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THE ADVANCEMENT OF IS EVALUATION:

A LITERATURE REVIEW

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Abstract

A significant amount of attention has been placed on IS Evaluation within the literature over the years and much has been written. In this paper we review the advancement of research in this area. We found however, that only a limited understanding of the phenomenon exists and only modest progression has been made: while the literature states the importance and objectives of IS evaluation, and its complexity and problematic nature,, not all concepts related are clearly defined. In addition, several taxonomies for classifying evaluation approaches exist, but there is no agreement as to which of these is acceptable for the entire research community, let alone for practice. Our review also shows that the literature is replete with reports of what industry uses in terms of evaluation approaches and methods, but that there is a lack of thorough accounts of actual evaluation practice, what works well and what the concrete problems associated with it are. Finally, we also found that the role and interplay of formality and intuition in IS evaluation is controversially discussed. On this basis the paper identifies a research gap and argues for more detailed empirical studies of actual evaluation practice to advance the field of IS, both in theory and practice.

Keywords: IS Evaluation, IS Investments, IS Value posit

1 INTRODUCTION

The practice of Information System (IS) evaluation in industry is undergoing constant change in response to the continued maturity and role technology plays in organisations. This has raised a number of challenges for the field, one that is addressed by practitioners and academics alike. Fuelled by constant competitive pressures, practitioners have responded to these challenges by adjusting their IS evaluation efforts. Researchers have also responded by seeking to better understand and explain the practice of IS evaluation, the result of which has been the development of more evaluation methodologies (Berghout & Renkema 1994). However Al-Yaseen & Eldabi (2004) found that these methodologies are not being used in industry, indicating that only a tepid understanding of the phenomenon exists. In this paper we therefore study and report the advancement in IS evaluation as it is presented in the research literature.

The paper has the following structure: in section 2 we introduce the various definitions of key concepts in IS evaluation. This is followed by two sections, one on the importance and objective of IS evaluation, and the other on its complexity and utilisation. In section 5, we discuss several taxonomies for IS evaluation. Our review finishes with a presentation of the diverse views on formality and intuition in IS evaluation. We close the paper by summing up our findings and argument for more detailed empirical studies of actual evaluation practice to advance the field, both in theory and practice.

2 KEY CONCEPTS IN IS EVALUATION

Research and discussion of any phenomenon benefit from a clear understanding of key concepts. In the area of IS evaluation these are terms such as ‘investment’, ‘IS investment’, ‘evaluation’, ‘IS evaluation’, ‘value’ and ‘IS value’. There is a clear and common understanding in the literature of what constitutes an investment. Lin & Pervan (2001b) define investments as “commitments of resources made with the purpose of realising the benefits that will occur over a reasonably long time in the future” (pg. 3). Hallikainen et al. (2002) provide a consistent view by stating that investments are an “...irreversible commitment of resources made in expectation of uncertain future gain” (pg. 1).

The terms ‘IS investment’ and ‘IS project’ are used interchangeably in the literature. IS investments are considered business based in so far as they have the potential to create economic wealth for an organisation. A comprehensive and widely accepted definition found in Bacon (1992) states that IS investments constitute:

“Any acquisition of computer hardware, network facilities, or pre-developed software or any ‘in house’ systems development project, that is expected to add to or enhance an organisation’s information systems capabilities and produce benefits beyond the short term” (pp. 335-336).

There is more discussion about the terms evaluation and IS evaluation. Evaluation is defined by Ballantine & Stray (1998) as being “...a wider consideration of investments at different times” (pg. 4), whereas it is defined by Lin & Pervan (2001b) as being a process that “...suggests planning and treatment by providing feedback information and contributing to organisational planning’ (pg. 3).

IS evaluation on the other hand is taken to be the assessment of the economic and non-economic worth of an IS within the context of its use. Smithson & Hirschheim (1999) define IS evaluation to mean “the assessment or appraisal of the value, worth or usefulness of an Information System” (pg. 160), a view that Remenyi (1997) also supports. It is seen in terms of the process or set of activities (Farbey et al. 1999, Fasheng & Teck 2000, Remenyi 1997) relating to the measurement and assessment (Remenyi 1997), at different or continuous points in time (Farbey et al. 1999) aiming to “establish the value of, or the contribution made by a particular situation” (Remenyi 1997, pg. 46).

Fasheng & Tech (2000) assert that IS evaluation “directly supports management decision making” (pg. 502). Another view considers the impacts, in that IS evaluation is performed “for searching and for making explicitly, quantitatively or qualitatively all the impacts of an IT project and the program and strategy of which it is a part” (Farbey et al. 1999, pg. 190). The terms IS and IT evaluation are also used interchangeably in the literature.

While these definitions supplement each other, the central concept of what is and constitutes value remains less clear. Value is an important concept which cannot be ignored, because it is rather integral to what the evaluation effort is trying to identify - that is the value of an IS investment or project. However, according to Bannister & Remenyi (2000) the definition of value is frequently inadequate, unclear, often partisan and at times completely missing from the discussion. The definition of value is not universally agreed upon amongst IS academics and consultants. This is alarming, because without a better understanding of what value is and how it can be optimised, present IT evaluation methods may be rather ineffective. Bannister & Remenyi (2000) argue that the problem associated with IT value is that it is largely defined in accounting and economic terms, which are quite limited. A study by Agarwal et al. (1992) revealed that value is dependent on the way IT is used, however this value is complex and cannot easily be quantified (Bannister & Remenyi 2000). Even though the value of IS has been the subject of interest for several decades, it is often an indirect consequence of a new process (Irani et al. 2005), and can be deceptive. The assessment of IS value is subjective, contextual and difficult to qualify. (Agarwal et al. 1992, Bajaj & Bradley 2005, Frisk & Roztocki 2005, Irani et al. 2005).

The state of IS evaluation research and the lack of agreement of what constitutes value is mirrored in practice. Many organisations are uncertain as to how to measure the value of proposed IS investments (Al-Yaseen & Eldabi 2004). Rather than merely adding the value of computers and software in the business, a broader understanding of what constitutes value is needed (Murphy & Simon, 2001). The lack of shared understanding of what value means leads to some serious misconceptions about the effectiveness of the metrics designed to measure it; detrimentally, the value of an IT investment to an organisation and to the decision makers in practice are both confounded (Bannister & Remenyi 2000). The conceptual problems have been summarised by Bannister & Remenyi (2004) by stating that:

“One of the sources of the gap between theory and practice is that, in much current research, the concept of value is ill defined. Indeed it is often absent from the discussion entirely like some axiomatic definition that all readers are assumed to share. On other occasion, value is defined in a narrow and/or partisan manner. The difficulty here is that if the user does not accept or share this worldview, any evaluation technique, which uses it, is a foundation crumbles. What is needed is a better understanding of IT value and how users, individual or corporate assess such value in their own minds” (pg. 2).

Two further concepts have to be discussed. The literature makes a broad distinction between what is known as pre- and post-implementation evaluation. Pre-implementation evaluation or ex-ante evaluation, is defined as being the assessment of what, how and why organisations should invest in IS (Al-Yaseen & Eldabi 2004). Williams & Williams (2004) see it as being predictive evaluation because of the speculative nature of evaluation that occurs at this pre-implementation stage of a project. Remenyi & Sherwood-Smith (1999) view it as predicting the impact of an IS on a future situation, whereas Murphy & Simon (2001) are of the opinion that it is the justification effort of the IS investment before being initiated. With this in mind it is easy to see that there is an element of estimation involved. Especially given that as Remenyi & Sherwood-Smith (1999) argue, the information needed to perform this evaluation is future estimates and as a result this evaluation is a function of the evaluator’s judgement.

Post-implementation evaluation or ex-post evaluation is not so much concerned with anticipating the value of IS, but rather with measuring the realised value of IS. Al-Yaseen & Eldabi (2004) define it as the effort to determine whether the IS investment has actually yielded the anticipated level of return or value. In the words of Irani et al. (2005), it involves the assessment of how well an IS project met stakeholder expectations. Smithson & Hirscheim (1998) see it as the assessment of the actual impact

of a system. The goal from this exercise according to Murphy & Simon (2001) is to justify the costs already invested and to guide future IS expenditure.

A considerable amount of published studies report on their findings from research on the value that IS investments have had on productivity gains (Brynjolfsson 1993, Brynjolfsson & Hitt 1998, Devaraj & Kohli 2002, Kelley 1994), organisational performance and even the shareholder wealth effects of these investments, as can be seen in [REF withheld due to anonymity of authors]. These have focussed on post-implementation evaluation of IS. As we are especially interested in pre-implementation evaluation, the following review of the literature concentrates on the pre-implementation evaluation of IS unless otherwise stated.

3 THE IMPORTANCE AND OBJECTIVES OF IS EVALUATION

The literature provides many arguments that should motivate the importance of IS evaluation. The rate of progress, development and innovation in IS has over the years increased, making technology not only cheaper but more accessible. This has resulted in IS being viewed by organisations as not only a source of prosperity and opportunity, but a major factor driving corporate strategy (Reddy 1990). IS is viewed by some organisations as a source of competitive advantage (Alter 1996, Banker, Kauffman & Morey 1990, Clemons 1991, Clemons & Weber 1990, O'Brien 2001), whilst others consider it to be a source of strategic advantage (Benjamin et al. 1984, McFarlan 1984).

There is evidence that corporate investment in IS is high and continues to rise (see for ex. Ballantine et al. 1996, Ghoneim & Irani 2005, Tallon et al. 2000). These investments continue to take up a larger portion of an organisation's capital and operational expenditure budgets. The higher stakes and increased visibility by management have effectively brought about greater emphasis and focus on the pre-implementation evaluation effort for IS investments. Lin & Pervan (2001b) argue that the evaluation of IS investments is becoming an important activity because of the increased investment levels and significance of IS in organisations. Murphy & Simon (2001) agree, by arguing that growing IS expenditure and their sheer importance in organisations have made the evaluation of these investments all the more critical.

Faced with a situation where demands for funds exceed supply, management have seen pre-implementation evaluation as one of many ways to allocate resources efficiently. The significance and growth of these investments in both dollar terms and percentage of total corporate expenditure (Powell 1992, Sheppard 1990) has put pressure on management to justify these investments (Dos Santos 1991). Managers are not only concerned about the substantial amount of spending on IT (Bannister & Remenyi 2004), but also about cost cutting arising from increased competition and globalisation (Ballantine et al. 1996, Serafeimidis & Smithson 1999). Some, like Barua et al. (1995) argued that the purpose of this pressure is to drive management to make more informed decisions. This is bizarre, since the adoption of IS is considered to be one of the most expensive, complex (Cronholm & Goldkuhl 2003), and time-consuming tasks that a firm can undertake, hence raising the importance of the IS evaluation act itself (Lin & Pervan 2001a, Patel & Irani 1999), and fuelling research to explore, understand and explain this practice.

Remenyi & Sherwood-Smith (1999) sum this up by providing two reasons why IS investments need to be evaluated - the first being an assessment of the utilisation of organisational funds; and the second being an assessment that IS evaluation can help improve investment management. This view is also in line with Fasheng et al.'s (2000) views who say that IS evaluation provides management with the information to make an effective choice between competing alternatives. This brings us to the objectives of IS evaluation. IS evaluation is part of a justification process (Willcocks & Lester 1994). It allows the organisation to control projects, and enables learning for future evaluations and estimations as well as gaining valuable information for project planning (Farbey et al. 1992).

King & McAulay (1997) propose that IS evaluations enable an organisation to make comparisons of the merit of a number of different investment projects competing for limited resources; and Lin &

Pervan (2001b) argue that the objectives of IS evaluation are that they enable organisations to gain competitive advantage, to develop new business, to improve productivity and performance, and to provide new ways of managing and organising. In closing, Ballantine et al. (1996) suggest that the objectives of IS evaluation are simply to support the broader objectives of the business and to provide for future business expansion.

4 THE COMPLEXITY AND UTILIZATION OF IS EVALUATION

It is thus not surprising to note that IS evaluation is problematic and challenging for organisations, and that pre-implementation evaluation is especially difficult (Frisk & Roztocki 2005, Powell 1999, Remenyi & Sherwood-Smith 1999). It is a complicated process and continues to be a critical issue (Irani et al. 2005, Serafeimidis & Smithson 1999). Ward (1990) summed this up by stating:

“Evaluating IS investments is clearly not a simple task. It requires a combination of management perception of the overall nature of business improvements that can accrue plus realistic appraisal of each investment, to ensure that maximum benefits can be realised at an acceptable cost. At the same time, consistent criteria must be applied to both the evaluation of investments and the setting of priorities across the variety of investments” (pg. 230).

Mirani & Lederer (1998) and Khalifa et al. (2001) report that IS evaluation being both subjective and contextual has meant that a unified ‘one-size fits all’ approach has not emerged or gained widespread acceptance. With this in mind, several authors argue that it is rather strange that IS evaluation methods continue to be developed for this purpose (see f. ex. Berghout & Renkema 1994, Bannister & Remenyi 2000, Cronholm & Goldkuhl 2003, Katz 1993).

Berghout & Renkema (1994) identified the existence of over 60 evaluation methods, and still, management continues its search for an acceptable way to solve the issues around IS evaluation (Al-Yaseen & Eldabi 2004). One reason why evaluation methods have not yet been adopted may be due to their level of complexity and limited process structure, with little fit to broader managerial decision making (Lefley & Sarkis 2005). Another reason might be that they do not satisfy Chikofsky & Rubin (1999)’s claim that “(in) this era of closely scrutinised IT budgets a well-defined measurement program can provide the hard numbers to justify your expenditures” (pg. 75).

Management are not looking for a unified approach, but rather for a usable and acceptable approach that suits their needs. In practice, according to Willcocks & Lester (1994), managers use simple methods like Net Present Value, Cost Benefit Analysis, Return on Investment, Payback periods and so on. Empirical results from Ballantine & Stray’s (1998) study found that generally 76% of the respondents used the Cost Benefit Analysis method to evaluate their IS investments, followed by 70% for Payback Period, and 52% for Return on Investment methods. However with regard to the effectiveness of these methods, [REF withheld due to anonymity of the authors] concluded that in fact financial evaluation methods alone, like those aforementioned, are not adequate in assessing the full extent of the value IS can add to organisations. IS evaluation methods continue to be developed, but industry only uses a few of them and these are mainly based on finance and accounting approaches. This is odd, however a greater effort spent on understanding why this is the case will help bridge the gap between research and practice. What methods practitioners use to evaluate their investments is generally known, but not much is known about how they use the approaches in detail, what works and what is problematic on a more exhaustive level. Instead, much research effort has however been spent on developing taxonomies for evaluation approaches and methods.

5 TAXONOMIES FOR IS EVALUATION

As in many young fields, the literature on IS evaluation is quite concerned with taxonomies. Ahituv (1980) provides what may be one of the first taxonomies, by grouping IS evaluation methods into

pragmatic assessments such as Cost Benefit Analysis, theoretical evaluations based on decision theory, and the ones that are a hybrid of the two. Melone & Wharton (1984) introduced four groupings - the first being political gambit models, the second being economics models, the third being scoring models and the last group consisting of a combination of the above. There does not appear to be recognition for less formal approaches before Zakierski (1987) proposed a two-level taxonomy - one grouping for objective methods, and the other for subjective ones. These are usually qualitative and rely on the attributes and opinions of users and system builders. The second group also comprises informal methods, and methods that are less objective and based on heuristics and intuition. As an addition, Molnar & Sharda (1991) introduced integrative methods. Patel & Irani (1999) reframed this later with the following taxonomy:

- Economic: Structured, accounting-based, does not include intangibles
- Strategic: combines tangible/intangible, risky projects
- Analytical and Structured: subjective, tangible/intangible, includes risk; and
- Integrated: combines subjective/formal structures, includes 'weighting factors', financial/non-financial.

Remenyi & Sherwood-Smith (1999) proposed two groupings - one being summative and the other formative - in another framing of evaluation methods. The summative category groups evaluation methods which are not reiterative, do focus on financials, and do not investigate in any detail the issues behind the numbers. Formative evaluation methods on the other hand, include views of various stakeholders that allow management to probe the reality behind the numbers; these are methods where frequent evaluations are performed and changes of evaluators are recognised along with changes in IS.

Wen & Sylla (1999) took a rather different approach; they divided evaluation methods into those which allow for the assessment of tangible benefits, those which allow for the assessment of intangible benefits, and their third category contained risk-based methods including real options, portfolio analysis, Delphi models and others. Bannister & Remenyi (2000) developed a taxonomy grouping IS evaluation methods into three areas:

- Fundamental measures: "... provide a single score or statistic by which to assess the investment; measures of this type are not confined to the purely financial, although financial measures are the most common". (pg. 235)
- Composite approaches: "... include the information economics of Parker and Benson (1988), portfolio methods, the balanced scorecard of Kaplan and Norton (1996), the investment portfolio approach (Ward 1994), and Simple Multi-Attribute Rating Technique (SMART) – Goodwin and Wright 1998" (pg. 235); and
- Meta approaches: "... select the optimum set of measures for a context or set of circumstances...by definition there is no question of the organisation wishing to use this approach for any sort of benchmarking other than for internal comparisons between different projects and/or possibly over time when the same meta approach is being applied" (pg. 235).

To summarize, there is a lack of agreement of an appropriate way of grouping the methods, but it appears that formal evaluation methods are recognised in all taxonomies. We will therefore take a closer look at the treatment of formal and informal intuitive approaches for IS evaluation.

6 FORMALITY AND INTUITION IN IS EVALUATION

Formality is an important topic in IS evaluation research. The absence of formality and structure is frequently lamented; for example in a study by Farbey et al. (1992), which revealed that 'only' half of the organisations had formal evaluation procedures, and some researchers see this as a problem

(Hallikainen et al. 1998, Ward 1990). In practice, many IS evaluation decisions are made by intuition (Marshall & McKay 2002, Bannister & Remenyi 2004).

The non-use of formal evaluation methodologies in itself does not have to be a problem. But for example Powell (1999) states that it is problematic that a large amount of money is invested in IS without formal evaluation. In the same vein, Ward (1990) argues that a lack of formal evaluations results in non-optimal selection of IS investments. A formal process to evaluation according to Marshall et al. (1998) provides “a clear paper trail, showing the documents submitted at each stage, the minutes of committees and meetings and a record of the point at which capital was officially committed” (pg. 13). They postulate that formality and structure in IS evaluation is positive because it provides “a scheduled set of occasions for face-to-face communication across multiple levels of hierarchy thus giving the chance to debate the specific project” (pg. 28). There is however no evidence whether the lack of formality leads to poor IS evaluations and that more formality will lead to better IS evaluations and decisions.

Agarwal et al. (1992) purport that IS evaluation is a human-centred activity that cannot be separated from the organisational context. They argue that perhaps due to the lack of formality, there is room for political manoeuvring throughout the course of an evaluation. Political manoeuvring, as a political instrument to shift the power balance of the involved stakeholders, has also been found by Serafeimidis & Smithson (2003) as part of evaluation practice. However, it remains/It remains, however, unclear whether formal approaches would decrease or eliminate these manoeuvres, or whether they are a natural and healthy part of the IS evaluation process.

This leads us to the discussion of informality in IS evaluation. Lubbe & Remenyi (1999) uncover that informal methods are used in practice. Marshall & McKay (2002) found that the evaluation of e-commerce investments in their set of organisations was haphazard, and relied on intuition. The underlying attitude seems to be that informality is harmful. However, the literature does not provide clear results as to whether informality and intuition lead to poor or good IS evaluations. This is interesting and directs this review towards the role of intuition in IS evaluation. Bannister & Remenyi (2000) - referring to their three-level taxonomy - say that the three approaches can be applied in three different ways, a positivist, reductionist or in a hermeneutic way. The first is where the decision maker “allows the methodology to make the decision” (pg. 235); the idea being is that the option with the highest score is selected. The hermeneutic approach is defined as “methods of interpretation of data which use non-structured approaches” (pg. 235). They continue their argument by stating that “the decision maker takes on board several different metrics directly and combines them in his or her mind in a manner which cannot be formally stated. It is in this area that instinct and intuition plays the biggest role” (pg. 235).

Instinct is defined by Bannister & Remenyi (2000) as not being ‘non-rational’ or ‘irrational’ per se, but rather is regarded as ‘super-rational’ which means it incorporates “processes of reasoning at a much higher level than is taken when a problem is worked out step by step” (pg. 237). It is posited that instinct plays a greater part, the more complex a decision is (Bannister & Remenyi 2004).

The IS evaluation literature contains plenty of evidence and arguments that managers base decisions on acts of faith, gut instinct or intuition for investments that are highly innovative and cannot be justified rationally using operational terms (Bannister & Remenyi 2000, Barua et al. 1995, Dos Santos 1991, Farbey et al. 1993, Katz 1993, Powell 1992, Small & Chen 1995, Weill 1990). Smithson & Hirschheim (1998) suggest that managers sometimes just take a chance when it comes to investing in strategic IS. Again, whether these decisions are of good or poor quality is not discussed, but Bonabeau (2003) argues that “the more complex the situation, the more misleading intuition becomes” (pg. 17), to an extent where it is said that one should rely less on intuition in an evaluation that involves multiple options, a lot of data to weigh, and more “unprecedented challenges”. He acknowledges that instinct plays a part in decision making and should not be ignored, however stresses that intuition is not a substitute for reason. This voice is echoed by Bannister & Remenyi (2000), who highlight that the decision maker of reason should not abandon or condemn instinct.

Instinct and intuition are imperative in IS evaluation because they address both non-financial and non-tangible aspects of evaluation, which are not, addressed by traditional, finance-based evaluation methods (Bannister & Remenyi 2000). Despite Bannister & Remenyi (2000) and Bonaneau (2003) pointing to the importance and role of intuition in IS evaluation, Marshall & McKay (2002) found that 'intuition' as an evaluation method itself did not appear to be particularly effective. This is perhaps so because as Guimares & McKeen (1989) suggest, decision makers ultimately apply their own inherent "biases, motivations, perceptions, skills and goals in the exercise of their judgement regarding the selection of MIS projects" (pg. 18). Lovallo & Kahneman (2003) provide a similar view of decision makers by stating that "managers make decisions based on delusional optimism rather than on rational weightings of gains, losses and probabilities" (pg. 5).

The process of decision making as part of IS evaluation thus involves a number of activities and factors - "some rational, some non-rational, some explicit, others implicit" (Bannister & Remenyi 2000, pg. 237). This, and the discussion above indicate that more studies about the balance of formality and application of formal methods on one hand, and intuition and instinct on the other, are needed to get a better understanding of IS evaluation.

7 CONCLUSIONS AND FUTURE RESEARCH

Much has been written on IS evaluation, and it is becoming increasingly and widely recognised as an important process (Lin & Pervan 2001b, Murphy & Simon 2001). However, as our review shows, only a limited understanding of the phenomenon exists.

Our research shows that while the literature states the importance and objectives of IS evaluations and their complexity and problematic nature, not all concepts are clearly defined. The terms 'evaluation' and 'value' are understood and used in many different ways. Several taxonomies for classifying evaluation approaches exist, but no agreement has been found as to which of these is acceptable for the entire research community, let alone for practice. The paper also showed that the literature is replete with reports of what practice uses in terms of evaluation approaches and methods, but we found a lack of thorough accounts and narratives of actual evaluation practice, describing and analysing what works well and what the concrete problems associated with it are.

We have argued elsewhere [REF withheld due to anonymity of the present authors] that financial evaluation methods alone are inadequate in presenting the rich picture of IS value at the pre-implementation stage. Our review shows that there are mixed reports on the use of formal and informal evaluation methods. This, coupled with the realisation emerging from the recent literature that intuition and instinct do play a part in IS evaluation, adds impetus for further research.

The gap found in the literature encourages future in-depth research to examine how IS investments are evaluated in practice, and why and how they are being used. Such studies could make two main contributions. First, they could provide detailed descriptions of existing practice including the governance and decision making activities of IS evaluation and make concrete improvement proposals to the IS evaluation practices in the organisations studied. Grounded in practice, a greater understanding of the phenomenon can subsequently lead to more appropriate and generally applicable approaches and a sustainable theory of IS evaluation. We will endeavour to undertake such studies in the future.

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