International Journal of Business and Systems Research
Print ISSN: 1751-200X Online ISSN: 1751-2018
DOI 10.1504/IJBSR.2015.066822

Investment appraisal and evaluation: preserving tacit knowledge and competitive advantage

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Abstract

This research asks if intuitive investment appraisal and evaluation are appropriate under conditions of rapid change, uncertain outcomes, limited information, and when competitive advantage derives from tacit knowledge. Measures and rational approaches to appraisal and evaluation require distal knowledge made explicit in documents and techniques. Converting valuable tacit knowledge, residing in individuals and organisational context, into coded distal knowledge, which is more easily replicated, risks jeopardizing the uniqueness of competencies and capabilities that underpin competitive advantage. The research investigates e-learning projects in higher education and finds little evidence of formal rational investment appraisal and evaluation in IS projects characterized by uncertainty and a lack of clear information.

Key words: investment appraisal, evaluation, tacit knowledge

1. Introduction

This study examines investment appraisal and evaluation of information systems (IS) projects. There are two aspects to IS appraisal and evaluation. First, ex-ante appraisal used to justify investment in either economic or intangible terms (Cauwenbergh et al. 1996; Marsh et al. 1988). Second, ex-post evaluation which is also used to justify investment (Cauwenbergh et al. 1996), but may feed back into the decision process, help control IS projects, hold managers to account for promised benefits (McAulay, Russell, and Sims 1997; Langley 1990; Marsh et al. 1988), and contribute to learning and evaluation process improvement (Farbey et al., 1992). Two principal approaches to investment appraisal and evaluation are (1) formal rational analytical, requiring measures and techniques; and (2) intuitive, based on experience. A potential problem with formal rational techniques is that measures and techniques require distal knowledge, in the form of documents, techniques, and financial data (Polyani 1962), while tacit knowledge, residing in individuals and in the organisational context, is a source of competitive advantage (Kogut and Zander 1992). By using rational techniques for analyzing investments, organisations may convert valuable tacit knowledge into coded distal knowledge which is more easily replicated, risking loss of competitive advantage.

IS investment is perceived to be different from other investment decisions due to rapid technological change, costs and benefits that are harder to identify and quantify, incomplete information (Cauwenbergh et al. 1996), and uncertain and hard to assess outcomes (McRea 1970; McGrath 1997; Schwartz and Zozaya-Gorostiza 2003). Information is an input into a decision process, reducing uncertainty (McRea 1970).

Analysis of IS investments is often seen as being inaccurate, or accurate but incomplete, therefore not useful; as a result, IS investments are frequently not evaluated (Benaroch and Kauffman 1999). IS investment is often justified using subjective measures or categorizing it as strategic, thus not requiring evaluation (McAulay, Russell, and Sims 1997).

This study examines implementation of new IS in UK public sector organisations, asking whether the decision to use intuitive investment appraisal and evaluation, or indeed no evaluation, is appropriate where rapid change occurs, outcomes are uncertain, information is limited, and competitive advantage derives from tacit knowledge. It considers whether the absence of use of formal rational analytical techniques helps preserve sources of competitive advantage from the coding and formalization inherent in such techniques.

The paper reviews the literature on investment analysis, then discusses intuitive analysis, proposing this may be the preferred method of analyzing and evaluating investment in rapidly changing technologies. The paper then presents a case study, findings and analysis, ending with concluding arguments.

2. Approaches to analysis

During the last 20 years growth in IS investment has been considerable (Schwartz and Zozaya-Gorostiza 2003) averaging 10% annually 1987-95: almost double GDP growth (OECD 1997). However, much IS investment takes place without evaluation (Benaroch and Kauffman 1999). Analysis of IS investment has been the subject of much research over the past 30 years, and many issues are as relevant today as then.

Researchers present rational investment appraisal and evaluation techniques with little evidence of use (McRea 1970; Mintzberg and McHugh 1985; McGrath 1997).

The role of appraisal and evaluation

The role of management is to choose the extent of analysis when preparing decisions (Werder 1999), but research suggests that investments in innovative strategic projects are difficult to manage using formal techniques (Mintzberg and McHugh 1985), and for IS projects, characterized by high levels of complexity and uncertainty, investment analysis tools such as IRR and NPV may be inadequate (McGrath 1997). From as early as the 1960s, while there were ex-ante claims justifying investment in IS, there were few attempts at ex-post economic evaluation (McRea 1970), or verification of ex-ante projections. If analysis is difficult and often neglected altogether, the role of management must be reconsidered.

There are two important schools of thought about managerial rationality. First, the ecology school proposes that management does not matter because organisations are so complex, dynamic and unpredictable that managerial decision making is insignificant compared to other forces and influences impacting upon the organisation and its environment (Werder 1999). Second, the intentionality approach, while conceding that the unstructured nature of managerial problems means they are complex with uncertain outcomes, risky, with no guarantee of success, nevertheless management has sufficient impact in intentionally directing an organisation and that it is better to manage actively than rely merely on evolutionary processes of the environment (Werder 1999). An alternative view is that organisations are a combination of different evolving influences including managerial action (Lewin, Long, and Carroll 1999); the co-evolutionary perspective suggests that not only does

management matter, but there are two forms of intentionality: intuitive management, and analytical rational management (Werder 1999).

Intuitive management proposes that the world is complex, management problems are unstructured, and human beings limited in their ability to understand such problems. With limited time in which to understand problems and make decisions, limited resources available for data collection and evaluation, attempts to make decisions rationally results in production of copious data quantities and "*paralysis by analysis*" (Werder 1999; Mintzberg 1994). Rational management proposes that while many management problems are unstructured, some are structured, and structured problems can be addressed rationally and analytically. As for difficult to understand unstructured problems, it may nevertheless be better to analyze than rely on intuition (Werder 1999; Dean and Sharfman 1996). A middle way advocates differing levels of application of rationality and intuition depending on environmental stability, information availability, and problem nature (Lewin, Long, and Carroll 1999; Brown and Eisenhardt 1997). From this approach, the role of management changes depending upon how it applies intentionality, and its mix of rationality and intuition (Werder 1999).

Formal Rational Techniques

One family of methods is from the logico-scientific approach, using formal rational techniques. The logico-scientific approach (Bruner 1986) seeks, through formal analysis, to establish a definable truth that can be tested, supporting a logical decision made using axioms based on modeling cause and effect. This is difficult in IS

investment as returns are not as easy to define as they are from many other investments.

McRae's (1970) classic argument presumes investment in computers is to increase future income. Since IS are production goods which are appraised based on estimated future income streams, their value is in the services they provide. Madan (1985) proposes current net market value in relation to income flows as the correct criterion for investment decisions. McRae suggests that IS investment can be categorized as delivering four types of benefit: reduced working capital; improved use of resources; improved decisions - all of which deliver incremental benefits and reduced administration costs - while improved speed and effectiveness of IS delivers increased utilization of factors of production. The choice of approach in evaluating IS projects includes the cost-effective approach (the least-cost method) and the cost-benefit approach, to determine the most efficient means of delivering the required service with the lowest input/output ratio (McRea 1970). Both approaches assume outputs and costs are known and quantifiable.

There are differing approaches to what needs to be measured. The cost-effective approach prefers an IS delivering the required service at the lowest cost, avoiding the need to evaluate the service itself (McRea 1970). If the service provided is data, an intermediate good to be used as an input into a further process, then the cost-effective method can be used. In order to evaluate information as a decision input it is necessary to compare the decision outcome with the information to the decision outcome without the information. The value of any discernible difference is the information value. McRea concludes this may be possible if only one source of

decision information is needed, when the difference in decision outcome can be clearly isolated and valued; otherwise it is unlikely the value of one information source can be discerned distinctly from others.

Where an IS increases asset utilization, either by speeding up asset control, optimizing asset consumption, or reducing investment, the key to improved profitability is higher capacity utilization. McRae suggests evaluation is possible by evaluating increased throughput such as increased service levels, or more customers served in a given timeframe. Evaluation of a reduction in investment in an asset might be even easier, in the form of reduced stock levels, debtors, staff, or fixed asset requirement.

McRae (1970) concludes that evaluating IS investment by using the free market pricing mechanism merely shifts the locus of decision making to the customer of the IS services. The advantage is that the customer may be less committed to an IS project, therefore more likely to impartially make their decision on the basis of comparable performance.

Thus, formal rational approaches to investment appraisal and evaluation start with a presumption that costs and benefits can be determined, and a choice is made to implement options that deliver optimal results, using techniques that are objective and scientifically-based (Werder 1999; McAulay, Russell, and Sims 1997; McGrath 1997). Such techniques tend to weigh current investments against future cash flows.

Beyond Simplistic Cost/Benefit

However, investment in IS is complex and contextually-situated (Jarvenpaa and Leidner 1998), and investment appraisal and evaluation techniques which consider the

wider organisational context appear to be more appropriate for IS investment. Three techniques are presented as suited for appraisal and evaluation of IS investment: IE, balanced score-card, and real options pricing. All are for use in situations where risk is high, costs and benefits difficult to determine, and outcomes uncertain. They are seen as useful for practitioners when specifically tailored to IS investment evaluation (Banker, Chang, and Pizzini 2004; Willcocks and Lester 1994; Wiseman 1994; Lipe and Salterio 2000; McGrath 1997; Schwartz and Zozaya-Gorostiza 2003).

IE (Wiseman 1994) begins with financial cost-benefit analysis but looks beyond simplistic analysis of direct financial costs and benefits, taking a broader perspective of risks and value, analyzing the new IS effects in both technical and business domains to understand the wider economic impact and value. An alternative method is the balanced score-card (Kaplan and Norton 1993) tailored to evaluating IS investment (Willcocks and Lester 1994). Real options pricing (McGrath 1997; Schwartz and Zozaya-Gorostiza 2003) can be adapted to consider areas of uncertainty that characterize IS investment.

3. Formal rational analysis

The use of formal analysis may differ depending upon organisational structure, leadership style, issues facing the organisation, and its relative vulnerability to market forces (Langley 1990). Higher levels of uncertainty may lead to more critical reactions and use of formal analysis to hedge against perceived risk. However, sometimes, higher uncertainty leads to less formal analysis due to a perception that pressure to act makes investment more likely irrespective of analysis outcomes (Cauwenbergh et al. 1996).

It is questionable whether the use of formal analysis in investment appraisal has a significant impact on project outcome (Langley 1990), but plays a role in guiding social interactions between individuals involved in the decision process. Formal analysis may be ritualistic, forcing participants in the decision process to be explicit in their argument, driving a decision forward, communicating information internally, engaging participation from differing hierarchical layers and disciplines, and helping to identify new information (Cauwenbergh et al. 1996; McAulay, Russell, and Sims 1997; Marsh et al. 1988). Managing an investment is not just about measurement, but also about ensuring people deliver what they promise (McAulay, Russell, and Sims 1997). Rational analytical investment appraisal techniques play a symbolic role signaling the organisation is rational, professional, and engages in well thought through projects (McAulay, Russell, and Sims 1997; Cauwenbergh et al. 1996). The value of signaling is to persuade external stakeholders of the value of a given project (McAulay, Russell, and Sims 1997), and 'sell' a proposal to others. Some managers believe financial analysis is an afterthought, justifying a decision, designed to promote a feel-good factor (Cauwenbergh et al. 1996).

The balanced scorecard provides a framework for linking performance measures with strategic decision makers, employing financial and non-financial performance measures along with customer satisfaction, internal process, and learning and growth activity measures (Banker, Chang, and Pizzini 2004). The scorecard should contain four types of measures: financial performance; customer relations; internal business processes and efficiency and; learning and growth (Kaplan and Norton 1993). This makes it complex to use, and may cause information overload for decision-makers (Lipe and Salterio 2000). One solution is to break the information down into groups

of similar types, assess each independently, then combine the results (Lipe and Salterio 2000). However, lack of information may affect decision makers, and the availability of strategy information to the decision maker influences performance evaluation and the degree of reliance on strategically-linked performance measures (Banker, Chang, and Pizzini 2004).

Real options represents a more sophisticated approach to IS investment appraisal than net present value (NPV), although both are grounded in economic rationality (McGrath 1997; Schwartz and Zozaya-Gorostiza 2003). The real options approach is of limited usefulness as there is an underlying assumption that there is some means of determining project costs and benefits in financial terms, and the formula requires costs to be known with certainty while IS projects are characterized by uncertainty (McGrath 1997) of costs, duration, and outcomes, particularly project benefits, which must be specified as cash flows (Schwartz and Zozaya-Gorostiza 2003).

Determining cash flows for an investment decision, or applying quantitative techniques leaves little room for opinion, which is seen to undermine technique credibility (McAulay, Russell, and Sims 1997). Financial analysis may not be perceived as objective or reliable, but as biased by personal preferences of those conducting the analysis (Cauwenbergh et al. 1996). In practice, projects tend not to proceed according to projections, if they do it raises suspicions that "someone's manipulating the numbers" (McAulay, Russell, and Sims 1997, 37). The alternative to formal rational approaches is intuitive analysis is explored next.

4. Intuitive analysis

Internal non-output effects from IS investment may have positive or negative impact on the organisation such as changed working conditions, culture or structure. Such change may increase or reduce costs or revenues, but costing organisational change is difficult, and attempting to directly relate social causes and effects is probably impossible (McRea 1970). Thus, intuitive analysis is ideal when investment projects are perceived as high risk, there is little available data or relevant precedent, and no clear optimal outcome (Agor 1986). Evidence suggests that investment decisions under high levels of uncertainty are based on intuition, rather than formal financial analysis (Cauwenbergh et al. 1996): the decision environment a "constantly changing world" where managers are "balancing and throwing things together" (McAulay, Russell, and Sims 1997, 33). Thus, unrestrained belief in figures or dependence on intuition, are equally pernicious (Cauwenbergh et al. 1996).

The use of formal rational techniques excludes gut feel, individual judgment and other forms of bias not regarded as logical or scientific. Alternatively, bounded and intuitive rationality, rooted in individual judgment and intuition, suggests decision makers have limited attention and make choices based on a perception of which decision opportunity is currently the highest priority (Simon 1983). They may choose an option that is satisfactory rather than optimal, based on subjective satisfaction, leaving decision behaviour inconsistent in approach or outcome (Simon 1983; Cyert and March 1963): decision-makers have repertoires of decision experiences that can be applied to situations familiar or new to make satisfactory decisions based on past experience. Thus, the decision maker is more bricoleur, using heuristics, luck, and make-do, rather than a rational, logical calculator of optimal choice from measured

alternative scenarios (Simon 1983; Ciborra 1998). Intuitive rationality suggests a reality constructed from history and experience by human actors.

Organisations develop unique competencies and capabilities to sustain competitive advantage (Nelson and Winter 1982; Wernerfelt 1984). They are embedded in their people, skills, knowledge and routines that increasingly rely on knowledge creation to survive (Matusik and Hill 1998). Knowledge is a social construct peculiar to an organisation, therefore difficult to imitate or learn, and is important because it can be costly to an originator of a knowledge-based competence or capability if a competitor imitates it and uses it to compete successfully against them (Simonin 1997). Where knowledge is coded it is easier to acquire, and easier to transfer internally for implementation, This poses something of a paradox, ease of transfer allows more rapid utilization internally, enhancing competitive advantage, but external imitation is easier, eroding competitive advantage (Kogut and Zander 1992).

5. Tacit and distal knowledge

Knowledge may be tacit or distal (Polyani 1962), and this distinction has influenced research into competitive advantage (Kogut and Zander 1992). Tacit knowledge is implicit, embedded in individuals and organisational context (Weick and Westley 1996), it is not coded or documented, residing in skills, routines, and experience. Decision teams that work together for a long time have insights and experience that contribute to their decision capability (McAulay, Russell, and Sims 1997). Competencies and capabilities are developed collectively by teams through adaptation and learning (Nelson and Winter 1982), thus competencies and capabilities are contextual, residing in the minds of the individuals and teams who develop them,

making them ‘sticky’ (Szulanski 1996) and hard to imitate (Tyre and von Hippel 1997).

Distal knowledge is explicit: specified, coded and formalized in rules, procedures, techniques and documents (Polyani 1962; Walsh and Dewar 1996). It can be stored in documents, databases and techniques. As such, it can be easily transferred and imitated. When used in decision-making, distal knowledge contributes to formal analysis, but is easier to imitate.

From a narrative approach (Bruner 1986) decision making is more a “search for meaning in a complex world where incomplete information is the norm, and no answer can guarantee a certain future” (McAulay, Russell, and Sims 1997, 33). IS investment can deliver external effects such as improved image, signaling that an organisation is modern using high technology, but this is probably impossible to evaluate (McRea 1970). Distal knowledge includes techniques and models used in financial management, proposals, business plans, and measurements. Such formal analytical appraisal techniques gather data, develop models and require distal knowledge, which is easy to replicate, thus not a source of competitive advantage (Kogut and Zander 1992). If a project can be undertaken without difficulty, be replicated by others, with commonly available technology, it is unlikely to provide sustainable high returns. Thus innovative use of technology, with high risk and complexity, employing tacit knowledge, if successful, is most likely to deliver competitive advantage.

Understanding the people who take the actions that implement strategy is important. Decisions are contextual, located in a specific place and time, building on an on-going story, based on understanding the organisation, its competitive position and preferences (McAulay, Russell, and Sims 1997). Such understanding resides in tacit knowledge, not in documents. Tacit knowledge need not be made explicit so long as people share sufficient experience and understanding of the underlying meaning of organisational history and goals. To make such experience and meaning explicit is difficult, unnecessary, and risks codifying the tacit knowledge that is a source of competitive advantage. This research proposes that where organizations require tacit knowledge for competitive advantage they will use intuitive methods of investment appraisal and evaluation, or no investment appraisal or evaluation. Where organizations do not require tacit knowledge for competitive advantage they will use formalized techniques for investment appraisal or evaluation which requires coded distal knowledge.

6. Research design

Consistent with the focus of obtaining rich data in a natural setting, this research adopts a multiple in-depth case study (Yin 1994) of e-learning adoption by similar UK higher education institutions (HEIs) across a relatively homogeneous industry. External performance measurement is standardized in the UK by virtue of governmental funding policies, and published rankings of universities. Research universities strive to compete on the basis of research assessment exercise ratings, and a number of published rankings for postgraduate courses. This provides an opportunity to identify six case organizations, one of which is a distance learning institution, operating at different levels of performance (Table 1).

(table 1 about here)

Thirty principal actors from the cases were interviewed; several from each to provide multiple sources. Interviewees were users of learning technologies, or involved in decisions to influence the use of learning technology. Research data is in the form of interview transcripts and notes, along with documents where available.

Semi-structured interviews were used to allow the interviewees to 'tell their own story'. Data were sorted into themes to identify five groupings of statements: First, information availability, clarity and completeness relating to identifying financial costs and benefits; Second, pace of technological change; Third, use of formal rational appraisal and evaluation techniques; Fourth, non-financial measures of performance; Fifth, use of subjective and intuitive appraisal and evaluation. These groupings guide the presentation of data next.

7. Case study and discussion

Cauwenbergh et al. (1996) suggest that the more complex and bureaucratic the organisation, the more it relies on formal appraisal and evaluation techniques. Hence, this research expected to find the use of appraisal and evaluation techniques differed between cases based on structure. The cases fall into two categories: first, those with a high degree of practitioner autonomy, the professional structure (Mintzberg 1989); second, those with a multi-layered top-down management style, a bureaucracy. Cases with a professional structure were expected to use less formal rational techniques, with bureaucracies a greater reliance on formal rational techniques. Many researchers suggest that rapidly changing technology and uncertainty about outcomes create difficulties in the use of formal rational techniques. E-learning is a relatively rapidly changing technology, therefore little use of formal rational techniques was expected.

Analysis of the data indicates little use of formal rational techniques in any of the cases, irrespective of structure. All the cases perceived themselves in a competitive environment irrespective of performance or position in rankings. E-learning was perceived to be uncertain, with a lack of full and clear information.

The following sub-sections present sample data (square brackets indicate researcher comments or additions to improve readability).

Grouping 1: Lack of clear information and measures, information is often incomplete, costs and benefits are hard to identify

If a rational analytical approach is taken, measures are required. This poses something of a problem. Where e-learning is supplementing existing face-to-face teaching and learning, it is difficult to separate out existing costs from new costs of implementation. Some interviewees pointed out that e-learning is an additional cost, one of many, and there is no attempt to separate out the different costs: *"[e-learning is] being used to support the modules, it's not being used to replace the teaching hours."* And *"So nobody … audits who's done what."*

In spite of the difficulties experienced by interviewees, they are still clearly trying to develop some way to identify benefits and measures of success: *"[We are] sort of trying to work out how well we're doing, and … what the costs are, [it] is very hard because it's not just, … it's not a distinct entity. It's very hard to quantify."*

Another interviewee posses this problem: "You know…how do you say, do you ask a lecturer to work out how many hours they've spent on re-engineering their course for

example? And then say that cost that much to do, I mean if you're trying to quantify, it's,…very difficult to say; what do you use as your markers?"

There are further attempts to find a suitable measure: "here the executive want to know how many courses have we got in Blackboard [VLE] so we tell them, but that is meaningless, you know, just because we've got 220 courses in Blackboard doesn't mean to say that there's 220 lecturers out there, in fact I know there aren't 220 lecturers out there [using it]."

"What are your markers of success? [Is it] figures for improved students? I mean what do you say is a mark of effectiveness? Is it that you've got X number of students? Is it that you've got X number of students who came out with a first? Is it that you've made X amount of savings? [Is it] because you haven't got everybody photocopying or something?"

In the above cases, not only is e-learning being developed on the fly and implemented experimentally, but so is evaluation. Without knowledge of how e-learning will ultimately work, or the ability to determine costs, is difficult to identify measures of effectiveness and costs.

Grouping 2: Technology is changing rapidly, outcomes are hard to assess, and uncertain

When new technology is used without clear understanding of how to use it, and learning takes place during implementation, the outcomes are uncertain: *"If we were to do it now, given the financial situation of the Institute, they would probably question the wisdom of [e-learning], it costs a lot of money for very little results"*

Because e-learning is new there are few existing examples to guide new users: *"I'd be very happy to design a course without having to produce the materials ... the problem is .. that in my particular area there isn't really much that's readily available, I don't teach terribly standard subjects, so unfortunately I'm in a position where I do have to design a lot of stuff .. from first principles."*

Where there are examples of early use it does not necessarily provide successful examples: *"... which was a DOS-based, command line thing in the 1980s. We used that on a course called Introduction to IT – that was in 1988 – it kind of worked."*

In order to try to control and manage the technology, and spread best practice, committees are formed with fluid membership; as skills are developed so membership changes: *"[It is composed of] individuals who have been interested in e-learning, which is an ever-growing group, and members of the course committee as well. So there's this ongoing learning experience, as well as a forum for people to say "well couldn't we do this, how about if you did, what would it entail if we had to do A, B, and C? Is there the capability out there? What would it cost us? How could we go about it? What sort of resources would we need? Is it doable within this time frame? How can we reformat the course requirements?" And so on, you know, all of those, and because of the diversity of the group they can answer those particular questions. It probably sometimes only meets every three months, sometimes more often depending on a particular need, [and this is] called [the] IT committee."*

In most cases the technology was implemented incrementally as the organisation learned to use it. Investment appraisal and evaluation cannot take place if the users do not even know what the technology can do, or how it will ultimately be used: *"we've gone about this slowly as well, we've produced some of these resources, before we put them into this final project, over two or three years, tested them out with the students right there, seen what they found more useful, and redesigned bits and pieces that really didn't go over the way we thought they would, you have this picture in your mind, you deliver it, and they use it in a completely different way, and sometimes that's very useful, it's very useful, and it's better than you thought it would be, and sometimes it just doesn't work at all. So we've gone about it in this [way], in a fairly slow, although anybody who's looked at [the] stuff that we've done in WebCT said how on earth did you do that in two months? And it just went from zero to …, well we didn't actually, and we [laughs] did it bit by bit, and then went full-tilt."*

Grouping 3: Formal rational appraisal, evaluation and techniques

In some institutions there is formal rational investment appraisal, but there is little confidence in that process: "Obviously the thing has been costed out and the resources worked out in general terms but I think if there is an institutional will to do this then obviously the global areas or cost and income projection will be done but not the detail.". And, "The other thing that strikes me about Blackboard [the VLE] or indeed anything like this is, it seems like a good idea, but nobody has bothered to demonstrate to me that it is a good idea, that there is a gain for my time". Also, "This is the first - it has been around for about 3 years, even possibly 4 years we have been using it - but this is perhaps the first year that they are asking students for their views, they are asking staff for their views on the Blackboard survey."

Where formal evaluation is used, it may take place following a period of experimental development, and may result from a decision to be 'strategic', and adopt a more rational approach: *"We are planning to use those projects more strategically so we will have them communicating with each other and we will be disseminating their findings and we are involved in the evaluation of practically all those projects. We will be looking to synthesize those evaluations so that we can then feed back into the planning process, which hasn't happened previously."*

Grouping 4: Non financial measures of performance

Where there is an overriding organizational objective, financial analysis is of insufficient priority to be used in investment appraisal. Organizational structures with empowered and experienced resource managers have past decision experiences to draw on and tacit knowledge about investment. The following discussion identifies there is also a power issue, which may relate to organizational structure where there is a high degree of autonomy for professional practitioners: Interviewer: *"Do you have a formal process for evaluating investment in e-learning? Did you look at the cost of introducing it and try to find financial benefits from it, try to justify it on a financial basis?"*. And *"No, it was on pedagogical grounds. There will be systems people who would have looked at how scalable it was against price, rather than the main driver being there."*

Also, *"The academics rule the roost around here so we would have chosen it on what we thought was best for our students, and then the IT people would have said whether the choice was viable or not."* And *"There's very little business case approach to [the] method of module delivery."*

Where the end user is important, evaluation may be from their perspective and evaluation subjective. Some interviewees were involved with end user evaluation: *"I have my students as part of my team, because when you're looking at e-learning you need to evaluate it, and the best way to evaluate it I think is with students."* And *"So we are evaluating, getting feedback from students all the time about whether they feel it's useful, whether it's helped them in any way, or how its use could be improved, but I don't have enough knowledge of that at the moment to say that it's an improvement on what we might have got otherwise."*

Grouping 5: Subjective and intuitive appraisal and evaluation

Other interviewees are less sure that evaluation of any benefits is possible, but are making subjective judgments about benefits: *"I think the short term advantages, both cost and other kinds - efficiency and effectiveness – are almost impossible to show and I don't think we have really got to the point where we can demonstrate the medium to long-term advantages, but my guess is that they are there."*

Where factors other than financial performance were of overriding importance there was non-financial evaluation, especially where technology use was innovative and experimental: *"We are constantly evaluating ourselves, we have an independent evaluator attached to the project, we are continually developing and innovating with and what we're doing, so I think we're delivering a very reliable product."*

Another important factor is organizational change, and e-learning may bring about transformational change (Sims, Powell, and Vidgen 2012; Katz and Oblinger 2000; Laurillard 1993). The effects of such change may outweigh any considerations of cost

or financial benefits: *"The 'after' thing, the embeddedness and the pain of the change processes that have to go on, the actual cost of the technology and the systems and the payback are small fry compared to the institutional change processes that go on. So trying to evaluate it later is almost impossible, I think."*

Where there are experienced managers who can observe competitors, and exercise their judgment, this is the basis for decision making, especially where fear of being left behind is one of the drivers and the ways in which the technology will develop is uncertain, as several interviewees explain: *"We have no systematic information about where we're [going], we've done it purely on the basis that we go around, and ... you spend a week in different universities, so ... it's quite a lot of time to poke around there, and it's a judgment based on that."* Also, *"Cambridge and Oxford are investing quite a lot of money in internet research areas and ... some of their materials on line as well. Edinburgh and Durham and others that we see ourselves on a par with, if they all move in that direction, then I guess we will be looking to see what benefits they had accrued from that and whether it was worth our following that."* and *"Thinking about the spend as well, sometimes you know, you get a view about how much people are spending on it, but it's not a really well-founded judgment."*

8. Conclusions

This research asks whether the use of intuitive investment appraisal and evaluation, or no evaluation, is appropriate where rapid change is occurring, outcomes uncertain, information limited, and competitive advantage gained from tacit knowledge. It also asks whether the absence of uses of rational techniques for investment decisions helps to prevent sources of competitive advantage from being jeopardized by converting

tacit knowledge into distal knowledge required for formal rational investment appraisal and evaluation.

There was evidence suggesting the application of experience and intuition, which may mean that tacit knowledge was being used. Little formal rational investment appraisal from a financial perspective was found. While there was appraisal, it was in the form of professional expertise about the usefulness of the technology, again suggesting tacit knowledge. Similarly, there was little evidence of ex-post evaluation of technology, where there was it was primarily in the form of subjective evaluation of end-user perception. Because of the power dynamics in organisations having professional structures, where the professional practitioner is perceived as expert and management's role is to support the activities of the professional, rational formal investment decision making does not appear to be in place.

All cases were concerned about competition, and one of the main drivers of e-learning is fear of falling behind (Sims, Powell, and Vidgen 2004). In such an environment tacit knowledge held by expert practitioners is perhaps not merely difficult to code, but perceived as being valuable in its tacit form. However, there is insufficient evidence to confirm this conclusion, and because of the nature of tacit knowledge, it is difficult to measure such an effect.

Further research is needed in identification of tacit knowledge, its value, and the risks associated with its transformation into distal knowledge. In particular, research methodology needs to be developed that will enable the study of such an elusive phenomena.

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Case	Size	Research	E-learning	Distance / Local
1.	Large	Active	Active	Distance not a focus / local use of learning technology through virtual learning environment (VLE)
2.	Small	Active	Active	Distance not a focus / local use of learning technology through VLE
3.	Large	Active	Active	Mainstream distance courses plus local use of learning technology through VLE
4.	Large	Less active	Active	Delivers courses at a distance via partners plus local use of learning technology through VLE
5.	Large	Active	Active	Solely distance learning
6.	Large	Less active	Active	Distance not a focus / local use of learning technology through VLE
7.	Small	Active	Active	Distance not a focus / local use of learning technology through VLE

Table 1 Selection of cases