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Abstract

There are a plethora of evaluation methods that aid the selection and assess the impact of IS. Whilst they have merit individually they are incongruent when viewed holistically and can be seen as micro tools that are not sufficiently related to macro organisational characteristics. It is particularly important to relate these evaluation methods to business context when strategically assessing IT, as an incorrect or a poorly related set of methods may hinder rather than enable an organisation.

This paper seeks to relate the prevalent categories of evaluation methods, and the many types of evaluation within those, to the business context of product and resourced based organisations. The resultant framework shows evaluation methods for IT projects, e-business and IT infrastructure directly related to business strategy and IT management practices.

Keywords

IS Strategy, Resource Based Theory, IS Evaluation, Infrastructure, e-business

INTRODUCTION

Organisational decision-making with regard to IT investment has been a recognised problem area for the last four decades (Renkema 2000, p.28). Surprisingly, this is that case even when IT evaluation is one of the most researched and written about topics in IT literature (Bannister 2004). Indeed, '*many a scholar, consultant and practitioner has tried to devise a reliable approach to measuring the business value of IT, none have succeeded'* (Keen 1991, p.162 cited Bannister 2004).

Ward and Peppard (2000) propose that management and evaluation of IT should be directly related to the strategy and context of an organisation. Vassilis (2003) identifies that a bureaucratic organisation would tend to have a cost driven authoritarian process and a less structured organisation more fluid and intuitive process of IT evaluation. However, the evaluation techniques used to appraise IT seem scarcely related to business context and are often presented as universal tools.

The main body of IS evaluation literature is concerned with project evaluation. Where individual projects are assessed in terms of feasibility, benefits management and success. Evaluation and appraisal of IT infrastructure is an increasingly published topic. E-business evaluation and industry evaluation are also major topics. The sheer volume of literature detracts from its usefulness.

The aim of this paper is to identify a framework of evaluation criteria against organisations' strategic context. Firstly, the primary strategic contexts that an organisation might adopt are analysed. These strategies are then amalgamated with theories that categorise the strategy processes and objectives of IT. This initial framework is then combined with evaluation methods. The result is a framework of evaluation methods related to organisations' strategic context.

STRATEGIC CONTEXT

There are currently two overriding views of an organisation's strategic context. They are product based and resource based strategies. Deise (2000) refers to these distinct types of organisations as Physcos and Knowcos. Physcos are organisations that compete by adding value to physical products and "require the movement of physical parts around the factory floor, purchasing capital equipment, and managing sizeable inventories of raw materials, work-in-progress and finished goods". Knowcos compete by focusing on resources, knowledge and competencies and "focus their core competencies on knowledge of a product or service" Deise (2000).

Organisations following a resourced based strategy will focus on improving or endowing its 'bundle resources within its administrative framework' to achieve competitive advantage (Melville et al, 2004). The focus is very much on leveraging resources and capabilities across many markets and products (Zack, 1999). Whilst product based organisations generally adopt a value chain perspective as described by Porter (1980). These organisations typically focus on product cost and adding value.

The traditional principle of management of IT in a product based organisations has been that IT must be implemented in such a way that the technical, economic and strategic impact of IT is in line with corporate strategy (Potter 1987, Venktraman 1987, Porter 1988, Zuboff 1988, Earl 1989, Agnell and Smithson 1990, Bjornsson and Lundegard 1992, Scott-Morton 1991, Kanter 1992, Benjamin and Levinson 1993, Burn 1993, Wilcocks et al 1997). In resource based organisations IS is often focused on enabling future strategy. In a resource based organisation IT should provide for whatever form the organisations may take (Evans, 2003, pp. 6) and must be evaluated in a more contextual and perhaps intangible manner.

The relationship between the strategic management of an organisation, the focus of IT in support of that process and underlying aim of IT investments can be explained by combining three theories; Strategic Lens theory by Johnson and Scholess (2002), categorisation of foci by McNurlin and Sprague (2004) and aims of IT by Dehning et al (2003).

Johnson and Scholes (2002) identify three strategic views or lenses for strategy development.

- Design lens, where strategy is developed through formal planning processes
- Experience lens, where protagonists make strategic moves based on environmental conditions and their knowledge, strategy is then emergent
- Ideas lens, where ideas proliferate from all levels of an organisation and impact strategy.

McNurlin and Sprague (2004) relate business strategy and the focus of IT. They use the terms utility, dependent and enable. Which can be briefly explained as follows.

- Utility: IT is focused on economies of scale
- Dependent: IT is focused on supporting current business programs
- Enable: IT is focused on creating flexibility to meet future changes in the marketplace

Dehning et al (2003) group IT into three categories of objectives or 'aims'; automation, information and transformation. Inter-relating these three works creates a context, aims and process model of strategy.

Dehning et al (2003) propose that the 'automation' classification has a focus of IT to improve efficiencies. Its underlying aim is to enable organisations to continue to compete. Competitive advantage is probably not sustainable for organisations in the automation category as competitive dynamics drive benefits to the consumer, and that this will probably cause industries to mature rapidly and become oligopolies. McNurlin and Sprague (2004) identify that IT in this type of organisation or industry is generally implemented in support of, or dependent upon, business strategy. Where business strategy directly creates IT strategy. Johnson and Scholes (2002) recognise that this type of organisation will have a 'design strategy lens' where strategy will be decided in formal planning meetings.

It is proposed that this approach typifies organisation in a traditional physical/product based environment identified as Physcos by Deise et al (2000) and fits well with the value chain concepts proposed by Porter (1980). They are also likely to adopt the principles of the Strategic Information Systems Planning process typified by Scott-Morton's (1991) model.

Dehning et al (2003) explain that informate initiatives provide information to aid decision making at all levels in an organisation and that the aim is to increase effectiveness. These initiatives will not have sustainable advantage as competitors will be able to imitate the technology and eradicate benefits. The 'informate' IT

initiative could be used in conjunction with McNurlin and Sprague's dependent or enabling strategy, and could feasibly be managed by anyone of the strategic lenses proposed by Johnson and Scholes (2002). It is, therefore, not possible to propose definitively management process for Dehning et al's 'informate' scenario.

Dehning et al (2003) propose that transformative IT aims to build upon a comprehensive 'informate' strategy that is so pervasive that it impacts the organisational culture and structure. This can create competitive advantage for organisations and industries alike. It is proposed that the strategy focus, using McNurlin and Sprague's definition, would be 'enabling'. Where IS would be primarily used to enable future business strategies. It would also probably be commensurate with the ideas lens proposed by Johnson and Scholes (2002) where strategic proposals are generated at all levels of an organisation.

The correlation of the three frameworks of strategy formulation, aim of IT and IT focus is shown in table 1.

Strategic Context	Physical Product	Not focused	Resource
Aim of IT	Automate	Informate	Transformate
Management Process	Decision/Planning	Uncertain	Ideas/Informal
IT Focus/ Management	Utility	Uncertain	Enabling

Table 1: Relationship Between IT and Management Objectives

Whilst there is uncertainty in the centre of the model, there are two extremes that show IT either as an automater or IT as a transformer. With the automate model IT is used to create efficiencies and is managed by formal planning methods. When IT is used as a transformer the focus is on effectiveness and the management processes are informal.

The formal planning process of automation is the basis of the physical/product based organisation with IT being managed through a SISP process. Whilst the transformer is much more aligned with a resource based strategy and will be driven by a more informal management process.

In summary, it is proposed that the organisation types of mainly physical/product organisations and resource/knowledge organisations can create an overrider for IT evaluation. It is further proposed that the emphasis shown in the model can be congruently related to IT evaluation.

EVALUATION LITERATURE

The Department of Finance 1994 defined Evaluation as "a systematic, objective assessment of appropriateness, effectiveness and/or efficiency of a program or part of a program. Depending upon the purpose of the evaluation and the stage of development of the program, an evaluation may focus on more than one of these issues". The main body of IT evaluation literature is concerned with project evaluation where individual projects are assessed in terms of feasibility and success. An increasing area of discussion is the evaluation of IT infrastructure; those IT investments that underpin an organisation. E-business evaluation and industry evaluation are also major topics. The aim here is to précis what are believed the main areas of IT evaluation and identify how they relate to an organisations strategic context.

Project Evaluation

Project evaluation helps management decide in a rational way the true business value of a potential project investment (Keen and Digrius ,2003). *"The IT project evaluation and selection process itself has serious*

implications for an organisation's ability to get the most value from IT investments." (Tanaszi, 2003). The methods employed to evaluate IT projects expenditure are split into two primary domains; ex-ante and ex-post.

Ex-ante

'Ex-ante is the predictive evaluation performed to forecast and evaluate the impact of future situations, the purpose being to support systems justification and often uses financial or other indicators to estimate the outcome' (Remenyi, 1997, p.55). Much of the ex-ante evaluation focuses on project portfolio management where projects bubble up from the low levels of an organisation and are sanctioned or not at a higher level (Keen and Digrius, 2003).

The ex-ante evaluation has two principal domains, tangible and intangible (Volino, 2000). The tangible methods are based on financial analysis such as Return on Investment (ROI) (Radcliffe, 1982), Cost Benefit Analysis (King and Schrems, 1978), Return on Management (Strassman, 1997). These tangible techniques do little more than identify the cost of an IT acquisition and the expected financial return. They are well suited to the automation of processes where relatively straightforward measures such as headcount and cost reductions are appraised (McKay and Marshal, 2004). This approach is well suited to the physical/product based organisation that hopes for efficiency gains.

The traditional evaluation methods of ROI and NPV that were appropriate in the 1990s are much less appropriate for resource based organisations (Chan and Qi, 2002). The nature of benefits from IT investments are changing to enabling competitive advantage through changing power of players, providing for strategic alliances and support of decision making (McKay and Marshall 2004). The benefits are then intangible as they assess effects of the system, which cannot be directly measured, cannot be valued or cannot be directly related to change (Remenyi, 1993). *'Although difficult to be precise about their actual value, especially in financial terms, intangible benefits can make a critical contribution to the success of an organisation'* (Remenyi et al, 2001).

There are many techniques that aim to assess intangible benefits. Braodbent and Weil (1997) developed an intangible evaluation method called the business maxims model. It aims to identify the business context from corporate executives, business-unit managers, and IT executives and uses this information to create what is termed IT and business maxims. These maxims then dictate key areas of expenditure. Another predominant model is Information Economics that assesses IT against the long-term organisational objectives using a scoring model that emphasises the core strategic issues (Parker et al, 1988). A similar model was developed by Rockart (1975) and is known as the Critical Success Factor (CSF) model. The aim is to identify the key factors that need to be managed to ensure organisational success and then to evaluate and monitor IT against these factors.

Intangible techniques predominately attempt to align IT with the strategic focus of an organisation rather than the specific strategies of an organisation. They, therefore, fit closely with a Resource/Knowledge focused organisations that is utilising IT to create strategic opportunities.

Ex-Post

Ex-post evaluations are concerned with post project success and are used to assess the value of existing situations and confirm, or refute, the value of an IT investment. (Remenyi et al p. 25, 2001). "*Post implementation evaluation or ex-post at the highest level is used to examine 'what is' against some previously suggested situation. This is done to confirm the value of the investment and support operational decisions about improvements*" (Remenyi, 2000). Banister and Remenyi (1999) identified the volume of research of ex-post evaluation to be remarkably small and complex in nature. There have been two seminal views on IS success; one was by De Lone and Mclean (1992) updated in 2003 and the other is by Seddon (1999). Delone and McLean produced the following model of IS Success using published theory from 1979 to 1989.

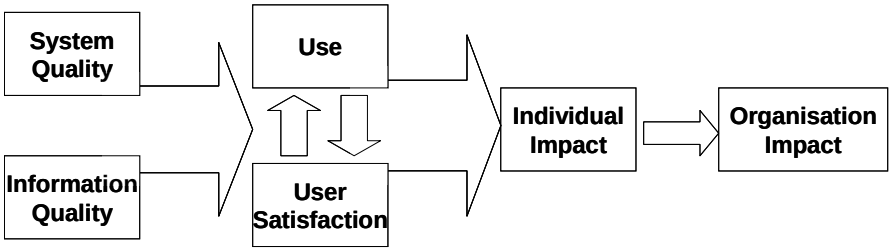

Figure 1: Delone and Mclean's (1992) Model of IS Success

The 'casual' model posits that organisational effect is a consequence of the impact of IT on an individual user and that an individual user will only use IT if he or she is satisfied with the system. Satisfaction in turn is related

to the quality of the system and the information it provides. IS success is therefore dependent on system and information quality.

Delone and Mclean reviewed their model from 1992 in 2003. There were two major changes. A dimension of service quality was added, the service quality or 'ServQual' had been proposed by Pitt et al in 1997, and is the quality of the IT function itself in meeting user demands in terms of service level agreements, training, etc. The proposal being that use was not only dependent on systems and information but also the relationship with the IT function and the support it provides. The second change was due to the increased capability of IT to provide benefits outside the organisation through e-business and other technological advances.

Seddon (1999) proposed that the original Delone and Mclean model was over simplistic as it did not differentiate between types of IT and types of user. Seddon proposed a 6 by 5 matrix of correlation between these two factors. Soon after Seddon published his paper Alter (1999) reported that the users proposed by Seddon's were in turn dependent upon system quality and that the model was simplistic in nature. Seddon (1999) then produced the following model.

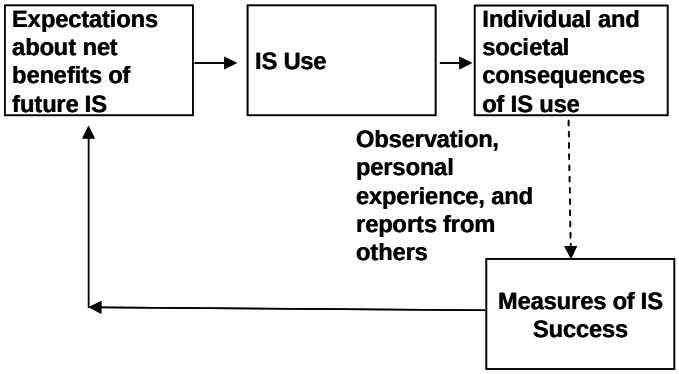

Figure 2: IS Success

The model posits that IT results are dependent on use and the societal impact. The model appears to be a good overview of the prevalent theories at the turn of the century. It is then accepted that IS success is dependent on quality of systems and in turn the acceptance by users.

The impact on an organisation from a strategic context is well described by Applegate et al (2002) who propose that commerce initiatives that would support a physical/product based organisation should be measured through efficiency and quality of internal process performance and work flow improvements; cost savings or cost avoidance; increased quality; decreased cycle time. They also suggest that flexibility and knowledge systems should be measured by individual performance goals; increase in the speed and effectiveness of decision making; increase the ability of the organisation to respond quickly and the ability for an organisation to respond to changes in the environment. Seddon et al (2002) similarly identify that there are two major domains of IS success measures, the user or stakeholder perspective of success, and the post implementation financial or ROI analysis.

The evaluation process at the highest level has the following four quadrants.

Tangible	Cost Benefit Analysis prior to project	Post project cost benefit appraisal, meets expectations of ex-ante costs and benefits
Intangible	Relate IT to business context. Try to identify total cost proposition	User acceptance, impact on individual performance, organisations ability to respond. Identify indirect cost and disbenefits
	Ex-ante	Ex-post

These quadrants can be congruently applied to table 1 as shown in table 2, where product based organisations are shown to focus primarily on tangible returns and resource based organisations focus on intangible measurements that aim to maximise responsiveness and personnel competence.

Strategic Context	Physical Product	Not focused	Resource
Aim of IT	Automate	Informate	Transformate
Management Process	Decision/Planning	Uncertain	Ideas/Informal
IT Focus/ Management	Utility	Uncertain	Enabling
Exante Evaluation	Tangible	Investment specific	Intangible
Ex-post Evaluation	Proposed benefits realisation System Use	Investment specific measures System Use	Responsiveness, personnel comp.. System Use

Table 2: Strategic Focus correlated with IT Objectives and Project Evaluation

Evaluation of IT Infrastructure

The evaluation of an IT project to sustain business competitiveness is obviously important, however, there are many aspects of IT that are considered infrastructure and these may have a distinct evaluation process. IT infrastructure may contain hardware platforms, base software platforms, communications technology, client server technology and other software that provide common handling mechanisms for different data types and methods, standards and tools (Broadbent et al, 1997). Renkema (1998) identifies two types of infrastructure; direct and indirect. Indirect infrastructure enables the use of IT whilst direct infrastructure is integrated with the business processes and products/services of an organisation. The overriding aim of infrastructure is to create standards and provide for other IT to be deployed.

Braodbent and Weil (1997) suggest that infrastructure is difficult to justify as executives have to make the decision about infrastructure prior to the strategies it will support. They identify that infrastructure is dictated by a firms strategic context and is built to support business maxims identified by senior managers. Mcnulin and Sprague (2004) further identify three drivers for IT infrastructure.

- The infrastructure was built as a desire for economies of scale and cost cutting.
- The infrastructure has been dictated by a series of strategic decisions these decision are based on political strength and therefore the infrastructure is dependent on incremental strategic decisions concerning their strategies and infrastructure has been decided by accident rather than design.
- A strategic view has been taken on infrastructure and it has been implemented to support and enable future strategies, whatever they may be.

Markus and Tanis (2000) observe that companies which continually change their organisational structures and business models and are not run in a top-down manner may find IS inhibiting. A major consideration for resource based organisations in particular will be the flexibility of the infrastructure.

Flexibility is defined as the degree to which the infrastructure is reusable and shareable. Flexible infrastructure will enable an organisation to respond quickly to changes in its environment and competitive situation, whilst inflexible infrastructure will inhibit an organisation to change (Kayworth et al, 2001). *"A firm with high infrastructure flexibility could make rapid changes to information systems in support of changing business*

needs while firms with low flexibility infrastructures will be unable to imitate the IT innovations of its competitors" Kayworth et al (2001). Interestingly, firms that have a more volatile market place would be expected to have more extensive IT infrastructure (McNurlin and Sprague, 2004). Building in flexibility adds cost and complexity to IS but also options that may be exercised in the future.

Organisations then take different approaches to IT infrastructure investments depending on strategic objectives. They might be costs savings through economies of scale, current strategy needs or longer-term requirements for flexibility. It is proposed that organisations which operate in a physical/product context will have deep infrastructure to increase standardisation and reduce costs. This is likely to create a rigid infrastructure designed for efficiency purposes. Organisations operating in a Resource/Knowledge environment will have flexible and relatively shallow infrastructure to maximise the potential and number of future strategies.

e-BUSINESS EVALUATION

e-business systems may contain a great deal of information of partner usage that may aid evaluation. The evaluation of e-business becomes more complex as the system becomes more pervasive and the extent of services increases. There are a number of models concerning the extent of e-business, the Stages of Growth of e-business (SOGE) by McKay and Marshall (2004) and the Leveraging the Organisation Through ICT and e-business by Price Waterhouse are good examples. These models propose that the impact of e-business on a value chain differs depending on the extent of the system.

"The greatest value of a Web site is its accessibility. Running a very close second is the fact that your web site can remember everything about the people who decide to visit – when they come, what pages they look at, how long they spend on each page, which products they find most interesting and more" (Cutler and Sterner, 2000).

E-business systems can be evaluated using what is known as e-metrics. E-metrics enable evaluation and segmentation of customer and prospect profiles (Cutler and Sterne, 2000). E-metrics are used to identify customer loyalty, attrition rates etc. and provide for rapid remedial actions to be taken to improve system performance. The process of e-metrics appears to be very much aligned with physical/product organisations where events are measured against current business emphasis.

Applegate et al (2002) identifies that evaluation methodologies of e-business systems in knowledge/resource based organisations should include the following criteria.

- Decrease the time, cost and risk of launching new online business initiatives
- Expand the reach of existing IT enabled businesses and the range of business opportunities that can be pursued
- Provide information to customers, suppliers, and partners that enables better decision-making; charge a price premium for products and services based on information value-added; launch new information based products and services; increase revenue per users and add new revenue streams
- Decrease time to market or just-in-time order replenishment; enable new channels to market and/or extend the reach and range of existing channels

CONCLUSION

Table 3 shows the evaluation categories, and the methods employed within them, related to the strategic context of an organisation and management techniques shown in table 1.

	Product based organisations Primary objective : Efficiency	Resource Based Organisation Primary objective : Effectiveness
IT Management Process	business and IT strategy alignment - IT tightly controlled	Aligned with business context - relative IT autonomy
Infrastructure	Dependent on strategy and rigid	Enables future strategies, flexible
Project Evaluation Ex-ante	CBA	Intangible Benefits
Ex-post Evaluation	User satisfaction Benefits realisation	Improve decision making, improve personnel performance and ability to respond to env.
E-business	E-metrics	Provide information to customers, suppliers, and partners, charge a price premium for products, launch new information-based products
Costs	Rigid control costs, TCO	Identify indirect costs and disbenefits

Table 3: IT evaluation and strategic context

The framework shows the business context and the expected emphasis of IT management and evaluation methods. However, it is unlikely that an organisation will focus solely on one aspect of strategy. For example a product focused organisation may have an R&D process that does not fit within the primary business context as it focuses on knowledge or other intangible objectives. The framework is perhaps then better conceptualised as a spectrum or scale where an organisation may utilise varying levels of emphasis depending on the type of IS, nature of a department or business unit, or particular strategic initiatives. The model shown in figure 3 depicts the possible need to overlap the evaluation and management practices depending on the focus on efficiency and effectiveness.

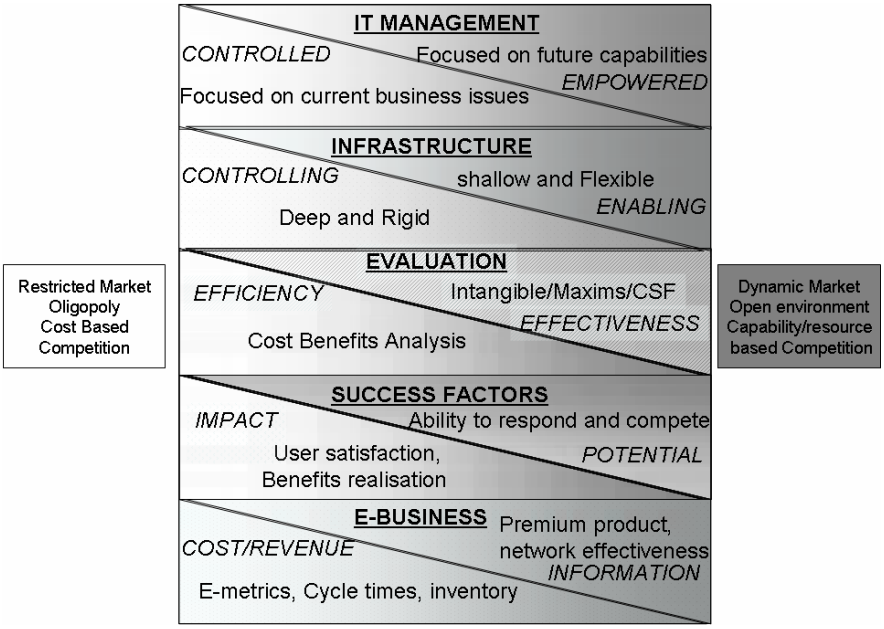

Figure 3: IT Evaluation framework

The type of IS might dictate the evaluation methods employed. The nature of Enterprise Resource Planning systems would predominately require a methodology aligned with the left of the model. Customer Relationship Management would perhaps be central and Knowledge Management towards the right. Where as organisations pursuing resource based strategies would be aligned with the right of the model whilst product organisations would be aligned with the left.

It is proposed that the congruent relationship between an organisations strategic context, IT management and evaluation techniques provides a sound basis for a more in-depth study that will further marshal the disparate and extensive evaluation theory against higher level organisational aims. It is further proposed that this research is becoming increasingly necessary due to the increasing focus of IS on areas other than efficiency.

MANAGERIAL IMPLICATIONS

The framework can be utilised to ensure monitor alignment between business context, IS management, IT aims and evaluation methods. Whilst it is not proposed that it is a methodology it can be used to identify the types of evaluation that would be practical for an organisation or a specific IS. It may also help with initial and ongoing evaluation of large scale IS such as Enterprise Systems as it could be utilised to identify the correct evaluation and management techniques of different aspects of the system.

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