

Factors Influencing the Effectiveness of Information System Implementation Among Small and Medium Manufacturing Enterprises in Malaysia

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ABSTRACT

This study examined information system (IS) effectiveness and its influence factors in the specific context of small and medium manufacturing enterprise (SME). The model evaluated the importance of manager participation in IS implementation, manager IS knowledge and accounting knowledge, and external experts (vendors, consultants, government agencies, and accounting firms) for IS effectiveness. The sample included 232 SMEs registered with the Federation of Malaysian Manufacturers. The results showed that manager accounting knowledge, and the effectiveness of vendors and accounting firms, are essential for IS effectiveness. Overall, the results suggested that managers of SMEs need to acquire sufficient accounting knowledge to help them better understand business information requirements. Secondly, SMEs should engage qualified vendors who have experience and understand unique characteristics of SMEs to overcome their lack of IS knowledge. SMEs should also exploit their good relationship with accounting firms to help them implement effective IS. Finally, it is important for SMEs to learn from their IS implementation so that opportunities can be recognised and priority given to initiatives that help IS support their information needs.

Keywords: Information systems effectiveness; information systems success; information technology adoption; small and medium enterprise; Malaysia.

ABSTRAK

Artikel kajian ini mengkaji keberkesanan sistem maklumat and faktor-faktor yang mempengaruhi keberkesanan dalam konteks firma yang bersaiz kecil dan sederhana (IKS). Model kajian menilai kepentingan penglibatan pengurus dalam proses pembangunan sistem maklumat, pengetahuan perakaunan dan sistem maklumat pengurus, dan penglibatan pakar luaran seperti pembekal, perunding, agensi kerajaan dan firma perakaunan terhadap keberkesanan sistem maklumat yang dibangunkan oleh firma IKS. Sampel kajian terdiri dari 232 firma IKS yang berdaftar dengan Persatuan Pekilang Malaysia. Dapatan kajian menunjukkan bahawa pengetahuan perakaunan pengurus dan penglibatan pembekal serta firma perakaunan telah memainkan peranan yang penting dalam menentukan keberkesanan pembangunan sesebuah sistem maklumat firma IKS. Secara keseluruhannya, dapatan daripada kajian ini mencadangkan supaya pengurus-pengurus firma IKS perlu mempunyai ilmu perakaunan yang mencukupi bagi membantu memahami keperluan maklumat perniagaan mereka. Kedua, firma IKS perlu mendapatkan khidmat nasihat daripada pembekal yang bertauliah dan berpengalaman serta memahami ciri-ciri unik firma IKS bagi mengatasi kekurangan pengetahuan mereka dalam bidang sistem maklumat. Firma IKS juga perlu memanfaatkan hubungan baik mereka dengan firma perakaunan bagi membantu mereka membangunkan sistem maklumat yang berkesan. Akhir sekali, firma IKS perlu belajar daripada proses pembangunan sistem maklumat mereka bagi membolehkan mereka mengenal pasti peluang serta memberikan keutamaan kepada usaha-usaha yang dapat membantu menyokong keperluan maklumat mereka.

INTRODUCTION

Governments and economists view small and medium enterprise (SME) sector as the mechanism by which national growth is created (Pollard & Hayne, 1997). Therefore, the flexibility and responsiveness of SMEs to adapt to changing demands is a key component of the country's economic growth strategy (Hunter & Long, 2003). In 2006, the Malaysian National SME Development Council reported that the SME sector comprised 99.2% of total business establishments and employed more than 5.6 million workers. The SME sector also contributed 32% of the real gross domestic product (GDP) and 19% of the total export value of the country. These data demonstrated that SMEs are essential for the prosperity of Malaysia.

As an economy based on knowledge emerges, information is considered crucial for the survival of any organisation, including SMEs (de Guinea, Keoley & Hunter, 2005). Furthermore, the globalisation of products, services, markets, and competition has increased the need for flexibility, quality, cost effectiveness, and timeliness (Hunter and Long, 2002). A key resource for attaining these requirements is an effective information system (IS) (de Guinea et al., 2005). Hunter and Long (2002) claimed that IS has revolutionised business practices and now plays a more central part of business strategies. Effective IS would lead to more available and more quickly retrieved information including external information, internal information, and previously encountered information (Huber, 1990).

SMEs, however, have unique characteristics compared to their larger counterparts. In fact, many studies had found that firm size is directly associated with IS effectiveness (de Guinea et al., 2005). The concepts of "resource poverty" and "technology diffusion" could provide an explanation for this uniqueness. According to Thong, Yap, and Raman (1996), resource poverty refers to the lack of financial and human resources. Similarly, technology diffusion theory argued that lack of knowledge inhibits firms from implementing IS. In case of SMEs, the lack of financial resources and internal expertise has forced them to make minimal commitments to IS implementation. For example, Cragg and King (1993), Ballantine, Levy, and Powell (1998), and Duxbury, Decady, and Tse (2002) found that the

main perceived barriers to the IS implementation among SMEs were the lack of time, financial resources, and skilled personnel. Therefore, SME managers tend to make business decisions on ad-hoc basis (Marriot & Marriot, 2000). While SMEs are considered flexible organisations that facilitate rapid and accurate assessment of their environment in order to respond to the goal of gaining opportunities (El Louadi, 1998), this approach often leads to an absence of formal business and IS planning (Ballantine et al., 1998). Consequently, results regarding large business, in particular relating to IS environment, may not apply to SMEs (Raymond, 1985). Therefore, Burgess (2002) suggested that there is a need to conduct additional research within the specific framework of SME.

This study had two main objectives. The first objective was to explore the level of IS sophistication, manager participation in IS implementation, manager IS knowledge, manager accounting knowledge, and the effectiveness of external experts commonly engaged by SMEs. Secondly, combining the theory of technology diffusion with the resource-based theory of the firm, this study aimed to identify factors that influence IS effectiveness in the specific context of manufacturing SMEs in Malaysia. This issue is worthy of study for several reasons. Firstly, Malaysia is seeking rapid developments of its technology-based environment. The establishment of the Multimedia Super Corridor (MSC) and the National Information Technology Agenda (NITA) in 1996 placed a priority on Malaysia to create a new generation of knowledge workers. These efforts are consistent with the increasing globalisation of demand and the utilisation of information technology as a competitive weapon. Secondly, SMEs represent about 91% of the total manufacturing establishments, thus having a significant role in the country's industrialisation programme (Ismail & King 2005). Despite this, the extent, mode, and quality of IS adoption among Malaysian SMEs are still lagging behind those of developed countries (Ismail, Tayib, & Abdullah 2003). Thus, a study investigating the factors that influence IS effectiveness may deepen current understanding of IS implementation in SMEs not only in Malaysia but also other developing countries of similar interest and environment. The

findings may also highlight the effectiveness of the policies and directions set by the Malaysian government.

Using technology diffusion and resource-based theories as a theoretical foundation, the next sections explain the theoretical background of the study and development of the research model, involving seven hypotheses about seven variables which were identified as likely to be associated with IS effectiveness. In the following sections, the results are discussed, the theoretical and practical implications are described, and the limitations of the study are identified.

THEORETICAL BACKGROUND

This study combined the theory of technology diffusion (Attawell, 1992) with the resource-based theory of the firm (Wennerfelt, 1995). Both theories have been adopted by previous researchers as a theoretical foundation to investigate the roles of managerial commitment and external IS experts to overcome the lack of knowledge and resources that SMEs face in the implementation of IS and, therefore, could influence the effectiveness of their IS (Thong et al., 1996; Thong, 1999, 2001; de Guinea et al., 2005).

According to Attawell's (1992) theory of technology diffusion, businesses tend to delay technology adoption due to the lack of knowledge about how to implement and operate IS. For example, Ballantine et al. (1998) found the lack of skilled personnel leads to the absence of business and IS strategies in SMEs. Ismail and King (2007) argued the lack of manager understanding of strategic accounting information inhibits SMEs from aligning their accounting information systems (AIS) capacity with AIS requirements. Similarly, Marriot and Marriot (2000) found that financial awareness among managers of SMEs varies considerably which then leads to ineffective IS implementation in many SMEs. In these circumstances, Thong et al. (1996), Thong (2001), Yap and Thong (1997), and de Guinea et al. (2005) argued that mediating entities, such as vendors, consultants, and government agencies, could play a vital role in the diffusion of IS. While the business managers could provide the expertise

in their areas of operation (de Guinea et al., 2005), a combination of advice from several external experts could provide relevant information for effective IS implementation. In addition to the three external experts commonly found in the IS literature, Davis (1997) and Mitchell, Reid, and Smith (2000) argued that accounting firms could also play a major role in IS implementation for SMEs. While accounting firms could advise SMEs in the areas of costing, expenditure, and cash flow to support monitoring and control (Mitchell et al., 2000), consultants and vendors could help them choose the right technology to match the business information requirements (Yap, Soh, & Raman, 1992; de Guinea et al., 2005). Consequently, the support of these external experts lowers the absence of both informational and technical knowledge regarding IS implementation that SMEs face.

Furthermore, Wennerfelt's (1995) resource-based theory of firm stated that businesses are collections of resources where the value of a resource is partially contingent upon the presence of other resources. Since SMEs often operate under severe time, financial, and expertise constraints (Cragg & King, 1993), they tend to control their limited funds for IS purposes (Yap, 1989; Thong, Yap, & Raman, 1994). Nevertheless, Thong (2001) argued that managers of SMEs have the power to commit resources toward the implementation of IS. In this case, managerial commitment can be a major factor that would contribute to the successful implementation of IS projects. Their commitment can be in the form of having sufficient IS and accounting knowledge, and active participation in IS implementation. Therefore, taking technology diffusion and resource-based theory into consideration, the conceptual model for this study theorised that managerial commitment and external expertise are factors that can alleviate the knowledge barrier and resource poverty that SMEs face in their use and implementation of IS.

The importance of management commitment for IS effectiveness in SMEs has been recognised consistently in the MIS literature (Yap et al., 1992; Cragg & King, 1993; Thong et al., 1996; Igbaria, Zinatelli, Cragg, & Carage, 1997; Thong, 1999, 2001; Seyal & Abd Rahman, 2003; de Guinea et al., 2005). According to Yap (1989), there are two reasons why managers support IS

implementation. Firstly, managers are in the best position to identify business opportunities for the exploitation of IS. The reason is that managers are the ones who understand their businesses the best (Thong et al., 1996). Thus, managers can bring IS into alignment with corporate objectives and strategies (Jarvenpaa & Ives, 1991). Secondly, IS implementation requires substantial investment and has an impact on the whole organisation (Yap, 1989). In the case of SMEs, managers have the authority to ensure sufficient allocation of resources and create a more conducive environment for IS implementation (Lucas, 1981). In addition, managerial commitment in the form of IS knowledge and participation in IS implementation would encourage users to develop positive attitudes toward the use of IS, and contribute to a smoother transition in the way work is achieved between non-use and use of IS (Thong et al., 1996). Furthermore, Igabria et al. (1997), Foong (1999), and de Guinea et al. (2005) found that management commitment is positively associated with the perceived ease of use and perceived usefulness of IS within SMEs. Therefore, management commitment toward IS can make the difference between successful and unsuccessful IS implementation (de Guinea et al., 2005).

IS effectiveness is one of the most common dependent variables in MIS literature (DeLone & McLean, 1992; Thong et al., 1996; Seddon, 1997; Foong, 1999; Thong, 2001). Raymond (1990) defined IS effectiveness as the extent to which IS actually contributes to achieving organisational goals. However, IS researchers are still wrestling with the problem of which construct has the greatest influence on IS since the definition and conceptualisation of IS effectiveness vary considerably among studies (de Guinea et al., 2005). Among the popular measures of IS effectiveness include IS usage (Lai, 1994; Magal & Lewis, 1995; Foong, 1999), user satisfaction (Bailey & Pearson, 1983; Montazemi, 1988; Yap et al., 1992; Raymond & Bergeron, 1992; Foong, 1999), and project success, service success, and economic success (Soh et al., 1992).

In an attempt to present an integrated view of the diverse approaches to defining IS effectiveness, DeLone and McLean (1992) synthesised a six-dimensional taxonomy based on a review of 180 published conceptual and empirical studies, namely, system quality,

information quality, system use, user satisfaction, individual impact, and organisational impact (Hunton & Flowers, 1997). Systems quality focuses on technical characteristics of the IS itself, such as system reliability, features and functions, and response time. Information quality refers to quantitative and qualitative characteristics of the IS output, such as information clarity, completeness, usefulness, and accuracy. System use reflects recipient consumption of the IS output such as regularity of use, number of queries, duration of use, and frequency of report requests. User satisfaction indicates recipient response to the IS such as overall satisfaction, enjoyment, difference between information needed and received, and software satisfaction. Individual impact refers to the effect of information on recipient attitude and behaviour, such as design effectiveness, problem identification, and improved individual productivity. Finally, organisational impact measures the effect of information on organisational performance indicators, such as contribution to achieving goals, cost/benefit ratio, overall productivity gains, and service effectiveness.

While many models have been proposed, IS effectiveness in this study was assessed using DeLone and McLean's (1992) model. Ballantine et al. (1998) described the model as "one of the more complete and better known". According to Ballantine et al. (1998), the model consolidates previous research, classifies the measures of IS effectiveness into plausible groupings, and thus has intuitive appeal, begins to identify different stakeholder groups in the process, and a number of researchers have considered it to be a suitable foundation for further empirical and theoretical research, and as such it has met with general acceptance. However, with the exception of Al-Mushayt (2000), previous studies examined the model on a piecemeal basis. Al-Mushayt's (2000) study represented the first attempt to validate DeLone and McLean's (1992) model as a summated measure for IS effectiveness in a large business setting. Results of the study suggested that the model is valid, unidimensional, and reliable, and can be summated. Therefore, using similar constructs used by Al-Mushayt (2000), this study examined IS effectiveness and its influence factors in the specific context of Malaysian manufacturing SMEs.

RESEARCH MODEL

Figure 1 depicts the research model, where seven variables are seen to be associated with IS effectiveness: managerial participation in IS implementation (X_1), IS knowledge (X_2), accounting knowledge (X_3), consultants (X_4), vendors (X_5), government agencies (X_6), and accounting firms (X_7). The dependent variable is IS effectiveness (X_8). The hypotheses of this model and a justification of the measurement of each variable are presented in the following discussion.

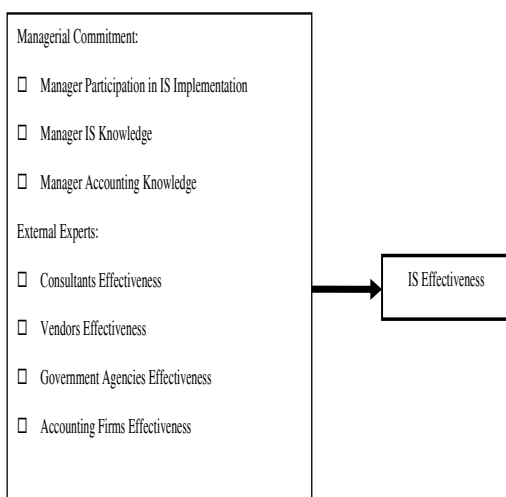


Figure 1: The Research Model

Managerial commitment plays an important role in IS implementation in SMEs (Thong & Yap, 1995; Igbaria et al., 1997; Lertwongsatien & Wongpinunwatana, 2003; Seyal & Abd Rahman, 2003). Manager commitment in the form of participation in the IS project can bring IS into alignment with the firms' objectives and strategies (Jarvenpaa & Ives, 1991). Their participation would also encourage users to develop positive attitudes toward the IS project, and thus is more likely to result in effective IS. More importantly, the manager has the authority to ensure sufficient allocation of resources for the IS project (de Guinea et al., 2005). Therefore, it is expected that in firms where managerial participation is prevalent, there will be a higher degree of IS effectiveness.

H_1 : There is a positive relationship between managerial participation (X_1) and IS effectiveness (X_8).

In addition to manager participation, researchers have also consistently found that manager IS knowledge is essential for the effectiveness of IS implementation (Seyal, Rahim, & Rahim, 2000; Thong, 2001; Hussin, King, & Cragg, 2002). Managers that are aware of the capabilities of existing and new technologies would be able to choose the right technology for their firms (Hussin et al., 2002). Since accounting is an important component of modern IS within SMEs (Mitchell et al., 2000), Ismail and King (2007) argued that managers with both IS and accounting knowledge are in a better position than those without the knowledge. These managers can better understand the firms' information requirements and then use their IS knowledge to determine IS deployment that matches the firms' information needs. Therefore, it is expected that in SMEs wherein the managers possess sufficient IS and accounting knowledge, there will be a higher degree of IS effectiveness.

H_2 : There is a positive relationship between manager IS knowledge (X_2) and IS effectiveness (X_8).

H_3 : There is a positive relationship between manager accounting knowledge (X_3) and IS effectiveness (X_8).

One key factor that contributes to the effectiveness of IS implementation in SMEs is the involvement of external IS experts such as vendors and consultants (Igbaria et al., 1997; Thong, 1999, 2001; de Guinea et al., 2005). However, Yap and Thong (1997) argued that government assistance, in addition to vendors and consultants, play an equally important role in accelerating IT adoption among SMEs. Furthermore, Davis (1997) posited that the accounting firm is an alternative but equally important source of advice for SMEs. His argument is supported by Breen and Sciulli (2002) and Hartcher (2003). These studies found accountants, the accounting profession, industry associations, and IS training

professionals play important roles in encouraging SMEs to computerise their accounting systems. Advice offered by these external experts enable SMEs to gain a broader perspective of both their information needs and information processing capacity. Therefore, it is expected that firms engaging these external experts will achieve higher degrees of IS effectiveness.

- H₄: There is a positive relationship between consultants effectiveness (X₄) and IS effectiveness (X₈).
- H₅: There is a positive relationship between vendors effectiveness (X₅) and IS effectiveness (X₈).
- H₆: There is a positive relationship between government agencies effectiveness (X₆) and IS effectiveness (X₈).
- H₇: There is a positive relationship between accounting firms effectiveness (X₇) and IS effectiveness (X₈).

In order to test the hypotheses, the research model is represented by the following regression equation:

$$X_8 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

where:

β_0 = constant; X₁ = participation; X₂ = IS knowledge; X₃ = accounting knowledge; X₄ = consultants; X₅ = vendors; X₆ = government agencies; X₇ = accounting firms; X₈ = IS effectiveness; and ε = error term.

The regression equation treated IS effectiveness (X₈) as the dependent variable and manager participation in IS implementation (X₁), manager IS knowledge (X₂), manager accounting knowledge (X₃), consultants effectiveness (X₄), vendors effectiveness (X₅), government agencies effectiveness (X₆), and accounting firms effectiveness (X₇) as the independent variables.

The following sections explain the methodology adopted and the measurement of the research variables.

RESEARCH METHOD

The focus of this study was on IS effectiveness in SMEs. This was further restricted to manufacturing firms because the manufacturing sector can provide a range of levels of IS sophistication (Cragg, King, & Hussin, 2002). The Malaysian Small and Medium Industries Development Corporation (SMIDEC) defined SMEs in manufacturing, manufacturing-related services, and agro-based industries as enterprises with full-time employees not exceeding 150 or with annual sales turnover not exceeding RM25 million. However, SMEs in this study were defined as any unit having between 20 and 150 employees. The number of employees is the most commonly used international definition in the literature, since in some cultures, small firms are reluctant to disclose precise financial details. Very small firms (with less than 20 employees) were excluded to increase the probability of sampling computerised firms.

To achieve this, a mail questionnaire survey was carried out to gather the data. The Federation of Malaysian Manufacturers database provides a total of 771 addresses of SMEs as defined in this study. Fifty addresses were used for the pre-test and pilot test, and the remaining 721 were used for the main survey. Following Dillman's (1978) suggestion, the questionnaire was refined in three stages: pre-testing with academics and research students, pre-testing with firm managers, and pilot testing with firm managers. The pre-test aimed to clarify the wording of both the questionnaire instructions and questions, whilst the pilot test attempted to examine patterns of respondents' answers, and thus their understanding of the questionnaire.

The questionnaires were addressed to the manager of the firms. Managers were chosen to be the respondents of this study because they were more likely to have valid perceptions of the IS approach adopted by the firms. This is because the manager commonly makes most key decisions and is perhaps the only person who can harness IS to achieve the firm's objectives and strategy. In addition, the manager is typically the owner of the firm, and thus it is reasonable to assume the current manager is the same manager who decides on the implementation of IS of the firm (Thong, 1999).

Measurement of Variables

a. Manager participation

This study adopted a similar instrument used by Hussin et al. (2002) to measure manager participation in IS implementation. The instrument which was originally developed by Jarvenpaa and Ives (1991) was tested and validated by Hussin et al. (2002) in the specific context of SMEs. Based on bipolar anchors with a five-point scale anchored between no participation and high participation, the respondents were asked to indicate their level of participation in the following five areas: definition of needs (information requirements), selection of hardware and software, implementation of systems, systems maintenance and problem solving, and planning for future IS deployment.

b. Manager IS knowledge

This study measured manager IS knowledge using a list of seven applications commonly found in SMEs. The respondents were asked to indicate their knowledge level regarding word processing, spreadsheet, database, accounting, e-mail, Internet, and computer-assisted production management applications based on bipolar anchors with a five-point scale anchored between no knowledge and extensive knowledge.

c. Manager accounting knowledge

Using the same scale as IS knowledge, respondents were asked to indicate their knowledge level relating to financial and managerial accounting techniques.

d. Sources of advice (external and internal expertise)

Four main sources of external expertise identified from the literature were included in the questionnaire: consultants, vendors, government agencies, and accounting firms. The questionnaire asked the respondents to identify the sources of advice used by their firms. They were then asked to rate the effectiveness of each external expert based on bipolar anchors with a five-point scale anchored between very ineffective and very effective.

e. IS effectiveness

Al-Mushayt (2000) developed six questions to measure IS effectiveness based on DeLone

and McLean's (1992) taxonomy. Using similar questions, the respondents were asked, based on bipolar anchors with a five-point scale anchored between strongly disagree and strongly agree, to indicate the level of effectiveness of their IS regarding systems quality, information quality, information use, user satisfaction, individual impact, and organisational impact.

RESULTS

Descriptive Statistics

A total of 232 firms responded to the survey after a period of 10 weeks and two follow-up reminders, resulting in about a 32% response rate. Preliminary analysis of the sample showed that 71% of respondent firms were established more than 10 years ago, which suggested that most respondent firms were mature companies. About 39% of respondent firms had between 20 and 50 full-time employees, while the remaining firms (61%) had between 51 and 150 full-time employees. Most of respondent firms (87%) reported that they had used computers for more than five years, while the remaining firms (13%) had only used computers for five years or less. This is an interesting finding as it suggests that respondent firms had considerable experience with computers.

Regarding IS sophistication, the results of this study showed that the software applications used the most by respondent firms were accounting (95%), word processing (82%), email (69%), spreadsheet (66%), and the Internet (60%). The most popular accounting modules adopted by respondent firms were general ledger (91%), accounts receivable (93%), accounts payable (93%), payroll (78%), billing (74%), inventory (70%), order entry (62%), and purchasing (60%). Overall, respondent firms primarily used administrative and transactional-based applications. The adoption of analytical-based applications such as budgeting, production planning, modelling, and project management is still minimal. The findings were consistent with the results reported by Lefebvre and Lefebvre (1988), Raymond (1992), Bridge and Peel (1999), and Foong (1999). These studies reported that SMEs used computers mainly for administrative

and operational tasks rather than for strategic planning.

Regarding external experts, the results indicated that most respondent firms sought support from multiple external experts for their IS implementation. The majority of respondent firms (81%) reported that they sought advice from vendors, consultants (60%), accounting firms (47%), and also government agencies (29%). These findings were consistent with the results reported by previous studies.

Table 1 presents the descriptive statistics for the main variables. To reiterate, the first objective of this study was to explore the level of managerial participation in IS implementation, IS and accounting knowledge, and the use of external experts. The results indicated that respondent firms perceived their IS implementation as fairly effective (mean = 3.38). Most managers of respondent firms participated highly in firms' IS implementation (mean = 4.03). However, their IS knowledge (mean = 2.67) and accounting knowledge (mean = 2.66) are only above average. When asked about the effectiveness of external experts, respondent firms rated accounting firms (mean = 3.23) as the most effective, followed by consultants (mean = 3.16), vendors (mean = 3.14), and government agencies (mean = 2.87). The element of trust could explain the finding. For example, Davis (1997) argued that most SMEs treated accounting firms as their most trusted business advisors. Furthermore, accounting firms are more knowledgeable about their clients and their clients' businesses and thus could help them implement effective IS that meets their business requirements.

Table 1: Descriptive Statistics

Variables	Mean	SD
X ₁ Participation	4.03	1.20
X ₂ IS knowledge	2.67	0.45
X ₃ Accounting knowledge	2.66	0.63
X ₄ Consultants	3.16	0.72
X ₅ Vendors	3.14	0.57
X ₆ Government agencies	2.87	0.99
X ₇ Accounting firms	3.23	0.85
X ₈ IS effectiveness	3.38	0.60

Hypotheses Testing

The second objective of this study was to identify factors that influence IS effectiveness. For this purpose, seven potential factors, managerial participation in IS implementation, managerial IS and accounting knowledge, effectiveness of consultants, vendors, government agencies, and accounting firms, were tested against IS effectiveness using a multiple regression technique. Multiple regression is one of the most widely used techniques in the analysis of data in the social sciences (Bryman & Cramer, 2001). The technique can be used to analyse the relationship between a single dependent variable and several independent variables (Tabachnick & Fidell, 2001). The objective of the analysis was to predict the changes in the dependent variable in response to changes in the independent variables, whereby each independent variable is weighted by the regression analysis procedure to ensure maximal prediction from the set of independent variables (Hair, Anderson, Tatham, & Black, 1998).

Before performing the multiple regression procedure, a factor analysis was conducted on all six items that measured IS effectiveness to find out whether they could be treated as a single measure. Al-Mushayt (2000) found the construct as unidimensional, reliable, and can be summated. The test was conducted using principal component analysis and varimax rotation with Kaiser Normalisation. The results of the test showed that there is only one factor with an Eigenvalue of more than 1, which explained 63% of the variance. The Cronbach's coefficient alpha for the overall IS effectiveness is 0.92. Similar to Al-Mushayt (2000), the results suggested that the IS effectiveness measures could be combined as a single measure and used as a dependent variable.

In interpreting the regression variate, Hair et al. (1998) warned that the researcher must be aware of the impact of multicollinearity. Highly collinear variables can distort the results substantially and thus make them not generalisable. According to Bryman and Cramer (2001), the Pearson's *r* between each pair of independent variables should not exceed 0.80, otherwise the independent variables that show a relationship at or in excess of 0.80 may be suspected of

exhibiting multicollinearity. The output in Table 2 showed that none of the correlations between all independent variables exceed 0.80, which indicated that multicollinearity does not exist. Another two common measures for assessing multicollinearity are the tolerance and variance inflation factor (VIF) values. A common cut-off threshold is a tolerance value of 0.10, which corresponds to a VIF value above 10 (Hair et al., 1998). From the output, it was observed that the tolerance values for total AIS capacity and total moderation were above 0.10. Likewise the VIF values for both variables are less than 10, thus confirming that the multicollinearity problem does not exist.

Table 2: Correlation Matrix between Independent Variables

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇
X ₁	1.00	.184	.398	.158	.176	.141	.034
X ₂		1.00	.630	.007	.145	.358	.199
X ₃			1.00	.009	.001	.105	.342
X ₄				1.00	.062	.546	.433
X ₅					1.00	.113	.234
X ₆						1.00	.360
X ₇							1.00

The results of multiple regression analysis displayed the correlations between the variables, the unstandardised regression coefficient (B) and intercept, the standardised regression coefficient (β), R, R², and adjusted R². A summary of results are shown in Table 3. The multiple R under consideration is 0.641 (R² = 0.411). The F value of 3.987 is significant at the 0.01 level, suggesting that it is extremely improbable that R in the population is zero. While the F ratio is useful as a test of statistical significance for the equation as a whole, a t value for each coefficient and an associated two-tailed significant test represent a test of the statistical significance of the individual regression coefficients. The output indicated that manager accounting knowledge (β_3 = 0.661; p<0.01), vendor effectiveness (β_5 = 0.348; p<0.01), and accounting firm effectiveness (β_7 = 0.531; p<0.01) contribute significantly to regression with t values

of 3.893, 2.578, and 3.299 respectively, thus providing support for H₃, H₅, and H₇. Managerial participation in IS implementation, manager IS knowledge, consultant effectiveness, and accounting firm effectiveness appear unimportant.

Table 3: Regression of X₈ against X₁, X₂, X₃, X₄, X₅, X₆ and X₇

Variables	Regression coefficient	T value	Significance
X ₁ Participation	.055	0.381	.705
X ₂ IS knowledge Accounting	.094	0.506	.616
X ₃ knowledge Consultants	.661	3.893	.000*
X ₄ Consultants	.282	1.636	.110
X ₅ Vendors Government	.348	2.578	.014*
X ₆ agencies	.251	1.363	.181
X ₇ Accounting firms	.531	3.299	.002*

R = 0.641; R² = 0.411; Adjusted R² = 0.308; F = 3.987; p < 0.001

DISCUSSION

The objectives of this study were twofold. Firstly, this study explored the level of manager participation in IS implementation, IS knowledge, accounting knowledge, and the effectiveness of external experts among manufacturing SMEs in Malaysia. Secondly, it examined the relationships between IS effectiveness and seven potential influence factors: managerial participation in IS implementation, manager IS knowledge, manager accounting knowledge, consultant effectiveness, vendor effectiveness, government agency effectiveness, and accounting firm effectiveness.

Results of this study revealed that respondent firms had considerable experience with computers, whereby 87% of the firms had used computers for more than five years. In terms of IS sophistication, most respondent firms used the computer mainly for administrative and operational tasks. The adoption of analytical-based applications for strategic decision-making is still minimal. These findings were in tandem with those of previous studies such as Foong (1999) and Hussin et al. (2002). Most respondent firms also reported that they sought support from multiple external experts such as vendors, consultants, accounting firms, and government agencies for their IS implementation. Similar to

findings from previous studies (Thong, 2001; de Guinea et al., 2005), the most sought after external experts are vendors and consultants. Despite this, it is interesting to note that respondent firms rated accounting firms as their most effective external expert. A possible reason is that accounting firms, compared to other external experts, are more knowledgeable about their clients' businesses and thus can help them implement effective IS. Furthermore, Davis (1997) argued that SMEs rely on accounting firms as their most trusted business advisors. It is also interesting to note the level of managerial participation in IS implementation among respondent firms. Despite their average IS and accounting knowledge, managers of the firms participate highly in their firms' IS implementation. The respondent firms also perceive their IS implementation as fairly effective.

Finally, IS effectiveness was tested against seven independent variables. Similar to Al-Mushayt (2000), IS effectiveness is conceptualised as a unidimensional construct. The results of this study supported the hypotheses regarding the relationships between manager's accounting knowledge and IS effectiveness (H_3), vendor's effectiveness and IS effectiveness (H_5), and accounting firm's effectiveness and IS effectiveness (H_7). It is also interesting to note that managers accounting knowledge ($t = 3.893$) appeared to have greater impact on the effectiveness of IS implementation among SMEs, compared to the advice offered by accounting firms ($t = 3.299$) and vendors ($t = 2.578$). This evidence suggested that, while gaining advice from external experts such as accounting firms and vendors could be important to SMEs, manager's accounting knowledge is crucial for the firms to implement effective IS. Furthermore, since most SMEs adopted accounting-based applications, accounting knowledge is becoming more of a necessity for managers of SMEs. These findings implied that manager's accounting knowledge, probably with the help of effective external experts, plays a crucial role for SMEs to achieve better IS effectiveness.

However, manager participation in IS implementation (H_1), manager IS knowledge (H_2), consultant effectiveness (H_4), and government agency effectiveness (H_6) appeared unimportant

in this study. The unexpected result relating to the relationship between managerial participation in IS implementation and IS effectiveness could be explained by Jarvenpaa and Ives' (1991) study. Jarvenpaa and Ives found "executive involvement" (or the degree of importance placed on IS by the managers) is more important than "executive participation" (or managers substantive interventions). Therefore, as argued by Hussin et al. (2002) and Ismail and King (2007), possessing good knowledge of accounting could fit into this concept of "involvement" because accounting knowledge would help managers (probably with the help of external experts) to decide on the right software to support the firms' information needs and thus make IS more effective.

This study also did not find support for (H_2), which postulated a positive relationship between managers IS knowledge and IS effectiveness. Similarly, this study also did not find support for (H_4), which postulated a positive relationship between consultant effectiveness and IS effectiveness. These rather unexpected findings could be a reflection of the firms having greater IT maturity and thus seeking direct expert advice such as vendors and accounting firms. The availability of powerful but user-friendly packages might also explain these findings. Furthermore, technical advice from vendors might be sufficient for the firms. As Zarowin (1998) argued, the simple business structure of SMEs may also facilitate the tasks of identifying and tailoring IS to the firm's strategy and information needs. Thinking in the context of SMEs, these advantages may increase their understanding of business information requirements and accessibility to sophisticated IS, and this eventually leads to more effective IS. Finally, this study also did not find support for (H_6), which postulated a positive relationship between the effectiveness of government agencies and IS effectiveness. The findings suggested that while government assistance is important in accelerating IS adoption among SMEs (Yap & Thong, 1997), it may not necessarily result in better IS effectiveness.

Implications

The findings of this study have several implications for research and practice. With respect to research,

there are three main implications. Firstly, there is a positive and significant association between manager accounting knowledge and IS effectiveness, vendor effectiveness and IS effectiveness, and accounting firms effectiveness and IS effectiveness. Thus, this study has complemented previous research by having supported this association within a Malaysian context. Further studies may replicate this study to enhance the external validity of the results. Secondly, there are contradictory findings between this study and previous literature with respect to the relation of manager IS knowledge and IS effectiveness, consultant effectiveness and IS effectiveness, and government agency effectiveness and IS effectiveness. There are a number of potential phenomena, such as SMEs IS maturity, that may affect the results. Future research could include these potential sources of differences in order to provide an empirical explanation of the differences between these results and previous findings. Therefore, findings of this study can only confirm parts of the arguments put forward by both technology diffusion and resource-based theories. Finally, it would be interesting to expand the research model by introducing new constructs such as sources of software and time to plan for IS, while using a more sophisticated techniques, such as structural equation modelling.

This study has three implications for practice. Firstly, managers of SMEs need to acquire sufficient accounting knowledge since accounting is the most important component of modern IS within SMEs. Being the person that best understands firm's business operations, accounting knowledge would further help the managers to identify business information requirements, and probably with the help of qualified and effective vendor, would be able to choose the right technology to meet those needs. Secondly, SMEs should engage qualified vendors who have experience and understand unique characteristics of the SME. Qualified vendors can also help SMEs overcome their lack of IS knowledge and thus SMEs should take the opportunity to increase IS knowledge of the

business. Merely engaging external experts such as vendors would not guarantee future IS success without a proper transfer of knowledge to the firms. Finally, SMEs should also exploit the good relationship with their accounting firms. Being the most trusted advisors to the SMEs, accounting firms are also the only external party that best understand their clients' business, and thus are in a better position to help SMEs identify their business information requirements, and with the help of vendors, would contribute to more effective IS. Therefore, it is important for SMEs to learn from their IS implementation so that opportunities can be recognised and priority given to initiatives that help IS support their information needs.

Limitations and Future Research Opportunities

It is important to note that this study was exploratory in nature and thus subject to a number of limitations which can be addressed in future research. The first limitation is related to the sample bias that might affect the generalisation of the findings. The sample was selected from a list of Malaysian manufacturing SMEs, and thus cannot be generalised to all SMEs. There are potential differences in the levels of IS sophistication among manufacturing SMEs and non-manufacturing SMEs, and between manufacturing SMEs in developing economies like Malaysia and manufacturing SMEs in developed economies. For example, manufacturing SMEs in developed countries may have greater access to IS benefits and services offered by relevant agencies when compared to those in developing countries. The second limitation of this study relates to the definition of the SME itself. While it is generally accepted that the number of employees could be used as a surrogate measure for firm size, expanding the definition to include the sales or revenue of the firms may produce different results. Finally, the study was based on a survey. This approach has shortcomings because it captures a situation or an event at a specific point in time. Future research could employ qualitative approaches such as case studies or a longitudinal study to further understand how SMEs implement their IS.

CONCLUSIONS

This paper examined seven hypotheses concerning the effectiveness of IS implementation in the specific context of manufacturing SMEs in Malaysia. More importantly, this study has highlighted two variables, manager accounting knowledge and accounting firms, which has received little attention in the literature. By systematically testing the seven hypotheses against IS effectiveness, associations between three variables and IS effectiveness were found, thus confirming part of the arguments put forward by technology diffusion and resource-based theories. The evidence suggests that the major factors that influenced IS effectiveness among the sample firms were manager accounting knowledge, vendor effectiveness, and accounting firm effectiveness. Thus, this study has made an important contribution by increasing the current understanding of IS implementation and its influence factors in SMEs. Manager participation in IS implementation, manager IS knowledge, consultant and government agency effectiveness, however, seemed to have an insignificant relationship with IS effectiveness. These unexpected findings indicates the need for further research into the processes associated with the effectiveness of IS implementation in SMEs.

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