Understanding IT Costs: An Exploratory Study using the Structured Case Method

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Abstract
Many companies are increasing their expenditure on information and communication technologies (ICTs) to obtain or even sustain a competitive advantage in their respective marketplaces. However, managers are often left with the quandary of how to evaluate investments in such technologies. Reasons of this difficulty have been suggested in the normative literature as centring on the socio-technical (human and organisational) dimensions associated with the deployment of ICTs. The inability of managers to determine the true costs of deploying ICT are considered attributable to a lack of knowledge and understanding of ICT related costs. In developing a broader picture of such costs and their respective taxonomies, the research presented in this paper uses a structured case method, to gain an understanding of how a construction firm embraced the information technology (IT) evaluation process. A review of the IT cost literature is presented and a conceptual framework (CF) to examine IT related costs is proposed. Findings from the case study are presented and discussed in the context of the CF.

Keywords
IT, evaluation, organisation and human costs, structured case method.

Introduction
Evidence suggests that the deployment of information technology (IT) within businesses has resulted in replacing old problems with new, and that significant disappointments can occur since unexpected difficulties and failures are often encountered, with expected business benefits not realized (Berghout and Renkema, 2001). Previously research in the IS evaluation domain has pointed toward static productivity gains, despite the increasing expenditure on IT and as a result this has given rise to the notion of a ‘productivity paradox’ (Stratopoulos and
Dehning, 2000). The difficulties of identifying the benefits of IT have been observed, and it has been suggested that some businesses may not have received any gains from their capital expenditure at all (Willcocks and Lester, 1996). According to David, there is often a time lag from the adoption of IT and when the expected benefits are achieved (David, 1990). In fact, David’s research has shown that productivity benefits begin to emerge within an industry sector once the diffusion rate of technology surpasses 50%. Evidence provided by Brynjolfson and Hitt, and more recently Stirroh, has shown that it has taken time for the productivity benefits associated with the adoption of IT to be achieved (Brynjolfsson and Hitt, 1996; Stirroh, 2001). Stirroh (2001) noted that the agriculture and construction sectors have been the only sectors in the US that have not experienced increases in productivity between 1995 and 1999. These industries have lagged other industries in embracing IT and consequently have not been able to acquire the benefits of increased productivity. Like the US, the construction sector in Australia is a ‘laggard’ in terms of its productivity output and adoption of IT, when compared to other sectors of the economy (DIST, 1998; Yellow Pages, 2002).

Business-to-business (B2B) e-commerce can significantly improve the performance of the construction industry’s supply chains, but its conservative nature and the short term focus of organisations (i.e. a focus on winning the next project) has tended to inhibit investments in IT despite calls from the Australian Federal Government to openly embrace information and communication technologies (ICT) (DIST, 1998). With this in mind, the authors of this paper present initial findings from an on-going research project that aims to develop cost and benefit taxonomies that managers of construction firms can use when evaluating their IT investments. Based on a review of the normative literature, an initial conceptual framework (CF) for exploring IT related costs, particularly those of an indirect nature, is proposed. Findings from a case study are presented and discussed in the context of the CF.

**IT Evaluation**

Most management executives are not comfortable with the available set of tools and techniques used to justify their investments in IT (Alter, 1999). Lefley and Sarkis (1996) proffer that investment justification processes used by management are typically based on the use of traditional appraisal techniques, which are inadequate for strategic decision-making. Such traditional techniques lack the preciseness in definition and results that management expect. Irani and Love (2000) have found that management tends to be myopic when considering IT investment decisions. The reason for this is that they have no agreed framework to evaluate their IT investment. The inability of construction firms 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 (Li et al., 2000). In addition, management gives less attention to the ‘hidden’ or indirect costs surrounding IT, which can be up to four times greater than its ‘direct’ IT cost component (Hochstrasser, 1992). The implications of ignoring ‘indirect’ costs can have far-reaching consequences for firms in all sectors. For example, reduced productivity because employees have not been sufficiently trained, and loss of employees to competitors. Li et al. (2000) have suggested that many construction firms may only realise the significance of these additional cost factors once they have developed their IT infrastructure.
Cost Implications of IT

The costs of IT are often perceived to be easier to estimate than the benefits, though Hogbin and Thomas (1994) argue that this is rarely the case. The costs associated with IT implementation appear more tangible in nature. 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. 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). However, 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. There might also be political and organisational reasons for not understating the cost implications of an IT investment; the main one being the need to gain support for, and acceptance from senior managers.

Farbey et al. (1993) found that those responsible for implementing IT in organisations are totally committed towards the ‘success’ of the IT investment. Yet, such stakeholders often ignore the ‘full’ cost implications of their investment. In this instance, the failure to identify the ‘full’ cost implications, when combined with the use of over optimistic savings and benefits, may result in several extra years of use to achieve expected financial returns. The impact to the organisation being a reduction in productivity and competitiveness due to the prolonged use of outdated technology.

Table 1 presents a summary of the limited research surrounding cost taxonomies. Notably, there has been limited identification of associated costs elements within the taxonomies identified (with the exception of Irani and Love, 2001). Thus, the taxonomies reported in the literature are of little use to decision-makers in their current form. Hence, there is much need for further research to identify cost elements and establish new and validate current taxonomies. The identification and such costs and appropriate grouping into taxonomies will therefore support improved ex-ante investment decision-making, and the controlling and reduction of IT/IS costs through benchmarking during post-implementation evaluation.

<table>
<thead>
<tr>
<th>Cost Taxonomies</th>
<th>Reference</th>
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<tbody>
<tr>
<td><strong>Financial / non Financial Activities:</strong> These costs are classified according to the activities causing them thus, emphasising a causal relationship. Hence, reactive in nature.</td>
<td>Kusters and Renkema (1996)</td>
</tr>
<tr>
<td><strong>Initial / Ongoing Costs:</strong> These costs are identified and assigned during the systems life cycle. However, they tend to be retrospective, which make their consideration during ex-ante evaluation difficult. Yet, as legacy systems and enterprise solutions become more integrated, such cost taxonomies warrant closer consideration in terms of identifying their respective cost elements.</td>
<td>Dier and Mooney (1994)</td>
</tr>
<tr>
<td><strong>Direct / Indirect: Human and Organisational:</strong> The direct cost element is assigned to the information technology component, whereas the indirect elements relates to the effect of the information system on the organisation and people.</td>
<td>Irani and Love (2001)</td>
</tr>
<tr>
<td><strong>IS Cost Divisions – Management, Employee, Finance, and Maintenance:</strong> This cost taxonomy identifies a set of cost factors and sub-systems that impact the organisation. However, this taxonomy falls short of identifying performance measures.</td>
<td>Mohamed and Irani (2002)</td>
</tr>
<tr>
<td><strong>Initial Investment / Ongoing Costs:</strong> These are based around the</td>
<td>Remenyi et al. (1996)</td>
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costs relating to the development of an information system infrastructure (initial investment) and operation of the infrastructure (ongoing cost).

Table 1. IT/IS cost taxonomies

**Direct Costs**

‘Direct’ costs are those that can be attributed to the implementation and operation of IT, which are typically the focus of senior managers. Although, these costs often go beyond the initial user specification of the system. Direct costs may also include unexpected additional hardware accessories, such as increases in processing power, memory and storage devices. Installation and configuration costs are also classified as direct costs, and typically include consultancy support, installation engineers and networking hardware/software. As hardware costs continue to fall in price, Wheatley (1997) predicts that IT-related human and organisational costs are set to rise. Strassmann (1992) concluded that at the US Department of Defence, for every $1 spent on IT and associated equipment, a further $7 needed to be spent on ‘softer’ human and organisational issues. Hochstrasser (1992) suggests that human and organisational costs are rarely budgeted for in IT investment proposals, which may partially explain the phenomenon of ‘cost-creep’, which occurs when organisations implement IT infrastructures.

**Indirect Costs**

‘Indirect’ costs are typically comprised of human and organisational factors. One of the largest ‘indirect’ human cost being that of management time (Irani et al., 1999). In other words, that time specifically spent on integrating new systems into current work practices. In the case of newly adopted technologies, management may spend time revising, approving and subsequently amending their IT related strategies. A significant amount of resource will also be used to investigate the potential of the IT, and in experimenting with new information flows and modified reporting structures (Love et al., 1996). Wheatley (1997) suggests that a further ‘indirect’ human cost, which is often overlooked, is that of system support and trouble shooting. System support cost factors are often substantial; with Wheatley (1997) reporting the results of a survey that found a third of respondent organisations could not estimate the additional cost of supporting IT in relation to its original purchase price. According to Wheatley (1997), typical lifetime support costs are at least 400% of the original purchase price. Further ‘indirect’ costs may result from employees developing new skills, and therefore increasing their flexibility/overall contribution towards the organisation. These employees may then request revised pay scales. Clearly, such ‘indirect’ costs associated with employee pay and rewards, together with the cost implications of increases in staff turnover need capturing, and bringing into the IT decision making arena.

Mohamed and Irani (2002) proposed a two-tier system for classifying indirect human costs. The first tier refers to management, employee, financial and maintenance and the second tier to particular cost components. In the first tier, management decides on the amount of IT expenditure; employees refers to all people related issues within the organisation, for example, training costs etc; financial refers to allocation of budgets; and maintenance to the development and implementation of technology. The second tier identifies indirect cost components and includes the following:

- **Time** - Management time is an indirect cost in terms of transferring their training to the IS staff, as neither staff nor management will be doing their routine jobs during that period.
Bannister (1999) supports this view by stating that the introduction of a new system will require training. Unless the organisation obtains a time recording system, the indirect cost of the time spent in training would not usually show up as an IS cost, but identified as a hidden or personnel related cost. Such costs include the time spent reading manuals, self-help activities, and informal job training, which are untraceable.

- **Learning costs** - As new users or new systems are introduced to the organisation, users are likely to embrace a learning curve. As a result, a temporary loss in productivity may be experienced, as the user becomes familiar with the new system. There is also the possibility that mistakes will occur during the implementation, migration or running of the system. It takes time to rectify problems as well as become familiar with the peculiarities of a system.

- **Costs of resistance** – The introduction of a new IS could result in an unexpected political power shift that can result in some individuals or groups resisting the change initiative. As a result, staff engage in other staff interdependently uses behaviour that endeavours to result in disruption or removal of an entire system that. Clearly this is an influential indirect human cost, as it has a great impact on the social fabric of the organisation, not only do they have to rectify the consequences of resistance but also, bear the cost of resolving the actual resistance if it can possibly be resolved. Moreover, lack of commitment to change could result in a non-operational working environment, user resistance resulting in escalating operational costs.

- **Effort and dedication** - This occurs when a new system is introduced, as management at all levels spend time exploring its boundaries, discovering the business potential, absorbing the transition from the old system to the new system, as well as identifying integration issues. Here managers are being less productive and thus not adding transparent value to the organisation. The time utilised by management and staff incorporating the new system into the existing organisational setting results in an indirect cost. Those members of staff influenced by the new system will take time to become familiar with it and as a result this hinders their daily operations.

- **Cost of redefining roles** – The introduction of IS in some cases can lead to organisational restructuring. The dismantling of an organisations’ hierarchy and reduction in the number of managerial levels, can lead to middle management being somewhat exposed and therefore lead to a change in roles and responsibilities. Kaye et al. (1995) suggests that it may also lead to the introduction of training, redundancy, or perhaps promotion.

- **Missed costs** - Bannister (1999) states that one of the major problems in tracing IS costs is mis-assigning them. Displacement costs (also called re-allocation) are proposed as being one of these miss-assigned costs, and are explained through the following example. If a member of the IS staff goes on training abroad, then cost of the aircraft is recorded as a travel expense, the accommodation as miscellaneous and other expenses as entertainment, when essentially they are all actually IS training costs. Bannister (1999) refers to disruption and displacement costs as missed costs.

- **Reduction in knowledge base** - This is usually a result of high staff turnover, or redundancies in the organisation. Some organisations may reduce labour costs, believing that they are justifying their investment in IT. Nevertheless, this is impossible to measure in financial terms, and can result in a significant change in the knowledge base of the organisation.

- **Moral Hazard** - Mende (1994) refers to this as ‘professionalism’. It is defined to be the state in which the IS managers are interested in gaining knowledge that will help them to determine their job market value rather than being interested in organisational benefits. It could occur when decision rights are appointed to individuals that are expert. Managers
may use their decision right to maintain their own interest rather than trying to meet organisational objectives (Dirks and Van Lent, 1997; Irani and Love, 2001).

- **Deskilling** - This is the inability to fully utilise the potential skills of employees. For example, as a result of a new system being introduced, the organisation may assign high skilled staff to undertake low skilled tasks (Kaye et al., 1995). As a result, either the employee may seek a different job, or the organisation continues to assign high salaries for less worth job roles. Investing in IT at the expense of reduction in labour cost may lead to a situation where it is difficult to predict accurately the costs involved, as there is less transparency. As an outcome, significant costs could result from losing time and money already invested in the employee that has left as well as requiring the same amount of money (if not more) for recruiting a substitute employee.

### Research Methodology

Previous research suggests that a construction firm's ‘failure’ with IT is primarily attributable to not meeting user expectations, which underlines the significance of the ‘soft’ human and organisational issues involved in IT (Irani and Love, 2001). Bearing this in mind, the authors adopted a research methodology that would involve and enfranchise an organisation and their senior staff so that theory and knowledge about the decision-making process for IT could be derived to develop an effective model for IT evaluation that takes accounts for both direct and indirect benefits and costs. The current research that is being undertaken involves a series of interventionist case studies undertaken by means of a structured-case research method (Checkland, 1995; Silverman, 1998; Carroll et al., 1998; Carroll and Swatman, 2000).

### Structured Case Method

The structured-case seeks to build theory, which may be seen as “a system of interconnected ideas that condense and organise knowledge” (Neuman 1991:p30) that attempts to explain, predict and/or provide understanding. The aim of adopting such an approach is to discover and discuss relationships between concepts, so as to build a ‘web of meaning’ with respect to the human and organisational issues of IT evaluation (Carroll and Swatman, 2000). The development of a series of conceptual frameworks (CF) as noted in Figure 1, from CF₁, CF₂… to CFₙ is used to demonstrate the process of knowledge and theory building where CFₙ is the latest version of the theory built to date. The theory-building process is not only inductive but is interrelated with practice (Carroll et al., 1998; Caroll and Swatman, 2000). Applied research can lead to theory building, which can lead to further field research and more theory building. Thus the research cycle can lead to changes to the CF. Each new CF expresses the pre-understanding for the next cycle, as part of the hermeneutic circle (Gummesson, 1991). That is, the natural human act and process of interpretation and understanding of the world (Carroll et al., 1998). Essentially, what is enacted is a spiral towards understanding, as current knowledge and theory lay the foundations for yet another research cycle that will expand, revise or validate the authors’ understanding of IT evaluation in construction. This is particularly appropriate for IT, as it is an area distinguished by rapid changes in practice, which suggest the need for theory, and practice to become closely intertwined (Galliers, 1997). It is envisaged that the structured-case will enable theory to be developed that will reflect the concerns, problems and issues facing construction firms (Carroll and Swatman, 2000).

### Initial Conceptual Framework

The initial CF₁, which is depicted in Figure 1, has been derived from the literature, practitioners’ insights, and the authors’ experiences, which we consider to be important in the...
IT evaluation process (Irani et al., 2000). As there has been limited IT evaluation research undertaken in construction, the authors have used the normative literature to develop a CF for IT evaluation in construction at an enterprise level. As mentioned above, the authors' particular interests centre on the importance of the human and organisational costs associated with the evaluation process, as it is considered that the implementation of IT can have cascading effects throughout an entire organisation if these issues are not adequately addressed.

![Conceptual Framework](image)

**Figure 1. The conceptual framework (CF1) for construction IT evaluation**

**Justification of CF1**

The case for looking at a stakeholder perspective during the evaluation process itself has been well justified through the literature (e.g., Wilcocks and Lester, 1991). The importance of establishing taxonomies that take into consideration human and organisational aspects is a significant departure from conventional approaches used to evaluate technological systems. By taking a stakeholder perspective, it is suggested that the process of investment and implementation of IT should be driven by the organisations capability, the level of competency available and the inherent culture, values and level of experience available...
within the construction firm. It is therefore of vital importance that the following steps are closely adhered to in preparation of introducing change based on the implementation of IT:

- corporate commitment by ‘selling’ the need for change and the importance of such an investment;
- communicating clearly the value, benefits and implications for such investments on people and the organisation;
- leading the change proactively by ensuring that the culture per se is not averse to modernisation and investment IT;
- the level of employee involvement and participation, empowerment of employees at various levels within the organisation; and
- a skill audit will have to take place prior to major investments and a necessary strategy of skill upgrade and development.

A stakeholder perspective during IT investment programs cannot and should not be considered as a one off, project-based approach. It is evidently clear that as construction firms enter an era based on IT, a continuous process of technological appraisal, evaluation, upgrading and integration needs to be adopted. This therefore indicates that stakeholder orientation should be a continuous process. Collective experience, expertise, experimentation, continuous improvement initiatives will all gradually impact the benefits that can be derived from IT adoption. The cost taxonomies proposed in CF1 are the scope of consideration in this research. Evaluating IT investments it is no longer appropriate to include only conventional, economically based costs as the justification process needs to focus on a variety of benefits, which may lie at a strategic, tactical and/or operational level (Figure 1).

The First Research Cycle

The first research cycle aimed to validate or further revise the proposed CF1. The construction firm (ABC) used for the first research cycle was a large construction and engineering contractor that has constructed many of Australia’s best known building’s and landmarks. In 2001 the annual turnover for ABC was $430.5 million, and in 2002 it was $474.7 million. ABC has a solid client base, and it estimates that 80 percent of its current projects are for repeat clients. ABC has offices throughout Australia and overseas in Hong Kong, Indonesia and Papua New Guinea.

ABC has an extensive IT infrastructure in place. At a project level, ABC only uses basic technologies as devices for inter-organisational communication. While ABC acknowledges the importance of IT as a mechanism for improving inter-organisational communication, the financial rewards that may be obtained from using IT are not considered to be beneficial in the short-term. At an enterprise level a packaged software system supports ABC’s management information system (MIS). The package software system is used to store information on a central server for estimating, cost planning, contract administration, and document control purposes. ABC has upgraded and introduced new hardware and software during the last two years, for example, document imaging systems, videoconference systems, e-mail and Internet and Intranet systems. The direct financial cost of implementing these technologies was estimated to be $650,000 for the state office involved in this study, which had an estimated turnover of $60 million in 2002. ABC’s management team did not undertake a rigorous IT evaluation process and as a result, has encountered several difficulties especially with the software system used to support strategic the management of business processes.
Data Collection

The data collection procedure has followed the major prescriptions by most textbooks in doing fieldwork research (e.g., Yin, 1989). A variety of secondary data sources were used to collect data with regard to the development of IT taxonomies for evaluating IT investments, such as internal reports, budget reports, and filed accounts. A variety of data sources have been used to derive the findings presented in this paper, which include interviews, observations, illustrative materials (e.g., newsletters and other publications that form part of the case study organisation’s history), and past project documentation. The authors have extensive industrial experience in the construction industry and have used this, together with a predefined interview protocol to determine the data needed for the research.

Interviews were conducted with the Regional Manager, Company Accountant, Quality Manager, Estimating Manager, Construction Managers, Project Managers, and general support staff at the enterprise-level. The duration of each interview was approximately thirty minutes, where every interview was conducted on a one-to-one basis, so as to stimulate conversation and breakdown any barriers that may have existed between the interviewer and interviewee. The authors acted as a neutral medium through which questions and answers were transmitted and therefore endeavoured to eliminate bias. In considering this, bias in interviews occurs when the interviewer tries to adjust the wording of the question to fit the respondent or records only selected portions of the respondent’s answers. Most often however, interviewer bias results from the use of probes, where these are follow-up questions and are typically used by interviewers to get respondents to elaborate on ambiguous or incomplete answers (Jick, 1979; Shaughnessy and Zechmeister, 1994). In trying to clarify the respondent’s answers the interviewer was careful not to introduce any ideas that may form part of the respondent’s subsequent answer. Furthermore, the interviewer was also mindful of the feedback respondents gained from their verbal and non-verbal responses. As a result, the interviewer avoided giving overt signals such as smiling and nodding approvingly when a respondent failed to answer a question.

Findings and Discussions

The variables identified in the CF were found to be interdependent and thus impossible to them. We use the generic headings from the proposed framework to present our initial findings and discussion. Taxonomies of indirect costs that were found to be experienced are can be found in Tables 2 and 3. ABC considers itself to be a pro-active and innovative construction and engineering organisation. They have a corporate philosophy founded on quality and as result operate a continuous improvement philosophy. The implementation of quality assurance and subsequently CI was a long and arduous task, but ABC are now reaping the benefits, eg, reduced rework, repeat client’s, increased market share and increased profitability.

Table 2. Classification of indirect human costs

<table>
<thead>
<tr>
<th>Indirect Human Costs</th>
<th>IT Cost Factor</th>
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</thead>
<tbody>
<tr>
<td>Management/Staff Resource</td>
<td>Integrating computerised administration and control into work practices</td>
</tr>
<tr>
<td>Management Time</td>
<td>Devising, approving and amending IT/IS and marketing and procurement strategies</td>
</tr>
<tr>
<td>Cost of ownership: System Support</td>
<td>Vendor support/trouble shooting costs</td>
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Employee Involvement

Table 3. Classification indirect organisational costs

<table>
<thead>
<tr>
<th>Indirect Organisational Costs</th>
<th>IT Cost Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity Losses</td>
<td>Developing and adapting to new systems, procedures and guidelines</td>
</tr>
<tr>
<td>Strains on Resources</td>
<td>Maximising the potential of the new technology through integrating information flows and increasing information availability</td>
</tr>
<tr>
<td>Process Re-design</td>
<td>The re-design of organisational functions, processes and reporting structures</td>
</tr>
<tr>
<td>Organisational Re-structuring</td>
<td>Covert resistance to change</td>
</tr>
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</table>

Decision-making

While reaping the benefits of their quality program ABC senior management (regional manager, company accountant, and construction manager) considered it was time to embrace the new millennium with a revised business strategy that centred on the strategic use IT. Senior management was convinced that IT would improve their organisation’s business performance. Attendance at business seminars on the strategic use of IT, as well as the encouragement of State Governments to adopt IT were factors that influenced management’s decision to invest and develop and an extensive IT infrastructure. Senior management considered that they were taking a long-term view when they decided to invest in IT. The regional manager stated that “...investing in IT will improve communication within the organisation, especially our sites. We consider this to be a long-term investment and are committed to being an innovative organisation”. This statement contradicts the claim made by Lefley (1994) that managers are more susceptible to make short-term decisions with respect to new technology than any other aspect of their company. Lefley (1994) further states that management is often reluctant to make long-term investments, as they are more amenable to their shareholders by investing in low risk short-term projects, which show high profits. This did not appear to be the case in ABC, as the investment in IT was considered to be a strategic decision that would enable long-term benefits to be achieved. The company accountant stated that the decision to extend and implement IT was considered “...a must, if the firm is to remain competitive in the future”. A budget was prepared by the company accountant and then different IT requirements were ranked in order of preference and in terms of the greatest perceived benefit by department heads (quality manager, estimating manager etc). After each requirement was ranked a cost was then allocated, albeit a nominal figure.

Employee Involvement
At no point did those people ranking the various technologies consider the indirect costs of implementation. Moreover, it was revealed that end-users had not been invited to participate in the decision-making process. The authors’ found this surprising as ABC had always involved their employees in the organisation’s decision-making process. In fact, employee involvement was seen to have been the key to ABC’s success. So why were they not included in deciding the IT requirements of the firm? It was difficult to obtain an answer to this question and is something that the authors’ found puzzling to say the least. From the interviews undertaken with employees and management it was simply a case of “management knew best” in this instance. It was also observed from the interviews that certain managers had hidden agenda’s to push, as they sought particular technologies to improve the effectiveness of business processes they were involved with. Promotions and bonuses within ABC were related to performance, so if departments were performing well the respective departmental manager would be given due credit.

Leadership
There was a lack of leadership during the decision-making and implementation process. As a result there was a degree of confusion within the organisation as to who was responsible for leading the IT project. Essentially, departmental managers were responsible for implementing IT within their specific areas. This created a degree of confusion as the company accountant and quality manager, who were responsible for implementing the packaged computer system, did not coordinate the installation of software to individual machines with departmental managers. This resulted in a delay to the systems operation, which subsequently had negative consequences on employee morale. Software glitches were also encountered, which in turn had an impact on the productivity of employees. In hindsight ABC should have developed bespoke software that matched the requirements and needs of end-users. It was, however, considered cheaper (reduced development costs) to purchase packaged software and amend it to suit the requirements of the firm. However, this has been a cumbersome and time-consuming task. The costs associated with amending the software are on going. ABC acknowledges the problems associated with purchasing packaged software and are now considering bespoke software.

Communication
The reasons why ABC introduced new technologies were deemed to be obvious by management but not so to employees. Meetings were held to discuss the implementation process after the decision to invest had been made. There was little communication between management and employees, especially those on site. One project manager made the following comment “I do realise that IT can improve the way we do things, but what am I going to do. I’ve never used a computer in my life. There’s no way I can start using one now...I’m almost 50”. What management had failed to do in this instance was inform staff that they would provide training and support for those using the new IMS.

Resources Development
Time was a factor that was overlooked during the implementation process. It was assumed that employees would conduct their day-to-day activities as well as become involved with the installation of new systems and technologies. Many employees found themselves working overtime during the implementation phase. Expertise was brought in from outside to assist with the installation of software and hardware systems. However, this was not considered enough, as users had specific software and hardware requirements that had not been taken into account. While it was acknowledged during the initial decision-making process that
an IT manager and a technician were needed they were not employed until six months after the initial implementation phase. This was because it was difficult to recruit experienced IT personnel, as there was a shortage of IT personnel with construction industry experience.

Training costs were not considered during the evaluation phase, they were simply overlooked. The costs of training were found to be considerable, as almost all people within the organisation had to be sent on an IT training course. Employees using the new technologies and software programs stated that their productivity had decreased and that they had to work longer hours. Moreover, it was revealed that while employees were away from their jobs due to re-training their colleagues work patterns were also disturbed. During this unfamiliarity phase, the losses in productivity did not go unnoticed by senior management. The regional manager stated “We made a mistake thinking that employees would automatically take to the new technology. Morale was poor at one stage because we failed to communicate our intentions. We are now doing our best to provide assistance and support those employees that need it. You’ll always get teething problems when you introduce something new into an organisation, but sometimes you have to take a risk and deal with the consequences as they arise. In hindsight we should have done things differently”. These consequences could have been accounted for during the evaluation stage, which in turn would have reduced the firm’s overhead and operating costs. Noteworthy, it is estimated that the total cost (which is on going) for implementing IT may well be in excess of $2 million, which is three times that originally budgeted for by ABC.

**Human and Organisational Costs**

The implementation of the packaged software IMS and Intra-net system meant that information was more readily available, which improved decision-making and communication. The introduction of the new systems meant that single departments were no longer needed. ABC’s organisational structure was re-designed to enable teams to be formed for particular projects. The new systems required employees to become multi-skilled, as information was readily available. The organisational boundaries that had previously existed within ABC essentially acted as obstacles to information flow and decision-making. Business process needed to be re-designed, as there was no further need for functional departments. The change in organisational structure meant that multi-skilled teams were formed to perform activities for specific projects. The internal layout of ABC’s head office has become more open and overtime it is anticipated that this will influence the culture of the firm. The re-design of the ABC’s organisational structure resulted in management spending time on integrating new systems into current work practice; a cost that had not been allowed for during the evaluation phase.

Two estimators that were close to retirement found the notion of using IT to perform their work too daunting, and as a result took earlier retirement. If staff had been involved in the decision-making process then these employees would have been able to prepare themselves for the change that had been cast upon them. In this instance it is very difficult to demonstrate that IT caused these employees to retire. However, the changes imposed on the organisation would have probably favoured newer, younger employees who were able to learn more quickly. Thus, the older employees may have lost their credibility because their knowledge and experience would have been tied to the previous work methods. The dis-benefits often associated with IT are largely caused by the way individuals react to change and not IT itself. Too some extent this was the case at ABC, as employees were not confident in the decisions made by senior management because they had not communicated the reasons why change, in the form of IT, was being introduced. But, however good a firm is, at least
some employees will always suspect the motives of management, simply because that is how people behave when confronted with change.

The findings presented have resulted in a modification of the initial CF$_1$. The revised framework, CF$_2$, can be seen in Figure 2. Here it can be seen that we have separated indirect costs into organisational and human costs and have modified the cost factors. This new framework will now form the basis of our next case study.

![Figure 2. Revised conceptual framework (CF$_2$) for construction IT evaluation](image-url)

**Conclusion**

Construction firms need to undertake a rigorous evaluation process before implementing IT if they are to achieve improvements in their business performance, otherwise inefficiencies in
decision-making and resource deployment will prevail. In addition, management needs to look beyond the use of traditional modes of investment justification, (which are based on the use of economic appraisal techniques) and consider the introduction of indirect costs into the formal decision-making process. This should then provide a more realistic view of the investments’ implications rather that providing a selective picture of quantifiable project benefits and costs. Failure to include indirect cost implications not only questions the value of traditional justification processes, but also has implications regarding the actual successes of many IT deployments. The case study identified problems that arose from not undertaking a rigorous investment evaluation process. Problems associated with the deployment IT such as training, lack of end-user involvement, process re-design have been addressed by case study firm, but at a cost! Despite the associated cost the construction firm has experienced many benefits such as quality of service improvements, cost savings (reduction in clerical salaries etc), and improved communication. Our future research will use the revised conceptual framework as our reference point for examining indirect costs. However, benefits will also be examined because of interdependence that exists between cost and benefit management.

References


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