Journal of Scientific Research and Development 2 (13): 194-202, 2015
Available online at www.jsrad.org
ISSN 1115-7569
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Study on the impact of technological innovation capabilities on competitive advantage and firm performance in the automotive industry in Malaysia: a conceptual framework

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Abstract: This paper focuses on applying the resource-based view (RBV) of firms to explain performance in the automotive industry in Malaysia. Specifically, we based our research on the comprehensive framework of RBV and reviewed previous empirical researchers to investigate the relationship between technological innovation capabilities (TIC), competitive advantage and firm performance in the automotive industry in Malaysia. The conceptual model using Partial Least Squares (PLS) has been proposed. Based on the proposed conceptual framework and reviewed, research hypotheses are being developed. The conceptual framework of this paper will be used at the preliminary stage of the research on TIC that can be expected to contribute in the development of automotive industry in Malaysia.

Key words: Technological innovation capabilities; Competitive advantage; Firm performance; Resource-based view; Automotive industry

1. Introduction

To sustain in the encountering rapidly changing environments, technological change and globalization, firms require recurring technological innovation to continuously retain their competitiveness and firms to face new challenges (Cheng & Lin, 2012; Shan & Jolly, 2012). The globalization of business activity together with the increasingly rapid development and diffusion of technology progressively led to a destruction of traditional sources of competitive advantage (CA) which requiring firms to obviously understand the varying nature of competitiveness (Nguyen, 2010). One popular approach used to understand competitive dynamics is the resource-based view (RBV) of the firm. According to this view, only those resources that are valuable, rare, hard to imitate, cannot be substituted and a firm also needed to be organized in such a manner that it could develop the full ability of those resources if it was to obtain a sustainable competitive advantage (SCA), leading to better performance of the firm (Barney & Hesterly, 2012; Barney, 1991).

Resource-based view helped to understand how firms employ their tangible and intangible resources to compete in the market (Barney & Hesterly, 2012). Resources in RBV are defined as the tangible assets such as plants, distribution centers, machineries, equipment, patents, information systems and etc. or intangible assets such as a well-known brand and teamwork among its manager, its reputation among its customers that are owned and controlled by firms (Amit & Schoemaker, 1993; Barney, 1991).

In today's dynamic environment with its rapid and erratic changes, tangible assets have become easily reachable, imitable, and interchangeable. It is essential for a firm to improve its competitiveness and to manage with external resources. As such, competitive pressures, the need to continually adapt, develop and innovate has become important for firms to have superior performance (Karagouni & Papadopoulos, 2007; Richard et al., 2004). According to Yam, Guan, Pun, & Tang (2004) in a dynamic environment, an inability to innovate eventually causes businesses to deteriorate and firms to go out of business. In accordance, scholars have emphasized that while facing rapidly changing environments, the firms need recurrent technological innovation to continually maintain their competitiveness (Cheng et al., 2012). Many studies also have shown that technological innovation could create positive impacts and improving the competitiveness of (Guan et al., 2006; Karagouni & Papadopoulos, 2007; Lahovnik & Breznik, 2013; Lang et al., 2012; Liang et al., 2010; Richard et al., 2011, 2010; Richard et al., 2004).

In other words, technological innovation is recognized as a driving force for achieving and sustaining a competitive advantage and helping firms to develop strategic capabilities to deal with the enhanced dynamism and uncertainty of the business environment (Burgelman et al., 2009). Technological innovation is considered the result of the innovation process. The innovation process may involve the combination of existing technology and inventions to make a new or improved product, process, or system (Diaconu, 2011). Incremental or

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sustaining innovations involve the alteration, modification, and improvement of existing products and services and/or production and delivery systems, thereby allowing them to be proactive and adjustable to external changes and achieve competitive success (Burgelman et al., 2009).

Given the critical role of technological innovation for businesses in adding value and attaining strategic objectives, this research will examine significant fields in strategic management and technological innovation as two disciplines to draw a general picture of technological innovation capabilities-based competitive advantage of the firm. In addition, to place the research issues in a specific context, automotive industry in Malaysia, was selected for empirical examination.

In order to manage the high competitiveness and the many demanding business factors in the automotive industry, it is important to create better strategic planning which strongly reflects an improvement in firm performance. The industry is also having experienced rapid technology changes (Oh & Rhee, 2008) and is currently in the need for technological innovation in order to create competitive advantages.

Moreover, the Malaysia National Automotive Policy (NAP) was introduced on 22 March 2006 and reviews on 22 Oct 2009 and unveils National Automotive Policy (NAP) 2014 on 20 January 2014 to enable the necessary transformation and optimum integration of the local automotive industry into regional and global industry linkages within the progressively liberalized and competitive global environment (Ministry of International Trade and Industry Malaysia, 2014). Therefore, to be competitive in global market local automotive industry should introduce new products to help them protect and increase their margins and meet customer requirements as well as investing in process innovation to help them lower their cost. Consequently, it's importance to the automotive industry to attain the best strategy to help firms develop and produce more product variants that meet customers' needs and differentiation from their competitors with a lower cost and at a reasonable price. This situation provides both great opportunities and overwhelming challenges for firms. To survive and develop, firms should consider developing a best strategy towards new resources and capabilities to achieve and sustain a competitive advantage.

In this context, conducting studies and recommending practical actions for the development of the automotive industry in Malaysia is important. Although some studies at the macro level exist (Economic Planning Unit & World Bank, 2009; Malaysia Productivity Corporation, 2012), there is still a lack of empirical research about specific matters at the firm level, especially studies about their technological innovation capabilities affecting their competitive advantage and performance through employing strategic management perspectives, which seem to be applicable in realizing why some firms perform better than others.

Particularly, the resource-based view (RBV) of strategic management theory is applied in the automotive industry setting, and conversational gaps in RBV are expected to be filled by this application. RBV is as a very popular theoretical view exploited for clarifying on organizational performance (Newbert, 2007), and many strategy scholars have been considerably influenced by the major arguments of the RBV. RBV assumes that a firm possesses or controls a pool of resources and capabilities (Barney, 2001; Newbert, 2008), and that these resources and capabilities, which are uncommon among firms, create competitive advantages, which can improve performance (Amit & Schoemaker, 1993; Barney, 1991; Newbert, 2008). However, relationships between these theoretical constructs such as technological innovation capabilities, competitive advantages and performance are still controversial among scholars. Specifically, term and aspect of capabilities have been managed in different perspectives without a broad picture. Hence, this study to examine the relationships between resources/capabilities and performance are direct or indirect through competitive advantages. In other words, this study will apply theoretical approaches outlined by Newbert (2007) whereby it should be the most suitable to explain performance. These arguments have area for future empirical studies. Therefore, the purpose of this study is to examine the relationships between technological innovation capabilities, competitive advantages and the performance of firms belonging to the automotive industry

This paper is structured as follows. Section 2 briefly reviews prior research about the theoretical constructs of RBV, technological innovation capabilities and proposed conceptual model as well as developing hypotheses. Following that, the section 3 explains the research methodology of this study and finally, makes some concluding remarks.

2. Literature review and hypothesis development

Over the last two decades, the RBV of the firm has appeared 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 (1991) based on works by many previous scholars. This theory viewed that resource at the firm level need to evaluate whether or not specific firm resources can be sources of maintained competitive advantage at the industry level. The core contribution of the theory was that it helped explain why some firms achieve sustainable competitive advantage. The theory considered that some firms achieve sustainability in competitive advantage by differentiating resource endowments that they generate (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 continue in the long run lead towards sustained competitive advantage. Barney's (1991) conceptual framework of the RBV as presented in Newbert's (2007) article is illustrated in Fig. 1.

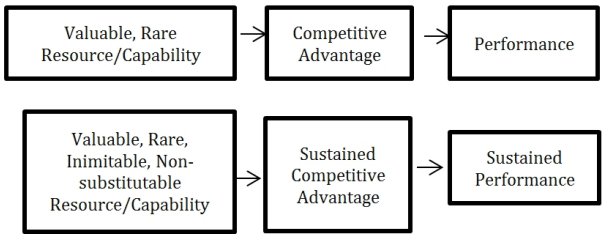

Fig. 1: Barney's (1991) conceptual framework of the RBV
Source: (Newbert, 2007)

In empirical studies of RBV, there have been many studies which focus 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, capability, or core competence that is valuable, rare, unique and non-substitutable, when organized by a firm, will affect its competitive advantage or performance. The organizing approach clarifies firm-level situations in which an effective exploitation of resources and capabilities is applied. Scholars utilizing the conceptual-level approach to try to investigate if attributes of a resource identified by Barney (1991) such as value, rareness, and inimitability, can effectively explain 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 capability as an independent variable. Based on an in depth analysis of all approaches, Newbert (2007) discovered that the most widely 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.

Newbert (2007) also assessed 55 empirical studies based on the resource-based view (RBV), and found 53 percent of them supported the expected results as suggested by RBV. Further, to explain the result, Newbert noted that researchers used three broad categories of independent variables - resources, capabilities and core competencies. The level of support varied widely among studies based on the resource categories used as independent variables.

When a specific capability was used as the independent variable, 71 percent of the tests were supported; when core competence was used as the independent variable, 67 percent were supported. But when specific resources were used as the independent variable, support level went as low as 37 percent. Although the authors of the original studies argued that these resources, capabilities and core competencies are valuable, rare, inimitable, or non- substitutable, the overall outcome indicated that these characteristics were not strong at the same level in different categories.

A further review of the specific instances of these resources, capabilities and core competencies revealed the following: The top three resources that were used are human capital, knowledge and experience; the top three capabilities that were used are information technology, technological and human resource; and the top three core competencies that were used are architectural, marketing and technology. A resource like human capital or experience is more likely to be imitable, substitutable, and less rare than technological capability or marketing competence of the firm. According to RBV, the valuable and rare resource could be supported only when it was inimitable. The inevitability of a resource depended on several factors: (1) the unique historical context in which resource bundles were created, (2) a causally ambiguous relationship between the resources and lead to competitive advantage, and (3) social complexity of the resources (J. Barney, 1991). It is essential to attain high performance and achieve firm's strategic positioning in the competitive environment are to have unique resources and innovative competencies (Zheng, 2014). Hence, it seemed acceptable that the usage of capabilities and competences as independent variables were more suitable if one wanted to use the resource-based view as a theoretical framework. Among the top three entries of capabilities and core competences categories, the term 'technological' was present in both categories. This means that technology is one of the key factors to sustain competitive advantage in firms.

Based on Newbert (2007)'s conclusion, this study focuses on only one of these approaches, and thus will follow 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 competitive advantage, which then contributes to its performance. This underlying theoretical logic is linked from the technological innovation capabilities to the competitive advantage and then the performance.

Technological innovation capabilities were viewed as a comprehensive set of elements of a firm that facilities and supports its technological innovation strategies (Burgelman et al., 2009) in the business environment and successful use of these capabilities to sustain competitiveness performance

for the firm. In another word, technological innovation is one of the key factors in a firm's competitiveness and hence necessary for firms which need to improve and sustain a competitive advantage and/or gain entry into new markets (Krishnaswamy et al., 2014). Technological innovation capabilities are a kind of integration of special assets or resources of the firm which comprises various assets such as technology, product, process, knowledge, experience (Guan & Ma, 2003; Karagouni & Papadopoulos, 2007; Türker, 2012; Richard et al., 2010). In the theory of resource-based view, when firms have successfully created differentiating resource configurations, they could better satisfy their customers' needs, they produced more efficiently, and in the long run, they achieved competitive advantage leading to superior performance (Barney, 1991; Ismail et al., 2012).

Therefore, the significant academic purposes of this paper are to provide more empirical evidence for RBV and to test the most direct relationship between technological innovation capabilities, competitive advantage, and finally, performance (Fig. 2)

Fig. 2: Relationship between technological innovation capabilities, competitive advantage, and performance

2.1. Technological Innovation capabilities and competitive advantage

According to Newbert (2007) a majority of the empirical studies in the resource heterogeneity approach of the RBV examines the direct relationship specific resources and/or capabilities and performance. Whereby, they presume that competitive advantage and performance have so far been used interchangeably, as they states that competitive advantage is often regarded as performance because they are based on a definition by Porter (1985) (Newbert, 2008). However, Newbert (2008) indicates a competitive advantage refers to the economic value that has been attributed from the firm's resources and capability that firms possess, performance refers to the economic value that the firm has generated from their commercialization. Moreover, Powell, (2001) point out a unidirectional correlation: that competitive advantage leads to enhanced performance, not the opposite. Therefore, among the possible relationships between technological innovation capabilities, competitive advantage and performance, a direct relationship between technological innovation capabilities and competitive advantage possible occurs rather than a relationship directly from that to performance.

H1: A firm's technological innovation capabilities have a positive impact on its level of competitive advantage.

2.2. Competitive advantage and 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. Competitive advantage was directly influenced by the four intangible resources under consideration (i.e. R&D capability, production capability, linkage capability and human resource capability), which, in turn, was modeled to influence the overall firm performance. The mediating effects of competitive advantage and the extent it technological innovation capabilities in firm performance are limited in the literature. Most previous literature addressing technological innovation capabilities has ignored the significance of competitive advantage of the relationship between technological innovation capabilities and firm performance (Lang et al., 2012; Shan & Jolly, 2012; Richard et al., 2010; Richard et al., 2011). Competitive advantage was considered a more sustainable outcome as it would take more time for a firm to lose such performance once it was achieved. Improving their technological innovation capabilities allows firms to improve their competitive edge in terms of diminishing costs, achieving a strong reputation among customers and raising their competitiveness in international 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 analyses on the relationship between competitive advantage and performance (Kamukama et al., 2011; Lo & Claver-corte, 2009; Mahmood, 2013; Newbert, 2008; Ray et al., 2004).

H2: A firm's competitive advantage is positively related to its performance in automotive industry.

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 unique 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 greater 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-capability combination, a firm must first acquire a competitive advantage coming from its exploitation (Newbert, 2008). Empirical testing supported this hypothesis. Considering the technological innovation capabilities as output that develops from specific resources and/or capabilities and their processes (Shan & Jolly, 2012), it is also hypothesized that the competitive advantage resulting from the technological innovation capabilities determines the performance

of a firm. Thus, mediating effect of competitive advantage on the association between technological innovation capabilities and performance in the automotive industry is still a controversial matter that is limited empirical research in the literature. Based on this paucity, the following hypothesis is suggested:

H3: A firm's competitive advantage will mediate the relationship between its technological innovation and its performance.

3. Methodology

In this study, sampling method by using a structured questionnaire. 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 simple approach (Saunders, et al., 2007; Zikmund, 2013).

Moreover, by using survey methods, it can clarify the question the survey respondents and verifying their responses to be used as data for analysis ((Sekaran & Bougie, 2010). Therefore, this paper used this approach.

The proposed conceptual model has been used to present the relationship between technological innovation capabilities, competitive advantage and firm performance is as shown in Fig. 3.

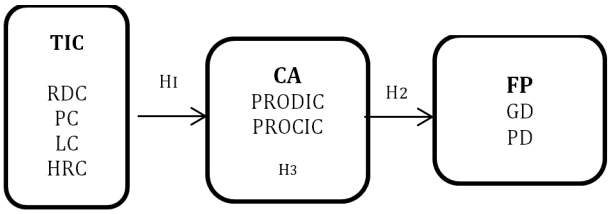

Fig. 3: A proposed conceptual model

Note: TIC = Technological Innovation Capabilities, RDC = R&D Capability, PC = Production Capability, LC= Linkages Capability, HRC= Human Resource Capability, CA=Competitive Advantage, PRODIC =Product Innovation Competitiveness, PROCIC= Process Innovation Competitiveness, FP= Firm Performance, GD=Growth Dimension, PD= Profitability Dimension

Fig. 3 shows the overall research model, illustrating the interactions among eight main latent constructs. These four latent constructs for technological innovation capabilities are R&D capability, production capability, linkage capability, human resource capability, for competitive advantage comprises of production innovation competitiveness and process innovation competitiveness. Additionally, there are two other latent constructs growth dimension and profitability dimension to capture overall firm performance. The full description of all the constructs used in the present study by the number of measuring items, scales, support to the hypothesis and their source of adoption is presented below.

3.1. Research variables

3.1.1. Technological innovation capabilities

Technological innovation capabilities involve multi-dimensional, complex, interactive innovation activities (J. C. Guan et al., 2006) with resource re-deployment in order to gain competitive advantage (Wang et al., 2008). Within this broad framework, a range of researchers has developed their own approach and components in assessing a firm's technological or innovation capabilities. However, each of these previous studies measured is an indicator of an element of the broad construct of TIC, but none is a comprehensive measure (Shan & Jolly, 2012) especially in the area of automotive industry. Different of the studies had different dimensions to measure technological innovation capabilities.

Therefore, this study proposed technological innovation capability measurement which is focused into four dimensions: R&D capability, production capability, linkage capability and human resource capability. The selection of these four factors are derived from previous studies by (Chen & Huang, 2009; Cruz-gonzález et al., 2014; Nieves et al., 2014; Oh & Rhee, 2010; Oluwale et al., 2013; Shan & Jolly, 2012; Richard et al., 2004; Yang, 2013).

R&D capability is the extent to which firm has resource capacity to develop new technologies, which is divided R&D capability into engineering, design and modularization capabilities (Oh & Rhee, 2010). These items in this study were taken from several published sources, including Oh & Rhee (2010), Oh & Rhee (2008) and Yang (2013). The production capability, however, refers to the extent to which firm has ability in operations strategy such as in dependability improvement, cost reduction, quality improvement and flexibility (Oh & Rhee, 2010). The production capability items used in this study were specialized sources originally considered by Oh & Rhee (2010) and Oh & Rhee (2008).

The linkage capability measures the extent to which firm has the ability to transfer information, skills and technology, and to receive them from other departments of the firm, external commercial linkages and public research institutes which is adopted from Shan & Jolly (2012), (Oluwale et al.(2013) and Cruz-gonzález et al. (2014). The final capability which is human resource capability indicates the extent to which firm has ability to have a pool of employee talent, skills and abilities that leads to innovation and brings economic value to organize through Human Resources Management (HRM) practices through training, compensation, performance appraisal, staffing and participation. Human resource capability was measured using a combination of instruments developed by Chen & Huang (2009) and Nieves, Quintana, & Osorio (2014). Specifically, respondents are asked for answers the items on a 5-point Likert scales.

3.1.2. Competitive advantage

Barney (1991) stated that a competitive advantage as the implementation of a strategy that accelerates the decrease of the cost, the utilization of market opportunities, and/or diminishing of competitive threats (Newbert, 2008). A review of the literature states that there is a broad understanding that continuous technological innovation is the key to achieving and sustaining a firm's competitive advantage. The dependent variable in the proposed path model is the firm's technological competitive advantage (i.e., competitive advantage attained through product and process innovations). The firm's technological competitive advantage is operationalized as a composite measure of its product innovation competitiveness and process innovation competitiveness. Using multi-dimensions of the construct defined by Karagozoglu (1993), including product innovation competitiveness and process innovation competitiveness then developed a scale to measure a firm competitive advantage which is adopted in this study. To measure the firm's product innovation competitiveness, respondents were asked to indicate the degree to which the product innovations commercialized by their firm in the past five years resulted in competitive advantages with regard to each of five key product dimensions: product cost, product quality, product features/functionality, deliverability, and value/ price ratio. Process innovation competitiveness was measured via a similar approach with regard to five production process dimensions: economies of scale, reliable scheduling, quality control, overall production costs, and response time to fulfill orders. On the basis of the 5-point measure, the higher the rate of each construct, the better the firm's competitive advantage.

3.1.3. Firm performance

Measuring performance is an issue with many challenges and debates. Researchers have used a wide variety 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 measures (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.

3.1.4. Control variables

As in previous empirical studies (Jean et al., 2014; Krush et al., 2013; Newbert, 2008; Richard et al., 2011; Yu et al., 2014), this paper controls some variables, including firm size (total number of employees), firm age (Firm age is measured by the number of years since entering Malaysia).

3.2. Data and sample

The population of this study will comprise in automotive industry in Malaysia. Questionnaires will be distributed to respondents from the listing of automotive industry that will be obtained from Malaysian Automotive Institute (MAI), Proton Vendors Association (PVA), and Malaysia External Trade Development Corporation (MATRADE). To analyze the data, Partial least squares (PLS) techniques will be adopted.

3.3. Analysis methods

Partial least squares (PLS) analysis is chosen as the most suitable technique for analyzing our model. PLS was chosen because it well suited for complicated models which consist of latent variables (Nwankpa & Roumani, 2014) and it can operate under limited number of sample size whereby this study only focus on automotive industry (Esen & Esen, 2013; Hortinha et al., 2011). Based on the above discussion, it is apparent that PLS provide relatively robust data analysis strategies. Therefore, this study will uses the Partial Least Squares (PLS) method to test its hypotheses.

4. Conclusion

On the whole, the aim of this paper is to investigate the significance of the relationship between technological innovation capabilities with a competitive advantage and firm performance in the Malaysian automotive industry. The main contribution of this paper was to encourage managers to take a consideration on the relationship between technological innovation capabilities, competitive advantage and firm performance. Many studies have been performed to identify the relationship of technological innovation capabilities in firm performance. However, there is lack of previous study to investigate the relationships between technological innovation capabilities, competitive advantage and firm performance, especially in the automotive industry. A conceptual model has been recommended to study the relationships between technological innovation capabilities, competitive advantage and firm performance in Malaysia automotive industry.

Based on proposed model and a previous studied, research hypotheses are being established. The next step of this study is to design a questionnaire, which will be applied for pilot study data collection in

Malaysia automotive industry. This paper also tries to conduct tests using the approaches of RBV due to the lack of research in this area. In doing so, the scholarly community as well as practitioners will have more empirical evidences related to the fundamental theory behind the RBV, thereby improving understanding of the relationships among technological innovation capabilities, competitive advantage and performance.

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