Understanding and Supporting Information Systems Evaluation

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The evaluation of information systems is an area of increasing concern to organizations as these systems become more central to the organization and high levels of investment in IT show no signs of falling. However, evaluation is a complex tangle of financial, organizational and technical threads, many of which are currently either avoided or dealt with ineffectively by organizations. This paper argues that considerable benefit could be gained by the provision of computer-based support, in the form of an evaluation workbench. In order to provide a conceptual basis to approach the complexities of evaluation, the paper discusses a conceptual framework, based on the content, process and context of evaluation. This framework is used to classify the evaluation activities and to discuss the benefits of the proposed workbench.

Keywords: Information systems, IT investment, evaluation, interpretive, decision support.

1. Introduction

After two decades of increasing investment in information technology (IT), the role of IT is no longer only supportive of isolated business functions but may be a strategic part of the core business of the organization (Scott Morton, 1991). However, senior management is becoming more concerned about the value they are getting from their extensive IT investments (Price Waterhouse Review, 1993) which are now regarded as capital investments instead of operating expenses (Earl, 1989; Farbey et al, 1993).

Evaluation is a complex and elusive (Dickson et al., 1988) notion that has a number of overlapping interpretations. It can be considered as a process to diagnose malfunctions and to suggest appropriate remedies as well as to contribute to the planning of organizational activities (Hawgood & Land, 1988). From the systems perspective (Angell & Smithson, 1991), evaluation is the crucial feedback function, which helps the organization learn and which helps managers to plan and control their investments. From a management point of view (Farbey et al, 1993; Willcocks & Lester, 1993a) IT evaluation establishes by quantitative and/or qualitative means the value of IT to the organization.

The main objective of this paper is to examine the prospects for providing computer-based support for the evaluation process, in terms of an evaluation workbench. As a first step, we discuss the changing role of evaluation in the management and planning of IS/IT in organizations. From this, we develop a framework for understanding the goals and activities of evaluation by considering its content, process and context. Then we argue that the evaluation exercise would benefit from automated support and use the framework as a basis for determining the main requirements and scope of such a workbench.

2. The changing role of IT and the evaluation of information systems

The history of IT applications can be seen in terms of the following three phases , each with its own requirements for the evaluation role (Blackler & Brown, 1988; Earl, 1992; Hirschheim & Smithson, 1988; Remenyi et al., 1991; Scott Morton, 1991; Zuboff, 1988):

Automation (up to the end of the 1960s); During this phase the emphasis of IT applications

was very much placed on reducing the operating costs and on the automation of clerical work. The evaluation techniques used during this phase aimed at the efficiency and control of resources. The efficiency was seen in terms of increased and improved capacity and quality, fewer errors, greater reliability, etc. The main concern was the relationship between inputs and outputs whereas the techniques were based on cost-efficiency analysis and tended to prioritize financial and short-term economic criteria, expressing everything in cash flow terms.

Information (1970s); IT was intended to facilitate a more effective management and control of the firm. Its effectiveness could be gauged in terms of the outcomes of given activities or services. The achievable benefits could be attributed to savings obtained through, for example, better stock control or production management. In contrast to the previous measures what was important here, was the relationship of the outputs towards the outcomes. These methods were based on a mechanistic approach to organizational analysis, such as cost-benefit analysis, which emphasized the achievement of predetermined outcomes as a measure of effectiveness (e.g. critical success factors).

Transformation (1985 onwards); In this phase the received wisdom is that firms should first identify their opportunities and find out what changes in their business are needed. Then they should agree what capabilities and actions, including IT, are needed to achieve the change needed and these should be managed as a whole if the benefits are to be realized fully. Today's emergent concerns are exemplified by the question: how can organizations compare a strategic investment in an IT infrastructure that has a range of intangible and uncertain benefits with other, more traditional, capital investments whose benefits are more tangible?

Thus, the role of information systems in organizations has changed over the years. They are no longer solely used to support or automate low-level or peripheral organizational functions. Instead, they are increasingly seen as the central feature of the firm's mainstream products or services, or of their delivery system. This may involve radical transformations in products, organizational structures, work-roles, and patterns of relationships between firms. Therefore, the traditional project driven and cost-based foundation of IS evaluation is becoming less relevant for modern organizations. The strong relation between a firm's business strategy and its IT strategy, the social nature of IS, and the range of intangible benefits demands a different approach.

2.1. Business driven evaluation

Various authors, such as Brett (1994) and Earl (1992) argue that IS evaluation should focus on business changes and business values (Parker et al., 1988) rather than on costs and benefits. Thus, IS should be viewed in terms of business purpose and as a vision of the organization's mission and goals. A business driven evaluation can be more persuasive than a conventional accounting appraisal in that it should allow a better estimate of the intangible effects. This should not be confused with the traditional 'business case' based on 'bottom-line' profit and value to shareholders.

Earl (1992), also argues that the functional aspects of IT, such as efficiency and standards, are valid but the pay-off is in business. Only the business can deliver the effectiveness and benefits. Galliers (1991 & 1993) views a business/systems strategy as an integration of information systems considerations into the business planning and strategy formulation process. This raises the issue of the identification of appropriate measures of performance that enable on-going evaluation and review which, in turn, provides an indication of the impact of the process on business performance. Such events may be triggered by the changes in company policy or the changes in the business environment.

Earl (1992), also believes that it is easier to justify IS against business plans for the following reasons:

- Senior managers understand more easily why the investment is being proposed.
- It highlights the extent to which the company is already committed.
- The benefits may be stated more confidently in terms of business rationale even if they are difficult to estimate accurately.
- Both the expenditure and the likely returns can be built into the business strategy and operating plans more easily.

- Arguments about competing priorities become clearer.

Although evaluation should be an on-going activity, its nature and purpose changes according to the stage within the life-cycle. According to Farbey et al. (1993) and Willcocks and Lester (1993b), during the early stages management is most concerned with defining the scope of strategy and high-level goals, sketching out the constraints, and estimating costs and benefits, activities typically within the province of senior management. However, in the later stages, the concerns are more detailed, involving more precise specifications of the project's aims. In ex post evaluation the aim is to identify costs incurred and benefits achieved and to determine the extent to which these were the outcome of the changes under consideration. Then, the problem becomes much more one of measurement, of determining the precise impact of the system on the business process.

Another determinant of the evaluation process is likely to be the type of project under consideration. There are many ways of classifying information systems, but for investment appraisal purposes the role they play in the business and the contribution they are expected to make should be the key parameters for such a classification (Parker et al.,1988; Ward, 1990). We discuss below the various classifications found in the literature but, in the absence of any widely agreed consensus, the approach of Willcoc ks (1994) would seem to be reasonable. He argues that organizations should develop their own classification based on their business strategies and overall missions.

3. A framework for discussing IS evaluation

In order to consider where and how computer-based support can be provided to the evaluation operation, it is important to gain a good understanding of the area. The elusiveness and complexity of evaluation requires a firm framework which can act as a foundation for discussion between researchers, evaluators and other organizational decision-makers of the various aspects of IS evaluation in its organizational and business context (Symons, 1991). This acts as a frame of reference for broad issues, as well as individual goals, activities and tools of the evaluation process. The framework proposed here expands the traditional, narrow approach of the identification and quantification of the tangible costs and benefits of an IT investment. This broader conceptualization (Figure 1) sets out the linkages between the content, process, and context of evaluation. This way of thinking (*contextualism*) originated from Pettigrew (1985), and has also been adopted by Farbey et al. (1993), Symons (1991) and Willcocks & Margetts (1994). We have also integrated it with the work of Galliers (1991 & 1992) on IS strategy and planning. A more detailed discussion of the contextualist conceptual framework for information systems evaluation can be found in Serafeimidis and Smithson (1996).

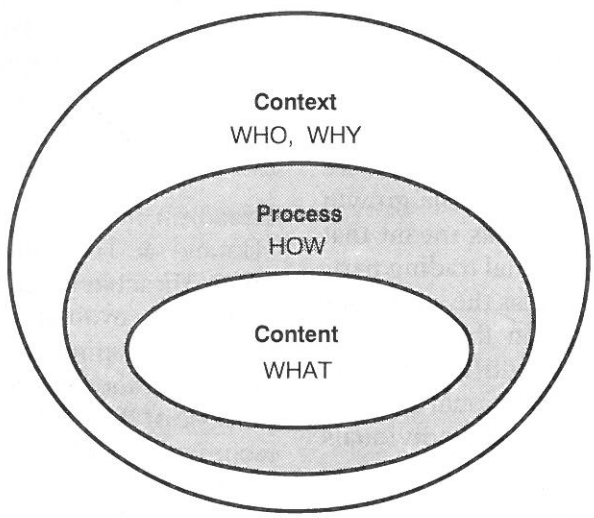

Fig. 1. The three rings of the evaluation 'onion' (Farbey et al. 1993)

3.1. Content, process and context of evaluation

The *content* of an evaluation refers to the values and criteria to be considered and what should be measured. It is here that it is particularly important to look beyond the narrow quantification of costs and benefits to an analysis of the opportunities presented by IT, together with the potential constraints on its application. The content emphasises the values and risks of IT investment, and its contribution to business strategy and organizational effectiveness. These include the linkage to business goals and consideration of the implementation process. In this layer, one aim is to reach a consensus amongst those involved in what is to be *measured.*

The intermediate layer concerns the *process* of evaluation. In this layer, the way in which evaluation is carried out (the techniques and methods used), its social role, the way it plays itself out over time, and the results of the evaluation are placed in the foreground. It includes assessments by managers, IS professionals and users at all stages of IS development and operation. It is very important that a means of communication with every level of the organization is established to achieve organizational and individual learning. The significance of the intervening process layer is that it draws attention to evaluation as a (group) learning process, mediating between content and context.

The *context* of evaluation may be an external one (e.g. the social, economic, political or competitive environment in which an organization operates) or internal (e.g. the structure, corporate culture, or political context within the organization — Scott Morton, 1991). Here, the following types of questions are generated: Who is involved? Why is the evaluation being carried out? What level of change is aimed at? Are there conflicting aims or interests? The growth of inter-organizational systems has meant that the goals and objectives of external trading partners must be considered as well as the ambitions of individuals or groups within the organization. Scott Morton (1991), identifies five sets of forces influencing the organizational context: management processes, structure, individuals and roles, technology and strategy.

The three layers are strongly linked together. The *content* provides the central kernel of *what* is to be evaluated, while the process describes *how* this should be done, and the *context* examines the organizational background, in terms of *who* is involved and *why*. As Pettigrew (1985) argues "Formulating the content of a strategic change crucially entails managing its context and process". Farbey et al. (1993) note that cases where systems are justified by a 'back-door' route represent the context entirely overwhelming the content. Moreover, a historical understanding of all the evaluation elements (context, content and process) is necessary because IT-related changes and their evaluation evolve over time and, at any particular point, present a series of constraints and opportunities shaped by the previous history. In the case study discussed below, we extend the notion of process to include the development process for an evaluation methodology, rather than limiting the discussion to its process aspects in use. However, the meanings of content and context remain unchanged.

4. Evaluation activities

The wide range of evaluation activities can be grouped according to the notion of content, process and context (Table 1).

4.1. Content activities

Value tracking, which should be the first step of a rigorous evaluation approach, is the investigation and determination of the desired, expected, and accepted values that the IT investment attempts to achieve. This should allow the appropriate evaluation approach to be adopted. Gains and losses, and values and risks are the focus of any evaluation approach but, before they can be evaluated, they must first be identified.

Based on the belief that IS are social systems (Boland & Hirschheim, 1987; Farbey et al., 1993; Hirschheim & Smithson, 1988; Symons, 1990), the evaluator should take into account beliefs and opinions, both about the nature and purpose of the evaluation besides the nature and purpose of IS and its components. Thus, besides technical and economic aspects, the evaluation should also consider social and organizational concerns. While people in the evaluation situation may be well aware of the intangible costs

Theoretical concepts		Evaluation Activities
CONTENT	WHAT VALUES CRITERIA MEASUREMENT	• Value tracking business values/risks; cost/benefits; quantitative/qualitative technical; social; organizational; economic aspects • Evaluation goals feasibility; choice of alternatives; go/no go; *ex ante, ex post*; monitor; change; kill off • Project classification business types of system • Metrics & measurement system benchmarks, financial & soft metrics
PROCESS	HOW WHEN	• Methods & techniques IE, CBA, SESAME, ROI, etc. • Alignment & matching • Learning
CONTEXT	WHO PURPOSE FACTORS WHY	*Inner* • Stakeholder map including external stakeholders such as trading partners • Organisation chart organization structure & roles • Business process model • Corporate information & information flows • Organisation planning organization's mission, vision, objectives, CSF, business strategy, business performance indicators • Competing and linked projects *Outer* • Economic, political and social context

Tab. 1. Frame of reference for the evaluation and its activities

and benefits, they may believe that such intangibles would not be acceptable as justification to those in authority (Currie, 1989). However, intangibles are increasingly being used in support of project proposals (Powell, 1992b). A dependence on 'hard' evaluation procedures, matching costs to profits in exclusively financial terms and talking about benchmarking of the technical component, is a very limited view of today's sophisticated IS. However, the application of 'soft' evaluation procedures necessitates that management agree on a consistent and relevant set of management goals and on a set of business criteria against which the investment is to be measured before evaluation of IT investments can proceed.

The total quality measurement (TQM) movement has provided a number of ways of defining and measuring quality. Some of the techniques developed under the umbrella of TQM provide useful ways of maintaining a continuous evaluation of the quality of both the development process and the information system as a product (Land & Tweedie, 1992).

Project classification distinguishes between the wide range of systems that are developed and operated by today's IS departments. As mentioned above, any classification needs to address the business aspects of the system under study. Thus, Parker et al. (1988) in their information economics approach suggest three main types of application: substitutive, complementary and innovative, based on the benefits accrued and how on the ways of their quantification to help justify the investments. Ward (1990) combined these ideas with McFarlan's (1984) well-known IS classification (strategic, high potential, factory and support). Hochstrasser (1990) based his classification on a system's primary objectives and indirect impact on the organization

to produce the following categories: infrastructure, cost replacement or automation, economy of scale, economy of scope, customer support, quality support, information sharing and manipulation, and new technology projects. On the other hand, Farbey et al. (1993) argue that projects should be classified on the basis of five groups of factors which influence evaluation. These are: the role of the evaluation, decision environment, system characteristics, organization characteristics, and cause and effect relationships between an investment and its benefits.

Evaluation goals, in other words the stated purpose of the evaluation, needs to be considered. Evaluation studies can take the form of *ex ante* feasibility studies or studies aimed at choosing between alternative proposals/systems or taking a 'Go — No Go' decision. Alternatively, evaluation studies may be more of an *ex post* exercise whose purpose is to monitor the progress of a system, perhaps with a view to making changes or abandoning them altogether.

Metrics and measurement is the technical core of the evaluation content. In order to manage or to evaluate something, one first has to understand it, then to describe it and, finally to measure it. Measurement is considered as an objective, empirical procedure by which numbers or symbols are assigned to entities in the real world in such a way as to describe them according to clearly defined rules. Mason & Swanson (1981) and Hirschheim & Smithson (1988), consider measurement as the link between the evaluation and the tools and methods of the evaluation.

The range of attributes which may need to be measured typically stretches from social and business aspects to software and system characteristics. Some concepts are measurable in principle (e.g. length, height), if not always in practice, while others are not even measurable in principle (e.g. beauty). Most current IS practice distinguishes between the measurable (e.g. software metrics, business performance indicators) and the unmeasurable (e.g. presentation quality) and between tangible and intangible impact. However, according to Farbey et al. (1993), there are 'grey areas' in between, such as business success, organizational effectiveness and broad 'miscellaneous' cost categories. This activity also considers risk which needs to identify clearly the organization's exposure to risk, plan those risks which can be controlled, and take account of any residual risk. Coleman & Jamieson (1994) distinguish between high level commercial risk, initial system/project risk, and full system project risk. Willcocks & Margetts (1994) argue that risks should be examined within a framework of internal context (e.g. organizational characteristics, changing business needs), external context (environmental pressures, competitors' use of IT), process (time factors, user commitment), content (size, complexity, technical uncertainty) and outcomes (cost, time, user acceptance, business process impact).

The measures need not always be cardinal ones, they could be ordered preferences along an ordinal scale (Stamper, 1973). However, one must be able to determine from the measures whether one is moving towards or away from the goal. If there is no way of determining this, then there is no measure. A frequent problem is that the goal itself may move, producing two sets of measure: those towards the original goal and those towards the revised one. A common error is to treat intangible or soft benefits as unquantifiable, and therefore just describe them in words. However, it is often possible to develop measures for softer benefits, although transforming those measures into bottom line returns may prove to be very difficult.

4.2. Process activities

Methods and techniques can be classified on the basis of various criteria. One approach is to group them according to the nature of the information that they provide (Farbey et al., 1993). Some provide a quantification of costs and benefits and rely on conventional accounting methods ('objective' according to Powell, 1992a) while others put more emphasis on the process of obtaining agreement on objectives and try to capture the plurality of stakeholders' interests. Normally quantification is not important for these 'subjective' techniques. Thus, on the objective side we have: cost/revenue analysis, cost-benefit analysis (CBA), SESAME, return on management (ROM), and return on investment (ROI). On the subjective side we have: multi-objective, multi-criteria methods, value

analysis, critical success factors, and experimental methods. In many ways, information economics (Parker et al., 1988) bridges the two classes, trying to take both sets of factors into consideration.

A survey by Hochstrasser & Griffiths (1991) found that the greater the expense and strategic importance of an IS the less relevant were formal evaluation methods. They found that 84% of companies invested in IT without using systematic methods to calculate either the true costs or benefits of that investment. Those who do use the method prefer cost benefit analysis. Grindley (1991), found that 83% of such analyses used to support proposals IT investment proposals are basically fiction. In many organizations, it seems that systems proponents either try to avoid such formal justification procedures or manipulate the proposal in such a way as to squeeze it through the least rigorous procedure. This evidence reflects the conceptual and operational problems of IS evaluation (Symons, 1990).

Alignment/Matching of evaluation techniques to situations is important because of the range of techniques available and the consensus that no single technique is valid in every evaluation circumstance (Farbey et al., 1993; Hochstrasser & Griffiths, 1991; Scott Morton, 1991; Symons & Walsham, 1991; Turner, 1981; Ward, 1990). However, some authors (Farbey et al., 1992; Willcocks, 1992) provide mechanisms to match evaluation methods with project classifications.

Evaluation can be viewed as a *learning process* (Earl, 1989; Etzerodt & Madsen, 1988; Farbey et al., 1993; Galliers, 1991; Symons & Walsham, 1991; Walsham, 1993). Suitably supported and structured, we envisage a process similar to de Geus's (1992) Structural Modelling Activity where groups are brought together specifically to construct working models of aspects of the organization. Lasting benefits can be gained from those involved making their mental models explicit as a prelude to reaching an agreement on what is important for the organization, based on a common understanding of how the organization functions. In the same way, we believe that a systematic procedure, based on explicit frameworks, could also be a powerful means for reaching a common understanding of a system's benefits, based on a consensus of the organization's objectives. In short, it becomes possible to challenge individuals' existing models of organizational ambition with a view to replacing them with a better, commonly agreed one.

4.3. Context activities

Stakeholder maps (Gilbert et al., 1988) are useful for identifying the various groups in an organization who might be thought of as being the stakeholders of a system and who thus have some interest in its evaluation. The evaluations of these stakeholders (individuals and interest groups) form a key element of the social context within which the evaluation process is carried out (Walsham, 1993). These assessments always exist, but may not always be incorporated within the formal evaluation activity; instead, they remain outside as a shadowy, yet often powerful, part of the informal context. Where stakeholders' conflicting assessments (Walsham, 1993) and evaluation criteria (Land, 1976; Symons, 1990) are recognised as legitimate input to the formal evaluation activity, this evaluation can be viewed as an attempt at resolving this conflict, at least in the short term. For large systems stretching across a number of departments there may be a large number of such stakeholder groups while, for highly specific or peripheral systems, few stakeholders are more likely. This is clearly related to the classification of projects.

Thus, such a mapping goes beyond the question 'who was involved in the evaluation?' to 'who might have been involved?'. Gilbert et al. (1988), show the following stakeholder groups: owners, financial community, activity groups, customers, customer advocate groups, trade unions, employees, trade associations, competitors, suppliers, government, and political groups. Farbey et al., (1993), suggest adding other external collaborators as well as the key role of the champion of the investment.

Organization charts and *business process modelling* are useful ways of understanding and representing business strategy, an essential prerequisite for developing an IS strategy (Earl, 1992). Such charts can be combined with the stakeholder map. Mintzberg (1983) highlights the five basic parts of an organization as: strategic, management, operating core, technostructure and support. A mapping of the available

key business processes within the organization offers the business an opportunity to rank IT investment proposals by their worth.

Evaluation activities can also highlight the potential benefits available in terms of corporate information and information flows, taking a much wider perspective than that of a single system. These, in turn, can be related to the mission, vision, objectives, and critical success factors of the organization. Where organizations do not explicitly define such key characteristics, these may either be implied from the way that they do their business or they may become part of the output of the evaluation process. Continuing at this broad organization-wide level, care needs to be taken to include in the analysis other projects or investment proposals that may compete with, or be otherwise linked to, the proposal under examination.

The context additionally includes many perspectives which are brought to evaluation by different parties influenced by the level of authority and control within the organization. The introduction of a new system, and the way in which it is evaluated, could be understood better if it is seen as social action, rather than as a straightforward investment evaluation (Farbey et al., 1993). Therefore, analysis of the formal and informal relationships supporting IS brings social and political interaction to central stage, and with it the importance of stakeholders' perspectives, where stakeholders may be groups or larger collectives (e.g. an organization). Conflicts of interest often emerge within as well as between stakeholder groups and they can affect the evaluation, much of which is subjective, based on stakeholder value judgements.

The *outer context* of evaluation may include external factors, typically beyond the control of the organization, which the organization and its members need to respond to and accommodate; for example, the national economic situation, national and local government policy, level of government support, markets and market demands, competition, supplier availability and expertise, and other environmental pressures.

5. The case for IT-based support for the evaluation of IS/IT

We have argued that, with increasing levels of IT investment and the growing centrality of information systems within organizations, evaluation is becoming widely recognized as a very important activity. It is important at the levels of operational monitoring and control, the allocation of scarce organizational resources, and business planning and strategy. However, despite its importance, it is often ignored or carried out inefficiently or ineffectively.

Most of the problems lie in the complexity of the evaluation process. We have shown above the considerable range of evaluation activities that may be relevant to the content, process and context of the evaluation. These activities may be applied either individually or in various combinations. They may also be applied to a very wide scope of projects, ranging from small departmental systems to corporate and inter-organizational systems. The goals (or purposes) of evaluations are likewise very varied, including feasibility studies, post-implementation evaluations and a range of other goals. Furthermore, there is potentially a large number of very different groups involved in the evaluation, both within the organization and externally. And yet, notwithstanding this complexity, evaluation should be a valuable organizational learning process.

This situation is recognized by most commentators as highly problematic and many academics and practitioners have responded with proposals for evaluation methodologies. However, there is no widely accepted evaluation methodology that is relevant in all cases. Rather than proposing yet another methodology, we would advocate a tool-based solution, with tools that could fit with most methodologies. However, such tools need to recognize the characteristics of evaluation, including the content, process and context aspects.

A key characteristic of evaluation is that it is information intensive. Evaluation is a type of decision process that requires, as input, large amounts of information. This is further supported by the notion of repeated and comparative evaluations over time, the way feasibility studies are followed by post-implementation

evaluations and various other monitoring and control mechanisms. Thus, information on a project needs to be retained and referred to at various stages throughout the system's life cycle and then, by different stakeholders for different purposes (e.g. accounting, IS planning). This information intensity within evaluation has led us to recommend the use of computer-based support tools.

However, another key characteristic of evaluation is that the information used is highly heterogeneous, including 'hard', historical, accounting and statistical information, future plans and speculations that are subject to change, and informal qualitative information in the form of gossip and hunches. This variety of information emanates from a variety of internal and external, formal and informal sources (Walsham, 1993). Furthermore, this information is often highly value-laden, with different interpretations and values originating from different groups involved within the evaluation. Therefore, this situation represents a considerable challenge for computer-based tools that are more often applied to much more deterministic information. However, despite these difficulties, we do not believe that they necessarily render computer-based tools as irrelevant. Rather, they represent particular constraints that need to be overcome through the design and implementation of the tools.

During the last year, as part of the conceptual development of the framework, we carried out semi-structured interviews with 34 practitioners and academics from 16 organizations and 5 universities in the UK. The preliminary findings support the issues and activities identified within the above conceptual framework. In addition, the practitioners expressed an interest in the tools and a willingness to experiment with the computer-based ones.

5.1. Potential benefits

Set against the above difficulties, we believe that there is a wide range of benefits potentially available from a computer-aided evaluation. These include not just increasing evaluation efficiency, but more importantly, the improvement of evaluation and IS planning effectiveness (Galliers, 1991; Lee & Gough, 1993) since appropriate guidelines and knowledge provided by the system should lead managers to implement the IS planning and management processes more thoroughly. Such support should increase the understanding of why the business change is being made through the new IT projects and help to minimise the risks involved through an integrated IT strategy with business themes.

Corporate strategy formulation

The workbench should generally support evaluation activities within the formulation of the corporate strategy through enabling managers to recognise (and perhaps maximise) the strategic value of IS to the organization, helping business and systems personnel achieve a mutual understanding of the project's values and risks. The use of the tools should help to clarify business objectives and critical success factors before significant resources are spent on analysis and design and facilitate the analysis of complex situations and the management of benefits.

More effective IS planning

The approach suggested here expects to increase evaluation efficiency, but what is more important, improve the evaluation and IS planning effectiveness (Galliers, 1991; Lee & Gough, 1993) since appropriate guidelines and knowledge provided by the system should lead managers to implement the IS planning and management processes more thoroughly.

Improved management and achievement of IT benefits

Another potential benefit is in helping business and IS communities to manage IT benefits in a better way. It is not enough to simply appraise the benefits of a project. We need to make sure that they are actually delivered, and that their successful delivery is converted into bottom line profits. A critical part of this process is to define a set of milestones and measures to enable the business to monitor and control benefit delivery through an integrated benefits management methodology framework (Heduan, 1992; Leyton, 1992).

Better communication and organizational learning

A computer-based system with a strong communication element should involve more stakeholders and should support various groups ('eval-

uation parties' — Gregory & Jackson, 1992) who, with their varying characteristics may generate different evaluation contexts (Galliers, 1991; Hawgood & Land, 1988). The assumption should be that multiple stakeholders are involved in an evaluation task and each stakeholder only knows a subset of the constraints and the interests a project has to satisfy. The stakeholders should work together to carry out the evaluation and produce the final report. They must communicate their partial solution to other stakeholders who then refine it. This should facilitate organizational learning (Galliers, 1991) by increasing the awareness of both risks and qualitative benefits, improving the understanding of the business processes, and highlighting any conflicting objectives within the organization. Furthermore, they will have the facility to evaluate quickly and easily when necessary.

Increase the variety of evaluation values and criteria in the content layer

There are potential gains in the effectiveness of the content aspects of evaluation. Provision of reliable and relevant computer-based tools should mean that the wide range of (often fairly elusive) values and criteria could be approached more systematically. The effect of incorporating different and perhaps conflicting criteria can be seen on the overall evaluation. Information could be updated and made available for repeated evaluations through the life cycle of the project and the information tailo red to different types of project.

A more efficient evaluation process

The process aspects of evaluation would certainly gain in efficiency as, with appropriate computer support, such as tools tailored to activities such as cost-benefit analysis, these techniques could be carried out faster and more accurately. However, perhaps more importantly, the learning aspects of the process could be more effective as advantage could be taken of both the tools and the information stored as a focus for improving the learning of both developers and user representatives. A growing basis of recorded knowledge of evaluation would certainly help organizational learning.

5.2. State-of-the-art of evaluation support

Many organizations currently rely on manuals, setting out corporate appraisal procedures which often reflect a top-down focus on 'hard' benefits and favour investments that provide cash benefits quickly. This approach typically focuses on measurement, which together with the emphasis on formal procedures, may cause problems in dealing with the 'soft' intangible risks and benefits.

Very few tools have been developed that support the investment decision (project selection) process. Two knowledge-based tools have been reported in the literature. One tool helps decision makers formulate goal-programming models to select a feasible set of IS projects (Santhanam & Schniederjans, 1993). The other system (Agarwal et al., 1992) allows users to rank projects based on qualitative and quantitative criteria. Other computer-based tools are in use but they too focus on the quantitative evaluation of IT investments, supporting either finance-based activities (e.g. cost benefit analysis, ROI) or the estimation of software costs and resources (Lederer & Prasad, 1993) (e.g. ESTIMACS, SOFTCOST, SLIM). These software tools are fairly crude, being little more than spreadsheets or automated algorithms which do not take into account the qualitative and intangible factors or the variety of stakeholders. Therefore, they are unable to provide a 'rich picture' of the evaluation activities as described above. Farbey et al. (1993) mention a number of computer-based decision support tools for multi-objective, multi-criteria (MOMC) methods. In addition, there have been some isolated in-house developments such as Coleman & Jamieson (1994) in Prudential Assurance and Heduan (1992) in BT.

6. Objectives and scope of the proposed system

In view of the above mentioned arguments above concerning the complexities and characteristics of the evaluation situation, we feel that it is important to state explicitly the required capabilities of a computer-based evaluation support system. As well as our own research, it is based

on the work of Bergeron & Raymond (1992), Berkeley et al. (1990), Coleman & Jamieson (1994), Finlay (1993), Heduan (1992), Lederer & Prasad (1993), and Lee & Gough (1993).

First, we feel that the system should aim primarily at the 'interactive' support of evaluation. Thus it will mostly work somewhere between the extremes of merely providing data and the total automation associated with optimisation software (Berkeley et al. 1990). This includes the provision of a range of tools to help the users structure their particular problems, as well as the guidance regarding methods plus any necessary contextual information. In other words, the workbench should be capable of processing the basic evaluation data and providing relevant information and tools to help the user interpret the information. The proposed workbench will not only be a repository of information about the investment and available methods and techniques, but it should support a direct dialogue between the user and the system aimed at improving the efficiency, effectiveness and understanding of the evaluation.

The second main characteristic of the workbench is the support of work groups. The activities could be carried out simultaneously by more than one person in collaboration, interrelating their thoughts in common organizational and evaluation models. This feature is potentially very important, considering the variety of stakeholders simultaneously involved in the evaluation exercise.

Third, the system will have to possess a wide range of tools, many exhibiting a high degree of flexibility. The workbench itself needs to be sufficiently flexible to adjust to a wide variety of projects and organizational situations. Thus, it should include the provision of information concerning the organization's financial or operating situation, current business problems and environment changes, the capabilities of particular IT systems or the procedures for carrying out specific evaluation processes. In terms of tools, these may range from simple structures for entering data and presenting information to a sophisticated collection of algorithms that carry out the necessary calculations automatically.

The workbench should have sufficient flexibility to serve:

- Functional (departmental) managers (or users) seeking increased quality and higher value systems.
- System developers looking for clearer user priorities and more stable requirements.
- Project champions or project managers who wish to ensure that systems are implemented and the benefits realised.
- Senior managers or sponsors who want to be assured that the investment supports the business objectives.

In terms of business-driven functions, we envisage providing support for the following functions:

Review of business objectives

This concerns business strategies and priorities and their relationship with IT investment strategies, leading to a determination of the success criteria for IT use within the organization. In other words, it is a review of existing mission statements, goals, objectives, CSFs, etc. The focus should be placed upon clarifying business objectives in order to identify relevant IT strategies. Based on these, the goals of the evaluation process regarding the business objectives should be defined.

Definition of the content, processes and structures for investment appraisal

Value tracking of the business values concerning an IT investment should be expressed in terms of financial performance (e.g. profitability), business performance (customer satisfaction, product quality), individual management goals (measurable objectives) and technical features (software metrics). In addition, the cost and risk factors should also be identified. For all these factors, suitable metrics need to be defined. This will include establishing common terms, processes and measures between the bu siness and IS managers. If a consensus is not possible, disagreements can be highlighted for resolution through negotiation between the disputing parties.

Theoretical concepts	Potential tools for support
CONTENT	• Questionnaires • Check-lists • Tick-lists • Knowledge bases with expert judgments & opinions • Case histories & examples • Risk management plan • Delphi session • Brainstorming session • Activity based costing
PROCESS	• Spreadsheet-based models • Activity based costing • Hypertext tools • Templates for decision making (i.e. MOMC) • Visual tools for direct manipulation • Gap analysis • Sensitivity analysis • Knowledge bases with expert judgments & opinions • Case histories & examples
CONTEXT	• Cognitive mapping tools (i.e. COPE) • Hexagons • SSM Tools • Impact diagrams • Business modeling tools (i.e. Information Engineering workbench) • Check-lists • Questionnaires • Interviews • Delphi • Brainstorming sessions

Tab. 2. Potential software tools for the evaluation workbench

Selection and application of methods for measurement

Having decided what to measure, we need to provide support regarding how the measurement process is to be undertaken. Based on standard guidelines, historical information and heuristics, the workbench should support the measurement of relevant variables and the collection and processing of this data in order to produce meaningful information for the stakeholders.

Comparison of IS projects

The workbench should help select potential IS projects based on strategic factors and on feasibility factors in the context of strategic function chains by ranking and classifying investment proposals by their worth, both to the business strategy and key business processes, using intangible benefits risks alongside tangible benefits and costs.

Benefits management

By focusing on projects from an investment management perspective, the workbench should allow both IS and business management to track the realization and management of benefits and the resultant value for money. This is really a case of providing tools for portfolio management (Ward, 1990), where this can be defined as the aggregation of all of the planned and current work.

Support group and individual learning

Here we envisage the provision of attractive, easy-to-use software tools that would stimulate the creativity of both individual users and groups, where the tools are being used in a group context. Evaluation is such a broad, complex and situation-dependent activity that relevant prompts from the workbench regarding the use of particular tools or information can only increase organizational learning. This would be 'learning through doing' rather than tutorial software.

User requirements	System requirements
• Division of labour between the user and the system • Security and confidentiality • Adaptive assistance • Interactiveness • A balanced use of a portfolio of methods & techniques • Access to historical data • Simplicity • Reliability • Accuracy • Easy to learn • Easy to use • Good documentation • Decision support	• Heterogeneous integration • Flexibility/Open architecture • Fast response • Visualisation • Portability/Compatibility • Upgradability • Minimum keyboard use/graphical interface • Information at various levels of detail • Allow remote access • Support work groups

Tab. 3. Design guidelines

Support and maintenance

The workbench should accommodate changing business and user requirements. The business objectives and priorities inevitably change over time, as well as the stakeholders and business processes. The tools themselves may also require maintenance and further development in order to support changes in the decision making processes surrounding IT investment appraisal.

7. Evaluation tools and design guidelines

A number of tools are available for supporting the evaluation activities. Selection of the most appropriate tools for each case should be based on two principles: the characteristics of the activity and the characteristics of the tools, and the contextual constraints. The objective of this paper was to present the arguments for providing mainly computer-based support for evaluation and to present the conceptual framework upon which our research is based. Thus, space does not permit more than listing of the tools envisaged and the guidelines for design. Nevertheless, we feel that such a listing and initial classification are useful here as they add a more concrete aspect to the conceptual discussion.

Table 2 shows the workbench's potential tools, classified within the content, process, and context architecture. We have identified these tools and classified them according to:

- their nature (i.e. hard, soft)
- their complexity
- the processing needs of the evaluation activities (i.e. idea generation, data collection, information transformation, decision making)
- the inputs required (i.e. type, sources, information detail)
- the outputs produced (i.e. recipient, number of recipients, type of output, degree of generalising the results to other cases, format of the results presentation).

A number of design guidelines for the workbench can be derived from the above discussion about the nature of evaluation. These issues are presented in Table 3, classified according to user and systems requirements.

The proposed workbench is characterised by a balance of user-driven and system-driven approaches. In a sense, both the system and user need to share the 'responsibility' for arriving at a satisfactory solution. The workbench would aid (but not replace) the users by providing guidance adaptable to their requirements (e.g. stakeholder group membership, goal of the evaluation, familiarity with the workbench), providing support to recognised critical patterns and conflicts, and presenting results (Gregor y & Jackson, 1992) in an appropriate manner. From the users' perspective, they can use the repository of tools, methods and techniques with interactive graphical visualisation and manipulation.

8. Conclusion

We have argued that the evaluation of information systems is an important but complex operation that would benefit from an appropriate provision of computer-based support. We have presented a conceptual foundation for evaluation, in terms of its content, process and context, as a prelude to the design of an evaluation workbench. This framework is useful for understanding the complex business, organizational, technical and social aspects of evaluation. We have used the framework to highlight the potential benefits of the workbench and to classify the wide range of evaluation activities and the potential tools to support those activities.

We feel that the framework offers a comprehensive foundation from which to move on to design and develop the workbench. The insight gained should help in developing a system that can cope with both the more creative aspects of using information systems to meet the strategic needs of the business as well as dealing with the technical and financial detail of evaluation.

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