficient approach, and in what circumstances it could be adopted.

The discussion of action research as an approach to research into IS evaluation could lead to further consideration of research methods in this area. This project has treated evaluation research as a reference discipline and drawn on it for techniques and understanding of the evaluation process, but the discipline has itself developed partly by drawing from other areas of the social sciences and partly by learning from the experiences of its practitioners. References to the discipline in this project have concentrated on its evaluation aspects, but it is a paradigm for social research in its own right, as not only the implementation of programmes of social or organisational change can be assessed, but also the validity of the underlying theory. The possibility of applying this paradigm to research in IS is worth investigation. Current evaluation research has been criticised for neglecting this aspect (Chen, 1990). Chen places an emphasis on the causal links between programmes and their intended results, but, in the same way as the IS discipline, evaluation research encompasses a number of social theories. The assumptions underlying the approach would therefore need to be considered.

6.7.2. Evaluation in IS methodologies.

A direction which was originally considered for the research project, but found impracticable, was the examination of evaluation in IS methodologies. This would be a useful area for future work, as a methodology could provide a structure for the evaluation process and support for those carrying out the evaluation, as well as linking it to development activities to provide a more streamlined implementation and to ensure that any information necessary for post-implementation evaluation would be available. This project has argued that evaluation is beneficial to the selection, development and management of IS: it is therefore desirable to support it throughout the life of the system. A methodology which stressed evaluation would need certain characteristics, some of which arise from the need to relate evaluation requirements to system and organisational characteristics. As an understanding of these factors is necessary for the development of the system as well as for selecting an evaluation approach, there will be some overlap in the required activities.

Two areas for work on this subject are suggested. The first is a study of the evaluation which takes place in existing IS methodologies. This would provide information about the linkages between evaluation and other development activities, and the information which methodology products can provide. Evaluation as part of the development and implementation process, such as feasibility studies, end of stage reviews and option selection, would be included, as well as post-implementation assessments. However, it is likely that many methodologies will be found to contain little explicit evaluation. It is suggested that a number of methodologies should be examined, and that these should be of different types: they might be selected on the basis of a categorisation such as that of Wood-Harper & Fitzgerald (1982). The study will require familiarisation with the chosen methodologies, including an understanding of their scope, structure, the tasks which are carried out, the intermediate and final products of these, and the underlying assumptions. The points to be investigated for each methodology could include:

- The purpose of any evaluation, and the ways in which the results of evaluation can be used.
- The object of evaluation - a design, proposal, software product, installed system etc.
- The breadth of the evaluation, i.e. the range of aspects which are or can be included.
- The techniques and tools used and the information required.
- The way in which evaluation is related to other parts of the methodology; other tasks or deliverables which support evaluation.
- The extent to which users are involved in the evaluation process.

- The inclusion of a variety of views in evaluation and in defining evaluation criteria.
- How far the approach to evaluation can be adapted to varying situations.
- The relationship between the defined scope of the methodology, i.e. the parts of the life cycle which are included, and the type of evaluation which is performed.

This survey would support the main area of work, which would be the inclusion of support for evaluation in a development methodology. The proposed methodology could be tested and refined in further action research studies. These would ideally cover the complete implementation process, though there might be scope for initial studies which could concentrate on particular stages. Projects operating in a range of organisational conditions and aimed at producing different sizes and types of system would be needed, in order to ensure the capacity to adapt to these differences, though if, as in the current project, attention was confined to a particular type of organisation, this would reduce the possible variety.

Specification of the methodology could take as its starting point the suggestions which have arisen from the current project, and the underlying assumptions about evaluation. The methodology might well adopt the view of systems development as a process of IS evaluation "in the large" proposed by Iivari (1988). Many existing methodologies cover only the analysis and design phases, and perhaps an initial feasibility study, but if support were to be given for evaluation during and after implementation, attention to the implementation and operational phases of system life would be needed. The current project has stressed the need to select evaluation approaches appropriate to the purpose of the evaluation and the characteristics of the organisation: a framework for making such choices would need to be included, and a contingent methodology with an existing framework for assessing such characteristics might be a good basis. The methodology must allow for the exploration of the relevant organisational factors, and these will be relevant to the development of the system as well as its evaluation.

The current project has shown that organisational and environmental changes can affect the requirements for evaluation. They can also affect system requirements. For both these reasons, attention to predicting and monitoring such changes should be possible within the methodology framework. The ability to support the selection of packaged software is also important. A programme for predicting and ensuring the achievement of benefits and the control of costs could be integrated with system selection or development and the implementation process; a similar procedure based on the achievement of defined objectives would be an alternative. These approaches would require different methods of

identification or agreement, but the structure for monitoring their achievement and for revising targets in the event of organisational change might be quite similar.

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