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Integration of Information Technology Among Small and Medium-Sized Enterprise Manufacturing Sector in Malacca

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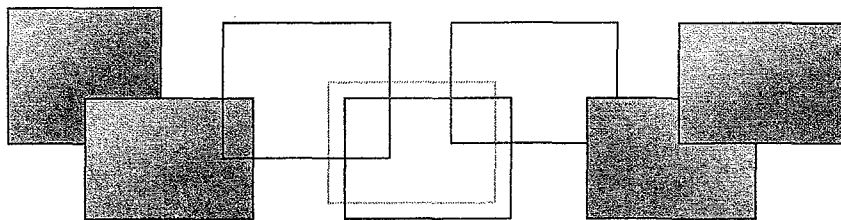
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INTEGRATION OF INFORMATION TECHNOLOGY AMONG SMALL AND MEDIUM-SIZED ENTERPRISE MANUFACTURING SECTOR IN MALACCA.

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ABSTRACT

This paper seeks to identify the extent of IT integration among Malacca Manufacturing SMEs, The significant environmental and organizational factors that affect IT integration, and the relationships between IT integration and the performance efficiencies of value chain activities

A study conducted on 100 SMEs discovered that the level of IT integration is limited to some functional area only. IT integration is found to be greater in the support activities of the value chain. Higher levels of IT integration are found mainly in manufacturing companies, companies which produce high technological goods and services, Companies with larger number of employees, and those with clear vision and mission objectives. Positive perception of management and employees toward computer technologies and systems are also found to result in higher IT integration levels. The overall correlation is significant to substantiate the hypothesis that higher levels of IT integration lead to better performance efficiencies in all functional areas.

Introduction

Globalization, the internationalization of market, the liberalization of trade, deregulation, the knowledge economy, e-business, and new form of organizations, all of these interrelated phenomena pose new challenges to small and medium sized enterprises (SMEs) (Raymond 2000). Most often less endowed in human, financial and technological resources than large enterprises. SMEs nonetheless, have advantages in term of flexibility, reaction time, and innovation capacity that make them central actors in the new economy.

Small and medium-sized enterprise (SMEs) firms are generally considered as small firms with the flexibility of equipment and human resources (van Dijk, 1955). They are often characterized by strong entrepreneurial leadership (Gorman and Doran, 1999) and generally service as sub-contractors or supplier of goods and services to large

corporation. Many SMEs to maintain high production standards, efficient process, and control system. These environmental forces are exerting pressure on the SMEs to replace traditional approach with new management concept and tool in formulating breakthrough strategies that lead to changes in their operational paradigm.

Winch and Mc Donald (1999) maintained that in order to address limitation of the SMEs, there is a need for the adoption of innovative new approaches with regards to their manager skills and business process which would enable them to maintain their competitive positions. One such innovative new approach is through a business infrastructure which is capable of supplying accurate real-time information to where and when it is needed (Yusuf and Little, 1998). Management activities will thus be improved through better control and timely internal and external information exchange.

In this respect, SMEs should consider information technology (IT) integration as an important approach in their pursuits to maintain their competitive position (Mutsaers, van der Zee and Giertz, 1998). IT integration can be defined as the use of computer-based technological hardware, data, and software application that is shared and accessed for organizational use over a communication network (Wyse and Higgins. 1993). The purpose of such an integration exercise is to strengthen the firm's operational efficiency and effectiveness is responding to customer needs and competitive pressures (Mutsaers, van der Zee and Giertz, 1998; Julien, 1999).

The role of IT in such organizations is vital because it contributes to the fundamental changes that are needed for production, co-ordination, and management towards achieving these goals (Morton, 1991). IT has helped organizations in pursuit of quality improvements to design goods that are easier to manufacture, improve new product cycle time through cross-functional integration of system, and use electronic networks to speed up communications internally, with supplier and customers. The effect of integrating information technology is to add value to the efforts of the organization in their pursuit for productivity improvement by providing an efficient means of generating the required information to make the necessary decisions and take appropriate action (Nolan, 1995).

The SMEs play an important role in providing linkages to the export-oriented industries by contributing significantly in terms of value added and labor absorption, particularly in the manufacturing sector which is considered the primary engine growth,

Therefore, it is imperative that they tap the vast potential that IT has to offer towards enhanced business performance. Although government initiatives to promote the adoption of IT are numerous and varied, little empirical research has been conducted to study the IT phenomena amongst Malaysian SMEs. The study also found that the diffusion and increasing use IT had a positive impact on firm-level productivity and productivity growth. This study plans to contribute further to the literature by investigating the extent of IT integration among SMES in Malaysia. The level of integration is assessed according to Porter's (1980) value chain model..

Literature View

As far as IT is concerned, the Malaysian government had formulated the National IT Agenda (NITA) in 1996 to serve as the framework for the orderly development of the country into an information and knowledge-based society by 2020. A key initiative was the Multimedia Super Corridor (MSC), which was designated as a test-bed for IT or information and communication technology (ICT) development and international hub for global and local IT players. To provide an enabling environment for such development, regulatory mechanism were also introduced in the form of a set of cyberlaws was the Communication and Multimedia Act 1998, aimed at promoting deregulation, streamlining licensing procedures and categories as well as facilitating market liberalization.

Analysis of the Eight Malaysian Plan (2001-2005) documents results in the identification of numerous initiatives and programs implemented during the Seventh Malaysian Plan between 1996 – 2000. They could be meaningful categorized into seven groups of objectives. The objectives are increasing awareness, knowledge, skills and access; encouraging and facilitating purchase of IT related equipments; promoting investment and development of IT business; infrastructures/ infostructure development; application development; and regulation development (see Figure 1)

Under the Eight Malaysian Plan period (2001-2005), continued focus will be given towards further strengthening the human resource capabilities, hard and soft infrastructure as well as the building of a critical mass of SMEs and internet users to

enable Malaysia to move rapidly towards becoming a developed of IT then will include positioning Malaysia as a major global IT and multimedia hub; upgrading and expanding the communication infrastructure to increase accessibility throughout the country as a means of bridging the digital divide; enhancing human resource development in IT ti increase the supply of highly skilled and knowledge manpower; promoting e-commerce and enhancing its use to enable Malaysia to compete more effectively in the global market; fostering local capabilities in creative content development; rolling out the MSC flagship applications to further provide the momentum for the development of the MSC; nurturing a critical mass of ICT-based SMEs; and promoting research and development (R&D) activities on soft factors of IT and information age developments that affect individuals, organizations and societies (Eight Malaysia Plan 2000 .p.379).

Objectives of the Research

These specific objectives of the study are to;

1. To identify the IT integration toward successful SMEs development in manufacturing sector.
2. To study the relationship between IT integration and performance SMEs in manufacturing sector
3. To determine the criteria needed for successful SMEs development in manufacturing sector.

Research Question

The paper attempts to answer the following two main research questions:

- What are the significant environmental and organizational factors that affect IT integration among SME?
- Are there any significant relationship between IT integration and the performance efficiency of The Malaysian SMEs value-chain activities?

Scope of the research

The research cover small and medium manufacturing sector in Malacca. Selection of population was done to those SMEs, listed by SMES Directort 2005 (The Small and Medium Industries Development Corporations (SMIDEC). The companies were selected at random to represent SMEs of Malacca locations.

Research Methodology

A survey was conducted through structured personal interview and electronic mails. Through the e-mail system, approximately 150 questionnaire were emailed to all manager SMEs companies either as owner or employees. Personal interview were conducted after a lapse of time to enable the prospective respondents to be familiar with the questionnaire. The total usable responses collected was 106. The answers used in hypothesis analysis are list of question answered by owner manager.

Environmental and Organizational Factor Affecting IT Integration

The respect nature of technological usage and the area of business operation of SMEs generally determine the level of information intensity that must be managed. Higher level of IT support not only creates vast amount of necessary information related to business process, but also offers analytical capabilities to improve process (Davenport and Short, 1990). With respect to these, a firm, with more information intensive products or service, is likely to make higher level of investment in IT infrastructure to create quick and swift changes in its processes and other business activities. Therefore, we can postulate that:

H1: SMEs that are engaged as producers of high technological goods and services will have higher levels of IT integration as compared to SMEs engaged as producers of low or matured technological goods and service.

Different industries have distinct sets of process. Manufacturing firm have processes that are tangible in which IT resources can be deployed for improvement initiatives. Further , manufacturing firms have to contend with more controls over over the process and activities (Bhatt 2000). Therefore, it is likely that there will be a higher level of IT integration in manufacturing firms as compared to the service-oriented firms

H2 : SMEs with manufacturing orientation will have higher level of IT integration as compared to SMEs that are service oriented.

The size of an organization can typically be measured by the number of its employees. Companies with fewer numbers of employees tend to have a smaller scale of production or service and therefore are less likely to incorporate or integrate IT resources in their business process. Thus , firms of larger size tend to show more concern for progressively enhanced and integrated functions. Therefore to be said that the size of the firms does have an influence on IT integration initiatives (Yusuf and Little, 1998)

H3 : SMEs with target number of employees will have higher levels of IT integration.

Vision and mission objectives articulate long-time plans. Successful organization are those that have a clear and agreed strategic vision and relatively clear and agreed means of progressing towards this vision. A good mission statement describes an organization's urpose, customers, products or service, market, philosophy, and basic technology.

The information system and the underlying information architecture of an organization shoulf be based on this strategic vision (King, 1995). The desired sustainable competitive advantage arises from an integration of supportive strategies and the synergy of the organization's various capabilities (Carter, 1999). Therefore, this attribute can also be a factor in determining the levrel of IT integration by SMEs

H4 : SMEs that have a clearer vision and mission objective will have

higher levels of IT integration.

The firms should articulate their goal for IT integration and identify areas within the corporation where IT integration could create value. This heightened sense of awareness by the management as how IT integration can change the fortunes of the corporation explains why IT integration is viewed as a valuable business resource to be managed rather than an overhead expense to be minimized (Tallon, Kramer and Gurbaxani, 2000). Therefore , the attitude of the employees as well as the management are important factor in influencing IT integration.

H5 : SMEs where employees find computer-based technologies easier to use will have higher levels of IT integration.

H6 : SMEs where the management have a better perception of computer-based system will have higher levels of IT integration.

To examine the impact of IT integration is to analyze the ways activities are performed at various functional level. In his value chain model Porter (1980) classifies the activities in an organization into two broad categories; (1) Primary (inbound logistics, operations, outbound logistics, marketing/sales, and service): and (2) support (corporate infrastructure, human resource management , technology development and procurement) activities. Therefore, how each activity is performed combined with its economics will determine whether a firms is a high cost or low cost producer relative to its competitors. Thus , companies that incorporate more IT integrated resources in the value chain activities will obtain higher efficiency levels in the individual activities of the value chain. This relationship can be tested with the postulation of the following hypothesis for each category of the generic activity.

H7 : SMES with higher level of IT integration in each of the following value chain activities will have higher levels of performance efficiency in that functional activity.

Results

The Extent of IT Integration

Table 1 presents the mean scores for IT integration in descending order for each of the value chain activities. The overall mean of these variable measures is 1.97 indicating that the level of IT integration in SMEs is generally very low. This average implies that only a limited amount of computers exist in some functional areas of the SMEs. They are sporadically distributed and are seldom used.

The management may still be evaluating the potentials of computers for effective use in the organization. The table also provides the mean scores for IT integration for the combined primary and secondary value chain activities. The mean for the support activities is higher indicating that IT is used more in the support functions such as corporate infrastructure and human resource management. A t-test was performed to see the difference of IT integration in these two broad activities and the result indicates that the mean for the support activities is significantly higher than for the primary activities (2.13 vs 1.85, $t = 7.614$, $p = 0.00$)

Table 1: Means for IT Integration

Value Chain Activities	Mean
Corporate infrastructure	2.30
Human resource management	2.22
Operations	2.16
Technology development	2.10
Marketing sales	1.89
Procurement	1.86
Inbound logistics	1.85
Outbound logistics	1.76
Service	1.56
Primary	1.85
Support	2.13
Overall	1.97
Scale: 1 = not used, 2 = low usage, 3 = moderate usage, 4 = heavy usage, 5 = very heavy usage	

Environmental and Organizational Factor Affecting IT integration

Table 2 present the statistical result for testing the first six hypothesis. These test use an index mean, which was derived from the responses for each of the value chain activities. To represent the level of IT integration. The results indicate that all six hypothesis are substantiated. For H1, analysis of variance (ANOVA) and Post Hoc test (using least Significant Difference) were performed and the results indicate that SMEs which produce high technological goods and services have higher levels of IT integration than those producers of low or matured technological goods and services. For hypothesis H2, the t-test result indicate that manufacturing companies have higher levels of IT integration compared to the service-oriented companies. Pearson correlation test were used for H3, H4, H5, and H6. The results provide support that SMEs that have larger number of

employees have higher levels of IT integration. So do the SMEs that have clear vision and mission objectives. With regards to attitude, the SMEs where their employees as well as the management have positive perception toward computer technologies and systems have higher IT integration levels.

Table @ : IT Integration and Environmental and Organizational Factors

Hypothesis					Support
H1: Nature of Business and IT Integration ANOVA	Sum of Squares	Df	Mean Square	F	Yes
Between groups	11.2	2	5.661	11.419	0.000
Within groups	51.075	103	0.496		
Total	62.275	105			
Post Hoc (LSD)	N	Mean		Mean Difference	Significance
(1) Low technology	24	2.0214		(1) – (2): 0.2151	0.200
(2) Matured technology	70	1.8063		(1- (3) : -0.8331	0.001
(3) High technology	12	2.8545		(2) – (3): -1.0481	0.000
Total	106	1.9737			
H2: Industry Segment and IT					Yes

Integration					
T-test					
	N	Mean	t		
(1) Service	49	1.7891	-2.334	(1) – (2): -0.3434	0.022
(2) Manufacturing	57	2.1324			
H3					
Organization Size and IT					Yes
Integration					
Pearson Correlation					
IT Integration- Number				Pearson Correlation	0.000
of Employees				0.567	
H4					
Clear Vision/Mission and					Yes
IT Integration					
Pearson Correlation					
IT Integration – Clear				Pearson Correlation	0.001
Vision/Mission				0.328	
H5: Employees Attitude					Yes
and IT Integration					
Pearson Correlation					
IT Integration -				Pearson Correlation	0.000
Employees Attitude				0.500	

H6: Management Attitude and IT Integration Pearson Correlation					Yes
IT Integration-Management Attitude				Pearson Correlation 0.000	0.000

IT Integration and Functional Performance

Since all of the items related to performance efficiencies are negatively worded, the responses were reverse-coded. An index mean was then computed for each value chain performance efficiencies and subsequently correlated with the corresponding value chain IT integration mean. Table 3 presents the test result of H7. The results provide support for four out nine value chain functions where higher level IT integration leads to higher performance efficiencies. The four functions are inbound logistics, outbound logistics, service, and technological development. Nevertheless, the overall correlation of 0.208 is significant to substantiate hypothesis H7.

Table 3 : IT integration and Functional Performance efficiencies

Hypothesis			Support
H7: IT Integration and Functionanl Performance Efficiencies			Yes
Pearson Correlation			
	Pearson Correlation	Significance	
a). Inbound Logistic: IT integration- Performance	0.255	0.009	Yes
b). Operations; IT Integration –Performance	-0.128	0.191	No
c).Outbound Logistics: IT integration- Performance	0.269	0.005	Yes
d). Marketing sales: IT Integration – Performance	0.142	0.147	No
e). Service: IT Integration- Performance	0.218	0.025	Yes
f). Corporate Infrastructure: IT Integration performance	-0.169	0.089	No
g). HR Management : IT Integration- Performance	0.157	0.112	No
h). Technology Development : IT Integration – Performance	0.217	0.006	Yes
i). Procurement : IT Integration –Performance	0.178	0.072	NO

Discussion

The first area this research examines is the extent of IT integration among SMES in Malacca. The result suggest that the level of IT integration is considerably low. The limited usage is described by the existence of a limited number of computers and usage in only some functional areas of the SMEs. The fact that IT integration is greater in the support activities of the value chain instead of in the primary activities reflects that the SMEs mostly use IT for administrative purposes rather than for strategic reasons. This is considered bad news especially to the Malaysian government which has been promoting and advertising in IT as a means to leap frog to a developed-country status. The SMEs may not have a sense of urgency in integrating IT into their business. They may believe that they can compete with foreign companies even if they do not change ways in doing business (Looi, 2001). They may also lack the knowledge and awareness on the potentials of IT integration.

Even if they realize the important or the potentials of integrating IT into their business, they may lack the skill or experience necessary to do it. Capital or financial resources to undertake such integration could also be a factor. Although of IT channeled through public and quasi-government bodies, the management of SMEs may not be aware of such facilities and the relevant application procedures. A lack of knowledge or imperfect information has been found to be the main reason why SMEs failed to approach appropriate funding bodies (Bannock and Partner, 1991; Harvey, 1992), Idris, Abd-Latif and Haron (2000)

The second area of the research examines the environmental and organizational factors affecting IT integration. The six substantiated hypothesis test results fully supported the prediction that the level of IT integration in the SMEs is affected by the environmental and organizational factors. SMEs that are engaged as producers of high technological goods and services have higher level of IT integrated process in their organizational activities as compared to SMEs engaged in producers of low or matured technological goods. This finding is further strengthened with H2 support which substantiates that manufacturing-oriented SMEs have higher levels of IT integration as compared to service-oriented SMEs. A similar support by Bhatt (2000) in his study reveals that the

moderating effect of network integration on process improvement initiatives and customer focus is more significant in manufacturing-oriented companies than service-oriented companies.

In terms of organization size, SMEs with larger number of employees have higher level of IT integration. This finding is also consistent with the outcome of the study by Yusuf and Little (1998). In their study on enterprise-wide integration of MRP II, the findings implied that those organizations with a larger number of employees have more problems to contend with and therefore perceive greater benefits from integration of people and functions. This integration, as a result, calls for a bigger role to be played by IT applications.

The support received by hypothesis H4, H5, and H6 indicates that a good organizational climate is important in IT integration. SMEs with clearer vision and mission objectives have higher level of IT integration. Successful organizations are those that have a clear and agreed strategic vision and a relatively clear and agreed means of progressing toward this vision because a clear mission statement is essential for effectively establishing objectives and formulating strategies.

If employees have a negative attitude toward IT integrated resources, the opportunities to incorporate IT will be very low. This further implies that the way to go around it is to provide proper education and training to the employees thus imparting the necessary awareness and skill that would change this negative perception.. This finding is supported by Tallon, Kraemer and Gurbaxani (2000). They concluded that when there is positive management perception on the potential of IT integration, there are clear goals for such investment. Another study by Ndubisi and Jantan (2003) addressed the usage of information system by Malaysian small and medium firms using the technological acceptance model.

The final area that this research examines is the relationship between IT integration and the performance efficiency of SMEs' value-chain activities. The overall significant correlation indicates that SMEs with higher level of IT integration have higher levels of performance efficiency of their value chain activities. This is an area of technology management where awareness can be given to Malaysian firms to increase their

competitiveness where awareness can be given to Malaysian firms to increase their competitiveness (Zain, Kassim and Mokhtar, 2003). On the contrary, the finding may also suggest that SME firms are focusing their IT integration efforts in the less critical areas (That is, support activities). These benefits are indirect or not easily seen and may take longer to realize,.

Conclusion

The outcomes of the study reveal that the extent of IT integration among SMEs Manufacturing in Malacca is considerably low despite the concerted government efforts and initiatives. The support value chain activities receive a higher level of IT integration compared to the primary activities. Nevertheless, the lower amount of IT integration given in the primary activities provide significant impact on performance efficiencies. Thus , an important implication from this study is the vast potential that IT has to offer if it is integrated strategically through the functional areas. A greater IT emphasis on the primary value-chain will provide SMEs with with a better performance efficiency. Perhaps SMEs should integrate IT in the functional areas of their critical success factors. The critical success factors are those relatively few activities that make a difference between having and not having a competitive advantage; they can overlap functional areas of the firm such as marketing or production, or they may be within one functional area. Therefore, by examining the functional areas that overlap the most by the critical success factors, SMEs will know which functional areas are highly strategic for IT integration.

This study also proved that the business environment plays a major role that motivates SMEs to seek and invest in IT integrated infrastructures in order to sustain or improve their competitive position. As a result, IT is becoming a necessity for SMEs in order to compete. Yet, due to their limited financial and resource capabilities which could be partly attributed to their lack of awareness on the availabilities of various financing facilities, they may have to opt for low-cost, generic IT facilities or infrastructure. This reasoning explains why SMEs integrate IT more in support value chain activities as

opposed to the primary activities which require customized. Company-specific and more expensive IT integration infrastructures.

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