# The role of top management in supporting the use of information technology in Australian hospitals

ROBERT REEVE AND GRAEME ROSE

Robert Reeve is an Associate Professor of Accounting at Macquarie University.
Graeme Rose is a Lecturer in Accounting at Charles Sturt University.

## Abstract

*The progressive use of information systems and information technology has the potential to transform the way complex organisations are managed and the way they operate. This article reports the findings of a study undertaken to examine the importance of various factors related to the progressive use of information technology in Australian hospitals. Our analysis of data from 84 hospitals shows that hospital size has a significant positive relationship with the progressive use of information technology, as does the chief executive officer's attitude to information technology; however chief executive officer participation in information technology activities does not. The implications of these findings for the role of top management are discussed.*

## Introduction

An information system uses information technology (IT) (primarily computers and telecommunications) to capture, transmit, store, retrieve, manipulate and display information used in one or more organisational processes. The information systems of organisations are increasingly becoming connected to those of their suppliers, customers, partners and to external information providers. Information systems offer capabilities that can be exploited by implementing systems that suit specific organisational needs and enable the organisation to better achieve its goals (Alter 1996; Zwass 1998). Information systems and IT in hospitals include systems that support both patient care and administrative processes, the management of these processes, and clinical and administrative knowledge work. Taken together, modern information systems and IT have the potential to transform the way organisations are managed and the way they operate (Jarvenpaa & Ives 1994).

This is certainly the case for hospitals, whether they be large metropolitan hospitals or smaller hospitals, such as those serving regional or rural communities. There are numerous opportunities to take advantage of IT, ranging from basic word processing and email, through to computerisation of personnel records, patient records, medical test orders and results, operating theatre schedules and inventories of medical supplies. There are also opportunities to take advantage of newer developments, such as accessing on-line medical databases to diagnose unfamiliar symptoms and sharing expertise using telemedicine.

However the implementation of IT is frequently unsuccessful (McFarlan 1971; Schewe 1976; Doll 1985; Weill 1991; Lederer & Sethi 1992; Benjamin & Levinson 1993). Ritchie (1997, p 62) points out that '…successfully implementing advances in information technology requires much more than investments in hardware and software'. While there are many factors that contribute to the success or failure of an implementation of IT, most experts agree that support by top management is essential (Rockart & Crescenzi 1984; Jarvenpaa & Ives 1991; Laudon & Laudon 1996; McNurlin & Sprague 1998; Zwass 1998).

This article reports the findings of a study undertaken to examine the importance of three factors related to the progressive use of IT in Australian hospitals. Two factors are associated with the type of support for IT provided by the chief executive officer (CEO) and the third is hospital size. Our study employed the theory and methodology developed by Jarvenpaa and Ives (1991) in their study of the role of the CEO in supporting the progressive use of IT in large US private sector firms.

The appropriate role for CEOs in achieving the progressive use of IT is not clear. Should CEOs personally participate in IT-related management activities, develop and maintain IT knowledge and keep abreast of IT developments relevant to their organisations? Alternatively, can CEOs better support the progressive use of IT by demonstrating a positive attitude towards IT and thereby communicate to staff the importance of IT to the success of the organisation? (Barki & Hartwick 1989; Jarvenpaa & Ives 1991). Jarvenpaa and Ives (1991) found that both CEO attitude to IT and CEO participation in IT had significant positive relationships with the progressive use of IT; with CEO attitude to IT having greater explanatory power. Our research tests the generalisability of these results to the Australian hospital context.

We also examine the effect of hospital size. Larger hospitals are generally more complex organisations than smaller hospitals (Neuhauser & Eigner 1987). This complexity, in terms of greater input and output, diversity and number of interdependent sub-units, leads to relatively greater task uncertainty, resulting in relatively greater information needs (Galbraith 1973, 1977). Therefore larger hospitals are expected to require more progressive use of IT than smaller hospitals. Smaller hospitals should be able to be managed and operated with relatively less investment in IT than larger hospitals, although it has been shown that higher performing small firms make more progressive use of IT (Raymond, Pare & Bergeron 1995). Larger hospitals are more likely to require

relatively greater investment in IT to assist the larger and more complex systems such as administration, communication, scheduling, human resource management and patient care.

Except for hospital size, the variables used in this study are those used by Jarvenpaa and Ives (1991) and are measured using their instruments. The dependent variable is progressive use of IT (PROGIT) in Australian hospitals. This is defined as the extent to which continual progress is made in the identification and evaluation of opportunities; and development, implementation, management and use of IT in achieving the hospital's goals. It follows that PROGIT is related more to the quality of IT used than to quantity.

In addition to hospital size, which is defined and measured in terms of the number of maintained beds, the other independent variables are CEO participation in IT and CEO attitude to IT. CEO participation in IT (termed 'executive participation' by Jarvenpaa and Ives) is defined as the CEO's knowledge of IT and substantive personal participation in its management within the hospital. CEO attitude to IT (termed 'executive involvement' in Jarvenpaa and Ives) is defined as the psychological state (attitude) of the CEO regarding IT; reflecting her or his vision for IT, and the degree to which he or she believes IT to be important for the hospital's success. The hypotheses tested in this study are therefore as follows:

- Hypothesis 1: there will be a positive relationship between CEO participation in IT and PROGIT, after controlling for the effects of CEO attitude to IT and hospital size.
- Hypothesis 2: there will be a positive relationship between CEO attitude to IT and PROGIT, after controlling for the effects of CEO participation in IT and hospital size.
- Hypothesis 3: there will be a positive relationship between hospital size and PROGIT, after controlling for the effects of CEO participation in IT and CEO attitude to IT.

## Data analysis and results

Data were collected through survey forms mailed to CEOs and senior information technology managers in 236 Australian hospitals, selected from Isaacson's 1994 yearbook. The sample was selected randomly from both public and private hospitals whose size was listed as greater than 100 maintained beds. Eighty-four useable responses were received. A comparison of respondents with non-respondents showed no significant differences in average hospital size, the proportion of public to private hospitals, or their geographic (state by state) distribution.

PROGIT was measured using a single question developed by Jarvenpaa and Ives (1991). Respondents were asked 'How would you describe your hospital's use of IT (information

technology and information systems)?' They were asked to choose from the following five responses:

- a leading hospital
- close follower
- middle of the pack
- somewhat behind, and
- laggard.

Hospital size was measured by the number of maintained beds in the hospital. CEO participation in IT and CEO attitude to IT were measured with multi-item scales, adapted from Jarvenpaa and Ives (1991). The four items used to measure CEO participation in IT were associated with the IT-related knowledge and activities of the CEO. The four items used to measure CEO attitude to IT were related to the CEOs' perceptions of the importance of IT and vision for IT. Refer to Jarvenpaa and Ives (1991) and Rose and Reeve (1997) for more details of the research methods employed. Copies of the survey forms are available from the authors.

Table 1 contains descriptive statistics for the variables used in this study. It shows that the hospitals in this study ranged from quite small (40 beds) to large (925 beds) with a mean size of 200 and standard deviation of 157 (beds). Seventeen hospitals reported having fewer than the 100 beds listed in their entries in Isaacson's yearbook. The mean size of these 17 hospitals was 79 beds. Data from these 17 hospitals were included in the analyses. The values for the other variables were measured on five-point (1–5) scales. All variables had mean values slightly above the mid-point (3), and all had standard deviations less than 0.9. All variables had approximately normal distributions except for hospital size, which was positively skewed. A square root transformation of this variable was undertaken which resulted in the approximately normal distribution required to use the variable in regression analysis.

**Table 1: Descriptive statistics** [N = 84]

| Variable name | Mean | Standard deviation | Minimum Possible/ Actual | Maximum Possible/ Actual |
|---|---|---|---|---|
| PROGIT [single question] **Y** | 3.26 | 0.88 | 1<br>1.50 | 5<br>5.00 |
| CEO participation in IT [4-item scale] $X_1$ | 3.16 | 0.71 | 1<br>1.75 | 5<br>4.50 |
| CEO attitude to IT [4-item scale] $X_2$ | 3.32 | 0.81 | 1<br>1.20 | 5<br>5.00 |
| Hospital size [number of maintained beds] $X_3$ | 200 | 157 | n/a<br>40 | n/a<br>925 |

In order to test the hypotheses, a multiple regression analysis was carried out of CEO participation in IT, CEO attitude to IT, and hospital size, on PROGIT. The regression equation was significant (p = 0.001) and explained approximately 20% of the variation in PROGIT ($R^2$ = 0.194). The results of this analysis are summarised in Table 2.

**Table 2: Results of multiple regression analysis of CEO participation in IT, CEO attitude to IT, and hospital size, on PROGIT** [N = 84]

**Multiple regression**
**PROGIT** = $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + E_i$

| Variable name | β | Beta | *t* | Significance of *t* *p-values* |
|---|---|---|---|---|
| CEO participation in IT $X_1$ | -0.020 | -0.016 | -0.151 | 0.880 |
| CEO attitude to IT $X_2$ | 0.438 | 0.404 | 3.739 | 0.001 |
| Hospital size $X_3$ | 0.038 | 0.205 | 2.039 | 0.044 |
| | $R^2$ | Adjusted $R^2$ | *F* | Significance of *F* *p-value* |
| | 0.194 | 0.164 | 6.456 | 0.001 |

Hypothesis 1 predicted a positive relationship between CEO participation in IT and PROGIT, after controlling for the effects of CEO attitude to IT and hospital size. That is, the greater the CEOs' knowledge of IT and participation in IT activities, the more progressive would be the hospitals' use of IT, regardless of the level of CEO attitude to IT and hospital size. Inspection of Table 2 shows CEO participation in IT has a negative standardised regression coefficient (beta) value of -0.016 which was not statistically significant ($p = 0.880$). This shows there is no significant relationship between CEO participation in IT and PROGIT, after controlling for the effects of CEO attitude to IT and hospital size, and therefore provides no support for this hypothesis.

Hypothesis 2 predicted a positive relationship between CEO attitude to IT and PROGIT, after controlling for the effects of CEO participation in IT and hospital size. That is, the more positive the CEOs' perceptions of the importance of IT, and vision for IT, the more progressive would be the hospitals' use of IT, regardless of the level of CEO participation in IT and hospital size. Inspection of Table 2 shows CEO attitude to IT has a statistically significant ($p = 0.001$), positive standardised regression coefficient (beta) value of 0.404, providing strong support for this hypothesis.

Hypothesis 3 predicted a positive relationship between hospital size and PROGIT, after controlling for the effects of CEO participation in IT and CEO attitude to IT. That is, the larger the hospital the more progressive would be its use of IT, regardless of the level of CEO participation in IT and CEO attitude to IT. Inspection of Table 2 shows hospital size has a statistically significant ($p = 0.044$), positive standardised regression coefficient (beta) value of 0.205, providing support for this hypothesis.

## Implications for the role of top management

Our empirical results show that, on average, the more positive the CEOs' attitude to IT, the more progressive is the use of IT in Australian hospitals, after controlling for the effect of hospital size and CEO participation in IT. This result is as expected. What is unexpected is our other finding that, on average, there is no relationship between the CEOs' participation in IT activities and the progressive use of IT in Australian hospitals, after controlling for the effect of hospital size and CEO attitude to IT. This result conflicts with Jarvenpaa and Ives (1991) who found significant positive relationships for both CEO support factors. However, we have no reason to doubt our empirical analysis which was more rigorous than theirs. They carried out two simple regression analyses, one for each factor. We used multiple regression analysis, therefore simultaneously controlling for the effect of the other CEO support factor and we also controlled for hospital size. Therefore, we believe that this conflict in findings is explained by differences between the CEOs of the Australian hospitals we surveyed and the CEOs in the large private sector firms surveyed by Jarvenpaa and Ives. For instance, CEOs in Australian hospitals may not have the same level of IT exposure or education which could result in their direct participation in IT activities being ineffective.

CEOs have ultimate responsibility for the performance of their hospitals and if they are to operate efficiently and effectively they need to make progressive use of IT. However CEOs' time is scarce and valuable. They need to identify the most appropriate and effective way of supporting the progressive use of IT within their hospitals. One implication of our findings for management is that it is more appropriate for CEOs to communicate their vision for IT, and their view of the importance of IT for the hospital's success, than engage personally in IT-related management activities. This finding could come as a relief to CEOs who do not feel comfortable with the rapid developments in IT, even though they do understand its importance. The message to CEOs is that they do not necessarily need to engage in IT-related activities. Instead, they can communicate their belief in the value of IT in other ways. The findings in this study suggest that the most crucial aspect of this communication is the climate of support that CEOs are able to provide to the organisation. That is, it will be more effective for CEOs to communicate their commitment and support for IT, rather than become personally active in an area in which they may have little expertise.

This should not, however, be interpreted to mean that CEOs of Australian hospitals should never personally participate in IT-related activities. There are some situations in IT development and implementation projects where the personal participation of the CEO is essential.

IT projects almost always cause changes (either to work practices and/or to organisational and management structures) and these changes often give rise to resistance or conflict. The more parts of the hospital that are to be affected by the new system, the more likely is change, resistance and conflict. It is often impossible for IT specialists or junior and middle-level user representatives to overcome this resistance or resolve the conflicts because they either do not know the organisational area well enough, or do not have any formal authority over the staff and managers involved. In situations like this, for a project to succeed, it is essential that one senior manager take responsibility for the success of the project. This manager must be sufficiently senior to have formal authority over all managers whose departments are impacted by the new system. In some projects, where the proposed system impacts upon departments whose managers report directly to the CEO, this role (often known as Executive Sponsor of the project) will have to be taken on by the CEO (Gane 1989). This example of direct personal participation in IT activities by the CEO is of the type envisaged in the findings of the Clwyd Resource Management Project into the performance of hospital information systems. This project reported that there needed to be 'specific identification in the project's management of who was responsible and accountable for identifying and realising the benefits as envisioned' (Ritchie 1997, p 60).

Our empirical results also show that, on average, larger Australian hospitals make more progressive use of IT than smaller hospitals, after controlling for the effects of CEO attitude to IT and CEO participation in IT. This result is as expected. Larger hospitals are generally more complex organisations than smaller hospitals (Neuhauser & Eigner 1987). This complexity, in terms of input and output diversity and number of

interdependent sub-units, leads to relatively greater task uncertainty resulting in relatively greater information needs (Galbraith 1973, 1977). To maintain performance levels hospitals must respond to these information needs in the way they are structured, managed and operated. Responses in all hospitals will include the use of:

- the hierarchy of authority
- rules, programs and procedures, and
- self-organising sub-units with decentralised decision-making authority.

If a hospital becomes larger and more complex, the responses to the increasing task uncertainty and information needs will include mechanisms to increase the ability of the hospital to process information. These mechanisms include:

- the progressive use of IT
- the use of lateral relations (joint-decision processes which cut across the lines of formal authority and include direct contact, liaison personnel and temporary inter-departmental committees)
- complex lateral relations, such as permanent inter-departmental committees
- integrating personnel (for example, project managers and unit managers), and
- the matrix organisation structure (Galbraith 1973, 1977, 1995).

In addition, if a hospital becomes larger and more complex, the responses to the increasing task uncertainty and information needs will include mechanisms to reduce the need for information processing. Mechanisms that reduce the need for information processing include:

- the use of slack resources (for example, queues, waiting lists, buffer inventories, under-utilisation of facilities), and
- the formation of self-contained structures – self-organising sub-units which, in addition to decision-making authority, are provided with all resources to enable them to function independently (Galbraith 1973, 1977, 1995).

Not only is the demand for PROGIT greater in larger hospitals than in smaller hospitals, but larger hospitals also have a greater capability to supply that demand. Larger hospitals can benefit from economies of scale and scope. They can justify employing larger numbers of specialist IT staff and investing larger amounts in hardware and software because they can spread these costs over a larger number of activities.

Our results have some clear implications for the role of top management in Australian hospitals with regard to their involvement with IT. However, our study was exploratory and could be refined and extended by further research. For instance Jarvenpaa and Ives (1991) recommend that attention be given to better measures of the progressive use of IT, and suggest that individual level factors such as decision-making style and leadership style be brought into future research. We suggest that additional organisational level variables, such as ownership mode (public or private) be included in future research.

It would be useful, for instance, to know whether private hospitals, being more strongly influenced by the need to recover all costs, are more likely to make progressive use of IT than public hospitals.

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