

Chapter 2 Literature Review

In this chapter, literature gathered from previous researches on IS/IT evaluation practices is organized and reviewed. The major topics covered include the importance of IS/IT evaluation, the various methods/techniques of IS/IT evaluation and the socio-technical framework for IS/IT evaluation. Finally, a brief conclusion on IS/IT evaluation practices is written based on the literature review.

2.1 The importance of IS/IT Evaluation

Evaluation is any activity that throughout the planning and delivery of innovative programmes enables those involved to learn and make judgements about the starting assumptions, implementation processes and outcomes of the innovation concerned (Jackson 2001).

Evaluation needs to be integrated into project design and implementation, and is concerned with both the progress of the project and with making judgements and leads to the reappraisal of actions and policies. The main purpose of evaluation is to provide information on which decision may be based (Jackson 2001). Furthermore, some form of evaluation is always taking place, as managers require formal decision making process rather than judgements guided only by their own perception. It is better to base decisions on well-constructed formal evaluation process than to rely on purely subjective judgements (Farbey et al 1993).

This subject of IT evaluation practices has indeed attracted many research. Primarily it is due to the high cost of IT investment (Remenyi et al 1991; Farbey et al 1993; Willcocks 1994). It is predicted, by the year 2000 the whole IT industry will account for some 10% of world economic activity (Willcocks 1994). A bad decision made over a large new computer system will affect the firm at least until a replacement can be installed, which may be a long time, and which the firm may not be able to afford. Due to the high investment in IT,

management and shareholders are also asking whether the promised returns on such investment have indeed been generated. For IT investment to deliver its value, the benefits needs to be managed. The study of evaluation is important because evaluation provides a driving force for the implementation of successful strategic IT (Farbey et al 1993).

But evaluation is a complex and elusive (Dickson et al 1988) notion that has a number of overlapping interpretations. IT evaluation 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 1998). 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 1994) IT evaluation establishes by quantitative and / or qualitative means the value of IT to the organization.

Therefore, IT evaluation carries different meaning depending on its purpose and its role. It follows then that evaluation must be studied in the context of which it is being performed.

Within the accounting literature, evaluation of IS/IT investment is generally not distinguished from other capital investments (Ballantine and Stray 1999). The focus of these studies is on the financial techniques used to evaluate investments whereas in IS literature, besides examining the financial techniques, many had also considered the wider issues of IS evaluation. More recent researches proposed a new focus on IS evaluation as a social process, that is, taking into consideration the context, process and content of which evaluation is performed (Giaglis et al 1999; Fitzgerald 2000). It is more than a one off financial cost benefit justification exercise.

2.2 Evaluation Methodologies

Looking at its broader view, IS/IT evaluation methodologies would include both the financial measurement criteria and the non-financial aspects of

evaluation. It is not enough to simply identify the financial outlay on IS (Willcocks 1994). Non-financial measurement criteria would include the qualitative or intangible aspects of measuring the cost and benefits. Expenditure on IT should be related to business performance measures such as business volume and key business indicator (Willcocks 1994; Cronk and Fitzgerald 1999). A balanced scorecard approach proposed by Kaplan and Norton (1992), is another example of non-financial criteria being incorporated into the IS evaluation exercise. Evaluation of IS is more of an art than a science and requires that IS is conceptualized as embedded in organizations and evaluation as itself a social process (Symons 1994).

The proceeding paragraphs would provide a review of the financial and non-financial methodologies commented by researchers on IS/IT evaluation practices.

2.2.1 Financial approach (Objective methods)

The traditional accounting approaches that are used to measure the financial aspect of the IS/IT project are similar to that applied for capital investment. Five major financial measurement criteria are listed in Table 2.1 below:

Cost/revenue analysis
Return on Investment (ROI)
Cost-benefit analysis
Return on Management (ROM)
Spending Ratios
Information Economics (IE)

Table 2.1 : Objective methods

2.2.1.1 Cost/revenue analysis

This method incorporates estimation of the cost of developing and implementing the system. The estimated cost is compared with the value of

tangible benefits expected to be obtained from the new system (Farbey et al 1993). However, it is difficult to derive a reliable estimates of cost because research have shown that up to 40% of relevant costs incurred on IS can be outside the traditional IS budget (Willcocks, 1994). In a study by Willcocks and Lester (1991), user department IS and training costs were in fact 29% of total costs but hidden in departmental, often non-IS related budgets.

The value of benefits the system should generate is estimated and the cost is then compared to the expected benefits. The biggest problem lies in estimating the indirect benefits. Direct benefits such as cost reduction, cost displacement and revenue growth appear quickly and relatively easy to track. Indirect benefits such as cost avoidance, risk reduction and gaining competitive advantage over time is difficult to attribute to the IT investments (Strassmann 1990).

2.2.1.2 Return on Investment (ROI)

ROI is the ratio of the average annual net income of the project divided by internal investment in the project (Willcocks 1994). ROI approaches are supported by a number of formal accounting based cash flow techniques (Farbey et al 1993). The main methods include discounted cash flow techniques (DCF) using internal rate of return (IRR) and net present value (NPV); others are, profitability index (PI), payback period, and present worth (Wiseman 1994; Bacon 1994; Coleman and Jamieson 1994; Farbey et al 1993).

NPV discounts all estimated cash flows for a project to present value, using a required rate of return or "hurdle rate". If the present value of cash inflows exceeds the present value of cash outflows, it means positive NPV and possibly project acceptance (Bacon 1992). IRR aims to find the discount rate that would equate the present value of estimated IS project's cash inflows to the present value of the project's cost (Brigham, Gapenski and Ehrhardt 1999). If the rate is greater than the required rate of return, the chances that the project would be accepted is high. The payback method on the other hand ignores the time value of money.

The above techniques have been criticized for its inherent limitations. Foremost is the difficulty in estimating cash flow for benefits that cannot be determined precisely (Coleman and Jamieson 1991; Bacon 1992; Farbey et al 1993). Secondly, these techniques do not take into considerations the problem of risk, which may be associated with the project (Farbey et al 1993; Willcocks 1994). Thirdly, the process and cost of conducting a DCF analysis is normally tedious and time-consuming (Brigham et al 1999). Consequently, capital budgeting techniques are used less frequently in IS/IT projects (Ballantine and Stray 1999).

2.2.1.3 Cost-benefit analysis

This method tries to improve on the cost/revenue analysis in that the intangibles are valued by imputing a monetary value for each element contributing to the costs and benefits of IT project (Farbey et al 1993). It attempts to find some surrogate measure for intangible cost or benefits, which can be expressed in money terms.

This method is difficult to use when cost or benefits cannot be expressed in cash terms (Coleman and Jamieson 1994). Also where there are widely different views on the intrinsic value of the intangibles and disagreement on the appropriate form of surrogate money value (Farbey et al 1993). This method does not support evaluation of IT projects based on a variety of business goals such as improve customer support or better decision making process, which are not possible to be quantified in the short term (Hochstrasser 1994). Another set of problem in this method is the politics of evaluation, for example, the temptation to make the figures come out right (Wiseman 1994).

2.2.1.4 Return on management (ROM)

ROM is a measure of performance based on the added value to an organization provided by management (Strassmann 1990). If ROM is computed before and after IT is applied to an organization, then the IT contribution to the

business can be assessed. ROM is management value added divided by the costs of management.

One of the difficulties in obtaining the value and cost relating to management is the task of separating management and operational cost. Moreover, it is uncertain if the computed figures actually represent what IT has contributed to the business performance (Willcocks and Lester 1994). A further serious criticism lies with the usability of the approach and its attractiveness to practicing managers. This is reflected in its lack of use, as identified in different surveys (Coleman and Jamieson 1991; Farbey et al 1993; Willcocks and Lester 1994).

2.2.1.5 Spending Ratios

Spending ratios are intended to provide a crude but simple view of how an enterprise compares to its peer enterprises in the same industrial sector. They are based on ratios of total expenditure against known aggregate values (Farbey et al 1993). This is a quick way for the organization to judge its position relative to its competitor.

While this method is good because it is simple to use, the ratios provide no explanatory information and do not provide any comparisons of the effectiveness of the systems employed by the peer group.

2.2.1.6 Information Economics (IE)

Marilyn Parker and Robert Benson devised IE in 1988. It retains ROI calculations for those benefits and costs that can be directly ascertained through conventional cost-benefits analysis. The analysis is extended by taking into consideration the expected value added to the organization as a result of IT implementation.

In IE 'value' is distinguished from 'benefits'. Value incorporates the risk factor in the activity (Farbey et al 1993). For example, in implementing an IT system, it raises some questions such as: "what are the staff attitude towards the system?" "How committed is the top management?" "What firm plans are there

for training?" The extra value derived might be a more satisfied and competent set of employees, improved customer service as well as better credit ratings for the company. The total value will only have been gained through taking risks (Wiseman 1994).

In IE both the business and technology personnel score the value and the associated risk factors. Discussions with personnel of all departments affected by the new IT system is carried out to quantify the intangibles (Anandarajan and Wen 1999). Usually, a more complex report based on a ranking and scoring technique of intangibles and risks are performed in IE method.

The criticism towards this method is that it requires considerable expertise to use and is expensive, as in-depth analysis to many possibilities, consequential of a system change, is required (Farbey et al 1993). IE method needs to be tailored and developed to meet evaluation needs in different organizations (Willcocks and Lester 1994). Quite often external consultant knowledgeable in this method is required and is a costly activity.

2.2.2 Non-financial approach (Subjective methods)

These methods are qualitative in nature and seek to derive a more comprehensive way of valuing IT investment. The methods can be classified as in Table 2.2 below: _

Multi-objective, multi-criteria (MOMC)
Value analysis
Critical Success Factors (CSF)
Experimental methods

Table 2.2: Subjective methods

2.2.2.1 Multi-objective, multi-criteria methods (MOMC)

This method attempts to measure value other than monetary value, by using a general measure of utility (Farbey et al 1993). Utility is defined as the

satisfaction of an individual's revealed preferences. Stakeholders to the system weight their preferences and decision is based on the system, which provides the highest measure of satisfaction.

Fadzilah (2000) in her study, proposed that other criteria such as societal factors, demand analysis factors, competitive factors, business risk factors and market acceptance factors be included in the evaluation process. The focus of IT evaluation can be segregated into three main inter-dependent groups: operational, technical and financial; and no one group should dominate.

2.2.2.2 Value Analysis

This method emphasizes benefits rather than costs and is used primarily for evaluating intangible benefits such as deriving "better information" from the IT investment. Value in terms of better decision making and value added to the organization as a result of the new system in terms of meeting organizational objectives, would be established (Farbey et al 1993; Cronk and Fitzgerald 1999).

Organizational performance metrics (quality, flexibility, market share) and milestones formed a crucial part of benefits management and they are appraised against key management objectives (Serafeimidis and Smithson 1999; Sarkis and Sundarraj 2000). Similar to MOMC, these values are aggregated to produce score for the benefits categories. Other non-financial benefits are similarly supported in the survey conducted by Ballantine and Stray (1999) and Bacon (1992).

2.2.2.3 Critical Success Factor (CSF)

This method is based on Rockart's notion of CSF (Farbey et al 1993). Top management is involved in determining organizational strategy for which management decision factors are very important drivers for IT investment (Lubbe and Remenyi 1999).

In IS evaluation therefore, management plays an important role to determine the set of objectives and expected benefits for the new system.

2.3.1 Content activities

Content activities set out what is to be measured in the IS evaluation exercise. Value tracking for the new system should be the initial step to establish the desired, expected, and accepted values to be achieved from the proposed system (Serafeimidis and Smithson 1996). Consistent with the belief that IS are social systems (Symons 1991; Farbey et al 1993), besides technical and economic aspects, the evaluator should also consider other social concerns. These include a review of business goals, organizational concerns and other intangible cost and benefits, which are related to the proposed system (Palvia et al 2001).

The issue on size, complexity, uncertainty and risk associated with the proposed system are also considered within the content of activities (Willcocks and Margetts 1994). Therefore, project classification, which distinguishes a wide range of systems, is normally considered in an evaluation exercise. One form of project classification is provided by Farbey et al (1993) in the form of an “eight rung” project ladder depicted in Figure 2 as follows:-

Rung 8	Business transformation
Rung 7	Strategic Systems
Rung 6	Inter-organizational systems
Rung 5	Infrastructure
Rung 4	MIS and DSS systems
Rung 3	Direct value added
Rung 2	Automation
Rung 1	Mandatory changes

Figure 2 The Project Ladder (Farbey et al 1993)

The model is the result of an empirical study of 12 projects in 9 organizations in UK from 1993 to 1996. The ladder is a framework that specifically relates to evaluation and each rung of the ladder relates to the

system characteristics. The ladder representation implies that applications at higher level are more complex, more risky and more subjected to business judgement than those below.

The focus of evaluation and the appropriate evaluation techniques are different for each rung of the ladder. Whereas precise quantification of costs and benefits are possible near the bottom of the ladder, the higher rungs rely more on experimental and judgmental processes. Moving up the ladder, each rung represents increasing potential benefits, but also increasing uncertainty on outcomes, increasing risk of failure and increasing difficulty of communicating the “case” for change to relevant stakeholders. Risk assessment becomes an important component of evaluation near the top of the ladder. At the top of the ladder decisions require not merely the consent of the top management team but the projects can only succeed with their continuous involvement. They represent some of the most complex and difficult activities faced by senior management.

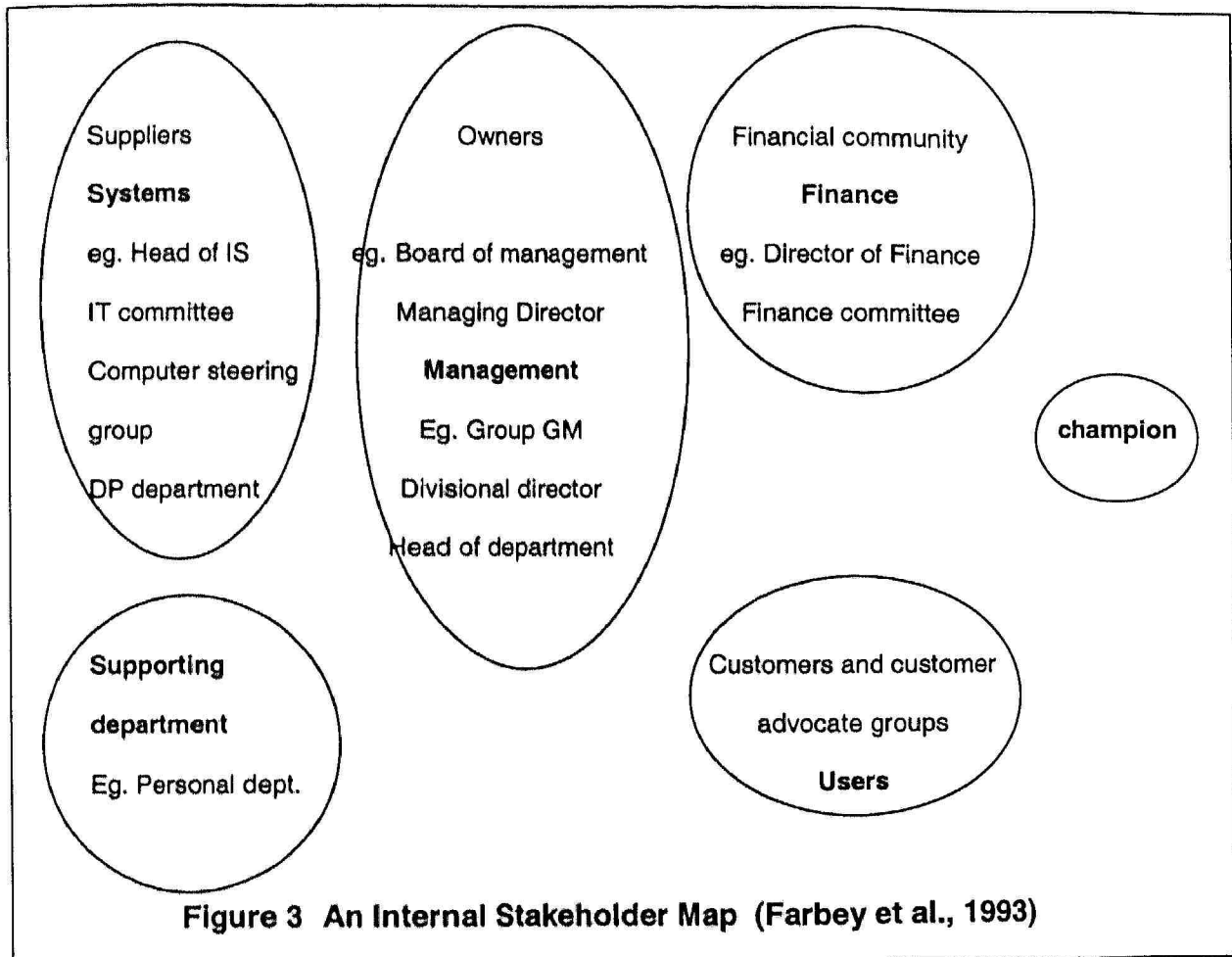
The way in which each applications need to be handled and the methods by which their impact can be evaluated changes from rung to rung. The focus of evaluation and the appropriate evaluation techniques are therefore, different for each rung of the ladder.

2.3.2 Process Activities

This part involves the measurement criteria, both financial and non-financial techniques. However, the emphasis is on subjective methods of evaluation. It focuses on the process of obtaining agreement on objectives through a process of exploration and mutual learning (Farbey et al 1993). Numbers are less important than a thorough understanding of the issues involved in an IS evaluation exercise. The various non-financial methods described in paragraph 2 above, are appropriate when IS evaluation is considered as a social process.

2.3.3 Context activities

Internal context activities include identifying stakeholder groups. Identification of stakeholders and their stakes is crucial both to the success of the project and to the acceptance of its evaluation. Stakeholder groups is depicted in the stakeholders' map in Figure 3 below:-



The evaluation of these stakeholders form a key element of the social context within which the evaluation process is carried out (Walsham 1993). Not only do different stakeholder groups hold different perceptions about the importance of a given feature or characteristic for evaluating system, but their actual assessments on those dimensions differ as well (Palvia et al 2001).

As a social process, the mental models of who is involved in the evaluation process is important. Peter Senge, the guru of learning organization, in his book "The Fifth Discipline" (1994), mentioned that mental models determine not only how we make sense of the world, but how we take action. Evaluation is one way, among many, in which people in organizations bargain and negotiate together to form a new consensus. In the process they adjust their mental models of the business and the relevance of the IS in helping them to achieve the business objectives (Farbey et al 1993). In Symons's (1994) view, this learning function of evaluation is critical during the development and implementation of a new system, when evaluation has both a "learning" and a control function. Hence the "*who*" involved would influence the process, that is, the "*how*" of the evaluation practice.

Another recent addition to the study of IS evaluation as a social process is the discussion on power and politics in IS development (Myers and Young 1997). One observation is that coalition of stakeholders, for example, the management, system people and clerical users develop as the system progressed. This throws into question one of the traditional assumptions of most critical management theorists, namely that organizational participants can be categorised into distinct groups and they often have 'hidden agendas' because of the underlying economic and power relations (Myers and Young 1997).

2.4 Conclusion drawn from previous studies

From the literature review discussed, the researcher draws the following observations:-

2.4.1 Traditional financial or accounting approaches to IS/IT evaluation is inadequate namely due to the following reasons:-

2.4.1.1 A major proportion of the cost and benefits attributable to the system is indirect, intangible and difficult to express in cash terms.

2.4.1.2 Estimation of costs and benefits may be arbitrary and subject to politics of the people involved in the evaluation.

2.4.1.3 Figures or numbers may not provide any form of comparisons to the effectiveness of the system employed.

2.4.2 In view of the inadequacies of the traditional accounting methods, there is a need to search for a more comprehensive model of evaluation. In this regard, IT evaluation should be considered as a social process. As a social process, organizational concerns such as business goals, type of project and associated risks factors, should be given due consideration within the content of the evaluation. In addition, the input and interaction/participation from the various groups of stakeholders in the IT project form a key element in the context of evaluation. Finally, there are various methods and techniques, which could be applied in the process of evaluation. The crux is to be able to select the most appropriate methods, within the context of the organization, which will be able to address specific needs such as feasibility, system design, benefits management or maintenance of the system (Farbey et al 1993).