International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, , June 2017

STUDY ON THE IMPACT OF LINKAGE CAPABILITIES ON TECHNOLOGICAL COMPETITIVE ADVANTAGE AND FIRM PERFORMANCE IN THE AUTOMOTIVE INDUSTRY IN MALAYSIA

Faridah binti Taju Rahim
Faculty of Industrial Management
Universiti Malaysia Pahang
Kampus Gambang
Lebuhraya Tun Razak ,
26300 Kuantan,
Malaysia.
faridahtajurahim@gmail.com

Yuserrie bin Zainuddin
Faculty of Industrial Management
Universiti Malaysia Pahang
Kampus Gambang
Lebuhraya Tun Razak ,
26300 Kuantan,
Malaysia.
yuserrie@ump.edu.my

ABSTRACT

This paper concentrates on applying the resource-based view (RBV) of firms to explain performance in the automotive industry in Malaysia. Particularly, we established our research on the comprehensive framework of RBV and reviewed previous empirical researchers to examine the relationship between linkage capabilities (LC), technological competitive advantage and firm performance. Linkage capabilities were operationalized as a second-order construct with three components: internal linkage, external commercial linkage, and linkage with public research institutions, government agencies and association. The analysis is carried out by using data from 56 companies in the automotive industry in Malaysia. Data were analyzed applying partial least squares (PLS) technique. The results indicate that the linkage capabilities has a positive relationship to the technological competitive advantage and firm performance, however technological competitive advantage had no significant effect on firm performance and hence no mediation effect is established. Among three of first constructs of linkage capabilities, internal linkages found to have the strongest relationship with its higher-order construct (linkage capabilities) in Malaysian automotive industry. These findings have considerable implications for academics as well as practitioners. Finally, this study also provides directions for future research.

Keywords*:* linkage capabilities, technological competitive advantage, firm performance, resource-based view, automotive industry.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

INTRODUCTION

There are increasing studies on how a firm can maintain their sustainable competitive advantage and improve firm performance in fast changing and unpredictable environments due to globalize of markets, technological change and innovative new product development (NPD) (Choi, Narasimhan, & Kim, 2016; Teece, Pisano, & Shuen, 1997). Competitive advantage is the ability of business to obtain profits above industry average or better than their competitor (J. Barney, 1991) by implementation of a strategy not being carry out by other firms that enables to reduce costs, to explore market opportunities, and/or the equalizing of competitive threat (Newbert, 2008) .

One popular approach used to understand competitive environment is the resource-based view (RBV) of the firm. According to this view, merely those firms who have the unique resources and capabilities provide the ability for competitive advantage in rapidly changing and unpredictable environments then leads to higher performance. If the firms' resources and capabilities are valuable, rare, hard to imitate, cannot be substituted and the firm also could organize and fully utilized those resources and capabilities, then they could direct to superior performance ((J. Barney, 1991; J. B. Barney & Hesterly, 2012; Grant, 1991).

In nowadays 's competitive environment, firms cannot depend on internally limited resources alone (Gathungu, Aiko, & Machuki, 2014) to pursue technology strategies. A technology strategy is establishes the actions a firm must consider to acquire, develop, and apply technology to gain a competitive advantage (Shan & Jolly, 2013). Therefore, they must collaborate with other firms or institutions to obtain information, skills, expertise, assets, and technologies and hence influence their internal resources (Gathungu et al., 2014).

Based on from Shan & Jolly study, linkage capabilities is indicating as an important source of technological innovation capabilities, competitive performance and firm performance (Shan & Jolly, 2012, 2013). Researchers have emphasized the importance of building relationships whether within firm or inter-firms or research institutions for developing technological innovations and technological development (Rasiah & Vgr, 2009; Shan & Jolly, 2012, 2013) as well as firm technological innovation capabilities (Lall, 1992; Rasiah, 2009; Xu, Lin, & Lin, 2008). Accordingly, innovation attends to result from numerous interactions among different organizations.

While previous research on firms has emphasised the importance of linkage capabilities for firm (Shan & Jolly, 2010, 2012, 2013), there is an ongoing debate centring on which type of linkage capabilities is most beneficial to competitive advantage and firm performance. Although, theoretical assertions confirm that competitive advantage mediates the association between linkage capabilities and firm performance (J. Barney, 1991), empirical evidence in the existing literature is limited (Newbert, 2008). The desire to understand the role of competitive advantage that obtained through technological innovations in the relationship between linkage capabilities and firm performance motivated this study. The rationale of this study is to examine the relationships between linkage capabilities and the performance of firms in the automotive industry in Malaysia whether there are direct or indirect through competitive advantages. Therefore, this study will apply theoretical approaches outlined by Newbert (2008) whereby it should be the most suitable to explain performance. This study is

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

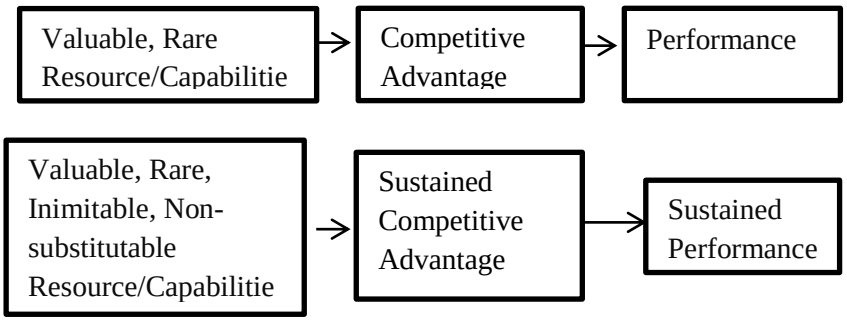
expected to enable scholars and practitioners to have a more definite and direct understanding of the effect of competitive advantage which obtained through technological innovation in the association between linkage capabilities and firm performance. Besides, more explanation for an outcome about how linkage capabilities transmit the effect of competitive advantage to firm performance will be explained and to find which of linkage capabilities dimensions that have a strong relationship with competitive advantage and firm performance.

This paper has the following structure. Firstly, we present a literature review and proposed conceptual model as well as developing hypotheses. Following, methodology of the study are then presented, which include information about the sample, study measures, data analysis and test results. Finally, a discussion of the results, implications and limitations are presented.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Resource based View Theory

Over the past two decades, the RBV of the firm has seemed as one of the most leading theoretical perspective in the strategic management field (Newbert, 2008; Priem & Butler, 2001). The RBV was formalized by J. Barney (J. Barney, 1991) based on works by many previous scholars. This theory indicated that resource at the firm level need to evaluate whether specific firm resources can be sources of maintaining competitive advantage at the industry level. The core contribution of the theory was that it helped clarify why some firms achieve sustainable competitive advantage. The theory considered that some firms achieve sustainability in competitive advantage by distinguishing resource endowments that they generate (J. B. Barney, 1986; Wernerfelt, 1984). The underlying assumptions of the RBV are that resources must be imperfectly mobile and heterogeneously distributed across firms (J. Barney, 1991). The differences or heterogeneity in resources owned by firms that remain in the long run lead towards sustained competitive advantage. Barney's (J. Barney, 1991) conceptual framework of the RBV as presented in Newbert's (Newbert, 2007) article is illustrated in Figure 1.



Source: (Newbert, 2007)
Figure 1: Barney's (1991) Conceptual Framework of the RBV

In empirical studies of RBV, there have been numerous studies which emphasis on different approaches to conceptualizing RBV. Newbert (2007) categorized the theoretical approaches utilized by previous empirical studies of RBV into four types: resource heterogeneity, organizing approach, conceptual-level, and dynamic capabilities. The resource heterogeneity

approach states that a particular resource, capabilities, or core competence that is valuable, rare, unique and non-substitutable, when controlled by a firm, will influence its competitive advantage or performance. The organizing approach clarifies firm-level conditions in which an effective exploitation of resources and capabilities is applied. Scholars utilizing the conceptual-level approach to try to examine if aspects of a resource identified by Barney (J. Barney, 1991) such as value, rareness, and inimitability, can successfully improve the performances. Lastly, the dynamic capabilities approach highlights given resource-level processes influencing on competitive advantage or performance, in which a specific resource links with a specific dynamic capabilities as an independent variable. Based on an in-depth analysis of all approaches, Newbert (2007) discovered that the most commonly used approach-resource heterogeneity-was not the one which expected the strongest support from empirical tests. It was also concluded that the firm's organizing perspective and its valuable, rare, inimitable capabilities (dynamic and otherwise) and core competencies may be more significant in affecting its competitive position rather than its static resources identified mostly by the resource heterogeneity approach. Therefore, in this study, we choose linkage capabilities as exogenous variables to investigate their relationship with competitive advantage and firm performance because linkage capabilities are not static resources.

A competitive advantage occurs when the firm is able to provide the same benefits as competitors but at a lower cost (cost advantage), or deliver benefits that better than those of competing products (differentiation advantage) (J. B. Barney & Hesterly, 2012). According to Karagozoglu (1993), competitive advantage also can attain via technological innovation, namely technological competitive advantage. Technological innovation includes both product / service and process innovations. Product innovations are products that are perceived to be new or significantly improved product (good or service) by either the producer or the customer (OECD, European Commission, & European Union, 1997; Wang, Lin, & Chu, 2011). Process innovation refers to new or significantly improved processes which either reduce the cost of production or enable to produce new products (OECD et al., 1997; Wang et al., 2011). Wang, Lin, & Chu (2011) also state that technological innovation is one of the sources of competitive advantage. That is, the most innovative firms involve in a persistent search for better products, services, and ways of doing things. They attempt to always upgrade their internal capabilities and other resources.

Based on Newbert (2007)'s conclusion, this study followed the conceptual framework of Newbert, (2008) by applying it to a practical condition of automotive industry in Malaysia. Newbert (2008) suggested exploitation of valuable, rare resources and capabilities influences to a firm’s technological competitive advantage, which then contributes to its performance. This underlying theoretical logic is linked from the linkage capabilities to the technological competitive advantage and then the performance (

Figure 2).

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

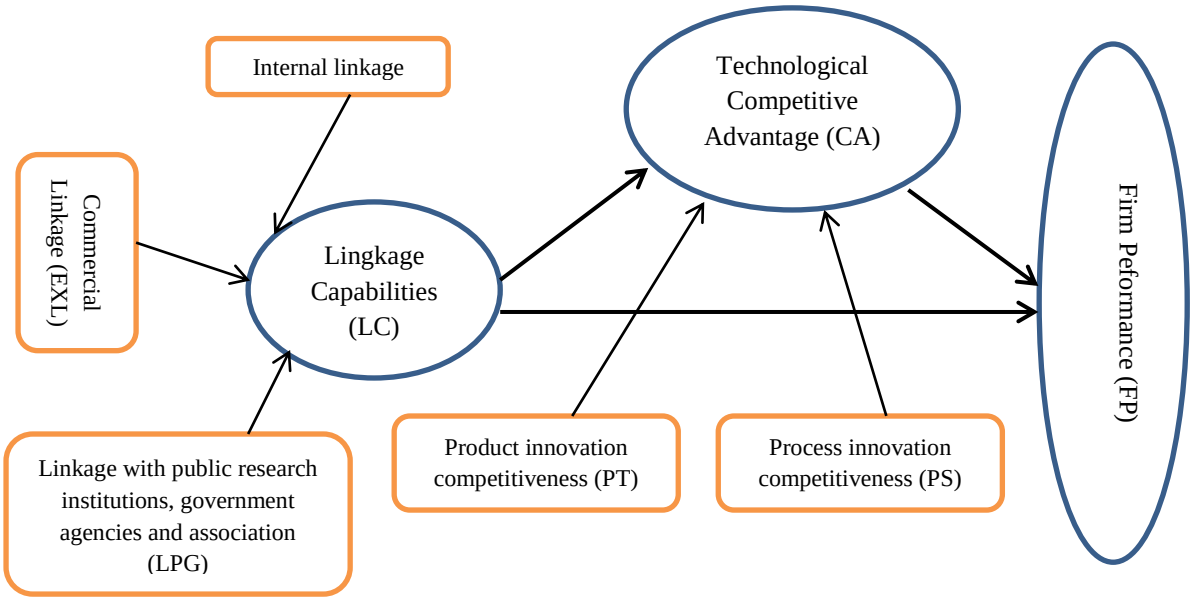


Figure 2: Relationship between Linkage Capabilities, Technological Competitive Advantage, and Performance

Linkage Capabilities, Technological Competitive Advantage and Firm Performance

According to Lall (1992), linkage capabilities are the skills needed to transfer information, skills and technology to, and get them from, part or raw material suppliers, providers, experts, service firms, and research institutions. Shan and Jolly (2013) defined linkage capabilities as a ability to transfer to or obtain from other departments within the firm, and from customers, suppliers, consultants, and research institutions, among others, information, competencies, and technology. Linkage capabilities are seen as an influential factor impacting firm success (Shan & Jolly, 2012). Previous studies have revealed that linkage capabilities have a positive and significant relationship with innovation, competitive performance and firm performance (Bagherinejad, 2006; Mohannak, 2007; Panayides, 2006; Shan & Jolly, 2012, 2013)

Shan and Jolly (2012) introduce a three-dimensional linkage capabilities scale for electronic information industry, consisting of internal linkages (IL), external commercial linkages (EXL) and linkage with public research institutes. It is postulated that this study offers a more detailed and contextually insightful conceptualization of linkage capabilities. The results show that the firm internal links and external linkages with economy do have a positive influence on firm performance. Oluwale, Ilori, & Oyebisi (2013) proposed another linkages that need to consider for automotive industry namely automotive associations whereby they found strong linkage with automotive associations. Doh & Kim (2014) also found that the importance of government support for regional SME innovations. Therefore, linkage capabilities in term relationship between association and government agencies were considered in this study which can contribute to the relationship between linkage capabilitiea, competitive advantage an firm performance.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Linkage capabilities enhance collaboration in network relationships and potentially improve innovation especially when complex information is shared among people. The formation of linkages implies the effective and active interchange of information and implementation of routines that would improve a firm's competitive advantage of new products, service or processes of from the ongoing changes to existing products, services or processes matched to customer preferences that are persistently assessed. It follows that linkage capabilities will influence the capability to innovate, since information about this relationship are mainly used for upgrades, changes and the introduction of new ideas, products or services. According to Hsu and Fang (2009) relational capital or linkage capabilities have become a crucial factor for firms to improve new product development.

In general, researchers have focused on the importance of building relationships as a way to enhance innovation (Shan & Jolly, 2013). According to Kim et al (2011) linkage capabilities can contribute to the innovation performance in Korean IT SMEs companies through external technology cooperation. The above explanation leads to the following hypothesis.

H_1:The greater the firm's linkage capabilities related to innovation, the better its technological competitive advantage performance..

The RBV suggests that a strong relationships, whether it is internal communication such as between department or external cooperation with other firms or institutions such as with suppliers or research institutions that become the valuable and rare resource that could help firms to achieve better performance. Firms that have strong linkages capabilities will process the information that they got from within firms or from external such as from suppliers and customers (Johnson & Filippini, 2013). Responses or feedback the firms obtain from interactions with customers, competitors and other networks are used to create core competence. Many new and good ideas will be created from this interaction. Through numerous relationships, a firm can obtain valuable and specific knowledge, competencies and resources. These advantages from linkages can in turn enable firms to be more innovative(Parida, Pemartín, & Frishammar, 2009). Moreover, network and linkages relationships may also lead to in inimitable competitive advantages that improve the firm's overall performance (Shan & Jolly, 2013). The following hypothesis is therefore proposed.

H_2:The greater the firm's linkage capabilities related to innovation, the better its overall firm performance..

Following Newbert (2008) and Kamukama, Ahiauzu, & Ntayi (2011), a two-staged approach was used to model the firm-level performance measures as dependent variables. Technological competitive advantage was directly influenced by linkage capabilities which, in turn, influence the overall firm performance.

The mediating effects of competitive advantage and the extent it linkages capabilities in firm performance are limited in the literature. Most earlier literature addressing linkage capabilities have ignored the significance of competitive advantage of the relationship between linkage capabilities and firm performance (Shan & Jolly, 2012). Competitive advantage was considered a more sustainable outcome as it would take more time for a firm

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

to lose such performance once it was achieved. Improving their linkage capabilities allows firms to improve their competitive edge in terms of diminishing costs, achieving a strong reputation between customers, suppliers and other organisations, and helping them enter in new market and enhancing their competitiveness in global markets. These advantages may, in turn, positively impact on the firm's overall performance (Kamukama et al., 2011; Lo & Claver-corte, 2009). Some empirical studies also support this notion. Particularly, J. Barney (1991) recommended the presence of this relationship. In tandem with this kind of research, many researchers supported for examines on the relationship between competitive advantage and performance (Kamukama et al., 2011; Lo & Claver-corte, 2009; Mahmood, 2013; Newbert, 2008; Ray, Barney, & Muhanna, 2004).

According to Newbert (2008) a firm must identify and employ resource-based strategies to generate economic value. Newbert (2008) also suggested that to produce a product or service with more benefits for example, in the form of distinctive features and/or lower cost than are related with the products or services of its competitors, a firm must develop a combination of valuable resource and capabilities superior than that of its competitors. It is hypothesized that no matter what processes of resources and capabilities are, they only indirectly affect performance. In other words, to create benefits from its resource-capabilities combination, a firm must first acquire a competitive advantage coming from its (Newbert, 2008). Empirical testing supported this hypothesis. Considering the linkage capabilities as output that develops from limited resources and/or capabilities and their processes (Shan & Jolly, 2012), it is also hypothesized that the competitive advantage resulting from the linkage capabilities determines the performance of a firm. Thus, mediating effect of technological competitive advantage on the association between linkage capabilities and performance in the automotive industry is still a need further clarification that is limited empirical research in the literature. Based on this paucity, the following hypotheses are suggested:

H_3: A firm's technological competitive advantage is positively related to its performance.

H_4: A firm's technological competitive advantage will mediate the relationship between its linkage capabilities and its performance.

RESEARCH METHODOLOGY

This study used a questionnaire which consists of three sections: demography in term of respondent and business profile, linkage capabilities and firm performance based on the perceptions of the top management of the automotive companies in Malaysia. A survey is considered as the most cost-effective among methods available for data collection due to its ability in performing effective data collection (Zikmund, 2013). In general, a survey typed questionnaire approach is quite low-cost of money, time-saving, and a simple approach (Saunders, Lewis, & Thornhill, 2007; Zikmund, 2013).

Research Variables

To have an appropriate measurement scale available, this study adopted the measurement from published work. Details on the initial items are shown in appendix 1.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Linkage capabilities

Linkage capabilities is the extent to which firm has the ability to transfer information, knowledge and technology, and to receive them from internal linkage such as other departments, headquarter and so on as well as external linkage such as commercial Linkage and public research institutes. Linkage capabilities items are separated into three scales: internal linkage, external commercial linkage, and linkage with public research institutions, government agencies and association (Doh & Kim, 2014; Oluwale et al., 2013; Shan & Jolly, 2012, 2013). The choice of these three factors are derived from earlier studies by Shan & Jolly (2012, 2013), Oluwale et al. (2013) and Doh & Kim (2014). Respondents were asked to assess the level of the impact of several different links on firm's technological development. The linkage capabilities measure is built on sixteen items. Respondents were surveyed based on a Likert-type scale graduated from 1 (no influence) to 5 (very strong influence).

Technological Competitive Advantage

Barney (1991) defined that a competitive advantage as the implementation of a plan that assists the reduction of cost, the exploitation of market opportunities, and/or neutralisation of competitive threats (Newbert, 2008). The firm's technological competitive advantage is this study is operationalized as an aggregate measure of its product innovation competitiveness and process innovation competitiveness. In measuring the firm's product innovation competitiveness, respondents were requested to answer the level of the product innovations commercialized by their firm resulted in technological competitive advantages with involve of five key product dimensions: product cost, product quality, product features/functionality, value/ price ratio and deliverability. Process innovation competitiveness was evaluated through the same approach with consist of five production process dimensions: economies of scale, quality control, reliable scheduling, overall production costs, and response time to fulfil orders. Constructs for these two factors are developed based on references from Karagozoglu (1993). On the basis of the 5-point measure, the higher the rate of each construct, the better the firm's competitive advantage.

Firm Performance

Measuring performance is an issue with many challenges and debates. Researchers have used a lot of methods and constructs to measure firm-level performance. It can be evaluated with the objective (financially) or subjective (non-financial) indicators. Atalay, Anafarta, & Sarvan (2013), Venkatraman (1989), Jaworski & Kohli (1993) used a subjective measure of overall performance, while Sher & Yang (2005) and Hung & Chou (2013) used objective instruments (e.g. Return on assets (ROA), return on sales (ROS), return on equity (ROE) and Tobin's q). This study will be used subjective scale because some firms are unwilling to reveal exact performance records, and respondents are less willing to disclose objective performance data. Atalay et al. (2013) subjectively measured overall firm performance adapted from Venkatraman (1989). They examined the interactions between innovation and firm performance within the viewpoint of the automotive supplier industry. Atalay et al. (2013) and Cruz-gonzález et al (2014) scale to measure firm performance was used for the current study. It is believed that this scale will assist as the most applicable indicator of firm performance.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Survey Administration

The methodology used in this study was a mail survey. The population of this study was included in the automotive industry in Malaysia. Surveys were disseminated to respondents from the listing of automotive industry that obtained from the Malaysian Automotive Institute (MAI), Proton Vendors Association (PVA), and Malaysia External Trade Development Corporation (MATRADE). The survey and a covering letter clarifying the purpose of the research were posted to the potential respondents. A self-addressed, stamped envelope was enclosed to smooth the progress of the return of the completed surveys. A total of 500 surveys was sent and a total of 56 usable completed questionnaires was collected. The valid response rate was 11.2 percent. Data analyses were performed on this sample size of 56 from automotive industry.The primary analysis methods used in this study is Partial least squares (PLS) techniques. The required minimum sample size for evaluating data using PLS is ten times the largest number of structural directions intended for particular construct in the structural model (Joseph F. Hair, Hult, Ringle, & Sarstedt, 2014). The largest numbers of paths pointing to a construct in the structural model are two, which represents the relationships between linkage capabilities and technological competitive advantage with firm performance. Therefore, based on the ten times rule of thumb, the needed minimum sample size is 20. PLS with normal theory significance testing is has more power than the other techniques at small sample sizes (Goodhue, Lewis, & Thompson, 2006) such as LISREL and regression.

DATA ANALYSIS RESULTS

This section presents the statistical analyses conducted in examining the impact of linkage capabilities constructs upon technological competitive advantage and firm performance. The characteristics of participants and their companies are presented, followed by preliminary evaluation and validation of measurement model.

Participants Characteristics

Of the 500 questionnaires distributed to the entire automotive companies' population as listed in the sampling frame, a total of 56 completed questionnaires were collected. This yielded a response rate of 11% of the total population (500 companies). Table 1 presents the characteristics of participants surveyed. More than 80% of the participants held managerial and higher positions in the companies, while 58% have bachelors' degree and 11% have a diploma. Only 21.9% possess master's degree and doctorate degree.

Table 1: Participants Profile

Measure		**Frequency (n=56)**	**Percentage (%)**
Position	CEO	3	5.4%
	General Manager	12	21.4%
	Managing Director	4	7.1%
	Director	6	10.7%
	Manager	22	39.2%
	Others	9	16.2%
Education	Diploma	6	10.7%
	Bachelor's degree	33	58.9%

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Measure		Frequency (n=56)	Percentage (%)
	Master's degree	10	17.9%
	Doctorate	2	3.6%
	Others	5	8.9%

Table 2 shows the company characteristics. With regard to type of industry, the majority of responding companies are from component manufacturer (32.1%), followed by the component supplier (30.4%), material supplier (17.9%) Original Equipment Manufacturer (OEM), (10.7%) and remaining responding companies are module assembly, (8.9%). Pertaining ownership of company, 66.1% are fully local, followed by foreign firms (17.9%). The remaining is joint venture (16.0%). In terms of number of employees, 53.6% of companies have over than 200 employees. 21.8% companies employ between 75-200 and 23.2% companies employ between 5 to 75 employees. A wide distribution of annual sales turnover for the financial year 2015 is evident with 48.2% turning over RM50m.

Table 2: Company Characteristics

Measure		Frequency (n=56)	Percentage (%)
Automotive Industry	Material supplier	10	17.9%
	Component supplier	17	30.4%
	Component manufacturer	18	32.1%
	Module Assembler	5	8.9%
	OEM	6	10.7%
Legal structure	Fully local	37	66.1%
	Foreign firms operating in Malaysia	10	17.9%
	Joint Venture	9	16.0%
	Government Linked Companies		
Number of employees	Less than 5	0	0.0%
	5.- 74	13	23.2%
	75 -100	5	8.9%
	101 – 200	7	12.5%
	Over 200	3	55.4%
Sales turnover	Less than RM300,000	1	1.8%
	RM300,000 – RM14,999,999	18	32.1%
	RM15,000,000 –RM49,999,999	10	17.9%
	Over than RM50,000,000	27	48.2%

Analysis Method

The method of partial least squares (PLS) analysis (Haenlein & Kaplan, 2004), an implementation of structural equation modeling (SEM) with Smart PLS3 (Ringle, Christian M., Wende, Sven, & Becker, 2015), was applied to test the measurement model and the proposed hypotheses. This approach was chosen since it fits the small sample research and handles formative indicators (Becker, Klein, & Wetzels, 2012). In order to operationalize the second order factors, the suitable for PLS estimation and as such linkage capabilities and technological competitive advantage as second order constructs were measured by the indicators of their first order constructs.

Data analysis utilized a two-step approach, as recommended by Anderson and Gerbing (Anderson & Gerbing, 1988). The first step contains the analysis of the measurement model, whereas the second tests the structural relationships among the latent constructs (Anderson &

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Gerbing, 1988). The aim of the two-step approach is to establish the reliability and validity of the measures before measuring the structural relationship of the model. SmartPLS 3 (Ringle, Christian M., Wende, Sven, & Becker, 2015) was used because it allows latent constructs to be modelled as formative or reflective indicators.. For linkage capabilities (LC), the rationale for operationalizing it as a formative second-order construct is as follows: (1) its underlying dimensions are indicator variables that form or source the formation or change in it (latent variable), (2) its underlying dimensions are not highly correlated, and (3) its underlying dimensions are not similar.

Measurement Model

The second order construct (i.e. linkage capabilities) was using the approach of repeated indicators proposed by Chin et al. (Wynne W Chin, Marcolin, & Newsted, 2003). The repeated indicators approach is easiest to implement (Wynne W Chin et al., 2003). In this approach, a second order construct is directly measured by observed variables for all of the first order constructs. As this approach repeats the number of manifest variables used, the model can be estimated by the standard PLS algorithm (Wynne W Chin et al., 2003). The repeated indicators approach can be used with approximately equal numbers of indicators for each construct.

The measurement model was evaluated on the criteria of reliability, convergent validity, and discriminant validity. Reliability was examined using the composite reliability values. Appendix 1 shows that all of the values were above 0.7; indicate that these constructs possess internal consistency. The convergent validity of the scales was assessed by two criteria (Fornell & Larcker, 1981): (1) all indicator loadings should be significant and exceed 0.7 and (2) the average variance extracted (AVE) by each construct should exceed the variance due to measurement error for that construct (i.e. AVE should exceed 0.50). All of the items exhibited a loading higher than 0.7 on their respective construct and, as shown in appendix 1, all of the AVEs ranged from 0.68 to 0.81, thus satisfying both conditions for convergent validity.

To date discriminant analysis is assessed using the Fornell and Larcker (Fornell & Larcker, 1981) criterion and Henseler's heterotrait-monotrait (HTMT) (Henseler, Ringle, & Sarstedt, 2015)criterion. Discriminant validity assessed using the Fornel and Larcker (Fornell & Larcker, 1981) was examined using the following two tests. First, the loading of each measurement item on its assigned latent variable is larger than its loading on any of the other constructs indicates the existence of good discriminant validity (Gefen, 2005) (Table 3). Second, the square root of the AVE from the construct is much larger than the correlation combined between the construct and other constructs in the model (Table 3) (Fornell & Larcker, 1981). Similarly, Henseler's HTMT criterion, which imposes more stringent assessment than the earlier criterion, suggests that all constructs are below 0.90 (Table 4), therefore discriminant validity has been established (Henseler et al., 2015).So, we conclude that the scales should have sufficient construct validity.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Table 3: Fornell and Larcker Criterion

Constructs	AVE	IL	EXL	LPG	PT	PS	FP
IL	**0.798**	**0.893**					
EXL	**0.711**	0.621	**0.843**				
LPG	**0.683**	0.369	0.738	**0.827**			
PT	**0.812**	0.666	0.443	0.427	**0.901**		
PS	**0.732**	0.456	0.395	0.608	0.520	**0.855**	
FP	**0.788**	0.255	0.356	0.233	0.061	0.181	**0.888**

Table 4: Henseler's heterotrait-monotrait (HTMT) Criterion

Constructs	IL	EXL	LPG	PT	PS	FP
IL						
EXL	0.666					
LPG	0.368	0.770				
PT	0.707	0.467	0.430			
PS	0.514	0.437	0.166	0.593		
FP	0.237	0.352	0.218	0.077	0.229	

Criteria: Discriminant validity is established at HTMT0.90

As presented in Table 5, the VIF values for all formative first-order constructs show minimal collinearity, ranging from 1.408 to 3.188. These values are significantly less than the recommended threshold value of 5.00. This indicates an absence of multicollinearity among the first-order constructs that formed the second-order constructs in the measurement model.

Table 5: Multicollinearity for First-Order Constructs

Predictor/First-order construct	Second-order construct	VIF
Internal linkage (IL)	Linkage Capabilities (LC)	1.678
External Commercial Linkage (EXL)		3.188
Linkage with public research institutions, government agencies and association (LPG)		2.265
Product innovation competitiveness (PT)	Competitive Advantage (CA)	1.408
Process innovation competitiveness (PS)		1.827

The significance of weight of each of the formative constructs is subsequently assessed in explaining the first order constructs. Table 6, which depicts the bootstrapping results using sub-samples of 500 cases, indicates the weights and path co-efficient for each of the formative second order constructs (Joseph F. Hair, Ringle, & Sarstedt, 2013),The bootstrapping results show that all constructs of formative second order constructs are found to be significantly related to linkage capabilities and technological competitive advantage respectively. In this study, internal linkages was found to have the strongest relationship (β=0.966, t=12.361, p<0.05) with its higher-order construct (linkage capabilities). This result concurs with previous studies conducted by Shan & Jolly (Shan & Jolly, 2012).

Table 6: Results for Formative Second-Order Constructs Indicator Validity

Second-order construct	Paths	β^a	Mean	Std. Error	T- Statistics	P values*	Significant
Linkage	IL → LC	0.966	0.923	0.078	12.361	0.000	Yes

Second-order construct	Paths	β[a]	Mean	Std. Error	T- Statistics	P values*	Significant
Capabilities (LC)	EXL → LC	0.765	0.763	0.128	5.992	0.000	Yes
	PGL → LC	0.594	0.543	0.191	3.113	0.002	Yes
Competitive Advantage (CA)	PT → CA	0.982	0.876	0.201	4.894	0.000	Yes
	PS → CA	0.673	0.720	0.191	3.526	0.000	Yes

Note : a β : path coefficient *p<0.05 (two-tailed)

The results of the measurement model evaluation suggest that the measurement model has demonstrated satisfactory reliability and validity as all fundamental criteria were achieved. Having established the reliability and validity of the measurement model estimations as illustrated in Table 3-6, the next step is to elaborate on the structural model evaluation that yields evidence supporting the theoretical part of the model.

Structural Model

The assessment of structural model is based on the five step guidelines provided by Hair et al. (2014) as listed below.
Step 1: Assess structural model for collinearity issues
Step 2: Assess the significance and relevance of the structural model relationships
Step 3: Assess the level of R^2
Step 4: Assess the effect sizes f^2
Step 5: Assess the predictive relevance Q^2

Step 1: Assess structural model for collinearity issues

Prior to assessing the structural model, it is important to ensure that there is no collinearity issue in the inner model of the study. Table 7 presents the VIF values of all the exogenous constructs in the structural model. Results indicate that VIF values are below the recommended threshold value of 5.0 indicating there are no significant levels of collinearity among the exogenous constructs (Joseph F. Hair et al., 2014).

Table 7: Collinearity Values among Exogenous Constructs

Exogenous Constructs	Endogenous constructs	VIF
Linkage Capabilities (LC) (2nd Construct)	***Competitive Advantage (CA)***	***1.000***
Internal linkage (IL) (1st Construct)	Product innovation competitiveness (PT)	1.678
	Process innovation competitiveness (PS)	1.678
External Commercial Linkage (EXL) (1st Construct)	Product innovation competitiveness (PT)	3.188
	Process innovation competitiveness (PS)	3.188
Linkage with public research institutions, government agencies and association (LPG) (1st Construct)	Product innovation competitiveness (PT)	2.265
	Process innovation competitiveness (PS)	2.265
Linkage Capabilities (LC) (2nd Construct)	Firm Performance (FP)	**1.907**
Internal linkage (IL) (1st Construct)		2.576
External Commercial Linkage (EXL) (1st Construct)		3.595
Linkage with public research institutions, government agencies and association (LPG) (1st Construct)		2.641
Competitive Advantage (CA) (2nd Construct)		***1.907***
Product innovation competitiveness (PT) (1st Construct)		2.280

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Exogenous Constructs	Endogenous constructs	VIF
Process innovation competitiveness (PS) (1st Construct)		1.565

Step 2: Assess the significance and relevance of the structural model relationships

Nonparametric bootstrapping was applied (Wetzels, Odekerken-Schröder, & Oppen, 2009) with 500 replications to test the structural model. In PLS analysis, examining the structural paths and the R^2 scores of the endogenous variables measures the explanatory power of a structural model. Table 8 shows the results of the structural path analysis. For testing H_1, we can report that the effect of linkage capabilities have strong impact on technological competitive advantage. This finding supports H_1, that a firm's linkage capabilities have significant and positive impact on its technological competitive advantage (β= 0.690, t = 6.029, $p < 0.05$).

In order to test Hypothesis 2, the results confirm that linkage capabilities have a positive relationship with firm performance (β= 0.437, t = 2.567, $p < 0.05$). Thus, H_2 is supported. The positive and significant influence in this study indicated that better firm's linkage capabilities the greater the opportunity for firm to gain a technological competitive advantage. The results are in line with the previous finding which is linkage capability play an important role in achieving technological competitive advantage (Shan & Jolly, 2013). The findings of this study may also be used as a guideline for firms to establish linkage or network for example with research organization and universities, suppliers and etc. for innovative activities or program which ultimately may gain technological competitive advantage in the marketplace.
The relationship between technological competitive advantage and firm performance of H_3 does not reveal evidence of significant relationships. This can be seen based on the results using smart PLS that are β= -0.209, and T-statistic = 0.805. According to the findings, H_3 is not supported. Evidence indicates that automotive in Malaysia are unable to improve firm performance mainly due to their lack of ability to innovate. Consequently, for these firms have a chance to enhance firm performance, they will have to start getting into place the necessary driver of competitive advantage which is technological innovation. The findings of this study provide practitioners with valuable insights on how automotive companies in Malaysia may gain technological competitive advantage. This finding contrasts with Newbert (Newbert, 2008) observation that competitive advantage exerts a positive influence on firm performance measures in their study.

Table 8: Results of Bootstrapping for Structural Model Evaluation

Hypothesis	Exogenous constructs	Endogenous constructs	β[a]	Mean	Std. Error	T-Statistics[b]	P values	Result
H1	Linkage Capabilities (LC)	Technological Competitive Advantage (CA)	0.690*	0.690	0.114	6.029	0.000	Supported
H2	Linkage Capabilities (LC)	Firm Performance (FP)	0.437*	0.479	0.170	2.567	0.011	Supported
H3	Competitive Advantage (CA)	Firm Performance (FP)	-0.209	-0.209	0.259	0.805	0.421	Not Supported

Note : a β : path coefficient b t-statistics >1.96 are significant at p<0.05 (two-tailed)

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

*Significant at the 0.05 level (two-tailed)

Step 3: Assessment of Coefficient of Determination (R2)

Having examined the significance and relevance of the path coefficients, the explanatory power of the structural model was determined. The explanatory power was examined by the coefficient of determination; R^2 values (Joe F. Hair, Sarstedt, Ringle, & Mena, 2012). R^2 indicates the amount of variance in the endogenous constructs, technological competitive advantage and firm performance, which is explained by the model (Wong, 2013). According to Chin (1998), R^2 values of 0.67, 0.33, or 0.19 for endogenous latent constructs in the inner model can be described as substantial, moderate, or weak, respectively.

Referring to Table 9, results indicate a moderate model with 47.6% (R^2=0.476) or 47.6% of the variance in competitive advantage explained by the first-order constructs, namely internal linkage, external commercial linkage and linkage with public research institutions, government agencies and association. Hence, with respect to Chin's (1998) recommendation, the explained variance of technological competitive advantage can be interpreted as moderate. The R^2 value for firm performance is 0.109, suggesting that linkage capabilities and competitive advantage only explains 10.9% of firm performance thus interpreted as weak model.

Step 4: Assess the effect sizes f^2

The quality criteria of the structural model are determined by two measures: f^2 value and the Stone–Geisser's Q^2. First, the effect size of the structural model was evaluated using Cohen's f^2. The effect size is calculated as the increase in R^2 relative to the proportion of variance that remains unexplained in the endogenous construct (Peng & Lai, 2012). The f^2 effect size measures the influence a selected predictor construct has on the R^2 values of an endogenous construct. f^2 values of 0.02, 0.15 and 0.35 respectively are regarded as small, medium and large effect sizes of the predictive variables (Joseph F. Hair et al., 2014)

Referring to Table 8, with respect to the relationships between linkage capabilities and technological competitive advantage, the analysis reveals that linkage capabilities (β=0.690, t=6.029, $p<0.05$), significantly and positively impacts on technological competitive advantage with a large effect size; f^2=0.907 With regards to the relationships between the linkage capabilities and firm performance, linkage capabilities (β=0.437, t=2.567, $p< 0.05$) show a significant and positive relationship with firm performance with a small effect size; f^2=0.112.

Step 5: Assess the predictive relevance Q^2

The second quality criterion for the structural model is the Stone–Geisser's Q^2, conducted to determine predictive relevance using the blindfolding procedure in SmartPLS (Joe F. Hair et al., 2012; Peng & Lai, 2012). Q^2 measures the extent to which the model's prediction is successful. A value of $Q^2 > 0$ confirms the presence of predictive relevance (Joseph F. Hair et al., 2014). Overall, the Q^2 value of 0.176 for technological competitive advantage, which is larger than 0, suggests that linkage capabilities possess predictive capacity over technological

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

competitive advantage (Joseph F. Hair et al., 2014) as shown in Table 9. Likewise, the Q^2 value of 0.087 for firm performance is confirming that the structural model exhibits predictive relevance for firm performance as the final endogenous construct. Further assessment of the structural model relates to the evaluation of mediating effects as presented in the following section.

Table 9: Determination of Co-efficient (R^2), Effect size (f^2) and Predictive Relevance (Q^2)

	Determination Co-efficient	**Predictive Relevance**	**Effect Size f ^{2}**			
	R^2	***Q^2***	**Competitive Advantage (CA)**	***Effect Size***	**Firm Performance (FP)**	***Effect Size***
Competitive Advantage (CA)	0.476	0.176			0.026	small
Firm Performance (FP)	0.109	0.087				
Linkage Capabilities (LC)			0.907	large	0.112	small

Evaluation of Mediating Effects

Mediation analysis was performed to test the mediating effect on firm performance. H_4 predicts that competitive advantage is mediating the relationship between linkage capabilities and firm performance. To investigate the mediation effect, first, all of the direct, indirect, and total effects between the variables were measured. Secondly, the analysis of Baron and Kenny's (Baron & Kenny, 1986) classic causal step approach was used to test the mediating effect. Four conditions must be met for a mediating effect to be established: a direct link between the independent and dependent variable; the independent variable must be linked to mediating variables; when both the independent and mediating variables are predictors of the dependent variable, the mediator must be significantly related to the dependent variable; when the mediator is added, the relationship between the independent variable and dependent variable must be significantly reduced. Contrary to the theoretical predictions, results (see Table 12 under "Mediation test: Steps 3 and 4) do not confirm the indirect relationship between linkage capabilities and firm performance. According to hypotheses results, linkage capabilities have a direct impact on firm performance. However, the statistical result shows that findings do not support the mediating role of technological competitive advantage on the relationship between linkage capabilities and firm performance.

Table 10: Direct, Indirect Effects of Linkage Capability on Firm Performance

Exogenous Variable	**Direct effect model**			**Indirect Effect**			**Total Effect**	**VAF**	**Type of mediation**
	β	Se	t- Stat		Se	t- Stat			
Linkage capabilities	0.437*	0.168	2.598	-0.114	0.293	0.770	0.293	-0.389	Direct-only non-mediation

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Table 11: Mediation tests using PLS

Hypothesis	Steps of mediating effect	Beta	t-Value
	Mediation test: Step 1—Independent Variables to Dependent Variables		
H_2	*Linkage capabilities – firm performance*	0.437	2.567*
	Step 2-Independent variable to mediators		
H_1	*Linkage capabilities – technological competitive advantage*	0.690	6.029*
	Mediation test: Steps 3 and 4—Independent Variables and Mediator to Outcome Variable		
H_1	*Linkage capabilities – technological competitive advantage*	0.437	3.012*
H_3	*Technological Competitive Advantage – firm performance*	-0.209	0.892

DISCUSSION AND MANAGERIAL IMPLICATION

This paper has concentrated on assessing the relationships among linkage capabilities, technological competitive advantage and firm performance in the automotive industry in Malaysia. Based on a review of the RBV literature, four hypotheses were proposed to test the aforementioned relationships. They are that the firm's linkage capabilities contribute to its technological competitive advantage, which in turn, affects firm performance and mediates the relationship between linkage capabilities and firm performance. As can be seen from the results of our regression analyses, H_1 and H_2 are supported; however, H_3 and H_4 are not supported. In other words, the analysis reveals that linkage capabilities significantly and positively impacts technological competitive advantage and firm performance. However, technological competitive advantage shows insignificant relationship with firm performance. Also, technological competitive advantage does not mediate the linkage capabilities and firm performance relationship.

These findings may be of interest to both academics and practitioners for a number of reasons. For academics, this study may be interesting because it is based on Barney (J. Barney, 1991) conceptual framework. Our findings empirically confirm Barney [3] conceptual framework showing the relationships among linkage capabilities, technological competitive advantage and performance. Linkage capabilities are a strategic resource and whose exploitation may provide a firm with a technological competitive advantage and superior performance According to RBV perspective, that if a firm possesses linkages capabilities that are valuable and rare, it will attain a competitive advantage. If firm possesses linkage capabilities are also both inimitable and non-substitutable, the firm will sustain this advantage, and the attainment of such advantages will enable the firm to improve its short-term and long-term performance (Amit & Schoemaker, 1993; J. Barney, 1991; Henderson & Cockburn, 1994; Newbert, 2008; Powell, 2001; Teece et al., 1997). This study also contributes to the linkage or networks literature by providing additional insights into the influence of linkage capabilities towards firm performance.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

For practitioners, as H_1 is supported, this study's finding indicates that linkage capabilities specified as a second-order construct was found to positively impact firm technological competitive advantage for firms that belong to automotive industry. This may influence the way in which owners/managers make decisions to improve their technological competitive advantage. Additionally, as indicated above, linkage capabilities provide explanatory power for technological competitive advantage in that order. Three linkage capabilities dimensions that contributed to the significance of this hypothesis were internal linkage (β=0.966, t=12.361, p<0.05) external and commercial linkage (ß=0.765, t=5.992 p<0.05) and linkage with public research institutions, government agencies and association (β=0.594, t=3.113, p<0.05), explaining a significant portion of the variance in technological competitive advantage (R^2=0.476 or 48%).

The results show that the greater the firm cooperates within its different departments such as R&D, production, marketing, purchasing, finance and management department, and with its customers, competitors, foreign institutions, consultancy ¯firms, government agencies, association and public research institutes, better its product and process innovation competitiveness. The present findings also extends support to an investigation by Shan and Jolly (Shan & Jolly, 2013) who examined the role of linkage capabilities in assisting product innovation and firm performance in China's electronic industry. They showed that firms were able to enhance product innovation through improving their linkage capabilities. Firms involved in learning activities such as discussions and meetings among internal departments or with external parties were able to drive greater knowledge transfer in formal and informal ways (Calantone, Cavusgil, & Zhao, 2002). These social relationships enable to create and use knowledge in innovations, and apply them efficiently in economy (Dolińska & Curie-Skłodowska, 2013).

As a whole, it was found that internal linkage, external and commercial linkage and linkage with public research institutions, government agencies and association, explain to a great extent the influence of linkage capabilities on technological competitive advantage in automotive industry in Malaysia. Linkage capabilities are posited as essential in automotive firms because such firms depend on close interactions between manufacturers, suppliers and customers. Results of this study indicate that developing greater linkage capabilities, in particular focusing on internal linkage, external and commercial linkage and linkage with public research institutions, government agencies and associations would benefit firms in terms of improved technological competitive advantage.

Linkage capabilities were found to exhibit the expected positive direct effect on firm performance, providing support for previous research (e.g.,(Parida et al., 2009; Shan & Jolly, 2010, 2012, 2013)). Therefore, H_2 was supported. The effect size (f^2=0.112) is in the range of small to medium. Internal linkage, external and commercial linkage and linkage with public research institutions, government agencies and associations play a dominant role in forming linkage capabilities in automotive industry in Malaysia, which in turn directly impacts firm performance. This finding aligns with Shan & Jolly (Shan & Jolly, 2013) study, that asserted firms can enhance their performance by improving their linkage capabilities. As a whole, the empirical results demonstrate that better linkage capabilities are associated with better firm performance. Firms can achieve this by investing in and managing their internal linkage, external and commercial linkage and linkage with public research institutions, government

agencies. The external knowledge resources complement with firms' internal effort to expand their knowledge base. Firms can enter into strategic alliances or cooperation agreements that allow for access to more strategically relevant innovation activities.

As reported above, H_3 is not supported. The finding that technological competitive advantage is not associated with overall performance does not mean that this aspect does not have value or a role to play in improving performance. Our results suggest that relationship technological competitive advantage can explain only 10.9% of the variance in firm performance. It means, technological competitive advantage is not the only factor that enhances performance; many different factors can do so. According to many studies, technological competitive advantage or innovativeness has a direct and positive effect on firm performance (Atalay et al., 2013; Calantone et al., 2002; Camisón & Villar-López, 2014; Shan & Jolly, 2013; Yam, Lo, Tang, & Lau, 2010). However, the aspects that help a firm's innovativeness do not always have a direct impact on the improvement of the firm's performance. Therefore, technological competitive advantage might have a relationship with a firm's overall performance through intermediate measures. In other words, there are many factors that mediate between technological competitive advantages aspects to facilitate and achieve innovations and firm performance. That may be because the paths from technological competitive advantage aspects to a firm's performance are difficult to track directly. Another reason might be that this study was conducted on automotive industry in Malaysia, whereas the other studies mentioned above were conducted in different countries and industries. This may account for differences in the findings of this study. Another reason could be that automotive industry in Malaysia might still be lacking some specific resources for ensuring innovation, or it may be that performance is not adequately backed up by innovation.

With regard with the model testing H_4, we can report that the mediation effects of technological competitive advantage on linkage capabilities and firm performance were not significant. One probable explanation that the product innovation and process innovation have the least impact on firm performance because innovation may be is not considered a priority for part manufacturers because product innovation should often come from the assemblers whereby from the sampled firms only 19.6% from module assemblers and OEM firms. Therefore, further research on the mediating role of technological competitive advantage on the relationship between linkage capabilities and firm performance is needed.
The role played by linkage capabilities in product innovation and process innovation competitiveness and firm performance can only cause firms that are not yet engaged networking with others and have to begin as soon as possible. If they want to compete with their competitors, firms have to have a good relationship with various firms and organizations. Firms must develop their linkage capabilities. Linkage capabilities include both the networks within a company and external linkage with the various firms and organization. There are also implications for policy makers such as government agencies that are interested in ensuring firm technological competitive advantage to be improved. Since only a few firms are generally do carrying out innovation because investment in innovation activities is quite high, therefore policymakers should have to discover directions of offering support to help them carry out innovation into their firms. According to hypotheses results, the study concludes that linkage capabilities have a direct impact on technological competitive advantage and firm performance.Obviously, our study emphasizes the

significance of linkage capabilities should provide hope and motivation to owners/ managers of firms as they pursue to build up these capabilities.

CONCLUSIONS

This study has been subject to some limitations. First, this study focuses only on the relationship of linkage to technological competitive advantage and firm performance. Future research may consider the influence of other components of capabilities such as R&D capabilities, manufacturing capabilities, marketing capabilities and etc. Second, this study is limited to automotive companies in Malaysia only. Future research can be performed in other industry and other developing countries as well. Third, the sample in this study is relatively small, so in future research should take into consideration by using higher sample size to allow for a more meaningful measure in this study. This study also conducted a survey in a single industry. Thus the extent to which the results of this study can be generalized remains to be discussed.

Another limitation regards the research method. This study is a survey-based study. One limitation of survey study is the problem of internal validity. Thus, a mixed-methods study, both quantitative and qualitative study or triangulation study, can be done for future study to enrich the result of this study and to avoid the limitation of the study. Nonetheless, such limitations should be considered as signalling opportunities, rather than forming barriers, for future studies

REFERENCES

Amit, R., & Schoemaker, P. J. H. (1993). Strategic Assets and Organizational Rent. *Strategic Management Journal*, *14*(1), 33–46.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. http://doi.org/10.1037/0033-2909.103.3.411

Atalay, M., Anafarta, N., & Sarvan, F. (2013). The relationship between innovation and firm performance : An empirical evidence from Turkish automotive supplier industry. *Procedia-Social and Behavioral Sciences*, *75*, 226–235. http://doi.org/10.1016/j.sbspro.2013.04.026

Bagherinejad, J. (2006). Cultivating technological innovations in Middle Eastern countries Factors affecting firms ' technological. *Cross Cultural Management: An International Journal*, *13*(4), 361–380. http://doi.org/10.1108/13527600610713440

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120.

Barney, J. B. (1986). Strategic Factor Markets: Expectations, Luck and Business Strategy. *Management Science*, *32*(10), 1231–1241.

Barney, J. B., & Hesterly, W. S. (2012). *Strategic Management and Competitive Advantage:*

Concepts (Fourth Edi). New Jersey: Pearson Education, Inc., publishing as Prentice Hall.

Baron, R. M., & Kenny, D. a. (1986). The Moderator-Mediator Variable Distinction in Social The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. http://doi.org/10.1037/0022-3514.51.6.1173

Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models. *Long Range Planning*, *45*(5–6), 359–394. http://doi.org/10.1016/j.lrp.2012.10.001

Calantone, J. . R., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, *31*, 515–524. http://doi.org/10.1016/S0019-8501(01)00203-6

Camisón, C., & Villar-López, A. (2014). Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, *67*(1), 2891–2902. http://doi.org/10.1016/j.jbusres.2012.06.004

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In *Modern methods for business research* (In G. A. M, pp. 295–358). Mahwah, NJ: Lawrence Erlbaum.

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/ Adoption Study. *Information Systems Research*, *14*(2), 189–217. http://doi.org/10.1287/isre.14.2.189.16018

Choi, K., Narasimhan, R., & Kim, S. W. (2016). Opening the technological innovation black box: The case of the electronics industry in Korea. *European Journal of Operational Research*, *250*, 192–203. http://doi.org/10.1016/j.ejor.2015.08.054

Cruz-gonzález, J., López-sáez, P., Navas-lópez, J. E., & Delgado-verde, M. (2014). Open search strategies and firm performance : The different moderating role of technological environmental dynamism. *Technovation*, 1–14. http://doi.org/10.1016/j.technovation.2014.09.001

Doh, S., & Kim, B. (2014). Government support for SME innovations in the regional industries : The case of government financial support program in South Korea ☪. *Research Policy*, *43*(9), 1557–1569. http://doi.org/10.1016/j.respol.2014.05.001

Dolińska, M., & Curie-Skłodowska, M. (2013). Learning of Innovative Companies Within Innovation Networks (pp. 389–397).

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39–50. http://doi.org/10.1017/CBO9781107415324.004

Gathungu, J. M., Aiko, D. M., & Machuki, V. N. (2014). Entrepreneurial Orientation , Networking , External Environment , and Firm Performance : a Critical Literature Review. *European Scientific Journal*, *10*(7), 335–357.

Gefen, D. (2005). A Practical Guide To Factorial Validity Using PLS-Graph Tutorial and Annotated Example. *Communication of the Association for Information Systems*, *16*, 91–109.
Goodhue, D., Lewis, W., & Thompson, R. (2006). PLS, small sample size, and statistical power in MIS research. *Proceedings of the 39th Hawaii International Conference on System Sciences*, *8*, 1–10. http://doi.org/10.1109/HICSS.2006.381

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage : Implications for Strategy Formulation. *California Management Review*, 114–135.

Haenlein, M., & Kaplan, A. M. (2004). A Beginner's Guide to Partial Least Squares Analysis. *Understanding Statistics*, *3*(4), 283–297. http://doi.org/10.1207/s15328031us0304_4

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, *46*(1–2), 1–12. http://doi.org/10.1016/j.lrp.2013.01.001

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. http://doi.org/10.1007/s11747-011-0261-6

Henderson, R., & Cockburn, I. (1994). Measuring Competence? Exploring Firm Effects in Pharmaceutical Research. *Strategic Management Journal*, 1–36.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. http://doi.org/10.1007/s11747-014-0403-8

Hsu, Y., & Fang, W. (2009). Intellectual capital and new product development performance : The mediating role of organizational learning capability. *Technological Forecasting & Social Change*, *76*(5), 664–677. http://doi.org/10.1016/j.techfore.2008.03.012
Hung, K.-P., & Chou, C. (2013). The impact of open innovation on firm performance: The moderating effects of internal R&D and environmental turbulence. *Technovation*, *33*(10–11), 368–380. http://doi.org/10.1016/j.technovation.2013.06.006

Jaworski, B. J., & Kohli, A. K. (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, *57*, 53–70.

Johnson, W. H. A., & Filippini, R. (2013). Integration capabilities as mediator of product development practices – performance. *Journal of Engineering and Technology Management*, *30*(1), 95–111. http://doi.org/10.1016/j.jengtecman.2012.11.002

Joseph F. Hair, J., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer On Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Thousand Oaks: Sage.

Kamukama, N., Ahiauzu, A., & Ntayi, J. M. (2011). Competitive advantage : mediator of intellectual capital and performance. *Journal of Intellectual Capital*, *12*(1), 152–164. http://doi.org/10.1108/14691931111097953

Karagozoglu, N. (1993). Environmental uncertainty , strategic planning , and technological competitive advantage. *Technovation*, *13*(6), 335–347.

Lall, S. (1992). Technological Capabilities and Industrialization. *World Development*, *20*(2), 165–186.

Lo, D., & Claver-corte, E. (2009). The whole relationship between environmental variables and firm performance : Competitive advantage and firm resources as mediator variables. *Journal of Environmental Management*, *90*, 3110–3121. http://doi.org/10.1016/j.jenvman.2009.05.007

Mahmood, R. (2013). Entrepreneurial Orientation and Business Performance of Women-Owned Small and Medium Enterprises in Malaysia : Competitive Advantage as a Mediator. *International Journal of Business and Social Science*, *4*(1), 82–90.

Mohannak, K. (2007). Innovation networks and capability building in the Australian high-technology SMEs. *European Journal of Innovation Management*, *10*(2), 236–251. http://doi.org/10.1108/14601060710745279

Newbert, S. L. (2007). Empirical Research on Resource-Based View of the Firm: An Assessment and Suggestions for Future Research. *Strategic Management Journal*, *146*(28), 121–146. http://doi.org/10.1002/smj

Newbert, S. L. (2008). Value. Rareness, Competitive Advantage and Performance: A Conceptual - Level Empirical Investigation of the Resource-Based View of the Firm. *Strategic Management Journal*, *768*(May 2005), 745–768. http://doi.org/10.1002/smj

OECD, European Commission, & European Union. (1997). *Oslo Manual :The Measurement of Scientific and Technological Activities Proposed guidelines for Collecting and Interpreting Technological Innovation Data*.

Oluwale, B. A., Ilori, M. O., & Oyebisi, T. O. (2013). An Assessment of Technological Capability Building in the Informal Nigerian Automobile Sector. *Journal of Business and Management Sciences*, *1*(4), 55–62. http://doi.org/10.12691/jbms-1-4-3

Panayides, P. (2006). Enhancing innovation capability through relationship management and implications for performance. *European Journal of Innovation Management*, *9*(4), 466–483. http://doi.org/10.1108/14601060610707876

Parida, V., Pemartín, M., & Frishammar, J. (2009). The impact of networking practices on small firm innovativeness and performance : a multivariate approach. *International Journal*

Technoentrepreneurship, *2*(2), 115–133.

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, *30*(6), 467–480. http://doi.org/10.1016/j.jom.2012.06.002

Powell, T. C. (2001). Competitive advantage: Logical and philosophical considerations. *Strategic Management Journal*, *22*(9), 875–888. http://doi.org/10.1002/smj.173

Priem, R. L., & Butler, J. E. (2001). Is the resource-based " view " a useful perspective for strategic management research? *Academy of Management Review*, *26*(1), 22–40.

Rasiah, R. (2009). Institutions and Public-Private Partnerships : Learning and Innovation in Electronics Firms in Penang, Johor and Batam-Karawang. *International Journal of Ins*, *1*(2), 206–233.

Rasiah, R., & Vgr, C. G. (2009). University-Industry Collaboration in the Automotive , Biotechnology , and Electronics Firms in Malaysia. *Seoul Journal of Economics*, *22*(4), 529–550.

Ray, G., Barney, J. B., & Muhanna, W. a. (2004). Capabilities, business processes, and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal*, *25*(1), 23–37. http://doi.org/10.1002/smj.366

Ringle, Christian M., Wende, Sven, & Becker, J.-M. (2015). SmartPLS 3. Retrieved March 24, 2016, from www.smartpls.com

Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research Methods for Business Students* (4th ed.). Harlow England: Pearson Education Limited.

Shan, J., & Jolly, D. R. (2010). Accumulation of Technological Innovation Capability and Competitive Performance in Chinese firms : A quantitative study. In *IAMOT 2010* (pp. 8–11).

Shan, J., & Jolly, D. R. (2012). Accumulation of technological innovation capability and competitive performance: a quantitative study in chinese electronic information industry. *International Journal of Innovation and Technology Management*, *9*(5), 1–18. http://doi.org/10.1142/S0219877012500381

Shan, J., & Jolly, D. R. (2013). Technological innovation capabilities, product strategy, and firm performance: The electronics industry in China. *Canadian Journal of Administrative Sciences / Revue Canadienne Des Sciences de l'Administration*, *30*(3), 159–172. http://doi.org/10.1002/cjas.1256

Sher, P. J., & Yang, P. Y. (2005). The effects of innovative capabilities and R&D clustering on firm performance: the evidence of Taiwan's semiconductor industry. *Technovation*, *25*(1), 33–43. http://doi.org/10.1016/S0166-4972(03)00068-3

Taylor, P., Kim, S. K., Lee, B. G., Park, B. S., & Oh, K. S. (2011). The effect of R & D , technology commercialization capabilities and innovation performance. *Technological and Economic Development of Economy*, *17*(4), 563–578. http://doi.org/10.3846/20294913.2011.603481

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, *18*(7), 509–533.

Venkatraman, N. (1989). Stategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement. *Management Science*, *35*(8), 942–962.

Wang, W., Lin, C.-H., & Chu, Y.-C. (2011). Types of Competitive Advantage and Analysis. *International Journal of Business and Management*, *6*(5), 100–104. http://doi.org/10.5539/ijbm.v6n5p100

Wernerfelt, B. (1984). A Resource-based View of the Firm. *Strategic Management Journal*, *5*, 171–180.

Wetzels, M., Odekerken-Schröder, G., & Oppen, C. van. (2009). Using PLS Path Modeling For Assessing Hierarchical Construct Models : Guidelines and Empirical Illustration. *MIS Quarterly*, *33*(1), 177–195.

Wong, K. K. (2013). Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS. *Marketing Bulletin*, *24*, 1–32. http://doi.org/10.1108/EBR-10-2013-0128

Xu, Z., Lin, J., & Lin, D. (2008). Networking and innovation in SMEs: evidence from Guangdong Province, China. *Journal of Small Business and Enterprise Development*, *15*(4), 788–801. http://doi.org/10.1108/14626000810917861

Yam, R. C. M., Lo, W., Tang, E. P. Y., & Lau, K. W. (2010). Technological Innovation Capabilities and Firm Performance. *World Academy of Science, Engineering and Technology*, *42*, 1009–1017.

Zikmund, W. G. (2013). *Business Research Methods* (9th ed.). Australia: Cengage.

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, , June 2017

Appendix 1: Internal Consistency and Convergent Validity of the First-Order Constructs

Second Constructs	First Constructs / Items	Items Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)	Validity
LINKAGE CAPABILITIES	**Internal linkage (IL)**		**0.952**	**0.798**	Yes
	R&D department with production department (IL1)	0.891			
	R&D department with marketing department;(IL2)	0.908			
	R&D department with purchasing department (IL3)	0.915			
	R&D department with finance department (IL4)	0.867			
	R&D department with management (IL5)	0.883			
	External Commercial Linkage (EXL)		**0.925**	**0.711**	Yes
	External linkage with suppliers of equipment, materials, components, or software; (EXL1)	Deleted			
	External linkage with clients or customers; (EXL2)	0.843			
	External linkage with competitors in the same industry (EXL3)	0.802			
	External linkage with other firms in the different industry (EXL4)	0.832			
	External linkage with Commercial laboratories/R&D enterprises (EXL5)	0.852			
	External linkage with foreign institutions (EXL6)	0.886			
	Linkage with public research institutions, government agencies and association (LPG)		**0.915**	**0.683**	**Yes**
	External linkage with private consultancy firms (LPG1)	0.911			
	External linkage with the universities or other higher education institutes; (LPG2)	0.852			
	External linkage with the government research institutes (LPG3).	0.740			

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Second Constructs	First Constructs / Items	Items Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)	Validity
	External linkage with trade/industry association such as Proton Vendor, Malaysian Automotive Association, Federal Manufacturers Association and etc. (LPG4)	0.832			
	External linkage with government agencies such Malaysia Automotive Institute, Ministry International Trade and Industry and etc.(LPG5)	0.786			
TECHNOLOGICAL COMPETITIVE ADVANTAGE	**Product innovation competitiveness (PT)**		**0.963**	**0.812**	Yes
	Product cost (e.g.. impact of innovations in materials, content, ease of manufacture logistical requirements etc.) (PT1)	Deleted			
	Product quality (PT2)	0.929			
	Product features. (PT3)	0.873			
	Product performance (PT4)	0.947			
	Product functionality (PT5)	0.940			
	Deliverability (e.g.. impact of innovations on product weight, ease of installation, packaging needed for shipping, etc.) (PT6)	0.870			
	Value/Price (i.e.. value the product provides to the customer compared to the price the customer pays for it) (PT7)	0.844			
	Process innovation competitiveness (PS)		**0.890**	**0.732**	**Yes**
	Economies of scale (PS1))	0.866			
	Reliable scheduling (PS2)	0.930			

International Journal of Industrial Management (IJIM)
ISSN (Print): 2289-9286; e-ISSN: 0127-564x; Volume 3, June 2017

Second Constructs	First Constructs / Items	Items Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)	Validity
	Quality control (PS3)	0.759			
	Overall production costs (PS4)	Deleted			
	Response time to fulfill orders (PS6)	Deleted			
	FIRM PERFORMANCE (FP)		**0.963**	**0.788**	**Yes**
	Sales growth rate (FP1)	0.789			
	Market share growth (FP2)	0.866			
	Productivity growth (FP3)	Deleted			
	Return on asset (net income/total assets) (FP4)	0.925			
	Return on sales (net income / sales) (FP5)	0.912			
	Growth in profit (FP6)	0.924			
	Return on Investment (Net income / Investment) (FP7)	0.968			
	Cash Flow excluding investments (FP8)	0.815			