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# Intranet Use for Management Accounting Systems in Hong Kong Public Hospitals: An Analysis Using Partial Least Square Approach

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## Abstract

*This study examines the relationships of organization support, user characteristics, task characteristics, and intranet characteristics for using intranet applications to support Management Accounting in Hong Kong public hospitals.  The research attempted to identify how the interactions of these antecedents helped to achieve Intranet User Information Satisfaction (IUIS) and thus efficiency of Management Accounting in hospitals in terms of Information Quality of Management Accounting Systems (MASIQ).  A mixed research approach integrating case study and survey research under a quantitative paradigm was adopted. Partial Least Squares analysis was used to examine the data.  The case study results reflected that use of intranet applications could support Management Accounting in hospitals. The survey results of 157 managers and executives in Hong Kong public hospitals showed that IUIS had a direct significant impact on MASIQ.  Meanwhile, user characteristics as IS Experience improved IUIS, and the extent of task characteristics also improved the performance of MASIQ.  The results have several implications for Accounting Information Systems management.*

**Keywords:** Information Quality of Management Accounting systems; Management Accounting Systems; Intranet; Hong Kong public hospitals

## Introduction

A critical question currently facing the management of health services in Hong Kong is "how to utilise limited government resources to suite the increasing public demand" (Ho, 2000).  It is critical because the Government has kept on reducing subvention to public hospitals (Hong Kong Hospital Authority, 2006). Health service is the third largest sector in terms of government spending (Hong Kong Government, 2006), and the expense in this sector keeps on increasing to match the health care demand of the aging population.

In Hong Kong the bulk of public expenditure on health service, financed through general tax revenues, is channelled through a statutory body, the Hospital Authority (HA).  In recent years, it has always been a concern if technology can help to improve the situation through efficacious and efficient management and control of health service.  HA has planned to build a health information infrastructure to network all healthcare providers, to support the electronic health records of all citizens, and to provide the public with an electronic gateway to health knowledge (Hong Kong Hospital Authority, 2006).

Intranet is been increasingly used in this venture as it is flexible and is not restricted by operating platform. Intranet facilitates communication, distributes information, and allows project coordination within the same organization (McChesney III, 2000). Through these structures, intranet supports platform-independent information access and updates,

communication-intensive business functions, and interpersonal communications. However, Intranet based applications are not worth pursuing if the end users are not satisfied with them. In view of the concern of Hong Kong Hospital authority, the impact of intranet use to support Management Accounting Systems (MAS) in Hong Kong public hospitals is explored in this research. Thus following predominant research questions is studied:

(i)What are the major determinants of Information Quality of Management Accounting Systems (MASIQ) and Intranet User Information Satisfaction (IUIS)?

The next section provides background to this study. This is followed by the research model and hypotheses, research methodology and instruments. Finally, results are described followed by discussions and conclusions.

## Background
### *Intranet use and management accounting systems*
Intranet and Web-enabled applications provide management with a working set of comprehensive intra-organizational and inter-organizational systems (Korgan et al., 1997). These systems organise information horizontally across the departments, and vertically through drill-down reporting capabilities. Intranet applications also enhance the information aspects of Management Accounting Systems (MAS).

Management Accounting Systems incorporate the structure, processes, tools, and content for the provision of information to aid Management Accounting in areas of management control and decision-making (Anthony and Govindarajan, 2001; Lowe, 1993). Several studies on the design of Management Accounting Systems (e.g. Chenhall and Morris, 1986; Gordon and Miller; 1976; Gordon and Narayanan, 1984; Larcker, 1981) have examined the information attributes as those relating to the focus of information, the quantification and its horizon. Chenall and Morris (1986) derive a structural set of instruments to measure the information quality of Management Accounting Systems (MASIQ). This information quality is conceptualised as a formal system designed for providing information to managers. Scope, timeliness, and levels of aggregation (including an orientation to formal decision models) are three dimensions of MASIQ (Chenhall and Morris, 1986).

The scope dimension has three sub-dimensions as focus, quantification, and time horizon (Chenhall and Morris, 1986; Gordon and Narayanan, 1984; Larcker, 1981). It is viewed as a continuum with narrow scope at one end and broad scope at the other. Narrow scope information has been linked with traditional accounting systems in that these systems are limited to providing information that is internally focused, financial, and history-based information. Broad-scope information is information related to external environment, which may be economic (such as GNP, market sales, and a company's market share) or non-economic (such as consumer tastes, competitors' actions, and technological advances).

The timeliness dimension is conceptualised into two sub-dimensions: frequency of reporting and speed of reporting. Frequency pertains to how often information is provided to managers, while speed refers to the time lag between when a manager requests for information and when the required information is provided to the manager (Bouwens and Abernethy, 2000). Timely information facilitates MAS to report on the most recent events and to provide rapid feedback on management decisions (Chenhall and Morris, 1986).

The aggregation dimension provides summary information by functional area (i.e. summary reports on activities of other business units, or other functions of the organization), by time period (e.g. month, year) or through decision models (supporting marginal analysis, inventory models, discounted cash flow analysis, what-if-analysis, cost-volume-profit analysis) (Chenhall and Morris, 1986). From Information Systems perspective, these three MASIQ dimensions are the essences of information quality that facilitate the support of the Management Accounting Systems.

The Intranet User Information satisfaction (IUIS) with respect to MAS use has been adapted from various sources including Delone and McLean (1992, 2003). In Management Accounting little empirical research has been conducted on the impact of user information systems satisfaction on MAS use. This study will therefore contribute to management knowledge by carrying out field research in this area.

### Information technology applications in public hospitals

For the efficient and effective utilisation of the government budget through advanced technology, Hong Kong Hospital Authority deployed significant resources to Information Technology (IT) in public hospitals.  Since 1997, HA has developed different IT systems and applications for management and control.  They provide and share information with staff from all aspects and areas of HA for enhancing awareness and knowledge with the ultimate goal of improving hospital services (Hong Kong Hospital Authority, 2001: 2006).  The long-term benefits to the public include access to the most up-to-date information by health care professionals.

For hospital management, HA has developed over twenty-six information technology systems and applications for use by clinical and administrative/financial services departments of public hospitals (Hong Kong Hospital Authority 2001). Five of them work on intranet for use by hospital administrative services and/or financial services departments.  They are Annual Plan System, Dietetics and Catering Management System, Executive Information System, HA Intranet, and Pharmaceutical Supplies System.

HA also supports two Web-enabled applications for communication, Microsoft Outlook and Microsoft Outlook Calendar. Each hospital uses them for the provision of a collaborative environment for staff to communicate electronically. Nine public hospitals have even developed their own hospital intranets for enhancing internal management and control since early 1997.  It is of utmost importance to identify the antecedents: (i) of information quality of these intranet and web-based applications for hospital management, and (ii) of user satisfaction with respect to these systems. The research model presented next attempts to achieve these objectives.

### The proposed research model and hypotheses development

Figure 1 illustrates the research model which has been developed after extensive literature review of Information Systems and Management Accounting. Primary aspects of the model are based on the MAS Model (Chenhall and Morris 1986) and the Information System Success Model (DeLone and McLean, 1992; 2003).

The model shows that four groups of antecedents (organizational support, task characteristics, user characteristics, and intranet characteristics) are hypothesised to exercise positive effects on Intranet User Information Satisfaction (IUIS) and/or Information Quality of Management

Accounting Systems (MASIQ). IUIS is based on DeLone and McLean's model (DeLone and McLean, 1992), where user information satisfaction is a major key to system success. MASIQ is measured in terms of scope, timeliness and aggregation (Chenhall and Morris 1986). For organization performance, MASIQ has long been employed as a surrogate to reflect organization success in the Management Accounting literature (Bhimani, 2003; Bouwens and Abernethy, 2000; Mia and Goyal, 1991). In the current study, MASIQ is considered to support Management Accounting in Hong Kong public hospitals (Kim, 1988).
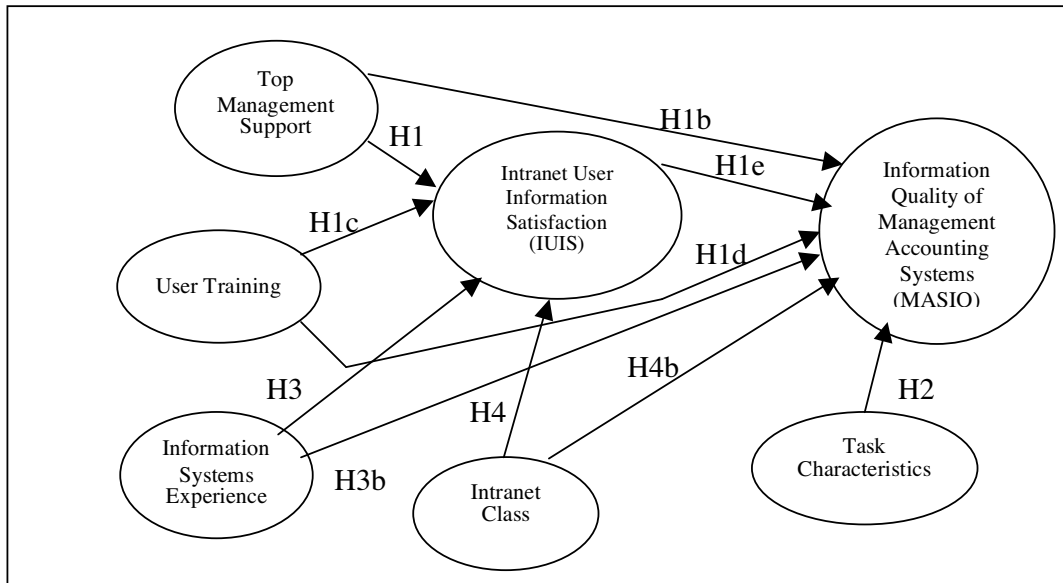


**Figure 1. The research model**

## *Research hypotheses*

The research model theorises that organization support in the form of Top Management Support and User Training in Information Systems affects MASIQ directly and indirectly through Intranet User Information Satisfaction (IUIS). Meanwhile, a user characteristic such as IS experience affects MASIQ directly and indirectly through IUIS. Also, the task characteristics, such as task variety and task structure directly affect MASIQ. In addition, an intranet characteristic as the sophistication of Intranet Class affects IUIS. To test the relationships of the above research model, four groups of hypotheses have been developed. It is noted that due to page limitation full derivation of the hypotheses are not presented in this paper.

## *Organization support*

Five hypotheses are presented in this group as follows.

**H1a**: Top Management Support positively influences the Intranet User Information Satisfaction (IUIS).
**H1b**: Top Management Support positively influences the MASIQ.
**H1c**: User Training in Information Systems positively influences the IUIS.
**H1d**: User Training in Information Systems positively influences the MASIQ.
**H1e**: IUIS positively influences the MASIQ.

*Task characteristics*
Task characteristics combine both task variety and task structure in the current research. One hypothesis in this group is presented as follows.

**H2**: The extent of task characteristics positively influences the MASIQ.

*User characteristics*
Two hypotheses in this group are presented below.

**H3a**: IS Experience positively influences the IUIS.
**H3b**: IS Experience positively influences the MASIQ.
*Intranet characteristics*
Two hypotheses in this group are presented as follows.

**H4a**: Sophistication of Intranet Class positively influences the IUIS.
**H4b**: Sophistication of Intranet Class positively influences the MASIQ.

Figure 1 shows the hypotheses.

## Research methodology
Traditional research design uses either an interpretivist or positivist approach. The former uses exclusively qualitative tools, while the latter predominantly uses quantitative tools but can also use qualitative tools. Attewell and Rule (1991) highlight the complementarities between quantitative and qualitative approaches. Bikson (1991), Gutek (1991) and Kling (1991) suggested that it is always best to utilise several methods of data collection to address the research issues adequately.

This study links Information Systems and Management Accounting that are two different disciplines of studies. It thus uses a mixed research design approach based on Gable (1994) which integrates case study (qualitative) and survey research methods (quantitative) for studying Information Systems.

## Instrumentation
### Case study interview
Through stratified sampling procedure, interviews were conducted with 3 big and 4 small public hospitals in Hong Kong. Each interview took 1 hour using 19 open-ended and semi-structured questions. The primary objectives of the interviews were to enhance the research model and to gauge the attitudes and feelings of the interviewees with respect to IUIS and MASIQ. Results largely reflected that top management support and user training contribute to intranet success in terms of intranet user information satisfaction
.

### Instruments/Questionnaire Development
The survey questionnaire instruments were adopted and modified from various sources. Baroudi and Orlikowski (1988)'s five items on information system satisfaction were adapted to measure intranet success. The three dimensions of MASIQ, scope, timeliness and aggregation, were modified from Chenall and Morris (1986). One item from Jarvenpaa and Ives (1994) was employed to measure top management support, and two items from Goodhue (1995) were used to measure user training.

Substantial instrument modification was required as these instruments were developed in the West. Instrument modification was done through pilot questionnaire distribution to six executives or specialists in different public hospitals in HK.

*Validity and reliability of questionnaire instruments*
Content validity was tested through the pilot questionnaire distribution. The results were satisfactory after accommodating the comments by hospital executives and specialists. 6-point Likert scale was used to avoid the likelihood of central tendency of Chinese respondents.

Reliability was measured through Cronbach's alpha (Cronbach, 1951). All Cronbach's alpha measured exceeded the generally accepted 0.65 reliability hurdle rate (see Table 1).

Table 1   Measurements from 157 valid responses

| V      Variables | Mean | Standard deviation | Cronbach's alpha |
|---|---|---|---|
| MASIQ (12 items, 6 points) | 2.66 | 0.95 | 0.886 |
| Intranet User Information Satisfaction (5 items, 6 points) | 3.93 | 0.92 | 0.951 |
| User Training (2 items, 6 points) | 3.68 | 1.12 | 0.712 |
| Top Management Support (1 item, 5 sub-questions) | 3.04 | 0.85 | NA |
| Task (10 items, 6 points) | 2.79 | 1.11 | 0.866 |
| IS Experience (free scale) | 6.73 | 4.02 | NA |
| Intranet Class (addition of 4 items, 6 points each) | 9.50 | 4.59 | NA |

*Questionnaire survey*
Survey subjects were the general managers and executives in financial services and administrative services departments of 37 public hospitals in Hong Kong. After telephone contact, questionnaires were first sent to the general managers of administrative services and financial services departments of the selected hospitals.  They were invited to administer the questionnaire distribution to their department executives.  Each survey participant was provided with a questionnaire together with a covering letter and a prepaid self-addressed envelope for the questionnaire to be returned directly to the researcher.  Questionnaires were pre-coded to enable non-respondents to be traced and followed-up.  The first reminder letter was sent to those who had not responded after three weeks, and the second reminder was sent after another three weeks.

**Survey results**
300 questionnaires were distributed and 164 questionnaires were returned. 157 valid questionnaires were identified after ruling out those with insufficient data or completed by inappropriate respondents.  It reflected a usable response rate of 52.33%.  The respondents had held their positions for an average of 5.69 years and had information systems experience of 6.78 years (see Table 2).

**Table 2   Demographic data of 157 valid responses**

| Age | 36.40 | | | | | |
|---|---|---|---|---|---|---|
| Sex | Male | 47.78% | Female | 52.22% | | |
| Years at current position | 5.71 | | | | | |
| Years of IS experience | 6.73 | | | | | |
| Organisa-tion level | Senior Management | 30 | Junior Management | 122 | Missing 5 | |
| Functions | Finance | Admin-istration | Human Resources | Procure-ment | Multi-functions | Missing |
| | 33 | 87 | 14 | 14 | 7 | 2 |

### *Initial structural model*

Partial Least Square (Chin 1998) was used for analyzing the data. A general partial least square (PLS) analysis is composed of two parts: the measurement part and the structural part. The measurement part specifies the relationships between the manifest variables (i.e. indicators) and the constructs (i.e. unobserved variables) that they represent while the structural part specifies the relations among the constructs (Cool et al., 1989).

The analysis of the measurement part was found to maintain the reliability and validity issues appropriately.

Figure 2 shows the structural paths of the research model.  The model comprises seven constructs.  Top Management Support (TMS), User Training (TRAIN), IS Experience (ISEXP), Intranet Class (IC), Task (TASK) are five exogenous constructs, while Intranet User Information Satisfaction (IUIS) is a mediated construct, and Information Quality of Management Accounting Systems (MASIQ ) is an endogenous construct.

The structural model is evaluated in terms of the explanatory power and significance of paths among the constructs. The explanatory power is evaluated by $R^2$ values of the endogenous constructs. Falk and Miller (1992) suggested that the variance explained, $R^2$, for endogenous variables should preferably be more than 0.10. The $R^2$ values for IUIS and MAS are 0.181 and 0.500 respectively, thus meeting the 0.1 requirement (see Figure 2).

In terms of the path coefficients, as shown in Figure 2, the t-statistics produced from a bootstrapping procedure indicate that four paths are not significant (t<1.64).  They are paths from TRAIN to IUIS, TRAIN to MASIQ, ISEXP to IUIS, and ISEXP to MASIQ. According to Barclay et al. (1995), non-significant paths may be deleted. Consequently, the paths from TRAIN to IUIS, TRAIN to MASIQ, and ISEXP to MASIQ are deleted. The fact that the two paths from TRAIN to IUIS and TRAIN to MASIQ are not significant reinforces the decision to exclude TRAIN from initial model.

One non-significant path, from ISEXP to IUIS, is retained for two reasons.  First, with regard to the path from ISEXP to IUIS, this study aims to assess the mediating effect of IUIS between user characteristics and MASIQ. ISEXP is deemed to be a substantial dimension of user characteristics. Second, the social perspective also supports the importance of Information Systems Experience.  In Hong Kong context, hospital executives usually feel

satisfied when they have previous exposure to new work practices and systems though they may not have sufficient training (Koch et al., 1992).
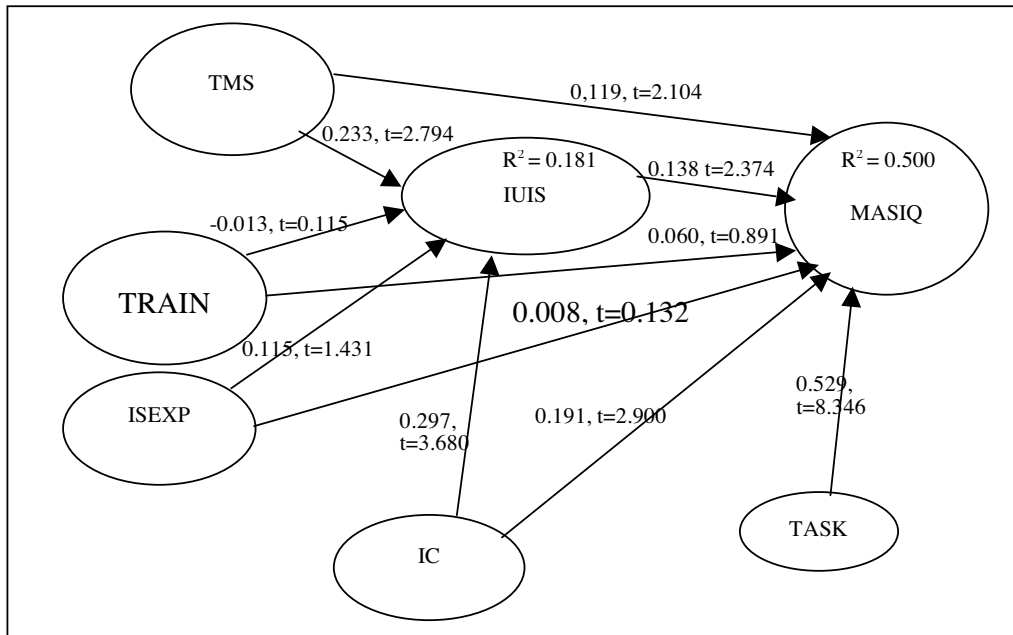


**Figure 2:  Structural path – the initial model**

## *Revised structural model*

The revised model of Figure 3 is the outcome of some adjustments with reference to the structural path examination of the initial model as discussed above.
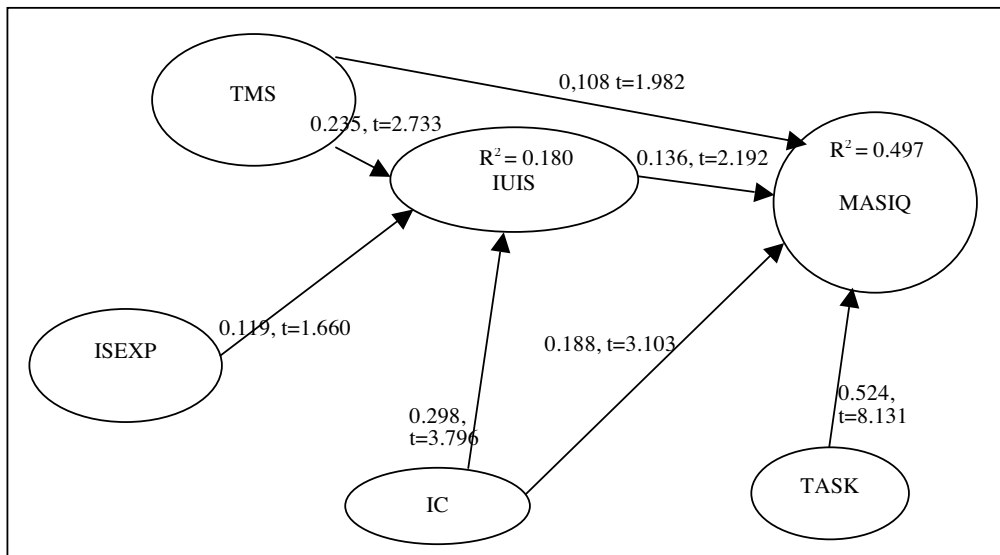


**Figure. 3. Structural paths – the revised model**

The revised structural model is evaluated with respect to the explanatory power and path significance.  The explanatory power of endogenous constructs suggests  that the revised model explains 18% of the variance in IUIS and 50% of the variance in MASIQ. The

explanatory power in the two constructs is almost the same as that in the initial structural model.

Further, to assess the significance of the structural paths, a bootstrapping procedure is undertaken. The results shown in Figure 3 indicate that all path coefficients in the revised model are significant (t>1.64) including the link from ISEXP to IUIS. The path coefficient of TASK to MASIQ is highly significant. Overall, the PLS analysis of the revised model produced satisfactory results.

*Results of hypothesis testing*
The tests of hypotheses show mixed results on the proposed relationships as illustrated in Table 3.

**Table 3  Summary of the hypothesis testing results (structural model)**

| Hypothesis | Findings | Results |
|---|---|---|
| **H1a:** Top Management Support positively influences the Intranet User Information Satisfaction (IUIS). | $\gamma$= 0.235 t-value=2.733** | Yes |
| **H1b:** Top Management Support positively influences the MASIQ. | $\gamma$= 0.108 t-value=1.982** | Yes |
| **H1c:** User Training in Information Systems positively influences the IUIS. | $\gamma$= -0.013 t-value=0.115* | No |
| **H1d:** User Training in Information Systems positively influences the MASIQ. | $\gamma$= 0.060 t-value=0.891* | No |
| **H1e:** IUIS positively influences the MASIQ. | $\gamma$= 0.136 t-value=2.192** | Yes |
| **H2:** The extent of task characteristics positively influences the MASIQ. | $\gamma$= 0.529 t-value=8.346** | Yes |
| **H3a:** IS Experience positively influences the IUIS. | $\gamma$= 0.119 t-value=1.660** | Yes |
| **H3b:** IS Experience positively influences the MASIQ. | $\gamma$= 0.008 t-value=0.132* | No |
| **H4a:** Sophistication of Intranet Class positively influences the IUIS. | $\gamma$= 0.298 t-value=3.796** | Yes |
| **H4b:** Sophistication of Intranet Class positively influences the MASIQ. | $\gamma$= 0.188 t-value=3.103** | Yes |
| * results of the initial model, ** results of the revised model | | |

In hypotheses H1a and H1b, the impact of Top Management Support on Intranet User Information Satisfaction and MASIQ are evaluated.  Significant results are found in these two top management related hypotheses.  Contrary to the prediction, the empirical evidence illustrates that the effects of User Training on both Intranet User Information Satisfaction ($\gamma$ = -0.013, t-value = 0.115) and MASIQ ($\gamma$ = 0.060, t-value = 0.891) are not significant.  As a

result, hypotheses H1c and H1d are rejected. This is somewhat surprising, as the results are inconsistent with the prior mainstream training studies (Chenhall and Langfield-Smith, 1999; Guimaraes et al, 1992). On the other hand, the effect of Intranet User Information Satisfaction on MASIQ is significant ($\gamma = 0.136$, t-value = 2.192). Thus, H1e is confirmed.

The impact of task characteristics on MASIQ is investigated by combining task structure and task variety to form Task. The current research provides strong support for the notion. Based on the revised model, the direct effect of Task on MASIQ, hypothesis H2, is strongly supported ($\gamma = 0.529$, t-value = 8.346).

The role of IS experience on Intranet User Information Satisfaction and MASIQ is evaluated in hypotheses H3a and H3b. In the initial structural model, H3a illustrates a weak link ($\gamma = 0.115$, t-value = 1.431) and H3b even illustrates a clearly weaker result ($\gamma = 0.008$, t-value = 0.132). H3a does improve to be significant in the revised structural model ($\gamma = 0.119$, t-value = 1.660). Therefore H3a is confirmed while H3b is rejected.

Finally, the findings illustrate strong support of sophistication of Intranet Class on Intranet User Information Satisfaction and MASIQ. Thus support is provided for hypothesis H4a, which states that there is a significant positive impact of sophistication of Intranet Class on Intranet User Information Satisfaction ($\gamma = 0.298$, t-value = 3.796). Hypothesis H4b, that suggests a direct positive effect of sophistication of Intranet Class on MASIQ ($\gamma = 0.188$, t-value = 3.103) is also confirmed.

## Discussion of results

Intranet User Information Satisfaction demonstrates strong and significant impact on MASIQ. This is in line with previous literature (Ives et al., 1983; Kim, 1988; Srinivasan, 1985). Task characteristics, in terms of task structure and task variety, also show significant relationships with MASIQ, as evidenced in the literature (Ramarapu et al., 1999; Zeffane and Gul, 1993).

Top Management Support has been found to exercise significant impact on Intranet User Information Satisfaction and MASIQ in the survey. The respondents were asked how they perceived top management's view on the role of Information Technology in their hospital. This significant relationship is an important finding in this study.

User Training has been found not to be significant in affecting Intranet User Information Satisfaction and MASIQ. To implement the new technology in the public healthcare sector, the Hospital Authority first develops the applications and then provides user-training workshops. In the multiple case studies an interviewee expressed that most Web-enabled applications were user-friendly; and thus users need not spend much time to learn IT applications. Another interviewee said that she could learn the applications herself. Therefore, contrary to the literature (Chenhall and Langfield-Smith, 1999; Guimaraes et al., 1992), the survey results show that User Training does not provide any significant effects on Intranet User Information Satisfaction and MASIQ.

IS Experience has been found not to have significant impacts on MASIQ. Most of the interviewees in the case studies stated that they picked up IT knowledge through learning by doing. As a result, the values of formal training and IS experience were diminished showing insignificant impact on MASIQ.

## Implications and conclusions

This study provides a conceptual framework to explain how hospital management improves performance through Information Systems. In Information Systems and Management Accounting, little research has been conducted to study the role of intranet on MASIQ. This study has developed, modified and validated research instruments that can be used to measure key indicators of top management support, user training, task, IS experience, intranet class, intranet user information satisfaction, and MASIQ for hospital management. From theoretical perspective it thus contributes significantly to the literature.

In practical aspect, efficient utilisation of limited government funding to public hospitals is now a significant concern to the Government and the public in Hong Kong. This study provides guidelines on key intranet systems, tasks and user strategies where hospitals can use intranet technology to support Management Accounting. In general, this study makes a significant contribution to advance the understanding of factors on how hospitals gain and sustain health delivery services through Information Technology.

Several limitations of the study should be noted, and the first limitation is the sample. Data were collected from Hong Kong public hospital managers and executives who used intranet and Web-enabled applications at work. Results may not be generalised to other industrial settings. Substantial modification of research instruments is required when conducting similar research in different industrial sectors. The results are also limited to the research model and the constructs (and items to measure the constructs) used. Future research should be directed towards these limitations.

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