

## GOING SOFT ON INFORMATION SYSTEMS EVALUATION

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### ABSTRACT

The way organisations do business has changed dramatically over the last twenty years and so have their information systems as they attempt to support and promote the business enterprise. The information system has a key role to play in the success or possible failure of the business yet, despite its importance, there is little evidence that the components of the information systems evaluation process have kept pace with its changing role as they tend to rely on techniques based on narrow tangible/objective methods rather than on more holistic approaches which, in addition to the more traditional methods, include social, political and cultural perspectives more in keeping with the complex interactions associated with modern organisations. The paper charts the recent progress of organisational change, the increasing role of information systems within the organisation, and the information systems evaluation processes. It concludes with a proposal as to how the evaluation process could be widened to include the views and interests of a larger range of stakeholders by drawing upon elements of the soft systems methodology.

### INTRODUCTION

The last twenty years have seen a tremendous change in the way companies do business. Much of this change can be attributed to the so called information revolution. The integrated interaction between information technology and business processes has not only changed the way organisations operate but how society responds to the new environment. The role of information systems within business organisations has changed from its initial function of automating clerical tasks (eg payroll, inventory) to providing pertinent information for operational, managerial and executive groups within the organisation (eg. Decision Support Systems, Executive Support Systems). In more recent times information systems have supported some organisations as they transform or re-engineer their operations in the face of a rapidly changing business environment.

The significant benefits accrued by a company as a result of the efforts of its information system group are not necessarily tangible in nature; in fact most appear intangible and as a result are difficult to quantify and measure in a satisfactory manner. Nevertheless the cost of information gathering and subsequent analysis is a significant burden for many organisations who, in the face of increasing competition and reduced profit margins, seek to reduce costs and improve efficiency and effectiveness.

Most information systems regimes appear to focus on the methods that favour tangible and objective assessment ignoring to some degree the organisational and social context in which the system resides. This paper draws upon the interpretivist framework of evaluating information systems based on the idea of content, context and process (Serafeimidis & Smithson, 1996; Avgerou, 1995; Symon, 1994) and proposes a soft systems approach to establishing evaluation criteria and strategies. Soft systems methodology is ideally suited as an evaluation methodology as it acknowledges cultural, political and social perspectives and, through innovative and meaningful and structured and collaborative debate between accommodating stakeholders, seeks to create an environment where appropriate action can be taken.

### CHANGING ROLE OF IS

Scott Morton (1991) argues that established organisations in their attempt to respond to the constantly changing business environment have seen their information systems pass through three phases or generations; automate phase, informate phase and the transformate phase.

#### Automate phase

The automate phase is associated with attempts by the organisation to reduce costs by replacing repetitive clerical tasks with automated computer-based systems. Given this role of information systems to automate existing processes by labour substitution (Loveman, 1994; Remenyi, Money & Twite, 1993) traditional cost benefit analysis can be applied to evaluate their performance. In addition to these financial benefits there are further perceived benefits such as greater speed, improved accuracy and so on.

### **Informatate phase**

Zuboff (1988), and Yates and Benyamin (1991) claim that most information systems in the late 1980s and early 1990s did not confine themselves solely to automating business activities but also generated, usually as a by-product (Scott Morton, 1991), large quantities of data previously unavailable to the organisation. Remenyi et al (1993) and Eason (1988) propose that during this informatate phase the information systems is intended to facilitate more effective management and control over the organisation's activities and empower users to improve their overall performance. Schein (1994) suggests that information systems in the informatate phase are also used to make critical organisational processes visible and understandable to other members of the organisation. Information systems in this phase of operation would normally expect their performance to be measured against criteria such as; time to arrive at a decision, return on investment, systems usage or user satisfaction.

### **Transformate phase**

Remenyi et al (1993), Cash et al (1992) and O'Brien (1996) claim that in some cases it is possible to radically change the way the organisation does business or even change the nature of the organisation itself through the way information systems are employed. Scott Morton (1991) warns that transformations of such magnitude may cause a redistribution of power and control within the organisation and as a result may be very threatening for those people involved. Quite clearly the transformation phase is associated with people, cultural and political issues. This proposition is supported by Schein (1994) who suggests that the cultural assumptions about the nature and use of information systems will themselves be crucial determinants of how such systems will be used to create further innovation.

## **INFORMATION SYSTEMS EVALUATION APPROACHES**

The changing role of information systems is invariably associated with considerable investment in both human (Scott Morton, 1991) and physical resources (Willcocks, 1994). The increasing level of information systems investment has made the evaluation of such systems an important issue for the organisation (Serafeimidis & Smithson, 1996; Willcocks, 1994; Kumar, 1990; Hirschheim & Smithson, 1988). However, a formal evaluation of information systems is seldom done and if such evaluation is carried out it is usually concerned with those aspects of information systems that are regarded as important by the systems builders and information systems' managers (Avgerou, 1995; Symon, 1994; Kumar, 1990).

The information systems literature contains a plethora of articles on information systems evaluation each with its own assessment framework. Summarising the literature Hirschheim and Smithson (1988) claim that most evaluation processes concentrate on technical rather than human, social or organisational aspects of systems. This view is supported by Serafeimidis and Smithson (1996) and Bacon (1994) who surveyed 80 companies in the USA, UK, Australia and New Zealand and found that 79% of them placed technical systems requirements as the primary evaluation criteria. The difficulties of quantifying qualitative benefits of information systems has led to the use of more subjective techniques but even so such intangible benefits are very difficult to measure (Willcocks, 1994; Bacon, 1994; Dos Santos, 1994).

However, Hirschheim and Smithson (1988) suggest that it is possible to classify evaluation techniques and methods into three zones, efficiency zone, effectiveness zone and the understanding zone. These three approaches are not distinct but can be thought of as a continuum ranging from highly objective and rational to very subjective and political.

### **Efficiency Zone**

The basic underlying assumption of the efficiency zone is that the systems' functions and goals of evaluation are non-controversial and that the achievement of more precise measurement of these functions is the overall aim of the evaluation process (Symon, 1994; Hirschheim & Smithson, 1988). Hirschheim and Smithson also claim that methods and techniques such as hardware performance and software maintainability can be classified in this zone. Tangible benefits such as these are invariably evaluated through efficiency metrics (Parker, Benson & Trainor, 1988).

Ginzberg and Zmud (1988) argue that most evaluation techniques in common use today were developed at a time where the primary use of information systems was limited to automating clerical tasks within the administrative function of the organisation. Not surprisingly therefore most information systems evaluation processes deal with efficiency metrics (Saunders & Jones, 1992).

### Effectiveness Zone

As the role of information systems changes the resulting benefits cannot be easily quantified (Wolstenholme, Henderson & Gavine, 1993; Eason, 1988). From an evaluation perspective Mahmood and Mann (1991) suggest that as the information systems become more embedded within the organisation's business activities it becomes more and more difficult to isolate the information systems factors from other interrelated factors such as norms, beliefs, culture, working environment and so on.

Efforts to evaluate these systems by using such traditional cost benefit analysis or return on information systems investment metrics have been unsatisfactory (Dos Santos, 1994; Wiseman, 1994; Tegginmath, 1993).

### Understanding Zone

The understanding zone represents a major shift in the evaluation process. It attempts to deal with the benefits that are associated with political and social activities. Quite clearly such evaluation will be relative to a particular set of interests which may or may not represent the position of all the stakeholders (Sauer, 1993). In the worst scenario the outcome of this evaluation may disproportionately affect some groups leading to a power imbalance within the organisation (Avgerou, 1995).

Hirschheim and Smithson (1988) suggest that in order to incorporate social and political aspects of any information systems evaluation a deeper understanding of the nature and the process of information evaluation itself is required.

## THE CONTENT, CONTEXT AND PROCESS OF EVALUATION

Symon (1994), Avgerou (1995) and Serafeimidis and Smithson (1996) have replied to this plea from Hirschheim and Smithson (1988) by proposing an interpretivistic framework to evaluate information systems. This framework is based on the idea of content, context and process of organisational change as developed by Pettigrew (1985).

The content element provides the central kernel of what is to be evaluated and the process describes how this should be done, while the context investigates the organisational background and environment. These are not discrete independent elements. Serafeimidis and Smithson (1996) and Symon (1994) argue that the elements are strongly linked and interact with each other.

### The Context of Evaluation.

Some researchers are adamant that an information system cannot be evaluated without due regard to its organisational and social context (Serafeimidis & Smithson, 1996; Avgerou, 1995; Symon, 1994). Cash et al (1992) have illustrated this viewpoint with examples on how organisations which have successfully implemented systems in a narrow technical sense have experienced unforeseen disastrous organisational consequences because they appear to have ignored the context in which the business resides. Davis and Hamann (1988) go further and claim that the existing business and industrial context helps define what is expected of an information systems.

Willcocks and Margetts (1994) and Serafeimidis and Smithson (1996) propose that the context of evaluation can be classified into two categories:

- External context  
Covers factors such as the economy, government policy, market demands, business competition, availability of supplies, external procedures, funding arrangements.
- Internal context  
Covers factors such as strategy, organisation structure, rewards system, corporate culture, human resources, individual roles, industrial relations.

### The Content of Evaluation

Flood (1994) suggests that activities performed within an organisation must satisfy some need or purpose. Globerson, Globerson & Frampton (1991) propose that by analysing the purpose of the organisation it is possible to identify and develop relevant criteria which can be used as the basis for measuring the *success* of an organisation. Delone and McLean (1992) used this approach and developed six evaluation measures:

- System quality  
Measures the processing system itself in terms of speed, log on time, reliability.
- Information quality  
Measures the information systems output in terms of clarity, conciseness.

- Information use  
Measures the use of the output of an information systems in terms of acceptance of reports, frequency of use.
- User satisfaction  
Measures the use of the output of an information systems in terms of user satisfaction, enjoyment.
- Individual impact  
Measures the effect of information on the behaviour of the recipient in terms of quality of decision analysis, cost awareness.
- Organisational impact  
Measures the effect of information on the organisational performance in terms of profit performance, return on investment.

### The Process of Evaluation

Serafeimidis and Smithson (1996) suggest that the process of evaluation covers how the evaluation is done and how the issues are perceived. From this proposition it can be seen that the process of evaluation is to some extent determined by how the stakeholders view the evaluation process. In fact, as pointed out by Yates and Benyamin (1991), organisations that take into account the human issues when they adopt an information systems, especially by encouraging participative involvement at multiple levels, frequently consider their investment successful. On the other hand organisations that adopt information systems without taking into account human and organisational issues were not be able to realise the system's full potential.

Serafeimidis and Smithson argue that the process of evaluation should be regarded as a means of encouraging the involvement and commitment of the stakeholders. Avgerou (1995) also claims that the evaluation process should be participative allowing all the stakeholders to openly express their views. Finally, the process of evaluating an information system should be regarded as a learning process, mediating between the context and content (Ward, Taylor & Bond, 1996; Serafeimidis & Smithson, 1996; Symon, 1994; Powell, 1992; Etzerodt and Madsen, 1988).

Evaluation is never value free as it invariably contains assumptions that are based on stakeholders' perspectives (Symon, 1994). Saunders and Jones (1992) found that senior managers put greater emphasis on managerial data than did the information system managers, while the latter put more stress on attitudinal criteria and other financial criteria relating to budget status and project completion.

Gregory and Jackson (1992) and Powell (1992) argue that the way the stakeholders perceive their organisation will be reflected through the forms of evaluation methods adopted by them.

They claim that the objectivist type of stakeholder has the following characteristics:

- believes in tangible realities and wants to prove everything
- puts more emphasis on the well-being of the organisation as a whole
- leans towards conformity at all times and has little regard for individual freedom
- concentrates on the end products of employees' labours
- tends to view decision making as a burden of those in authority and considers that cooperation of colleagues should be assured by using appropriate rewards and punishments.
- prefers quantitative information resulting from surveys and structured interviews.

This type of stakeholder is likely to seek to quantify system inputs and outputs in order to attach values to the systems (Powell, 1992).

The subjectivist type of stakeholders is characterised as follows:

- more interested in individual perceptions
- tends to be more concerned with the well-being of the individual members of the organisation and the implications of the organisational policies on their lives
- capitalises on the unique abilities of the individual
- tends to be more concerned with the actual processes conducted to achieve the desired results
- tends to view decision making as a participative interaction.

This type of stakeholders is likely to adopt subjective methods which recognise the imperfection of computed values and rely instead on the attitudes and opinion of the users and the system builders (Powell, 1992).

Gregory and Jackson (1992) argue that both approaches are legitimate. Indeed, the policies for evaluating information systems performance are probably shaped over time by integrating common interests and requirements of various information system executives, top managers and key users within the organisation (Saunders and Jones, 1992).

Although both subjectivist and objectivist approaches are legitimate approaches toward evaluating information

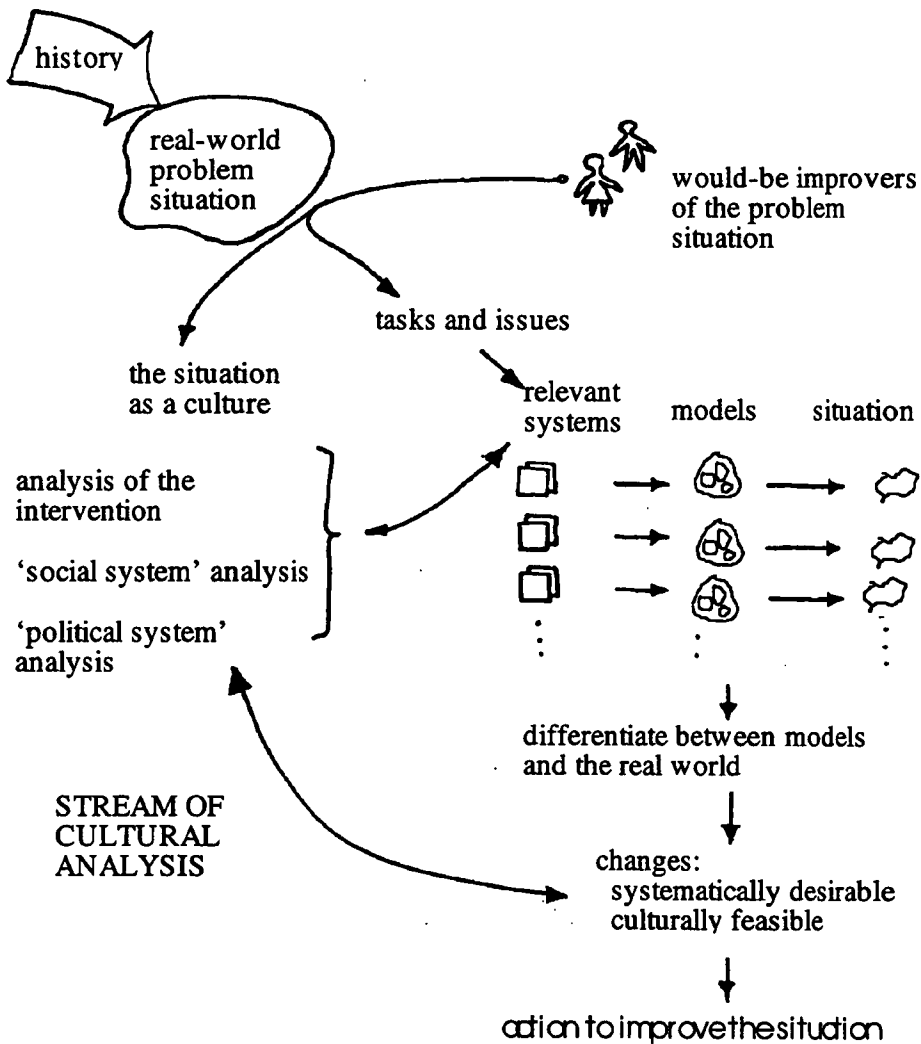
systems, Remenyi et al (1993) suggest that even in the more objectively oriented approaches the determination of the efficiency metric will almost invariably be based on subjective criteria and any suggestion that the method is totally objective should be resisted.

**SOFT SYSTEMS APPROACH TO INFORMATION SYSTEMS EVALUATION**

The context, content and process of evaluation framework outlined above does not provide the analyst with sufficient support to construct an effective evaluation system. It is argued here that Soft Systems Methodology (SSM) could be used by evaluators to gain a better insight into the evaluation framework, context, content and evaluation processes.

**Soft Systems Methodology**

Consider the modified form of SSM shown in Figure 1 (Checkland and Scholes, 1990).



**LOGIC-BASE STREAM OF ANALYSIS**

Figure 1

- (i) **Finding out, history and would-be improvers**  
 Would-be-improvers enters the real world problem situation with the intention of improving matters. Entry into the situation is acceptable as historical information has suggested that there are a number of conflicting issues which need examining.
- (ii) **Streams of enquiry**  
 Two interacting streams of structured inquiry are undertaken in order to clarify the issues and seek ways to debate them. The intention is that the process will lead to meaningful and feasible changes being made that will improve the situation.  
 The cultural stream of enquiry consists of three analyses of the problem situation; intervention of the would-be improvers, situation as a social system and situation as a political system.  
 The logical stream of enquiry identifies relevant systems that address both primary-tasks and issues. Checkland and Scholes (1990) suggest that a primary-task system is normally visible in the real world and represents some organised purposeful action whereas an issue-based system is essentially a system concerned with reducing the effects of human conflict. Such systems are not normally mapped into the real world. These systems are expressed using closely worded root-definitions which describe the system's transformation process. The definitions also acknowledges the worldview (*weltanschauung*), stakeholders' views and opinions and system constraints. A conceptual model is then constructed which reflects each root definition and includes three measures of performance, efficiency (eg. Have we been prudent in the use of resources?), effectiveness (eg. Have we achieved the goal set out in the RD's transformation?) and efficacy (eg. Have we done what we set out to do?).
- (iii) **Differences between models and the real-world**  
 The conceptual models are then used to ask questions about the real world. Such questioning leads to debate. The aim of the debate is not to improve the model but to find accommodation between the different interests in the problem domain. Achieving accommodation requires cultural knowledge acquired through actions performed in the cultural stream of enquiry. In fact, both streams of enquiry support each other's learning by recursive interplay.
- (iv) **Changes: Systematically desirable and culturally feasible**  
 Seeking to identify desirable and culturally feasible changes to improve the situation requires reference to the various world-views (*weltanschauungen*).
- (v) **Action to improve the situation**  
 Agreed action is taken, learning takes place and the process is then repeated.

### **Relevance of SSM to Information Systems Evaluation**

SSM has relevance to information systems evaluation for a number of reasons.

- SSM has been used for some years and it is a well known and credible methodology.
- The overall aim of SSM is to take subjectivity seriously rather than intuitively so that a meaningful purposeful action can be taken.
- An information system involves many stakeholders each of whom possesses a different perspective and level of commitment within the problem domain.
- Soft systems methodologies encourage those concerned to openly declare their judgments and views and, by using root definitions and conceptual models, matters of concern can be debated.
- A key component of the methodology is for the stakeholders to reach accommodation. One of the ways of focusing on accommodation is to examine the purpose of the system. This can be achieved through building a model of purposeful activity and declare the worldviews on which the model is built (Checkland, Clarke & Poulter, 1996).
- SSM forces the users to analyse political and social dimensions
- SSM is a methodology for learning.
- An integral feature of SSM is that it provides a mechanism for the elements of the system to be monitored and controlled. Checkland & Scholes (1990) argues that in monitoring one must look at certain features related to standards of good and bad performance and therefore the monitoring activity is contingent upon defining measures of performance. Globerson et al (1991) state that performance is an expression of the level of expected achievement or behaviour. In addition, they go on to argue, setting standard of performance is an ongoing process, depend on the nature of the organisation. Therefore, it can be said that as the efficacy, efficiency and effectiveness criteria

change over time, the criteria against which the information systems is evaluated will also change over time.

### Evaluation using SSM

#### (i) Scenario

Consider an organisation which has passed through the automate phase. Let us assume that would-be improvers of the situation have entered the problem domain and have performed several of the SSM activities and have identified several relevant systems. One relevant task-based system suggests that the organisation would like to evaluate its information system from a wider perspective than it had done previously. This decision is based on the observation that the information system provides both tangible and intangible benefits to its operational, managerial and executive staff.

In addition to the task-based issue a cultural issue has surfaced that would suggest that some information systems specialists are sceptical perhaps even antagonistic towards the broadening of the evaluation process.

On the basis of the 'finding out' phase two relevant systems were identified (RS1, RS2):

RS1. *A system to identify broad-based information systems evaluation criteria.*

RS2. *A system to change the views of the information systems specialist so that they will accept the idea that interpretivistic evaluation criteria are acceptable and effective measures of systems performance.*

#### (ii) Root Definition (RD1) and CATWOE

The following Root Definition and CATWOE capture the essence of the first relevant system. The second relevant system is not pursued as this stage. Quite clearly it is important but does not contribute directly to the evaluation process.

RD1. *A company-owned and operated system, staffed by members of the information systems group, which identifies appropriate (information systems) evaluation methods by using elements of Soft Systems Methodology to enable the information system better fulfil its role in supporting the business function. The system is to operate within the current company's structure and resources.*

#### CATWOE

The elements of CATWOE form a useful mnemonic (C - customers, A - actors, T - transformation, W - weltanschauung, O - owner, E - environmental constraints). It allows the developers to check their root definition and conceptual model for completeness. The key element in CATWOE is the transformation process while the other elements describe the people and environment in which the transformation takes place.

C	Information Systems Management, Users, <u>Management</u>
A	Information Systems Staff, Users, Audit Team
T	Need for appropriate evaluation methods representative of the role of information Need met systems within the organisation →
W	A belief that management is willing to expand the scope of evaluation to include subjective criteria
O	<u>Management</u>
E	<u>Company's structure, financial and time constraints</u>

It is expected that choosing different combinations of CATWOE would result in different perspectives of the problem domain being exhibited. This would lead to an increase in the richness of the understanding of the situation and would enhance debate and discussion which in turn could lead to an acceptable accommodation by the parties involved.

These CATWOE components imply:

- Evaluation will benefit the organisation as a whole as well as individual or groups of stakeholders (Customers).
- Evaluation of information systems needs the support of the stakeholders (Customers, owners of the system (Owners), and those who carry out the evaluation process (Actors).
- The system must contain a transformation process.

- The information system resides within an environment where the organisation and its members have certain beliefs, norms and values (Hirschheim and Smithson, 1988; Avgerou, 1995). This is captured by the weltanschauungen (W) and while not a constraint in the normal meaning of the word does affect whether changes to the systems are culturally desirable and acceptable.

The root definition and its CATWOE components should be defensible and reasonable to the organisation.

(iii) Conceptual Model

The conceptual model (Figure 2) shows how the transformation in the root definition could be achieved. It too should reflect the CATWOE components.

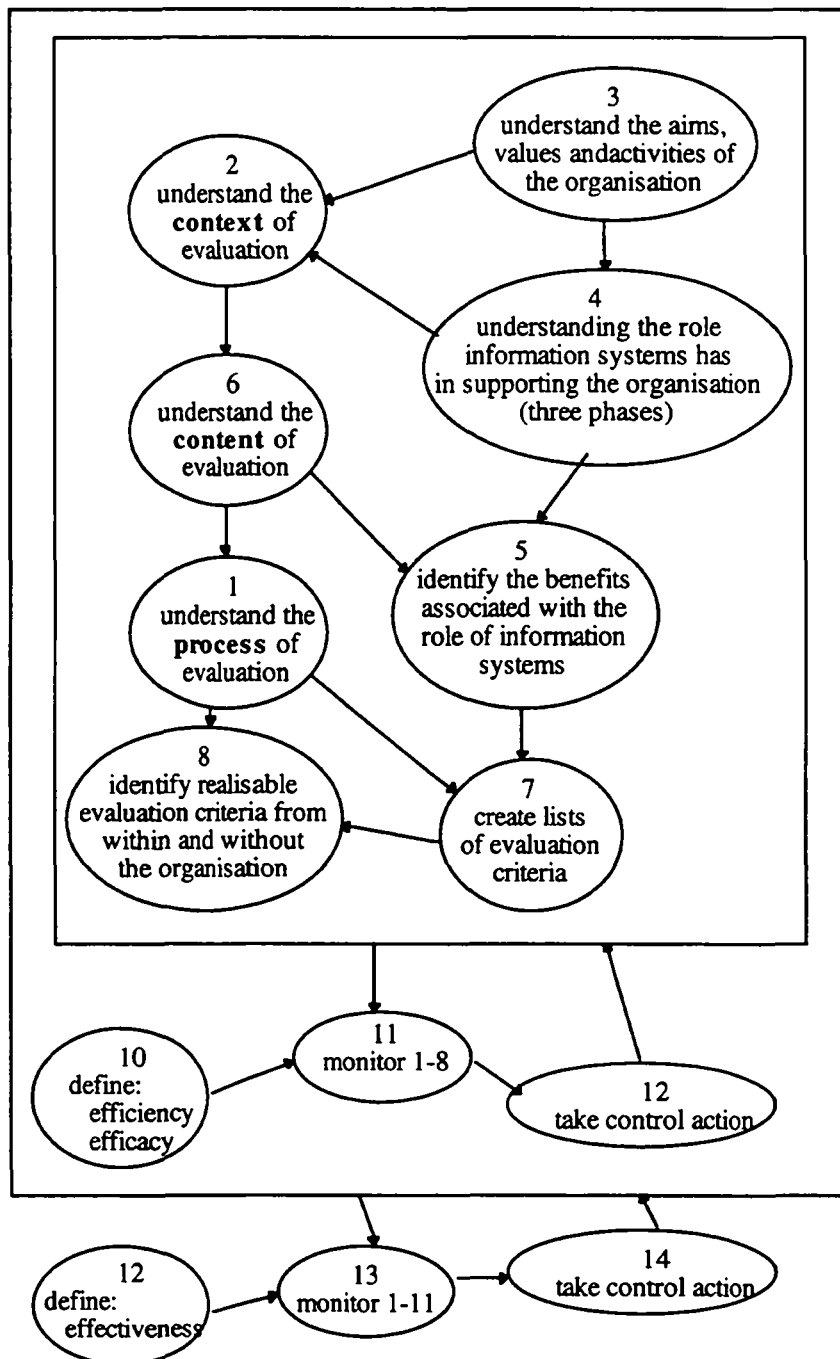


Figure 2

The model is a representation of a purely abstract idea and cannot be validated against any real world situation and is only one model out of many relevant to debating the real world situation. The model is used to generate



debate by comparing it with a real world situation to highlight some changes that are culturally feasible and systemically desirable so that a meaningful action can be taken.

It can be seen from the above model that the system and its sub-systems are themselves monitored and controlled. Monitoring and controlling the evaluation process will enable it to learn and improve its performance. Embedded in these criteria are organisation resources, political activity, social values, etc.

### SUMMARY

The changing role of information systems within enterprising organisations has brought about the consequence that information systems evaluation can no longer rely exclusively on objective methods if it is to gain any determination of the value of the information systems. The political nature and social condition have become crucial determinants in any evaluation of information systems.

The need to effectively evaluate information systems has never been greater. The cost of developing and implementing such systems has risen alarmingly and it has become good business practice for organisations to scrutinise all their investment to ensure that their investments do indeed provide added value.

SSM coupled with an interpretivist framework should provide evaluators with a methodology that not only identifies contextual and content based evaluation criteria but establishes a learning cycle that monitors and controls the entire evaluation process. SSM takes account of the subjective nature of human interactions and treats these interactions rigorously rather than intuitively.

SSM adopts a dual approach to domain assessment by examining the interplay between the logic and cultural aspects of the problem domain. The cultural stream draws upon the social and political dimensions while the logical stream features tasks and activities within the problem domain. The resulting relevant systems, root definitions and conceptual models promote debate among the stakeholders so that the learning process is enabled and accommodation can be reached. The process culminates in an agenda for change that results in desirable and culturally feasible action to improve the situation.

SSM also pinpoints the importance of having a system that is able to learn from its experience and from new external knowledge.

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