THE DEVELOPMENT OF THE MALAYSIAN TECHNOLOGY CONTENT FRAMEWORK TOWARDS THE ESTABLISHMENT OF THE MALAYSIAN TECHNOLOGY INDEX IN MANUFACTURING INDUSTRY

Abdullah Ibrahim[1], Siti Aishah Md Hasan[2]

[1]Professor, Faculty of Engineering Technology, University, Malaysia Pahang, Malaysia

[2]Faculty of Industrial Management, University, Malaysia Pahang, Malaysia

ABSTRACT

Appropriate technology plays a vital role in the ability of manufacturing enterprises to be productive and competitive. Today, most companies accept the fact that they must acquire relevant technology to strengthen their technological capabilities and core competencies. The proposed study intends to investigate the content of technology in that affect the application of new technology in Malaysian manufacturing industry. Next, this study aims to develop the Malaysian Technology Content Framework, in which this framework will form the basis for the development of Malaysian Technology Index for manufacturing industry. This study is carried out through three phases which involves survey of literature and practices, interviews or participatory dialogue with industry players, and pilot testing. This study indicates that all technology contents are significantly correlated with the technology strategy implementation at p-value of 0.000 (p<0.05). In detail, the results show that human, technology, organization and information are significantly correlated with technology strategy with a correlation value of 0.880, 0.798, 0.857, and 0.449 respectively. It is also found a significant correlation between technology strategy and technology application at 0.839 which will lead to the application of new technology.

Keywords: Technology Content Framework, Technology Index, Technology Strategy, Manufacturing Industry, Technology Capability

I. INTRODUCTION

Continuous updating of technology is important for a modern manufacturing organisation to become a global competitor. Competitiveness in the manufacturing environment can be characterised by world class manufacturing principles. Such principles would include the manufacture of products at competitive cost, supply of products at competitive price, high quality, short lead times and variety of product features. A major role of technology is to optimise these characteristics, and the direct impact of technology in the organisation can thus be seen in the fewer, faster and more accurate processes within the product development, manufacturing and supply cycles. Although most manufacturing organisations accept the fact that they must acquire relevant technology to strengthen their technological capabilities, the task of choosing and exploiting the newly acquired technology to get optimum results, remain a difficult one.

In order to apply and manage technology effectively, Malaysian firms need to develop their technological capability that guides their utilization of technological resources. However, Malaysia's technological performance does not achieve up to the mark, showing that most of the firms in Malaysia still lack of capabilities to make available and use of latest technology. A study by UNIDO found that manufacturing industry in Malaysia was characterised by assembly and processed type production which resulted the level of skills required were relatively simple in assembly and process activity. The implication of this situation is that the industries involved require workers with a low level of technical skills. This paper, therefore, intends to investigate the content of the technology within the manufacturing industry in Malaysia and tries to establish the Technology Content Framework. This framework is hoped can be used as a basis for the development of the Malaysia Technology Index.

II. TECHNOLOGY

Technology has become one of the important elements to the society, business and industry in newly industrialized countries [1]. It always plays a major role in the creation of wealth and now technology is accepted as a key source of competitive advantage [2]. There are several technological entities besides hardware such as software and human skills. Lorentzen et al.[3] state that technology involved knowledge, equipments, and documents that help firms to upgrade their performance whereas Van Wyk [4] suggests that technology is competence, created by people, and expressed in devices, procedures and human skills, in which these constituent elements need to be combined to form as a technology entity.

A study conducted by Dolinsek and Strukelji [5] on some of the largest companies in the technologically most advanced manufacturing sectors such as ExxonMobil, iRobot, Boeing, Microsoft, and Sony shows that in these companies, technology refers to methods, techniques, procedures, processes, machine, and devices that people and organizations use in their activities. Also, their study shows that these companies do not immediately refer to technology as knowledge or skills, but they rather emphasize technological or technical expertise, technical knowledge, and technical skills.

III. TECHNOLOGY CAPABILITY

Technological capability has been explained in various ways depending on the interest of the researchers. Garcia-Muina [6] conceptualized technological capability as a tool for implementing competitive strategy and creating value in any given environment. They further defined it as the ability to jointly mobilize different scientific and technical resources which enables a firm to successfully develop its innovative products or productive processes. Technological capability is also able to make the right investment choices; increase production capacity, and engage in continuous upgrading of product quality [7]. However, Wang et al [8] argue that technological capability plays a critical role in competitive strategy for business performance but such an impact depends on the characteristics of business environment.

IV. TECHNOLOGY CONTENT

Technology contents makeup a 'TIHO Framework' where Sharif [10] proposes that any technology consists of four components; 1) Technoware (T) is the physical assets such as equipment or machinery that is used to carry out a specific activity or task, 2) Inforware (I) is the knowledge and information of how to use hardware in order to carry out the required activity or task, 3) Humanware (H) is the human skills needed for using hardware and infoware in order to carry out the required activity or task, 4) Orgaware (O) is the organizational and managerial structure to coordinate three above components in order to carry out the required activity or task.

4.1Technology

Rush et al. [11] posited once a new technology option is decided upon, a firm needs to deploy the resources to exploit it either by creating technology via in-house R&D, or acquiring it through a joint venture or technology licensing. According to Lane et. al [12], the ability of a firm to manage the acquisition of new technology and modify such acquired technology will determine the successful of implementation of firm's technology strategy. Therefore, the following hypothesis is proposed:

H1: The acquisition of technologies significantly predicts the implementation of technology strategy.

4.2 Human

The capabilities of the companies often rely on its people since they are essentially as part of mechanism for innovation in organization [13]. Identify and recruit the right employees with the right education and skill sets will ensure the successful of firms and organizations. According to Monappa [14], employees are recognized as a finite resource and the key to implement a new strategy of the organization. A study by Ashekele and Matengu [15] on an SME manufacturing enterprise at the northern town of Rundu, Namibia found that relatively high levels of skill among employees provided impetus for a desire to be more competent.

Mohamed et al. [16] reveal that knowledge base factor, level of employee's readiness which includes technical skills, experience, and willingness to learn give affects to the technology transfer performance. Meanwhile, a research carried out by United Nations Commission [17] found that a lack of sufficiently skilled labour force unable to assimilate and adapt new knowledge to local conditions is an impediment to the implementation of new strategy for technology transfer activities. As such, the following hypothesis is proposed:

H2: Human with core competencies significantly predicts the implementation of technology strategy.

4.3 Information

Empirical research has looked at the nature of the linkages distinguishing between the role played by specific factors such as suppliers, customers, and universities [18] as source of information. The importance of some knowledge sources may also have been overestimated when they have been examined in isolation from other sources of knowledge [19].

Reichstein and Salter [20] argue that knowledge from suppliers enhances process innovations in firms with a cost-focus strategy. In addition, Bodas Freitas et al. [19] discover that firms with process innovations pursuing innovative strategies are generally tend to set up linkages with customers and governmental research institutes while firms with product innovations tend to engage in formal collaborations with competitors, suppliers, and other firms in the group. In this regard, the following hypothesis is proposed:

H3: Successful technology strategy implementation depends on information gained from external linkages.

4.4 Organization

Organization is very important as it makes management and scheduling work load easy. It brings together all the components of technology implementation. Efficient organizational design is very important as a source of competitive advantage in a world of temporary advantage [21]. According to Crossan and Berdrow [22], designing organizations in the present economy context should take into account organizational learning, as knowledge is considered to be one of the most important resources to the designation of sustainable competitive advantage. In leading firms, the learning process can become conscious and formal leads to continuous improvements in effectiveness, efficiency, and strategy formulation [11]. Therefore, the following hypothesis is proposed:

H4: Successful strategy implementation depends on good internal organization.

V. TECHNOLOGY STRATEGY

Conventionally, the broad objective of technology strategy is to guide a firm in acquiring, developing and applying technology for competitive advantage. It is one of the important factors for determining a firm's long-term competitiveness [23]. According to Beer et al.[24], strategy can be implemented by aligning an organization's goals, resources, and capabilities together with the environmental factors. More specifically, the adoption of technology strategy is considered as the most important thing especially for high-tech industries because it is directly related to the development of the technological capabilities through its interaction with the external environment [25].

A study that was carried out by Cooper and Edgett [26] in Corning Glass which manufactured fibre-optic cable, and Nortel Network which produced the boxes at each end of the cable to convert the light signal into an electronic signal shows that by developing a renewed innovation strategy resulted into better product innovation performance. Sharma [27] has shown that technology strategy is correlated with the organizational performance in firm level particularly for the firms in the growth stage and involved in the production of consumer and industrial goods.

VI. METHODS

This study was conducted in two phases: Phase 1 was a survey of literature and practices, while phase 2 was a participatory dialog and consultation with industrialists. Phase 1 aimed to search literature on the development of framework for technology contents as well as current practices both in Malaysia and abroad. Phase 2 was a survey whereby questionnaires were mailed and delivered to the targeted manufacturing firms. This study focused only on electrical and electronics manufacturing firms in Malaysia with more than 500 employees. Electrical and electronics manufacturing companies were chosen because they are the leading sector in Malaysia's manufacturing sector. Furthermore, the electrical and electronic manufacturing companies have developed significant technological capabilities and skills for the production of higher value-added products.

6.1 Data Collection

About 161 electrical and electronics manufacturing companies hiring more than 500 employees have registered with the Federation of Manufacturing Malaysia (FMM). The researcher was able to reach 131 companies for a survey but only 110 returned, making 84% response rate. Data were also collected from focused group discussion with top management of four related companies. The discussion was focused on the issues related to technology content, such as techniques applied to identify the appropriate technologies that can be exploited, the process of matching the technology used with the knowledge and skills of employees.

6.2 Questionnaire Design

The questionnaire was designed by adapting and modifying from Rush et al.[11], who assessed the technological capabilities of the firms by emphasising the development of technology policy. The questionnaire was divided into two sections which consist of 29 items. Section A comprises questions about demographic information of respondent. A total of 24 questions in Section B comprising independent and dependent variables were measured using five-point Likert scale from 1= strongly disagree to 5= strongly agree. A pilot test that was carried on 25 managers of manufacturing companies found the instrument was reliable with a score of 0.616 and above [28].

VII. RESULTS AND DISCUSSION

This study employed the Statistical Package for Social Science (SPSS) to analyse data in the first phase to compute the frequencies, means, and standard deviations. In the second phase, Structural Equation Modelling (SEM) was employed. SEM allows the simultaneous modeling of relationships among multiple independent and dependent constructs [29]. The analysis of the research model was conducted using PLS because PLS allows the analysis of both reflective and formative measures [30].

7.1 Validity of the Constructs

Validity was examined by using both convergent and discriminant validity analysis. According to Sekaran [31], convergent validity examines whether the measures of the same construct are correlated highly, whereas discriminant validity determines the measures of a construct have not been correlated too highly with other constructs. Factor loadings, composite reliability and average variance extracted were used to assess convergent validity. According to Gholami et al.[32], all factor loadings should be statistically significant and standardized loading estimate should be 0.5 or higher. Composite reliability (CR) equal to or greater than 0.7 and average variance extracted (AVE) equal to or greater than 0.5 is considered acceptable.

Table 1: Measurement Model

Contruct	Item	Loadings	Cronbach α	AVE	CR
Search	S8	0.960	0.914	0.921	0.959
	S9	0.959			
Competence	CC10	0.841	0.687	0.760	0.863
	CC11	0.901			
Awareness	AW6	0.840	0.624	0.727	0.842
	AW7	0.864			
Learning	L21	0.892	0.700	0.627	0.829
	L22	0.876			
	L23	0.564			
Assess and Select	AST15	0.811	0.642	0.733	0.846
	AST16	0.899			
Acquisition	TA17	0.950	0.890	0.901	0.948
	TA18	0.949			
Linkage_1	EL24	0.789	0.836	0.753	0.901
	EL26	0.889			

	EL27	0.920			
Linkage_2	EL25	0.660	0.767	0.695	0.870
	EL28	0.909			
	EL29	0.908			
Technology Strategy	TS12	0.857	0.892	0.823	0.933
	TS13	0.954			
	TS14	0.909			
Technology Application	IT19	0.915	0.744	0.795	0.886
	IT20	0.867			

Table 1 shows that the Crobach Alpha for all the constructs range between 0.624 and 0.914 which meet the benchmark of 0.6 as suggested by Hair et al.[32]. In addition, the loadings for all reflective items are greater than the recommended value of 0.5 indicating convergent validity at the indicator level [35]. The AVE values are range between 0.627 and 0.921, which exceed the recommended value of 0.5, indicating convergent validity at the construct level. The CR values are range between 0.829 and 0.959, which exceed the recommended value of 0.7, indicating acceptable reliability.

Next, the discriminant validity was examined by comparing the square root of the AVE for the construct with the inter-construct correlations. As shown in Table 2, the square root of each AVE (shown on the diagonal) is greater than the related inter-construct (shown off the diagonal) in the construct correlation matrix, indicating adequate discriminant validity for all of the reflective constructs. As can be seen, all model evaluation criteria have been met, providing support for the measures of reliability and validity.

Table 2: Inter-construct correlations

	1	2	3	4	5	6	7	8	9	10
acquisition	**0.949**									
application	0.815	**0.892**								
assess	0.748	0.750	**0.856**							
awareness	0.595	0.719	0.759	**0.853**						
competence	0.539	0.539	0.535	0.559	**0.872**					
learning	0.783	0.754	0.714	0.607	0.647	**0.792**				
linkage 1	0.410	0.460	0.450	0.543	0.246	0.430	**0.868**			
linkage 2	0.127	0.215	0.320	0.483	0.288	0.115	0.639	**0.834**		
search	0.619	0.784	0.804	0.827	0.545	0.774	0.431	0.211	**0.960**	
strategy	0.708	0.830	0.790	0.771	0.665	0.766	0.488	0.309	0.849	**0.907**

Note: Values in the on diagonal represent the square root of the AVE while the off diagonal represents the correlation

7.2 Hierarchical Component Model

Hierarchical component models (HCM) or higher order models most often involve testing second-order structures that contain two layers of components [33]. In addition, higher-order modeling involves summarizing the lower-order components (LOCs) which capture the sub dimensions of the abstract entity, into a single multidimensional higher-order construct (HOCs) which captures the more abstract entity [38]. As shown in Table 3, there are four HOCs and eight LOCs applied in this study.

Table 3: Hierarchical Component of Study

Lower-Order Components	**Higher-Order Constructs**
Competence	Human
Search	
Awareness	Organization
Learning	
Assess and select	Technology
Acquisition	
Internal Linkage	Information
External Linkage	

An HCM is characterized by reflective-formative relationship which indicates a formative relationship between the HOCs and the LOCs, whereby each of the constructs is measured by reflective indicators. To establish the HOCs' measurement model, Hair et al.[34] indicate that all the indicators from the LOCs should be assigned to the HOCs in the form of a repeated indicators approach. Number of indicators should be similar across the LOCs otherwise the relationships between the HOCs and LOCs may be significantly biased by the inequality of the number of indicators per LOC. Figure 1 provides the graphical presentation on the Hierarchical Component Model for this study.

Then, convergent validity of each HOCs' indicators should be determined first. According to Gholami et al.[32] all factor loadings should be statistically significant and standardized loading estimate should be 0.5 or higher. Next is to validate the formative measures, multicollinearity between indicators. Multicollinearity can be assessed by looking at the value of tolerance and variance inflation factor (VIF). Tolerance is an indicator of how much of the variability of the specified independent variable is not explained by the other independent variables in the model [40]. If this value is very small, it indicates that the multiple correlation with other variables is high (above 0.9), suggesting the possibility of multicollinearity. VIF, on the other hand, is the inverse of tolerance value.

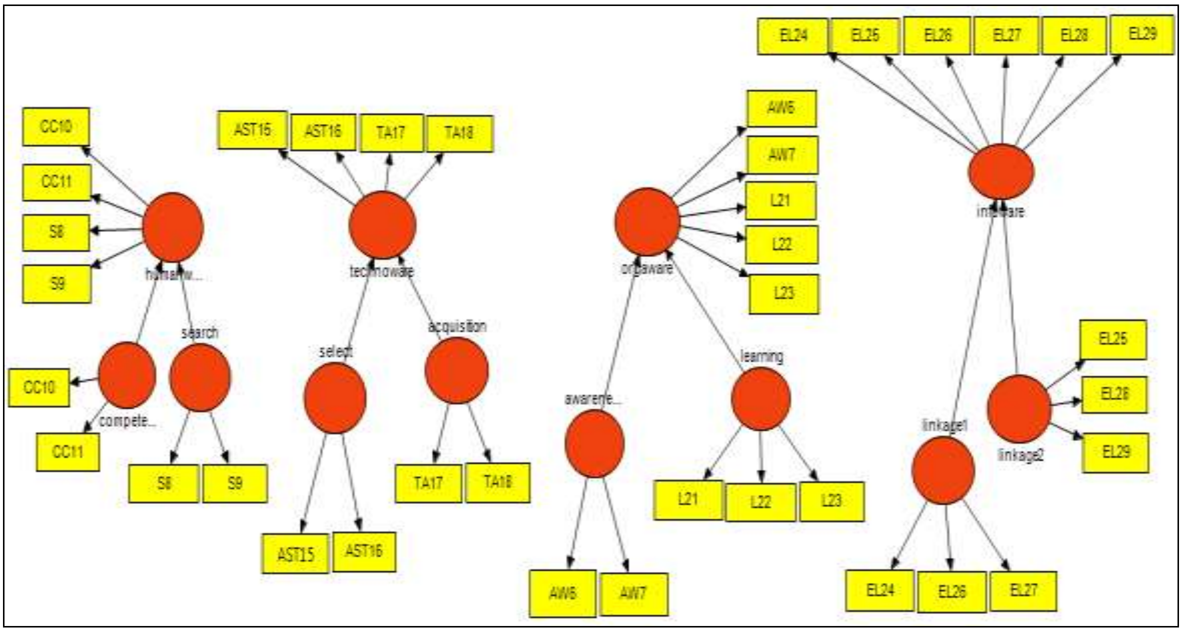

Figure 1: Hierarchical Component Model (Reflective-Formative Type)

In the context of PLS-SEM, a tolerance and VIF values of less than 0.2 and greater than 5.0 respectively indicate a potential collinearity problem [32]. These levels indicate that 80% of an indicator's variance is accounted for by the remaining formative indicators associated with the same construct.

As presented in Table 4 below, the results show that all the loadings of each HOCs' indicators are greater than recommended value of 0.5 except for indicator L23 (0.433), however, this indicator will not be deleted. In addition, the result of collinearity statistics shows that the tolerance values of all HOCs constructs are within the recommended value (greater than 0.2) indicate that the data has not violated the multicollinearity assumption. This is also supported by the VIF value which is below the cut-off of 5.0.

Table 4: Outer Loading, Tolerance and VIF for Hierarchical Component Model

Item	Construct	Weight	Tolerance	VIF
AST15	Technology	0.666	0.453	1.587
AST16		0.887		
TA17		0.903		
TA18		0.897		
CC10	Human	0.636	0.564	1.772
CC11		0.793		
S8		0.894		
S9		0.875		
EL24	Information	0.636	0.643	1.554
EL25		0.683		
EL26		0.877		
EL27		0.864		
EL28		0.756		
EL29		0.760		
AW6	Organization	0.711	0.630	2.206
AW7		0.767		
L21		0.749		
L22		0.909		
L23		0.431		

7.3 Correlation

The result of correlation matrix indicates that all the technology contents are significantly and positively correlated with technology strategy implementation at p-value of 0.000 ($p<0.05$) as presented in Table 5. In detail, the results show that human, technology, organization, and information are significantly and positively correlated with technology strategy implementation with a correlation value of 0.88, 0.798, 0.857, and 0.449 respectively. In addition, there is also a significant and positive relationship between technology strategy implementation with technology application when the analysis shows the correlation value of 0.839 at p-value of 0.000 ($p<0.05$).

Table 5: Correlation matrix of all variables

		H	T	O	I	TS	TA
Human (H)	Pearson	1					
	Sig. (2-tailed)						
Technology (T)	Pearson	0.781**	1				
	Sig. (2-tailed)	0.000					
Organization (O)	Pearson	0.915**	0.840**	1			
	Sig. (2-tailed)	0.000	0.000				
Information (I)	Pearson	0.372**	0.381**	0.473**	1		
	Sig. (2-tailed)	0.000	0.000	0.000			
Technology Strategy (TS)	Pearson	0.880**	0.798**	0.857**	0.449**	1	
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		
Technology Application (TA)	Pearson	0.785**	0.830**	0.883**	0.389**	0.839**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	

*Correlation is significant at p<0.05 (2-tailed).

**Correlation is significant at p<0.01 (2-tailed).

7.4 Measuring Structural Model

After analysing the measurement model, the next step in a PLS analysis is to create a structural model by the inner model. To do this, the researcher first examined the path loadings between constructs to identify significance using computed T-statistics. To test the significance, all the data were run using 500 bootstrapped samples with 0 cases per sample. Table 6 presents the path coefficients (β), t-value, and significance for the structural model.

Table 6: Summary of the structural model

Hypothesis	Relationship	Std Beta (β)	SE	t-value	p-value	Decision
H1	Technology → Strategy	0.258	0.097	2.826**	0.002	Supported
H2	Human → Strategy	0.594	0.115	5.341**	0.000	Supported
H3	Information → Strategy	0.1	0.054	1.763*	0.039	Supported
H4	Organization → Strategy	0.051	0.199	0.277	0.391	Not Supported
H5	Strategy → Application of Tech	0.83	0.034	24.503**	0.000	Supported

**p<0.01, *p<0.05

As shown, four out of the five hypotheses were supported. Technology (β=0.258, p < 0.01), Human (β=0.594, p < 0.01), and Information (β=0.100, p < 0.05) were all positively predict the adoption and implementation technology strategy. Thus, H1, H2, and H3 were supported while H4 was not supported. On the other hand, the implementation of technology strategy positively related to the application of new technology (β=0.830, p < 0.01). This supports for H5 of this study. It also demonstrates that human has the strongest effect in predicting the implementation of technology strategy followed by technology and information.

In addition, Figure 2 provides the graphical presentation of the model with the explanatory power of the estimated model which can be assessed by observing the R^2 of the endogenous constructs. The R^2 values of 0.75, 0.50, or 0.25 for the endogenous constructs can be described as substantial, moderate, and weak [34]. Therefore, the R^2 value of technology strategy is 0.816 which indicates substantial while application of technology is 0.689 can be considered moderate. This study also revealed that approximate 82% of the variation in technology strategy adoption can be explained by all the technology content variables (Human, Organization, Information, and Technology) while approximate 69% of the variation in the new technology application can be explained by the implementation of technology strategy.

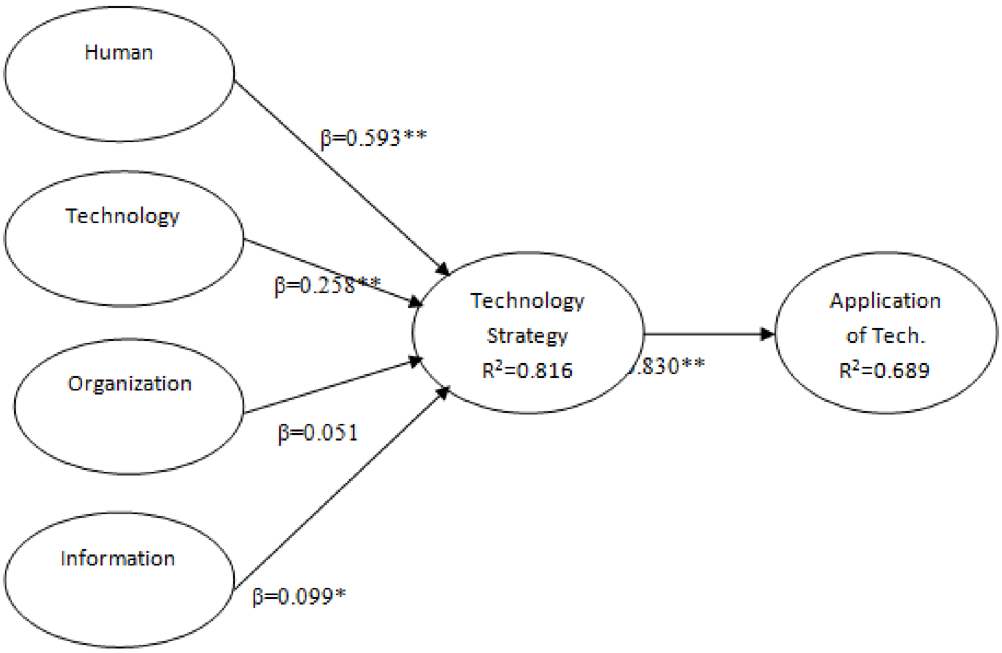

Figure 2: Results of the Structural Model. Note: **P< 0.01, *P< 0.05

VIII. CONCLUSION

The findings obtained from this study reveal that there are strong relationships between the key technology content and technology strategy implementation as well as between technology strategy implementation and technology adoption and application. The results will guide industry players in selecting and applying new technology, hence make it competitive globally.

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REFERENCES

[1] Tai-Yue, W. and Shih-Chien, C., "The influences of technology development on economic performance - The example of ASEAN countries", Technovation. 27, 2007, 471-488.

[2] Reisman, A., Comparative technology transfer: A tale of development in neighbouring countries, Israel and Turkey Comparative Technology Transfer and Society. 3(3), 2005, 322-370.

[3] Lorentzen, J., Mollgaard, P., and Rojec, M.," Host-country absorption of technology: Evidence from automotive supply networks in Eastern Europe", Industry and Innovation. 10(4), 2003, 415-432.

[4] Van Wyk, R. 2004. Technology: A unifying code; A simple and coherent view of technology.SA:Stage Media Group.

[5] Dolinsek, S. and Strukelj, P., Technology, Wealth and Modern Management of Technology.Managing Global Transitions. 10(1), 2012, 29-49.

[6] Garcia-Muina, F. and Navas-Lopez, J., "Explaining and Measuring Success in New Business: The Effect of Technological Capabilities on Firm Results", Technovation. 27(1-2), 2007, 30-46.

[7] Marjolein C. and Romijn, H., Technological Learning in Small Enterprise Clusters:Conceptual Framework and Policy Implications, In: Mani, S. and Romijn, H. Eds. Innovation, Learning and Technological Dynamism of Developing Countries, UNU Press, Tokyo and New York, 2004, 135-157.

[8] Wang, E.T.G., Tai, J.C.F. and Wei, H.L., "A virtual integration theory of improved supply-chain performance", Journal of Management Information Systems. 13(2), 2006, 41-64.

[9] Kyriakou, D., Technology and sustainable growth: Towards a Synthesis, Technological Forecasting and Social Change. 69, 2002, 897–915.

[10] Sharif, N., The Evolution of Technology Management Studies: Techno-economics to Technometrics, Technology management: Strategies and applications for practitioners. 2(3), 1995, 113-148.

[11] Rush, H., Bessant, I. and Hobday, M., Assessing the technological capabilities of firms: Developing a policy tool. R&D Management. 37(3), 2007, 221-236.

[12] Lane, P., Salk, J. E., and Lyles, M. A., "Absorptive capacity, learning and performance in international joint ventures", Strategic Management Journal. 22(12), 2001, 1139-1157.

[13] Subramaniam, M. and Youndt, M.A, "The influence of intellectual capital on the types of innovative capabilities", Academy of Management Journal. 48, 2005, 450-463.

[14] Monappa, A. 2005. Liberalization and Human Resource Management: The new economic policy and human resource management. Challenges for the corporations of tomorrow. New Delhi: Sage Publication.

[15] Ashekele, H.M. and Matengu, K., Success factors in technology transfer to SME's: Rundu woodwork common facility center. Proceedings of the Portland International Conference on Management of Engineering & Technology 2008 (PICMET 2008),Cape Town, South Africa, 2008, 2190 – 2196.

[16] Mohamed, A. S., Sapuan, S. M., Megat Ahmad, M. M. H., Hamouda, A. M. S. and Hang Tuah, B. T., "The effect of technology transfer factors on performance: An empirical study of Libyan petroleum industry", American Journal of Applied Sciences. 6(9), 2009, 1763-1769.

[17] United Nations Commission, Technology transfer to small and medium enterprises and identifying opportunities for domestic and foreign direct investment in selected sector. Economic and Social Commission for Western Asia, 2005.

[18] Laursen, K. and Salter, A., Searching high and low : What types of firms use as a sourceof innovation? Research Policy. 33, 2004, 1201-1215.

[19] Bodas Freitas, I. M., Claussen, T, Fontana, R. and Verspagen, B., Formal and informal external linkages and firms' innovative strategy. A cross-country comparison. Paper presented at the Schumpeter Society Conference. Rio de Janeiro, 2008.

[20] Reichstein, T, and Salter, A., Investigating the sources of process innovation among UK manufacturing firms. Industrial and Corporate Change. 15(4), 2006, 653-682.

[21] Daft, R., Understanding the Theory and Design of Organizations. Mason, OH: Thomson South Western.

[22] Crossan, M.M. and Berdrow, I. 2003. "Organizational learning and strategic renewal", Strategic Management Journal. 24(11), 2007, 1087-1105.

[23] Fuchs, P.H., Mifflin, K.E. ,Miller, D. and Whitney, J.O., Strategic Integration: Competing in the age of capabilities. California Management Review. 42(3), 2000, 118-147.

[24] Beer, M., Voelpel, S.C., Leibold, M. and Tekie, E.B., Strategic management as organizational learning developing fit and alignment through a disciplined process. Long Range Planning. 38(5), 2005, 445-465.

[25] Zahra, S.A. and Bogner, W.C., "Technology strategy and software new ventures' performance: Exploring the moderating effect of the competitive environment", Journal of Business Venturing. 15(2), 1999, 135-173.

[26] Cooper, R.G. and Edgett, S.J., Developing a product innovation and technology strategy for your business. Research Technology Management. 53(3), 2010, 33-40.

[27] Sharma, S., "Technology strategy, contextual factors and business performance: An investigation of their relationship", South Asian Journal of Management. 15(3), 2008, 19-39.

[28] Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C., Multivariate data analysis. 6th ed. New Jersey: Prentice-Hall International Inc., 2006.

[29] Byrne, B.M., Structural Equation Modeling with AMOS: Basic concepts, applications and programming. Mahwah, NJ: Lawrence Erlbaum Associates, 2001.

[30] Ringle, C.M., Wende, S. and Will, A. 2005. SmartPLS 2.0 (beta), available at www.smartpls.de (assessed October, 2013).

[31] Sekaran, U., Research methods for business. A skill building approach. 4th ed. NY: John Wiley & Sons Inc., 2003.

[32] Gholami, R., Ainin, S., Ramayah, T. and Molla, A., "Senior manager's perception on green information system (IS) adoption and environmental performance: Results from a field survey", Information and Management Journal. 50, 2013, 431-438.

[33] Ringle, C.M., Sarstedt, M. and Straub, D.W., A critical look at the use of PLS-SEM. MIS Quarterly. 36, 2012, iii-xiv.

[34] Hair, J.F., Hult, G.T.M, Ringle, C.M. and Sarstedt, M., A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks, California, 2013.

[35] Pallant, SPSS survival manual: A step by step guide to data analysis using SPSS. 4th ed. New York: McGraw Hill, 2010.

[36] Hair, J.F. Ringle, C.M. and Sarstedt, M., "PLS-SEM: Indeed a silver bullet", Journal of Marketing Theory and Practice. 19, 2011, 139-151.

Biographical Notes

Dr. Abdullah Ibrahim is working as a Professor in the Faculty of Engineering Technology, Universiti Malaysia Pahang, Malaysia.

Siti Aishah Md Hasan is presently pursuing PhD in the Faculty of Industrial Management, Universiti Malaysia Pahang, Malaysia.