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Delivering the Business Value of Information Technology: Evaluation Practices of Construction SMEs

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Abstract

With calls from the government for the construction industry to improve its performance and openly embrace information technology (IT), this research sought to examine the practices that organisations use to evaluate and justify their investments in IT. It was considered that this would enable those areas for improving the evaluation process to be identified and the business value of IT was maximised. A questionnaire survey was used to obtain information about the evaluation practices of 126 construction organisations. The analysis of their responses identified three key findings. First, different organisation types significantly differ in the amount they investment in IT and firm size (i.e. in terms of turnover and number of employees) does not influence investment levels in IT. Second, the evaluation process that is adopted by construction organisations is used as a both control and learning mechanism. Third, a major barrier to justifying IT investments was attributed to having no strategic vision in place. Thus, it is concluded that if construction organisations are to leverage the benefits of IT and deliver business value to customers and suppliers in their supply chain then IT should form an integral part of their business strategy.

Keywords: *Australia, construction, IT evaluation, investment, business strategy, value*

INTRODUCTION

The construction industry operates in project environment, where there is a high degree of differentiation and interdependency between organisations. Information technology (IT) evaluation in construction is a difficult, complex, and a time consuming process (Andresen *et al.*, 2000) and the problems associated with assessing its benefits and costs seem to be more acute than in any other industry (Marsh and Flanagan, 2000). The reasons for this are due to industry's peculiar size and structure, its fragmented supply chain, and under capitalization. Yet, construction industry, through the products that it creates, its size and ability to create employment, has the potential to influence an economy's gross domestic product (GDP) more than any other service industry. An increase of 10% in the Australian construction industry's efficiency, would improve the economy's service industry contribution to GDP by over 2.5% (Stoerkerl and Quirke, 1992). Consequently, it is essential that industry operate efficiently and productively. The Latham Report, which investigated ways of improving the UK's construction industry, suggested that the effective implementation of IT could reduce project costs by as much as 30% (Latham, 1994). Calls for organisations in the Australian construction industry to embrace IT have also been made through the publication of a number of government-initiated reports (DIST, 1998; DISR, 1999). Previous research has shown that contractors' have predominately used IT to automate existing processes and that the associated benefits of IT adoption have simply been reduced cycle times (Love *et al.*, 1996). Some contractors, however, have re-designed their business processes to

leverage IT benefits, and as a result had achieved significant productivity gains (Marosszkey *et al.*, 2000). While there are some businesses leveraging IT benefits, most inter-organisational applications of IT are confined to the automation of communications (Yellow Pages, 2000). For example, e-mail partially replaces ordinary mail, telephone and fax. It is also common for computer-aided-design files to be e-mailed to and from consultants, and Electronic Fund Transfer automates payments among contractors. Such technologies have enabled cycle times to be reduced and are now considered a necessity for efficiency gains. The factors that have inhibited the adoption of IT and communication technologies in construction include (DIST, 1998): resistance from management; tight profit margins which make it difficult to fund investments in an IT infrastructure; lack of IT awareness; lack of employee education and training; degree of organisational change required; and a belief that the industry is doing well without IT. Bearing in mind the calls from the government for the construction industry to improve its performance and openly embrace IT, this research sought to examine the practices that organisations use to evaluate and justify their investments in IT so that areas for improving the evaluation process identified and business value obtained.

IT INVESTMENT JUSTIFICATION

Weill and Olson (1989) quoted a figure of 2% of revenue as being a nominal figure for IT investment and specifically noted that such as estimate was likely to be an underestimate due the decentralized nature of organisations and the purchasing of end-user equipment from revenue rather than capital sources. In some organisations, investments in IT may exceed 50% of their annual capital investment and it has been suggested by 2010 that average IT expenditure could be as high as 5% of revenue (Graeser *et al.* 1998). In contrast, Australian construction contractors' investments in IT have been found to be less than 1% of their turnover (Tucker *et al.*, 1996)

The process of investment justification has been identified as a major barrier to implementing IT in many construction firms (Love *et al.*, 2000). A lack of awareness about information and communication technologies coupled with much reliance on cashflow contributes to making the evaluation processes a burdensome one that requires considerable resources. Consequently, managers often view the justification process as a barrier that has to be overcome, and not as a technique for evaluating the projects contribution to obtaining a competitive advantage in their respective marketplace. This has serious consequences for the organisation as during the preparation of an IT proposal managers may spend too much time and effort investigating technical aspects of IT. Moreover, managers may be easily susceptible to persuasion by software developers and consultants, and be prepared to accept untypical demonstrations, which show unrealistically high levels of savings. Hence, managers may focus their efforts on trying to identify and estimate maximum benefits and savings, at the expense of overlooking the full cost implications of IT.

The inability of construction organisations to quantify the full implications of their investments in IT, from both a cost and benefit perspective, questions the predictive value of those justification processes that are dependent on traditional appraisal techniques. There remain, however, serious implications with not carrying out a

rigorous evaluation process. For example, a lack of management guidelines to support investment decision making may force organisations to adopt one of the following positions (Small and Chen, 1995):

- refuse to implement an IT infrastructure that could be beneficial to the long-term competitiveness of the organisation;
- invest in IT as an act of faith; or
- use creative accounting (assigning arbitrary values to benefits and costs) as a means of passing the budgetary process.

The costs associated with IT implementation appear more tangible in nature than its benefits. The reasons for this are that the assumptions and dependencies on which they are based are often not fully acknowledged, or are poorly understood by management (Irani and Love, 2001). Indeed, it is considered widespread practice during the investment decision-making process to account for the upper estimates for costs and the lower estimates for benefits (Hogbin and Thomas, 1994). This heuristic appears not to be solving the problem of IT projects running over budget, as much of the problem lies in management not fully understanding IT cost portfolios (Hogbin and Thomas, 1994). A dilemma appears to be emerging, with the need to identify costs to support their management, which in turn contributes towards their control. There might also be political and organisational reasons for not understating the cost implications of an IT investment; the main being the need to gain support for, and acceptance from senior managers (Curry, 1989; Irani *et al.*, 2001). Many managers tend to make optimistic estimates of benefits and cost savings of IT, as they do not have a clear understanding of the associated indirect costs and benefits. In this instance, the failure to identify the direct and indirect cost implications of IT, when combined with the use of over optimistic savings and benefits, can result in several extra years of use to achieve expected financial returns.

Evidence from previous studies suggests that organisations in the construction industry do not use systematic evaluation techniques to evaluate their IT investments (CIRIA, 1996). Then again, Andresen *et al.* (2000) found that construction organisations regarded the use of evaluation techniques as a ritual of legitimacy, which were costly to implement and therefore did not generate value to the decision-making process. Construction organisations using traditional approaches to appraise their IT often do not know how to evaluate the impact that the IT investments will have on their organisation (Love *et al.*, 2000). Furthermore, several authors have suggested that generic evaluation techniques exclusively based on standard accounting methods simply do not work, and as a result have advocated an application specific approach that focuses on the characteristics of the IT being sought (Farbey *et al.*, 1993: Willcocks, 1996 Irani, 2002). However, numerous methods for evaluating the benefits of IT in construction have been proposed (Construct IT, 1998; Baldwin *et al.*, 1999). Baldwin *et al.* (1999), for example, have assessed the benefits of IT from an efficiency (doing things right), effectiveness (doing the right things), and performance (doing better things). Love *et al.* (2000) adopt a similar approach but categorise direct and indirect benefits and costs from a strategic, operational and tactical level. Here emphasis is placed how IT can contribute to the various hierarchical levels of an organisation and thus enable

management to determine how it is influencing its competitive advantage, structure and processes and day-to-day business activities.

RESEARCH METHOD

A review of the literature revealed that only a limited number of studies have examined the evaluation practices implemented by construction organisations. So because the industry is project-based and therefore there is a high degree of interdependency between organisations, different evaluation and benefits management practices of organisation types (such as architects, consulting engineers, consulting project managers, quantity surveyors and contractors) were examined to provide an overview of IT management practices being adopted. Thus, we sought to test the following hypothesis:

- There are no significant differences in IT investments with firm size and type
- There are no significant differences between organisations in their approaches to evaluating and justifying their IT investments
- There are no significant differences between organisations motivations for IT adoption.

Larger Australian construction organisations have been found to investment more in IT than their smaller counterparts (Tucker *et al.*, 1996). However, as the construction industry has a low adoption rate for IT, there should be *no significant difference* between firms in terms of their investment in IT. Similarly, we suggest that this also applies to the motivation for adopting IT, and approaches to evaluation. In testing these hypotheses, a questionnaire was developed and distributed to construction organisations throughout Australia. Eight research variables were included in the study to test the hypotheses. Respondents were asked to indicate, using a 5-point Likert scale, the extent to which the eight factors were undertaken or had been experienced within the organisation. On the scale, one indicated 'not at all' and five indicated 'to a very large extent'. The responses were subjected to reliability and validity tests as described below.

Questionnaire Survey

Stratified random sampling was used to select the study sample from the telephone directory "Yellow Pages". Prior to determining the sample size for the main study, a pilot survey of 25 selected organisations, which comprised of architects, consulting engineers, consulting project managers, contractors and quantity surveyors (QS) from the Metropolitan region of Melbourne, in the State of Victoria. This was undertaken to test the potential response rate, suitability and comprehensibility of the questionnaire. Each organisation was contacted by telephone and informed of the aims of the research.

On obtaining their consent, the questionnaire was mailed, with a stamped addressed return envelope enclosed, for respondents' returns, comments, feedback and completion. The respondents were also asked to review the design and structure of the survey. All comments received were positive, and as a result, the questionnaire remained unaltered for the main survey. The response rate for the pilot survey was

100%. In the main survey, 50 questionnaires were mailed to each of the aforementioned organisation types throughout Australia, which equates to 250 questionnaires distributed. One hundred and one valid responses were received from the main survey. As the pilot questionnaire required no changes, they were added to the sample, which resulted in 126 valid responses representing a total consolidated response rate of 42%.

Sample Characteristics

Figures 1 and 2 provide a breakdown of the valid responses by respondents by organisation type and State. Figures 3 and 4 provide details about the sample's distribution in terms of the number of people employed and the turnover of organisations. Of the 126 organisations, 75% employed less than 30 employees and 79% had a turnover less than $A10 million. Thus, most of the sample was comprised of small and micro organisations.

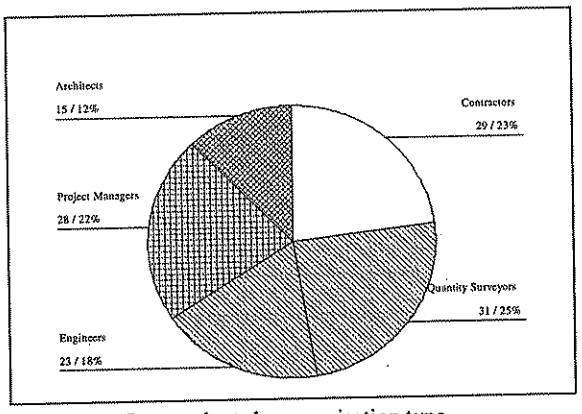

Figure 1. Respondents by organisation type

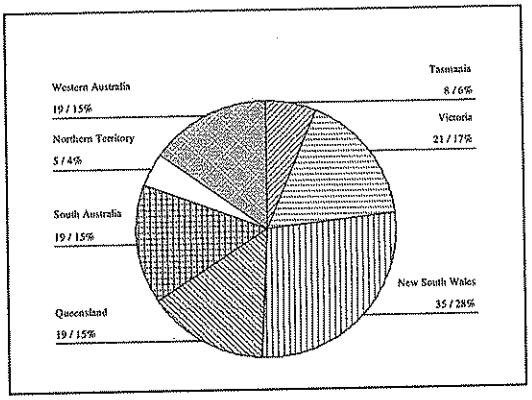

Figure 2. Respondents by State

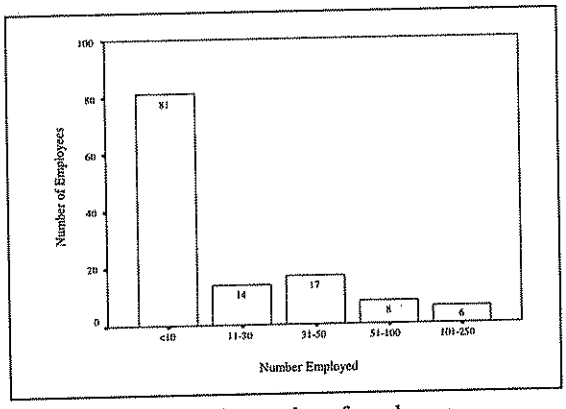

Figure 3. Firm size by number of employees

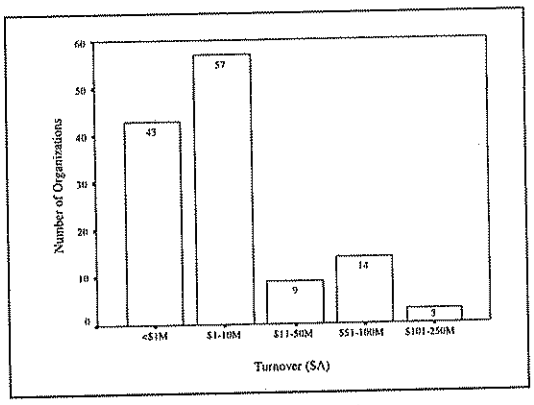

Figure 4. Number of organisations by turnover

Data Analysis

The data collected were analysed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 11.00. Prior to undertaking the detailed analysis, each of the ten constructs that were used to examine the evaluation process within the research

instrument were tested for reliability. The reliability of the research instrument was evaluated using Cronbach's coefficient alpha (α). An α value of 0.70 or above indicates a reliable measurement instrument. The α level for each of the constructs examined was above the required threshold value: *justification inhibitors* (α = .89), *evaluation process* (α = .92), and *motivation* (α = .75). Internal consistency requires homogeneity of the questionnaire. As a measure of internal consistency, the inter-item Pearson correlation coefficients of the eight multiple item factors were calculated. The inter-item correlations for each of the constructs were significant at the $p < 0.000$ level. A measure has *content validity* if there is general agreement among subjects and researchers that the instrument has measurement items that cover all aspects of the variable being measured. Content validity was not evaluated numerically and was therefore subjectively judged by the researchers. The measures of the constructs developed for this study have content validity since the selection of measurement items was based on an exhaustive review of the literature. Furthermore, pre-test subjects indicated that the content of each factor was well represented by the measurement instruments employed.

One-way analysis of the variance (ANOVA) was used to compare the means of respondents IT investment as a percentage of turnover and to determine if there were any significant differences among them. The Kruskal Wallis test, a non-parametric equivalent to the ANOVA, was undertaken to test whether there were differences between respondents' rankings of the independent variables. This test was undertaken because variables had a continuous distribution and were measured using an ordinal scale of measurement. To interpret the output from the Kruskal Wallis test it is important to look at the Chi-square, degree of freedom, which are corrected for ties. These values were used to indicate whether there is a difference between respondents and if the value of $p < 0.05$, then there is a significant difference between groups.

FINDINGS AND DISCUSSION

There are no significant differences in IT investments with firm size and type

Tables 1 and 2 provide a summary of organisations investment in IT as a percentage of their turnover and also reveal that the organisations sampled are small-to-medium sized enterprises (SME's) in terms of the number of people employed. Table 1 reveals that almost all the contractors sampled (93%) invested less than 1% of their turnover on IT, whereas over 50% of the other organisations sampled invested between 1% and 5% of their turnover.

Table 2 indicates that 90% of organisations invested less than 5% of their turnover on IT, with 44% investing less than 1%. Only 10% of organisations sampled invested more than 5% of their turnover in IT, most of which were architects and QSs. The ANOVA revealed that investments in IT did no significantly vary with firm size (turnover and number of employees) ($p < 0.05$). However, differences in IT investments were found between organisation types, F (4, 126) = 10.488, ($p < 0.05$). A Tukey's *honestly significant difference* (HSD) post hoc test was undertaken but did not identify where differences between organisations were ($p < 0.05$). The results indicate that investments in IT have not increased despite the widespread use of e-business and e-commerce applications throughout the economy.

Table 1. Organisations types in relation to IT investment as a percentage of turnover

Organisation Type	IT Investment as a % of Turnover				
	< 1%	1-5%	6-10%	11-20%	Total
Contractor	27 (93%)	2 (7%)	-	-	29 (100%)
Quantity Surveyors	8 (26%)	16 (52%)	6 (20%)	1 (3%)	31 (100%)
Engineering Consultants	6 (26%)	15 (65%)	2 (9%)	-	23 (100%)
Project Management Consultants	8 (29%)	18 (65%)	2 (7%)	-	28 (100%)
Architects	6 (40%)	7 (47%)	2 (13%)	-	15 (100%)
Total	55 (44%)	58 (46%)	12 (9%)	1 (1%)	126 (100%)

Table 2. Number of employees in relation to IT investment as a percentage of turnover

Number Employed	IT Investment as a % of Turnover				
	< 1%	1-5%	6-10%	11-20%	Total
<10	39 (48%)	34 (42%)	7 (9%)	1 (1%)	81 (100%)
11-30	7 (50%)	6 (43%)	1 (7%)	-	14 (100%)
31-50	3 (18%)	10 (59%)	4 (24%)	-	17 (100%)
51-100	2 (25%)	6 (75%)	-	-	8 (100%)
101-250	4 (67%)	2 (33%)	-	-	6 (100%)
Total	55 (44%)	58 (46%)	12 (9%)	1 (1%)	126 (100%)

There are no significant differences between organisations in their approaches to evaluating their IT investments

Table 3 provides a summary of the extent to methods for ex-ante evaluation were used. Here it can be seen that ex-ante evaluation methods are not used by more 40% of organisations who make investments in IT and then only a relatively small percentage use the identified techniques, albeit 'to some extent'. Based on our experience, we suggest that a reason for the lack of consideration given to ex-ante evaluation of IT investments is not due to a lack of knowledge of the available techniques, but rather that IT does not form an integral part of business strategy for leveraging a competitive advantage.

At a tactical and operational level, however, IT is used to automate tasks such as design and documentation, the production of Bills of Quantities, or site administration. The emergence of e-business applications, however, for the procurement of materials (Kong *et al.*, 2001) and sharing information between project participants (Elliman and Orange, 2000) are beginning to be embraced by some organisations as they seek to improve the quality, efficiency and effectiveness of their operations and service. The adoption and implementation of such technology requires significant capital outlay and as a result, ex-ante evaluation will have to form an integral part of their IT management strategy if they are too remain competitive. From the results presented, it is suggested that construction organisations are less likely to adopt a formal ex-ante evaluation process. In contrast, it has been suggested that financial techniques are more appropriate for evaluating IT investments in small-to-medium sized enterprises SMEs than large organisations, as automation is typically undertaken for cost efficiencies (Ballantine *et al.*, 1996).

Table 3. Ex-ante methods used for evaluating IT investments

Evaluation Method	Mean (n=126)	SD	Not at all	Some extent	Moderate Extent	A large extent	Very large extent
Return on Investment	2.11	1.17	56 (44%)	20 (16%)	32 (25%)	15 (12%)	3 (2%)
Discounted cash flow and IRR	1.72	1.03	73 (58%)	27 (21%)	18 (14%)	4 (3%)	4 (3%)
Net Present Value (NPV)	1.69	.09	74 (59%)	25 (20%)	18 (14%)	9 (7%)	–
Profitability Index	1.78	1.08	73 (58%)	23 (18%)	15 (12%)	14 (11%)	1 (1%)
Payback Period	2.19	1.23	55 (44%)	18 (14%)	30 (24%)	19 (15%)	4 (3%)
Present Worth	1.98	1.08	57 (45%)	28 (22%)	30 (24%)	8 (6%)	3 (2%)

Table 4 identifies the formative evaluation processes adopted by those construction organisations sampled. Over 50% of organisations prepare an IT benefits delivery plan prior to, and during system design and implementation. There is considerable divergence in the use of formative evaluation processes within the sample. A Kruskal-Wallis test was undertaken to determine if there were any significant differences between the size of the organisation (i.e. turnover and number of people employed), the type and the evaluation processes employed.

In the case of turnover, the analysis revealed that there were significant differences between turnover and all evaluation processes, with the exception of the 'use of IT to develop future processes' ($\chi^2 = 7.06$, $p < 0.13$). This implies that when construction organisations do implement IT, they aim to utilize its value adding potential. There were also significant differences between the number of people employed and all of the evaluation process adopted ($p < 0.05$). However, no significant differences between organisation types where evaluation processes adopted were identified ($p < 0.5$). The size of the organisation therefore influences the extent of evaluation processes implemented. Ballantine *et al.* proposed that SMEs were more likely to focus on control rather than learning (Ballantine *et al.*, 1996). These findings indicate that the evaluation process is used by many construction organisations as both a control and learning mechanism, even though it may not form an integral part of their business strategy. While construction organisations may not use formal methods for evaluation, they appear to be conscious about the cost implications of their IT investments as they are dependent on having a positive cash flow.

Factors inhibiting the evaluation process of organisations sampled are identified in Table 5. A significant proportion of organisations indicated that they encountered some difficulty, albeit to some extent, when determining their IT investment, particularly the need to demonstrate quick financial returns. Significant differences between turnover and the justification inhibitors were identified for the following variables:

- 'limited managerial and technological knowledge' ($\chi^2 = 20.77$, $p < 0.00$);
- 'lack of strategic vision' ($\chi^2 = 29.49$, $p < 0.00$); and
- 'reluctance of employees to adapt to new technology' ($\chi^2 = 18.15$, $p < 0.01$).

Table 4. Evaluation processes implemented

Evaluation Process	Mean (n=126)	SD	Not at all	Some extent	Moderate Extent	A large extent	Very large extent
Prepare a benefits delivery plan	2.40	1.51	49 (39%)	21 (17%)	26 (21%)	22 (18%)	8 (6%)
Prepare a benefits delivery plan during system design	2.00	1.20	61 (48%)	27 (22%)	19 (15%)	14 (11%)	5 (4%)
Prepare a benefits delivery plan during the implementation of IT	1.92	1.17	63 (50%)	30 (24%)	19 (15%)	7 (6%)	7 (6%)
Prepare a benefits delivery plan once the technology is implemented	1.81	1.06	67 (53%)	30 (24%)	16 (13%)	11 (9%)	2 (2%)
Plan organisational changes associated with the implementation of IT *before approval*	2.47	1.26	37 (29%)	32 (25%)	25 (24%)	24 (19%)	8 (6%)
Plan organisational changes associated with the implementation of IT *during system design*	2.23	1.18	47 (37%)	25 (20%)	37 (30%)	11 (9%)	6 (5%)
Plan organisational changes associated with the implementation of IT *during implementation*	2.45	1.28	42 (33%)	23 (18%)	31 (25%)	22 (18%)	8 (6%)
Plan organisational changes associated with the implementation of IT once the technology is implemented	2.61	1.28	37 (29%)	18 (14%)	34 (27%)	30 (24%)	7 (6%)
Conduct reviews during the implementation of IT	2.50	1.23	38 (30%)	25 (20%)	28 (22%)	32 (25%)	3 (2%)
Conduct post implementation reviews	2.60	1.15	30 (24%)	26 (21%)	37 (30%)	30 (24%)	3 (2%)
Use IT to develop future processes	2.80	1.23	29 (23%)	16 (13%)	40 (32%)	33 (26%)	8 (6%)

Table 5. Justification inhibitors

Justification Inhibitors	Mean (n=126)	SD	Not at all	Some extent	Moderate Extent	A large extent	Very large extent
Limited managerial and technological knowledge	2.19	2.19	43 (34%)	37 (29%)	28 (22%)	15 (12%)	3 (2%)
Lack of strategic vision	2.07	2.07	52 (41%)	33 (26%)	27 (21%)	8 (6%)	6 (5%)
Unable to identify financial benefits	2.28	2.28	45 (36%)	25 (20%)	36 (29%)	15 (12%)	5 (4%)
Limited organisational resources and resistance to technology related change	2.23	2.23	44 (35%)	34 (27%)	25 (20%)	21 (17%)	2 (2%)
The need to show quick financial returns with minimal risk	2.52	2.52	27 (21%)	40 (32%)	35 (28%)	14 (11%)	10 (8%)
A multiplicity of justification and implementation paths	2.34	2.34	34 (27%)	37 (29%)	35 (27%)	18 (14%)	2 (2%)
An ability to account for the full business benefits	2.36	2.36	36 (29%)	35 (28%)	34 (27%)	15 (12%)	6 (5%)
Unable to identify and manage the scope of IT/IS related costs	1.93	1.93	53 (42%)	42 (33%)	20 (16%)	8 (6%)	3 (2%)
Reluctance of employees to adapt to new technology	1.69	1.69	69 (55%)	39 (31%)	9 (7%)	6 (5%)	3 (2%)
Inability to select an appropriate IT appraisal technique	2.27	2.27	52 (41%)	33 (26%)	27 (21%)	8 (6%)	6 (5%)

It was also found that there was significant difference between the number of people employed and justification inhibitors for the following variables:

- 'inability to select an appropriate IT appraisal technique' ($\chi^2 = 11.06, p < 0.02$)
- 'lack of strategic vision' ($\chi^2 = 14.79, p < 0.05$); and
- 'an ability to account for the full business benefits' ($\chi^2 = 10.84, p < 0.02$)

In addition, to examining differences with respect to the size of the organisation, differences between organisation types were analysed to provide a clearer picture about where differences fundamentally lie. Several significant differences between organisation types and justification inhibitors were identified:

- 'limited managerial and technological knowledge' ($\chi^2 = 18.99, p < 0.01$);
- 'lack of strategic vision' ($\chi^2 = 11.69, p < 0.02$);
- 'unable to identify financial benefits' ($\chi^2 = 11.69, p < 0.01$);
- 'an ability to account for the full business benefits' ($\chi^2 = 17.83, p < 0.01$);
- 'reluctance of employees to adapt to new technology' ($\chi^2 = 22.15, p < 0.00$); and
- 'inability to select an appropriate IT appraisal technique' ($\chi^2 = 11.63, p < 0.02$).

Considering the evidence provided, a lack of strategic vision is a key factor inhibiting the justification process for organisations. An inability to select an appropriate technique also appears to be a problematic issue as organisations have limited managerial and technical knowledge about the justification process. Information technology has not been an integral part construction organisations business strategy and therefore it would be expected that the justification process would be an arduous task. As construction organisations are now needing to embrace IT to gain a competitive advantage, as well as improve the efficiency and effectiveness of operations, it is anticipated that they will begin to evaluate their investments in a more systematic and structured manner. We suggest that the construction organisations learn from the experiences of businesses that have faced similar difficulties with IT investments.

There are no significant differences between organisations motivations for IT adoption

Table 6 identifies the motivations for organisations adopting IT. It is shown here that SMEs embraced IT to improve productivity (i.e. cost efficiency) and the performance of business processes. Notably, to gain a competitive advantage, improve service quality and profitability were also identified as primary motivations for its adoption. Unexpectedly, over 70% of organisations sampled suggested that a motivation for adopting IT was to support the strategic direction of the organisation, yet it would appear that they lacked a specific IT strategy.

Table 6. Motivation for adopting IT

Motivation for Adopting IT	Mean (n=126)	SD	Not at all	Some extent	Moderate Extent	A large extent	Very large extent
Improve productivity (i.e. cost efficiency) of business processes	4.02	1.03	6 (5%)	4 (3%)	17 (14.0%)	53 (42%)	46 (37%)
Improve performance of business (effectiveness) processes	4.13	0.85	1 (1%)	6 (5%)	14 (11%)	59 (47%)	46 (37%)
Seemed like a good idea at the time	2.00	1.11	56 (44%)	31 (25%)	26 (21%)	9 (7%)	4 (3%)
To gain a competitive advantage	3.73	0.98	1 (1%)	15 (12%)	31 (25%)	49 (39%)	30 (24%)
Improve profitability	3.66	1.01	2 (2%)	13 (10%)	42 (33%)	37 (29%)	32 (25%)
Pressure from rivals who are implementing IT	2.32	1.10	32 (25%)	47 (37%)	26 (20%)	16 (13%)	5 (4%)
Support the strategic direction of the organisation	3.27	1.17	9 (7%)	27 (21%)	29 (23%)	42 (33%)	19 (15%)
Improve service quality	3.92	1.01	17 (14%)	18 (14%)	48 (38%)	43 (34%)	–
Improve market share	3.1	1.29	15 (12%)	25 (20%)	30 (24%)	32 (25%)	24 (19%)

Differences between the number of people employed and motivation factors were found to be significant for all factors, with the exception of 'to gain a competitive advantage' ($p < 0.05$). With respect to turnover, the only significant differences were found to be with 'support the strategic direction of the organisation' ($\chi^2 = 18.07$, $p < 0.01$) and 'improve service quality' ($\chi^2 = 17.75$, $p < 0.01$). Noteworthy, the only significant difference between organisation types for motivation factors was 'to improve service quality' ($\chi^2 = 13.83, p < 0.00$).

Information technology can be used for an array of services provided by construction organisations. For example, at an operational level IT applications such as Computer Aided Design (CAD) can be used to improve the quality of contract documentation produced, especially when design professionals integrate and coordinate their outputs with each other. This appears to be a relatively straightforward process, but cultural and behavioural barriers, juxtaposed with problems associated with interoperability have hindered the production of effective contract documentation and thus had an adverse affect on the service quality of organisations (Love *et al.*, 2003).

CONCLUSION AND RECOMMENDATIONS

The research reported this paper has examined the IT evaluation management practices of construction organisations. To date, there has been limited research undertaken in this area and so the findings presented should provide the impetus for organisations to re-consider their approaches to IT evaluation. The inherent difficulties in identifying and assessing the benefits and costs associated with IT adoption are often a cause for uncertainty about the expected impact the investment might have on the business. As a result, it is all too easy for businesses and management to ignore, or ineffectively evaluate their IT investment. The key findings suggest that:

- organisation types significantly differ in the amount of turnover they investment in IT;
- IT investment levels among SMEs were not influenced by organisational size (i.e. in terms of turnover and number of employees);
- the scope of purpose of *ex-ante* IT evaluation was considered broader than a financial control mechanism. Instead, construction SMEs used *ex-post* evaluation as an opportunity for learning and thus regenerated knowledge within the organisation; and
- having no strategic vision in place is a major barrier to justifying IT investments.

Based on our findings we recommend that if construction organisations are to deliver value to their internal and external stakeholders then they should focus on the following during the investment justification process:

- making IT, and the use of other technologies such as e-commerce and e-business applications, an integral part of their business strategy;
- conducting an assessment of the IT available to the organisation so that features and costs can be readily identified;
- developing an expected IT benefits and costs management plan, which also incorporates anticipated indirect costs; and
- determining if sufficient IT benefits exist and if organisational culture is supportive of adopting IT and other technologies.

Fundamentally, the competitiveness of construction organisations depends on the basic role of the owner/manager (their drive), intangible investment (i.e. intellectual capital), tangible investment in information and communication technology and their strategic capability (i.e. ability to be innovative and adapt to change). Without a positive attitude within the organisation and top management support, then expected benefits may not be achievable and IT may be seen as a sinkhole

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