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Cappuccio, Carlo; Goode, Sigi; and Lodhia, Sumit, "Ex-ante and Ex-post Ecommerce Evaluation: current status and directions for future research" (2002). *ACIS 2002 Proceedings*. 35.

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Ex-ante and Ex-post E-Commerce Evaluation: current status and directions for future research

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Abstract

After the recent “dotcom meltdown”, many organisations now appear to be re-evaluating their e-Commerce ventures. Similarly, some firms are exhibiting healthy business operations. E-Commerce evaluation remains an important but difficult issue. The application of these evaluation methods may assist in correcting system behaviour and improving future performance. These methods receive considerable attention in the literature, and debate surrounding their efficacy continues.

This paper argues that, despite the apparent differences between conventional information systems and newer e-Commerce systems, e-Commerce evaluation should fall within the context of more traditional IS evaluation. However, this evaluation may be best conducted before and after system adoption. The paper discusses perspectives for undertaking such evaluation, and proposes valuable avenues for further research in the area.

Keywords

E-Commerce evaluation, e-Commerce adoption, ex-ante analysis, ex-post analysis

INTRODUCTION

The drive for productivity gains and improved organisational performance has been accompanied by a growth in the use of information technology by organisations. In addition, the sheer cost of new technology and the number of possible adoption avenues further complicate the adoption decision making process (Gebauer and Buxmann, 2000). Kaplan and Norton (1993) observe that effective measurement is an integral part of the management process, and the process should not be undertaken lightly. However, both the *ex-ante* and *ex-post* evaluation of an information system can be problematic and extremely difficult to conduct accurately (Giaglis *et al.*, 1999, Sethi and King, 1994). Consequently, managers must approach their decision to adopt a technology with care.

Clarke (2000) observes a lack of solid research in the area, with studies to date providing only a limited understanding of this new phenomenon. The evaluation of the relative success of this phenomenon is of particular concern given the recent decline in e-Commerce ventures. This downturn has meant that established organisations and potential entrepreneurs are now re-evaluating their online ventures. Given the shortage of research into e-Commerce and the importance of conducting information systems evaluations both *ex-ante* and *ex-post* implementation, this paper seeks to benefit the wider information systems literature by examining commonly used ex-ante and ex-post information system evaluation approaches with respect to electronic commerce.

Research into e-Commerce is challenging. Aside from criticisms of research legitimacy in information systems (Nunamaker *et al.*, 1990), e-Commerce in itself presents an unconventional research theatre. The area is at once popular with researchers (Liu *et al.*, 1997), yet is still subject to much debate and disagreement (Vehovar *et al.*, 2001). Research in the area also appears to span multiple disciplines (Ngai and Wat, 2002). This paper is cognisant of the immature nature of research in the area and accordingly seeks to position itself within the framework of formulative research. In the words of Nunamaker *et al.*, (1990:90):

The goal of formulative research (also called exploratory research) is to identify problems for more precise investigation, to develop hypotheses, as well as to gain insights and to increase familiarity with the problem area.

This paper is structured as follows. The paper first presents a brief introduction to e-Commerce and its assessment in commercial environments. This is followed by discussion of specific methods of e-Commerce evaluation in an *ex ante* and then an *ex post* regard. Subsequently, the paper develops a framework for e-Commerce evaluation based on the preceding discussion. Following a discussion of this model, and in the spirit of Nunamaker's arguments above, the paper presents a series of propositions. Finally, conclusions and areas for further research are offered.

E-COMMERCE AND ITS ASSESSMENT

E-Commerce has recently grown in prominence, driven by growing interest from researchers, organisations, the media and the public alike (Coltman *et al.*, 2001). E-Commerce can be seen as relatively immature with many organisations changing to adapt to new requirements and effects (Wyckoff and Colecchia, 1999). E-Commerce incorporates new approaches to retail transactions, marketing, knowledge distribution and numerous ancillary activities (Applegate *et al.*, 1996; Kardaras and Papathanassiou, 2000). Numerous definitions of e-Commerce exist in the literature, and some regard this as a testament to the magnitude and complexity of the technology (Poon and Swatman, 1999a). This paper seeks a broad definition of electronic commerce. Clarke (1999) offers, "the conduct of business with the assistance of telecommunications and telecommunications-based tools". A broad definition is important for a number of reasons.

Driven by market expectation, enriched global customer contact, improved information dissemination and business performance, many organisations have begun to implement e-Commerce in the hope of gaining some competitive advantage (Rosen and Howard, 2000; Larsen and Bloniarz, 2000). However, despite the benefits, which are expected to accrue from a comprehensive e-Commerce system, applications have not always been able to deliver the promised benefits (Giaglis *et al.*, 1999). This may be due to the nature of the technology: Gebauer and Buxmann (2000) argue that inter-organisational systems such as e-Commerce are investments with lifetimes of several years. Hence, they should be evaluated using a long-term perspective.

E-Commerce is different to many computer applications in that it is an interorganisational system that is able to support multiple business functions. Traditional information systems, on the other hand, tend to support organisations internally, and do not have the same interorganisational focus (Poon and Swatman, 1999a). This external dimension of e-Commerce may change the way organisations operate (Kardaras and Papathanassiou, 2000; Isakowitz *et al.*, 1998; Venkatraman, 2000), with authors such as Raghunathan and Madey (1999) suggesting that e-Commerce will offer new business opportunities through the potential to deal with customers globally.

Considering the breadth and potential of electronic commerce, organisations are faced with a difficult task in evaluating the technology both before and after implementation. Gebauer and Buxmann (2000) argue that estimating the value of an e-Commerce system is generally more difficult than the estimation of typical information systems due to the complexity of the technology. It is suggested that this difficulty is caused primarily through uncertainty and risk that arises through the external nature of electronic commerce, where the value of the investment depends not only on internal factors, but also on the decisions and loyalty of associated business partners. To further complicate the situation, the difficulty in determining intangible benefits makes both ex-post and ex-ante analysis difficult (Giaglis *et al.*, 1999). Managers risk losing e-Commerce benefits by not taking these factors into consideration: Riggins and Rhee (1998) argue that a failure on the part of management to adopt a long-term strategy and outlook to their e-Commerce investment can result in unrealised system potential.

Strategic systems, such as electronic commerce, which have the ability to transform an organisation, are typically implemented to achieve the strategic goals of the business (Bergeron *et al.*, 1991; Clarke, 1994). Evaluating such systems is problematic, as these

impacts flow through an organisation and associated market structures (Gebauer and Buxmann, 2000). These effects also depend on changes in organisational structure, process, and the alignment between the information system and the business strategy (Ragowsky *et al.*, 1996; Teo and King, 1997).

Venkatraman (2000) and Isakowitz *et al.* (1998) argue that organisations that implement e-Commerce as a standalone system may find the strategic benefits of the technology more difficult to achieve. Similarly, Magretta (1998) suggests that e-Commerce is most effective where the system becomes part of the organisation's business strategy and becomes entwined with organisational processes. These arguments suggest that organisations that are less involved in electronic commerce, having implemented the system on a small scale should not be using similar measures to organisations that have a comprehensive system in place as the costs and benefits of adoption would be likely to differ.

With the drive to remain competitive (or, at least, to maintain the hope of *future* competitiveness), firms may pursue a policy of loss-leadership in order to gain market foothold. While this method has worked in other environments, notably the online and print publishing groups (Gallaughier *et al.*, 2001), its value in e-Commerce environments is questionable. Further, firms may have the capacity to invest in cutting edge technology, but lack sound business models with which to make use of that technology. As such, e-Commerce ventures may simply become cost sinks (Whelan and McGrath, 2002), which continue to soak up funds in the managerial and strategic hope that one day a profit can be extracted from this expenditure. These arguments suggest that the analysis of this particular business approach should not be confined to a particular point in time, but rather undertaken over numerous time periods. Further, in order to compare profitability and value (or otherwise), such analysis could be undertaken before implementation. An ex-ante and ex-post approach to evaluation will benefit not only those companies that have already ventured into e-Commerce investment but also those business units that may consider adopting e-Commerce technology.

The discussion presented in this section makes several fundamental points. First, it appears that e-Commerce presents new methods for doing business. Second, organisations have expectations of how e-Commerce will benefit their operations. Third, e-Commerce systems appear to be different to more traditional systems. Fourth, these differences, coupled with the competitive nature of the wider industry make evaluation difficult. Finally, in an attempt to match the competition, firms may adopt unsound business models in the hope of gaining a future foothold in the market.

EX-ANTE EVALUATION

If e-Commerce can sometimes take many years to deliver on expectations (hence making early success declaration impossible), organisations would be well advised to undertake some form of evaluation of the benefits of e-Commerce prior to implementation to assess the value of such a system. Giaglis *et al.* (1999) suggest that the overall goals of e-Commerce are similar to those of Business Process Reengineering, in that both try to facilitate radical change upon an organisation through way of reduced costs, faster customer response, or improved service quality, for instance. Larsen and Bloniarz (2000) suggest that before implementation, organisations develop forecasts and collect baseline data pertaining to the present situation. Following implementation, these measures could be used to determine how well the system functions and identify any problems or areas of concern to managers.

Costs

Giaglis *et al.* (1999) argue that because the main areas of expenditure in e-Commerce involve hardware, software, telecommunications, training and business reorganisation, the costs of e-Commerce are easier to identify than are the benefits. Management do not always give these costs due consideration (Larsen and Bloniarz, 2000). In particular, Larsen and Bloniarz (2000) offer some suggestions and identify areas that should be included in cost evaluation. First, the development of a website is an ongoing process, hence, organisations should plan resources for continued maintenance of the service. Second, the cost of human resources required to implement e-Commerce is generally much larger than technology

costs. Third, e-Commerce can incorporate all of an organisation's functions, and therefore all parties that may be affected should be accounted for. Fourth, e-Commerce may require large infrastructure investment to support it. Finally, internally hosting a website may be more expensive than outsourced sites, particularly where there is a lack of skilled personnel.

In light of these cost considerations, Larsen and Bloniarz (2000) construct a cost framework suitable for e-Commerce evaluation, breaking costs down into five main categories: organisational readiness, access for staff and other users, end-user support, content development and maintenance, and host of site infrastructure. These groupings include all costs pertaining to the website, comprising technical, planning and decision making costs.

Gebauer and Buxmann (2000) offer an alternative model. They suggest that costs of an inter-organisational system can be grouped according to *point in time* and *frequency of occurrence* (i.e. one-time setup costs, current costs) and *specificity* (general system costs, partner-related costs). One-time costs occur only at the start of a specific planning period, while current costs occur on an ongoing basis and are necessary for the operation of the system. General system costs are all expenses necessary to develop the system and prepare the organisation (i.e. infrastructure, maintenance). Partner-related costs are concerned with those costs required to establish and maintain links with trading partners. These costs vary according to the system used. For instance, World Wide Web browser technology is negligible compared to the costs required to implement and maintain an EDI system (Gebauer and Buxmann, 2000). By estimating these factors, organisations are more aware of the costs associated with e-Commerce adoption.

Justification of an e-Commerce project can be a difficult process, and development costs may be high (Bingi *et al.*, 2000).

Cost Savings

Cost and time economies are central to the potential benefits of e-Commerce (Gebauer and Buxmann, 2000). Wyckoff and Colecchia (1999) identify several areas in the sales process where e-Commerce facilitates cost reductions. First, the establishment and maintenance of an e-Commerce site is considerably cheaper than a physical shopfront. Furthermore, only one such site is necessary to have global accessibility whereas an organisation may require many physical shopfronts in order to achieve the same effect. Second, firms can improve the efficiency of the sales process by providing customer information online (Rosen and Howard, 2000), reducing error rates and customer order completion times (Wyckoff and Colecchia, 1999). Third, e-Commerce allows organisations to eliminate a large portion of customer support costs by moving these services online. Fourth, e-Commerce requires fewer, albeit higher skilled employees, allowing changes to be made to an organisation's human resources requirements. Fifth, e-Commerce facilitates more efficient ordering processes and sales lifecycles, hence reducing the need for large inventories. Finally, depending on the nature of the transaction, organisations can reap significant distribution savings through e-Commerce through electronic product distribution (such as software or financial services).

Benefits

Bingi *et al.* (2000) argue that, due to the substantial intangible benefits associated with electronic commerce, traditional information system assessment methods are unsuitable as it is difficult to rely solely on tangible benefits to justify a large e-Commerce project. However, intangible benefits are difficult to quantify, so reliance on these measures may not give a true reflection of reality, potentially jeopardising the validity of the evaluation process.

E-Commerce adoption benefits may be largely qualitative, and hence, difficult to measure *a priori* in monetary terms. This impediment to measurement is a common theme in the e-Commerce literature (see Giaglis *et al.*, 1999; Colecchia, 1997; Jutla *et al.*, 1999). In light of this problem, Giaglis *et al.* (1999) distinguish between different groups of benefits, identifying four separate types: *hard*, *intangible*, *indirect* and *strategic*. *Hard* benefits are directly attributable to the information system and are easily measured. *Intangible* benefits can also be attributed to the information system, but are more difficult to measure than hard benefits due to their qualitative nature. *Indirect* benefits are quantifiable, but their value can not be

entirely attributed to the information system. Finally, *strategic* benefits generally can only be partially attributed to the information system: these benefits are generated over the long-term and are the result of a number of contributing factors. Furthermore, strategic benefits are difficult to quantify in advance due to the time frame and risk involved in assessing such benefits.

Information technology investments have been commonly evaluated by established accounting techniques, such as cost-benefit analysis and return on investment (ROI) (Giaglis *et al.*, 1999). However, such an analysis may not be suitable for e-Commerce as these methods are unable to adequately measure the intangible, indirect and strategic benefits of a system. Recognising this problem, Giaglis *et al.* (1999) argue that a technique is required that is able to measure these benefits through quantitative means. For this purpose, the authors advocate the use of a Business Process Simulation technique, which enables an organisation to gain a better understanding of their business systems and how changes will affect key performance indicators. Furthermore, it allows managers to evaluate the value of systems under different situations and configurations. Such a method may be appropriate for assessing the value of e-Commerce as it allows the wider business processes to be examined with the technology as the focal point (Giaglis *et al.*, 1999). Larsen and Bloniarz (2000) present an alternative method for measuring the value of electronic commerce. Similar to Giaglis *et al.* (1999) the authors distinguish between tangible and intangible benefits and direct and indirect benefits. However, Larsen and Bloniarz suggest that tangible benefits when compared to current practices should be categorised using the terms, “better”, “cheaper” and “faster”. An organisation is then able to examine those benefits that are expected to accrue, and how strongly they will impact.

Perceived Benefits

Small organisations may base their adoption decisions on their perceived benefits of an e-Commerce system rather than using more structured evaluation techniques (Poon and Swatman, 1999a; 1999b). The use of perceived measures can be problematic as the true value may not be obtained (Ragowsky *et al.*, 1996; Thong *et al.*, 1996). This also suggests that evaluation processes may vary with the extent of organisational resources: if these are dynamic, then the evaluation itself may also fluctuate. One way that organisations can make better judgments on the perceived benefits of e-Commerce is through the observation of competitors and other organisations that have implemented the technology. Rogers (1983) discusses this by characterising the adoption of an innovation as a two-step process, where early adopters implement an innovation and late adopters try to learn from these experiences.

The perceived benefit could be distorted if vendors seek to augment the power of their systems before purchase (Irani *et al.*, 2001). Larsen and Bloniarz (2000) also suggest that due to the perceived simplicity of e-Commerce technology, numerous organisations, particularly smaller ones, do not develop an appropriate e-Commerce plan. Consequently, these services are incomplete and fail to meet the objectives set by the business, falling well short of management expectations and resulting in unforeseen development expenses.

EX-POST EVALUATION

Ex-post e-Commerce evaluation may be problematic, as benefits may be unreliable, indeterminate or unrelisable in the current period (perhaps due to the accrual of these benefits in pure terms over multiple time periods). Further, the strategic nature of e-Commerce poses measurement difficulties because impacts may be the result of a wider business change, rather than a single cause or the influence of external factors (such as government policy) which may be difficult to isolate (Ragowsky *et al.*, 1996). To further complicate this, the costs and benefits of an information system are difficult to quantify and objective assessments of these measures are error prone (Thong *et al.*, 1996).

It is also important to note that, in order to make accurate judgments regarding system costs and benefits, data ideally need to be collected both before and after implementation (Ragowsky *et al.*, 1996; Thong *et al.*, 1996). The implications of either a prolonged or extemporaneous adoption process are marked: if benefits are difficult to realise and unpredictable, then certain evaluation methods may be more suitable than others. This

suitability, however, may not be systematic and, depending on the time period at hand, may display considerable idiosyncrasy.

Costs

Ex-post e-Commerce evaluation costs are generally simpler than ex-ante evaluation, as costs may have already been realised and are intrinsically quantifiable. According to Larsen and Bloniarz (2000), the cost of human resources needed to develop and operate an e-Commerce system is typically the largest cost in the implementation process. This is attributed to the highly skilled employment that is required to support the system (Wyckoff and Colecchia, 1999). Assessing the labour expenses devoted to e-Commerce should be a relatively simple task for organisations.

Similarly, evaluation should be made of all other expenses required to facilitate the development and maintenance of an e-Commerce system. As discussed above, Larsen and Bloniarz (2000) suggest that the costs associated with e-Commerce can be categorised into five different groupings, while Gebauer and Buxmann (2000) offer an alternate cost grouping. Additionally, advertising and marketing expenses need to be realised.

Benefits

Gebauer and Buxmann (2000), among others, suggest that e-Commerce evaluation should be conducted through an examination of all costs and benefits pertaining to the technology. Evaluating the benefits of e-Commerce ex-post implementation is important, with assessments of the technology in the planning stage often not being realised, falling well short of expectations (Poon and Swatman, 1999b). The major difficulty with measuring benefits of e-Commerce is the intangible nature of the resulting benefits (Bingi *et al.*, 2000; Giaglis *et al.*, 1999). Furthermore, Larsen and Bloniarz (2000) correctly point out that performance indicators that attempt to measure the true value of e-Commerce to an organisation are error prone, as they don't adequately account for other influential factors such as the organisational environment. In these circumstances, numerous authors advocate the use of perceptual measures (Thong *et al.*, 1996; Ragowsky *et al.*, 1996; Poon and Swatman, 1999b).

The Balanced Scorecard

Donath (1999) argues that e-Commerce needs to be considered in a different light to traditional information systems, suggesting that assessments should emphasise intellectual, rather than tangible, capital. For this purpose, the authors suggest the use of the balanced scorecard to assess the true value. The balanced scorecard was devised by Kaplan and Norton (1992) as a means of evaluating both quantitative and qualitative measures, acknowledging the importance and expectations of different stakeholders while relating these performance measures to a particular strategy choice. The scorecard facilitates this by presenting managers with four different perspectives from which to determine measures, answering four main questions (Kaplan and Norton, 1992):

1. How do customers see us? [Customer perspective]
2. What must we excel at? [Internal perspective]
3. Where to improve and create value? [Innovation and learning perspective]
4. How do we look to shareholders? [Financial perspective]

By applying the balanced scorecard to electronic commerce, managers are in a better position to assess those areas that are important to the technology and to apply these to a long time period that is critical to the success of electronic commerce.

In addition to these measurements, several authors suggest numerous measures that can be used to assess the benefit of an e-Commerce system. Sriram *et al.* (2000) suggest that the benefits of EDI adoption can be categorised as operational and strategic benefits. They consider operational benefits to come from standardised procedures, reduced clerical work, improved response time and greater accuracy. Conversely, strategic benefits can be attributed to a reduced cost of operations, cost advantages relative to competitors, the formation of customer and supplier relationships, greater productivity and barriers to entry.

Gebauer and Buxmann (2000) argue that the observable benefits of e-Commerce accrue primarily through cost savings in areas of receiving, processing and communicating information, particularly through the staffing of these activities.

The Value Chain

Porter and Millar (1985) argue that the role of information technology in competition is through the value chain. As a product passes through each stage of the chain, some value is added accompanied by a cost. Porter and Millar (1985) argue that a business is only profitable when the value it creates is greater than the cost of performing the activities in the value chain. Further, to gain a competitive advantage, organisations must adopt either a “low cost” or “product differentiation” strategy (Porter and Millar, 1985; Clarke, 1994).

Gonsalves *et al.* (1999) suggest that one benefit of e-Commerce is its ability to facilitate competitiveness by connecting customers to the organisation and enhancing the value chain. Similarly, Wyckoff and Colecchia (1999) argue that by obviating certain stages, e-Commerce can reduce costs within the value chain, hence, avoiding unnecessary costs while retaining value. This is particularly relevant for those products that can be distributed electronically, as intermediaries add less value. Magretta (1998) argues that e-Commerce can transform the traditional boundaries of the value chain to what is known as “virtual integration”. Virtual integration sees the traditional boundaries of the value-chain disappearing as the supply chain becomes integrated, promoting tighter relationships with both customers and suppliers.

Porter’s Five Forces Model

Porter’s Five Forces model concentrates on an organisation’s interaction with its environment, suggesting that there are five competitive forces which surround an organisation: the threat of new entrants, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers and the intensity of rivalry among existing competitors (Porter and Millar, 1985). To be beneficial in terms of the model, e-Commerce must be able to achieve one of the following: install barriers to entry, increase negotiating power with suppliers, create switching costs for customers, offer new products or substitutes, or by changing the terms of competition. Organisations can assess the benefits of their e-Commerce systems by examining to what extent these factors have been realised.

Customer Resource Life Cycle (CRLC)

The CRLC offers an alternative method to understanding competitive applications by concentrating on the relationship between the organisation and the customer (Gonsalves *et al.*, 1999). They suggest that e-Commerce can be evaluated using the CRLC by showing areas where the technology offers value to the customer, in particular in areas of analysing, acquiring, managing and disposing of a product. The authors argue that e-Commerce is able to facilitate customers through these processes by establishing one-to-one customer relationships. Similarly, Magretta (1998) suggests that the value of e-Commerce comes from its ability to develop strong ties with customers. To maintain one-to-one customer relationships, organisations should seek to maintain its share of existing customers rather than attempt to gain new ones.

Figure 1 shows a framework of approaches available for e-Commerce evaluation. Comparing the ex-ante and ex-post e-Commerce evaluation approaches, a number of interesting issues come to light. The ex ante side of the shows a number of interesting points. First, it suggests that while most of the costs are reasonably tangible, the benefits are less easy to quantify. This may make evaluation somewhat difficult. Second, the reader’s attention is drawn to the interesting interplay between cost and benefit, namely that some studies in the literature perceive that a “reduction in benefits” is a cost and, conversely, a “reduction in cost” constitutes a benefit.

The framework in its entirety highlights the number of approaches available for e-Commerce evaluation. To some degree, this range is unsurprising, given the youth and recent popularity of electronic commerce. Second, the model emphasises the similarity in pre- and post-implementation cost evaluation and the marked differences in pre- and post-implementation benefits evaluation.

Discussion

Some prior studies have argued that evaluation approaches that have their roots in the information systems domain are inappropriate for examining online environments and e-Commerce adoption (Benbunan-Fich, 2001). Other studies have argued that these approaches, while unsuitable in certain applications, are generally sound. However, to date, there is little evidence of any study that has compared the various approaches, and argued why some methods are inappropriate for e-Commerce evaluation and provided insights into what could be done to improve e-Commerce evaluation. This study attempts to address the existing deficiencies in the literature by evaluating the commonly used pre- and post-adoption e-Commerce approaches and suggesting an alternative approach to e-Commerce evaluation, one that attempts to rectify existing limitations.

<p>Ex-ante Cost Evaluation</p> <p>Larsen and Bloniarz (2000)</p> <ul style="list-style-type: none"> Organisational readiness User Access Costs End User Support Costs Content Development and Maintenance Costs Infrastructure and hosting costs <p>Gebauer and Buxmann (2000)</p> <ul style="list-style-type: none"> Setup costs Partner Costs General System Costs 	<p>Ex-post Cost Evaluation</p> <p>Larsen and Bloniarz (2000)</p> <ul style="list-style-type: none"> Organisational readiness User Access Costs End User Support Costs Content Development and Maintenance Costs Infrastructure and hosting costs <p>Gebauer and Buxmann (2000)</p> <ul style="list-style-type: none"> Setup costs Partner Costs General System Costs Advertising and Marketing costs
<p>Ex-ante Benefit Evaluation</p> <p>Giaglis et al. (1999)</p> <ul style="list-style-type: none"> Return on Investment (ROI) Business Process Simulation <p>Larsen and Bloniarz (2000)</p> <ul style="list-style-type: none"> Tangible Benefits <ul style="list-style-type: none"> Speed Cost Economies Quality Intangible Benefits <ul style="list-style-type: none"> Direct Benefits Indirect Benefits Perceived Benefit Cost Savings 	<p>Ex-post Benefit Evaluation</p> <p>Balanced Scorecard</p> <ul style="list-style-type: none"> Business Performance Customer Relationships Information Relationships Operating Costs <p>Value Chain</p> <p>Porter's Five Forces Model</p> <ul style="list-style-type: none"> Barriers to entry Increases in negotiating power Customer switching costs New products or substitutes Changes in competitive terms <p>Customer Resource Life Cycle</p>

Figure 1: The Ex-ante and Ex-post Framework

Closer examination of e-Commerce evaluation approaches suggests that it is benefits measurement that poses the greatest difficulty in terms of application. As highlighted by the framework in Figure 1, the evaluation of both ex-ante and ex-post e-Commerce costs can be undertaken through two very similar models. These models enable the major costs of e-Commerce implementation to be more precisely identified and subsequently quantified. Organisations could adapt and refine these models to suit their needs in this regard.

The variation in approaches to both ex-ante and ex-post benefit evaluation is striking. However, models used at the ex-ante stage may be difficult to apply in the ex-post stage. This appears contrary to the approaches for costs, which should ensure continuity from the ex-ante stage. However, some argue that these costs, while comparable, may simply be ignored or discarded if they are deemed unsuitable (Remenyi *et al.*, 1997). Added to this, the difficulty in measuring intangible and indirect benefits explicitly, the long time period required to measure strategic benefits and the relative ease with which e-Commerce technology is

exposed to competitors makes a particular e-Commerce benefits approach largely redundant for some situations. This time period could even be a contributing factor for e-Commerce failures in some organisations.

The ex-ante and ex-post benefits approaches are largely mutually exclusive, indicating that they each serve dedicated purposes. For example, at the ex-ante stage, the concern could be the measurement of tangible or intangible benefits, perceived benefits or even cost savings. Similarly, at the ex-post stage, the emphasis could be on specific issues such as customers or competition, or the focus may be broader in terms of the balanced scorecard or value chain approaches. The surfeit of approaches has added to the difficulty in measuring e-Commerce benefits rather than simplifying an already difficult task.

Given the range of e-Commerce benefits analysis approaches, the speed of the technology, and the pressure from competitors, managers might be tempted to opt for the approach that is easiest, simplest or most cost beneficial to apply, without considering its ability to precisely measure benefits. However, disregarding elements that are not easily measured can be highly problematic as illustrated by the McNamara fallacy (Yankelovich, 1972):

The first step is to measure whatever can be easily measured. This is ok as far as it goes. The second step is to disregard that which can't be easily measured or give it an arbitrary quantitative value. This is artificial and misleading. The third step is to presume what can't be measured easily really isn't important. This is blindness. The fourth step is to say that what can't be measured really doesn't exist. This is suicide.

Applying this to the e-Commerce domain, a need arises for more efficient approaches for measuring e-Commerce success, one that could even attempt to measure strategic, indirect and intangible benefits.

While acknowledging that no particular measurement approach for e-Commerce benefits is always suitable in a given circumstance, it is suggested that a contingent perspective be used. Organisations need to consider the context within which they are to implement e-Commerce and adapt a particular approach or even a combination of approaches to suit their purposes (for example see Earl, 1989). This would enable measurement approaches to be aligned to the objectives of the e-Commerce implementation.

While a contingent perspective does not necessarily reduce the multiplicity of approaches available for evaluating e-Commerce benefits, it does make e-Commerce evaluation far more flexible. Rather than applying a specific rigid approach exclusively for evaluating e-Commerce projects, a multidimensional approach could assist in effectively measuring the strategic, intangible and indirect benefits that characterise this phenomenal mode of commerce. A simple measure may not always be sufficient in measuring e-Commerce success, and thus multiple measures are a necessity, at least in the foreseeable future (see, for instance, Delone and McLean, 1992) for a similar perspective on information systems success). The key to e-Commerce evaluation success might incorporate the ability to identify those approaches suitable for measuring the context in which e-Commerce is to operate in an organisation. Such a perspective could also assist in the reduction of e-Commerce failures.

Based on the premise that different evaluation methods exist for different applications, the paper poses the following research propositions:

- P₁ The results of the evaluation will depend on the evaluation method chosen.*
- P₂ If each evaluation method is designed to measure a specific facet of business performance, then it may be necessary to use several evaluation methods at once.*
- P₃ If several methods are in use at once then there may be some overlap in terms of analysis and applicability. This overlap may introduce bias into the analysis.*
- P₄ If this evaluation bias is systemic; it could be reduced by removing unnecessary evaluation methods from the evaluation mix.*

Based on the premise that different evaluation methods exist for different time periods, the paper poses the following research propositions:

P₅ The results of the evaluation will depend on the time period chosen.

P₆ If the time period affects the outcome of the test then different metrics may have greater applicability in different time periods.

P₇ If different time periods exist in the evaluation, then there must be a point at which some metrics stop having explanatory power and others start becoming more useful.

CONCLUSIONS

This paper has gathered e-Commerce evaluation approaches suggested in the e-Commerce literature and categorised them according to ex-ante or ex-post applicability. Based on this analysis, the paper makes a number of important points. First, a number of e-Commerce evaluation approaches are in use in the literature. Second, with the range of approaches available for this purpose, there is a risk that only those approaches that are easy to use will be employed, regardless of accuracy. The evaluation process is made more difficult by the nature of electronic commerce, where much of the value lies in intangible benefits that are generated through a long-term strategic process. Consequently, care is required to ensure that evaluation considers both the tangible and intangible sides of the technology, and that any given approach can be applied over a time frame that is suitable for electronic commerce. While these evaluation techniques may not be considered ideal, they are arguably the most suitable approaches and techniques available for such analysis. Organisations need to adapt approaches based on their motives for undertaking e-Commerce and the specific context of its operation. This could involve selecting a number of different approaches for measuring the e-Commerce implementation. By understanding the nature of these approaches and their application to electronic commerce, organisations and researchers are in a better position to assess the true value of this technology, hence, assisting managers in their technology decision making and researchers by adding a new dimension to the existing literature.

The paper is subject to a number of limitations. First, with the current popularity of e-Commerce (and its evaluation), there may be approaches in use that have not been covered in this paper. Additionally, some approaches may be in active employment without the users' knowledge (such as the "gut feeling" or "system reputation"). Second, while there has been inconclusive anecdotal evidence concerning the value of e-Commerce evaluation, it could be argued that successful and accurate approaches would constitute a closely guarded competitive advantage for the organisation using it. Hence, there may be a dearth of such approaches in popular circulation. Third, the reader is reminded that despite the significant literature coverage of e-Commerce, the technology is very new and much research is still required to ascertain its benefits (or otherwise). In this vein, it is possible that too little time has elapsed to permit successful e-Commerce evaluation. This would be consistent with Gebauer and Buxmann (2000). Further, it is possible that not all of these approaches will apply to each of the different kinds of e-Commerce (such as B2B, B2C, C2B and C2C, as discussed by Applegate *et al.* 1996). Again, this problem might be addressed at a later date.

The industry in which an organisation is competing may also have some bearing on the types of approaches that can be used to evaluate electronic commerce. Kettinger and Grover (1995) discuss this with respect to strategic systems, arguing that the benefits of such systems depend not only the internal capabilities of an organisation, but also on industry conditions. De Figueiredo (2000) suggests that the success of e-Commerce for organisations may vary depending on the attributes of a product, arguing that with customer perceptions differing between products, not all goods can be sold effectively online. An example that demonstrates these differences is distribution costs. Wyckoff and Colecchia (1999) discuss distribution costs, arguing that whereas costs can be significantly reduced for digital products (i.e. financial services, software), they may in fact increase for tangible productions. Therefore, approaches should be developed and used with the industry in mind.

This paper presents a number of avenues for further research. First, and most importantly, this study should be extended to determine those evaluation methods that suit particular commercial environments the best. This will contextualise the arguments presented in this

paper, in addition to assisting practitioners in system specification and management. Second, research is required to determine which approaches organisations actually use to evaluate their e-Commerce ventures. Ideally, this research should also take into account at what stage in the implementation process this evaluation occurs. Second, researchers should examine the success of this evaluation. Depending on the location of the organisation, relevant legislation may permit the examination of financial documentation, especially for publicly listed companies. Such research may also assist in predicting e-Commerce success: taken in the context of the wider IS success research, this additional study may assist the IS discipline in understanding the relationship between online and more traditional systems. Third, work is required to incorporate the range of IS success approaches into the ex-ante/ ex-post model. Evaluation methods such as user satisfaction, system use and data quality would aid in contextualising the evaluation process, and would also allow managers to better compare their e-Commerce and conventional systems.

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