INTERNATIONAL JOURNAL OF INDUSTRIAL MANAGEMENT (IJIM)
ISSN: 2289-9286 e-ISSN: 0127-564X
VOL. 14, ISSUE 1, 491 – 505
DOI: https://doi.org/10.15282/ijim.14.1.2022.7060

ORIGINAL ARTICLE

FIRM'S TECHNOLOGICAL CAPABILITIES TOWARD TECHNOLOGY TRANSFER PERFORMANCE IN MALAYSIAN MANUFACTURING COMPANIES: THE ANTECEDENTS THAT LEAD TO SUCCESSFUL DEVELOPMENT OF FIRM'S TECHNOLOGICAL CAPABILITIES

Siti Aishah binti Md Hasan[1], Abdullah bin Ibrahim[1]

[1]Faculty of Electrical and Electronics Engineering Technology, Universiti Malaysia Pahang, 26600 Pahang, Malaysia.

ABSTRACT – Drawing upon Resource-Based View (RBV) theory, this study empirically examines the antecedents that lead to the development of firm's technological capabilities. This study also investigates the effect of firm's technological capabilities on the performance of technology transfer activities in Malaysian manufacturing companies. The data were obtained from 133 Malaysian manufacturing companies, which were selected using systematic random sampling. This study employed a survey method by using a self-reporting questionnaire. The data collected were thoroughly analysed through Structural Equation Modelling (SEM) with Partial Least Squares (PLS) version 2.0. This study discovers five antecedents that influence the development of the firm's capabilities of Malaysian manufacturing companies; technological competencies, transformational leadership, technological learning, external linkages, and technology strategy. In addition, all the antecedents significantly influenced the development of the firm's technological capabilities. Moreover, the results of this study indicate that the firm's technological capabilities significantly related to technology transfer performance.

ARTICLE HISTORY
Received: 25-10-2021
Revised: 6-11-2021
Accepted: 31-7-2022

KEYWORDS
Technological Capabilities
Technology Transfer
Performance
Manufacturing Companies
Malaysia

INTRODUCTION

Technological advancement has become an important part of Malaysian growth in which continuous technology upgrading plays a significant role in encouraging and pushing Malaysian economic development. Malaysia perceives technology transfer as one of the most serious constraints in its efforts to advance the level of economic development (Hamdan, Fathi and Mohamed, 2018). Malaysia has been aspired to move towards a technology-driven pattern of development from the beginning of participation in technological development since the 1960s. As a developing country, Malaysia strived to stand at par with many developed countries with regard to its technological competitiveness (Perkins, Rasiah and Woo, 2017). In fact, Malaysia has capabilities to develop and create new technologies on its own (Economic Planning Unit, 2021).

Malaysia steers its technological development with the formulation of the First National Science and Technology Policy (NSTP) in 1985 with the focal point to promote scientific and technological self-reliance in accelerating socio-economic growth (Government of Malaysia, 1986). Malaysia has further formulated the Fifth Malaysia Plan (1986-1990) (Economic Planning Unit, 1986) and the First Industrial Master Plan in 1986 (Ministry of International Trade and Industry, 1994), followed by the Action Plan for Industrial Development in 1990 to strengthen science and technology capabilities to overcome the structural weakness that has been associated with the national industrial development. The commitment of the government to accelerate its technological development and performance was reflected in the increment of budget allocation in science and technology, which steadily escalating from RM540.5 million throughout the Fifth Malaysia Plan (1986-1990) to RM4,709 million throughout the Eight Malaysia Plan (2001-2005) (Shah, 2004). Malaysia has established a number of institutions to coordinate the efforts of the government. The establishment of the Ministry of Technology, Research and Local Government in 1973 and then became known as the Ministry of Science, Technology and the Environment (MOSTE) to contribute towards R&D and industry, and increase the capability of the local manufacturers to develop and absorb new indigenous technologies. Malaysian Technology Development Corporation (MTDC) was set up in 1991 while Technology Park Malaysia was established in 1992 to spearhead the development of technology businesses in Malaysia.

Despite the IMD World Competitiveness Yearbook 2015 reveals that Malaysia is one of the most competitive in the world [Malaysia Productivity Corporation (MPC), 2015], Malaysia's technological performance, however, is still lags behind. The Global Competitiveness Reports disclose that comparatively low technological readiness stands out as the major competitive challenge to technological development and performance [World Economic Forum (WEF), 2015]. Malaysia still incapable to adopt and make available of latest technologies to enhance its industries productivity, and also reflected the potential of the local firms to develop their own capability.

*CORRESPONDING AUTHOR | I. MD Hassan | ✉ aishah0802@yahoo.com

Issues Pertaining to the Development of Firm's Technological Capabilities.

Malaysia's decision to embark on building its technological capability is related to country's ambition to become a fully developed by the year 2020, but the fact is Malaysian industries face daunting challenges to develop and improve their technological capability and gear up country's economy to a higher level of development (WEF, 2014). The Grant Thornton International Business Report (IBR) has revealed that 62 per cent of businesses in Malaysia are finding it hard to source skilled workers (Grant Thornton, 2013). Insufficient skilled and talented workforces continue becomes a major obstacle to most manufacturing firms in Malaysia (WEF, 2016).

The vision of government of Malaysia in transforming local firms to a knowledge-enabling industry has forced local firms to implement a learning work culture which is driven by brain power, skills and diligence, fully technology intensive, and in possession of a wealth of information (International Business Publications Incorporation, 2014). Lack of knowledge sharing atmosphere, unwillingness of employees to share their knowledge, and the failure of the local firms to implement knowledge management programs that sustain organizational learning impede the firms to exploit and absorb new knowledge and information for the development of their innovative technologies and capabilities. Besides that, the visible leadership and commitment of top management must be sustained to develop capabilities and become a knowledge-driven organization (Moshari, 2013). However, The Southeast Asia results of Global Human Capital Trends 2016 survey found that leadership was identified as the top issue addressed by 97% of respondents worldwide, and only 40% of Malaysian respondents felt ready or very ready to deal with this issue (Deloitte, 2016).

In addition to accelerate technological upgrading, human resource development and industrial restructuring, the Vision 2020 also emphasizes the manufacturing firms to determine the way of developing industrial linking or networking for their growth (Mohan and Ismail, 2015). The Malaysia Education Blueprint 2015-2025 (Higher Education) has highlighted the need to take collaboration between universities and industry. However, there are mismatches in output from universities and industry expectations (Azmi, Hashim and Yusoff, 2018). Moreover, industrial linkages among manufacturing sector are considerably low especially SME-Large sectors linked (MPC, 2017).

Statement of Problem

Technological performance of Malaysia is still lagging behind when compared to regional competitors and countries at the similar level of development. Reports done by World Economic Forum in the Global Competitiveness survey for example, found that Malaysia's technological global competitiveness is not achieving up to the mark when Malaysia's position is on a downtrend (WEF, 2014). One of the current aims of government Malaysia is to become a knowledge-based economy where all Malaysian firms required to strengthen their capability by increasing reliance on the application of latest knowledge intensive technologies. However, the latest findings of the Global Competitiveness Report 2014-2015 (WEF, 2014) regarding the technological performance of Malaysia in the global competitiveness technology indicator are incongruent with this aim. The report found weaknesses in answering the questions related to the readiness of Malaysian firms to compete globally, and concluded that most of the firms in Malaysia still lack of capabilities to make available, absorb, and use of latest technology (WEF, 2014).

In addition, the findings of the Malaysia Productivity and Investment Climate Survey (World Bank, 2009) disclosed that Malaysia faces a daunting challenge to improve its technological capabilities and gear its economy to higher growth and move to higher level of development. These circumstances consistent with the previous study conducted by Rajah (2010) and Suzana (2013), who revealed that the involvement of local firms in technological activities is still low and most of the local firm's incompetent to produce the indigenous technology.

Consequently, while most existing studies are relevant to the context of industrialised countries (Ortega, 2010; Ariffin and Figueiredo, 2006) where technological capabilities have already been substantially created in industry, they have less relevance in the context of industrialising country like Malaysia where significant technological capabilities still have to be built up. Moreover, as many firms strive to achieve competitive advantage, they are confronted with the questions of how to determine the antecedents that shaping the technological capabilities of their firms. Therefore, this study is carried out to identify and examine the antecedents that influence the development of firm's technological capabilities in Malaysian manufacturing industry.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

Technology Transfer Performance

Technology transfer is an important mechanism for transforming technological capabilities generated from technological activities such as research and development projects, into new or improved productivity functions. Much efforts have been devoted by the Malaysian government to seek out technological progress via technology transfer activities. Currently, technology transfer has been used as a mean to transform Malaysia from the status of a developing country to a developed nation (Rahman Hamdan, Mohamad Syazli, and Mohamed, 2018). In addition, technology transfer was exploited to leverage Malaysia to participate in the high value- added activities.

Although technology transfer is not a new business phenomenon, it is difficult to give a precise definition due to internal process complexity. Ramanathan (2003) defined technology transfer as a movement of technology from one entity to another and created proper understanding and effective use of technology upon successful. Amy, Wei-Ming and Tsai-Ying (2010) view technology transfer as a complicated process involving the complexity of the technology, the capability of the owner and acquirer of technology to train and learn, respectively, and the complex interaction between

the two parties. Shmeleva et al. (2021) describe technology transfer as a distinct and complex type of communication process subject to regulatory and legal support, and the development of appropriate policies. Meanwhile, Gavrilyuk and Khvorostyanaya (2020) defined technology transfer as a movement of technology from the inventor to the initiator of the technology to create added value upon effective use of technology. From academic perspective, technology transfer encompasses a variety of activities that move academic discoveries carried out by the university into the public sector through the technology commercialization process (Van Norman and Eisenkot, 2017).

Performance of technology transfer activities have been measured by many authors with different perspectives. Whangthomkum et al. (2006) measured technology transfer effectiveness of 27 flexible packaging firms in Thailand into human resource performance, process performance, and business performance. Furthermore, a study carried out by Sarina et al. (2009) suggested that firm's investment in quality practices improves the process of transferred technology. Moreover, empirical research conducted by Lin et al. (2009) on 110 companies from the R&D Consortia in Taiwan focus on firms' technology advantage and marketing advantage in order to measure the performance of technology transfer. A study carried out by Stewart and Waroonkun (2007) in the construction industry identified three technology transfer outcomes, namely economic advancement, knowledge advancement, and project performance by using financial, schedule and quality indicators. Gunsel (2015) suggested that technology transfer effectiveness constituted to faster technological development, shorter product life-cycles, improve production capacity, and enhance intra- and inter-organizational transfer networking. Moreover, Secundo et al. (2016) revealed that the efficiency of university technology transfer was grouped into six efficiency areas which included IP strategy and policy, organization design and structure, human resource, technology, industry links, and networking. Subsequently, Siti Norbaya and Mohd Hafiz (2017) proposed non-financial measurements on the effectiveness of technology transfer. They concluded that R&D investments generated from technology transfer activities having greater importance in determining the SMEs performance such as shorter life cycle, continuous investment by high-tech SMEs, greater absorptive capacity, greater capacity to implement cooperation strategies with similar firms.

Firm's Technological Capabilities

Technological capabilities are a core resource and distinctive competency that enables firms to create firm value. Technological capabilities have empowered firms to create opportunities to support their competitive advantage (Heredia et al., 2022). Lin and Lai (2021) noted that firms with greater technological capability will gain more unique resources and skills and engage in more strategic activities, and thus can gain competitive advantages and increase their profitability while enhancing their organizational performance.

The bulk definitions on technological capability have shown it has expanded through times. For example, Noorhassidah, Alina and Eta (2017) define technological capability as 'the ability of the organizational and individual resources which include firm knowledge, skills and experience to design and produce new innovative products, improve competitive advantage, thus achieved desired results' (p.722). Wang et al. (2006) identified the concept of technological capability as a set of pieces of knowledge that includes both practical and theoretical know-how, methods, procedures, experiences and physical devices and equipment. They further referred technological capability of China high-tech firms as the ability to increase knowledge about the physical world in a unique way as well as transform this knowledge into designs and instructions for the creation of desired outcomes.

Jafari, Akhayan and Rafiei (2017) indicated that knowledge and technological capabilities were the key factors that facilitated the effectiveness of technology transfer. Kimosop et al. (2016) empirically examined the relationship between strategic capabilities and firm performance of 450 women-owned entrepreneurial ventures in Nairobi, Kenya. Their results of multiple regression analysis found that strategic capabilities have a significant effect on the overall ventures performances. Specifically, dimension of information technology capabilities and technological capabilities were found as strong predictors of venture performances. A study of Tzokas et al. (2015) advanced their current understanding of organizational antecedent impacting on absorptive capability and its influence towards the performance of 158 South Korean semiconductor firms. Applying structural equation modelling, their results confirmed that technological capability of the firms enhances the overall performances of the firm. Meanwhile, Neill, Singh, and Pathak (2014) reveal a positive and significant path relationship between technology capabilities and financial performance. From the above point of views, this study proposes that:

H1: Firm's technological capabilities have positive relationship with technology transfer performance.

Technological Competencies

In the last decades, competency-based view gained considerable attention in the literature on competitive advantage (Prahalad and Hamel, 1990; Hafeez, Malak, and Zhang, 2007; Sanchez, 2012). Martin and Whiting (2016) further assert that competencies are used in many organizations and provide an outline of the skills and abilities an employee should acquire to perform a job and achieve the required standard performance. The competent employees are an important wealth for transformation and services activities as well as for managing various process or functions of organizations (Park, 2010). According to Mohammed Abdulaal and Nordin (2020), competent employees reflected in human resource of the organization is the source of knowledge while knowledge is a source of strength and power of the organization. Moreover, Shaharudin et al. (2021) assert the firms to make an investment in skills advancement of their employees in order to face the challenges of new industrial revolution.

A study conducted by Hassan et al. (2013) measures the impact of employee creativity of 164 banking employees working in different branches of seven Pakistani banks operating in Multan city on organization. Their results indicate employee competency reflected by their creativity has shown significant positive relation with organization innovation capability. An empirical study of Bolivar-Ramos et al. (2012) indicates that organizational innovation capability of 201 Spanish technological firms is influenced by technological distinctive competencies through the development of employees' technological skills. Moreover, Martin-Rojas et al. (2013) shows there is a significant positive relationship between technological distinctive competencies and corporate entrepreneurship capability of 160 technology firms in Europe. Consequently, the following hypothesis was proposed:

H2: Technological competency is significantly influencing the development of firm's technological capabilities.

Transformational Leadership

Good leadership is essential for optimal performance and job satisfaction. A good leader should have capability to create and implement a good strategy to enhance strengths, reduce weaknesses, assess the crisis, and find new opportunities (Osborn, Hunt and Jauch, 2002). Daniel et al (2020) agree that leadership skills, traits and competencies reflected the attributes of a smart leader especially in smart city development. According to Cogaltay (2015), transformational leadership is one of the best ways to create performance and competitive advantage. Studies show that transformational leadership resulted in positive effects on organizational outcome (Anantatmula, 2010; Yang et al., 2011).

Empirical research conducted by Jansen, Vera, and Crossan (2009) at autonomous branches of a large European financial services firms has revealed a positive relationship between transformational leadership and the ability of the firm to pursue exploration innovation. Schweitzer (2014) used in-depth interviews and a questionnaire survey comprising 369 strategic business alliances. His data confirmed that the positive relationship between transformational leaderships and the development of innovation and operational capabilities of a strategic alliance. The pioneering study of Seyal (2015) discovered the significant relationship between transformational leadership styles of thirty-five Bruneian technical and vocational schools' leaders with the technology adoption capabilities. Khadim et al. (2016) empirically tested that technological innovation capabilities of 370 software houses in Pakistan are positively and significantly influenced by transformational leadership. Recently, Hui, Phouvong, and Phong (2018) explore an effective way to successfully improving innovation of Vietnamese manufacturing firms. Their result revealed that transformational leadership style significantly affects firm's innovation capability. Along the same vein, the present study agrees that:

H3: Transformational leadership significantly influencing the development of firm's technological capabilities.

Technological Learning

Technological learning is a strategic tool for the knowledge-based economy in the age of globalization to achieve competitive advantage (Allameh and Moghaddami, 2010; Chiva et al., 2013). Salarian et al. (2015) described technological learning as a set of organization's technological activities that include knowledge acquisition, sharing and interpreting of information, which have conscious or unconscious influences on positive organizational culture. A lack of emphasis on technological learning diminished performance of the organization, and the organizations may lose their efficiency and effectiveness which would make it hard to recover (Usefi et al., 2013).

From a knowledge-based perspective, Kim (2001) emphasizes the importance of technological learning for the development of technological capability especially for those firms that initially lack of technological capability. An empirical study conducted by Kumar et al. (2008) show that technological learning culture affect the ability of 62 Cuban hospitality companies to cultivate technological capability through innovation projects. Furthermore, a comprehensive model of technological learning developed by Chen, Pu and Shen (2010) highlights the importance of technological learning sources, contents, levels, agent, and environment in predicting both firm's technological innovation capability and performance. Thus, the fourth hypothesis was proposed as follows:

H4: Technological learning is significantly influencing the development of firms' technological capabilities.

External Linkages

Gronum et al.gus (2012) has identified the external relationships as a critical success factor to the firm's technological innovation capability development and performance. Johnson's (2011) study revealed and concluded that having close relationships with firms in the supply chain has also been posited as being instrumental for firms' innovation activities through joint research and product development. An empirical study of Simao, Rodrigues, and Madeira (2016) reveals the impact of external relationships to firm's capability to execute innovation activities. Their findings found that the capability of 684 firms based in Portuguese territory to innovate positively and significantly influenced by the cooperation of the firms with business partners which include clients, suppliers, other firms of the group and competitors, and also with science partners which include universities, other higher education institutions, research public institutions, non-profitable private organizations and consulting firms. Another study by Wickramaratne, Kiminami, and Yagi (2017) have examined the relation of external relationships and entrepreneurial infrastructure on the entrepreneurial orientations of

109 tea factories located in a low grown area in Sri Lanka. Their findings indicated the importance of external relationships to enhance the entrepreneurial orientations, specifically relationships with supply chain partners and government facilitating institutions. Therefore, the following hypothesis was proposed:

H5: External linkages significantly influencing the development of firm's technological capabilities.

Technology Strategy

Over the years, researchers and practitioners (Bagheri et al., 2012; Apulu and Latham, 2011) have recognized that technology plays an important role in gaining competitive advantage. However, despite superior technology, organizations may fail to compete successfully in the marketplace if they take a tactical rather than a strategic view of managing their technology (Ahmad and Schroeder, 2011). More importantly, the organizations need to craft their technology strategies to exploit their potential to gain competitive advantage (Li-Hua and Lu, 2013). Li-Hua and Lu (2013) define technology strategy as the pattern of choices that the firms make concerning technology development, technology direction and technology capacity building. Therefore, technology strategy is vital for every technology-driven company to build, maintain and exploit their technological assets. Eesley et al. (2014) assert that firms pursuing a technology-driven strategy often persuade managerial focus on technological development in order to achieve technological milestones necessary to develop products and services.

A study carried out by Cooper and Edgett (2010) in Corning Glass and Nortel Network shows that by developing a renewed innovation strategy improved firms' capability to produce better product innovation. Lee et al. (2020) discovers facilitating technological upgrading strategy accelerates the growth and sustainability of small and medium contracting enterprises in Klang Valley. However, Lefebvre et al. (2013) did not find any significant relationship between the firm's strategy (operationalized in terms of prospector, analyser and defender) and the firm's openness capability. Hence, this study posited that:

H6: Technology strategy significantly influencing the development of firm's technological capabilities.

Theoretical Framework

Based on the discussion mentioned above, the theoretical framework of this study is shown in Figure 1.

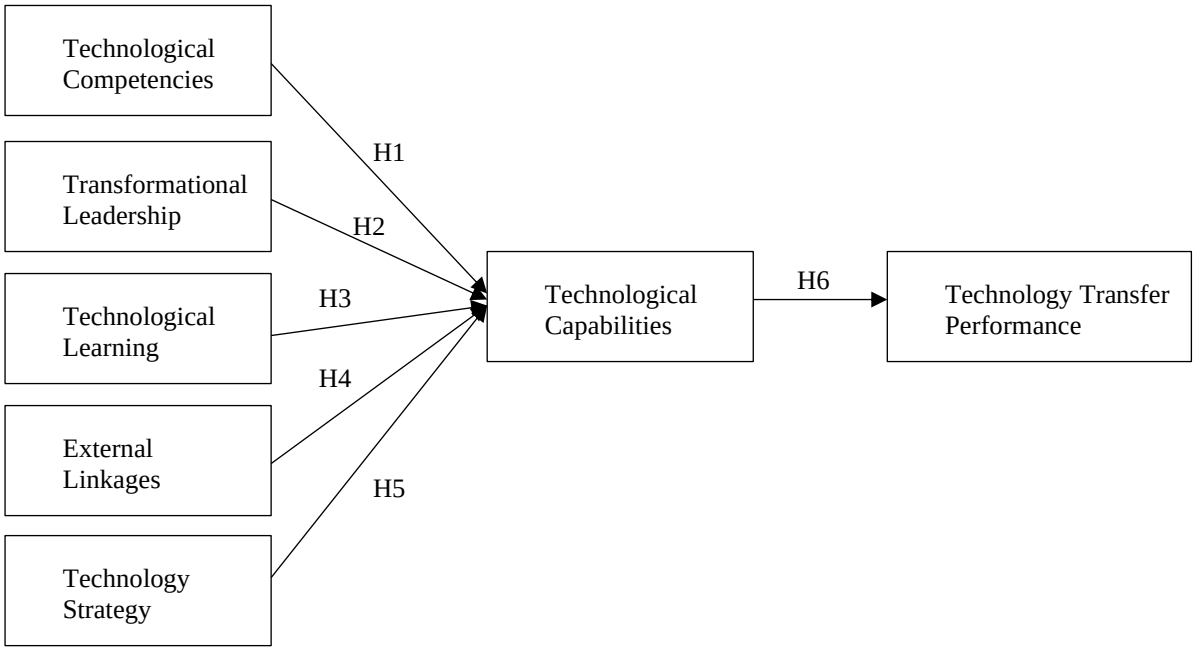

Figure 1. Theoretical framework

RESEARCH METHODOLOGY

For the purpose of examining the conceptual model of this study, the data was collected from manufacturing companies listed in Federation of Malaysian Manufacturers (FMM) directory 2013. Manufacturing industry was chosen because they are the leading industry in Malaysia's economy which contributing significantly to the country's manufacturing output, exports, and employment. Being the largest sector in Malaysia, manufacturing companies have developed significant technological capabilities for the production of higher value-added products (MIDA, 2012).

This study adopted systematic random sampling whereby each company from within the population has an equal chance of probability to be selected as a sample (Othman Talib, 2013). Questionnaires were used as an instrument for undertaking the survey and were distributed to the respondents using both online and offline methods. A total of 331 questionnaires were released and 139 valid returned questionnaires could be used in this study at a response rate of 41.9%. The survey completed by the managers of the manufacturing companies who are usually involved in all decision making within the organization.

The respondents consisted of 82.7% of male and 17.3% of female. Most of the respondents fall between the age between 30 to 39 years old (68.4%) followed by the age of 40 years and above (21.9%) and those age between 21 to 29 years old (9.7%). Furthermore, majority of the respondents gained working experience between 7 to 9 years (67.7%) while 15.7% of them possessed more than 10 years of working experience. The rest of 14.3% and 2.3% of the respondents have been working between 1 to 3 years old and between 4 to 6 years old, respectively.

DATA ANALYSIS AND RESULTS

Partial least squares (PLS) technique through SmartPLS 2.0 software (Ringle, Wendle and Will, 2005) was applied to analyze the data collected. PLS has the ability to analyze a set of latent variables and a series of cause-and-effect relationships within the structural equation models (Gustafsson et al., 2004). Moreover, model complexity is generally not an issue for PLS-SEM as long as appropriate data meet minimum sample size requirements, the complexity of the structural model is virtually unrestricted (Hair et al., 2022). Following the suggestion of Chin (1998), a two-step approach was adopted in analyzing the data whereby the measurement model was first estimated followed by assessing the structural model. Additionally, the bootstrapping method (500 resamples) was done to determine the significance levels for loadings, weights and path coefficients (Chin, 1998).

Assessment of Measurement Model

Measurement model, alternatively called the outer model was assessed first in order to determine the goodness of measure for this study to ensure the instrument used indeed measure the variables they are supposed to, and they have measure them accurately (Sekaran, 2003). Measurement model consists of relationships among the latent variables and their item indicators (Ramayah et al., 2012). For measurement model assessment, two types of validity must be conducted; convergent validity and discriminant validity.

Convergent Validity

The convergent validity is to refers to the positive correlation of the same construct and by assessing the outer loading, average variance extracted (AVE), and composite reliability (CR) (Janadari et al., 2016; Hamid et al., 2017). Therefore, the values must be according to its threshold values in which the outer loading must exceed 0.40 (Hair et al., 2011), AVE must exceed 0.5, and Composite Reliability must exceed 0.7 (Hair et al., 2022; Hamid et al., 2017; Janadari et al., 2016).

Based on Table 1, the entire factor loading exceeded 0.500. Factor loadings value for technological competencies range between 0.801 and 0.894. Furthermore, the factor loadings value for transformational leadership is between 0.718 and 0.849. Next, the factor loading value for technological learning is between 0.710 and 0.859. Factor loadings value for external linkages range between 0.791 and 0.868. Meanwhile, the factor loadings value for technology strategy is between 0.796 and 0.889. Next, the factor loading value for technological capabilities range between 0.772 and 0.845. Lastly, the value of factor loading for technology transfer performance is between 0.779 and 0.878.

Table 1. Convergent Validity

Item indicators	Loadings	Composite Reliability	AVE
Technological Competencies			
TC1	0.801		
TC2	0.879	0.924	0.775
TC3	0.885		
TC4	0.894		
TC5	0.804		
Transformational Leadership			
TL1	0.836		
TL2	0.799		
TL3	0.718	0.886	0.731
TL4	0.826		

Item indicators	Loadings	Composite Reliability	AVE
TL5	0.849		
TL6	0.836		
Technological Learning			
LE1	0.738		
LE2	0.710		
LE3	0.853	0.858	0.702
LE4	0.859		
LE5	0.795		
LE6	0.764		
External Linkages			
EX1	0.814		
EX2	0.868	0.894	0.761
EX3	0.859		
EX4	0.828		
EX5	0.791		
Technology Strategy			
TS1	0.796		
TS2	0.854	0.909	0.763
TS3	0.873		
TS4	0.854		
TS5	0.889		
Technological Capabilities			
FTC1	0.772		
FTC2	0.769		
FTC3	0.807	0.883	0.723
FTC4	0.827		
FTC5	0.829		
FTC6	0.845		
Technology Transfer Performance			
TTP1	0.821		
TTP2	0.878		
TTP3	0.814	0.889	0.742
TTP4	0.809		
TTP5	0.779		
TTP6	0.831		

Based on Table 1, all the values AVE are 0.50 and above. The values of AVE for technological competencies is 0.775. This indicates 77.5% of total variance explained by the construct. Next, the value of AVE for the transformational leadership is 0.731 which indicates 73.1% of the variance. Besides, the AVE for technological learning is 0.702, which means 70.2% of total variance explained by the construct. Moreover, the AVE for the external linkages and technology strategy is 0.761 and 0.763, respectively. The value of AVE for the technological capabilities is 0.723 which indicates 72.3% of the variance. Lastly, the AVE for technology transfer performance is 0.742 which indicates 74.2% of the variance. In addition, CR is an assessment of the measurement model's internal consistency. Table 1 shows that CRs of all the latent variables exceeded the threshold value of 0.70. As a conclusion, all latent construct reliability is acceptable because the value of CRs is more than 0.7.

Discriminant Validity

Discriminant validity, on the other hand, refers to the extent to which a particular construct is truly different from other constructs by empirical standard in which the indicator loading must be above all its cross-loading (Hair et al., 2014). The assessment of discriminant validity using Heterotrait-Monotrait ratio of correlation (HTMT) measurement must be below the more conservative threshold of 0.85 and significantly lower than 0.9 over the sample size (Ringle and Ting, 2018). HTMT criterion is important for interpreting the causal effect in the modeling analysis (Madina et al., 2017). Moreover, discriminant validity issues and empirical evidence are required to use the HTMT criterion due to its high sensitivity and specificity (Madina et al., 2017).

Table 2. Heterotrait-Monotrait (HTMT) criterion

	TC	TL	LE	EX	TS	FTC	TTP
TC							
TL	0.621						
LE	0.545	0.336					
EX	0.357	0.389	0.769				
TS	0.269	0.455	0.634	0.399			
FTC	0.342	0.322	0.601	0.344	0.327		
TTP	0.566	0.414	0.711	0.387	0.333	0.518	

Note: TC (Technological Competencies), TL (Transformational Leadership), LE (Technological Learning), EX (External Linkages), TS (Technology Strategy), FTC (Technological Capabilities), TPP (Technology Transfer Performance)

Assessment of Structural Model

The structural model comprises the hypothesized relationship between exogenous and endogenous variables in the model (Ramayah et al., 2012). Table 3 shows the result of the structural model. The explanatory power of the estimated model can be assessed by observing the R2 of the endogenous constructs. The R2 value obtained from the analysis were 0.575 and 0.638. The result indicates that 57.5% of variance in technological capabilities can be explained by the antecedents of technological competencies, transformational leadership, technological learning, external linkages and technology strategy, while 63.8% of variance in technology transfer performance is explained by technological capabilities. Overall, the proportion of variance explained in each endogenous construct by predictor constructs is acceptable.

Table 3. Results of the Structural Model

Hypotheses	Relationship	Coefficient	t-value	R^2	Hypotheses results
H1	FTC→ TTP	0.444	7.412**	0.638	Supported
H2	TC→FTC	0.154	2.204*		Supported
H3	TL→FTC	0.132	2.094*		Supported
H4	LE→FTC	0.172	2.851**	0.575	Supported
H5	EX→FTC	0.122	2.056*		Supported
H6	TS→FTC	0.181	3.172**		Supported

Note: **p<0.01, *p<0.1

DISCUSSION

This paper aimed to provide some insights into the firm's technological capabilities that propel the successful of technology transfer activities among Malaysian manufacturing companies. In particular, this study investigated the relationship between firm's technological capabilities and technology transfer performance. This study also empirically identified and examined five antecedents that influencing the development of firm's technological capabilities, namely technological competencies, transformational leadership, technological learning, external linkages and technology strategy.

The finding of this study contributed to and strengthened previous theories and conceptual model in the context of the Malaysian manufacturing industry where technological competencies and technological capabilities has a positive relationship. According to Esposito, Freda and Bosco (2015), firm's technological competencies is one of the major factors explaining why firms are different, how they change over time, and whether or not the firms are capable of staying competitive, thus contributing to the development of firm's technological capabilities. Martin and Whiting (2016) assert technological competencies as the skills and abilities an employee should acquire to perform a job, be competent, and achieved the required standard performance. The result of this study also consistent with other studies whose indicated the effects of technological competencies on the firm's technological capabilities (Zoia et al., 2018; Unal, Erdil and Ince, 2021).

This study also confirmed that transformational leadership of an organization influence the development of firm's technological capabilities. The crucial role of leaders is to create goals, values, and systems that lead to continuous performance. Aga et al. (2016) asserted that transformational leadership occurs when leaders inspire their followers to act and create a higher sense of purpose. Moreover, leaders who apply transformational leadership to a greater extent should be able to help reduce task conflict by conveying a shared vision and focusing individuals' efforts on the team goal (Kammerhoff et al., 2019). The result of this study consistent with other studies whose revealed the effects of transformational leadership on the firm's technological capabilities (Khadim et al., 2016; Hui, Phouvong, and Phong, 2018).

Next, this study found that technological learning positively influences the development of technological capabilities of the Malaysian manufacturing firms. According to Saadat and Saadat (2016), the aim of learning is not only enhancing employee's knowledge and skills but also developing and growth of the organization and building flexible dynamic learning organization. Salarian et al. (2015) urged the firms to create technological learning culture by acquiring and sharing the knowledge. Therefore, it can enhance the levels of organizational commitment among employees and yield to positive work outcomes (Hanaysha, 2016). This study consistent with the study of Al-Juboori et al. (2021) whose revealed the effect of technological learning on the technological innovation capability.

Besides that, this study revealed the positive effect of external linkages on the development of firm's technological capabilities. This study supports the work of Simao, Rodrigues, and Madeira (2016) and suggests that establishing the relationship with other external entities plays a crucial role in the development of the firm's technological capability. Furthermore, the result of study in line with the study carried out by Wickramaratne, Kiminami, and Yagi (2017) whose discovered the importance of external linkages for the development firm's technological capabilities.

Furthermore, this study suggests that the execution of technology strategy has a positive influence on the development of the technological capabilities of Malaysian manufacturing companies. Successful organizations commonly relying on continuous planning processes to ensure operational efficiency. Therefore, without a well-developed technology strategy, firms can easily fall behind competition (Kabeyi, 2019; Othman, Wan Mohd Noor and Mohd Isa, 2021). The result of this study consistent with other studies whose revealed the influence of transformational leadership on the development of firm's technological capabilities (Hao and Song, 2016).

Lastly, this study found that firm's technological capabilities have positive impact on the technology transfer performance. Jafari, Akhayan and Rafiei et al. (2017) indicated that technological capabilities were the key factors that facilitated the effectiveness of technology transfer. According to Heredia et al. (2022), technological capabilities have enabled organizations to create opportunities to support their competitive advantage. This study consistent with the study of Vitorino Filho and Moori (2018) and Salisu and Abu Bakar (2020) whose revealed the effect of technological capabilities on the firm's performance.

CONCLUSION AND IMPLICATIONS

In a conclusion, this study contributes to understanding on the factors that contribute to the development of firm's technological capabilities, and also the relationship between technological capabilities and technology transfer performance. There are six hypotheses generated from this study. The result of the study discovered the influence of technological competencies, transformational leadership, technological learning, external linkages and technology strategy on the development of firm's technological capabilities. Besides that, this study also revealed the positive effect of technological capabilities toward the performance of technology transfer activities of the manufacturing companies in Malaysia particularly companies involved in this study.

This study discovered a few implications. From the result, this study revealed valuable evidence on the contributing factors that influence the development of firm's technological capabilities and suggested useful improvement in enhancing technology transfer performance for the manufacturing companies in Malaysia. Therefore, future studies suggested that Malaysian firms especially in manufacturing sector should boost up and continually focus on technological competencies reside in their employees, managerial aspect of transformational leadership, technological learning enhancement, strengthen their external linkages with other parties, and well-developed technology strategy as important components to enhance their technological capabilities.

This study contributed to the body of knowledge in the field of firm's technological capabilities and technology transfer performance. However, the study proved its significant contribution in the context of manufacturing companies in Malaysia toward the development of firm's technological capabilities and technology transfer performance by addressing the factors that contribute to the development of technological capabilities of Malaysian manufacturing firms, which have not been addressed by past studies yet as a whole. This study will provide valuable information and create awareness to the owners or managers of manufacturing firms in Malaysia particularly to the firms involved in this study regarding the influence of technological competencies, transformational leadership, technological learning, external linkages and technology strategy which could improve their firm's technological capabilities. Moreover, technological capability has an obvious effect on technology transfer performance. Consequently, this paper extend the current body of knowledge in both theoretical and practical areas. Investing more on these factors (technological competencies, transformational leadership, technological learning, external linkages and technology strategy) will help owners or managers to develop their firm's technological capabilities, and further improve their performance of technology transfer activities. This study also extends and provides validation to the theory of resource-based view (RBV).

ACKNOWLEDGEMENT

The authors would like to thank UMP for funding this work under an internal grant RDU110109.

REFERENCES

Aga, D., Noorderhaven, N. & Vallejo, B. (2016). Transformational leadership and project success: The mediating role of team-building, International Journal of Project Management, 34(5):806-818. http://doi.org/10.1016/j.ijproman.2016.02.012

Ahmad, S. & Schroeder, R.G. (2011). Knowledge management through technology strategy: Implications for competitiveness. Journal of Manufacturing Technology Management. 22(1), 6-24. https://doi.org/10.1108/17410381111099789

Al-Juboori, Z. M. A., Singh, H., Mansor, N. N. A., Kakar, A. S., Zulfiqar, U., & Pitchy, A. L. B. A. (2021). The impact of organizational learning, on firm performance in the context of manufacturing SMES in Malaysia, Mediating role of innovation capability. International Journal of Academic Research in Business and Social Sciences, 11(5), 796–813. http://dx.doi.org/10.6007/IJARBSS/v11-i5/9898

Allameh, M. & Moghaddami, M. (2010). Determining the relationship between organizational learning and performance. Case study: Department of Niroo Moharreke, Iran Khodro company. Journal of Executive Management, 10(1), 75-100. https://www.sid.ir/en/journal/ViewPaper.aspx?id=197167

Amy, H.I. Lee, Wei-Ming, Wang & Tsai-Ying, Lin (2010). An evaluation framework for technology transfer of new equipment in high technology industry. Technology Forecast and Social Change, 77(1), 135–150. https://doi.org/10.1016/j.techfore.2009.06.002

Anantatmula, V. S. (2010). Project manager leadership role in improving project performance. Engineering and Management Journal, 22(1), 13–22. http://doi.org/10.1080/10429247.2010.11431849

Apulu, I. & Latham, A. (2011). An evaluation of the impact of information and communication technologies: Two case study examples. International Business Research, 4(3), 3-9. http://doi.org/10.5539/ibr.v4n3p3

Ariffin, N. & Figueiredo, P.N. (2006). Globalisation of innovative capabilities: Evidence from local and foreign firms in electronics industry in Malaysia and Brazil. Science, Technology and Society, 11(1), 191-227. https://doi.org/10.1177/097172180501100107

Azmi, I. A. G., Hashim, R. C., & Yusoff, Y. M. (2018). The employability skills of Malaysian university students. International Journal of Modern Trends in Social Sciences, 1(3), 01-14. http://www.ijmtss.com/PDF/IJMTSS-2018-03-09-01.pdf

Bagheri, S., Kousha, Janati, A. & Asghari-Jafarabadi, M. (2012). Factors influencing the job satisfaction of health system employees in Tabriz, Iran. Health Promotion Perspectives, 2(2), 190-196. http://doi.org/190-196. 10.5681/hpp.2012.022

Bolivar-Ramos, M. T., Garcia-Morales, V. J. & Garcia-Sanchez, E. (2012). Technological distinctive competencies and organizational learning: Effects on organizational innovation to improve firm performance. Journal of Engineering and Technology Management, 29(3), 331-357. https://doi.org/10.1016/j.jengtecman.2012.03.006

Chen, J., Pu, X. and Shen, H. (2010). A comprehensive model of technological learning: Empirical research on Chinese manufacturing sector. In: Fu X., Soete L. (Eds). The Rise of Technological Power in the South, Palgrave Macmillan, London.

Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In: G. A. Marcoulides (Ed.), Modern methods for business research (pp. 295–336). Lawrence Erlbaum Associates Publishers.

Chiva, R. Ghauri, P. & Alegre, J. (2013). Organizational learning, innovation and internationalization: A complex system model. British Journal of Management, 25(4), 1-19. https://doi.org/10.1111/1467-8551.12026

Çogaltay N. (2015). Conceptual Perspectives on Leadership. In: Karadag, E. (Eds.), Leadership and Organizational Outcomes (pp. 1-18). Springer International Publishing. https://doi.org/10.1007/978-3-319-14908-0_1

Cooper, R. & Edgett, S. J. (2010). Developing a product innovation and technology strategy for your business. Research Technology Management, 53(3), 33-40. http://doi.org/10.1109/EMR.2010.5645762

Daniel, C. J. Y., Abdul Wahid, N., & Tan, C. L. (2020). Why smart leaders are important in smart city development – A conceptual framework. International Journal of Industrial Management, 5, 1–9. https://doi.org/10.15282/ijim.5.0.2020.5617

Deloitte. (2016). The new organization: Different by design. Global Human Capital Trends. Deloitte University Press: 1-124. Available at: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/HumanCapital/gx-dup-global-human-capital-trends-2016.pdf

Economic Planning Unit. (1986). Fifth Malaysia Plan 1986-1990. Prime Minister's Department, Putrajaya. https://www.epu.gov.my/en/economic-developments/development-plans/rmk/fifth-malaysia-plan-1986-1990

Economic Planning Unit. (2021). Malaysia Digital Economy Blueprint. Prime Minister's Department, Putrajaya. https://www.epu.gov.my/sites/default/files/2021-02/malaysia-digital-economy-blueprint.pdf

Eesley, C. E., Hsu, D. H., and Roberts E. B. (2014). The contingent effects of top management teams on venture performance: Aligning founding team composition with innovation strategy and commercialization environment. Strategic Management Journal, 35(12), 1798 –1817. https://doi.org/10.1002/smj.2183

Gavrilyuk, A. V. & Khvorostyanaya, A. S. (2020). Strategic framework for light industry technology transfer. Intelligence Innovation Investments, 6, 20-32. http://doi.org/10.25198/2077-7175-2020-6-20.

Esposito, G., Freda, M. F. & Bosco, V. (2015). Examining perception of competency through practicum competencies outline, European Journal of Training and Development; Limerick, 39(8), 700-720. http://doi.org/10.1108/EJTD-05-2015-0037

Gronum, S., Verreynne, M. L. & Kastelle, T. (2012). The role of networks in small and medium-sized enterprise innovation and firm performance. Journal of Small Business Management, 50(2), 257-282. http://doi.org/10.1111/j.1540-627X.2012.00353.x

Government of Malaysia. (1986). The National Science and Technology Policy, Kuala Lumpur: SIRIM

Grant Thornton (2013, October 16). 62% Malaysian businesses find hard to hire skilled workers, highest in ASEAN. [Press release]. https://www.grantthornton.com.my/en/press/press-releases-2013/62-percent-Malaysian-businesses-find-hard-to-hire-skilled-workers-~-highest-in-ASEAN/

Gunsel, A. (2015). Research on effectiveness of technology transfer from a knowledge-based perspective. Procedia - Social and Behavioral Sciences, 207, 777-785. https://doi.org/10.1016/j.sbspro.2015.10.165

Gustafsson, A., Johnson, M. D. & Roos, I. (2005). The effects of customer satisfaction, relationship commitment dimensions, and triggers on customer retention. Journal of Marketing, 69(4), 210-218. https://doi.org/10.1509/jmkg.2005.69.4.210

Hafeez, K., Malak, N. and Zhang, Y. B. (2007). Outsourcing non-core assets and competences of a firm using analytic hierarchy process. Computers & Operations Research, 54(2), 153-164. https://doi.org/10.1016/j.cor.2006.01.004

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). A primer on partial least squares structural equation modeling (PLS-SEM) (3rd ed.). Thousand Oaks, CA: Sage

Hamdan, A. R., Fathi, M. S. & Mohamed, Z. (2018). Evolution of Malaysia's technology transfer model facilitated by national policies. International Journal of Engineering & Technology, 7(2.29), 196-202. http://doi.org/10.14419/ijet.v7i2.29.13317

Hamid, M. R., Sami, W. & Sidek, M. H. M. (2017). Discriminant Validity Assessment: Use of Fornell & Larcker criterion versus HTMT Criterion, Journal of Physics: Conference Series, 890(1), 1-5. http://doi.org/10.1088/1742-6596/890/1/012163

Hanaysha, J. (2016) Testing the effects of employee engagement, work environment, and organizational learning on organizational commitment, Procedia-Social and Behavioral Sciences, 229:289-297. http://doi.org/ 10.1016/j.sbspro.2016.07.139

Hao, S. & Song, M. (2016). Technology-driven strategy and firm performance: Are strategic capabilities missing links? Journal of Business Research, 69(2), 751-759. https://doi.org/10.1016/j.jbusres.2015.07.043

Hassan, M.U., Nawaz, M.S., Abbas, G., & Sajid, M. (2013). Impact of high-performance work practices on employee loyalty and financial performance through mediation of employee satisfaction: Empirical evidence from the financial sector of Pakistan. Middle-East Journal of Scientific Research, 16(8), 1037–1046. https://doi.org/10.5829/idosi.mejsr.2013.16.08.11984

Heredia, J., Castillo-Vergara, M., Geldes, C., Gamarra, F. M. C., Flores, A. & Heredia, W. (2022). How do digital capabilities affect firm performance? The mediating role of technological capabilities in the "new normal". Journal of Innovation & Knowledge, 7, 1-10. https://doi.org/10.1016/j.jik.2022.100171

Hui, L., Phouvong, S. & Phong, L. B. (2018). Transformational leadership facilitates innovation capability: the mediating roles of interpersonal trust. International Journal of Business Administration, 9(3), 1-9. http://doi.org/10.5430/ijba.v9n3p1

International Business Publications Incorporation (IBP) (2014). MALAYSIA: Knowledge Based Economy Master Plans and Programs Handbook (7th ed), IBP.

Jafari, M., Akhavan, P. & Rafiei, A. (2017). Technology transfer effectiveness in knowledge-based centers: Providing a model based on knowledge management. International Journal of Scientific Knowledge, 4(7), 24-39.

Janadari, N., Subramaniam, S., Ramalu, S. S. & Wei, C. (2016). Evaluation of measurement and structural model of the reflective model constructs in PLS-SEM. Paper presented at the Sixth (6th) International Symposium of South Eastern University of Sri Lanka, South Eastern University of Sri Lanka. https://www.researchgate.net/publication/327572183_EVALUATION_OF_MEASURMENT_AND_STRUCTURAL_MODEL_OF_THE_REFLECTIVE_MODEL_CONSTRUCTS_IN_PLS-SEM

Jansen, J. J. P., Vera, D. & Crossan, M. (2009). Strategic leadership for exploration and exploitation: The moderating role of environmental dynasim. The Leadership Quarterly, 14(1), 5-18. https://doi.org/10.1016/j.leaqua.2008.11.008

Johnson, M. & Templar, S. (2011). The relationships between supply chain and firm performance: The development and testing of a unified proxy. International Journal of Physical Distribution & Logistics, 41(2), 88-103. https://doi.org/10.1108/09600031111118512

Kabeyi, M. J. B. (2019). Organizational strategic planning, implementation and evaluation with analysis of challenges and benefits for profit and non-profit organizations. International Journal of Applied Research, 5(6): 27-32. http://doi.org/10.22271/allresearch.2019.v5.i6a.5870

Khadim, R., Asghar, M., Khan, R., Farooq, O., & Afzal, M. (2016). Determining the Role of Transformational Leadership on Firm Performance through Organizational Innovation and Technological Innovation Capabilities. European Online Journal of Natural and Social Sciences, 5(4), 951-965. https://european-science.com/eojnss/article/view/4605

Kim, L. (2001). The dynamics of technological learning in industrialisation. International Social Science Journal, 53(168), 297-308. http://doi.org/10.1111/1468-2451.00316

Kimosop, J., Korir, M. & White, M. (2016). The moderating effect of demographic characteristics on the relationship between strategic capabilities and firm performance in women-owned entrepreneurial ventures in Nairobi, Kenya. Canadian Journal of Administrative Sciences, 33(3), 242-256. https://doi.org/10.1002/cjas.1399

Kumar, U., Kumar, V. & de Grosbois, D. (2008). Development of technological capability by Cuban hospitality organizations. International Journal of Hospitality Management, 27, 12-22. https://doi.org/10.1016/j.ijhm.2007.06.002

Lefebvre, V. M., Molnar, A., Kuhne, B. & Gellynck, X. (2013), February 18-22. Network competence and open innovation behaviour in the food sector: An empirical investigation. International European Forum on System Dynamics and Innovation in Food Networks. Innsbruck-Igls, Austria. http://doi.org/10.22004/ag.econ.164739

Li-Hua, R. and Lu, L. (2013). Technology strategy and sustainability of business: Empirical experiences from Chinese cases. Journal of Technology Management in China, 8(2): 62-82. https://doi.org/10.1108/JTMC-05-2013-0024

Lin, FJ. & Lai, C. (2021). Key factors affecting technological capabilities in small and medium-sized Enterprises in Taiwan. International Entrepreneurship Management Journal, 17, 131–143. https://doi.org/10.1007/s11365-019-00632-2

Madina, M., Adolescents, A., Lee, S. U., & Baek, H. (2017). Discriminant Validity Assessment: Use of Fornell & Larcker criterion versus HTMT Criterion Discriminant Validity Assessment: Use of Fornell & Larcker criterion versus HTMT Criterion.

Malaysian Investment Development Authority (MIDA). (2012, February). Malaysia Investment Performance 2011. (online). https://www.mida.gov.my/wp-content/uploads/2020/12/20140126142931_slides2011eng.pdf

Malaysia Productivity Corporation (MPC), (2015a). Malaysia in the IMD World Competitiveness Yearbook 2015. (online). https://drive.google.com/file/d/0B8yYkeS1SHv1TFdzVHVDUllraWM/view?resourcekey=0-bZ9BFZL4z15w9o_bdxbLzA

Malaysia Productivity Corporation (MPC), (2017). Malaysia Productivity Report 2016/2017. (online). https://www.mpc.gov.my//wp-content/uploads/2017/05/Productivity-Report-2017.pdf

Martin, M. & Whiting, F. (2016). Human Resource Practice (7th ed.). Chartered Institute of Personnel and Development.

Martin-Rojas, R., Garcia-Morales, V. J. & Bolivar-Ramos, M. T. (2013). Influence of technological support, skills and competencies, and learning on corporate entrepreneurship in European technology firms. Technovation, 33(12), 417-430. https://doi.org/10.1016/j.technovation.2013.08.002

Ministry of Industrial Trade and Industry (MITI). (1994). Review of The Industrial master Plan, 1986-1995. https://www.miti.gov.my/miti/resources/auto%20download%20images/557f968be4aaf.pdf

Mohammed Abdulaal, A., & Nordin, N. (2020). Review paper: The mediating role of creativity on the relationship between knowledge management and human resource management toward innovation performance in the Jordanian SMEs. International Journal of Industrial Management, 8, 12–18. https://doi.org/10.15282/ijim.8.0.2020.5759

Neill, S., Singh, G. & Pathak, R. D. (2014). Technology and marketing capabilities in a developing economic context: assessing the resource-based view within a boundary condition. International journal of business and economics, 13(1), 75-92.

Noorhassidah Mohd Radzi, Alina Shamsuddin & Eta Wahab. (2017). Enhancing the competitiveness of Malaysian SMEs through technological capability: A perspective. The Social Sciences, 12(4), 719-724. http://doi.org/10.36478/sscience.2017.719.724

Ortega, M. J. R. (2010). Competitive strategies and firm performance: Technological capabilities' moderating roles. Journal of Business Research. 63(12), 1273-1281. https://doi.org/10.1016/j.jbusres.2009.09.007

Osborn, R. N., Hunt, J. G., & Jauch, L. R. (2002). Toward a contextual theory of leadership. The Leadership Quarterly, 13(6), 797–837. https://doi.org/10.1016/S1048-9843(02)00154-6

Othman, S.Z., Wan Mohd Noor, W.S. & Mohd Isa, M.F. (2021). "How to Create a Competitive Organization, Leveraging Strategic Capabilities in Malaysia", Sergi, B.S. and Jaaffar, A.R. (Ed.) Modeling Economic Growth in Contemporary Malaysia (Entrepreneurship and Global Economic Growth), Emerald Publishing Limited, Bingley, pp. 135-150. https://doi.org/10.1108/978-1-80043-806-420211012

Park, J.S.-Y. (2010). Naturalization of competence and the neoliberal subject: Success stories of English language learning in the Korean Conservative Press. Journal of Linguistic Anthropology, 20(1), 22-38. http://doi.org/10.1111/j.1548-1395.2010.01046.x

Perkins, D. H., Rasiah, R. & Woo, W. T. (2017, August). Explaining Malaysia's past economic growth and future prospects (JCI Working Paper No.2). https://jci.edu.my/wp-content/uploads/2018/05/JCI-WP2.pdf

Prahalad C.K., Hamel G. (2006). The Core Competence of the Corporation. In: Hahn D., Taylor B. (Eds.), Strategische Unternehmungsplanung- Strategische Unternehmungsfuhrung (pp. 275- 292). Springer, Berlin, Heidelberg.

Rahman Hamdan, Abdul, Syazli Fathi, Mohamad and Mohamed, Zainai (2018). Evolution of Malaysia's technology transfer model facilitated by national policies. International Journal of Engineering and Technology. 7(2.29), 196-202. http://dx.doi.org/10.14419/ijet.v7i2.29.13317

Rajah, R. (2010). Are electronics firms in Malaysia catching up in the technology ladder? Journal of the Asia Pacific Economy, 15(3), 301-319, https://doi.org/10.1080/13547860.2010.494910

Ramanathan, R. (2003). An Introduction to Data Envelopment Analysis: A Tool for Performance Measurement. Sage Publications, New Delhi.

Ramayah, T., Mohamad, O., Omar, A., Marimuthu, M. & Yeap Ai Leen, J. (2013). Determinants of technology adoption among Malaysian SMEs: An IDT perspective. Journal of Information and Communication Technology, 12(1), 103-119.

Ringle, C. M., & Ting, H. (2018). Convergent validity assessment of formatively measured constructs in PLS-SEM, 3. doi:10.1108/IJCHM-10-2017-0649

Ringle, C. M., Wende, S. & Will, A. (2005). SmartPLS 2.0.M3. Hamburg: SmartPLS. Retrieved from https://www.smartpls.com

Salarian, M., Baharmpour, K., & Habibi, S. (2015). Organizational commitment and its relationship with organizational learning (Case study: General directorate of ports and maritime of Mazandaran province). International Journal of Life Science, 5(6), 67-73.

Salisu, Y. & Abu Bakar, L.J. (2020). Technological capability, relational capability and firms' performance: The role of learning capability, Revista de Gestao, 27(1), 79-99. https://doi.org/10.1108/REGE-03-2019-0040

Sanchez, J. (2012). The influence of entrepreneurial competencies on small firm performance. Revista Latinoamericana de Psicologia, 44(2), 165-177.

Sarina, M. N., Rushami, Z. Y. & Fariza, H. (2009). Quality practices as a moderator in technology transfer performance. International Journal of Business and Management, 4(7), 96-105. http://doi.org/10.5539/ijbm.v4n7p96

Schweitzer, J. (2014). Leadership and innovation capability development in strategic alliances. Leadership & Organization Development Journal, 35(5), 442-469.

Secundo, G., De Beer, C. & Passiante, G. (2016). Measuring university technology transfer efficiency: A maturity level approach. Measuring Business Excellence, 20(3), 42-54. https://doi.org/10.1108/MBE-03-2016-0018

Sekaran, U. (2003). Research Methods for Business: A Skill-Building Approach. (4th Ed.), John Wiley & Sons, New York.

Seyal, A. H. (2015). Examining the role of transformational leadership in technology adoption: Evidence from Bruneian technical & vocational establishments (TVE). Journal of Education and Practice, 6(8), 32-43.

Shah, M. H. (2004, August). The Malaysian experience in science and technology development and its relevance for OIC countries. [Paper presentation]. Fourth International Malaysian Studies Conference, UKM, Bangi, Malaysia.

Shaharudin, M. S., Zulkifli, W. N., Gui, A., & Fernando, Y. (2021). Drivers Human Resources 4.0: Technological, Organisational & Environmental of Human Resources 4.0 at Malaysian Private Companies. International Journal of Industrial Management, 12(1), 306–318. https://doi.org/10.15282/ijim.12.1.2021.6123

Shmeleva, N., Gamidullaeva, L., Tolstykh, T., & Lazarenko, D. (2021). Challenges and opportunities for technology transfer networks in the context of open innovation: Russian experience. Journal of Open Innovation: Technology, Market and Complexity, 7, 197. https://doi.org/10.3390/joitmc7030197

Simao, L., Rodrigues, R. G. & Madeira, M. J. A. (2016). External relationships in the organizational innovation. RAI Revista de Administracao e Inovacao, 13(3), 156-165. https://doi.org/10.1016/j.rai.2016.06.002.

Siti Norbaya Yahaya & Mohd Hafiz Bakar. (2017). Role of technology transfer through research and development to increase competitiveness. Do SME's in Malaysia take advantages on it? International Journal of Business and Management Invention, 6(12), 51-60.

Stewart, R. A. & Waroonkun, T. (2007). Benchmarking construction technology transfer in Thailand. Construction Innovation, 7(3), 218-239. https://doi.org/10.1108/14714170710754722

Suzana Ariff Azizan (2013). Strengthening Malaysia's scientific and technological development through human capital development. Procedia - Social and Behavioral Sciences, 91, 648-653. https://doi.org/10.1016/j.sbspro.2013.08.465

Talib, O. (2013). Asas Penulisan Tesis, Penyelidikan & Statistik. Universiti Putra Malaysia Press, Serdang, Selangor.

Tzokas, N., Kim, Y. A., Akbar, H. & Al-Dajani, H. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs. Industrial Marketing Management, 47, 134-142. https://doi.org/10.1016/j.indmarman.2015.02.033

Unal, E., Erdil, O. & Ince, H. (2021). The effect of leadership and talent development programs on performance: A research on retail sales representatives, Business & Management Studies: An International Journal, 9(2), 603-624. https://doi.org/10.15295/bmij.v9i2.1808

Usefi, S., Nazari, R. & Zargar, T. (2013). The Relationship between organizational learning and organizational commitment in sport organizations. Management and Administrative Sciences Review, 2(6), 682-688.

Saadat, V. & Saadat, Z. (2016). Organizational learning as a key role of organizational success, Procedia - Social and Behavioral Sciences, 230, 219-225. http://doi.org/10.1016/j.sbspro.2016.09.028

Van Norman, G.A. & Eisenkot, R. (2017). Technology transfer: From the research bench to commercialization. JACC: Basic to Translational Science, 2(2), 197-208. http://doi.org/10.1016/j.jacbts.2017.03.004

Vitorino Filho, V.A. & Moori, R.G. (2018). The role of technological capabilities in the competitive advantage of companies in the Campinas, SP Tech Hub, Innovation & Management Review, 15(3), 247-268. https://doi.org/10.1108/INMR-06-2018-0035

Wang, Y., Lo, H. P., Zhang, Q. and Xue, Y. (2006). How technological capability influences business performance. An integrated framework based on the contingency approach. Journal of Technology Management. 1(1), 27-52. https://doi.org/10.1108/17468770610642740

Whangthomkum N., Igel, B. & Speece, M. (2006). An empirical study of the relationship between absorptive capacity and technology transfer effectiveness. International Journal of Technology Transfer and Commercialisation, 5(1/2), 31-55. https://doi.org/10.1504/IJTTC.2006.008652

Wickramaratne, A., Kiminami, A. & Yagi, H. (2017). External relationships and entrepreneurial orientation of tea manufacturing firms in Sri Lanka. International Food and Agribusiness Management Review, 20(3), 293-306. http://doi.org/10.22434/IFAMR2015.0070

World Bank (2009). Malaysia - Productivity and Investment Climate Assessment Update. http://documents.worldbank.org/curated/en/817201468049816610/Malaysia-Productivity-and-investment-climate-assessment-update

World Economic Forum (WEF) (2014). The Global Competitiveness Report 2014-2015. http://www.weforum.org

World Economic Forum (WEF) (2015). The Global Competitiveness Report 2015-2016. http://www.weforum.org

World Economic Forum (WEF) (2016). The Global Competitiveness Report 2016-2017. http://www.weforum.org

Yang, L. R., Huang, C. F. & Wu, K. S. (2011). The association among project manager's leadership style, teamwork and project success. International Journal of Project Management, 29(3), 258–267. https://doi.org/10.1016/j.ijproman.2010.03.006

Zoia, M.G., Barbieri, L., & Cortelezzi, F. (2018). The determinants of Italian firms' technological competencies and capabilities. Eurasian Business Review, 8, 453–476. https://doi.org/10.1007/s40821-018-0103-2

CONFLICT OF INTEREST

The author(s), as noted, certify that they have NO affiliations with or involvement in any organisation or agency with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, jobs, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, expertise or beliefs) in the subject matter or materials addressed in this manuscript.

AUTHORS' BIOGRAPHY

Author's Full Name: Siti Aishah binti Md Hasan
Author's Email: aishah0802@yahoo.com
Author Professional Bio (not more than 150 words): Puan Siti Aishah is pursuing PhD Technology Management at Universiti Malaysia Pahang (UMP) and currently attached to Faculty of Electrical and Electronics Engineering Technology.