The proliferation of knowledge-based workforce in knowledge-based economy: Evidence from Malaysian High-Tech Industries

Weldali, L.M.S[1], Osman, A[2], Safizal, M.[3], Ismail, M.S[4]
[1234]School of Business Innovation & Technopreneurship, University Malaysia Perlis
[1]layth@dubaied.ae, [2]abdullahosman@unimap.edu.my, [3]safizal@unimap.edu.my, [4]sheriff@unimap.edu.my

***Abstract*—The aim of this study is to describe the proliferation of knowledge-based workers in the high-tech industries in Malaysia. A total of 1,000 firms representing production and manufacturing sectors of the country's knowledge-based economy were selected from the Federation of Malaysian Manufacturers' list by using the stratified random sampling technique. Self-administered questionnaires and self-addressed stamped envelopes were distributed to the respondents using postage mail. 120 questionnaires (12%) were returned and data entry was carried out using a statistical package and descriptive statistics was applied on four variables namely demographic, manpower requirements, technology and IT adoption, and training of the firms. The empirical result indicates the growing importance of knowledge-based workers to the emergence of k-economy sectors in Malaysia. Based on the findings, several recommendations being put forward at the end of the report.**

Keyword: ***Knowledge Workers, Knowledge Economy, SMIs,***

I. INTRODUCTION

Malaysia is fast moving toward obtaining a knowledge economy (k-economy), which is underpinned by innovation and enterprise. This progress is further expedited by industries known to encourage innovation, promote competitiveness, and create employment and wealth in the society [1]. Industries can play an important role in leveraging the national economy by having a workforce that is highly skilled, trainable in new technology, and knowledgeable. A healthy competition can subsequently exist in both domestic and international market. With the present globalization, industries are now commonly expanding to international settings with the help of IT, specifically the Internet that allows e-commerce and increases competitiveness [2]. A knowledge-based economy requires a workforce that is highly skillful, learned, and innovative. Industries under this economy possess a positive motivation and attitude, are innovative, and have entrepreneurial skills that allow them to take advantage of many opportunities that are widely available as a result of globalization and the proliferation of advanced technology. To achieve a knowledge-based economy, greater emphasis should be given in enhancing the workforce by equipping them with academic credentials, technical requirements, and the right skill set that can increase their work efficiency as well as boost their positive attitude and creativity. Knowledge workers (k-workers) are vital for the transformation of a nation to a knowledge-based economy.

SMIs in Malaysia are still operating in a traditional manner and are mostly family-based [3]. SMIs continue to use traditional and obsolete technology to produce cheap and low-quality products with limited market penetration. Among the problems faced by SMIs include the lack of able personnel to negotiate funding, skilled workers and learned manpower [4];[5] and expertise in using and managing technology [6], as well as the low level of IT skills and knowledge [7], poor user attitude toward technology, and low skill/knowledge level in using equipment for maintenance work [8]. Other problems include the lack of resources or facilities in carrying out effective training programs and the difficulty in hiring employees to be trained as substitutes [9].

Previous studies had shown a close relationship between individuals and the organizations they belong into. This finding is linked to the characteristics of human resources that contribute to organizational development, including organizational and managerial capabilities, speed and flexibility, organizational learning, and integrated multiple competencies [10], as well as flexibility and adaptability ([11];[12]). Individual capability has increased by identifying the appropriate skills, knowledge, behaviors, and capabilities required to meet current and future needs for personnel selection; the ability to focus individual and group development plans is also required to eliminate the gap between competencies requested by a project, job role, and enterprise strategy ([13];[14]). Sophistication, organizational characteristics, and organizational performance have some effect on the adoption or non-adoption of management competency in organizations [15]. The following are also required: skill supply with skill demand [16], skills and knowledge management [17], organizational rules for implementing change [18], individual workability ([19];[20]), performance measurement [21], and high achievement [22]. In the present k-economy, human resource development is focused on the capability of individuals and the organization they support to adapt to the latest information and communication technology (ICT). This paper attempts to make an assessment of human resource development based on the application of ICT and other related technology in Malaysia.

In developed countries, an increasing number of industries are adopting IT in their effort to obtain a competitive advantage and maintain their position in the market. A study in the UK found that even small industrial firms with less than 100 employees adopt IT by using at least one PC to support their business [23]. The study found that firms adopt IT to improve operational procedures, produce information at a low cost, make new management tools for decision making available, facilitate billing and

LIBRARY

invoicing, facilitate business growth, facilitate inventory control, and to be innovative. The benefits derived from IT include better record keeping, timeliness, accuracy, expanded information, improved customer service, increased productivity, and enhanced management control and decision making. These benefits have encouraged an increasing number of firms in the industrial sector to adopt IT. However, studies had also shown that the industrial sector, which constitute more than 90% of small- and medium-sized industries [24], generally has end-users with low levels of computer literacy and who receive only elementary formal education. In addition, these industries also lacked qualified IT personnel, specific policy and planning on IT adoption, formal IS methodology, and end-user participation, as well as minimal technology diffusion throughout the firm [25]. This paper also assesses the IT adoption level of Malaysian industries as well as the public sector in terms of end users, IT personnel, education and training, and the types of technology and IT products used as a form of comparison.

II. METHODOLOGY

The study is a field study that implements a cross-sectional survey involving a sample of firms representing production and manufacturing firms listed in the Federation of Malaysian Manufacturers [26] and government and government-linked companies. Proportionate random sampling was used to consider different sample frame sizes according to the industries[27]. A total of 1,000 firms were selected. Questionnaires were distributed to the selected firms, and 120 questionnaires were received. Among the firms chosen to accomplish the questionnaires, 46 firms were categorized as small-sized (with less than 50 employees), 29 firms were medium-sized (between 50 to 199 employees), and 45 were large-sized (with 200 and more employees). Questionnaires with self-addressed stamped envelopes were sent to the selected firms in the FMM list, along with a cover letter describing the aims of the study and instructions in accomplishing the questionnaire. Twelve percent of the questionnaires were returned, which was considered small but represents the typical response rate reported by other studies on SMIs, that is, from 10% to 20% ([28];[29];[30]). Data entry was carried out using a statistical package within which a database of returns was created. Data analysis was subsequently conducted using descriptive statistics on the demography, manpower requirements, technology and IT adoption, and training of the firms.

III. ANALYSIS OF FINDINGS

The distribution of sample concentrated in the central and northern regions of Malaysia that located the ICT and high technology industries. This observation is supported by the development of industrial and high-technology parks and free trade zones in the Klang Valley of the central region and the Bayan Lepas Free Trade Zone, Prai Industrial area, and the Kulim High Technology Park in the northern region. Therefore, the sample is proportionate to the distribution of the industry targeted for this study, and findings from this report well represent the technology and ICT industry in Malaysia. The survey also examined the number of companies involved in the Multimedia Super Corridor (MSC) initiative introduced by the government of Malaysia. Figure 1 shows the percentage distribution of MSC and non-MSC companies in the sample. Notably, 100 from 120 companies responded to this question.

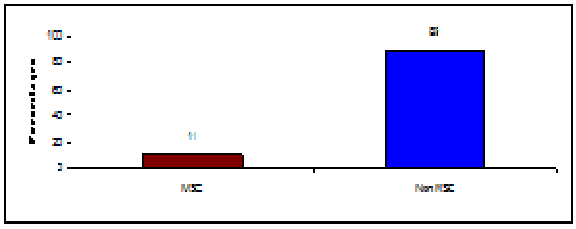


Figure 1: Distribution of MSC And Non-MSC Companies

In terms of company ownership, majority of the companies are Malaysian and locally owned, accounting for 58.3%. Foreign-owned companies accounted for 22.5% of the sample, while the remaining 19.2% was from the government sector. Figure 2 shows the ownership distribution of companies in the sample.

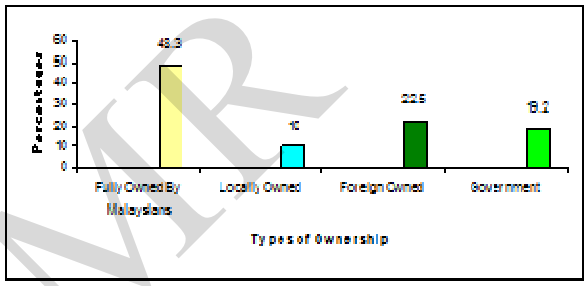


Figure 2: Company Ownership

The size of the companies in terms of the number of employees was examined. Table 1 shows the distribution of the companies in the sample by category, that is, small-, medium-, and large-sized companies. The table shows that small-sized companies in the survey with employee size of less than 50 accounted for 38.3% of the sample. Medium-sized companies with 50 to 199 employees comprised 24.2% of the sample. Large-sized companies with 200 and more employees constituted to 37.5% of the sample. Therefore, majority of the respondents come from small- and medium-sized enterprises (SMEs), accounting for 62.5% of the sample.

Table 1: Category of companies by number of employees

Category	**Number of Employees**	**Frequency**	**Percent**
Small	49 and below	46	38.3
Medium	50 to 199	29	24.2
Large	200 and above	45	37.5
	Total	**120**	**100%**

The succeeding section of the survey analyzes the availability of skilled workers for the adoption of technology and/or ICT in the company.

IJBAMR

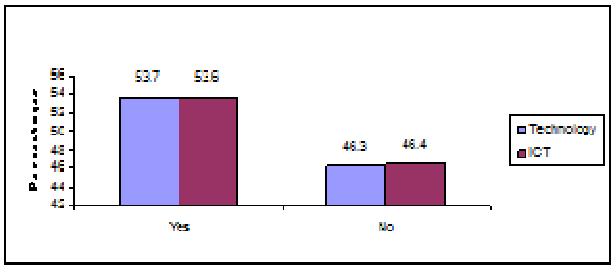


Figure 3: Availability of skilled workers in technology and ICT adoption

Figure 3 shows that more than half of the companies in the sample had skilled workers in both technology and ICT at approximately the same proportion. Total of 46% of respondents indicated they did not have a sufficient number of skilled workers in both technology and ICT. Considering that majority of the sample respondents came from industrial areas, this finding is not ideal. A significant number of organizations within the industry still experience difficulty in acquiring positions that require skills and expertise. A closer look at the distribution of skilled workers shows that, for the technology industry, slightly more than 30% of the companies have 10 or fewer skilled workers. In the technology sample, 23% indicated having more than 50 skilled workers, and approximately 45% have 10 to 50 skilled workers. For the ICT category, 25.5% have fewer than 10 skilled IT workers, and the same proportion indicated having more than 50 skilled workers. The remaining half of the sample for the ICT category has 10 to 50 skilled workers. Figure 4 shows the distribution of the technology and ICT samples according to the number of skilled workers available.

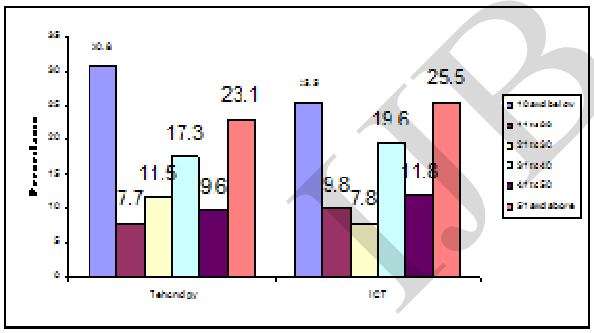


Figure 4: Number of skilled workers in technology and ICT industries

Figure 5 shows the distribution of the management workforce according to different management levels. The result shows that majority of the companies had 25 or fewer employees in all management level categories, ranging from as low as 64.2% at the operations level to 75.8% at the middle level. The figure presently increases to 92.6% at the top management level.

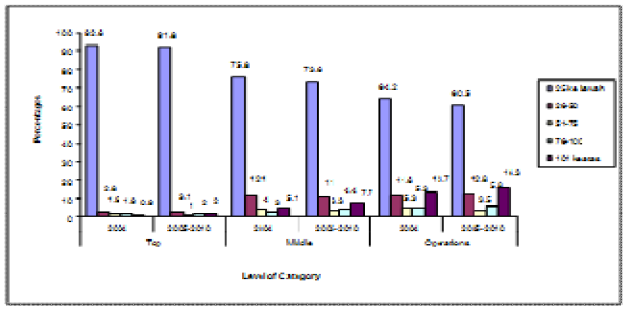


Figure 5: Distribution of workforce by management category

The increasing trend is seemingly consistent for the next five years, as the figures indicated. However, the demand for management workforce across all three management levels slightly decreased. A slight decrease was observed at the top-level management, suggesting that the respondents do not perceive any increase in workforce demand in the next five years among companies with 25 or fewer employees across all management levels. The larger the company, the trend appears to be the opposite where an increase in management workforce demand is supposedly observed for the next five years across all three management levels. The operations level showed the highest increase, as shown in Figure 5. Larger companies are expected to have more job openings for all management categories, particularly at the operations level of Malaysian technology and ICT industries within the next five years.

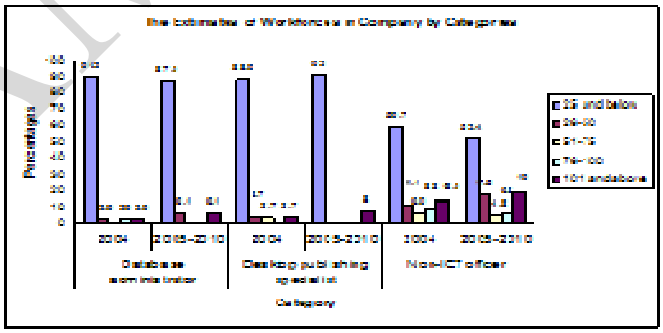


Figure 6: Distribution of workforce by technology

The trend of the workforce in the technology industry shows an equally distributed proportion of skilled, semi-skilled, and unskilled workers for companies with 25 or fewer employees across all three categories. Figure 6 demonstrates a slight decrease in the demand for technology workforce in the next five years for companies with 25 or fewer employees across skilled, semi-skilled, and unskilled worker categories. However, the biggest decrease was in the semi-skilled worker category at an almost 7% reduction. Unskilled workers had the least decrease in demand at only 2%, as shown in Figure 6. Finding showed that larger companies tend to have an increased demand for skilled, semi-skilled, and unskilled workers in the next five years. Unlike small companies tend to have less demand for technology workforce in the future, large companies require a sufficient number of technology-capable employees within the next five years. This finding is particularly true in the semi-skilled category where the demand appears to be the highest.

IJBAMR

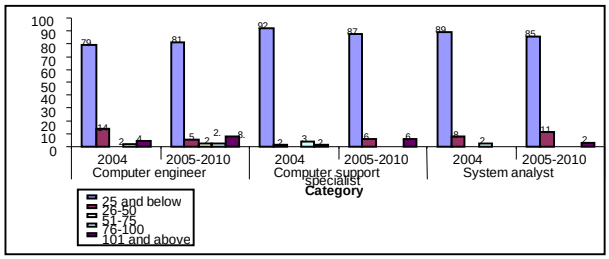


Figure 7: Distribution of ICT workforce

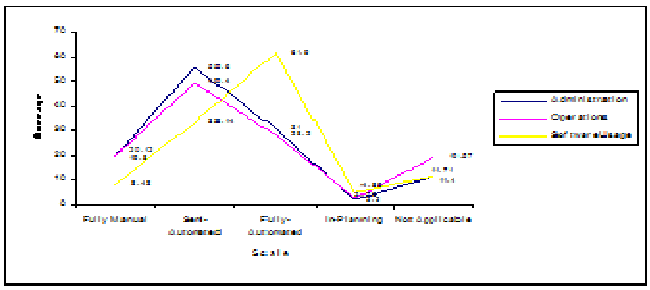


Figure 8: Comparison of ICT adoption level

Figures 7show the distribution of the workforce demand in the ICT industry. The highest proportion of companies in the sample came from the computer support specialist category with 25 and fewer employees, accounting for 92.2%. Database administrators follow at 91.2%, and then systems analysts at 89.2% of companies with 25 or fewer employees.The current demand for ICT workforce is in the ICT support category, followed by the categories requiring database administrators, systems analysts or application developers, and desktop publishing specialists. The demand for hardware or computer engineering was comparatively lower at 79.1% of the companies with 25 or fewer employee sample. However, in the next five years, the demand for computer engineers was predicted to increase by 2%.

A significant proportion of the sample in this study exhibited a demand for non-ICT officers who use computers in their daily operations. For companies with 25 or fewer employees, 59.7% of them employed non-ICT officers. Thus, almost 60% of the companies employed non-ICT officers who became knowledge workers. The transformation can be considered as a significant development toward becoming a knowledge society. However, in the next five years, the number of non-ICT workers will be reduced by 7% in companies who employ 25 or fewer employees.

Figure 8 shows comparison among companies on the level of ICT adoption in the administration, operation, and software application areas. An average of 55.6 applications is semi-automated and only 31 applications are fully automated, while in the latter, an average of 49.4 applications are semi-automated and only 28.2 applications are fully automated. Thus, semi-automated applications dominate both administrative and operative applications. Interestingly, traditional word processing (use of typewriter), manual spreadsheet, project planning, and human resource planning are still manually used. However, on the average, only 8.43 applications are manually accomplished. Software usage in fully automated applications is the highest at an average of 61.9%. The sample respondents also indicated that a number of applications are performed in planning, where software usage is highest at 4.86 applications.

Figure 9 shows the usage of e-business applications among the respondents. Business-to-business (B2B) refers to electronic transactions between companies, business-to-customer (B2C) refers to the availability of electronic facilities provided by a company to its customers, and business-to-government (B2G) refers to the portion of the e-government initiative that provides online access for companies and individuals to government services. The results indicated that only a small percentage of the sample (20% for B2C, 21.7% for B2B, and 25.8% for B2G) has not experienced e-business. Therefore, up to 80% of the companies in the sample have participated in e-business. The participation in the B2C category was among the highest, followed closely by the B2B category. The B2G category had the least participation at 74.2% of the sample.

Among the most frequently used e-business was B2C, whereas the least used was B2G. An ample opportunity to expand e-government initiatives remains, particularly at the state, local government, and the district and housing or village levels. Only with the implementation of these initiatives will Malaysia fully realize its potential to achieve a knowledge-based economy through a knowledge-based society.

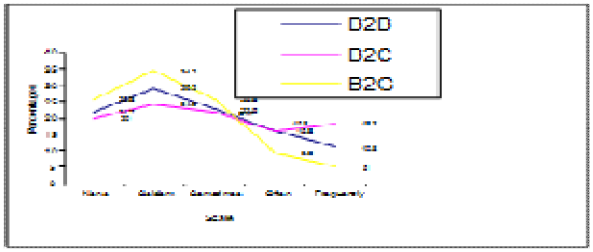


Figure 9: Usage of e-business applications

On technology adoption, intermediate technology dominated fully and semi-automated categories, which suggests that solutions for technology adoption are currently most popular in intermediate technology that is more economical than integrated technology but has the power and capability exceeding those of stand-alone technology. Figure 10 shows the trends in technology adoption, from fully manual to fully automated technology. Intermediate technology also dominated the fully manual category. Industries should consider integrated technology as increasingly feasible and economical integrated solutions in their entry to the era of globalization and in becoming more competitive.

IJBAMR

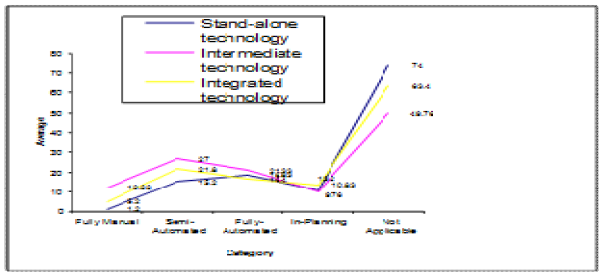


Figure 10: Technology Adoption

As organizations adopt IT, ICT training requirements become increasingly necessary. Respondents were asked on the frequency of their conduct of ICT training for their staff members in the administration and operations areas. The result showed that administrative staff members undergo more frequent ICT trainings than their operations counterparts. This result is relatively surprising given the requirement for operations personnel to be equipped with the necessary ICT skills and knowledge to become effective and efficient end users who are responsible for the day-to-day operations of the business. Figure 11 shows the frequency of ICT training attended by administrative and operations personnel.

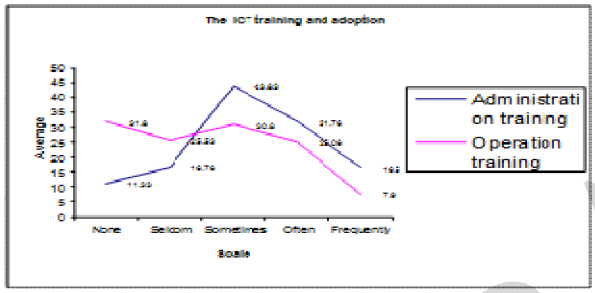


Figure 11: ICT Training

Figure 12 shows the frequency of technology training according to the three technology categories; stand-alone, intermediate, and integrated technologies. The graph indicates a trend in technology training that must be addressed, in which a high proportion of the sample in all three technology categories have none or very little training on the technology they adopted. The result showed a decrease in the average technology training in all three categories as the frequency of training increases. Competent and skillful technology adopters are achieved after sufficient training, and firms must be prepared to allocate an appropriate training budget.

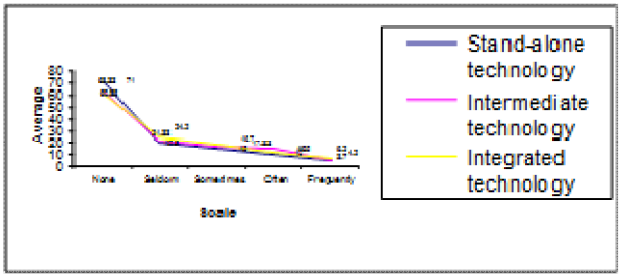


Figure 12: Technology training

The final part of the questionnaire examined the productivity of the respondent companies based on whether the companies are production-based, service-based, or both. Figure 13 illustrates the result of the productivity trends from low, moderate, to high productivity, as indicated by the respondents. Service-based companies have better productivity performance than production-based companies. The graph indicates that productivity performance for service-based companies increases from double at the low to moderate productivity to almost triple at the high productivity category. This finding suggests that more focus should be given to the service industry to help accelerate the Malaysian economy, particularly in the effort to become a fully developed nation in the near future.

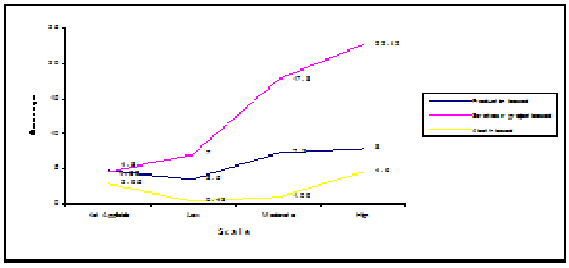


Figure 13: Measurement of productivity

IV. Discussion and Conclusion

The development of human resources contributes to sustainable productivity for continued economic growth. The present study suggests that the industrial sector should be aware in adopting ICT and other advanced technology to generate a high value-added economy. This study has also shown that a large vacuum exists for well-educated skilled manpower in the areas of IT and other high technology for SMEs in the industrial sector. The findings may not be favorable in the era of the k-economy at present, where the demand for progress in high technology development and IT is high as a result of globalization. The findings revealed a low level of IT manpower and low technology adoption among SMEs. The requirements for skilled human resource in ICT and knowledge for other technologies have shown high percentages of fulfillment in terms of manpower requirements. K-workers, such as employees with technology and ICT skills, adopt IT products in carrying out their job functions. The percentage of k-workers with technology skills was found to be higher than those with ICT skills.

The size of the k-workforce at the managerial level was found to fulfill the requirement. However, higher job demands are expected in the future for all three managerial levels. Moreover, high staff turnover is anticipated as other companies expand their operations after the recent economic recovery. The results of this study in terms of technological skill suggest that the current need for all categories of skilled and unskilled workers is almost fulfilled. However, the demand for skilled and unskilled workers may increase in the future. In addition, relevant training programs should be given to specific employees. Firms should also be encouraged to support re-training to address the issue of trainees not being adequately trained. Moreover, firms should consider introducing incentives to encourage employees to increase their ICT literacy. The government may also consider subsidizing tax incentives for training programs to encourage SMEs to invest in ICT and high-technology training. With the current technology

IJBAMR

and ICT capability, further research and development work should be carried out to determine the best use for technology and ICT in training, either through computer-assisted learning and instruction, e-learning and/or using virtual reality, or other modeling and prototype development.

REFERENCES

[1] Zulkhairi, M.D, Strategic application portfolio in SMEs. Malaysian Management Journal, Vol. 6, (1 & 2),pp.1-15, 2002.

[2] Westhead, P., Wright, M. and Ucbasaran, D, International market selection strategies selected by 'micro' and 'small' firms. OMEGA The International Journal of Management Science,Vol. 30 (1), pp. 51-68, 2002.

[3] Hodge, S, "The SME/SMIs. IT Annual Roundup 2001", 2001.

[4] Nwankwo, Quality assurance in small organizations: myths and realities. International Journal of Quality & Reliability Management, Vol. 17(1), pp.82-99, 2000.

[5] Moha Asri, A and Mohd Isa, B, Small and medium enterprise in Asia Pacific: Prospects in the New Millenium. Nova Science Publisher: New York, 2000.

[6] Raymond, L, End-user computing in the small business context: Foundations and directions for research, Data Base, Vol. 20 (4), pp. 20-26, 1990.

[7] Hussein, S.M. and Zulkhairi, M.D. (2004). Firm competitiveness and the challenges of globalization: Selected case studies from the IT industry in Malaysia. Presented at the 8th International Conference on Global Business and Economics Development, Guadalajara, Mexico 7-10 Jan, 2004.

[8] Shamsuddin, A., Masjuki, H., and Zahari, T, State of implementation of TPM in SMIs: a survey study in Malaysia. Journal of Quality in Maintenance Engineering,Vol. 10(2), pp. 93-106, 2004.

[9] Gustafsson, R., Klefsjo, B., Berggren, E., andGranfors-Wellements, U, Experiences from implementing ISO 9000 in small enterprises – a study of Swedish organization. The Quality Magazine, Vol. 13 (4), pp. 232-246, 2001.

[10] Ma, H, Competitive advantage: kinetic and positional. Business Horizons, Vol. 43(1), pp. 53, 2000.

[11] Gasco, J. L., Llopis, J., and Gonzalez, M. R, The use of information technology in training human resources: An e-learning case study. Journal of European Industrial Training, Vol. 28(5),pp. 370-382, 2004.

[12] Englehardt, C. S., and Simmons, P. R, Organizational flexibility for a changing world. Leadership & Organization Development Journal, Vol. 23(3), pp. 113-121, 2002.

[13] Draganidis, F., and Mentzas, G, Competency based management: a review of systems and approaches. Information Management & Computer Security, Vol. 14(1), pp. 51-64, 2006.

[14] Boselie, P., and Paauwe, J, Human resource function competencies in European companies. Personnel Review, Vol. 34 (5),pp. 550-566, 2005.

[15] Heffernan, M., and Flood, P. C, An exploration of the relationship between the adoption of managerial competencies, organizational characteristic, human resource sophistication and performance in Irish organizations. Journal of European Industrial, Vol. 24 (4), pp. 128-136, 2000.

[16] RCSA, Submission from the recruitment and consulting services association to the economic development committee of the Parliament of Victoria inquiry into labor hire in Victoria, Recruitment and Consulting Services Association, Sydney, 2004

[17] Garavan, T. N., Morley, M., Gunnigle, P., and Collins, E, Human capital accumulation: the role of human resource development. Journal of European Industrial Training, Vol. 25(4), pp. 48-68, 2001.

[18] Markham, S. K, Corporate championing and antagonis as forms of political behavior: An R & D perspective. Organization Science, Vol. 11 (4), pp. 429-447, 2000.

[19] Arthur, M.B., and Rousseau, D.M, Introduction: The boundary less career as new employment principle. The Bounderless Career, Oxford University Press, New York, NY, 1996.

[20] Ellig, B.R, Employment and employability: Foundation of the new social contract. Human Resource Management Journal, Vol. 37 (2),pp.173-178, 1998.

[21] Morgan, N. A., Clark, B. H., & Gooner, R, Marketing productivity, marketing audits, and systems for marketing performance assessment: integrating multiple perspectives. Journal of Business Research, Vol. 55, pp. 363-375, 2002.

[22] Sandberg, J., Understanding human competence at work: an interpretive approach. Academy of Management Journal, Vol. 43 (1), pp. 9-17, 2000.

[23] Dahalin, Z. and Golder, P.A, Information technology adoption and end-user computing survey: Preliminary results, Division of Electronic Engineering & Computer Science, Aston University, 1998.

[24] DTI, Competitiveness UK: Speech by the Right Hon. Margaret Beckett MP, President of the Board of Trade, 4 June 1997. Retrieved June 12, 1997 from the World Wide Web: http://www.dti.gov.uk/Minspeech/ compspch.html, 1997.

[25] Montazemi, A.R, An analysis of information technology assessment and adoption in small business environment, Information Systems and Operations Research, Vol. 25 (4),pp. 327-337, 1987.

[26] FMM, Federation of Malaysian Manufacturers (FMM), 2002. Kuala Lumpur, 2002.

[27] Kerlinger, F.N, Foundations of Behaviour Research. 4rd Ed. Holt, Rinehart & Winston, New York, 2000.

[28] Palvia, P., Means, D.B. Jr. and Jackson, W.M, Determinants of computing in very small businesses, Information & Management, Vol. 27, pp. 161-174, 1994.

[29] Lai, V.S, A survey of rural small business computer use: Success factors and decision support, Information & Management, Vol. 26, pp. 297-304, 1994.

[30] Raymond, L. and Bergeron, F, Personal DSS success in small enterprises, Information & Management, Vol. 22(5), pp.301-308, 1992.

IJBAMR