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Zahir Irani
Brunel University

Ahmad Ghoneim
Brunel University

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IDENTIFYING, MANAGING, AND CONTROLLING INFORMATION SYSTEM COSTS: AN EXPLORATORY CASE STUDY

Zahir Irani and Ahmad Ghoneim

Information Systems Evaluation and Integration Network Group (ISEing)

Department of Information Systems and Computing

Brunel University

Zahir.irani@brunel.ac.uk

Ahmad.ghoneim@brunel.ac.uk

Abstract

Cost is a significant factor that needs consideration during the appraisal of IT/IS investments due to the enormous amount of monies being invested. In addition, managers often determine the success or failure of IT/IS investment based on a retrospective view of whether the project was delivered within the budget allocated. However, a major barrier to the use of many methods that are integral to the appraisal of IT/IS investments is their failure to account for the indirect/intangible cost elements associated with many IT/IS projects. Furthermore, many managers remain unaware of the existence and nature of these indirect costs, which makes their inclusion within any robust appraisal process difficult if not impossible. In this paper the authors set the scene for longitudinal research that starts off reviewing the IT/IS evaluation literature associated with investment decision making and IT/IS related costs. In doing so, proposing a research agenda and scope that will form the basis of a longitudinal study. This paper will propose the scope of the research and report preliminary finding of the costs experienced by an educational institution in Egypt that has sought to establish an IT/IS infrastructure. The case study reports that although many managers were familiar with the indirect/intangible costs relating to IT/IS projects, they actively tried to avoid such costs during the evaluation process. The authors highlight the consequences of such avoidance and disregard of IT/IS costs.

Keywords: Costs; information systems; taxonomy; case study

Introduction

Organisational reliance on IT/IS continues to grow and is in part reflected by the large sums of money being spent on its adoption. The World Information Technology Services Alliance (WITSA, 2000) reported that the global information and communications industry surpassed the US\$ 2 trillion mark in 2000, and predicts it reaching the US\$ 3 trillion level by 2004. It therefore appears reasonable to suggest there may be an increased reliance on capital budgeting as a management process for allocating finances to the adoption of new technology. Love and Gunasekaran (1997) state that the driving force behind many IT/IS investments is strategically orientated, with typical benefits including higher product quality, increases in flexibility, and quicker response time. However, Irani and Love (2001) explain that most management executives remain uncomfortable with the available set of tools and techniques used to justify their investments. 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 *et al.*, (2001) found that managers tend to be myopic when considering IT/IS decisions, primarily because they have no sufficiently robust framework to evaluate the benefits and costs of IT/IS investments. Worryingly, management gives little or no attention to the 'hidden' or indirect costs surrounding IT/IS, which are reported by Hochstrasser (1992) as being up to four times greater than its 'direct' IT/IS cost component. The implications of ignoring these 'indirect' costs would appear far-reaching, and as a result, may lead to project 'cost-creep' or failure. The reason for this is that many companies only realise the significance of these additional cost factors

once their IT/IS project has been initiated. As a result, it is often considered too late to stop the investment because of the project's often-considerable momentum. Poor IT/IS decision-making can therefore result in significant financial losses, which can often translate into a loss in competitiveness, and jobs. The costs associated with such losses are invariably passed on to the customer. Clearly, there is much need for a model to assess and mitigate the indirect costs of IT/IS adoption. In doing so, offering management a more realistic insight into the cost implications of developing IT/IS infrastructures.

Project Scope

Traditional approaches to IT/IS appraisal are unable to accommodate the costs associated with deploying 'organisational-wide' IT/IS solutions. The reason for this is that such techniques are based on the use of financially quantifiable costs and benefits. Yet, increasingly the development of an IT/IS infrastructure is recognised as having intangible benefits and hidden cost, which cannot be easily accommodated within traditional justification processes. This project anticipates that the key to controlling and mitigating the costs of IT lies in the understanding of a particular organisation's social dynamics and both the collective and individual knowledge of its staff. In response, the aim of this research is to develop a model that management can use as a *frame of reference* to assess and mitigate the indirect costs (human and organisational) associated with developing an IT/IS infrastructure. The objectives of the research are therefore to:

1. Develop cost taxonomies associated with the evaluation of indirect IT/IS costs; and,
2. Identify indirect cost indicators that can be used by managers for justifying and building the business case for the implementation of an IT/IS infrastructure.

Expected Outcomes

This research will enable business organisations to inform and enrich their strategic plans and increase their competitiveness in national and international markets. Results from the research will also be used to develop new business processes and information systems. The outcomes of the research include:

- Cost factors and resulting taxonomies for IT/IS systems (which incorporate views from management executives, project managers, end-users, customers, suppliers and the like);
- A reference model that managers can use to justify their investment in IT/IS and to provide a deeper business knowledge underpinning organisational decision-making, and the role that stakeholders have in promoting, planning and managing IT/IS change.

Information Systems Evaluation: Cost Taxonomies

Traditional investment appraisal techniques are often used to appraise capital investments in IT/IS (Ballantine and Stray, 1999). These techniques are based on conventional accountancy frameworks, and often facilitated under the auspices of the finance director. They are specifically designed to assess the 'bottom-line' financial impact of investments, by often setting 'direct' project costs against quantifiable benefits achievable. Yet, as more organisations realise that such techniques are unable to accommodate strategic benefits and 'indirect' costs, many companies are left with the quandary of deciding which approach to use, if any. Consequently, there has been ubiquitous debate about the types of techniques that constitute meaningful justification. The inability of many companies to quantify the 'full' implications of their investments in IT/IS; 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. Small and Chen (1995) point out a lack of management guidelines to support investment decision making, with such implications forcing many companies to adopt one of the following positions:

- refuse to undertake IT/IS projects that could be beneficial to the long-term competitiveness of the organisation;
- invest in IT/IS projects as an 'act of faith'; or
- use creative accounting (assigning arbitrary values to benefits and costs) to pass the budgetary process.

Cost Implications of IT/IS Projects

The costs of IT/IS are often perceived to be easier to estimate than the benefits associated with such projects, however, Hogbin and Thomas, (1994) explain that this is rarely the case. The costs associated with IT/IS projects appear more tangible in nature because 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. However, this heuristic appears not to be solving the problem of IT/IS projects running over budget, as much of the problem lies in management not ‘fully’ understanding IT/IS cost portfolios. There might also be political and organisational reasons for not understating the cost implications of an IT/IS investment; the main one being the need to gain support for [the release of funds], and acceptance of the project, from senior managers.

Ezingear *et al.*, (1999) found that many manufacturing companies, ‘fail’ to account for the ‘full’ complement of IT related costs. Similarly, Hogbin and Thomas (1994) report that during the proposal generation process, management often allow for a contingency factor of between 10-25% of the projects’ costs, with this extra sum of money then being added to the projects’ budget before submission to decision makers. Clearly, this ‘fudging’ is not acceptable to best practice management, and demonstrates that managers are unclear of where the cost implications of adopting IT/IS lie.

The proposed research will add to the body of literature in the area of project management and IT/IS evaluation through developing taxonomies of costs and performance measures/metrics. It will also explore the grouping of IT/IS related costs that result from enterprise-wide information systems integration into cost taxonomies. The area of benefit classification is mature and well reported in the normative literature. Yet research surrounding cost classification remains under developed and reported in the normative literature, largely due to its negative connotation. It remains in nobody’s interest to highlight cost factors even though cost overrun remains a major contribution to information systems being deemed a failure. Table 1 presents a summary of the limited research surrounding cost taxonomies as reflected in the literature. Worryingly, there is *little* identification of associated costs elements within the taxonomies identified [with the exception of Irani and Love, 2001] and thus, the taxonomies reported in the literature [table 1] 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 1. Cost Taxonomies

Cost Taxonomies	Reference
Financial/non Financial Activities: These costs are classified according to the activities causing them thus, emphasising a causal relationship. Hence, reactive in nature.	Kusters and Renkema (1996)
Initial/Ongoing Costs: These costs are identified and assigned during the systems life cycle. However, they tend to be retrospective, which make their consideration during <i>ex-ante</i> 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.	Dier and Mooney (1994)
Direct/Indirect: Human and Organisational: 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.	Irani and Love (2001)
IS Cost Divisions – Management, Employee, Finance, and Maintenance: 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.	Mohamed and Irani (2002)
Initial Investment/Ongoing Costs: These are based around the costs relating to the development of an information system infrastructure (initial investment) and operation of the infrastructure (ongoing cost).	Remenyi <i>et al.</i> , (1996)

Financial/Non Financial Activities

According to Kusters and Renkema (1996), activities are either financial or non-financial. Financial activities induce costs and are the only costs considered when financially appraising an investment. While non-financial activities are not considered, such

are used to anticipate potential problems that may occur during the implementation of IT/IS projects. For example, activities such as resistance to change do not induce cost, thus are non-financial activities.

Initial/Ongoing Cost Classification

Dier and Mooney (1994) explain IT costs as being classified into two main categories: Initial costs and the ongoing costs. These two categories compose of lifetime cost of any system, although there is increasing debate about the start and end point in information system lifecycles. The lifetime costs were defined as ‘*The total attributable costs which are incurred throughout the life of a computer application*’ (Dier and Mooney 1994, p.4), while the ongoing costs were defined as ‘*the costs incurred from year to year in maintaining and modifying the application*’. Dier and Mooney (1994) argued that the initial costs of many IT projects represent a small percentage of its total lifetime costs.

Direct/Indirect Human and Organizational Cost Classification

Irani and Love (2001) confirm the model proposed by Hochstrasser (1990), which divides information system costs into direct, and indirect [human and organizational] components. Indirect human costs are concerned with the time, effort, motivation, training, and dedication of the human factor (i.e. project managers, IT staff, users etc.) throughout the IT/IS investment life cycle. On the other hand, indirect organizational costs include organizational issues affected by the implementation of IT/IS projects. These organizational issues include productivity, resources, business process re-engineering, organizational restructuring, resistance etc.

Cost Classification according to Tangibility

Remenyi *et al.*, (1996) define cost classification based on its tangibility. Costs are said to be tangible if they ‘*will directly effect the profit in an adverse way*’ while intangible costs are those which ‘*will indirectly lead to an increase in the cost profile*’. Intangible costs are not quantified [financial or otherwise], and might include things such as the cost of setting up a project team. According to Kaye *et al.*, (1995) tangible costs have a historical cost in accounting terms, and usually have a physical form. However, *intangible costs* have no physical form, and can only be estimated and cannot be based on past costs. That is why intangible costs are very difficult to measure and manage. Interestingly, Remenyi *et al.*, (1996) defined hidden cost to be an obscure cost that may occur in another department as a result of a new IS adoption. Kaye *et al.*, (1995) made no differentiation between the intangible costs and the hidden costs. He regards hidden costs as being a type of intangible costs.

An Exploratory Case Study

The Academy was initiated in 1972 as an Arab League specialized organization under the name “Arab Academy for Maritime Transport” educating, training, and preparing students in all areas of science and technology that are related to all elements and areas of maritime transport. At that time, the Academy offered a Bachelor Degree in Maritime Transport, in addition to special Engineering and Maritime certificates. Now, the Academy offers further educational programs, awarding the Bachelor Degree certificate in Engineering in the areas of Electronics and Communication, Computer Science, Mechanical Engineering, Maritime Engineering, Industrial Engineering, Power and Control, Structural Engineering, as well as Architectural Engineering. In addition, a Bachelor Degree in the areas of Business Administration, Hotel Management, and Tourism Management, are also being awarded.

The Arab Academy of Science, Technology and Maritime Transport (AAST) offers post-graduate education leading to the degree of Master of Science in Maritime Engineering, Electronics and Communication, Computer Science, Mechanical Engineering, Operations Research, International Transport and Logistics, Environment Protection and Maritime Law. This is in addition to a Master of Business Administration Degree that is offered on one of three bases: academic, professional, or business. Postgraduate diplomas in all the above-mentioned areas are also offered.

Sensing its responsibilities as an Arab League specialised organisation and a means of culminating joint Arab work, the AAST's endeavors to improve international relations for the benefit of its students and programs never cease. Hence, it extends its services

to the Arab world through offering some programs in Saudi Arabia and Kuwait. Moreover, new branches of the Academy were established in United Arab Emirates, Bahrain, Qatar, in addition to the new branch in Cairo.

Information and Documentation Center (IDC)

The main objective of the Information and Documentation Center is to develop the Management Information Systems that help users in different departments to do their work in easy, accurate, productive and compact way. It provides the infrastructure that links the whole Academy together. Systems are developed for Admission, Registration, Academic Fees, Academic Guidance, Library, all Financial Operations, Inventory, Purchasing, Personnel, Payroll, Medical Services, and most of the operations related to education, students, and security software system. A dual Pentium processor NCR 3455 server in a UNIX based environment using INFORMIX-SE database management system was representing the main computing facility in the center.

The case investigation into the costs associated with developing an IT/IS infrastructure focuses on the latest project conducted by the IDC, which in the integration of different systems and includes changing the current database from INORMIX-SE to INFORMIX DYNAMIC SERVER and upgrading all of their current hardware.

Cost Taxonomy: The Academics’ Perspective

Since the AAST is an Arab League specialized organization, it had to follow imposed restrictions in many areas such as in the costing and budgeting systems. An area that is crucial for the case study is the costing restrictions concerning costs classification. In order to study the IT/IS cost classification criteria in the AAST, it was necessary to take such restrictions into account. The Arab league determined certain cost classification criteria to be followed by all of its organizations including the AAST. These costs were general and can be used in any working environment. A summary of the eight cost categories are presented below in table 2.

Table 2. Summary of the AAST’s Cost Factors.

Cost Categories	Examples of Cost Elements
Employees Expenses	Salaries, wages, Bonuses, overtime, social security, health insurance.
Travel and Transportation Expenses	Accommodation, transportation, travelling compensation, Other type Expenses.
Service Requirements Expenses	Publications & Advertising, posting, publishing, phones, rents, Insurance (cars, buildings, labs, equipments)
Goods and Maintenance	Spare parts, water, electricity, materials, books, and depreciation (buildings, equipments, furniture, tools, PCs, Printers).
Capital Expenses	Buildings, furniture, equipment, and tools.
Main Board and Committees Expenses	Transportation (cars, buses), parties, Meetings Bonuses
Activities and Programs	Conferences, researches, Training programs, scholarships and grants.
Arab and International level Commitments	Contributions in Arab organizations, Contributions in International organization

When asked about how does the IT/IS costs fit in these eight cost categories, the Costing Manager (CM) replied:

‘Any IT/IS costs must be documented and classified under one of the eight cost categories, and it is the BM’s responsibility to include all the IT/IS costs in the Financial Statements using the predefined cost categories’.

The CM added that neither he, nor the Budgeting Manager (BM) and the Information and Documentation Center Manager (IDCM) could alter this cost heading, and that only the Arab League could change these cost categories and their elements. It was interesting to know that although the IDCM was very enthusiastic regarding commenting on the different cost classification

criteria from the literature review; he showed no interest in trying to implement any of them. He elaborated on this issue saying that:

'My main wish is for the people 'managers, employees' to "start" using the system first...When this day comes, I would begin worrying about the issue of the IT/IS costs classification'.

The IDCM along with the Integrated Simulator Center's Systems Manager (ISC'SM) were the two interviewees who examined the IT/IS cost classification criteria and gave their opinions and recommendations. The IDCM was responsible of the full renewal project implemented. In order to plan for such project, a full technical description and a primary cost estimation must be written in what is known as a Request For Proposal RFP made by a technical committee. The Financial Offers from different companies are then examined by a technical committee headed by the IDCM and a financial committee headed by the Purchasing manager. The IDCM then lobbies senior management to get their resources. Sometimes they even have to compromise either the functionality or the quality of the system (specification) in order not to exceed the budget limit approved. When the investment decision is made, the IDCM has only to wait for the Hardware and Software to be bought and installed without interfering in any financial operation related issues. Thus, IDCM does not know or care how the CM allocates and the IT/IS costs. Furthermore, the project is planned far in advance and is included in the yearly IDC's budget, which is revised and approved upon by the financial manager before the financial year starts. So each department has to specify its yearly budget (needs and 'estimated' costs based on the previous years spending, with a further 10 percent increase allocated for cost-creep).

The IT/IS investment decision only takes account of direct cost estimations. Hardware and software bought for the *new* system are considered assets of the AAST, and are included in the balance sheet while other indirect costs [depreciation] are calculated year by year in the yearly financial statement. The project's hardware, software maintenances, upgrades, and consumables are summed together with other similar projects' maintenance, upgrades and consumables of other departments to get the total cost of the IDC not giving any specific quotas for the IT project separately. For example, the cost of the two main PC's needed for the project is summed with any other hardware needed throughout the year for the center itself. If additional hardware or software is needed throughout the project's implementation stage, the IDCM has to write a Requirements Request to the BM specifying the technical requirements and their costs. The BM checks the IDC's budget and decides either to approve or reject this request. These new hardware or software needs are not recorded as additions to the project itself but as an additional requirements for the whole IDC, and the IDCM does not have to specify what these hardware and software are for exactly as long as he is still within the budget limits. The CM's duty is to allocate the costs regardless of their origin (being part of a IS project needs or a general need for the IDC).

The AAST is considered to be a decentralized institution, but actually when it comes to financial issues it is very centralized as both the IDCM and the CM explained. They stated that very low yearly budgets are allocated to each department so that every time something is needed, a requirement request is placed then negotiations regarding the urgency and necessity and costs of such need starts. In addition, the CM non-proudly confessed that all investment decisions and costs' allocations are based on 'act of faith' assuring that the cost classification is done on the same concept. For them the key issue behind such classification process is mainly to keep track of what was spent and who spent it.

Avoiding Budget Overrun

Budget overruns is not applicable because if a projects requires additional money (in addition to an accepted 10 percent rise), then sometimes it has to be postponed until the next 'financial' year for it to be included in the yearly budget. Another solution would be that the BM could allocate the project additional money from another projects' budget that were not fully spent. This way they insure that any money in addition to the estimated budget at the beginning of the year is not spent. In doing so, the reason for the increase in the budget is not investigated and ignored resulting from the bad management of IT/IS costs. The AAST policy is to cover for budget overrun not to try to identify the cost factors and managing and controlling them. Clearly, this is reactive and not proactive.

Avoiding IT/IS Indirect Costs

The AAST accommodates some of the indirect costs resulting from the adoption of the new system by passing the burden to the employees. This is demonstrated in the case of training, which leads to a loss in productivity during the learning curve and loss of employee time when helping other employees to use the new system. Also the overtime that results from the additional time

spent by the employees training to use the new system. The resistance to change to the new system that may result in loss in productivity because the system is not being used effectively.

When asked about the training of the IT staff, the IDCM replied:

"Training is essential and is regarded by employees as an opportunity to increase their skills and knowledge. It is done after the official working hours but no overtime is paid for it, because if an employee chooses not to attend the training course someone else would be also keen on attending such course».

Concluding Comments

High levels of IT/IS spend are not necessarily an indication of poor management and similarly, runaway costs are not a guarantee of success. It is not the level of expenditure on IT/IS that is important but the appropriateness of this expenditure; and how well it is managed. This paper has highlighted a number of cost models as reported in the literature, which all seek to offer different taxonomies for classifying IT/IS costs. There is however, conflict between the different models as each has a different way of looking at the not of cost. The authors of this paper have sought to outline a research agenda, which is currently in progress. In addition, an exploratory case study has been described, which has sought to highlight the complexity and legacy of existing thinking, which all seeks to highlight the need to establish new notions of what constitutes an IT/IS. The case study provided two main conclusions:

- Indirect costs cannot be avoided but instead must be managed.
- Indirect costs drivers may change but the costs still occur.

The case study also raised an important question that is of the usability of the different cost taxonomy models in real life. The answer to this question is that it does not matter whether the cost element is called covert resistance or cost A as long as we know what it affects and represents and as long as we can identify it. But the better and more logical identification leads to better management of the costs that in turn leads to better control over the costs. The control over the costs means that costs could be reduced which is the main aim when evaluating and appraising IT/IS projects.

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