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# INFORMATION TECHNOLOGY IN THE MALAYSIAN PUBLIC SECTOR

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## ABSTRACT

*This study explores the use of IT in the Malaysian public sector. It also investigates the role of three categories of contextual variables, namely external, organisational and technological, in relation to the level of IT usage. The results reveal that the usage level is significantly different among the four aspects of office activities being examined, i.e., information and analysis, daily operations, communication, and strategic application. Correlation analysis shows that technological factors are most influential on organisations with high level of IT usage rather than the external and organisational factors. For these organisations, good IT facilities that provide integrated IT applications for strategic intent with good user support and distributed structures promote the use of IT.*

## ABSTRAK

*Kajian ini memeriksa penggunaan IT dalam sektor awam di Malaysia. Ianya juga mengkaji peranan tiga kategori pembolehubah mengikut konteks, iaitu luar, organisasi dan teknologi, berhubung dengan tahap penggunaan IT. Hasil kajian mendedahkan bahawa tahap penggunaan IT berbeza dengan nyata sekali antara empat aspek aktiviti pejabat yang dikaji, iaitu maklumat dan analisis, operasi harian, komunikasi, dan aplikasi strategik. Analisis korelasi menunjukkan bahawa faktor teknologi paling berpengaruh dalam organisasi yang tinggi tahap penggunaan IT dibanding dengan faktor luar dan organisasi. Bagi organisasi ini, kemudahan IT yang baik yang menyediakan aplikasi IT bersepadu bagi tujuan strategik dengan sokongan pengguna yang baik serta berstruktur teragih menggalakkan penggunaan IT.*

*Keywords: IT usage, public sector, external factors, organisational factors, technological factors.*

## INTRODUCTION

Computerisation started in the Malaysian public sector as early as 1965. The focus then was on computerising routine functions in the financial and administrative sectors. For the early half of the 1990s (1991-1995), 1.4 billion Ringgit Malaysia (RM) (around US$0.4 billion[1]) was allocated for computerisation projects (Economic Planning Unit 1996, p. 456) in the public sector. The allocation was increased to RM2.3 billion (around US$0.6 billion) for investing in IT-related programmes and projects in the subsequent five years (Economic Planning Unit 1996, p. 467). The focus in the 1990s has been to integrate information technology (IT) into management processes, automating data collection so that accurate information can be generated for planning and control purposes, and for effective decision making.

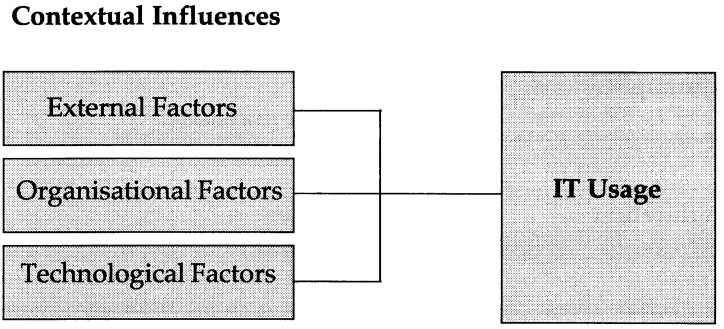
In response to a relentless pace of change in the business environment, Malaysian public officials are required to constantly search for more efficient and effective methods for the delivery of public services that satisfy customers. The public sector is expected to utilise IT to increase productivity and efficiency as well as to enhance service quality. Chiu, (1997), the Director-General of the Malaysian Public Complaints Bureau, suggests that efforts be directed at upgrading both the capacity and the reliability of administrative routines when improving work processes. Adopting better technology and encouraging innovations are recommended for the strengthening of work processes.

With billions of Ringgit allocated to satisfying service and other functional needs across various government departments, many challenges face public sector managers. These include: how IT can help and contribute in meeting the demands of a better-educated public in a fast-changing environment; the aspects of services in which IT is most likely to be useful, and thus be given priority in computerisation; and the factors that influence the contribution that IT can and does make to enhancing public services. This paper investigates the use of IT in the Malaysian public sector through a mail survey. It also examines factors associated with the use of IT in public agencies.

## THE RESEARCH MODEL

Figure 1 presents the research model developed and used in the study. The development of the model was influenced by past factor research and the unique characteristics affecting public agencies, such as government legislation, public accountability and budgeting methods (Cahill et al., 1990; Mohan et al., 1990; Babcock et al., 1995).

**Figure 1**
Schematic Diagram of the Theoretical Framework




*The Dependent Variable - IT Usage*

The dependent variable in this study is the extent of IT use. It is measured along four major aspects, namely strategic applications, communication, daily operations, and information and analysis. Generally, research into the use of IT has implicitly defined IT usage as either the amount of effort expended by individuals interacting with an information system (e.g. frequency, intensity, and diversity of use as in Thompson et al., 1991; Bergeron et al., 1995), or the diffusion of the technology (e.g. number of pieces of IT equipment and the number of applications as in Cragg and King, 1993; Rogers et al., 1996), or the degree of impact on certain activities by reports or other information products generated by the information system (e.g. impact on decision making, productivity, and business performance as in Sanders and Courtney, 1985; Yap et al., 1992; Stevens et al., 1994).

This study adopted the approach taken by Kraemer et al. (1981), Sparrow (1990), Stevens et al. (1994), and Sethi and King (1994) in the design of the IT usage constructs. The IT usage is operationalised by measuring the extent to which IT affects the four major activities within an organisation as listed in Table 1.

*The Independent Variables – Contextual Influences*

The influencing variables that have previously been found to influence the use of IT can be classified into four categories, namely personal, external, organisational, and technological (Stevens and LaPlante, 1986; Cahill et al., 1990; Nedovic-Budic and Godschalk, 1996). As this study is to measure the extent of IT use at the organisational level, it is appropriate to exclude variables under the personal category. Laudon (1985) explored the power of external and

**Table 1**
The Framework for Assessing IT Use

| Aspect | Attributes |
|---|---|
| 1. Strategic applications | Vision<br>Strategic decisions<br>Strategic plans |
| 2. Communication | Top-down<br>Horizontal<br>External |
| 3. Daily operations | Process control<br>Training and education<br>Service improvement<br>Working environment |
| 4. Information and analysis | Databases<br>Decision support tools<br>Information quality<br>• Timely<br>• Relevant<br>• Comprehensive<br>• Accessible<br>• Accurate<br>• Consistent |

organisational factors to explain the pattern of adoption, utilisation, and management of information system technology in criminal justice and concludes that both external and organisational factors provide more powerful explanations than either of them taken separately. Kraemer et al. (1981) agree that external variables are of some significance to several information-processing tasks of US local government. However, in their study on the impact of alternative policies for the management of information systems, they found that management strategies for shaping technology, structure, socio-technical design, and organisational context of computing operations are more important in explaining performance variations than is the external environment. The finding of King and Teo (1994) is also in agreement with Laudon (1985) and Kraemer et al. (1981) who found that internal factors play a stronger facilitating role than external factors.

A comprehensive list of factors influencing IT use has been compiled from past research literature (e.g. Cheney and Dickson, 1982; Boynton et al., 1994; Stevens

et al., 1994; King and Teo, 1994; Nedovic-Budic and Godschalk, 1996; Grover and Segars, 1996). They are classified into the three groups as shown in Table 2.

**Table 2**
Contextual Factors Influencing IT Use

| External factors | Organisational factors | Technological factors |
|---|---|---|
| economic climate | organisational structure | IT experience |
| IT marketplace | organisational size | IT facilities |
| legislation influence | managerial IT knowledge | user support |
| public accountability | top management support | IT integration |
| inter-organisational co-operation | financial resources<br>goal alignment<br>budgeting method | IT structure<br>IT competency |

## DATA SOURCE

*The Questionnaire*

Items for each aspect of the dependent variable (Table 1) were phrased by asking respondents how much IT has been used by their organisations to perform various processes along the four aspects identified. A seven-point Likert scale was used with 'not at all' and 'maximum feasible amount' as the extreme anchors.

Based on Table 2, a single item was formulated for each of the contextual factors influencing IT use. The contextual variables were measured using a seven-point semantic-differential scale, except for two factors: organisational size and IT experience.

The organisational-size factor was operationalised using a ratio scale to capture the number of staff employed in an agency. The size of the workforce was considered a more appropriate operational measure in this context than annual sales or market share because a public agency is not profit-driven and its market share is irrelevant. A five-point scale was used to categorise organisational size using the definition of SMEs by the Malaysian Ministry of International Trade and Industry (MITI). According to MITI, firms that employ fewer than 50 employees are classified as small enterprises while those with 50 or more employees but less than 150 belong to the medium category.

The IT experience of an organisation was operationalised as stages of technological growth. This enabled the IT experience to be categorised into one of the six stages based on the 'stages of growth' model developed by Galliers (1991). The movement through the stages is primarily a shift in the types of applica-

tions; a transition from principally clerical and transaction processing systems to interactive information systems concerned with strategy and long term planning. The actual number of years an agency has been involved in using IT was not used here. This was to minimise effort and time from respondents when answering this question, particularly if an agency has had IT long before the respondent joined the agency. Furthermore, an agency with ten years of transaction processing systems may not necessarily have more effective IT experience than another agency that began with its IT applications later but which has used them with strategic intent.

Once an initial research instrument had been developed, pretesting was carried out to ensure completeness and precision. Personal interviews were conducted with nine participants in order to improve the instrument progressively in terms of both content and construct validity. The selection of participants was designed to get maximum feedback from academic and practitioner experts. The instrument was continuously re-edited for the successive interviews. The process was complete when the last two participants made no recommendation for any significant changes.

The final version of the questionnaire was then pilot-tested with six university administrative officers in Malaysia. The questionnaires were completed in the presence of the researcher. The respondents faced no apparent difficulty in gauging the use of IT in their organisations.

*Targeted Respondents*

The survey questionnaire was sent to 110 Malaysian public agencies that have applied for the Malaysian Prime Minister's Quality Award, during 1992-1997. These agencies were selected because they represented the leading public agencies in Malaysia in terms of service quality.

A total of 42 responses were obtained; a response rate of about 40% is quite good for the mail survey.

The responses were examined for non-response bias by comparing early-late responses as well as known organisational characteristics such as size and location. The results indicated that non-response bias did not appear to be a significant issue.

The instrument was rigorously validated prior to any formal data analysis (Nunnally, 1978; Churchill, 1979). All the dependent constructs have acceptable reliability (Cronbach's alpha above 0.7) and construct validity (unifactorial construct with factor loadings well above 0.5 for all items). The same tests were deemed inappropriate for the independent variables as they were a single-item construct each.

## ANALYSIS AND RESULTS

The use of IT among responding Malaysian public agencies is slightly above average (4.8 on the 7-point scale) as shown in Table 3. The use of IT among the four aspects of office activities is significantly different at the 0.05 level ($F_{3,64}$ = 2.94, $p < 0.05$). Duncan's range test found that IT use on 'strategic application' is significantly lower than 'information and analysis' and 'daily operation' at the 0.05 level. The high usage of IT to produce quality information for decision making is supported.

**Table 3**
Extent of IT Use in Bussiness Activities

| Business Activity | Mean | Std. Deviation |
|---|---|---|
| Strategic application | 4.36 | 1.39 |
| Communication | 4.83 | 1.10 |
| Daily operations | 4.88 | 1.02 |
| Information & analysis | 5.08 | 1.01 |
| **Overall use** | **4.80** | **0.99** |

The three categories of contextual variables discussed in the early section were used to test for association with the extent of IT use using regression analysis. Prior to the analysis, violations of the regression assumptions were checked.

Following the rule recommended by Speed (1994) and Hair et al. (1995, p. 105), three regression analyses were initially run separately, one for each of the three categories of contextual variables, keeping the ratio of the number of observations to the number of independent variables above five, the minimum recommended ratio. Using the results of the three regression analyses, only significant independent variables were retained as predictors in the final regression. By doing so, it was hoped meaningful relationships between dependent and independent variables would be detected despite the small sample size. For this study the observation-to-variable ratios range from 1 : 5.3 to 1 : 8.4.

Taking only the independent variables that showed a significant effect on the IT usage in the previous three regressions, eight independent variables (two external, four organisational and two technological factors with $p < 0.10$) were entered simultaneously in the fourth regression. Five out of the eight independent variables yield a significant relationship with the IT usage (adjusted $R^2$ = 0.72). The regression results showing the significant correlation at the 0.10 level are presented in Table 4. It may be concluded that organisational factors affect IT usage more than external and technological factors.

**Table 4**
Significant Correlation Between IT Use and the Contextual Variables

| Contextual variable | Coefficient | Significance |
|---|---|---|
| Organisational size | 0.350 | 0.00 |
| Managerial IT knowledge | 0.355 | 0.05 |
| Top management support | 0.368 | 0.05 |
| Goal alignment | 0.331 | 0.06 |
| IT experience | 0.434 | 0.00 |

Cluster analysis was used to divide the 42 agencies into groups based on the four aspects of IT usage. These agencies could validly be partitioned into three groups, i.e. low, moderate and high IT-usage groups.

Having identified the three distinct IT-usage groups, further characteristics of the groups were examined. Table 5 shows that the three IT-usage groups are not significantly different in terms of organisational structure and size. Regardless of their level of IT usage, the three groups tend to adopt the conventional organisational structure where decision making is centralised. Most of them are also large organisations according to the SME definition of the Malaysian Ministry of International Trade and Industry (MITI) with 150 or more employees.

**Table 5**
Characteristics of the IT-Usage Clustering Groups

| | Cluster | | | |
|---|---|---|---|---|
| | **Low** | **Moderate** | **High** | **Pearson Chi-square** |
| **Organisational structure:** | | | | |
| centralised | 8 | 16 | 10 | 2.72 |
| decentralised | 0 | 4 | 4 | |
| **Organisational size:** | | | | |
| < 150 staff | 0 | 6 | 4 | 3.10 |
| ⊕ 150 staff | 8 | 14 | 10 | |
| **IT experience:** | | | | |
| uncoordinated functional IS | 8 | 16 | 4 | 14.74* |
| integrated IS | 0 | 4 | 10 | |

* 2-tail exact $p < 0.01$

However, the chi-square exact test revealed that the groups are different in IT experience at the 1% significance level (Table 5). The majority of the high IT-usage group also had a high level of IT sophistication with integrated information systems (Table 5). However, the situation is the other way round for the low and medium IT-usage groups. All of the low IT-usage members have less IT experience where most of their information systems are focused on meeting functional needs and are typically uncoordinated.

Using these groups, correlation analysis between the level of IT usage and contextual influences were conducted. The results are presented in Table 6. When the IT usage level is low, only two factors are significantly associated with the use. They are organisational structure and IT structure. This may imply that an organisation that adopts a centralized decision making structure and centralized IT management structure has a low IT usage level.

For the high IT usage group, technological factors play a vital role. Organisations with a high IT usage level have good IT facilities for business operations with extensive user support. They also use IT with strategic intent. The IT integration is good even though these organisations have a distributed IT management structure and decentralised decision making structure.

**Table 6**
Results of Correlation Analysis

| Contextual Variable | IT Usage Level | | |
|---|---|---|---|
| | Low (n = 8) | Moderate (n = 20) | High (n = 14) |
| **External factors** | | | |
| Economic climate | n.s. | -.541* | n.s. |
| IT marketplace | n.s. | n.s. | n.s. |
| Legislation influence | n.s. | n.s. | n.s. |
| Public accountability | n.s. | n.s. | n.s. |
| Inter-organisational co-operation | n.s. | n.s. | n.s. |
| **Organisational factors** | | | |
| Organisational structure | -.843** | n.s. | .547* |
| Organisational size | n.s. | n.s. | n.s. |
| Managerial IT knowledge | n.s. | n.s. | n.s. |
| Top management support | n.s. | n.s. | n.s. |
| Financial resources | n.s. | n.s. | n.s. |
| Goal alignment | n.s. | n.s. | n.s. |
| Budgeting method | n.s. | n.s. | n.s. |
| **Technological factors** | | | |
| IT experience | n.s. | n.s. | .562* |
| IT facilities | n.s. | n.s. | .679** |
| User support | n.s. | n.s. | .584* |
| IT integration | n.s. | n.s. | .726** |
| IT structure | -.727* | n.s. | .563* |
| IT competency | n.s. | n.s. | n.s. |

*p≤0.05 **p≤0.01 n.s. = not significant

## CONCLUSIONS AND IMPLICATIONS

Regardless of the level of IT usage, organisational factors are found to affect the use. However, when the level of usage is taken into consideration, correlation analysis shows that organisational factors are no longer significant. This is especially true when an organisation already has a high level of IT usage. Technological factors are most influential on high IT-usage organisations rather than the other two categories of contextual factors. For these organisations, good IT facilities that provide integrated IT applications for strategic intent with good user support and distributed structures promote IT use.

The results indicate that for an organisation to increase its IT usage level, it has to decentalise its organisational structure and shift the IT management from a centralised to a distributed structure.

This study was conducted on the Malaysian leading public agencies. The results reveal that the IT usage level is slightly above average. Obviously the findings cannot be generalised to the whole public sector because these agencies are likely to have good IT facilities. Based on this, one may conclude that the actual IT usage level in the Malaysian public sector is in fact rather low. With billions of ringgit allocated to the IT projects, much is yet to be achieved. Maybe public managers should look at the technical factors to start with. As there is a difference between the high and low IT usage groups in terms of organisational structure and IT structure, maybe the top management of the low usage group should re-examine the management structure of their organisation.

## ENDNOTES

1. Using the exchange rate in mid 2000.

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