Cost-Benefit Assessment of the Organisational Impact of a Technical System Proposal

Introduction

Of the many tasks that have to be undertaken if information technology is to be successfully implemented one of the most crucial is the early assessment of the organisational impact of a proposed technical system. Typically the wider implications of technical system implementation are not appreciated until development work is well advanced and it may be difficult to change direction. The earlier this assessment can be made the more influence can be exerted upon technical system design and the methodology for its implementation. The problem, however, is how to make an assessment when the proposal is only an outline 'on the drawing board' and there is nothing concrete for users to evaluate.

The procedure presented here is designed to meet this need. The rationale and general structure is presented in Chapter 6[1] and the check-lists that follow provide the working documentation for the assessment. The circumstances under which this procedure is most relevant and has been most tested are as follows. As a result of a feasibility study an outline conceptual specification for a technical system has been proposed for a specific organisational setting. A group, perhaps comprising user management, technical staff and user representatives are charged with assessing this proposal for organisational and user acceptability.

The procedure takes a group of this kind through the following stages:

1. *Systems specification*. Stating the technical proposal in a form which facilitates the assessment of organisational impact.
2. *Organisational specification.* Outlining that part of the organisation which will be affected by the system and describing the actual or planned work roles that will be occupied by users of the system.
3. *User Cost-Benefit Assessment.* An assessment of the impact of the system upon the major work roles of potential users.
4. *Organisational Match Assessment.* An assessment of the overall impact upon the organisation.
5. *Socio-technical Design.* A series of check-lists to support the development of a strategy for the development of an acceptable socio-technical system.

In addition to its value in assessing specific technical proposals it has also proved useful as a training aid, helping people appreciate the way in which technical systems influence organisational issues and thereby developing their ability to play a constructive role in technical developments within their own organisations. In this instance case studies need to be developed with technical and organisational specifications similar to the organisational contexts with which the trainees are familiar.

Stage 1: The Technical System Specification

[1] chapter 6 refers to Eason's own book, Eason, 1988. section 3.5 above presented a summary of the rationale and the general structure of the technique.

The following information needs to be extracted from the outline conceptual proposal.

1. Purpose and Overall Configuration
   - What is the overall rationale for the system?
   - What scale is envisaged (how much of the organisation will be affected)?
   - What kind of system is envisaged (an integrated, mainframe-based system a net work, stand-alone micros, etc.)?
   - How does the system relate to existing technical systems, i.e., does it replace them, extend them, have to be compatible with them, etc?

2. Planned Benefits
   - What benefits are used to justify the planned expenditure?
   - resource reduction?
   - resource effectiveness?
   - individual enhancement?
   - organisational enhancement?
   - What priorities are placed upon the achievement of these benefits?

3. System Functionality
   - What, in global terms, are the main categories of service to be offered to users:
   - reports/enquiry facilities available?
   - communication facilities?
   - text processing services?
   - data processing and calculation services?
   - control facilities, e.g. for monitoring and directing equipment, and processes? etc.
   - What requirements, in global terms, will this place upon users:
   - requirements for data input to the system?
   - requirements for standardisation procedures across the organisation?
   - requirements for timing, security, etc?

4. Management Development, Management Control
   - From what location will the completed system be managed both on a routine and a developmental basis?
   - From what location will the system be developed and what plans exist for the management of the project?
   - What kind of development and implementation strategy is envisaged (e.g. prototypes and trials, phased implementation, 'big bang', etc.)?

It should be noted that very little information about the physical characteristics of the system is sought at this stage; indeed such information should not be available because decisions of this kind should follow a detailed examination of the concepts being advanced. This means that the assessment of impact can cover functionality and acceptability but not usability since this depends upon the specific form of system delivered. However, the analysis of users to be undertaken can lead to the statement of usability criteria[2] to be used as the system is developed.

Stage 2: Organisational Description

[2] see Macaulay, 1995, for an explanation of usability and usability criteria

A statement of the characteristics of the organisational setting into which it is planned the technical system will be implemented.

1. Organisational structure and work roles
   - What is the reporting structure in the part of the organisation to be affected by the system?
   - What are the main categories of work role to be affected by the systems?
     - primary users?
     - secondary users (occasional or indirect users)?
     - tertiary users (those affected but without direct access)?
     - non-users but affected by implications, e.g. job displaced by the system?
   - What changes are envisaged in the work roles or reporting structure by the time the system is implemented (either as a result of the system or because of other organisational changes)?

2. Overall allocation of relevant tasks to work roles
   A top level task description of the way in which the activities of the organisation that the technical system is designed to support are currently handled in the organisation. It should show:
   - How the overall tasks are subdivided and allocated to existing work roles (how are responsibilities allocated?)
   - The existing contribution of technology to the tasks undertaken within each work role.
   - The task interdependencies between the work roles. It may be that these can be shown as a time-related task-flow, as a complex process is worked through. However, care must be taken not to assume a too simplistic or well structured set of relationships. An analysis of the relationships between responsibilities may provide a more abstract and powerful expression of the interdependencies.

3. An Allocation of Functionality Table
   The development of a table expressing the planned allocation of the functionality of the technical system to the work roles in the organisation. This brings together the system specification and the organisational specification and provides the basis for the cost-benefit assessment.

   - Take each major role and list the system functionality which will be available to the role.
   - Annotate the list with the allocation of responsibilities for data inputs and any other requirements which will be laid upon the work role.

System Functionality	User Work Roles

Figure.....

Stage 3: User Cost-Benefit Assessment

The following check-lists can now be completed on behalf of each of the user work roles identified in the allocation of functionality table. The aim is to express the changes that the planned system would bring to each user role and to assess how the users would be likely to evaluate these changes.

In making the evaluation the underlying rationale is that users will be concerned with two aspects of the change:

> *Benefits:* which may be in terms of the ability to perform tasks more effectively, desirable changes in the nature of the job, improved salaries, greater power and influence or enhanced career prospects, etc.
> *Costs:* which may be financial but include the effort it takes to use a system, loss of job security, effort to learn and adapt, risk of failure, loss of job satisfaction and loss of privacy, etc.

The check-lists cover the major changes that research has shown often result from the introduction of information technology. The list is divided into five kinds of impact that range from the most direct to the most indirect. In practice, it is easier to predict the effects at the top of the list than at the bottom. The first issue is job security because when there are issues of this kind affecting a user group they will tend to dominate the entire evaluation process. Supposing a job remains to be done, the next section reviews the changes in information service that result from the functionality in the system which will be provided for the user group. The main categories of service need to be entered in this section. It is important to consider both the categories the access to and those that are provided because access by others to facilities debarred from the user group may have important consequences for them.

The third section reviews the major dimensions of a job that may be changed and this is followed by a section examining the organisational procedures that may change and

influence the user. Finally, the indirect effects upon personnel policies which affect the user are reviewed.

In completing the questionnaire the significant changes that may affect the user are first listed. It is most unlikely that any specific user group will experience changes on all of these dimensions so that this is a question of trying to identify major areas of change. Where there are changes an assessment can be made of the likely evaluation of users. Separate columns are provided for benefits and costs because some changes have elements of both, for example, job changes can lead to the loss of valued skills but the development of new ones that will be valuable in the future.

It may be sufficient to give a qualitative expression to this evaluation, simply identifying all benefits as positive outcomes and all costs as negative outcomes. In practice, however, we have found that teams engaged in this exercise like to give quantitative expression to the evaluation. If this is done an overall score can be given for each user group and, across the user population, the winners and the losers can be clearly seen. We give below the scoring system that has evolved for this purpose but we would caution against too literal a use of the figures; the ability to predict changes and human responses to them is not such as to support fine discriminations between the totals that result.

To score the check-list put a total between +1 and +5 in the benefit column for each change that would be regarded as a benefit. A high score represents a change the user would be eagerly awaiting, a low score is a marginal benefit that would excite little interest. Similarly where a change may have a negative element to the user enter a score in the costs column of between -1 and -5 where -5 is a striking issue and -1 is a minor anxiety that may soon be forgotten. Averages can be calculated for each sub-section, treating costs and benefits separately. Dimensions where no changes are anticipated should be ignored. Totalling the scores for each subsection gives an overall score for the user group where the total possible is 25. Although the totals must be treated with caution a high benefit, low cost conclusion is indicative of a good response. A low benefit, high cost outcome will probably lead to user resistance and it may be useful to explore what form this might take (for example, non-use, partial, use, opposition to implementation, negotiation for protection or other benefits, etc). Quite often a high benefit, high costs outcome is obtained which suggests the reception of the system could be good if only some of the costs could be removed. In practice, it is common to find all of these outcomes for the same system because different user groups are affected in different ways.

Check-list 1

Problem Outcome

USER COST-BENEFIT ANALYSIS

User Group: .....

Issues	Change	Benefits	Costs
1. Job Security			
2. Information Facilities in System (System Functionality) (a) ..... (b) ..... (c) ..... (d) ..... (e)			
	Average		
3. Job Content (a) Task Variety (b) Effort Required (c) New Skills Old Skills Lost (d) Work Pace Deadlines (e) Workload (f) Satisfaction			
	Average		
4. Organisational Procedures (a) Discretion/Autonomy (b) Standardisation/Formality (c) Power and Influence (d) Privacy (e) Communications (f) Status			
	Average		
5. Personnel Policies (a) Basic Pay (b) Other Rewards (c) Career Prospects (d) Industrial Relations			
	Average		
	TOTALS		

The first check-list is an assessment of the probably outcomes of the planned system. It is quite likely that in completing the check-list respondents think of ways in which the outcomes for the users could be improved by changing the nature of the technical system, the way it is implemented or the social system of which the user is a part. A second check-list is provided for these desirable outcomes. It includes the same dimensions and can be scored in the same way. In this case, wherever a more desirable outcome is identified an 'If...' statement could be inserted to specify the conditions under which this desirable end would be obtained. A complete list of "If..." statements constitutes a useful specification of the requirements of the user groups, and can be used in replanning or detailing the system. There is of course no

guarantee that the requirements of the different user groups will be compatible with one another.

Check-list 2

Desired Outcome COST-BENEFIT ANALYSIS

User Group: .....

Issues	Change	Benefits	Costs	Conditions
1. Job Security				If...
2. Information Facilities in System (System Functionality) (a) ..... (b) ..... (c) ..... (d) ..... (e)				If...
	Average			
3. Job Content (a) Task Variety (b) Effort Required (c) New Skills Old Skills Lost (d) Work Pace Deadlines (e) Workload (f) Satisfaction				If...
	Average			
4. Organisational Procedures (a) Discretion/Autonomy (b) Standardisation/Formality (c) Power and Influence (d) Privacy (e) Communications (f) Status				If...
	Average			
5. Personnel Policies (a) Basic Pay (b) Other Rewards (c) Career Prospects (d) Industrial Relations				If...
	Average			
	TOTALS			

If the end product of this evaluation is a number of user groups who have very negative scores it is unlikely that the system can be effectively implemented except by management coercion. It may be, however, that the analysis has identified a number of more productive routes and an effective strategy can be to reformulate the technical plans and repeat the evaluation to check whether a better prognosis can be obtained. When the outcome is reasonably positive, i.e. all user groups show some positive outcomes even if there are considerable costs, stage 4 of the evaluation can be addressed.

Stage 4: The Assessment of Organisational Cost-Benefit

Check-list 3 provides a basis for making an assessment of the cost-benefit of the system from an organisational viewpoint. It is likely that a formal cost-benefit assessment will be made in terms of the value of tangible benefits set against the costs of system development and purchase. The aim here is to express the cost-benefit to the organisation across a wide range of organisational impacts.

Check-list 3

ORGANISATIONAL COST-BENEFIT ANALYSIS

	Change	Benefits	Costs
1. Planned Benefits (a) Resource Reduction (b) Resource Optimisation (c) Individual Enhancement (d) Organisational Enhancement			
	Average		
2. System Operation (a) Reliability (b) Security (c) Compatability (d) Vulnerability to Stoppages			
	Average		
3. Organisational Match (a) Control Mechanisms (b) Flexibility (c) Adaptability (d) Culture and Values			
	Average		
4. User Group Responses (a) ..... (b) ..... (c) ..... (d) ..... (e) ..... (f)			
	Average		

The check-list has the same construction as the check-lists for user groups. It provides a number of dimensions for which the cost-benefit can be assessed by identifying the change and evaluating this for positive and negative implications.

The first section lists the major forms of planned benefits which were discussed in Chapter 2[3]. It would be expected that the main positive effects would arise from this section. However, the achievement of one type of benefit may well inhibit the achievement of other benefits which may be regarded as a negative outcome.

The second section lists the direct organisational implications of using information technology systems which are discussed in Chapter 8[4]. They range from issues of data security and reliability to the degree to which new systems are compatible with existing systems.

Broader organisational issues are considered in section three. A technical system may, for example, help or hinder the organisation's ability to respond flexibly to external demands, to adapt over time and to adopt values, control mechanisms, etc. of its choosing.

The final section summarises the likely reactions of the major user groups. The results of the earlier analysis can be summarised for all the user groups on a +5, -5 scale as a way of reviewing the ease of difficulty of implementing the system as planned.

Completing this check-list provides a basis for assessing whether the planned system as outline is likely to be beneficial and acceptable to the organisation as a whole. If it is, we can proceed to stage 5 which presents procedures for detailing and developing the system. If there are significant difficulties it may be appropriate to review the technical system outline, the organisational structure or the development plan to seek a better match with organisational needs. A new concept derived in this way may be evaluated by conducting stages 3 and 4 once again.

Stage 5: Developing a Strategy for Design and Change

The outline, conceptual plan which has been assessed as acceptable can now be detailed. It is likely that the analysis will have revealed a range of problems and a series of desirable outcomes. In developing the plans for the system and the way it is designed, these 'costs' and 'benefits' need to be carried forward to ensure the benefits are realised and the costs are eliminated or managed. The strategy that is developed should set this as a target for the organisation as a whole and for each of the major user groups.

The strategy has three components reflected in the three check-lists that follow.

The first step is to review the social system (and therefore the organisational change) that is appropriate to achieve the business goals of the enterprise. The second step is to construct an outline technical system which will support the social system. Finally,

[3] of Eason, 1988
[4] of Eason, 1988

a project design process is required to construct and deliver the planned socio-technical system.

The check-list (check-list 4) for the social system is based upon Chapter 7[5] and part of Chapter 9[6]. It attempts to identify the overall enterprise goals and to structure the social system to serve these goals. This section may be about a major or a minimal change and should use the ideas generated in the analysis phase. It should be remembered that the assumptions of no change in the social system if a new technical system is implemented are not tenable. Therefore, even if no change is intended, this section should be reviewed because enforced changes may have to be managed. The second part of the check-list identifies the dimensions of the organisational changes that will take the enterprise from its current to its future state.

Check-list 4

SOCIAL SYSTEM DESIGN

Organisational Objectives

1. *Enterprise Goals:* state as operational aims in specific time-scales.
2. *Organisational Structure:* overall section/department/group structure to take responsibilities for enterprise goals.
3. *Job Design Philosophy:* policies with respect to the allocation of duties to individual employees.
4. *Control and Co-ordination:* policies to govern the way in which activities are co-ordinated in pursuit of goals.
5. *Values and Customs:* policies to govern the ways in which goals will be pursued.

Organisational Changes

For each of the following assess the degree of change and the appropriate mechanisms for making the transition.

1. Structural Changes in the Organisation.
2. Jobs to Phase Out.
3. New and Different Jobs to Introduce.
4. Skill Changes.
5. Implications for training, grading, team building, etc.
6. Industrial Relations Implications.

Check-list 5 is a specification of those aspects of the technical system which most directly support the social system, i.e. support the role allocations between users. These issues are discussed in the user acceptability section of Chapter 8[7]. The check-list does not provide for a complete technical specification but concentrates upon the articulation of system services and requirements to match the articulation in the social system.

---

[5] of Eason, 1988
[6] of Eason, 1988
[7] of Eason, 1988

Check-list 5

TECHNICAL SYSTEM SPECIFICATION

Within the specification derived from check-list 4 develop a technical system specification which supports the social system which addresses the following topics for each user group.

1. *Facilities*
   - who needs what services from the system? (How is system functionality to be allocated?)
2. *Access*
   - who should have what degree of access to data bases?
   - how should access be controlled?
3. *Data Input*
   - by what means will data be entered, verified, etc?
   - who has the authority/responsibility for updating or amending which data?
4. *Interface Specification*
   - what special requirements will users have of the man-computer interface (ease of use, ease of learning, etc.) i.e. what will define usability for each user group?
5. *Customisation*
   - what requirements will there be for customisation of services to specific user groups?
6. *Adaptation*
   - what requirements will there be for adapting or evolving the system to meet developing user needs?
7. *Implementation Strategy*
   - what strategy will be used for implementation? e.g. prototypes, trials, phased introduction of facilities, etc?

The final check-list seeks to establish the composition of the team who will develop the system and the procedures by which they will work. It is the design of the temporary vehicle which will manage the innovation. It is based upon Chapter 5[8] and concentrates upon the roles of users and technical staff in the development of the system.

Check-list 6

PROJECT DESIGN PROCESS

Considering the needs of (a) the management commissioning the system, (b) the technical staff and (c) each of the user groups, construct a process of designing the system by establishing the following:

1. *Steering Committee*
   - what is the customer-contractor relationship?
   - who makes policy decisions?
2. *Main Design Group*

[8] of Eason, 1988

- should there be user representatives?
- what is the role of user representatives?
- should users be trained for systems design?
- should it be full or part-time secondment?

3. *Working Parties*
   - should there be working parties on specific issues?
   - if so, which issues and what composition?
4. *Consultation, Training and Support*
   - who should consult and train each group of users?
   - what strategies should be used?
   - what point of need support strategy should be employed after implementation?
5. *Information Dissemination*
   - by what means will everybody be kept informed of design progress?
6. *Other Organisational Management Procedures*
   - What need is there to report to/consult existing management structures in the organisation?
   - Board of Directors
   - Information Technology Strategy Committee
   - Industrial Relations Bodies
   - etc.

Bear in mind that user participation has to be accomplished whilst the pressures to get the work done remain as normal.

The outcome of completing these check-lists should be a broadly-based specification of a socio-technical system which should serve significant enterprise goals and should be functional, usable and acceptable to the user groups within the organisation. Furthermore, the composition of the design process should assign responsibilities for this specification to users so that the system can be developed in detail without losing sight of the user and organisational variables that have been identified as significant.